

THE GLOBAL DRACUNCULIASIS ERADICATION CAMPAIGN

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## ABSTRACT

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*Dracunculiasis*, also referred to as Guinea worm disease (GWD), is an ancient scourge on the brink of eradication. It is contracted when humans drink water from sources infested by microcrustacean copepods harboring Guinea worm (GW) larvae. The copepods dissolve in the stomach and release the GW larvae which make their way to the gut of the final host. Soon after, male and female GWs mate and approximately one year after entering the human body, a gravid female GW protrudes through the final host's skin to release her larvae, causing extreme pain and debilitation. The most common treatment involves the slow extraction of the GW over time, but the cycle can be repeated without education/prevention and control interventions. In 1981, a global campaign to eradicate GWD was initiated simultaneously with the United Nations' International Drinking Water Supply and sanitation Decade (1981-1990). This thesis contributes to the existing body of literature on GWD by providing a review of the disease's history, research, and global programmatic findings from 1981 to 2013. It reconstructs the Global Dracunculiasis Eradication Campaign (GDEC) using the data made publicly available by the Centers for Disease Control and Prevention, the World Health Organization, and their affiliates chiefly through three publications: *Guinea Worm Wrap-Up*, *Morbidity and Mortality Weekly Report*, and *Weekly Epidemiological Record*. Through this reconstruction of GDEC, hypotheses are generated about why GWD continues to persist in four sub-Saharan African countries: Chad, Ethiopia, Mali, and South Sudan.

Ši tezė skirta Viktorijai Marijai, viskas ką darau yra dėl tavęs, mano Mažyle.

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## KEY TO ABBREVIATIONS

BCCI	Bank of Credit and Commerce International
CCC	Case containment centers
CCR	Case containment rate
CAR	Central African Republic
CCRTCD	Collaborating Center for Research, Training, and Control of Dracunculiasis
CCRTED	Collaborating Center for Research, Training, and Eradication of Dracunculiasis
CDC	Centers for Disease Control and Prevention
CIDA	Canadian International Development Agency
DBL	Danish Bilharziasis Laboratory
DANIDA	Danish International Development Agency
DW	Drinking water
EC	Endemic country
EL	Endemic locality
GDEC	Global Dracunculiasis Eradication Campaign
GoS	Government of Sudan
GoSS	Government of Southern Sudan
GW	Guinea worm
GWD	Guinea worm disease
GWEP	Guinea Worm Eradication Program
HDI	Health and Development International

HE	Health education
ICCDE	International Commission for the Certification of Dracunculiasis Eradication
ICT	International Certification Team
ICGDE	International Coordinating Group for Dracunculiasis Eradication
IDWSSD	International Drinking Water Supply and Sanitation Decade
IMPACT	<i>l'Initiative internationale contre les incapacités évitables</i> (International Initiative against Avoidable Disablement)
ITFDE	International Task Force for Disease Eradication
JICA	Japan International Cooperation Agency
LBV	Locality-based volunteer
LBW	Locality-based worker
MDA	Mass drug administration
MoH	Ministry of Health
NID	National immunization days
NIHI	National Institute of Health at Islamabad
NTD	Neglected tropical disease
NGO	Non-governmental organization
OAU	Organization of African Unity
OPEC-FID	Organization of the Petroleum Exporting Countries Fund for International Development
OCCGE	<i>l'Organisation de coordination et de coopération pour la lutte contre les grandes endémies</i> (Organization for Coordination and Cooperation against Endemic Diseases)
OLS	Operation Lifeline Sudan
PAHO	Pan American Health Organization

PFG	Precision Fabrics Group, Inc.
PHC	Primary health care
SIDA	Swedish International Development Agency
TCC	The Carter Center
U.N.	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VC	Vector control
WASH	Water and Sanitation for Health
WB	World Bank
WHA	World Health Assembly
WHO	World Health Organization
WHO/AFRO	World Health Organization/Regional Office for Africa
WHO/EMRO	World Health Organization /Regional Office for the Eastern Mediterranean



*[T]his is not a control program, it is an eradication program, and ‘almost eradication’ does not count. No formerly endemic region is safe until all areas are Guinea worm-free. Our entire investment up to now is at risk until the last Guinea worm is dead.*

–Donald R. Hopkins (CDC, 2000e, p. 10)

## 1. INTRODUCTION

On 8 May 1980, the World Health Organization (WHO) declared smallpox officially eradicated at Thirty-third World Health Assembly (WHA), almost two-and-one-half years after the last case was reported from Somalia in October 1977 (CDC, 1997l). Consequently, smallpox became the first and only human disease to ever be eradicated purposefully (Hopkins, 1983). Following the demise of smallpox, health authorities involved in the Smallpox Eradication Program deliberated on the next candidate disease slated for eradication (Cairncross, Muller, & Zagaria, 2002). The eradication of smallpox informed public health policy by demonstrating the global impact that a “community-based prevention programme can have, the considerable resources which can be mobilized for such an effort, the value of establishing measurable goals and monitoring disease incidence in programme execution, and the remarkable cost-benefit implications of prevention programmes” (Henderson, 1987, p. 535).

Dracunculiasis, more commonly known as Guinea worm disease (GWD), is a crippling, waterborne infection caused by the parasite *Dracunculus medinensis*, or simply, the Guinea worm (GW). Unlike other parasitic diseases, GWD is theoretically easy to prevent as the only mode of transmission is through the consumption of water infested with microcrustacean copepods harboring infectious larvae (Reddy, Narasaiah, & Parvathi, 1969). Transmission of GW effectively ends when humans no longer drink from these sources (Brieger, Johnson,

Adeniyi, & Akpovi, 1982). It is the only disease with the potential to vanish through the provision of secure, potable, permanent drinking water (DW) sources (Hopkins & Foege, 1981). However, providing clean DW to everyone is a public health challenge and unfortunately, it is the most expensive option, making it practically unobtainable for many countries that suffer from endemic GW transmission (Hopkins et al., 2000).

Characteristically a disease of poverty, GWD is usually confined to rural areas lacking access to safe sources of DW, typically located far from the centers of power and thus, of little interest to health authorities (Muller, 1985). If eradication is achieved, GWD would be the second infectious disease to be eradicated after smallpox (Bourne, 1982). Moreover, it is the first parasitic disease pursued by the WHO for eradication (Hopkins, Ruiz-Tiben, Kaiser, Agle, & Withers Jr., 1993) and the first targeted campaign to do so without the advantage of a vaccine (Hopkins, Ruiz-Tiben, Eberhard, & Roy, 2007). Since GWs are solely transmitted through the ingestion of water, Bourne (1982) suggested GWD was especially vulnerable to a resolute campaign targeting its eradication.

While mortality is rarely associated with GWD, its crippling effects can have an enormous socioeconomic impact on communities, especially during periods of peak agricultural productivity when crops need harvesting or planting (Ward, 1983). Eradication could benefit the overall health and well-being of millions of people (Bourne, 1982), particularly the nutrition status of young children, through improved agricultural output which, according to Hopkins and Foege (1981) provided “a tangible stimulus for villagers to help build and maintain safe water sources” (p. 495). Addressing the problem of GWD through the delivery of safe DW sources will not only assist in the elimination of other waterborne infectious diseases (Muller, 1979), it would ease the burden of millions of women and girls tasked to collect water on a daily basis (Watts,

2007) and alleviate the vicious cycle of poverty by improving health and the ability to productively work (Ward, 1983).

Humans do not develop immunity to GWD, therefore, infection can occur numerous times during the transmission season (Gilles, 1983) and no vaccine or effective antiparasitic drug exists for treatment (Ruiz-Tiben, Eberhard, & Roy, 2012). Moreover, local beliefs and ignorance about the origin and cause of GWD are important determinants of the continued transmission of GW and part of the insidious cycle of poor health and education associated with extreme poverty in the remote rural areas where it is common (Ruiz-Tiben & Hopkins, 2006).

Classified as a neglected tropical disease (NTD) by the WHO, GWD is one of 17 diseases included in this group that affects the lives of nearly one billion people while endangering the health of millions. They are diseases of neglected people—rural, impoverished, and uneducated. Including GWD, the other NTDs are Buruli ulcer (*Mycobacterium ulcerans* infection), Chagas' disease (American trypanosomiasis), cysticercosis, dengue/severe dengue, echinococcosis, endemic treponematoses (yaws, endemic syphilis [bejel], and pinta), fascioliasis, human African trypanosomiasis (sleeping sickness), leishmaniasis, leprosy (Hansen's disease), lymphatic filariasis (elephantitis), onchocerciasis (river blindness), rabies, schistosomiasis (bilharziasis), soil transmitted helminthiasis (ascariasis, hookworm disease, trichuriasis), and trachoma (CDC, 2010a).

Approximating the worldwide prevalence of GWD in the mid-twentieth century, Stoll (1947) suggested 48 million people suffered annually. In 1976, the WHO (1982) projected a worldwide prevalence of 10 million. On the African continent alone, Watts (1987a) estimated 120 million people were at-risk for GWD with a minimum of 3.32 million cases occurring annually in 1986 (2.77% of the population at-risk). With the inclusion of India and Pakistan, the

global estimate increased to approximately 3.5 million (Hopkins, 1987). By 1989, most countries confirmed as or suspected of endemicity had begun nationwide active GWD case searches. That year, 892,055 cases were enumerated as part of the Global Dracunculiasis Eradication Campaign (GDEC) in 15 known endemic countries (ECs). Since then, numbers have fallen dramatically as evidenced by the 148 cases reported for 2013 (WHO, 2014). This 99.98% decrease since 1989 is an indicator of GDEC's success.

Various terms are employed in discussions on ridding the world of disease. "Control" is used to describe lowering rates of incidence/prevalence. "Elimination" is a form of disease control that refers to the absence of incidence to a point that the disease no longer presents a problem to public health (CDC, 1993e). However, to eliminate further need for disease control measures requires a disease's eradication, which was defined by the International Task Force for Disease Eradication as the "reduction of the worldwide incidence of a disease to zero as a result of deliberate efforts, obviating the necessity for further control measures" (CDC, 1993e, p. 1). A successful eradication campaign brings about public health benefits that are permanent whereas disease control programs have unspecified ends and the malady may linger indefinitely. Bourne (1982) noted that the term "eradication" should be used with caution in the early stages of such a campaign as previous disease eradication campaigns, i.e., malaria, led to disappointment amongst global health officials involved.

### **1.1. Research Purpose**

This thesis contributes to the existing body of literature on GWD by providing a review of the disease's history, research, and global programmatic findings over a span of 33 years in one document. For researchers concerned with helminthic, infectious, tropical, and waterborne

diseases, or diseases that are endemic in developing countries, a presentation of this parasitic infection, the only human disease that is solely transmissible through water consumption, is presented. Furthermore, this thesis provides a critical review of GWD surveillance case reports by agencies participating in GDEC. It reconstructs GDEC using data made publicly available by the Centers for Disease Control and Prevention, the WHO, and their affiliates, chiefly through three publications: *Guinea Worm Wrap-Up*, *Morbidity and Mortality Weekly Report*, and the *Weekly Epidemiological Record*. Through this reconstruction of GDEC, hypotheses are generated about why GWD continues to persist in four sub-Saharan African countries: Chad, Ethiopia, Mali, and South Sudan.

## **1.2. Research Goals**

This thesis is a historical reconstruction of GDEC from its inception in 1981 through 2013. It seeks to identify specific actions at various geographic scales that got the campaign up and running, continue to provide impetus to this day, and have contributed to the near eradication of GWD. The goal of this thesis is to understand why this “easily eradicable” disease still occurs in the four countries of Chad, Ethiopia, Mali, and South Sudan, after more than 30 years of interventions focused on eradication. A thorough review of the literature related to GDEC is conducted to answer the following questions:

- 1) What are the most effective prevention and control measures that have led to the successful interruption of Guinea worm transmission in previously endemic countries?
- 2) What preventative methods are available to ensure previously endemic and at-risk countries from preventing the (re)introduction of Guinea worm disease today?

- 3) What factors do the last four endemic countries share in common that allow the transmission of Guinea worm to continue?

This thesis is formatted as follows: The Background section begins by presenting historical accounts of GWD's distribution and contributions by ancient writers that led to the contemporary scientific and colloquial names used for the disease and its biological agent as well as more recent occurrences of its epidemiology in non-endemic countries. I provide a brief review of GWD's biological agent, the GW, and its life cycle. In order to complete its life cycle, the GW needs egress to the environment outside of its host in order to disburse larvae which depends the disease phase in human. Roughly a year subsequent to the ingestion of larvae, gravid female GWs journey to break through the skin of its host to complete the cycle of life which leads to the disease in humans. Dracunculiasis is discussed along with its clinical manifestations, treatment, and transmission. After introducing the agent and disease, the ensuing morbidity and its effects are presented. I conclude this section on the topic of mortality even though death is rarely a direct cause of GWD. Next is the Data and Methods section which explains what data sources were employed and the data collection method used for this thesis. The majority of this thesis is found in the Results section. Here I reconstruct the global campaign starting with the proceedings that led up to the launch of GDEC and begin presenting yearly epidemiological data and events related to GWD that occurred from 1981 through 2013. These findings are synthesized in the Discussion section. Finally, the Conclusion and Recommendations section provides future directions for GDEC.

## 2. BACKGROUND

Historical accounts of Guinea worm disease (GWD) can be traced far back into antiquity (Hirsch, 1883). The Ebers Papyrus (ca. 1550 B.C.E.), written during Dynasty XVIII of ancient Egypt (ca. 1550 B.C.E. - ca. 1292 B.C.E), mentions the malady occurring amongst Pharaohs and those of the regal court (Adamson, 1988). Plutarch (ca. 46-120 C.E.) described Greek historian and geographer Agatharchides's (ca. 150 B.C.E.) reference to the inhabitants living along the shores of the Red Sea suffering from GWD (Hirsch, 1883). Galen (131-210 C.E.) named the disease "dracontiasis" (Castellani & Chalmers, 1919). Avicenna (980-1037 C.E.) was the first to offer a scientific description of clinical symptoms associated with GWD and called the Guinea worm (GW) "irk al medina" which is Arabic for "Medina thread" (Watts, 1996). Published in *Systema Naturae* (1758), Linnaeus conferred the contemporary scientific name *Dracunculus medinensis*; Latin for "little dragon of Medina," reflecting the eighteenth century association of GW to one of two destinations for Islamic pilgrimage, Medina (Watts, 1987b).

Not endemic to the Western Hemisphere, GWD was introduced to the Americas via the transatlantic slave trade (Hoepli, 1969). The first documented incidence in the Americas occurred in 1599 after Dutch sailors arrived in Buenos Aires from the Guinea Coast of west Africa—from which the name "Guinea worm" originates. As early as the 1680s, English explorer William Dampier used the term. Writing from the Caribbean island of Curaçao in 1693 he noted his and others' affliction with GWD upon their arrival in Virginia the year before after inhabiting the West Indies for more than a year (Watts, 2000).

The most recent imported case of GWD documented in the United States (U.S.) occurred in the latter half of 1995 in a nine-year-old female Sudanese immigrant that had relocated to

Nashville, Tennessee in September 1995. A month prior to her arrival, she had been treated for GWD until the entire GW was successfully extracted. Three weeks after coming to the U.S., she developed a new ulcer over her left ankle and soon after, a GW began to protrude. She was admitted to the hospital for surgical removal and intravenous antibiotics (Spring & Spearman, 1997).

Another case documented in a non-endemic country occurred in Japan in July 1983. This was the first known human case of GWD ever recorded in the country. A 42-year-old man was seen in a hospital for a generalized urticarial reaction. He was injected with an antihistamine and within two days the rash cleared up. A week later, the man noticed an ulcer had developed on his lower right leg. In mid-August, he returned to the hospital where he was examined. Over the next six days the ulcer continued to grow, though slowly. As a result, an operation was performed on the pus filled ulcer where upon exploration a “white worm-like substance” was removed. Laboratory results concluded the substance to be a gravid female GW. After a travel history of the man had been taken it was presumed the GW had been contracted in Japan, since seven years had passed since the man last left the country, and the prepatent phase only lasts 10-14 months (Kobayashi et al., 1986).

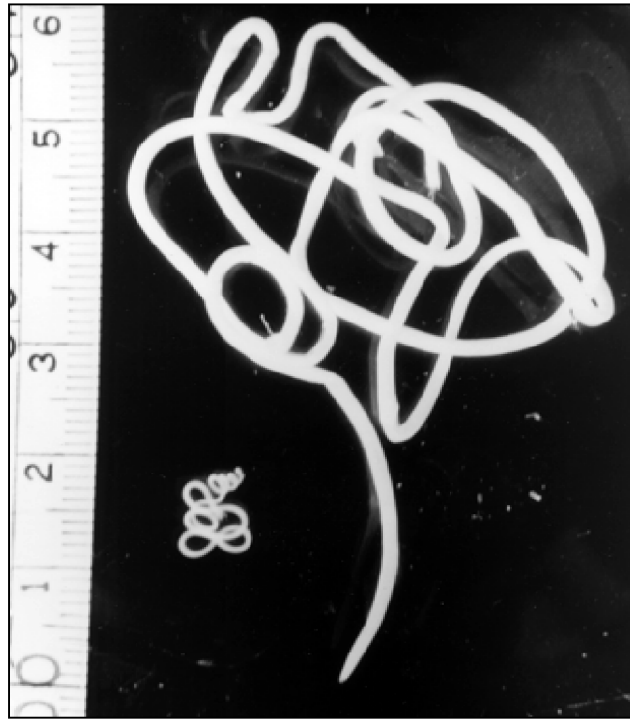
Isolated cases of indigenous GWD have been reported from Indonesia and Korea with articles subsequently published in 1926 and 1927, respectively. Each of the incidents from Indonesia, Japan, and Kora were thought to be from zoonotic transmission as the possibility existed that GW transmission occurred through the ingestion of raw freshwater fishes acting as a paratenic hosts rather than drinking water infested with copepods harboring GW larvae (Cairncross et al., 2002).



Dracunculiasis is an infection caused by the parasitic nematode *Dracunculus medinensis* (*D. medinensis*), or simply, the Guinea worm. Harboring GWs does not necessarily mean a person will suffer the disease. The GW itself does enter the disease phase unless/until it is ready to emerge through the skin of its final host. A tiny freshwater crustacean, or copepod (*Cyclops* sp.), is the intermediate host which *D. medinensis* depends to perpetuate its lifecycle as well as the vehicle to transmit infective third-stage larvae to the final host. The transmission cycle of dracunculiasis was described by May (1950) as a “three-factor complex” consisting of human, copepod, and the GW. The symbiosis of these actors is presented below.

## **2.1. Biological Agent**

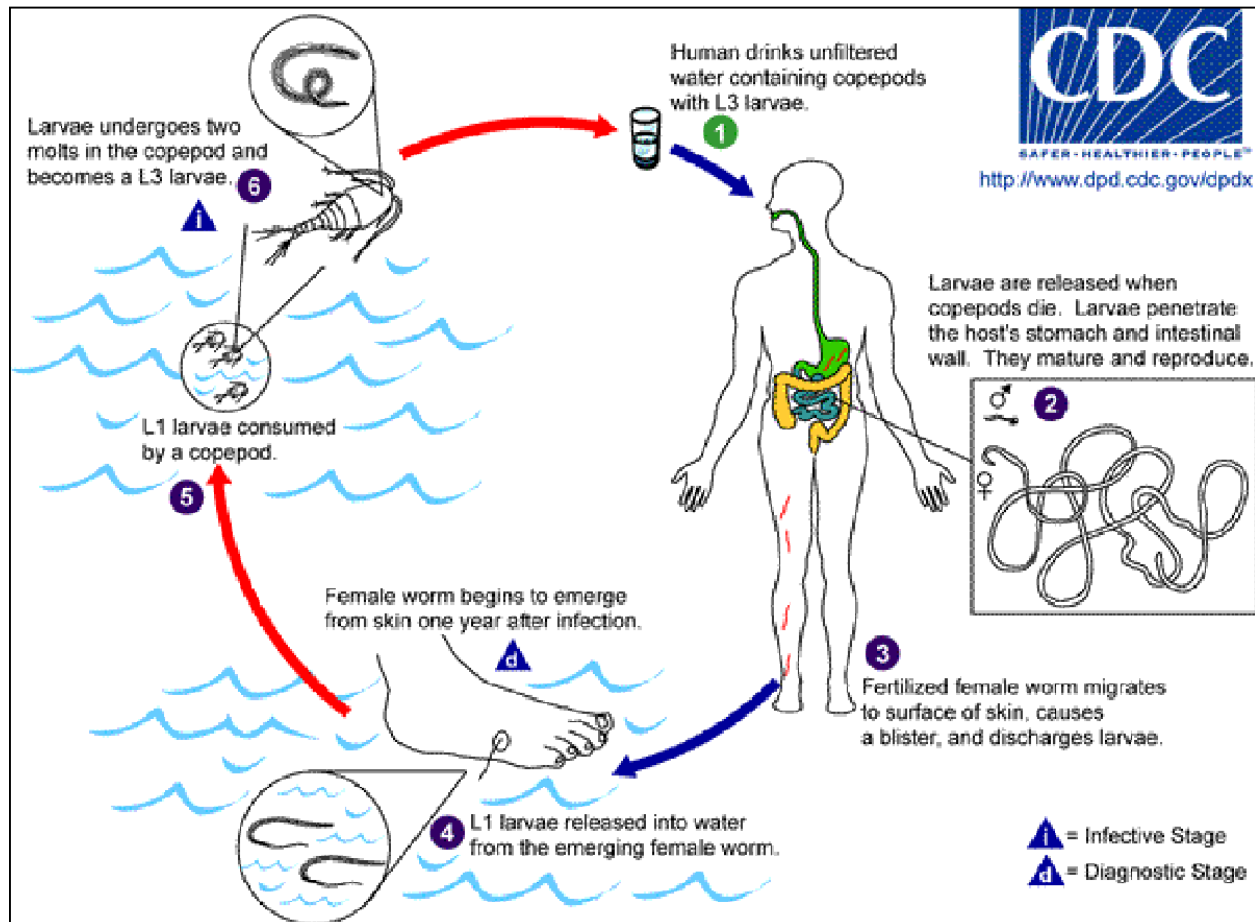
The *D. medinensis* parasite is the only species of the *Dracunculus* genus that results in the manifestation of dracunculiasis in humans, which are natural reservoirs. One of the longest nematodes known, the mature female is the largest tissue parasite found in humans (WHO, 2005a). A gravid female presents as a flaccid, thin, milky-white thread, measuring 500-800 millimeters in length and 1-2 millimeters in diameter (Muller, 2002). One specimen nearly 1,200 millimeters long has been documented (Hunter, 1996). The parturient female GW has a double uterus filled with 1-3 million embryos that take up the entire body cavity. Smaller than their female counterparts (Figure 1), males measure 15-40 millimeters in length and 0.40 millimeters in diameter. The male GW is rarely recovered for study because shortly after mating they become encysted, die, and are typically absorbed by the human host, although some calcified specimens occasionally appear in x-rays (Muller, 2002).



**Figure 1.** Male and female specimens of *D. medinensis* (measured in centimeters); the female is the larger of the two (Cairncross et al., 2002).

#### **2.1.1. The Transmission Cycle of Dracunculiasis/Life Cycle of *D. medinensis***

The transmission cycle of dracunculiasis is synonymous with the life cycle of *D. medinensis*. Mating and fertilization transpire inside the final host for which *D. medinensis* also depends on for transportation to a water source so it can release its larvae starting a new life cycle. A graphic depiction of these cycles is presented below in Figure 2.



**Figure 2.** The transmission cycle of dracunculiasis/life cycle of *D. medinensis* (CDC, n.d.-b).

**2.1.1.1. Embryogenesis.** First-stage *D. medinensis* larvae have pointed tails and fully formed guts measuring 490-737 micrometers in length and 18-24 micrometers in diameter. They live in water for 4-7 days thrashing around in movements that mimic free-living aquatic nematodes until ingested whole by one of a variety of carnivorous microcrustacean copepods (intermediate host) required for further development. Once inside the intermediate host, the anterior end of the larvae penetrates the gut wall reaching the hemocoel in 1-6 hours where they undergo two molts becoming infective third-stage larvae within 14 days (Muller, 2002).

**2.1.1.2. Intermediate Host.** Tiny, free-swimming, carnivorous, freshwater microcrustacean copepods, sometimes referred to as water fleas, are the vectors that harbor

larvae of *D. medinensis* (Figure 3). They favor transient or permanent stagnant sources of freshwater, preferably one that is rich in organic matter and shaded by trees (Watts, 1984). Russian naturalist Aleksey Fedchenko provided the first accurate description of the development of *D. medinensis* larvae within the copepod in 1870 (Muller, 1971). Until the 1980s, all of the copepod species were classified as sub-genera of the single genus, *Cyclops*. This has been subdivided and the most important species for the transmission cycle of GWD/life cycle of *D. medinensis* are listed in by the following genera (Muller, 1990):

- *Mesocyclops*: *M. aequatorialis* and *M. kieferi*
- *Metacyclops*: *M. margaretae*
- *Thermocyclops*: *T. crassus* (Figure 3), *T. incises*, *T. inopinus*, and *T. oblongatus*



**Figure 3.** Female *T. crassus* with egg sacs (Hopp, 2006).

**2.1.1.3. Definitive Hosts.** The aim of *D. medinensis* larvae is to secure a final host in which to fully mature and mate in order to perpetuate the life cycle. Contemporary thought

dispels the possibility of zoonotic transmission to humans from other nonhuman definitive hosts (Cairncross et al., 2002).

*2.1.1.3.1. Humans.* When humans ingest water from sources infested with intermediate host copepods that harbor infective third-stage *D. medinensis* larvae, the copepod dissolves in the stomach releasing the larvae. Once liberated, the larvae make their way through the gut until penetrating the duodenal wall of their human host. Within 15 days, *D. medinensis* can be found in the abdominal and thoracic muscle planes from where they will continue their journey to the connective and subcutaneous tissues until mature male and female larvae meet and mate about 100 days after being consumed by the human host (Muller, 2002).

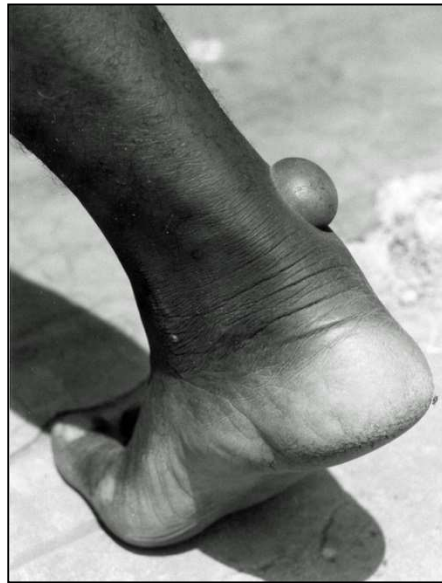
*2.1.1.3.2. Other animals.* Various species of *Dracunculus* are known to naturally infect some mammals and reptiles. Cases of GWD have been found in cattle, dogs, donkeys, foxes, horses, jackals, and sheep in Uzbekistan and documented reports amongst dogs in 1958 and a domestic cat in 1963 from Kazakhstan (Republic of Uzbekistan, 1999). In scientific experiments, dogs proved to be the most successful definitive hosts of *D. medinensis* in a laboratory setting (Muller, 1971). Recently, GWs obtained from dogs in Chad were found to be genetically identical to *D. medinensis* which is the only species that causes GWD in humans (see Eberhard et al., 2014). More about the finding is presented in the Discussion section.

## **2.2. Dracunculiasis**

Mature female GWs move freely throughout the connective tissues until ready to emerge. Males die about six months after initially ingested. Ten to 14 months after infested copepods have been consumed gravid female GWs begin a journey to surface through the skin of the host (Muller, 1983). This is when the GW enters the stage of an infectious disease in humans.

### 2.2.1. Clinical Manifestations

**2.2.1.1. Symptoms.** Though female GWs are present in their human hosts for 10-14 months, infected individuals are asymptomatic until a gravid, mature female is ready to erupt through the skin causing an inflammatory reaction that results in localized erythema and tenderness which is typically the first acute symptom. This may be accompanied by nausea, vomiting, pruritus, watery diarrhea, hives, giddiness, fainting, or shortness of breath (Muller, 1983). The gravid GW secretes a milky-white toxic irritant occupied with eosinophils, monocytes, and polymorphonuclear leukocytes below the derma resulting in a burning sensation followed by the rise of a large blister that is red in color (Figure 4) above the dermis indicating the site of imminent emergence (Gilles, 1983).



**Figure 4.** The female GW induces a painful blister (CDC, n.d.-c).

**2.2.1.2. Diagnosis.** An individual who presents with one or more skin lesions accompanied by an emerging GW is a positive diagnosis of GWD (Figures 5, 6). People living in endemic areas rarely have trouble identifying a case of GWD. Those afflicted are usually familiar with the signs and symptoms associated with the patent phase (Tayeh & Cairncross, 1993).



**Figure 5.** A GW and the skin lesion created (WHO, n.d.).



**Figure 6.** A GW emerging from an infected person's foot (Medicine, n.d.).

**2.2.1.3. Site of emergence.** Although GWs emerge from the lower extremities in 80-90% of cases (Figures 5, 6, 7, and 8), they can be found surfacing from other parts of the body, including the head, torso, upper extremities, buttocks, and genitalia (Ruiz-Tiben & Hopkins, 2006). Muller (1971) suggested the preference to surface from the lower limbs was a geotactic response. The emergence of multiple GWs at the same time is not uncommon. In fact, it is normal to observe one to three GWs emerge in unison. Reddy et al. (1969) documented a case with 40 GWs surfacing simultaneously.



**Figure 7.** A GW emerging from the bottom of a foot (Wolfe, 2003).

**2.2.2. Treatment.** Treating GWD is a tedious process that can last for months and each time a new GW emerges it further cripples the sufferer while increasing the risk of tetanus and various secondary infections (Lucas, Oduntan, & Gilles, 1969). Numerous traditional remedies exist in endemic areas despite their ineffectiveness (Muller, 1971). There is neither a vaccine to prevent the disease nor any medication to treat it. Treatment includes removing the whole GW and general wound care. A method practiced since antiquity and still used today, it is recommended to extract the GW slowly, only a few centimeters a day, by rolling it on a stick



(Figure 8). This is still a useful technique so long as it begins when the GW first emerges (Cairncross et al., 2002). Patients should rest and elevate the affected part(s) while attempting to keep the local lesion as clean as possible. When indicated, a tetanus toxoid injection should be given (Gilles, 1983).



**Figure 8.** Traditional method of slowly winding out the GW on a stick (CDC, n.d.-a).

**2.2.2.1. Surgical Removal.** The first large scale study on surgical extraction techniques was conducted in southern Rajasthan, India where practitioners of Ayurvedic medicine developed a simple, effective, and quick procedure to completely extract GWs before they erupt. Successful extraction of the whole GW through a small incision provides a remarkable decrease in morbidity. Through the application of contemporary aseptic procedures, simple surgical instruments, and a local anesthetic, the process is painless and the small incision usually heals in 1-2 days (Rohde, Sharma, Patton, Deegan, & Sherry, 1993).

**2.2.3. Transmission.** Seeking relief, sufferers immerse the affected body part(s) in water causing the blister to rupture. Shortly after, a skin lesion (ulcer) develops, where nearly five centimeters of the GW's anterior end can be seen (Muller, 1979). On contact with water, a prolapsed loop of double uterus responds with a spasmodic, contractile force which releases

copious amount of first-stage GW larvae in a milky stream. Subsequent contractions release a diminished number of larvae until they have all been expelled, which can take 2-6 weeks or as long as five months. One person with GWD has the potential to contaminate sources of DW wherever ecological conditions permit a suitable habitat for copepod species that harbor GW larvae as each emerging GW can purportedly release as many as three million larvae (Hunter, 1996).

According to Muller (1979), interrupting transmission of GW in an endemic area for one complete season ends indigenous transmission unless a new case imported from another area reinfects DW sources. Transmission of GW typically occurs via stagnant small bodies of fresh water containing copepods infested with GW larvae. Common water sources that harbor such populations are ponds, cisterns, pools in dried-up river beds, temporary hand-dug wells, and step wells (Ruiz-Tiben, Hopkins, Ruebush, & Kaiser, 1995). The intermediate host vector is water bound and cannot fly, thus transmission is local (Cairncross, Braide, & Bugri, 1996). Completion of the GW's lifecycle comes when the female expels the last of her larvae. However, so long as the larvae are deposited in a freshwater body infested with the requisite copepod species and ingested, a new transmission cycle begins.

**2.2.3.1. Seasonality of Transmission.** Occurrence of infection is linked to the use of small DW sources in semi-arid regions and the seasonal variation of rainfall. In order to control GW transmission, an understanding of seasonal patterns of distribution and occurrence are key (Watts, 2007). Watts (1994) identified four patterns of seasonality: 1) areas of predominantly wet season transmission; 2) areas of predominantly dry season transmission; 3) year round transmission; and 4) desert transmission.

Bordering the southern periphery of the Sahara Desert, Burkina Faso, Ethiopia, Mali, Mauritania, Niger, and Sudan experience their peak transmission season during the mid-year rainy season (May to October) when only stagnant surface water sources are available. Benin, Ghana, Ivory Coast, and Togo experience peak transmission during the dry season (October to March) when surface water is most scarce and concentrated in certain areas. Nigeria experiences two peak transmission seasons; one occurs in the southern half of the country from November to February and another in the dryer northern half from May to August (Ruiz-Tiben & Hopkins, 2006). South Sudan experiences a longer transmission season than Sudan (Hopkins, Ruiz-Tiben, Eberhard, & Roy, 2010). Months of seasonal GW transmission for individual endemic countries (ECs) and previously ECs are presented below in Table 1.

Months of Guinea Worm Transmission for Endemic and Previously Endemic Countries												
Country	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Benin												
Burkina Faso												
Cameroon												
CAR												
Chad												
Ethiopia												
Ghana												
India												
Ivory Coast												
Kenya												
Mali												
Mauritania												
Niger												
Nigeria	South				North						South	
Pakistan												
Senegal												
South Sudan												
Sudan												
Togo												
Uganda												
Yemen												

**Table 1.** Months of GW transmission in endemic and previously endemic countries (Hopkins et al., 2010; Hopkins, Ruiz-Tiben, Eberhard, & Roy, 2013; Ruiz-Tiben & Hopkins, 2006).

**2.2.4. Morbidity.** Most individuals who suffer from GWD recuperate spontaneously whether or not they seek treatment (Muller, 1979). However, it is an enormous source of morbidity. Extensive pain leads to a reduced labor force often causing economic devastation for ELs (Belcher, Wurapa, Ward, & Lourie, 1975). Kale (1977) found the most severe disabilities to be correlated with the location of a surfacing GW and coincidentally the period of incapacitation was protracted along with the severity of disability as the number of emerging GWs increased. Secondary bacterial infections are accompanied by inflammation and pain at the site of the skin lesion (Ruiz-Tiben & Hopkins, 2006).

When female GWs do not emerge, they typically become encysted and calcify whereas male GWs are encapsulated, die, and are typically absorbed by the human host. However, serious problems have been attributed to the location of some GWs including death. A retrospective study of 10,032 x-rays by Reddy et al. (1968) showed 20 calcified GWs present in the pelvis and abdomen of one patient. Citing multiple studies, Ruiz-Tiben and Hopkins (2006) found the period of incapacitation averaged 8.5 weeks with a range of 2-16 weeks. Rohde, et al. (1993) noted a significant decrease in morbidity through surgical extraction with the wound completely healed in 9.5 days when performed before the subcutaneous emergence of the GW.

**2.2.4.1. Populations at Risk.** Overall, GWD is distributed equally amongst sexes. Of course in some instances exceptions could be found. Occupational role was found to be a factor that placed individuals at higher risk of infection. A study by Ward, Belcher, Wurapa, and Pappoe (1979) in southern Ghana found that males, especially those involved with farming activities, had the highest risk of infection. In Uganda's Kotido District (1996-2001), the majority of GWD cases were found in women aged 11-40 years (Rwakimari, Hopkins, & Ruiz-Tiben, 2006). These authors concluded that the women were more likely to be infected as a

consequence of the role they played in gathering household water supplies, thus, increasing their likelihood to drink directly from contaminated sources of DW before without filtering it as may be done at home.

The overall health of mothers and their ability to care for young children is affected by GWD. When a mother cannot look after herself, she becomes weak, is underfed, and therefore is less able to look after her children (Watts, Brieger, & Yacoob, 1989). In addition to the crippling pain and misery produced, GWD affects the socioeconomic well-being of entire communities where it is an annual recurrence. When adults are incapacitated by GWD, children are usually tasked to take over agricultural and household responsibilities instead of attending school, so long as they are not incapacitated themselves. School-aged children who suffer from GWD may miss school if they are too disabled by pain associated with the emerging GW (Ruiz-Tiben & Hopkins, 2006).

**2.2.4.2. Socioeconomic Impact.** The seasonal pattern of GWD typically coincides during the most labor intensive times of the agricultural season. Whether harvesting or planting, the economic impact on communities can be severe. Agricultural productivity is negatively impacted by the disabling effects of GWD, contributing to further economic devastation in already poor, rural communities that suffer from high annual incidence rates (Ward, 1983). From an analysis of previous studies on agriculture production and seasonal disability as a result of GWD in West Africa, Shulman (1983) suggested “a causal relationship between labor losses resulting from dracunculiasis-related physical incapacitation, production of inadequate staple food supplies, and seasonal chronic malnutrition” (p. 141). By reducing GWD-related disability, crop yields would increase as an appropriate labor force is more readily available for harvesting and/or planting, thus contributing to an improved nutritional status (Shulman, 1983).

In October 1986, Sudanese health officials worked with UNICEF to assess the distribution and prevalence of GWD in areas of the Nuba Mountains in Kordofan Province. The study suggested that disability associated with GWD was very likely “a major contributing factor to the continually poor agricultural output and the resulting low income level of farmers in this area” (WHO, 1987b, p. 128).

Research conducted to examine the correlation of GWD-related morbidity and rice production for nine LGAs in four adjoining States of southeastern Nigeria (Anambra, Benue, Cross River, and Imo) from September-December 1987, concluded that through the provision of clean DW supplies in rural areas, prevalence of GWD would decrease along with disability that reduces worker productivity which would in turn enhance rice production. As a result, the author suggested agricultural productivity would double and raise the overall quality of life for inhabitants of the area generating an estimated \$20 million annual return in profits from sales of rice alone (de Rooy, 1987).

A cost-benefit analysis of the Global Dracunculiasis Eradication Campaign (GDEC) funded by the World Bank compared expenditures on associated eradication activities to economic gains as a result of GDEC. Prevention of GWD is economically beneficial to income generation as a consequence of increased agricultural production as more than half of a locality’s inhabitants can be simultaneously immobilized (Ruiz-Tiben & Hopkins, 2006). Based on an average five weeks of lost labor per individual incapacitated by a GWD-related disability, a 29% economic rate of return (ERR) was calculated. According to the authors, an institution like the World Bank considers an ERR of > 10% to be a sound economic investment (Kim, Tandon, & Ruiz-Tiben, 1997).

A cross-sectional survey of school children aged 6-14 from four primary schools in Idere, Ibarapa LGA, Oyo State, Nigeria during the 1981-1982 school year found high rates of student absenteeism corresponded with GWD season. Of the 1,495 students enrolled at the time of this research, 21.2% of them showed signs of GWD. Records obtained from the schools indicated GWD as the cause cited by 85 students that permanently dropped out of school (Ilegbodu et al., 1986). Preventing large numbers of school aged children, especially those who suffer annually from GWD from attending school and not completing their education, further contributes to the cycle of poverty found in endemic area (Smith et al., 1989).

**2.2.5. Mortality.** Mortality is rarely associated with GWD, but death is not unheard of. This may be seen as one of the reasons it has not received the international notoriety of the “killing diseases.” One fatal complication is tetanus that may result from secondary bacterial infections in subcutaneous lesions (Hopkins, 1983). Some secondary infections involve bones, the periosteum, tendons, and other deeper structures and tissues in the body that can become lethally septic (Gilles, 1983). Mortality has been linked to GWs that entered the brain or heart (Hopkins, 1990). Reddy and Valli (1967) implicated GWs as the source of lesions in extradural spaces causing compression of the spinal cord that resulted in death.



### **3. DATA AND METHODS**

#### **3.1. Data Sources**

An extensive literature review of the Guinea worm and Guinea worm disease (GWD) was carried out from which all the data presented herein was extracted. Quantitative and epidemiological data were obtained from the archives of three secondary data source journals: Guinea Worm Wrap-Up (1983-2014) and Morbidity and Mortality Weekly Report (1981-2014) from the Centers for Disease Control and Prevention and the Weekly Epidemiological Record (1982-2014) from the World Health Organization. For the purposes of uniformity, all campaigns involved in the global eradication of GWD worldwide are collectively known as the “Global Dracunculiasis Eradication Campaign” (GDEC). A “Guinea Worm Eradication Program” (GWEP) refers to large scale national eradication campaigns. Most countries involved in GDEC used “GWEP” in reference to their national campaign. The two exceptions were Ethiopia and Nigeria. To maintain consistency and eliminate confusion, herein each national program will be referred to as a “GWEP” with the country’s name placed before it.

#### **3.2. Methods**

This thesis is a retrospective study composed from annual records of GWD case reports (see Meade & Emch, 2010) that reconstructs GDEC starting from its inception to the final data collected for 2013. All quantitative figures and epidemiological information were collected from secondary data sources. Quantitative data reported in the three journals listed above were compared and when an inconsistency from one journal appeared it was further investigated to identify the most up-to-date source of information (or likely source of error). Outside of these

three journals, literature that published epidemiological figures was employed as a reference to aid in the determination of the most valid figures. The literature review was conducted in a similar manner as outlined by Creswell (2014). The literature on GWD in general is presented in thematic order and the literature on the GWEP is reported in chronological order.

### **3.3. Limitations**

Information presented in this thesis was dependent on the accuracy of the data collected found in the source journals. When applicable, updated figures from one year were corrected retrospectively to reflect the most accurate data during the year it was intended keeping the reader from having to back track. Spatial data was limited to that which the reporting agency decided to make available. In several instances, inconsistencies occur in the names of locations reported over multiple years and even between journals conveying information during the same epidemiological year, making it difficult to pinpoint geographic entities. Updating governmental administrative divisions and their level of political authority were not kept current for many endemic countries. Thus, some reports from second-level administrative divisions printed within the source journals did not always reflect the appropriate administrative division name. When possible, this thesis provides the accurate naming convention.

#### 4. RESULTS

A literature review of the Global Dracunculiasis Eradication Campaign (GDEC) is outlined annually beginning with 1981 and includes each calendar year up to 2013. International interest was slow at first, but once it began to catch on, support for the global campaign grew. By the end of 1989, almost all endemic countries (ECs) had instituted a national Guinea Worm Eradication Program (GWEP) and two years later, every one of them had performed some level of an active Guinea worm disease (GWD) case search. Data on the number of localities that reported  $\geq 1$  cases of GWD begins with 1991 as valid information was limited to only a few ECs before that. After suspicions of indigenous cases were confirmed late in 1993, Yemen was added the list of known ECs in 1994 bringing the number up to 20. Sudan completed the first thorough nationwide active case search in 1996 that finally provided a solid portrayal of the true nationwide extent of GWD, resulting in an explosion of the global case total.

Levels of governmental administrative divisions for each country are identified when they are first mentioned as well as updated by year in countries where reorganization of first-, second-, and when applicable, third-levels occurred. Total case numbers and the number of localities that reported  $\geq 1$  cases of GWD in one calendar year do not always reflect the collective sums that were published by the World Health Organization (WHO). In some instances I have updated them to reflect numbers published at a later time and added them retrospectively where appropriate. Key political events that occurred in ECs are mentioned briefly such as coup d'états, civil wars, and ethnic conflicts, but the backgrounds of these instances are not covered in detail.

#### 4.1. Events Leading to the Global Dracunculiasis Eradication Campaign

At the United Nations (U.N.) General Assembly's session in November 1980, the approaching time period from 1981-1990 was proclaimed as the *International Drinking Water Supply and Sanitation Decade* (IDWSSD). Under Resolution 35/18, member countries of the U.N. committed "to bring about a substantial improvement in the standards and levels of services in drinking-water supply and sanitation by the year 1990" (WHO, 1981, p. 1). In December 1980, the Assistant Director for International Health at the U.S. Centers for Disease Control (CDC)<sup>1</sup> noted that because the aim of the IDWSSD was "to provide safe drinking water for all peoples of the world by December 1990" the Resolution "afforded an unprecedented opportunity to eradicate dracunculiasis" (Hopkins & Hopkins, 1991, p. 19). Shortly after, in a letter to the editor of *Science*, Hopkins and Foege (1981) asserted the provision of safe drinking water (DW) to all localities that are without may alone result in the disappearance of GWD. They suggested this as a means to "provide a visible, measureable 'health benefit' as an early indicator of progress of the Decade" (p. 495) and by April 1981, the eradication of GWD was recognized as a sub-goal by the IDWSSD Steering Committee<sup>2</sup> (CDC, 1983a).

Hopkins (1983) promoted the opportunity to eradicate GWD during the IDWSSD over other methods of disease control by differentiating between the scales "elimination" and "eradication" programs. In the former, the focus is on "the complete interruption of transmission of the disease from a defined geographic region or country" while the latter's aim is "the elimination of the disease worldwide" (p. 208).

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<sup>1</sup> The words "and Prevention" were added in 1992, but, by law, the well-known three-letter acronym was retained (CDC, 1996k).

<sup>2</sup> The Steering Committee consisted of representatives from United Nations Development Program, the World Health Organization, the World Bank, the United Nations, the United Nations Children's Fund, the International Labor Organization, and the Food and Agriculture Organization of the United Nations (CDC, 1983a).

As the IDWSSD commenced, of the population without access to safe DW, it was estimated that just over six percent lived in areas of the world where GWD was endemic. The U.N. began asking governments of countries affected by GWD to verify its existence as well as its extent in preparation for strategies to provide safe sources of DW. Areas identified as endemic were to be given priority (Bourne, 1982).

The first concerted effort to eradicate GWD took place in the Soviet Union (Tayeh & Cairncross, 1993) where the disease was known to exist in nine populated areas of Soviet Central Asia in 1923 (Litvinov & Lysenko, 1983). This led to the establishment of the Tropical Institute in Bukhara, which was charged with eradicating GWD from the remaining foci of the Soviet Union that resulted in the last indigenous case being reported in 1931 (Litvinov, 1991). As infrastructure for the delivery of potable water was developed, an inadvertent result was the disappearance of GWD from some countries of Southwest Asia and North Africa (Hopkins & Hopkins, 1991).

India began efforts to rid the country of GWD after a preliminary assessment of its geographic was carried out in October 1979 through surveys sent to the Directors of Health Services in all States and Union territories in the country (Rao, 1981). All surveys were returned by mid-1980 and showed the disease having occurred between 1977 and 1979 in the States (first-level administrative division) of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu<sup>3</sup> plus the union territory of Goa (WHO, 1983a). Later, it was determined that cases reported from Goa were actually imports from Karnataka State (Rao, 1983). From the data, it was estimated 1.8 million people were at risk of contracting GWD in 726 localities throughout seven States and one Union territory in 1979. The study was

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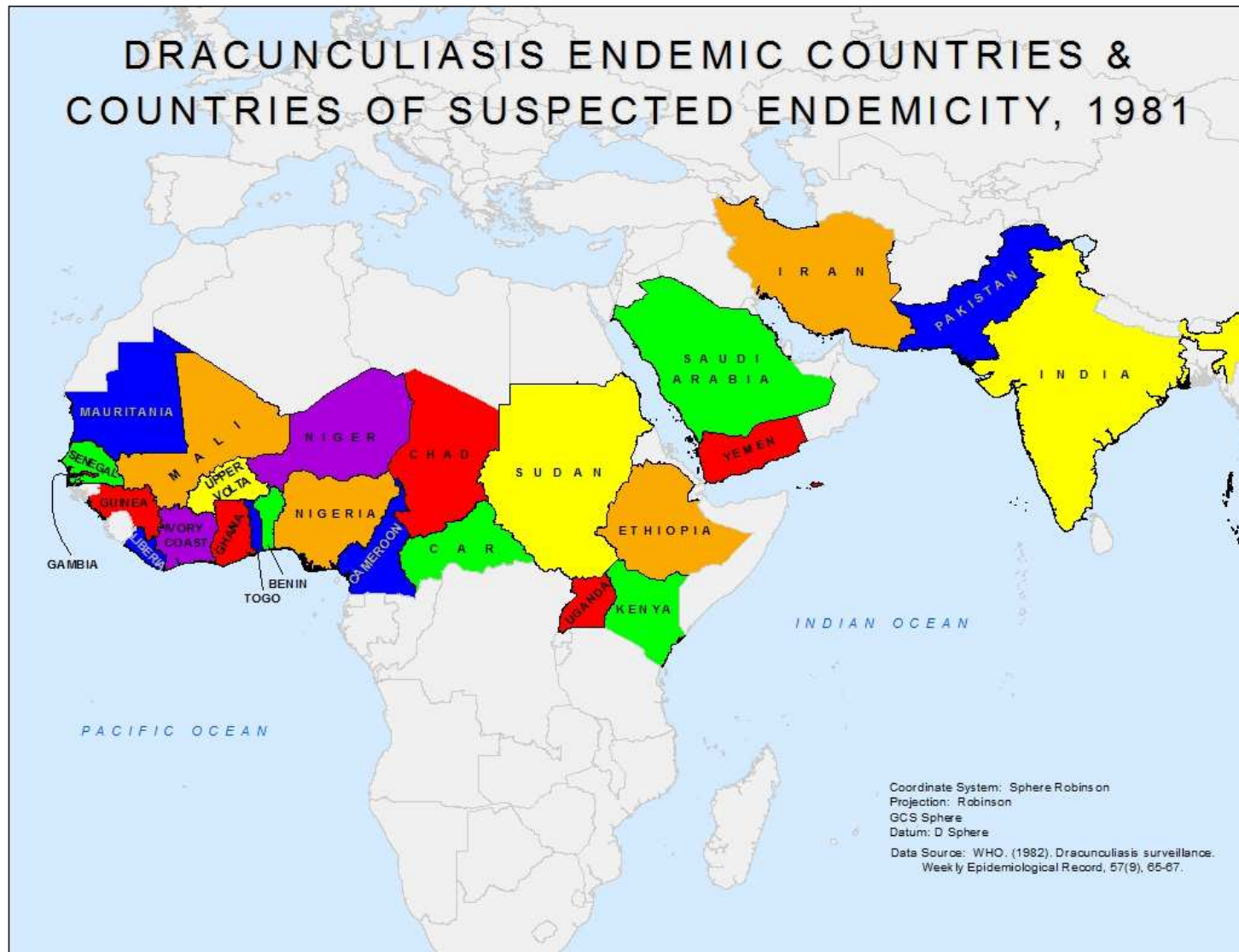
<sup>3</sup> Tamil Nadu's government actually began its own program to battle GWD in 1960 (Kapali, Sadanand, & Prakasam, 1984).

extended through 1980 and as a result the distribution of GWD was found to be more extensive than earlier surveys had implied: 5.9 million people were at risk in over 7,500 localities (Rao, 1981).

*A Task Force on Eradication of Guinea Worm Disease in India* (hereinafter referred as the *Task Force*) comprised of directors of Health Services, delegates of the Union Ministry of Health and Family Welfare, the National Institute of Communicable Diseases (NICD), the Central Public Health Environmental Engineering Organization, and the State Public Health Environmental Engineering Organization, met for the first time in November 1980 in the national capital, Delhi. After the delegates met, suggestions were made to Indian government officials who endorsed the recommendations made (WHO, 1983a).

#### **4.2. 1981**

During the Thirty-fourth World Health Assembly (WHA) in May, Resolution WHA 34.25 was adopted as an “opportunity to eliminate dracunculiasis (Guinea worm disease) as a public health problem in affected areas, where the prevalence of the disease could serve as a uniquely visible and measurable indicator of progress for the Decade” (WHA, 1981). Although cases of GWD were not adequately documented in all affected areas, it was suspected that GW transmission existed in 25 countries found in South Asia and sub-Saharan Africa (Figure 9) based on official data as well as published reports over the previous 31 years (WHO, 1982).



**Figure 9.** Map of countries that were known or suspected to be endemic for dracunculiasis in 1981 (adapted from WHO, 1982).

In Togo, the locality of Kati, Kloto Prefecture (second-level administrative division), Plateaux Region (first-level administrative division) a health education (HE) project was implemented to battle GWD which affected 928 of the approximately 3,000 inhabitants in 1981 (Foly & Caudill, 1987; WHO, 1987c). A nationwide hydraulic survey began in Benin to determine the presence of waterborne diseases, especially GWD, which would offer an epidemiological foundation for its presence to be taken into account for the placement of new wells that provide a safe DW (WHO, 1984a). The Medical Officer for Uganda's Kitgum District (second-level administrative division) in Northern Region (first-level administrative division), led a search for active cases of GWD in 12 localities that surrounded the District capital of Kitgum, in December. Cases were discovered in each locality with the average point prevalence estimated at 13.3% (WHO, 1984b).

In March, India's *Task Force* convened for a second time in Jaipur, the capital of Jaipur District (second-level administrative division) in Rajasthan State, and a third assembly took place in Bhopal, Bhopal District, Madhya Pradesh State, in July. Another active case search was conducted from May through June to provide a more accurate depiction of GWD's extent in the seven endemic States. Paramedical workers carried out the enumeration task and recorded locations of DW. Results indicated 5.9 million people were at risk for GWD in 7,533 localities. In October and November, another active case search was carried out in the seven endemic States. It concluded that 12.2 million people were at risk of GWD in 10,582 localities (WHO, 1983a). As a result, a *National Plan* to eradicate GWD was developed. It consisted of intensified surveillance in endemic areas; determination of priority areas to improve access to sources of safe DW; community HE; and the training of health officers and distribution of operation

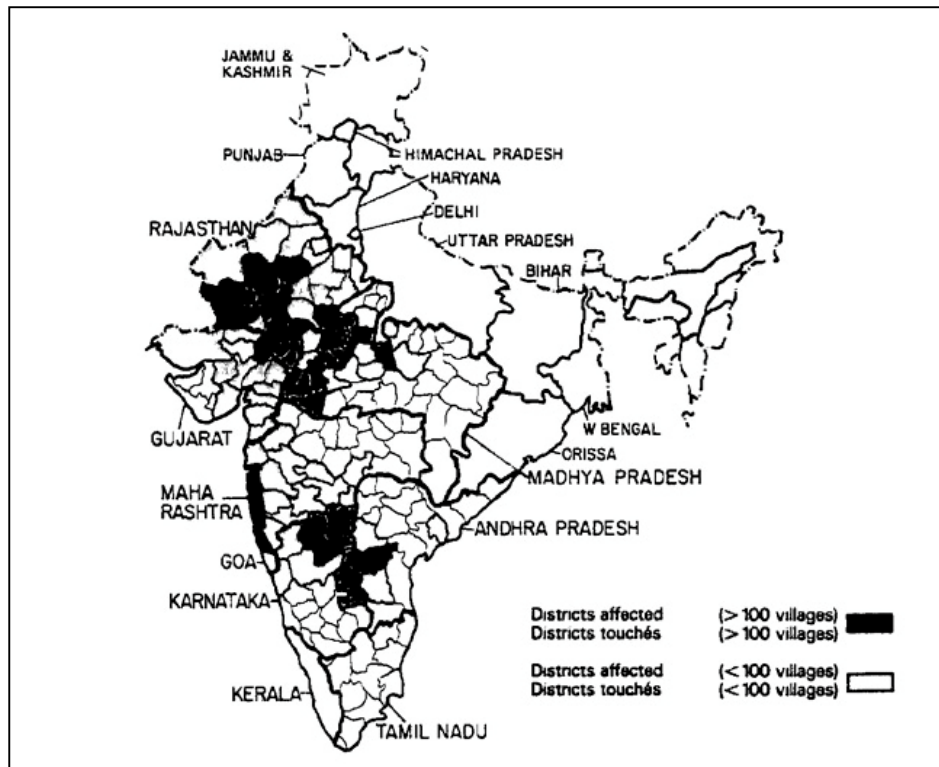


manuals for GWD eradication. India's goal was to eradicate GWD by December 1985 (Rao, 1981; WHO, 1983a).

#### **4.3. 1982**

A project to compare the efficacy of HE and the provision of safe DW to control GWD in Burkina Faso was sponsored by *l'Organisation de coordination et de coopération pour la lutte contre les grandes endémies* (Organization for Coordination and Cooperation against Endemic Diseases [OCCGE]) with additional support provided by the *Strengthening Health Delivery Systems* program of USAID and the WHO Regional Office for Africa (WHO/AFRO; CDC, 1983a).

In conjunction with a WHO sponsored workshop, India's *Task Force* met again from 27-30 April, in Aurangabad, Aurangabad District, Maharashtra State. For the first time, India was able to determine the actual number of people who suffered from, as well as the number of localities that were affected by GWD after a third nationwide active case search was completed in June. The final report indicated 12.6 million people in 11,736 localities were at risk for contracting GWD in six States (Figure 10). Rajasthan State was the most endemic with 14,905 cases found in 6,104 localities. Follow-up visits were made in at least two Districts of each endemic State and suggested that half the actual number of GWD cases may have been miscounted (WHO, 1983a).



**Figure 10.** States endemic for GWD in India, June 1982 (WHO, 1983a, p. 21).

Steps adopted by India to achieve its goal of eradication included: bi-annual active case searches in each endemic District; survey sources of DW for each EL to determine priority for improvement and provision of safe sources of DW; community HE on GWD's mode of transmission and protective measures; chemical treatment of unsafe sources of DW; train District-level health officers, environmental engineers, and other staff involved. Notable features that were implemented by India involved: primary responsibility for all eradication activities were retained by each endemic State; implementation of interventions were conducted within India's primary health care (PHC) system by the healthcare workers present in addition to their other tasks; efforts were coordinated at the national efforts to provide safe sources of DW to the entire rural population by the end of the IDWSSD. India also accomplished the development, publication, and distribution of operation manuals to associates affiliated with eradication efforts;

creation of HE materials for endemic States to use; and the organization of four-day courses to train District-level staff (WHO, 1983a).

A “Workshop on Opportunities for Control of Dracunculiasis” was held in Washington, D.C. from 16-19 June. With funding provided by the United States Agency for International Development (USAID), the Board of Science and Technology for International Development of the U.S. National Academy of Sciences and the WHO organized the event which was the first international assembly devoted entirely to GWD. More than 30 of the world’s leading authorities on communicable disease control, epidemiology, health education, parasitic diseases, sanitary engineering, and vector biology were in attendance. The aims of the Workshop were to share contemporary knowledge about GWD in regard to its epidemiology, surveillance, prevention and control, and economic impact; review alternate control methods that emphasized cost-effectiveness; assess economic, social, and administrative feasibility to incorporate disease control efforts to coincide with PHC alongside water and sanitation projects; and to identify and recommend future basic field and operational research required for the development, implementation, and evaluation of control methods (WHO, 1983b).

Participants attending the *Workshop* concluded that since GWD was easily diagnosed and well known methods of control already existed ECs needed to implement control activities that work in parallel with opportunities provided during the IDWSSD. Recommendations were also made for national health authorities in all endemic or suspected endemic countries assess the nationwide extent of GWD and promote the reporting all GWD incidents. International and bilateral organizations involved in the IDWSSD were urged to press health and political authorities of ECs to prioritize ELs for the provision of safe DW supply projects (WHO, 1983b).

Under the Ivory Coast's Ministry of Public Health and Population, the National Public Health Institute implemented a HE program to include in the national effort to provide hydraulic wells as safe sources of DW to rural areas of the country. The purpose of the HE program was to reduce the incidence of waterborne diseases associated with lack of access to safe sources of DW. Tasked to regularly visit approximately 50 localities every one or two months, health educators taught inhabitants about water-related problems, helped with efforts to improve sanitation, and instructed localities how to maintain their respective wells and conduct simple repairs. To evaluate the HE program, the condition of wells and status of sanitation in for each locality was assessed and diarrhea and GWD were used as progress indicators. The initial survey visited 1,770 localities with 228 (12.88%) of them with cases of GWD (WHO, 1985b).

<b>1982</b>		
<b>Country that Reported Cases of GWD</b>	<b>Case Totals</b>	<b>Percentage of the Global Case Total</b>
Ghana	3,413	5.44
India	49,926	79.65
Ivory Coast	3,920	6.25
Mali	401	0.64
Mauritania	903	1.44
Niger	1,530	2.44
Togo	2,592	4.13
<b>Totals</b>	<b>62,685</b>	<b>100.00%</b>

**Table 2.** Case totals and percentage of the global case total from countries that reported incidents of GWD (WHO, 1986a, 1987a).

The global GWD case total reported in 1982 was 62,685 with data submitted by seven countries. Though Togo (with a population of 2.8 million) officially reported 2,592 cases of GWD in 1982, an informal study by the country's Division of Epidemiology estimated that a more accurate annual count would be 440,000 (CDC, 1984a). India concluded the year with a

count of 42,926 cases, all from active surveillance. Epidemiological data was collected by passive surveillance methods with the exception of India. Data for the other 18 countries suspected of GWD endemicity in 1981 by the WHO was not available and included Benin, Cameroon, Central African Republic (CAR), Chad, Ethiopia, Gambia, Guinea, Iran, Kenya, Liberia, Nigeria, Pakistan, Saudi Arabia, Senegal, Sudan, Uganda, Upper Volta, and Yemen.

#### **4.4. 1983**

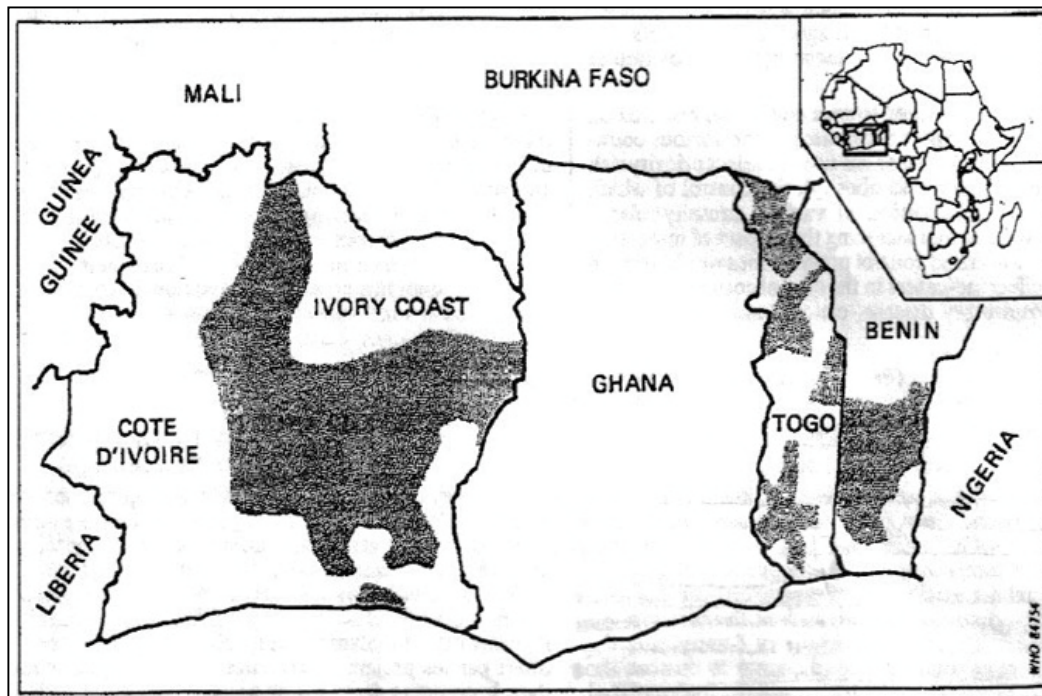
In February, the CDC provided a consultant epidemiologist for Benin, Ivory Coast, and Togo after a request made by WHO/AFRO to assist in the implementation of national *Plans of Action* to control or eradicate GWD in conjunction with IDWSSD undertakings for the West African countries (CDC, 1983a). Representatives from each country gave valuable information about their respective country's IDWSSD activities and GWD control programs. Hydrologists from Benin's Ministry of Public Works had been to 1,412 localities in the Provinces (first-level administrative division) of Atakora, Atlantique, Mono, Ouémé, and Zou as part of a national hydraulic survey that began in 1981 to determine the presence of waterborne diseases at time of the consultant's arrival. Evidence of GWD was found in 676 (47.88%) of the localities that had been visited in Benin (WHO, 1984a).

In 1973, Ivory Coast embarked on a rural water supply initiative that aimed to provide at least one well to every locality with > 100 inhabitants and two wells for localities with > 700 that produced 15-20 liters of DW daily per person. An estimated 10,000 wells had allegedly been drilled and fitted with pumps at the beginning of the year. Random studies in localities that lacked permanent sources of safe DW suggested GWD infection rates of 14-55% in populations

surveyed. Unverified reports indicated the national initiative may have resulted in positive effects for some localities in Ivory Coast (WHO, 1984a).

All five Regions (first-level administrative divisions) of Togo were considered GWD endemic with 19 of 21 Prefectures (second-level administrative divisions) affected. Earlier studies reported annual incidence rates ranging from 27-67% in some ELs. A nationwide rural DW supply program comprised of six separate projects had drilled 280 new wells by February. At the time of the consultant's visit, several similar projects were in deliberation. Supervised by Togo's Ministry of Public Health, HE projects were being carried out by U.S. Peace Corps volunteers (PCVs) in the country's hyperendemic Regions of Savanes and Plateaux (WHO, 1984a).

Of the three countries, GWD was only officially reportable in Togo (CDC, 1983b; WHO, 1984a). By March, the extent of GWD was determined for each country (Figure 11) and respective Ministries were consulted on the feasibility of GWD "elimination" on a national scale. The cases actually documented were thought to be a small percentage of the number of incidents that actually occurred, thus, not a true representation of the actual prevalence in each country (WHO, 1984a).



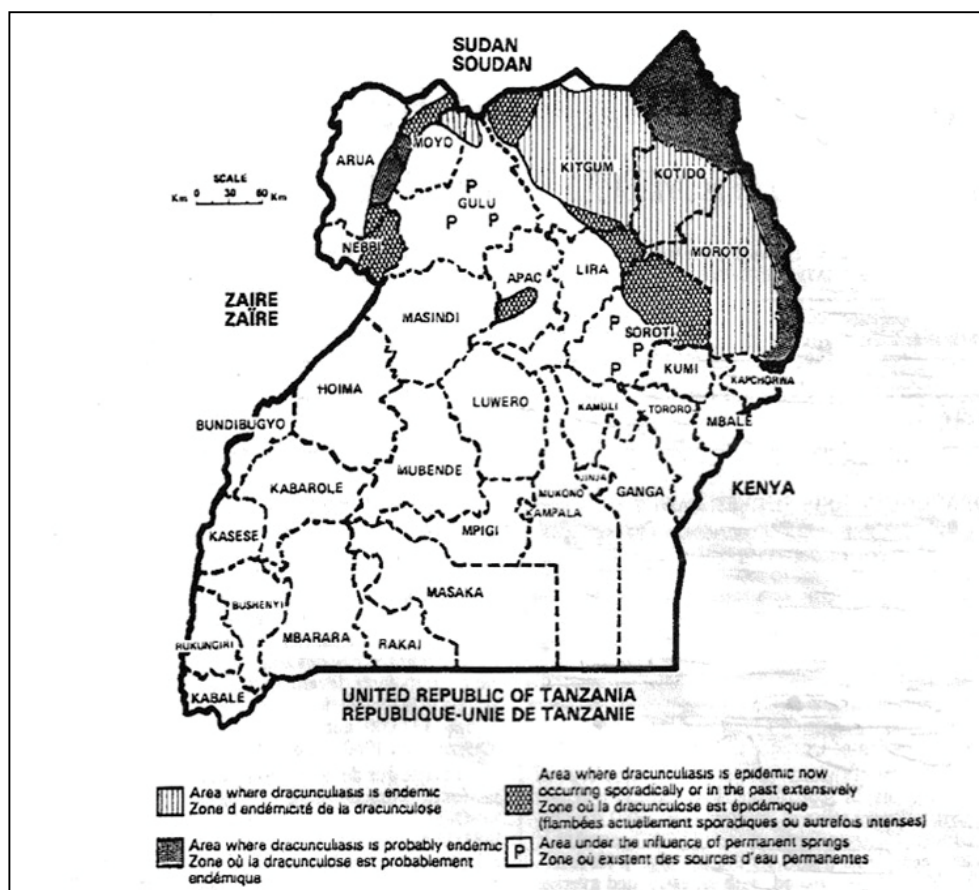
**Figure 11.** Areas endemic for GWD in Ivory Coast, Togo, and Benin, 1983 (WHO, 1984a, p. 2).

In April, civil war broke out in Sudan between the Arab/Islamic North and the black African/Christian and animist South (O'Ballance, 2000).

UNICEF appealed to the CDC for an epidemiologist to visit Uganda to assess whether or not reduction in the number of cases of GWD was a feasible means to monitor the effectiveness of the UNICEF water supply project to decrease the incidence waterborne diseases. The epidemiologist arrived in April to begin the month long consultation (CDC, 1983b). Locations for the provision or rehabilitation of safe DW sources were previously reserved by UNICEF but first, the geographic extent of GWD in Uganda had to be ascertained. Districts (first-level administrative division) in northern Uganda were chosen to for active case searches. These Districts were: Apac, Gulu, Kapchorwa, Kitgum, Kotido, Lira, Mbale, Moyo, Nebbi, Soroti, and West Nile (WHO, 1984b).

Methods used to determine the boundaries of endemicity included records provided by government health units, active case searches of localities, roadside and market searches, cases documented by health care providers, and cluster surveys in localities of thought to be endemic with some selected at random. Incidence rates were determined using retrospective data acquired by individual case histories and accounts given by parents for children who had previously suffered from GWD. The greatest area of GWD endemicity spanned large portions of Kitgum, Kotido, and Moroto Districts. Two other Districts had GWD endemic areas at their northern boundaries, Moyo and Gulu. Arua, Kotido, and Moyo Districts possessed areas where GWD was thought to probably be endemic. Districts with areas classified as epidemic with sporadic incidents or had a history of an extensive occurrence were Apac, Arua, Kitgum, Lira, Moyo, Nebbi, and Soroti (Figure 12; WHO, 1984b). A *Plan of Action* was devised followed by the formation of an inter-ministerial Steering Committee. Control tactics included HE, surveillance, patient care, and the provision of safe supplies of DW with assistance from UNICEF (CDC, 1986b).





**Figure 12.** Provisional geographic boundaries of GWD endemicity in Uganda, 1983 (WHO, 1984b, p. 70).

In May, USAID was invited to review Pakistan's *Malaria Control Program*. While there, two advisors investigated the status of GWD in Punjab Province (first-level administrative division), which at the time had a population of nearly 47 million. They found GWD to be widespread throughout the Province. There were 14,155 cases of GWD reported to health authorities from the hospitals of Punjab Province in 1980. At the time, hospitals were estimated to serve only half the population, therefore, this number was not a true reflection of the Provincial distribution (WHO, 1985d).

India officially launched its national GWEP in 1983. The *Task Force* held its sixth conference in conjunction with the WHO-assisted Workshop on eradication from 13-16 July in

Tirupati, Chittoor District, Andhra Pradesh State. A review of the country's progress was conducted and a list of ELs was compared to lists of localities where plans for the provision of a safe source of DW were to be supplied during 1983-1984. The State of Andhra Pradesh reported all its ELs had access to  $\geq 1$  safe source of DW (WHO, 1984d). Of India's six endemic States, a total of 86 Districts reported ELs: Andhra Pradesh, 6, Gujarat, 13, Karnataka, 8, Madhya Pradesh, 21, Maharashtra, 15, and Rajasthan, 23 (WHO, 1989b).

A revised edition of the *Operation Manual on Guineaeworm Eradication Programme in India*, produced by the NICD was distributed to attendees. The *Task Force* suggested additional funds be secured for safe sources of DW to be delivered in all ELs of the country's most affected State, Rajasthan. In addition, a new method of classification was proposed that identified cases of GWD as indigenous, imported, or migrated with GWD (WHO, 1984d).

An epidemiologist was requested from the CDC by UNICEF in October to assess its DW and sanitation projects in the Nigerian States (first-level administrative division) of Gongola, Imo, and Kwara. Data on GWD was collected and analyzed to determine priority areas for UNICEF projects (WHO, 1984c). To determine whether or not GWD incidence was a suitable indicator of progress, a retrospective method was devised to evaluate the impact of earlier water and sanitation schemes to determine the correlation between GWD incidence and UNICEF's proposed developments in rural areas of the three States (CDC, 1984a).

1983			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Total Cases Compared to 1982
Ghana	3,040	5.38	-10.93%
India	44,819	79.30	-10.23%
Ivory Coast	2,259	4.00	-42.32%
Mali	428	0.76	6.73%
Mauritania	1,612	2.85	78.52%
Niger	ND	N/A	N/A
Togo	ND	N/A	N/A
Upper Volta	4,362	7.72	N/A
<b>Totals</b>	<b>56,520</b>	<b>100.00%</b>	<b>-9.83%</b>

**Table 3.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1982 (WHO, 1986a).

Six countries submitted reports to the WHO in 1983 of documented cases of GWD for a global case total of 56,520; only a quarter of the known or suspected ECs to have at least sporadic indigenous occurrences of GWD. This may have been attributable to the fact that GWD was not yet an officially reportable disease in the majority of them, thus the true global extent continued to be underreported. India was the only EC to provide numbers based on active surveillance (WHO, 1985e).

As presented in Table 3, countries that continued to report cases of GWD to the WHO from the previous year included Ghana, India, Ivory Coast, Mali, and Mauritania. Upper Volta submitted data for the first time since GDEC began and reported the second highest number of cases. India continued to maintain the greatest proportion of the global case total, yet reported 10.23% fewer cases of GWD compared to 1982. Although Niger and Togo released data on GWD in 1982, neither country provided information for 1983 (CDC, 1986b). Of the two countries that reported an increase in cases of GWD, Mauritania added 709 cases to the previous year (78.52%) which was much more significant than the 27 cases Mali added during the same

period (6.73%). Though the global case total fell 9.83% from 1982, this did not represent a true global reduction in cases of GWD as one less country reported data in 1983. In Table 3 and all subsequent tables, the letters “ND” indicate “no data” while N/A signifies “not applicable.”

#### 4.5. 1984

In collaboration with the U.S. Department of Health and Human Services, the WHO designated the CDC as a *Collaborating Center for Research, Training, and Control of Dracunculiasis* (CCRTCD). In its capacity, the CDC was charged to monitor literature published concerning GWD; carry out research in the control, diagnosis, treatment, and prevention of GWD; investigate changes in the epidemiology of GWD; advise and work in partnership with researchers interested in GWD; encourage efforts in the surveillance, study, and control of *D. medinensis* by other countries through consultation, preparation, implementation, and evaluation; and provide supportive training (CDC, 1984b). In November, *l’Initiative internationale contre les incapacités évitables* (International Initiative against Avoidable Disablement [IMPACT]) held a seminar in Kenya and issued the “Nairobi Declaration” to bring attention to the crippling effects of GWD as a major cause of disability on the African continent. A presentation of the negative socio-economic consequences for communities that essentially relied on subsistence farming was given. Specifically, the loss of work days due to incapacity caused by emerging GWs during both the planting and harvesting seasons that lead to malnutrition and the effect on education for children due to their absence from school (CDC, 1984c).

In July, the Indian GWEP’s *Task Force* met in Udaipur, Udaipur District of Rajasthan State. Under the context of PHC, India’s GWEP concentrated its efforts on identifying every EL to determine precedence for providing safe sources of DW. Active GWD case searches were

conducted in every locality of the country's seven endemic States during April and May and again in October and November. In collaboration with the WHO and India's GWEP, provision of safe DW to GWD endemic areas was aided by the *Danish International Development Agency* (DANIDA) in the State of Madhya Pradesh; the *Swedish International Development Agency* (SIDA) in the State of Rajasthan; and USAID in the State of Gujarat. In October, the WHO and USAID responded to a request from the Nigerian Ministry of Health for support developing a national *Plan of Action* to combat GWD by providing two consultants to assist (WHO, 1985e).

On 4 August 1984, Thomas Sankara renamed Upper Volta to Burkina Faso ("fatherland of honest men"). The original ten Departments were reorganized into 30 Provinces (first-level administrative divisions) on 15 August (Law, 1999).

1984			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1983
Burkina Faso	1,739	2.29	-60.13%
Chad	1,472	1.94	N/A
Ethiopia	2,882	3.80	N/A
Ghana	4,244	5.60	39.61%
India	39,792	52.50	-11.22%
Ivory Coast	2,573	3.39	13.90%
Mali	5,008	6.61	1,070.09%
Mauritania	1,241	1.64	-23.01%
Niger	ND	N/A	N/A
Nigeria	8,777	11.58	N/A
Togo	1,839	2.43	N/A
Uganda	6,230	8.22	N/A
<b>Totals</b>	<b>75,797</b>	<b>100.00%</b>	<b>34.11%</b>

**Table 4.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1983 (WHO, 1989e).

By the end of 1984, GWD was known to be endemic in two south Asian and 17 sub-Saharan African countries, but it still was not an officially reportable disease in the majority of countries where it was presumed to be endemic. India continued to be the only EC to have established a national GWEP and provide epidemiological data from nationwide active surveillance (WHO, 1985e). In 1984, data was submitted from 12 ECs to the WHO—twice as many as in 1983—for a global case total of 75,797; 34.11% more cases than the previous year. Countries that continued to provide numbers on GWD were Burkina Faso, Ghana, India, Ivory Coast, Mali, and Mauritania. Moreover, Chad, Ethiopia, Nigeria, and Uganda provided numbers for recorded cases of GWD to the WHO and combined the four countries were responsible for 25.54% of the year's global case total. While Togo did not convey data for 1983, the country reported 1,839 cases of GWD in 1984. For a second consecutive year, data was not received

from Niger. However, in response to the Niger's appeal for assistance with drawing up a national *Plan of Action* to combat GWD, the WHO and USAID sent two consultants to assist in October (WHO, 1985e).

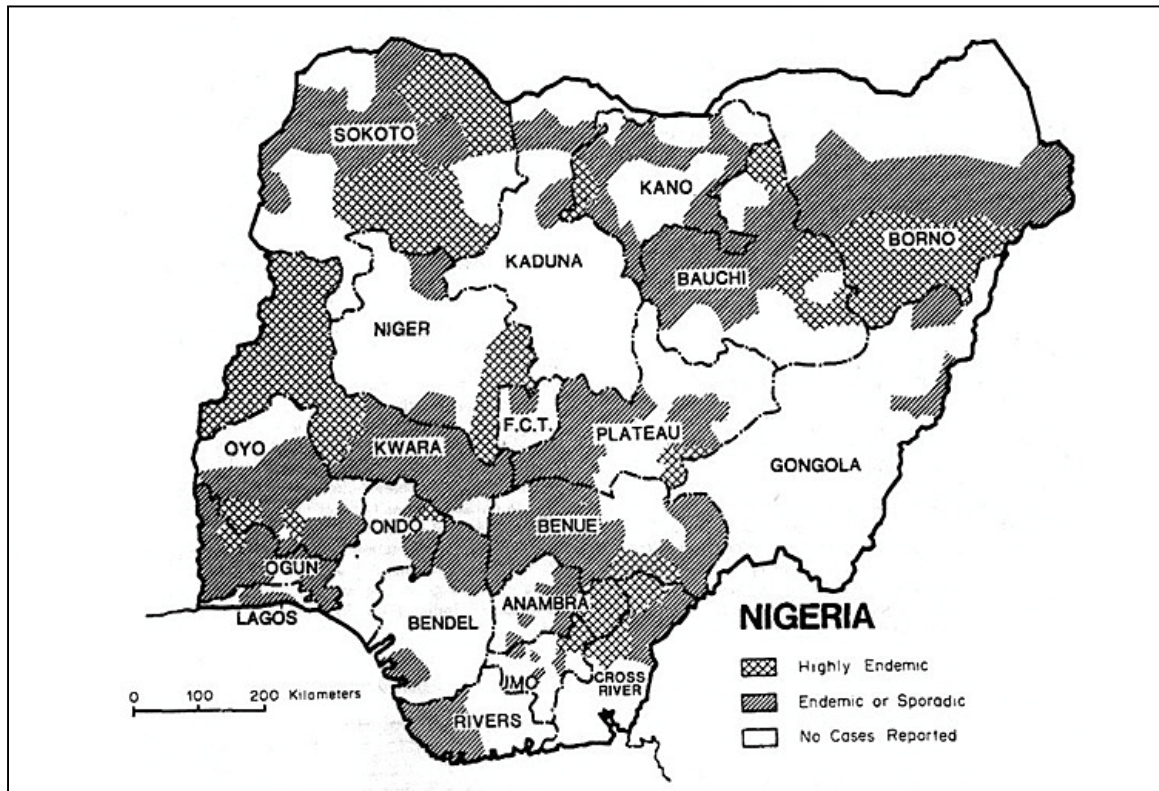
#### 4.6. 1985

An independent appraisal of India's GWEP was performed in January by a team of public health experts that visited each endemic State. The team reviewed records of active case searches, assessed cooperation between water supply authorities and public health staff at all government levels, and noted the nature and extent of HE and vector control (VC) methods. For the third consecutive year, Tamil Nadu State reported zero indigenous cases during the last active case search in November 1984. As a result, Tamil Nadu was removed from India's list of endemic States (CDC, 1985a).

Sponsored by the Federal Ministry of Health, UNICEF, and the WHO, Nigeria hosted its first *National Conference on Dracunculiasis*, from 25-27 March at Ilorin, the State capital of Kwara—the first assembly of this kind outside of India. The *Conference's* main objectives were to assess the national status of GWD and elicit suggestions for its control or elimination from Nigeria (CDC, 1985a). More than 250 people were in attendance including delegates from 17 of 19 States and the Federal Capital Territory. Each delegate made a brief presentation on GWD in their respective area (WHO, 1985c).

Following these presentations, Edungbola, Watts, Kale, Smith, and Hopkins (1986) met with each delegate to document the information previously presented and transcribed it onto a map of Nigeria's 303 Local Government Areas (LGAs; second-level administrative divisions). Areas were identified as "Highly Endemic," "Endemic or Sporadic," or "No Cases Reported."

The graphical representation provided an initial assessment of the distribution and endemicity of GWD in Nigeria for the first time at such a level of detail (Figure 13). According to the authors, the map was developed as “an invaluable first step towards creating an awareness of the extent and severity of the problem in Nigeria” (Edungbola et al., 1986, p. 555).



**Figure 13.** Map of Nigeria showing the distribution and endemicity of GWD during 1983-1985, by LGAs of each State and the Federal Capital Territory of Abuja from data compiled in March 1985 (Edungbola et al., 1986, p. 557).

As a result of the *Conference*, Nigeria arranged its 19 States and FCT into two Zones to facilitate nationwide GWD data collection. The Eastern Zone consisted of nine States while the Western Zone consisted of 11 States and the FCT. A Zonal Coordinator was appointed to each of the new quasi-political divisions. Each State and the FCT appointed a representative to report on



the status of GWD within their respectful political boundaries to the respective Zonal Coordinator (CDC, 1985b).

The U.S. Peace Corps began training volunteers in Benin and Togo in anti-GWD efforts associated with water supply and HE. Under USAID, the Water and Sanitation for Health (WASH) project prepared a booklet on possible control interventions against GWD to be provided to all USAID missions in countries where GWD was endemic (CDC, 1985a). In Burkina Faso, the Ministry of Public Health created a National Commission for the Control of Dracunculiasis. The Commission was charged to manage an aggressive national assault on GWD which was known to affect all Provinces of Burkina Faso (CDC, 1985b).

India held a Task Force meeting of its GWEP in Bangalore, Bangalore District, Karnataka State from 24-26 July. It was revealed that a UNICEF-sponsored DW supply project in Dungarpur and Banswara Districts of Rajasthan State UNICEF (WHO, 1985a). By the end of the year, each endemic State had implemented the treatment of sources of DW with temephos (CDC, 1986b).

Togo's Ministry of Public Health and Ministry of Education began a collaborative effort with UNICEF to implement a HE campaign that teaches children about GWD in areas that were known to be endemic (CDC, 1985b). By the end of the year, three additional Pakistani Provinces were found to be endemic in addition to Punjab: Baluchistan, North-West Frontier (NWFP), and Sind. Of critical significance was the border that Punjab and Sind Provinces shared with India's most endemic State, Rajasthan (WHO, 1985d).

1985			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1984
Burkina Faso	458	0.80	-73.66%
Cameroon	168	0.29	N/A
CAR	31	0.05	N/A
Chad	9	0.02	-99.39%
Ethiopia	1,467	2.57	-49.10%
Ghana	4,501	7.89	6.06%
India	30,950	54.27	-22.22%
Ivory Coast	1,889	3.31	-26.58%
Mali	4,072	7.14	-18.69%
Mauritania	1,291	2.26	4.03%
Niger	1,373	2.41	N/A
Nigeria	5,234	9.18	-40.37%
Senegal	62	0.11	N/A
Togo	1,456	2.55	-20.83%
Uganda	4,070	7.14	-34.67%
<b>Totals</b>	<b>57,031</b>	<b>100.00%</b>	<b>-24.76%</b>

**Table 5.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1984 (WHO, 1990g).

Significant events in 1985 included India's GWEP's impact on case reductions, the initiation of interventions against GWD in ECs of West Africa, and increased involvement of various bilateral and multilateral development agencies in GDEC activities (WHO, 1986a). Data for reported cases of GWD was still unavailable for many countries where indigenous cases were thought to occur. A global total of 57,031 cases of GWD were reported from 15 ECs for the year. Incidents of GWD were reported from Cameroon, CAR, and Senegal for the first time since the start of GDEC. Overall, the number of cases reported decreased by 24.76% compared to 1984. Ghana and Mauritania were the only countries to report an increase in case numbers from the previous year; 6.06% and 4.03%, respectively. The one significant drop in reported cases of GWD compared to the previous year came from India with a 22.22% reduction, which continued

to be the lone EC to have undertaken nationwide active surveillance and implemented eradication activities at the end of 1985. The global case decrease did not accurately reflect a true drop in GWD endemicity.

#### **4.7. 1986**

Using the extraordinary opportunity offered by the IDWSSD to combat GWD, on 16 May during the Thirty-ninth WHA, Resolution WHA 39.21 was adopted calling for the “elimination” of GWD (WHA, 1986); the first declaration of its kind since the successful end of the Smallpox Eradication Program (Hopkins, 1987). The Resolution endorsed efforts to “eliminate” GWD in each EC associated with the IDWSSD as well as the collective approach of active GWD surveillance, HE, personal prophylaxis, and VC. Furthermore, WHA 39.21 called on all EC to establish within the context of PHC, plans of action for the “elimination” of GWD and give priority for the provision of safe sources of DW to ELs and intensify national surveillance efforts for GWD. Included was an invitation to all bilateral and international development agencies, private voluntary organizations, foundations, and appropriate regional organizations to assist ECs’ efforts to add a GWD “control” component to water supply, rural development, HE, and agricultural programs that were in progress or new to ELs by giving required support and providing extra-budgetary funds for the effort (WHA, 1986).

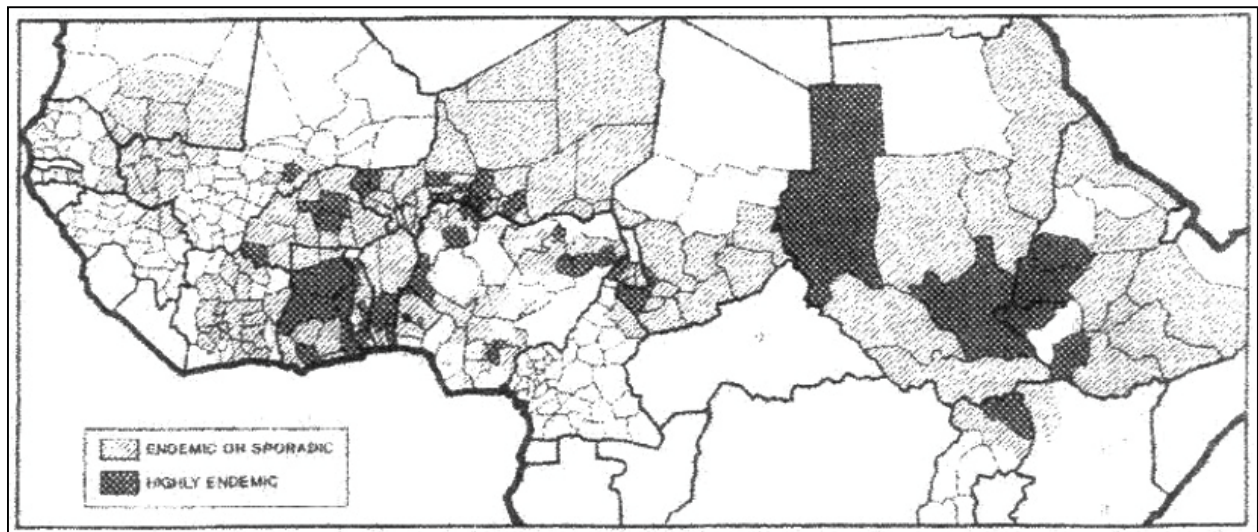
Convened by WHO/AFRO and cosponsored by the Carnegie Corporation of New York, USAID, and the USA for Africa Foundation, and the WHO, the first *Regional Conference on Dracunculiasis in Africa* was held from 1-3 July in Niamey, Niger. More than 50 people attended which included delegates from fourteen of the 19 African countries known to be affected by GWD at the time: Benin, Burkina Faso, Cameroon, Chad, Ethiopia, Guinea, Ivory Coast,

Mali, Niger, Nigeria, Senegal, Sudan, Togo, and Uganda. Objectives of the Workshop were to assist GWD-endemic UN member States with surveillance and review the progress made to establish a reasonable baseline for surveillance of GWD; clarify the extent of GWD and its adverse socioeconomic impacts; review various intervention measures and strategies available to control GWD and the relative cost effectiveness of each; and identify locations that required area-specific research (WHO, 1986b).

To demonstrate the effects GWD has populations where it is endemic, examples were presented that included the agricultural losses associated with temporary and permanent disability; frequent school absenteeism which added to future socioeconomic decline; and sterility (WHO, 1986b). Participants had the chance to share their experiences with GWD, learn effective measures to intensify the elimination and control of GWD, and better understand the severity of its impact on the health and productive capacity of populations affected by GWD. Before the Workshop concluded, attendees unanimously endorsed resolution WHA 39.21 (CDC, 1986b).

A map depicting the known range of GWD on the African continent was made from information collected at the *Workshop* (Figure 14). Up to July 1986, this map was the most thorough graphic to illustrate the range of GWD than anything seen before (WHO, 1986b). Representatives provided data for their respective countries on the known extent of endemicity and an estimated number of cases of GWD. Two of the five African countries not in attendance made the latest data on GWD in their country available. No data was received from CAR, Kenya, or Gambia. Data collection methods were modelled similar to those used in March 1985 at the first *National Conference on Dracunculiasis in Nigeria*. Figure 14 is a depiction of the

data collected from Nigeria in March 1985 and the rest of Africa's ECs in July 1986 (Watts, 1987a).



**Figure 14.** A map of the known extent of GWD on the African continent based on information presented in July 1986 at the first *Regional Conference on Dracunculiasis in Africa* (Watts, 1987a).

Nigeria's National Council on Health declared GWD a serious public health problem on 7 March after it adopted proposals to control GWD (CDC, 1986a). With support provided by USAID, a consultant from the CDC was sent to assist Cameroon with preparing a national *Plan of Action* against GWD in July. In collaboration with Togo's MoH and Ministry of Education, UNICEF and the U.S. Peace Corps began a GWD eradication program for affected localities and schools that included HE in the country. Though GWD endemicity is mostly confined to the northeastern part of Uganda, it was noted that due to population movements GWD may have spread to other areas of the country (CDC, 1986b).

In September, Sudan's the first survey on GWD in decades was conducted in El-Buram Rural Council District in the southern portion of Kordofan Province by Provincial health

officials and the UNICEF Water and Environmental Sanitation Project. Carried out in eighteen localities, 397 households with a total of 3,337 people were visited. Prevalence rates ranged from 0.01-0.79 with an average of 0.25 amongst the 18 localities. Of all households, 67.00% had at least one person suffering with GWD (WHO, 1987b). At the Regional Meeting of WHO/AFRO in September, WHA 39.21 was adopted to “eliminate” GWD from the continent. All endemic member countries of WHO/AFRO were directed to collaborate in the mobilization efforts of bilateral and international agencies to help develop and implement national *Plans of Action* against GWD (CDC, 1986c).

In the course of a visit to Pakistan in early November, former U.S. President Jimmy Carter convinced Pakistani President, General Zia-ul-Haq to allow his non-governmental organization (NGO), the Carter Center (TCC), to work with the country’s public health leaders to “eliminate” GWD from Pakistan. With support from Pakistan’s Prime Minister, President Zia-ul-Haq accepted President Carter’s offer that led to an initiative for the “elimination” of GWD from the country (Carter, 1991; CDC, 1986c). The agreement resulted in a *Workshop on Dracunculiasis in Pakistan*, hosted by TCC at its Atlanta headquarters on 21 November, co-sponsored by Global 2000, Inc. (established 1 August 1986) at TCC and CCRTCD. Pakistan was represented by the National Institute of Health at Islamabad (NIHI), the agency charged with implementing the country’s GWEP. This marked TCC’s initiation in the global struggle against GWD (CDC, 1986c). Soon after, TCC was appointed to lead GDEC in collaboration with the CDC, UNICEF, and the WHO (Hopkins, 2013) through its Global 2000, Inc. program that was established as a component of TCC in August 1986.

The Nigerian State of Anambra’s MoH launched a GWEP on 20 December at a ceremony attended by federal, state, and local politicians as well as residents who were victims

of GWD with most from Abakaliki LGA, which at the time had the highest prevalence rate in the country. A rural water supply initiative that was underway would give priority for new sources of DW to ELs along with VC and HE. Support for the State's GWEP came from various levels of the Nigerian government, UNICEF, and the WHO (CDC, 1987a).

1986			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1985
Burkina Faso	2,558	5.56	458.52%
Cameroon	86	0.19	-48.81%
CAR	ND	N/A	N/A
Chad	314	0.68	3,388.89%
Ethiopia	3,385	7.35	130.74%
Ghana	4,717	10.24	4.80%
India	23,070	50.11	-25.46%
Ivory Coast	1,177	2.56	-37.69%
Mali	5,640	12.25	38.51%
Mauritania	ND	N/A	N/A
Niger	ND	N/A	N/A
Nigeria	2,821	6.13	-46.10%
Senegal	128	0.28	106.45%
Sudan	822	1.79	N/A
Togo	1,325	2.88	-9.00%
Uganda	ND	N/A	N/A
<b>Totals</b>	<b>46,043</b>	<b>100.00%</b>	<b>-19.27%</b>

**Table 6.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1985 (WHO, 1990g).

By the end of the year, GWD was known to be an officially reportable disease in Benin, Burkina Faso, Cameroon, Ethiopia, Ghana, India, Ivory Coast, Pakistan, Togo, and Uganda. However, only India and Ivory Coast had conducted nationwide active surveillance (WHO, 1987d). India continued to report a decrease in incidence with 23,070 cases of GWD found in 7,102 ELs (CDC, 1988c). National GWD surveillance data was not available from Pakistan,

although plans to conduct active case search activities in 1987 were in progress. A total of 46,043 cases of GWD were reported from 12 ECs in 1986 and represented a reduction of 19.27% in global case reports compared to 1985. Numbers submitted by Burkina Faso, Chad, Ethiopia, Mali, and Senegal reflect efforts of active surveillance. As in the previous two years, all cases were reported from sub-Saharan Africa and India.

#### **4.8. 1987**

With the assistance of USAID, rural water projects in areas of Benin's Provinces of Atacora and Zou were initiated in January. Several PCVs were appointed to assist in the northern portion of Zou which, at the time was the most GWD endemic area of the country. Of the estimated 80,000 annual cases nationwide, around 19,000 (23.75%) were thought to be specifically from Zou Province. An initial survey carried out in the six Districts (second-level administrative division) of Zou in the same month found that nearly half of all localities had no less than 1% of their population affected by GWD with nearly a quarter of those with more than 5% (CDC, 1988b).

In February, Global 2000, Inc. sent two consultants to Ghana to help draft a national *Plan of Action* to "eliminate" GWD (CDC, 1987a). In March, preliminary studies on GWD were launched in two localities of Pakistan that were selected based on their history for indigenous transmission and their locations exemplified the country's two principal ecological zones of endemicity: Aghzar Khel locality of Bannu District (second-level administrative division), NWFP represented the northern endemic area and the locality of Chachi in Tharparkar District of Sindh Province symbolized the southern endemic area (CDC, 1987b; WHO, 1988a).



On 17 March, the *International Taskforce of the Select Committee on Hunger* of the U.S. House of Representatives listened to accounts of problems caused by GWD. Two-hours of testimonials were heard by the five-member Committee from delegates representing five of the agencies involved in the global effort to eradicate GWD. Their purpose was to bring greater attention to the disease and seek opportunities for more involvement of the U.S. government with GDEC. President Carter provided a written statement of his personal experience in Pakistan the previous November. USAID's prospective contribution to GWD "control" activities where water and sanitation projects functioned consisted of providing technical assistance to improve efforts as well as assist with surveillance activities, epidemiological maps, and support for drafting national *Plans of Action* with approval from the *Committee* (CDC, 1987a). Furthermore, USAID proclaimed that through its Water and Sanitation for Health (WASH) and Vector Biology Control initiatives, a GWD Information Center would be established to collect and organize written material; respond to data requests and provide a French translation of Guinea Worm Wrap-Up; configure databases of consultants and specialists, ongoing GWEP projects, and epidemiological data; and prepare documents for health officials (CDC, 1987b; WHO, 1988b).

A Plan of Action to "eliminate" GWD in Pakistan was drafted at the beginning of the year (CDC, 1988b). Active case searches in combination with enhanced surveillance had been implemented nationwide to identify all ELs and on 19 May, Regional Managers of GWEPs assigned at the Provincial level met at NIHI in Islamabad to settle plans for the final stage of the initial search (CDC, 1987b). Approximately 48,000 localities were visited nationwide from April to June. Search teams tried to determine if cases of GWD were present in each locality over the past two years. Localities that were positive for cases of GWD were separated in two categories: < 10 cases or  $\geq 10$  cases. The search resulted in the positive identification of 401 localities that

experienced at least one case of GWD in three Provinces: NWFP, 79; Punjab, 70; and Sindh, 252. Of the 401 localities, 77 reported  $\geq 10$  cases of GWD had occurred between 1985 and 1987. It was estimated that the population at risk for contracting GWD was 361,000 within the three Pakistani Provinces (WHO, 1988a).

Funded by IMPACT and UNDP, an initial survey of eight localities in the Lakamané Rural Commune (third-level administrative division), Diéma Cercle (second-level administrative division) of Kayes Region (first-level administrative division) in northwestern Mali was conducted in May for preparation of anti-GWD activities. This was the first anti-GWD endeavor in the country since the start of GDEC (Audibert et al., 1993; CDC, 1987b).

In June, Ghana began an official collaborative effort with Global 2000, Inc. to eliminate GWD from the country and drafted a *Plan of Action* which accentuated the need for funding (CDC, 1987b).

Nigeria's Anambra State GWEP began a determined HE campaign that included "jingles" broadcast over the radio multiple days per day, posters, and town criers that relayed GWD-related messages to the population (CDC, 1987b). In June, more than 6,000 trained enumerators began the task of identifying all ELs in Nigeria (WHO, 1989d). The Nigerian newsmagazine, *African Concord*, published a 13-page story on GWD called, "G-Worm Plague: The Shame of Nigeria" in its 4 August issue that illustrated the disease's affects in the country (CDC, 1987c). In the 16 November issue of a Nigerian-published weekly Pan-African newsmagazine, *Newswatch*, an article called, "Worm from the Gods" discussed the problem of GWD in Nigeria (CDC, 1987d). On 23 September, Nigeria added two new States, Akwa Ibon and Katsin, for a total of 21 and the FCT (Law, 1999). A pilot study to measure the correlation between GWD morbidity and rice production was carried out from September-December in four

adjoining States of southeastern Nigeria (Anambra, Benue, Cross River, and Imo). It concluded that GWD-related morbidity resulted in an annual economic loss of roughly \$20 million (de Rooy, 1987).

Hydrological evaluations were carried out in Cameroon's Mayo-Sava Department (second-level administrative division) of Extreme North Region (first-level administrative division) in September after Cameroonian health authorities compiled a list of the Department's confirmed ELs (CDC, 1987d).

The U.N. *Steering Committee* for the IDWSSD met on 5-6 November in the Dominican Republic where progress made in the fight against GWD was reviewed. The *Committee* emphasized its continued support for efforts to eradicate GWD as one of its subgoals (CDC, 1987d). The associate administrator of the UNDP proclaimed GWD to be "one of the most easily preventable diseases. By eventually eradicating guineaworm [*sic*], this historic struggle will be one of the most enduring and important legacies of the Water and Sanitation Decade" (CDC, 1987d, p. 1).

Personnel from Ghana's MoH conducted the first comprehensive survey in what was estimated to be the country's most endemic Region, Northern, from June-July with funding obtained from UNICEF. Northern Region makes up nearly one-third of Ghana's surface area, but comprises just over eight percent of the population. In this dry savanna woodland vegetation zone, transmission of GWD occurred during the dry season, lasting from November through April and DW was acquired from stagnant pools in dry stream beds and human-made catchments. Interviews with community leaders took place in 995 localities that had a population of more than 200 from seven Districts to find out retrospectively if one or more cases of GWD had been present within their community within the past year. A total of 801 (80.50%) of the

localities reported the occurrence of at least one case of GWD in that time. Of the localities surveyed, the proportion classified endemic ranged from 6.62% of 151 in Maprusi District to 98.76% of 241 for Dagomba West District (WHO, 1989a).

Ghana officially launched its national GWEP on 7 December with assistance from Global 2000, Inc. and the Bank of Credit and Commerce International (BCCI) with an objective to eradicate GWD from the country by 1993. Nigeria's Anambra State's GWEP began the VC component after it received 2,000 liters of temephos donated by American Cyanamid which included delivery costs. By the end of the year, Cameroon appointed a National Coordinator its GWEP (CDC, 1987d).

By the end of 1987, Pakistan's GWEP completed a nationwide active case search and determined the national extent of GWD. A detailed collection of baseline demographic data was gathered for epidemiological purposes. Descriptive information relevant to control, such as water collection behavior, was collected from each household in an effort to implement and evaluate control interventions. Results would be used to form a more realistic plan to implement subsequent interventions for the rest of the national GWEP. In Aghzar Khel, it was concluded that transmission of GWD was connected to enclosed cisterns that households used to collect rainwater. Transmission was found to occur chiefly amongst inhabitants of Chachi that collected DW from the desert environ in large depressions called "tarais" that filled with rainwater in the wet season. Based on data collected, HE that encouraged the filtering of DW was begun in both localities and sources of DW were treated with temephos (WHO, 1988a).

1987			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1986
Benin	400	0.15	N/A
Burkina Faso	1,957	0.74	-23.49
Cameroon	ND	N/A	N/A
CAR	1,322	0.50	N/A
Chad	ND	N/A	N/A
Ethiopia	2,302	0.87	-31.99
Ghana	18,398	6.98	290.04
India	17,031	6.46	-26.18
Ivory Coast	1,272	0.48	8.07
Mali	435	0.17	-92.29
Mauritania	227	0.09	N/A
Niger	699	0.27	N/A
Nigeria	216,484	82.17	7,574.02
Pakistan	2,400	0.91	N/A
Senegal	132	0.05	3.13
Sudan	399	0.15	-51.46
Togo	ND	N/A	N/A
Uganda	ND	N/A	N/A
<b>Totals</b>	<b>263,458</b>	<b>100.00%</b>	<b>472.20%</b>

**Table 7.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1986 (WHO, 1990g).

The year ended with official inaugurations of national GWEPs in Pakistan and Ghana and brought the total number of ECs with a fully functional GWEP to three. Burkina Faso was unable to secure funds to implement a national *Plan of Action* and conduct a nationwide case search (WHO, 1988b). Fourteen ECs, all from sub-Saharan Africa except Pakistan, reported 263,458 cases of GWD in 1987 for a surge of 472.20% compared to the previous year. The proliferation in the global case total was resultant of the increased awareness brought to GDEC by international assemblies devoted to eradication efforts. Nigeria had the most notable change after it reported < 3,000 incidents the year before. India's six endemic States reported 17,031 cases of GWD found in 5,634 ELs amongst 67 Districts (WHO, 1989b). The most highly

endemic State of Rajasthan recorded 7,896 cases for 46.36% of all cases amongst its 2,755 ELs (WHO, 1989c).

International partnerships between ECs and their various administrative level divisions with donor agencies and numerous NGOs helped push forward efforts to determine the scope of national endemicity which was evident not only in Nigeria, but Ghana as well. Though GWD was an officially reportable disease in Ivory Coast, the increase of < 100 cases from the previous year did not reflect a true account of effective surveillance since the country had not yet conducted a nationwide case search. Pakistan joined India as the second country outside of sub-Saharan Africa found to be endemic, with case numbers submitted after the country's first nationwide search was completed.

#### **4.9. 1988**

Pakistan's GWEP established anti-GWD interventions and began active surveillance in its three endemic Provinces: NWFP, Punjab, and Sind. Each Provincial Regional Manager was tasked to prepare one "Village Implementer" (VI) for each EL of their respective Province to conduct monthly surveillance and oversee the implementation of anti-GWD interventions. Employees of local health departments were reassigned as "Field Health Workers" and were instructed on the use of temephos to treat unsafe sources of DW each month throughout the transmission season (WHO, 1990f).

India's NICD organized an independent appraisal of the national GWEP in the country's six endemic States from 29 February to 7 March. The appraisal teams included observers from Burkina Faso and Nigeria, two sub-Sahara African countries that were in the process of initiating their own national GWEPs. In the conclusion, the evaluation credited the consistent declines in

annual GWD incidence to the Indian GWEP's well-organized approach to case search processes, better methods of HE, increased coverage of temephos usage, and provision of safe sources of DW in > 85% of ELs (WHO, 1989b).

With support from Global 2000, Inc. and BCCI, Nigeria's MoH established a *Secretariat* for the national GWEP. The primary goal of the *Secretariat* in the first year was to collaborate with all 21 Nigerian States to ensure each conducts thorough case searches and identifies every EL within its borders. Pakistan's GWEP held a meeting to discuss the achievements realized after its first operational year at the NICD on 7 March. Furthermore, attendees contemplated the extensive execution of interventions before the start of GWD transmission season (CDC, 1988a).

The second *Regional Conference on Dracunculiasis in Africa* met in Accra, Ghana, 14-18 March, with 126 participants in attendance including representatives from India and Pakistan, 17 of the 19 African countries known or suspected to be endemic for GWD in 1988 (Benin, Burkina Faso, Cameroon, CAR, Chad, Gambia, Ghana, Guinea, Ivory Coast, Mauritania, Mali, Niger, Nigeria, Senegal, Sudan, Togo, and Uganda) CDC, Global 2000, Inc., USAID, U.S. Peace Corps, WASH, and various other international agencies and organizations involved in GDEC . International recognition was increased by the presence of President Carter and his wife who, prior to the gathering, visited two endemic Ghanaian localities where he saw more than 200 people with GWs emerging from various parts of their bodies (Carter, 1991). The opening ceremonies ended with the showing of a documentary film about GWD: "Guinea Worm: The Fiery Serpent" (Yacoob & Yohalem, 1988). Funded in cooperation of the CDC, Global 2000, Inc., UNDP, and UNICEF, the movie was completed just before the Workshop began and was primarily shot in Nigeria's Anambra State (CDC, 1988a). Country reports on anti-GWD

activities were presented by all African countries in attendance except CAR (Yacoob & Yohalem, 1988).

Delegates developed outlines during a workshop that specified steps to be taken and ascertained impediments to eradication efforts in their respective countries. The greatest problems each faced were identified as lack of resources, data, commitment and sustainability, awareness of socioeconomic consequences of GWD at all levels, intersectoral coordination, and community involvement and education. At the end of the workshop “The Waters of Ayole,” a film on Togo’s Rural Water Supply Program sponsored by UNDP and USAID was shown (Yacoob & Yohalem, 1988).

Data was presented on the impact GWD has on maternal and child health (see Brieger, Watts, & Yacoob, 1988) and rice cultivation in southeastern Nigeria (see de Rooy, 1987). Gambia and Guinea claimed GW transmission had “seemingly” been interrupted. It was an officially reportable disease in Gambia, but there had not been reports of a single case of in the previous decade. In February and March, Guinea conducted active case searches in previously endemic areas and did not find evidence to suggest further occurrence of GW transmission (Yacoob & Yohalem, 1988).

New field training materials were presented and reviewed. One of the noted conclusions were the negative effects on gathering support for GDEC due to the absence of national mandatory reporting on GWD. It was recommended that each EC establish active surveillance for GWD and provide an annual report to the WHO by the end of every March (Yacoob & Yohalem, 1988). For the purpose of surveillance, attendees agreed to adopt a standard definition for a case of GWD as “an individual exhibiting or having a recent (one year) history of skin lesion with emergence of a worm” (Yacoob & Yohalem, 1988, p. 13 ).



Personnel from Ghana's MoH conducted the second component of its national survey in what was estimated to be the country's least endemic Region, Eastern, in March. The Region is situated in the southeastern portion of the country where it receives quite a bit more rainfall than Northern Region, where the first component of the national survey took place the year before, with vegetation that varies from savanna to tropical woodland and was the second most populated Region at the time. Retrospective data on the presence of GWD over the previous year and current DW sources was obtained from interviews with community leaders of 468 localities randomly distributed amongst the Region's 12 Districts. A total of 51 (10.90%) of the localities reported the occurrence of at least one case of GWD in that time. The number of localities surveyed per District ranged from six in New Juabeng to 101 in Akim West and the proportion of localities surveyed per District that reported the presence of GWD ranged from 8.33% in Suhum Kraboa to 50.00% in New Juabeng. An underground source of DW was used exclusively in 28 (5.98%) of the surveyed localities and of these, GWD reportedly only occurred in one of them (WHO, 1989a).

Nigeria's *National Task Force for Guinea Worm Disease Eradication* commenced its first meeting in Lagos from 5-6 May. Ghana convened its first meeting of its national GWEP from 11-12 May in Accra. Delegates from each Region of Ghana attended and agreed upon a strategy to promptly commence anti-GWD activities to the best of their ability with the resources available. This was followed by the initiation of the GWEP in Northern Region announced by Ghanaian President, Flight Lieutenant Jerry John Rawlings, in early June after a one-week tour of 21 ELs in the Region. President Rawlings called GWD "a disease of underdevelopment" and took the lead to educate the public on actions needed to be rid of it (CDC, 1988b).

The National Council on Health declared GWD to be an officially reportable disease in Nigeria at the end of June, endorsed the proposed eradication strategy submitted by the *National Task Force for Guinea Worm Disease Eradication*, and set 1995 as the target date for eradication. By this time, each of Nigeria's four Primary Health Care Zones (hereinafter referred to as "Zones") had appointed a Zonal Coordinator for anti-GWD activities. Cross River State, located in southwestern Nigeria conducted the country's first active case search to determine the extent of GWD within its administrative boundaries on 22 August (CDC, 1988c). It found 10,959 cases of GWD in 71 ELs (WHO, 1989d).

On 14 September, the thirty-eighth session of WHO/AFRO adopted a Resolution that endorsed efforts to "eradicate" GWD in association with the IDWSSD along with the "combined strategy of provision of safe sources for drinking-water, active surveillance, health education, vector control and personal prophylaxis for eradicating the infection." In addition, the group called on all affected member countries, "to establish as quickly as possible, within the context of primary health care, plans of action for eradication of dracunculiasis by 1995" and to "intensify surveillance of dracunculiasis, and report the resulting information regularly to WHO" (WHO/AFRO, 1988, p. 23).

On 1 December, the *International Task Force for Disease Eradication* (ITFDE) was formed at TCC with a \$370,000 two-year grant provided by the Charles A. Dana Foundation. The main goals of the ITFDE were "to promote the eradication of guinea worm and polio and to systematically evaluate other diseases as to their actual or potential eradicability" (CDC, 1988d, p. 1).

Benin held its first *National Conference on Dracunculiasis* at Cotonou, Atlantique Department, from 13-15 December. The status of GWD and control measures underway were

reviewed as well as problems associated with needed resources and a national *Plan of Action* was approved and an “elimination” target date of 1992 was set (CDC, 1988d). An independent evaluation of Pakistan’s GWEP in December determined inadequate surveillance activities led to previously unknown ELs in the Dera Ghazi Khan District of Punjab Province and Tharparkar District of Sind Province (WHO, 1990f). By the end of December, all 22 States in Nigeria had formed a *Task Force* for GWD eradication and all but Bendel State had completed the training component for active case searches set to begin in January 1989 (CDC, 1988d).

During the *Workshop* in March, UNDP’s Regional Bureau for Africa pledged \$50,000 in support of national anti-GWD efforts for 1988 throughout the region. In addition, WHO/AFRO announced it would reserve an equal amount for anti-GWD activities for the region as well. A pledge of ~\$17,000 was made by BCCI for the two localities in Ghana visited by President Carter in March. UNICEF also agreed to dedicate \$50,000 for anti-GWD activities conducted in Ghana (CDC, 1988a).

The Japan International Cooperative Agency (JICA) provided nearly \$7 million to cover the cost of drilling roughly 500 boreholes in ELs of Nigeria’s Anambra State (CDC, 1988a). A rural water supply project facilitated by Ghana’s Ministry of Works and Housing in the Nanumbra District of Northern Region began in April with a nearly \$6 million grant from Japan, the project aimed to drill 159 boreholes in ELs. At the time, Nanumbra District was the largest producer of yams in Ghana and was also responsible for a significant output of cotton, maize, and rice (CDC, 1988b). An award was granted in August by SIDA to UNICEF for use in India’s Udaipar District of Rajasthan State which has approximately 780 ELs (CDC, 1988c).

The U.S. Peace Corp designated a PCV to work on a full-time basis with Ghana’s GWEP in September. A drilling rig for borehole wells was donated for use in the West Mamprusi

District of Ghana's Northern Region by the Netherlands based *Inter-Church Coordination Committee for Development*. The Seventh-Day Adventist Church provided a new vehicle to Ghana's GWEP for use by its national response team. Global 2000, Inc. received 2,500 liters of temephos from American Cyanamid to be used in implementing a VC component in Ghana's Northern Region (CDC, 1988c). In October, the London-based charity, *Band Aid*, donated \$120,000 to support a pilot project on GWD-control efforts in Burkina Faso's Bam and Oubritenga Provinces (CDC, 1988c; WHO, 1990b). To aid the global GWEP, in October, the U.S. Peace Corps announced its proposal to assign at least ten PCV to each EC of Africa where the organization was functioning. Rotary International provided a grant for \$300,000 for Nigeria's Anambra State GWEP to be disbursed over a three-year period for construction of rainwater catchments in ELs (CDC, 1988d).

1988			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1987
Benin	33,962	4.35	8,390.50
Burkina Faso	1,266	0.16	-35.31
Cameroon	752	0.10	N/A
CAR	ND	N/A	N/A
Chad	ND	N/A	N/A
Ethiopia	1,487	0.19	-35.40
Ghana	71,767	9.19	290.08
India	12,023	1.54	-29.41
Ivory Coast	1,370	0.18	7.70
Mali	564	0.07	29.66
Mauritania	608	0.08	167.84
Niger	ND	N/A	N/A
Nigeria	653,492	83.65	201.87
Pakistan	1,110	0.14	-53.75
Senegal	138	0.02	4.55
Sudan	542	0.07	35.80
Togo	178	0.02	N/A
Uganda	1,960	0.25	N/A
<b>Totals</b>	<b>781,219</b>	<b>100.00%</b>	<b>196.53%</b>

**Table 8.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1987 (WHO, 1991b).

By the end of 1988, programs of active surveillance were underway in Ghana, Ivory Coast, Nigeria, and Pakistan (WHO, 1989e). Globally, fifteen ECs documented 781,219 cases of GWD in 1988. This 196.53% increase from the previous year, was indicative of the momentum generated by national and international conferences and outcomes of the first reports from nationwide case searches in Benin, Ghana, and Nigeria. Pakistan and India were still the only confirmed ECs known outside the African continent.

Nigeria's nationwide active case search undertaken from August 1988 through March 1989 resulted in 653,492 cases of GWD found amongst 5,872 localities in every State except Akwa Ibom. Ondo State reported the greatest number of cases with 197,391 in 308 localities

throughout all 17 of its LGAs. Not only was Ondo the most endemic State, it was also the greatest producer of the country's leading agricultural export, cocoa (WHO, 1989d). It was estimated that some 15 million Nigerians were at-risk for GWD (CDC, 1989a). Complete coverage in some areas of Nigeria was hindered due to logistical problems, thus, underreporting was presumed by the evaluation teams, but they were contented with the value of the data collected (WHO, 1989d). The fact that there were some 13,000 fewer cases recorded compared to 1988 may have been a result of anti-GWD activities already in place. For the first time, Nigeria's zones of endemicity were defined as a result of active surveillance (CDC, 1989a).

India enumerated 12,023 cases of GWD from 4,278 ELs in its six endemic States. Gujarat State recorded 27 incidents and determined 22 of them had been imports from other States. Rajasthan, India's most endemic State was responsible for 46.74% of the national total with 5,619 cases of GWD and 2,258 ELs (CDC, 1989a). Pakistan's GWEP enumerated 1,110 cases in 153 ELs. Occurrence of GWD were highest from June through September in simultaneity with the rainy season (WHO, 1990f)

#### **4.10. 1989**

The IMPACT sponsored trial in Burkina Faso's Bam and Oubritenga Provinces began in January. Each locality in both of the two nearly adjacent Provinces was visited within a two-week period and household surveys were conducted. In Bam, evidence of GWD was present in 140 of the 255 localities (54.90%) as it was in 218 of Oubritenga's 307 localities (71.01%). However, GWD was known to be endemic all across the country (WHO, 1990b).

India's *Task Force* met in conjunction with a workshop for the GWEP at the NICD from 23-25 January to review the epidemiological situation, anti-GWD activities, and performance indicators as well as plan and prepare interventions for 1989-1990 (WHO, 1989c).

Pakistan's GWEP carried out an extensive case search in Dera Ghazi Khan District of Punjab Province and Tharparkar District of Sind Province due to their findings related to inadequate surveillance the previous year. An additional 80 ELs were discovered and anti-GWD activities were implemented immediately. As a result, "Sector Supervisors" were assigned to Pakistan's GWEP. This additional classification of field staff was created to serve as a bridge between VIs and Regional Managers to enhance the effectiveness of locality-based active surveillance (WHO, 1990f).

The second *National Conference on Dracunculiasis in Nigeria* was held from 20-22 March in Lagos. Including instantly from all 21 Nigerian States and the FCT, nearly 300 people attended the event from national and international institutions and donor agencies. The Conference's chief objectives were to present findings of the active case search that started in August 1988 and lasted through March 1989 in all every State and the FCT in addition to assessments of the case searches by teams of international and national observers; provide evidence of the negative impact on agriculture, health, and school absenteeism due to GWD; create a national *Plan of Action* to "eliminate" GWD by 1995; and put on trainings to aid each State with the development of a *Plan of Action* based on the outcome from the active case searches within their respective administrative borders. Based on one of the Conference's recommendations, GWD became an officially reportable disease in Nigeria (WHO, 1989d). The most significant result of the *Conference* was the declaration made by the Federal government's

Directorate of Food, Roads, and Rural Infrastructure that all future DW supply projects would give priority to GWD-affected localities (CDC, 1989a).

The first *Regional Conference on Dracunculiasis Eradication* of the WHO Regional Office for the Eastern Mediterranean (WHO/EMRO) was held at the NIH in Islamabad, Pakistan, from 2-4 April. There were 21 attendees with representatives from India, Nigeria, Pakistan, Somalia, Sudan, and Yemen. Pakistan and Sudan were the only WHO/EMRO member countries known to be endemic at the time as there had been no evidence of GWD's existence in the once suspected ECs of Saudi Arabia, Somalia, or Yemen. Moderate to high levels of endemicity were known to occur in Sudan's Provinces of Blue Nile, Eastern Equatoria, Kasala, Red Sea, and Southern Kordofan. The *Conference* assessed national GWD status and control measures in the WHO/EMRO and provided assistance with national *Plans of Action*. The formulation of criteria for certification of GWD "elimination" in formerly ECs was proposed to the WHO. In addition, the *Conference* accepted the case definition of GWD proposed in 1988 during the second *Regional Conference on Dracunculiasis in Africa* (CDC, 1989a; WHO, 1989f).

The ITFDE first met in April to systematically evaluate of potentially eradicable disease candidates; identify specific barriers to eradication efforts that may be overcome by further research or other endeavors; and to promote specific eradication campaigns (Duffy et al., 1990). Members of the ITFDE agreed that GWD eradication was achievable and supported the assessment that, "there are no more remaining technical obstacles to guinea worm eradication, and that the chief requirements for eradicating this disease are increased public, political, and financial support" (CDC, 1989c, p. 2).



All endemic States of India celebrated “Guinea Worm Education Day” for the first time in April (CDC, 1990a). Burkina Faso presented a revised *Plan of Action* to eradicate GWD at the *International Donor’s Conference* in July (see below). In August, President Carter was accompanied by members of Ghana’s MoH to pay a second visit to the two ELs he had gone to in March 1988. Incidence of GWD had fallen by nearly 90% due to the anti-GWD interventions that were put in place since President Carter’s initial visit (CDC, 1989c). Mali appointed a Program Coordinator for its GWEP in October (CDC, 1989d) and drafted a *Plan of Action* to eradicate GWD (WHO, 1990g).

After the second ITFDE meeting in October, criteria were established to evaluate a disease’s eradication potential: the epidemiologic vulnerability of a disease; the accessibility of practical, yet, effective interventions; a disease’s impact on human health and welfare; commitment from national and/or international governments and support agencies; and the costs associated with an eradication campaign. Of the eight diseases considered for eradication, dracunculiasis and poliomyelitis were the only ones found to be feasible and technically possible at the time rabies (Duffy et al., 1990).

At the headquarters of Global 2000, Inc. in November, a review of Pakistan’s GWEP was held that evaluated the country’s GWD status and discussed plans for 1990 in November. At the request of the government of Benin and UNICEF, an epidemiologist from the CDC was sent to help the country prepare for a nationwide GWD case search. Global 2000, Inc. put together a team to visit Togo after the government and UNDP requested a consultation for assistance in Northern Region with the “elimination” of GWD (CDC, 1989d).

In Ghana, some 12,000 personnel visited 19,767 localities from 7 November 1989 to 2 February 1990 to conduct the country’s first nationwide active case search. The search took 60

working days to complete at a cost of nearly \$50,000 which was provided by BCCI, Global 2000, Inc., and USAID. During the search, data on schistosomiasis was also collected (WHO, 1990c). In the Douentza Cercle of Mali's, research on the economic impact GWD had on agriculture was conducted. It found that in the 90 localities that were part of the study 38,653 work days were lost that resulted in an economic loss of nearly \$104,000 per year (CDC, 1990b).

In January, UNDP's Regional Director for Africa pledged \$249,000 to assist ECs of Africa with GWD eradication during 1989-1990 and was distributed through Global 2000, Inc. The amount represented the estimated cost of providing consultants to help prepare national plans of action and other associated GWD eradication activities. The Danish Bilharziasis Laboratory (DBL) together with DANIDA announced an annual grant of approximately \$143,000 during the period 1989-1992, to aid the GWEP in Ghana's Northern Region (CDC, 1989a).

UNICEF's *Executive Board* approved a resolution for the "elimination" GWD in the 1990s, at its annual meeting in New York on 25 April. Moreover, the Board authorized \$1.55 million to help each EC of Africa conduct nationwide active GWD case searches during 1989-1990 (CDC, 1989b). On 20 May, the forty-second WHA adopted Resolution WHA 42.29 which declared "the goal of eliminating this disease as a public health problem from the world in the 1990s" (WHA, 1989). Funding and assistance provided by UNICEF resulted in the initial conception or commencement of national case searches in all ECs except Sudan.

Funding for GDEC received significant financial support as a result of an *International Donor's Conference* sponsored by Global 2000, Inc. and BCCI in association with UNDP and UNICEF. Assembling in Lagos, Nigeria, 30-31 July, the conference raised \$9.67 million to support assessments of the extent of GWD in preparation for national plans of action for each EC

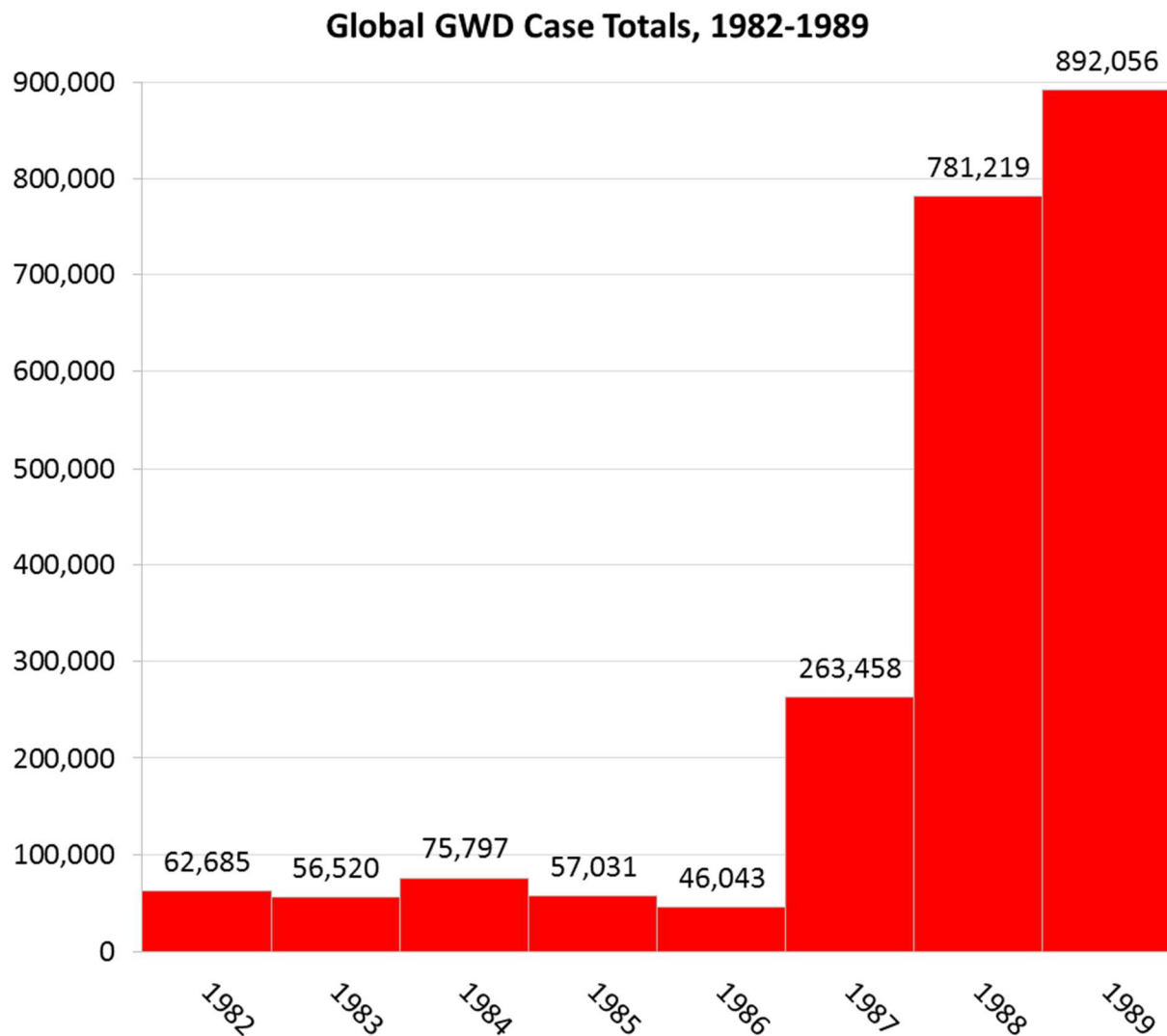
in Africa, by the end of 1990. President Carter was the keynote speaker in addition to representatives from 15 international organizations. On the first day of the *Conference*, President Carter toured the EL of Idiori, Ewekoro LGA, Ogun State with a convoy of government officials and national print, radio, and television media (CDC, 1989c). Moreover, the conference marked the increased dedication to GDEC from UNDP and UNICEF (Hopkins & Ruiz-Tiben, 1990). Just before the commencement of the *Conference*, Nigeria's president announced the new *Nigeria Guinea Worm Eradication Fund*, a private national initiative for the eradication of GWD (CDC, 1989c).

In August, USAID's mission to Ghana appropriated \$2.35 million for the country's GWEP. Ghana also received 1,500 cloth filters that were donated to the country's GWEP by the *International Christian Chamber of Commerce* which also created a revolving fund to recover money earned by the sale of the filters that went for ~\$0.45 each (CDC, 1989c). Additionally, 21,000 grey baft filters had been handed out to households of ELs in October. The *Nigeria Guinea Worm Eradication Fund* was formally launched on 13 December (CDC, 1989d). With financial support provided by UNICEF, Burkina Faso began a nationwide case search in December to determine the national extent of GWD (WHO, 1990b).

1989			
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1988
Benin	7,172	0.80	-78.88
Burkina Faso	45,004	5.04	3,454.82
Cameroon	871	0.10	15.82
CAR	ND	N/A	N/A
Chad	ND	N/A	N/A
Ethiopia	3,565	0.40	139.74
Ghana	179,556	20.13	150.19
Guinea	1	0.00	N/A
India	7,881	0.88	-34.45
Ivory Coast	1,555	0.17	13.50
Kenya	5	0.00	N/A
Mali	1,111	0.12	96.99
Mauritania	447	0.05	-26.48
Niger	288	0.03	N/A
Nigeria	640,008	71.75	-2.06
Pakistan	534	0.06	-51.89
Senegal	ND	N/A	N/A
Sudan	ND	N/A	N/A
Togo	2,749	0.31	1,444.38
Uganda	1,309	0.15	-33.21
<b>Totals</b>	<b>892,056</b>	<b>100.00%</b>	<b>14.19%</b>

**Table 9.** Case totals, percentage of the global case total from countries that reported incidents of GWD, and the percent change in case totals compared to 1988 (WHO, 1991b).

Guinea reported one incident of GWD in 1989—its first confirmed indigenous case reported to the WHO since the early 1980s—and joined fifteen ECs to report 892,056 cases of GWD; a global increase in the case total of 14.19% compared to the previous year and the most cases enumerated since GDEC began (Figure 15). The case in Guinea was discovered in miner that had reportedly not left the country, but claimed to have stayed for some time in a settlement with migrants from other ECs during the period transmission would have occurred. Five ECs enumerated cases of GWD from active surveillance or nationwide case searches: Cameroon, Ghana, India, Nigeria, and Pakistan (WHO, 1991b).



**Figure 15.** Global GWD case totals, 1982-1989.

Cameroon's GWEP reported 871 incidents of GWD in 13 ELs with 493 (56.60%) of the cases from the single locality of Sanda Wadjiri in Mayo Sava Division (CDC, 1990c). Ghana's first nationwide case search recorded total of 179,556 cases found in in 6,873 ELs throughout the country's ten Regions (WHO, 1990c). Nigeria's second nationwide case search resulted in 640,008 cases of GWD found in 6,097 localities in every State. This represented 3.83% more ELs with a mere 2.06% decline in total cases compared the previous year. Six cases enumerated

in Akwa Ibom State were determined to have been imported from other States. Of special note was the progress made in Kwara State which recorded 16,197 cases for a 66.41% reduction from 50,356 cases in 1988 (WHO, 1990e).

Case totals from Benin were not indicative of the true national incidence as surveillance activities were concentrated in Zou Province. Burkina Faso's finalized case total was calculated retrospectively after a nationwide survey in 1990. Totals for Ethiopia, Ivory Coast came from limited surveillance. Kenya's five reported cases were discovered as the result of an active case search carried in the Turkana District of Rift Valley Province. Most of the Provincial inhabitants were nomadic who oftentimes trekked to potentially GW-endemic areas of neighboring ECs (WHO, 1990g). Mali's 1,111 cases of GWD were based on searches in 68 ELs throughout Douentza Cercle of Mopti Region during September and October (CDC, 1990b). While 2,749 cases enumerated in Togo reflect an increase in surveillance activities, a nationwide case search had yet to be completed by year's end. Uganda's data for 1989 was collected via passive surveillance (WHO, 1991b).

India enumerated 7,881 cases of GWD from 3,596 ELs in six endemic States. Gujarat State reported only six cases, but claimed they were imported; five from Madhya Pradesh and one from Rajasthan (CDC, 1990a). Pakistan enumerated 534 incidents of GWD found in 46 ELs. Both were reductions from 1988 of 51.98% and 4.58%. The slight decrease in the number of ELs was the result of 80 additional ELs discovered within the previous year (WHO, 1990f).

#### **4.11. 1990**

The case containment strategy was introduced in Pakistan after an evaluation of the national GWEP at the end of the 1989 transmission season with the aim of maximizing the

effectiveness of surveillance and control efforts. The method was put into action in 1990 and consisted of case identification within 24 hours of GW emergence, case management, obtaining the affected person's travel history, mobilizing inhabitants to implement prevention measures, and reporting cases up the appropriate chain of command (Kappus et al., 1991).

The *Task Force* of India's GWEP met at NICD in Delhi from 15-16 January to review the GWEP's status, make an epidemiological assessment, and prepare for the coming year (WHO, 1990d).

Benin's first nationwide case search was initiated in February in Zou Province in conjunction with the water and sanitation projects already underway (CDC, 1990b).

An informal consultation on the "Criteria for the Certification of Dracunculiasis Elimination" was held at WHO headquarters from 19-21 February with representatives of 23 countries in attendance. Objectives of the meeting were to outline criteria and propose a sequence of events to be followed during the process of verifying the "absence of dracunculiasis transmission" in addition to "certifying its *elimination* from formerly endemic countries." In addition, the definition of a case of GWD was updated to include, "[a] recent (within one year) history of a skin lesion with emergence of a guinea worm is the usual time-frame for use in surveillance programmes." Explanations that differentiated "elimination" and "eradication" of GWD were also given. "Elimination" of GWD "is the confirmed absence of clinical illness (the interruption of *Dracunculus medinensis* in man) for three years or longer from a sizeable geographical unit (e.g., a country) with such a low risk of reintroduction of the parasite that preventive measures could be minimized." "Eradication" of GWD "is the confirmed absence of clinical manifestations (the interruption of transmission of *Dracunculus medinensis* in man) for three years or longer from a continent" (WHO, 1990a, p. 3).

Proposed criteria for certification of “elimination” were classified as “countries with dracunculiasis transmission during the 1980s” or “formally endemic countries (transmission occurred before 1980.” In the former, countries applying for “certification of elimination” were required to submit a “country report” to the WHO describing “the procedures and provides evidence in support of the assertion that dracunculiasis has been eliminated.” In the latter, certification of elimination could be granted once satisfactory documentation of has been provided that describes in detail the previously endemic area(s) extent; proof that an active case search that had been carried out in the previously endemic area(s) no more than two years prior to the request for certification to verify no residual foci exists; and countries applying may only receive certification once a substantial risk for reintroduction of GWD no longer exists from neighboring ECs (WHO, 1990a).

A parasitic disease research laboratory was established in Ghana’s Northern Region to study GWD and schistosomiasis as a collaborative effort of the MoH and DANIDA (CDC, 1990a).

In partnership with the Federal MoH, BCCI, Global 2000, Inc., and UNICEF cosponsored the third *National Conference on Dracunculiasis in Nigeria* on 19 March in Lagos, with nearly 150 people in attendance (WHO, 1990e). Results from the second nationwide case conducted from November 1989 through March 1990 were presented by the FCT and all States except Kano which had no yet completed its search by the time of the *Conference*. Nigeria’s GWEP *Task Force* met the following day which coincided with the country’s first “National Guinea Worm Day” celebration (CDC, 1990a).

The third *Regional Conference on Dracunculiasis in Africa* was hosted by Ivory Coast, 28-30 March in Yamoussoukro, sponsored by Global 2000, Inc., IMPACT, UNDP, UNICEF,



and the WHO. Nearly 120 people attended which included delegates from India and 17 endemic African countries as well, representatives of the sponsoring agencies, and other personnel from numerous other organizations affiliated with GDEC (WHO, 1990h). Kenya was the only EC from the African continent not represented (CDC, 1990a). Of particular interest was the presence of a representative from the Organization of African Unity (OAU) for the first time at a meeting related to GWD. The main goals were to review the status of GWD and related control measures; to assist ECs with the development of or enhance national *Plans of Action*; and mobilize greater support for the targeted eradication date of 31 December 1995 (WHO, 1990h).

Some of the recommendations adopted at the *Conference* include the need for all ECs that had yet to conduct a nationwide case search to do so by the end of the year; the necessity for all ECs to establish a target date in 1995 for the elimination of GWD as soon as possible; all ECs should appoint a National Coordinator, draft a *Plan of Action*, and convene a national conference on GWD; asked for neighboring countries to cooperate in GWD surveillance and control methods; mobilization of political leaders of ECs and an additional plea to ensure the inclusion of GWD eradication on the agenda at the assembly of the OAU in July; see to it that the topic of GWD is incorporated into the May meeting of the African Development Bank/World Bank *All Africa Rural Water Supply and Sanitation Workshop and Water Supply and Sanitation Sector Conference*; the U.N.'s "World Summit for Children" and the New Delhi Global Consultation on "Safe Water 2000," both in September; DW supply projects need to give priority to ELs and contain an effective HE component along with social mobilization; a decree from the WHA in 1991 to initiate a process to certify GWD eradication (WHO, 1990h).

Monthly case searches started to be carried out by India's GWEP (CDC, 1990c). In April, Togo's MoH formed an inter-ministerial commission charged to coordinate the country's GWEP

activities. The *All Africa Rural Water Supply and Sanitation Workshop and Water Supply and Sanitation Sector Conference* met from 7-11 May in Abidjan, Ivory Coast where the significance of GWD eradication was acknowledged and DW projects would give priority to ELs (CDC, 1990b).

Cameroon's MoH celebrated the first "National Guinea Worm Day" on 4 June in Mora, Mayo-Sava Department, Extreme North Province (CDC, 1990b). A revised Plan of Action to eradicate GWD from Cameroon was endorsed by the country's national GWEP Task Force on 29 June. However, expansion of anti-GWD related activities were delayed due to administrative difficulties that hindered efforts to expand the eradication program quickly in the Mayo-Sava Department. The country's endemic focus is concentrated in a small area of the Mandera Mountains of the Extreme North. Transmission occurs in during the rainy season that starts in March or April and continues through October (Greer, 1991).

President Carter spoke at the *Assembly of Heads of State and Government* of the OAU held in Addis Ababa, Ethiopia on 10 July. He provided a synopsis of the development of global GWEP and the growth of international interest in the eradication campaign. Later that day, President Carter and his wife met with government officials from the seven endemic Francophone countries of Africa to speak more in depth about the status of national GWEPs in Benin, Burkina Faso, Ivory Coast, Mali, Mauritania, Niger, and Togo. President Carter and his wife concluded the day as hosts of a reception attended by representatives of the African Development Bank, the Economic Commission for Africa, UNDP, UNICEF, and the World Bank (CDC, 1990b).

On 12 July, the WHO renamed its affiliate at the CDC the *Collaborating Center for Research, Training, and Eradication of Dracunculiasis* (CCRTED). On 17 July, the U.S. Peace

Corps hosted a meeting of the *International Coordinating Group for Dracunculiasis Eradication* (ICGDE) where the four U.N. agencies were represented for the first time: the WHO, the World Bank, UNDP, and UNICEF. They reviewed the status of GDEC, addressed the significance of rural water supply and sanitation programs carried out in the 1980s, and came up with suitable arrangements to further endorse GDEC through research presentations and publications (CDC, 1990b).

The “eradication” of GWD was endorsed by UNICEF and 71 heads of state in September, during the “World Summit for Children” held in New York City (CDC, 1990c).

With support from UNICEF, Burkina Faso’s MoH carried out the first nationwide case search in November and December (CDC, 1991b).

On 28 March, TCC announced a donation of temephos worth about \$2 million to be used for African GWEPs with shipment and distribution to be provided by UNICEF (CDC, 1990a). IMPACT provided a grant for \$200,000 to Mali’s GWEP to be used in the highly endemic Douentza Cercle of Mopti Region (WHO, 1991b). A donation of more than 1.4 million monofilament nylon filters for GWEPs in Africa was made to TCC from Precision Fabrics Group, Inc. (PFG), on 11 October. The DuPont Corporation manufactured the thread used to construct the filters and shipped and distributed them to endemic African countries (CDC, 1990c). Nigeria received a grant from Japan for 22 four-wheel drive vehicles, 299 motorcycles, and spare parts. A grant from the Malaysian Organizing Committee for “Sport Aid 88” provided a \$20,000 grant to IMPACT for use in anti-GWD activities in Mali. Health and Development International (HDI) received a donation of \$100,000 that allowed the non-profit agency to begin contributing to eradication efforts (CDC, 1990d).

The *Nigerian Journal of Parasitology* issued a series of six pieces that studied the biological, cultural, epidemiological, and social facets of GWD in Nigeria in addition to its “elimination” from West Africa (see Adeyemi, 1990; Johnson, Atting, Boxshall, & Braide, 1990; Onwuliri, Adeiyongo, & Anosike, 1990; Onwuliri, Braide, Anosike, & Amaefuna, 1990; Suleiman & Abdullahi, 1990; Ugwu & Nwaorgu, 1990).

1990					
Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1989	Number of Localities that Reported $\geq 1$ Cases of GWD	Percentage of Global Number of Localities that Reported $\geq 1$ Cases of GWD
Benin	37,414	6.00	421.67	3,756	19.92
Burkina Faso	42,187	6.77	-6.26	2,261	13.90
Cameroon	742	0.14	-14.81	82	0.43
CAR	ND	N/A	N/A	ND	N/A
Chad	ND	N/A	N/A	ND	N/A
Ethiopia	2,333	0.37	-34.56	ND	N/A
Ghana	123,793	19.85	-31.06	5,111	27.11
India	4,798	0.77	-39.12	897	4.76
Ivory Coast	1,360	0.22	-12.54	ND	N/A
Kenya	6	0.00	20.00	ND	N/A
Mali	884	0.14	-20.43	ND	N/A
Mauritania	8,036	1.29	1,697.76	511	2.71
Niger	ND	N/A	N/A	ND	N/A
Nigeria	394,082	63.20	-38.43	5,238	27.78
Pakistan	160	0.03	-70.04	56	0.30
Senegal	38	0.01	N/A	ND	N/A
Sudan	ND	N/A	N/A	ND	N/A
Togo	3,042	0.49	10.66	584	3.10
Uganda	4,704	0.75	259.36	ND	N/A
<b>Totals</b>	<b>623,579</b>	<b>100.00%</b>	<b>-30.10%</b>	<b>18,856</b>	<b>100.00%</b>

**Table 10.** Case totals, percentage of the global case total, and percent change in case totals compared to 1989; number of localities that reported  $\geq 1$  cases of GWD and percentage of the global number of localities that reported  $\geq 1$  cases (CDC, 1991a, 1991b; Greer, 1992; WHO, 1991b, 1993b).

As the IDWSSD came to an end, merely four of the 19 suspected and/or confirmed ECs had established national GWEPs, while only five others had completed some scale of active case search (WHO, 1991b). Data for localities that reported  $\geq 1$  cases of GWD are presented for 1990 as this is the first year that such information was available for more than just a few ECs. Fifteen of 19 ECs reported 623,579 cases of GWD in 1990 for a reduction of 30.10% compared to the previous year. Benin completed its first nationwide search in June and recorded 37,414 cases in 3,756 ELs. Burkina Faso finished its case search in December and enumerated 42,187 incidents found in 2,621 ELs. The country's most endemic Province was Sanmatenga with 12,436 cases or 29.48% of the national total (CDC, 1991b). Cameroon's 742 cases of GWD were recorded from 82 ELs all located in the Mayo-Sava Department, Far North Province (Greer, 1992).

Ghana's second nationwide case search found 5,111 ELs with 123,793 incidents for a 31.06% reduction compared to 1989. Ghanaian President Rawlings' tour of ELs in the country's Northern Region back in June 1988 created needed momentum as evidenced by case reductions of more than half in the majority of the 21 ELs he visited in just under two years (WHO, 1990c). Mauritania's first active case search was carried out in 1,882 localities in five Departments (second-level administrative division) of three Regions (first-level administrative division) located at the southern and southeastern part of the country (WHO, 1992b). The search recorded 8,036 incidents of GWD in 511 ELs. As a result of anti-GWD interventions during the year, Nigeria's GWEP enumerated 38.43% fewer cases compared to 1989, amongst 5,238 ELs. Togo's national case search reported 3,042 cases from 584 ELs.

India's GWEP enumerated 4,798 cases of GWD found in 897 ELs. Both are reductions from 1989 of 39.12% and 75.06%, respectively. For the second consecutive year, all of Gujarat State's 22 cases were determined to be imports from other endemic States (WHO, 1991b). None

of the cases were indigenous to Gujarat, but it still represented an increase of 266.67% in the State over a single year. Pakistan's 160 cases were recorded in 56 ELs for decreases from the previous year by 70.04% and 61.64%, respectively.

Even though the goal of eradicating GWD by the end of the *Decade* was not met, more could have been achieved to bring the program closer to the goal had it not taken so much time for many of the ECs to take action. The main reasons cited by the IDWSSD (1990) for this failure were the more critical problems that were occurring in the ECs of sub-Saharan Africa, namely the debt crisis, famine, civil wars, and the AIDS epidemic; the lack of a true count of cases that led many to believe GWD was not as prevalent as once thought; and an inability to comprehend the association between rural water supply projects and “child survival” among some officials.

#### **4.12. 1991**

Pakistan's GWEP cash reward scheme that would give ~\$40 to anybody who reports a positive case of GWD anywhere in the country in addition to the VI who first informs the national GWEP beginning in January (Azam, 1995).

Ghana began the year with the implementation of monthly locality-based surveillance in carried out by LBWs (CDC, 1991a).

India's *Task Force* met from 17-18 January at NICD in Delhi. The country's GWD status was presented, accomplishments of the national GWEP as well as problems were discussed, and actions that need to be taken in order to achieve zero cases of GWD by the end of the year were deliberated (CDC, 1991a).

In January, the *Executive Board* of the WHO approved a draft decree that called on GWD eradication to be submitted at the WHA in May. The resolution's intent was to reinforce the goal of GWD eradication by 1995 as opposed to "in the 1990s" as stated in Resolution WHA42.29 ratified at the 1989 WHA (CDC, 1991a).

During February and March, Mauritania's GWEP formulated a *Plan of Action* that would conduct anti-GWD activities in the ELs found as a result of the case search in 1991 (CDC, 1991a).

Nigeria held its fourth *National Conference on Dracunculiasis* in Lagos from 20-21 March where over 300 people in attendance. The first day of the Conference coincided with national "Guinea Worm Eradication Day." The Vice President spoke at the opening ceremonies where he directed all GWD-endemic LGAs to make at minimum ten percent of their health budgets available for anti-GWD activities. In commemoration of "Guinea Worm Eradication Day," three new postage stamps were unveiled to relay the importance of GWD eradication around the country. In addition, it was announced that PHC would be broadened to include all ELs to hasten anti-GWD interventions. The *Conference* was covered by various national media outlets (WHO, 1991a).

Ghana convened a meeting with Regional GWEP Coordinators and Regional Directors of Health Services on 12 April in the Central Region's Cape Coast. Attendees appraised the GWEP's interventions and final counts over the past year (CDC, 1991b).

On 13 May, the Forty-fourth WHA adopted resolution WHA 44.5 that committed to achieve "eradication" of GWD by the end of 1995 (WHA, 1991). Thus, the decree submitted in January was accepted and provided an additional impetus to the attain eradication of GWD by the proposed target date. During the *Assembly*, a three-phase strategy for surveillance and

interventions recommended for national GWD eradication programs was shared based on experiences in Ghana, Nigeria, and Pakistan. Presented was the three necessary activities of a national GWEP's operational phase: 1) establish a national program office and conduct baseline surveys to ascertain the extent of GWD by means of a nationwide survey; 2) implement locality-based interventions in all ELs; 3) institute intensive case containment measures when the remaining numbers of cases are sufficiently low (Hopkins & Ruiz-Tiben, 1991; Hopkins et al., 1993). Also, WHA 44.5 also pressed the WHO "to immediately initiate country-by-country certification of elimination so that the certification process can be completed by the end of the 1990s" (WHA, 1991).

The *Coordinating Committee* for Uganda's GWEP met for the first time on 14 May in Entebbe (CDC, 1991c).

The first meeting of *National Program Coordinators of Guinea Worm Eradication Programs* convened from 25-28 May in Brazzaville, Republic of Congo. National GWEP coordinators and/or other national representatives from every ECs of the African continent except Mali were present along with some of GDEC's partners, namely, Global 2000, Inc., HDI, UNDP, UNICEF, and the U.S. Peace Corps. Recommendations subsequently adopted were: anti-GWD activities for 1991-1992 outlined during the *Meeting* to be implemented in all ECs; improvement in the dissemination of data related to GWD and eradication activities between ECs; at the May convening of the WHA ratify a resolution to endorse "eradication of dracunculiasis by 1995" as proposed at the September 1988 session of WHO/AFRO; ECs complete nationwide case searches and draft a national *Plan of Action* as soon as possible; ECs expand locality-based surveillance and anti-GWD interventions as soon as possible; institute governmental policies that give priority to ELs for DW projects; initiate a secretariat for national



GWEPs; support operational research that is applicable to the eradication campaign; those ECs with highly endemic areas near international borders establish appropriate channels of communication for GWD surveillance with those neighboring countries (WHO, 1991c).

As part of GDEC's data management component, the *Dracunculiasis Eradication Program Geographic Information System* (DEPGIS) was developed by researchers at Hunter College in New York that originally consisted of various computer programs used in conjunction with maps and digital geographic data. A pilot project was carried out in Dassa District in Zou Province, Benin. An ongoing rural DW supply project created digital spreadsheet to store information on wells and boreholes which included their approximate location. Preexisting maps were digitized and Landsat-5TM imagery was obtained. The imagery unveiled settlements not shown on the maps, but had been visited by the rural DW supply project for data collection (Clarke, Osleeb, Sherry, Meert, & Larsson, 1991).

A symposium on GWD eradication, hosted by the U.S. Peace Corps, was held from 3-6 June in Benin. Nearly 40 people attended including ten National Program Coordinators and PCV from two ECs (CDC, 1991c).

Cameroon's GWEP celebrated "National Guinea Worm Day" on 26 June. The head of Nigeria's Northeast Zone which borders Cameroon's endemic Extreme North Province was present for the celebration (CDC, 1991c).

The first annual *Program Reviews* of Ghana and Nigeria's GWEPs were held jointly in July at TCC headquarters in Atlanta (CDC, 1991c).

In July, Nigeria implemented monthly locality-based surveillance reports (CDC, 1992b). On 27 August, Nigeria became 30 States and the FCT with the addition of Enugu, Abia, Jigawa, Yobe, Taraba, Kebbi, Kogi, Osun, and Delta. Gongola and Bendel's names were changed to

Adamawa and Edo, respectively. The highly endemic eastern portion of Anambra State became Enugu State (Law, 1999).

A mid-year review of India's State-level GWEPs was held in Delhi on 9 August (CDC, 1991c).

Uganda's *Coordinating Committee* put on a seminar from 2-6 September to train health workers from eight northeastern Districts in preparation for active locality-based case searches. Cameroon's national Task Force convened on 23 September. The *Dracunculiasis Operations Research Network* (DORN) held a workshop at Centre Muraz in Bobo Dioulasso, the administrative capital of Houet Province, Burkina Faso from 23-28 September. Representatives from Benin, Burkina Faso, Ivory Coast, Mali, and Togo received help in the development of research proposals which led to six proposals (CDC, 1991c).

Niger and Uganda began their first nationwide case searches in October (CDC, 1991c).

Ethiopia held its first *National Guinea Worm Eradication Workshop* from 6-7 December in Nazareth with nearly 90 people in attendance from around the country. UNICEF provided financial assistance for the first national case search scheduled to take place in 1992 (CDC, 1991d).

UNICEF's *Technical Support Team* (TST) for GWD eradication met from 10-13 December in Connecticut (CDC, 1991d).

Sudan assigned a new Program Manager to the GWEP and subsequently formed a national Secretariat in December (CDC, 1991d).

Prior to the WHA in May, UNICEF approved \$4.5 million in support of GDEC to be used during the period of 1992-1994 in addition to the already existing UNICEF missions active in ECs (CDC, 1991b). The *Organization of the Petroleum Exporting Countries Fund for*

*International Development* (OPEC-FID) provided a \$300,000 grant to WHO for development of a certification process for GWD eradication in June. The Georgia-Pacific Corporation made an arrangement with TCC to donate paper products for use in African GWEPs in July. Furthermore, Communicorp agreed to provide printing services at no charge. In Ghana's Northern Region, DBL handed out 3,000 t-shirts with messages about GWD prevention and provided 150 bicycles to Region's GWEP with funds from DANIDA. An arrangement between HDI and Norsk Hydro provided 3,000 t-shirts for Nigeria's GWEP with "Stop Guinea Worm Now—Just Ask Me How" printed on them to promote GWD prevention (CDC, 1991c). A five-year grant was awarded to Global 2000, Inc. in November by the *Conrad N. Hilton Foundation* to establish a *Secretariat* for Ethiopia's GWEP (CDC, 1991d).

1991

Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1990	Number of Localities that Reported ≥ 1 Cases of GWD	Percentage of Global Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1990
Benin	4,006	0.95	-89.29	ND	N/A	N/A
Burkina Faso	ND	N/A	N/A	ND	N/A	N/A
Cameroon	393	0.09	-47.04	81	0.65	-1.22
CAR	ND	N/A	N/A	ND	N/A	N/A
Chad	ND	N/A	N/A	ND	N/A	N/A
Ethiopia	ND	N/A	N/A	ND	N/A	N/A
Ghana	66,697	15.76	-46.12	3,718	29.73	-27.25
India	2,185	0.52	-54.46	576	4.61	-35.79
Ivory Coast	12,690	3.00	833.09	503	4.02	N/A
Kenya	ND	N/A	N/A	ND	N/A	N/A
Mali	16,024	3.79	1,712.67	1,099	8.79	N/A
Mauritania	ND	N/A	N/A	ND	N/A	N/A
Niger	32,829	7.76	N/A	1,517	12.13	N/A
Nigeria	281,937	66.60	-28.46	4,908	39.25	-6.30
Pakistan	106	0.03	-33.75	35	0.28	-37.50
Senegal	1,341	0.32	3,428.95	68	0.54	N/A
Sudan	ND	N/A	N/A	ND	N/A	N/A
Togo	5,118	1.21	68.24	ND	N/A	N/A
Uganda	ND	N/A	N/A	ND	N/A	N/A
<b>Totals</b>	<b>423,326</b>	<b>100.00%</b>	<b>-32.11%</b>	<b>12,505</b>	<b>100.00%</b>	<b>-33.68%</b>

**Table 11.** Case totals, percentage of the global case total, and percent change in case totals compared to 1990; number of localities that reported ≥ 1 cases of GWD, percentage of the global number of localities that reported ≥ 1 cases, and percent change in the number of localities that reported ≥ 1 cases compared to 1990 (CDC, 1992d; WHO, 1993b).

Eleven of 19 ECs recorded 423,326 incidents from 12,505 localities reporting  $\geq 1$  cases of GWD in 1991; reductions of 32.11% and 33.68%, respectively, compared to 1990. While the number of ELs decreased overall, there were 469 new ELs discovered in 1991. As the year came to a close, many of the known ECs either finished or had just commenced their first nationwide case searches. Together, Ghana and Nigeria enumerated 348,634 incidents, or 82.36% of all reported cases. However, Nigeria alone was responsible for 66.60% of the global case total. Benin's 4,006 recorded cases were not indicative of the national level of endemicity due to inadequate surveillance focused on Zou Province. Cameroon's GWEP reported 393 cases enumerated in 81 ELs for reductions of 47.04% and 1.22%, respectively. The significant decline in total cases reflects the intervention of anti-GWD activities in 1990. Furthermore, Cameroon implemented case containment.

In November, Ivory Coast completed its first nationwide case search and counted 12,690 cases in 503 ELs. Mali's first nationwide case search led to 16,024 cases found in 1,099 ELs. Niger's final tally after its first nationwide case search found 32,829 cases in 1,517 ELs. Senegal's first national active case search was completed in July and resulted in 1,341 cases identified in 68 ELs from three Departments (second-level administrative division) in two Regions (first-level administrative division): Matam Department of Matam Region (on the border of Mauritania) and the Departments of Bakel (on the border of Mali), and Kedougou (on the border of Guinea) in Tambacounda Region (CDC, 1991c). The first nationwide case search in Togo enumerated 5,118 cases.

A preliminary case search where GWD was believed to be endemic carried out in CAR claimed to have discovered ten cases, but they were never confirmed. It was thought that transmission of GWD may have been eliminated from CAR as 1991 marked four consecutive

years without any confirmed cases reported from the country (WHO, 1992b). Chad had not provided data on GWD since 1986. Data from Ethiopia, Kenya, Mauritania, Sudan, or Uganda was not available for 1991.

By the end of the year, India's had interrupted indigenous transmission of GWD in three of its seven endemic States: Gujarat and Maharashtra joined Tamil Nadu. The national GWEP enumerated 2,185 cases in 576 ELs for reductions of 54.46% and 35.79%, respectively, compared to 1990. One case was recorded in Ramnathpuram District of Tamil Nadu State, but upon investigation it was determined to have been imported from the adjacent State of Andhra Pradesh. Rajasthan was still the most endemic States in India, responsible for 1,712 or 78.35% of the national case total, but still a decline of 49.29% from 3,376 reported the previous year (WHO, 1992a).

Pakistan, GWEP recorded 106 cases of GWD in 35 ELs. Both were decreases compared to 1990 of 33.75% and 37.50%, respectively. Only one case occurred in 22 ELs, or 62.59% of all ELs, while Ganju, Dera Ismail Khan District, NWFP was alone responsible for 43 cases, or 40.57% of the national case total (WHO, 1992c). Pakistan was unable to interrupt GWD transmission in 1991 as planned.

#### **4.13. 1992**

India convened a *Task Force* meeting of its GWEP at NICD in Delhi from 9-10 January. Of note was the interruption of GW transmission in Gujarat and Maharashtra States. After three consecutive years of surveillance and not a single case reported, twelve Districts in five States began 1992 free of GW transmission (WHO, 1992a).

A joint *Program Review* for Benin and Togo's GWEPs was held in Benin's most populous city, Cotonou, from 14-15 February sponsored by the CDC, Global 2000, Inc., UNDP, UNICEF, U.S. Peace Corps, and the WHO. It was recommended that both countries implement anti-GWD interventions in all ELs as soon as possible (CDC, 1992a).

Nigeria hosted the fourth *Regional Conference on Dracunculiasis in Africa*, 17-19 March in Enugu, the capital of Enugu State, with almost 400 people in attendance that included all ECs except CAR, Chad, and India. Coordinated by the WHO, the *Conference* was supported by the CDC, Global 2000, Inc., Nigeria's GWEP, UNICEF, UNDP, the WHO, and the U.S. Peace Corps. Practicums on certification of GWD eradication, HE, prioritization of rural DW projects, and surveillance were offered. National GWEP Coordinators that worked in collaboration with OCCGE in the endemic Francophone countries of Africa (Benin, Burkina Faso, Ivory Coast, Mali, Mauritania, Niger, Senegal, and Togo) made plans to celebrate a "National Guinea Worm Eradication Day" in unison starting 30 April 1992. General recommendations were made in addition to others on HE, Surveillance, and water supply (WHO, 1992d).

President Carter hosted a "Guinea Worm Summit" on 23 April at TCC with national and international organizations that play key roles in the campaign to muster additional support (CDC, 1992b).

Mauritania conducted a *National Conference on Dracunculiasis* from 26-29 April. Mobilization efforts to promote national awareness of GWD eradication and prevention was organized by OCCGE and carried out on 30 April in Benin, Mali, Mauritania, and Niger (CDC, 1992b).

The U.S. Peace Corps held a workshop that focused on GWEP evaluations in Nouakchott, Mauritania from 2-6 May. National Program Coordinators from Benin, Chad, Mali,

Mauritania, Niger, and Nigeria were part of the nearly 65 people present. A representative from WASH gave an initial summary appraisal of efforts by the Peace Corps on GWD eradication over the previous three years (CDC, 1992b).

On 8 May, during the annual WHA, nearly 40 individuals devoted to the eradication campaign held an informal meeting to assess the status of GDEC. After the workshop, Chad put together a national *Intersectoral Committee* for its GWEP (CDC, 1992b).

Kenya's National Program Coordinator made a two-week investigative trip to the Turkana District in June. Nearly 12,000 southern Sudanese refugees fleeing Ethiopia began to arrive in the Turkana District the same month (CDC, 1992b).

Mauritania completed training of locality-based volunteers (LBVs) assigned one to each of the country's 81 most ELs in June and July. Burkina Faso's GWEP became fully operational in July. It conducted national mobilization efforts for GWD, onchocerciasis, and trypanosomiasis from 16-17 July with support provided by the World Bank as part of its reassignment of plan for the Onchocerciasis Control Program (OCP; CDC, 1992c).

UNICEF's TST met in France from 24-28 August to talk about the prospects for integration of surveillance programs for preventable childhood diseases in addition to GWD in the 19 ECs and identifying less expensive technologies available to provide safe sources of DW (CDC, 1992c).

President Carter paid visits to the endemic Francophone African countries of Benin, Burkina Faso, Mali, Niger, and Togo from 2-8 September to meet with Heads of State and their respective Ministers of Health, Water, and Rural Development to mobilize political support for GWD eradication. While in Mali, President Carter announced GDEC's recruitment of General Touré to lead eradication efforts in Mali as well as assist GDEC's endeavor in all endemic



Francophone countries of Africa. In Burkina Faso, President Compaoré presented President Carter with a section of cloth manufactured by Faso Fani (see below). President Carter toured an EL in both Burkina Faso and Niger during his trip (CDC, 1992c).

Ethiopia began its first nationwide case search in September. Togo completed training of locality-based workers (LBWs) as well as supervisors for each Prefecture in mid-September (CDC, 1992c).

In October, UNICEF and WHO/AFRO established an *Interagency Technical Team* (ITECH) in Ouagadougou, Burkina Faso to assist GWEPs of the endemic Francophone countries of Africa (CDC, 1993a).

General Touré was appointed as the head of the *Intersectoral Committee* for Mali's GWEP on 7 October. The first assembly of the *Committee* took place at Bamako on 12 October and received extensive media exposure (CDC, 1993a).

In October, a WHO consultant traveled to Iran and visited the last known endemic area of Larestan County, Fars Province. The consultant conducted an evaluation of surveillance procedures and determined the evidence was adequate enough to initiate the certification of eradication process (CDC, 1993a; WHO, 1993b).

A team from the WHO arrived in Pakistan in, to assess the GWEP's surveillance and case containment competence from October through November. The risk of imported cases of GWD from India was of some concern, but the team concluded that once indigenous transmission has ended, Pakistan would begin the process of certification (WHO, 1993c).

General Touré's advocacy campaign continued with a trip to the U.S. from 8-20 November. First, he met with consultants on GWD and GDEC at TCC and the CDC as well as a representative of WHO/AFRO and the Japanese Consul General in Atlanta. Next, in New York

City, General Touré visited the offices of UNDP, UNICEF, and CARE. Washington, D.C. was the final stop where he spoke with officials from the World Bank, AID, and the U.S. Peace Corps (CDC, 1993a).

The first of an annual series of *Program Reviews* for national GWEPs was held 28-31 October, in Entebbe, Uganda, for the endemic Anglophone African countries of Ethiopia, Ghana, Nigeria, Sudan, and the host country (CDC, 1993a).

Mali held a *National Conference on Dracunculiasis* from 30 November to 4 December to discuss the progress of the nationwide case search completed in the Regions of Kayes, Koulikoro, Mopti, and Segou. A workshop to prepare Regional *Plans of Actions* was attended by leaders of the four Regions (CDC, 1993a).

The endemic Francophone countries of Africa met in two separate assemblies for their *Program Review*: the first from 3-5 December in Bamako, Mali, for Mali, Mauritania, and Senegal; the second from 7-9 December in Ouagadougou, Burkina Faso, for Burkina Faso, Cameroon, and Niger (CDC, 1993a).

From 14-17 December, UNICEF's TST met in Ouagadougou, Burkina Faso where they discussed integrated locality-based surveillance for GWD, mortality, natality, and vaccine-preventable diseases; development of a GIS to map localities for disease control, sanitation, and water on the African continent; and the schedule of the 1993 assembly of *National Program Coordinators of Guinea Worm Eradication Programs* (CDC, 1993a).

National "Guinea Worm Week" was observed in Togo in December. Monthly locality-based reporting was successfully implemented by the end of the year in Nigeria and anti-GWD interventions were operational in every one of Ghana's known ELs (WHO, 1993b).

Cameroon began to offer cash rewards of ~\$4 by the end of 1992 for patients who were positively diagnosed with GWD within 24 hours of a GW's emergence and confirmed by a member of the *Health Outreach Team* (Sam-Abbenyi, Dama, Graham, & Obate, 1999).

A donation of \$100,000 from the *A.G. Leventis Foundation* was received by TCC for use in Nigeria's GWEP. Some of the funds were used to purchase sewing machines to make cloth filters for the GWEP by inhabitants of ELs (CDC, 1992a). Faso Fani, a textile firm located in Burkina Faso, consented to produce a cloth pattern to advertise GDEC with the phrases "Target 1995" and "Eradication of Guinea Worm" in English and French. The cloth was to be used as an incentive for locality-based workers. Ghana's MoH received \$10,000 from *Scancem International* to train locality-based workers. Nigeria was granted nearly \$3,000 by the Dutch Embassy for the preparation of a primary school workbook to teach students about GWD prevention (CDC, 1992b).

At the end of August, UNICEF approved an additional \$5.707 million to the national GWEPs of Benin (\$625,000), Burkina Faso (\$210,000), Cameroon (\$298,000), Ghana (\$324,000), Mauritania (\$200,000), Niger (\$550,000), and Nigeria (\$3.5 million) for GWD eradication activities. Motorcycles for Togo's 23 Prefecture supervisors were donated by USAID and the WHO also made available one four-wheel drive vehicle for the national GWEP (CDC, 1992c).

1992

Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1991	Number of Localities that Reported ≥ 1 Cases of GWD	Percentage of Global Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1991
Benin	4,315	1.10	7.71	453	3.47	N/A
Burkina Faso	11,784	2.99	N/A	908	6.95	N/A
Cameroon	127	0.03	-67.68	32	0.24	-60.49
CAR	ND	N/A	N/A	ND	N/A	N/A
Chad	156	0.04	N/A	37	0.28	N/A
Ethiopia	303	0.08	N/A	64	0.49	N/A
Ghana	33,464	8.49	-49.83	3,185	24.37	-14.34
India	1,081	0.27	-50.53	249	1.90	-56.77
Ivory Coast	ND	N/A	N/A	ND	N/A	N/A
Kenya	ND	N/A	N/A	ND	N/A	N/A
Mali	ND	N/A	N/A	ND	N/A	N/A
Mauritania	1,557	0.40	N/A	ND	N/A	N/A
Niger	500	0.13	-98.48	1	0.01	-99.93
Nigeria	202,917	51.51	-35.03	4,616	35.31	-5.95
Pakistan	23	0.01	-78.30	7	0.05	-80.00
Senegal	728	0.18	-45.71	79	0.60	16.18
Sudan	2,447	0.62	N/A	180	1.38	N/A
Togo	8,179	2.08	59.81	584	4.47	N/A
Uganda	126,369	32.08	N/A	2,677	20.48	N/A
<b>Totals</b>	<b>393,950</b>	<b>100.00%</b>	<b>-6.94%</b>	<b>13,072</b>	<b>100.00%</b>	<b>4.53%</b>

**Table 12.** Case totals, percentage of the global case total, and percent change in case totals compared to 1991; number of localities that reported ≥ 1 cases of GWD, percentage of the global number of localities that reported ≥ 1 cases, and percent change in the number of localities that reported ≥ 1 cases compared to 1991 (CDC, 1993d; WHO, 1993b, 1994).

Fifteen ECs reported a global total of 393,950 cases from 13,072 localities that reported  $\geq 1$  cases of GWD in 1992 for a decrease of 6.94% in the former and a 4.53% increase in the latter, compared to 1991. Limited surveillance in Benin and Burkina Faso resulted in 4,315 cases present in 453 ELs in the former and 11,784 cases discovered in 908 ELs in the latter. Cameroon saw declines in both total cases and ELs by 67.68% and 60.49%, respectively, compared to the previous year. Ethiopia's first nationwide case search yielded 303 cases found amongst 64 ELs in two Provinces: Gambela, 57 and South Omo, 7 (CDC, 1993c).

The case total reported by Ghana was 49.83% less than 1991 recorded from 14.34% fewer ELs. Mauritania's 1,557 cases of GWD were found mostly amongst 141 ELs under surveillance. However, the exact number of localities in which all cases were enumerated was not available. In Niger, data was obtained from only one EL that accounted for the national case total of 500. The greatest proportion of cases was found in Nigeria with more than half of the global case total. A decrease of 28.03% over the previous year was similar in terms of proportion as it was for 1990-1991. Less significant was the reduction in ELs of merely 5.95% compared to last year. Senegal saw a significant reduction in total cases compared to 1991 even though the GWEP recorded incidents found in ten new ELs not identified the year before (WHO, 1993b).

Although results from Sudan did not accurately reflect nationwide endemicity, it began to establish the true extent of GWD in the country based on active surveillance that was limited due to insecurity mainly in the southern States. Thus, the initial case search's results were limited to only five States. Togo was the only other EC to report an increase in cases compared to 1991 other than Benin, but the 59.81% increase was much more significant than the latter's reported 7.71%.

Upon completion of its first nationwide active case search in July, Uganda passed Ghana in terms of endemicity and moved into second place with 126,369 cases (32.08% of the global case total) recorded in 2,677 ELs. Seventeen northern Districts were covered commencing in the northeastern portion of the country. All Districts but Iganga were found to be endemic. The three most endemic Districts Kitgum, Kotido, and Moroto, were responsible for 119,906, or 94.89% of Uganda's 1992 case total. What's more, each bordered southern Sudan while Moroto also shared a border with Kenya (WHO, 1993a).

Significant reductions in both incidence and the number of localities that reported  $\geq 1$  cases of GWD compared to 1991 were seen in India of 50.53% and 56.77%, respectively. Rajasthan State was responsible for 1,712 or 78.39% of the national total (CDC, 1993b). After three years of case containment measures, Pakistan enumerated 23 cases found in seven localities that reported  $\geq 1$  cases in two Provinces: NWFP, 5 and Sindh, 2. Ganju, Dera Ismail Khan District, NWFP was the most endemic for the second consecutive year. Though 64.29% fewer cases were recorded compared to 1991, the 15 cases enumerated in 1992 were responsible for 65.22% of Pakistan's 1992 GWD case total (WHO, 1993c).

Almost every known EC was involved in GDEC by end of 1992. No data was made available from Ivory Coast, Mali, Chad, or Kenya. The latter two were the only ECs that had yet to begin national case searches. The transition to monthly locality-based surveillance was cited as the cause of Ivory Coast's GWEP not submitting data for 1991 (WHO, 1993b).

#### **4.14. 1993**

Pakistan's GWEP enhanced its reward scheme in January, offering ~\$120 to patients with GWD that follow through with case containment measures and ~\$20 to anyone who reports

a case. Ivory Coast formally launched its national GWEP on 7 January. An inaugural ceremony was held to present the results of the nationwide case search and the *Plan of Action*. Delegates from various national and international donor agencies and organizations involved in the country's GWEP attended (CDC, 1993a).

Mali's *Intersectoral Committee* met on 8 January to go over anti-GWD interventions and activities planned for the year. A *Program Review* was conducted for the endemic Francophone countries of Africa (Benin, Chad, Ivory Coast, and Togo) in Abidjan, Ivory Coast, 12-15 January. General Touré attended the *Review* and while in the national capital, he met with the Ivorian President and Ministers to discuss the countries' GWEPs (CDC, 1993a).

India's *Task Force* met in Delhi from 19-20 January to review epidemiological data from the previous year. The absence of indigenous transmission in the States of Gujarat and Maharashtra since 1991 was noted (CDC, 1993b).

Chad's nationwide case search got underway on 4 March. That same month, Global 2000, Inc. and the CCRTED began to provide direct assistance to the GWEPs of Mali and Niger; the first ECs of Francophone Africa to receive assistance from Global 2000, Inc. Niger formed a national *Secretariat* as a result (CDC, 1993b).

During a televised speech at an international conference for nurses held in Accra on 16 March, Ghana's President Rawlings stated "in addition to the need for nurses that can operate the most sophisticated equipment, but nurses who could 'mobilize a village to combat Guinea worm'" (CDC, 1993b, p. 6).

From 18-19 March, Ghana's GWEP conducted a *Program Review* in Accra. With nearly 60 people in attendance, presentations were made on planned anti-GWD activities and the

coverage rate of EL for household cloth filter distribution, VC, and safe DW supply in place at the Regional level (CDC, 1993b).

A ceremony was held on 19 March to celebrate Nigeria's fourth "National Guinea Worm Eradication Day" in Lagos. During the event, a speech was given about an experience with the Chair of Paikoro LGA recounting a visit to an EL where "the village head wept openly because, according to him, Chairman Danjuma Baba was the first government official ever to visit the village" (CDC, 1993b, p. 8).

Benin hosted the second assembly of *National Program Coordinators of Guinea Worm Eradication Programs*, 23-26 March, in Cotonou, with all ECs present except Chad and Ethiopia. About 80 people attended including delegates from CAR, Gambia, Guinea, and Iran, representatives of Global 2000, Inc., UNICEF, and the WHO, in addition to General Touré who spoke about mobilization in Mali. National Coordinators presented progress reports on their respective programs. Coverage rates for all known ELs of six operational indices in 1992 were shared by fourteen ECs: ELs with a trained locality-based health worker; ELs reporting cases of GWD monthly; EL provided with HE; ELs where cloth filters were distributed to every household; ELs with safe source of DW available; and ELs with VC carried out (Table 13). Presentations and discussions were also held on case containment, GIS and mapping, and surveillance strategies. After his presentation, General Touré left to meet with Benin's president (CDC, 1993b).



Key Operational Indices, 1992							
Country	Number of ELs	Trained Locality-based Health Worker	Monthly Case Reports	Health Education	Cloth Filters	≥ 1 Safe Source of DW	Vector Control
Benin	3,762	1.99%	11.99%	14.01%	11.99%	39.00%	0.00%
Burkina Faso	2,621	100.00%	0.00%	22.01%	22.01%	3.01%	0.00%
Cameroon	32	100.00%	100.00%	71.88%	100.00%	25.00%	100.00%
Ghana	3,100	100.00%	97.00%	100.00%	75.00%	40.00%	21.00%
India	249	0.00%	0.00%	100.00%	100.00%	95.98%	100.00%
Ivory Coast	503	11.93%	0.00%	37.97%	0.00%	85.09%	0.00%
Mali	1,230	6.02%	6.02%	6.02%	6.02%	60.00%	0.00%
Mauritania	511	27.98%	0.00%	27.98%	27.98%	0.00%	0.00%
Niger	1,157	0.00%	0.00%	17.98%	0.00%	3.98%	0.00%
Nigeria	4,576	100.00%	77.99%	100.00%	70.00%	30.00%	0.00%
Pakistan	7	100.00%	100.00%	100.00%	100.00%	14.29%	85.71%
Senegal	79	69.62%	100.00%	78.48%	78.48%	37.97%	0.00%
Togo	581	93.98%	40.96%	35.97%	76.08%	74.01%	0.00%
Uganda	2,677	84.01%	76.02%	91.00%	15.02%	9.00%	0.00%

**Table 13.** Rates of coverage for ELs in 1992 of six “Key Operational Indices” as reported at the *National Program Coordinators’* assembly in March 1993 (CDC, 1993b).

Shipments of “Guinea Worm Cloth” arrived in Benin, Chad, Ivory Coast, and Mauritania in March and UNICEF’s TST met on the 26<sup>th</sup> of the same month (CDC, 1993b).

“National Guinea Worm Eradication Day” was celebrated in seven of the ten ECs of Francophone Africa for the second consecutive year on 30 April. That same month, General Touré visited five ELs in Kayes Region and toured ELs of Mopti and Segou Regions in May (CDC, 1993c).

A consultative trip by the WHO to Yemen in preparation for certification from 19-30 May led to the possibility that endemic GW transmission still occurred. A nationwide case search was recommended (CDC, 1993c).

During the U.N. *Conference on Environment and Development* held in Rio de Janeiro from 3-14 June, it was recommended that the GW be prohibited from any suggestions to protect its survival as a species (Muller, 1992).

Uganda’s GWEP held its first seminar from 24-25 June where the final results of the nationwide case search were presented and activities of the GWEP were reviewed (CDC, 1993c).

With support from UNICEF public health and medical authorities from Kenya’s five suspected endemic Districts gathered in July to implement surveillance strategies in their respective Districts (CDC, 1993d).

President Carter met with Benin’s President to go over the status of the country’s GWEP and then continued on and visited Ethiopia, Kenya, Sudan, and Uganda from 31 July to 8 August. The visits were an attempt to help focus attention on these national GWEPs. In Kenya, associates traveling with President Carter managed to meet with the head of *Operation Lifeline Sudan* (OLS) together with delegates from two rebel groups of southern Sudan to discuss the

possibility of implementing anti-GWD measures in uncontested areas of the southern States (CDC, 1993d).

A course on the use of temephos was conducted in Niamey, Niger from 7-9 September and attended by affiliates from the GWEPs of Niger, Senegal, and Togo (CDC, 1993d).

The annual *Program Review* for endemic Anglophone countries was held 20-24 September, in Addis Ababa, Ethiopia. In addition to the host country, representatives from the national GWEPs of Kenya, Ghana, Nigeria, Sudan, and Uganda attended with the additional presence of a delegate from Yemen. Ivory Coast hosted the annual *Program Review* for the endemic Francophone countries of Benin, Cameroon, Ivory Coast, and Togo from 11-15 October in Abidjan (CDC, 1993d).

A collaborative effort by the WHO and UNICEF in October 1993 resulted in the *Joint Program on Data Management and Mapping* located within the *Division of Control of Tropical Diseases* at the WHO. The newly established unit was called *HealthMap* and served as the basis for epidemiological mapping. The unit was charged with developing a data management and mapping system to provide information seen as essential to follow-up on the progression of national GWEPs and for establishing a foundation for the certification process of eradication. Furthermore, the DEPGIS would be incorporated into the surveillance and control activities of other diseases (Cairncross et al., 2002; WHO, 1994).

The endemic Francophone countries of Burkina Faso, Chad, Mali, Mauritania, Niger, and Senegal met for the annual *Program Review* from 29 November to 3 December in Ouagadougou, Burkina Faso. On 6 December, the ICGDE gathered in Washington, D.C. with a representative of WHO/AFRO in attendance for the first time (CDC, 1994a).

In cooperation with the *African Medical and Research Foundation* and UNICEF, Kenya began a national active case search in at-risk Districts that commenced in the northern part of Turkana District in December. That same month an end-of-year in-country evaluation was conducted on Cameroon's GWEP. Suggestions on surveillance and case containment improvement were made (CDC, 1994a).

General Touré travelled to Burkina Faso and met with President Compaoré from 17-22 December to talk about the country's GWEP (CDC, 1994a).

On 12 March, Global 2000, Inc. received a donation from the Saudi Ambassador to the U.S. for \$1.9 million to be used for GDEC activities (CDC, 1993b). In August, Uganda's GWEP procured an annual grant of ~\$80,000 for 1993-1995 from USAID. An annual grant for up to \$2,000 was set up by HDI available to ECs that report  $\leq 500$  cases of GWD to aid in the implementation of cash rewards for reporting cases (CDC, 1993d). The Italian NGO, *Associazione Volontari per il Servizio Internazionale* (Association of Volunteers in International Service) received a "small-scale grant" from Japan in the amount of \$23,378 in addition to the purchase of a vehicle for its GWD eradication efforts in Kitgum District, Uganda in December. HDI procured \$17,000 for Uganda's GWEP to purchase t-shirts and provide more incentives for LBWs (CDC, 1994a).

1993

Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1992	Number of Localities that Reported ≥ 1 Cases of GWD	Percentage of Global Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1992
Benin	16,334	7.11	278.54	3,672	20.97	730.46
Burkina Faso	8,281	3.60	-29.73	535	2.98	-41.08
Cameroon	72	0.03	-43.31	19	0.11	-40.63
CAR	ND	N/A	N/A	ND	N/A	N/A
Chad	1,231	0.54	689.10	106	0.59	186.49
Ethiopia	1,120	0.49	269.64	113	0.63	76.56
Ghana	17,918	7.80	-46.46	2,280	12.71	-28.41
India	755	0.33	-30.16	186	1.04	-25.30
Ivory Coast	8,034	3.50	N/A	511	2.85	N/A
Kenya	35	0.02	N/A	5	0.03	N/A
Mali	12,011	5.23	N/A	1,295	7.22	N/A
Mauritania	5,882	2.56	277.78	452	2.52	N/A
Niger	25,346	11.03	4,969.20	1,233	6.87	123,200.00
Nigeria	75,752	32.97	-62.67	3,614	20.15	-21.71
Pakistan	2	0.00	-91.30	1	0.01	-85.71
Senegal	815	0.35	11.95	165	0.92	108.86
Sudan	2,984	1.30	21.95	285	1.59	58.33
Togo	10,349	4.50	26.53	698	3.89	19.52
Uganda	42,852	18.65	-66.09	2,677	14.92	0.00
<b>Totals</b>	<b>229,773</b>	<b>100.00%</b>	<b>-41.67%</b>	<b>17,937</b>	<b>100.00%</b>	<b>37.22%</b>

**Table 14.** Case totals, percentage of the global case total, and percent change in case totals compared to 1992; number of localities that reported ≥ 1 cases of GWD, percentage of the global number of localities that reported ≥ 1 cases, and percent change in the number of localities that reported ≥ 1 cases compared to 1992 (CDC, 1994b, 1994e; WHO, 1994, 1995d).

National GWEPs were in some form of operation in every EC by the end of 1993. Eighteen ECs enumerated 229,773 cases from 17,932 localities that reported  $\geq 1$  cases of GWD in 1993. While the global case total fell 41.67% compared to 1992, the number of localities that reported  $\geq 1$  cases of GWD increased 37.22%. Improved surveillance was the factor that led to the identification of more ELs. Monthly surveillance reports were submitted by ten of the 18 known ECs throughout the year (WHO, 1994). By year's end, Cameroon, Ghana, and Nigeria had implemented the patient-based case containment intervention established by Pakistan's GWEP (see Kappus et al., 1991).

Benin's GWEP reported astounding increases in both total cases and ELs compared to 1992 as surveillance was extended to all Departments. Burkina Faso's final case count was reduced by 29.73% compared to the previous year enumerated in 41.08% fewer ELs. Though Cameroon continued to see reductions in both total cases and ELs, their rate of change was less significant than the year before. Chad's initial case search was completed in March 1994 and covered nine Prefectures (first-level administrative divisions) of which six were found to be endemic with a total of 1,231 cases enumerated in 106 ELs. Moyen Chari and Salamat Prefectures were the most endemic with 388 cases each amongst nine ELs in the former and 37 in the latter. Mayo Kebbi Prefecture had the most ELs (47) with 157 cases of GWD. The second most endemic Prefecture was Guera with 288 cases discovered amongst four ELs. Due to security concerns, two areas of Logone Oriental Prefecture were not accessible (CDC, 1994b).

Ghana saw incidents reduced by 46.46% and ELs decline 28.41% from the previous year. However, the national GWEP discovered 520 newly ELs that did not report a single case in 1992. Data from the first operational year of the GWEP in Ivory Coast counted 8,034 cases discovered in 511 ELs. As no reports were made available for 1992, the data results for 1993

compared to totals submitted in 1991 showed a case reduction of 36.69% from eight more ELs. Increased surveillance activities in Mauritania yielded 5,882 cases discovered in 452 ELs. Niger's second nationwide case search enumerated 25,346 cases amongst 1,233 ELs. Nigeria's official case total for 1993 was 75,752 enumerated in 3,614 ELs. This was an enormous reduction in incidents of 62.67% from 21.71% fewer ELs from 1992. As a result of Senegal's move to implement anti-GWD interventions in all previously identified ELs, the country counted 815 cases in 165 localities that reported  $\geq 1$  cases of GWD. The 11.95% increase in the former was much less significant than the 108.86% surge in the latter compared to the previous year. Togo's GWEP revealed improvements made in surveillance activities with a 26.53% increase in cases reported from 19.52% more localities that reported  $\geq 1$  cases of GWD compared to 1992.

Ethiopia's case search of at-risk areas of GWD endemicity fell short of complete coverage by the end of 1993. Only two of the five Districts suspected of endemicity in Kenya were searched. The result was 35 cases discovered in five localities that reported  $\geq 1$  case. Mali's nationwide search did not reach all Regions of the country by year's end. However, 12,011 cases were identified in 1,295 ELs as a result of the limited search. The Sudanese MoH finished the nationwide case search in all areas that were accessible and recorded 2,984 cases of GWD in 285 ELs. Both categories were increases compared to 1992, however, were estimates (WHO, 1994).

India's GWEP continued to report decreases in both total cases and the number of ELs. The decline in the former of 30.16% was the lowest rate of reduction since 1988. Again, Rajasthan most endemic State with 547 cases reported for a reduction of 30.93% from 1992 and Karnataka State recorded an 82.64% decrease in the same time. Madhya Pradesh State experienced an increase in total cases reported by 96.70% as it reported 179 compared to the

previous year (CDC, 1993b). It was suggested that more stringent case containment measures needed to be implemented due to the slowdown in reduction rates (WHO, 1994).

Both cases reported by Pakistan's GWEP were from the EL of Ganju, Dera Ismail Khan District, NWFP. The first was recorded in June. In the second case, a GW reportedly emerged from an 18-year-old female on 6 October, but was kept secret until 17 October because the father did not want her to be hospitalized. Due to inadequate case containment measures in 1992, Pakistan's GWEP enabled a source of DW to be contaminated and because it was unknown, it was not treated with temephos and the DW source continued to be used by other inhabitants, effectively delaying the end of indigenous transmission for another year (CDC, 1994a).

#### **4.15. 1994**

The year began with Pakistan in the Precertification Phase. Mali's *Intersectoral Committee* held a *National Conference on Dracunculiasis* from 3-7 January. A course on the use of temephos was conducted shortly after from 12-14 January for national GWEP affiliates of Benin, Burkina Faso, Chad, Ivory Coast, Mali, Mauritania, and Senegal (CDC, 1994a).

Ivory Coast's GWEP implemented locality-based monthly reports in January (CDC, 1994c).

On 14 February, Sudan restructured its first-level administrative divisions from nine Provinces to create 26 new States (WHO, 1995a).

Burkina Faso hosted the fifth *Regional Conference on Dracunculiasis in Africa* in Ouagadougou, from 29-31 March, sponsored by the CDC, Global 2000, Inc., UNICEF, and the WHO. President Compaoré was the first Head of State of a host country to preside at the opening ceremony of the *Conference*. This was also the first time all ECs were represented. General



Touré was among the nearly 150 people in attendance. The *Conference* called on ECs to be sure to implement locality-based surveillance and the distribution of cloth filters to every household is carried out along with HE prior to the next respective GW transmission season and the implementation of case containment should occur as quickly as possible in all ELs. In addition, annual evaluations of national GWD surveillance systems and all interventions were suggested. It was recommended that ECs update their list of ELs annually to include newly detected ELs and remove localities found to no longer be endemic so the national GWEP can concentrate resources on interventions in ELs and limit no longer endemic or localities at high risk for GWD to surveillance activities only. ECs were asked to send monthly incident reports that also include newly ELs and investigations of the origin of imported cases to the WHO. All ECs were asked to provide their respective UNICEF country office with the most current list of ELs so they can be added in a GIS and subsequently mapped. They were asked to include the following information for each EL: the administrative division, at the lowest administrative level; population; number of GWD incidents recorded in 1993; source of DW and its functional condition; location of the closest health facility and school; and the presence of a trained LBW (CDC, 1994b).

Ethnic violence broke out in Ghana's highly endemic Northern Region on 31 January near Bimbilla, the District capital of Nanumba North, after a dispute between two men of Konkomba and Nanumba ethnicity. This led to an inter-ethnic dispute that became known as the "Guinea Fowl War" and spread throughout the Region. The Dagomba, Gonja, and Nanumba ethnic groups were embroiled in a fight against the Konkomba. After attacks on the Konkomba in the Regional capital, Tamale, the ethnic group retaliated by burning down nearly every Dagomba, Nanumba, and Gonja settlement that existed along the main road that ran from Bimbilla to the locality of Yendi. On 10 February, the Ghanaian government declared a state of

emergency as the conflict escalated in the Districts of East Gonja, Gushiegu-Karaga, Nanumba, Saboba-Chereponi, Tamale Municipal, Yendi, and Zabzugu-Tatale. Finally, the warring parties were coerced into signing a peace treaty by the government in June (Jönsson, 2009). Anti-GWD interventions were interrupted as a result (CDC, 1994d).

Celebrations for “National Guinea Worm Eradication Day” were carried out during the month of April in the endemic Francophone African countries of Benin, Burkina Faso, Ivory Coast, Mali, Mauritania, Niger, Senegal, and Togo. Uganda celebrated its first “National Guinea Worm Eradication Day” on 13 June which was also the first day of the two-day *National Conference on Dracunculiasis* held in Kampala. Representatives from the GWEPs of each endemic District were present (CDC, 1994c).

A meeting between the GWEPs of the adjacent ECs of Benin and Togo occurred on 24 June to review anti-GWD activities and exchange surveillance data (CDC, 1994c).

In protest of Nigeria’s military government failure to relinquish power to a democratically elected government, the country’s oil workers’ unions called for strikes in July (Isaac, 1995). A shipment of filter material was received too late to be handed out to each household of endemic States in the north where transmission of GWD peaked from June through September due to delays at the Port of Lagos (CDC, 1994d).

On 1 August, the WHO established a *Dracunculiasis Eradication Unit* in the *Division of Control of Tropical Diseases*. During the same month, Mauritania’s GWEP began to treat DW sources with temephos (CDC, 1994d).

The state of emergency issued in Ghana’s Northern Region was lifted in August (Jönsson, 2009).

President Carter paid visits to Chad, Ghana, and Mauritania from 29 August to 6 September to meet with Heads of State, various national government officials, donor agencies, and National GWEP Coordinators from each country. Status updates of anti-GWD activities were provided and each Head of State and Minister of Health vowed to continue advocacy efforts until GWD is eradicated (CDC, 1994d).

The annual *Program Review* for endemic Anglophone countries of Africa met in Nairobi, Kenya from 19-23 September. Representatives were present from Ethiopia, Ghana, Kenya, Nigeria, and Uganda. Sudan was the only country from the group that did not attend (CDC, 1994d).

At an assembly of the Nigerien government, the national GWEP, and representatives of donor agencies held in Niamey, General Touré provided the keynote speech and later met with Niger's President. From there, General Touré's next stop was in Brazzaville, Republic of Congo where he attended the annual conference of Health Ministers from countries in the WHO/AFRO Region to advocate continues support for GDEC (CDC, 1994d).

Based on the May 1993 recommendation by the WHO, Yemen prepared to conduct its first nationwide case search. In September, information about GWD and a reward for reporting cases was publicized via newspaper, radio, and television announcements across the country (WHO, 1995c).

The annual *Program Review* for the endemic Francophone countries of Africa occurred from 10-14 October in N'Djamena, Chad with representatives from of Benin, Cameroon, Chad, Niger, and Togo present. Also in attendance was General Touré who met with the Chadian Prime Minister and President to discuss the eradication of GWD. Before his return to Mali, General Touré stopped in Ouagadougou to meet with Burkinabe President Compaoré (CDC, 1994d).

Officials of the Adrar Region of Mauritania reported 67 cases of GWD found in the Regional capital of Atar in October to the national GWEP. In response, team was sent to confirm the cases and an active search was carried out which discovered 38 additional incidence in the city. Additional searches were carried out in the four Departments of Adrar Region (CDC, 1994d).

Nigeria's national *Task Force* met in the Sokoto State capital from 17-18 November with GWEP workers from the country's 45 most highly endemic LGAs (CDC, 1994e).

Yemen's GWEP was alerted to suspected cases in Wesab District of Dhamar Governate in November where household searches conducted in two suspected ELs revealed incidents of GWD. The first nationwide active case search in Yemen officially began in December and discovered cases in al-Sudah District of Sana'a Governate (WHO, 1995c).

On 14 December, Ethiopia's GWEP held its first national *Program Review* in the capital, Addis Ababa (CDC, 1994e).

By the end of the year, *HealthMap* had georeferenced four-fifths of all known ELs and mapped them with DEPGIS (WHO, 1995d).

Almost \$155,000 was generated by Nigeria's Kano State GWEP through a fundraiser in January. The Japanese Embassy in Mali contributed ~\$6.7 million on 9 February to assist with a JICA project to install 500 wells that would provide safe sources of DW for Mali's ELs (CDC, 1994b). On 18 May, during a seminar on the eradication of GWD in Oslo, Norway's Ministry of Development Cooperation unveiled a \$1.4 million donation to GDEC that would be split between Global 2000, Inc. and UNICEF. HDI was responsible for the procurement of these funds. The portion allocated to Global 2000, Inc. was to assist case management, VC, and

various actions in the eradication campaign. UNICEF's share was for GWEPs in Burkina Faso, Niger, and Uganda (CDC, 1994c).

A grant for \$3.5 million to be distributed over three years was made to Global 2000, Inc. for GDEC on 1 October by USAID at a ceremony held in Washington, D.C. that commended continued donations from American Cyanamid, DuPont, and PFG in a cooperative effort to aid TCC and USAID in the effort to eradicate GWD. Nearly 100 people were in attendance which included the ambassadors to the U.S. from Ghana, Mali, and Sudan. Substantial funding was committed GDEC by the *Canadian International Development Agency* (CIDA) for approximately \$6.36 million to UNICEF. The money was for GWEPs in Benin, Burkina Faso, Cameroon, Chad, Ethiopia, Ghana, Ivory Coast, Kenya, Mali, Mauritania, Nigeria, Sudan, Togo, and Uganda (CDC, 1994d). Fifty motorcycles were donated to Mali's GWEP by JICA in December. The IACGDE met on 7 December in Washington, D.C. where the Pan American Health Organization (PAHO) announced it was preparing for countries in the western hemisphere to be certified free of GWD (CDC, 1994e).

In response to a request from President Carter, DuPont de Nemours & Co. together with PFG increased their donation of monofilament nylon cloth for assembling filters. On behalf of Global 2000, Inc., President Carter made visits to Chad, Ethiopia, Ghana, Ivory Coast, and Mauritania, during the months of August and September in an effort to promote the eradication campaign among political heads, medical leaders, and NGOs. Similarly, General Touré made stops in Burkina Faso, Chad, Ivory Coast, Niger, and Senegal and also attended the WHO/AFRO annual summit of African Ministers of Health, in Brazzaville, Congo (WHO, 1995d).

1994

Country that Reported Cases of GWD	Case Totals	Percentage of Global Case Total	% Change in Case Totals Compared to 1993	Number of Localities that Reported ≥ 1 Cases of GWD	Percentage of Global Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1993
Benin	4,302	2.61	-73.66	420	4.21	-88.84
Burkina Faso	6,861	4.16	-17.15	479	4.80	-10.47
Cameroon	30	0.02	-58.33	18	0.18	-5.26
CAR	10	0.01	N/A	ND	N/A	N/A
Chad	640	0.39	-48.01	126	1.26	18.87
Ethiopia	1,252	0.76	11.79	99	0.99	-12.39
Ghana	8,432	5.11	-52.94	1,101	11.03	-51.71
India	371	0.22	-50.86	70	0.70	-62.37
Ivory Coast	5,061	3.07	-37.01	244	2.44	-52.25
Kenya	53	0.03	51.43	12	0.12	140.00
Mali	5,581	3.38	-53.53	647	6.48	-50.04
Mauritania	5,029	3.05	-14.50	420	4.21	-7.08
Niger	18,562	11.25	-26.77	866	8.67	-29.76
Nigeria	39,774	24.11	-47.49	3,103	31.08	-14.14
Pakistan	0	N/A	N/A	N/A	N/A	N/A
Senegal	195	0.12	-76.07	49	0.49	-70.30
Sudan	53,271	32.29	1,685.22	779	7.80	173.33
Togo	5,044	3.06	-51.26	508	5.09	-27.22
Uganda	10,425	6.32	-75.67	1,027	10.29	-61.64
Yemen	94	0.06	N/A	17	0.17	N/A
<b>Totals</b>	<b>164,987</b>	<b>100.00%</b>	<b>-28.20%</b>	<b>9,985</b>	<b>100.00%</b>	<b>-44.33%</b>

**Table 15.** Case totals, percentage of the global case total, and percent change in case totals compared to 1993; number of localities that reported ≥ 1 cases of GWD, percentage of the global number of localities that reported ≥ 1 cases, and percent change in the number of localities that reported ≥ 1 cases compared to 1993 (WHO, 1995b, 1995d).

As most national GWEPs began to implement the case containment strategy, issue #46 of the *Guinea Worm Wrap-Up* printed the accepted definitions for a case of GWD and an EL. The definition of a case of GWD continued to be the same as the one proposed at the March 1988 *Regional Conference on Dracunculiasis Eradication in Africa* hosted by Ghana: “An individual exhibiting or having a recent (about one year) history of skin lesion with emergence of a guineaworm [*sic*].” It was reiterated that one patient equaled one case of GWD no matter how many GWs surface and emphasized that each emerged GW needed to be contained. An EL was defined as “a collection of residences, usually sharing a single chief, where one or more case(s) of dracunculiasis has occurred in the past 12 months” (CDC, 1994e, p. 15).

A global total of 164,977 cases were counted from 9,985 localities that reported  $\geq 1$  cases of GWD in 1994; decreases of 28.20% in the former and 44.33% in the latter, compared to 1993. Pakistan was the first GDEC country to report zero cases for a full year in 1994 (Azam, 1995). Yemen joined GDEC after its endemic status was confirmed in November, with 52 cases identified in five localities (WHO, 1995c). The top three ECs were Niger, Nigeria, and Sudan, which combined accounted for 111,607 incidents, or 67.65% of all cases reported in 1994, with 18,562, 39,744, and 53,271 cases, respectively.

The most significant decreases in terms of sheer numbers occurred in Benin where significant progress was indicated by the 73.66% reduction in total cases and 88.84% drop in localities that reported  $\geq 1$  cases of GWD compared to 1993. Burkina Faso also continued to see decreases in both categories. The larger decrease in cases compared to localities that reported  $\geq 1$  cases of GWD was representative of the low number of cases left in the country. Of the 30 cases reported in Cameroon, eight were believed to have been imports from Nigeria’s Borno State which borders Cameroon’s Far North Province.

Chad's more efficient surveillance activities were shown by the discovery of more ELs while the number of cases dropped due to interventions previously put in place. Ethiopia experienced outcomes similar to those seen in Chad. Total incidents as well as localities that reported  $\geq 1$  cases of GWD in Ghana were both significant drops compared to 1993 despite the hindrance to the national GWEP by conflicts in the country's highly endemic Northern Region. The GWEP of Ivory Coast reported declines in both categories but more so was the proportional decrease in localities that reported  $\geq 1$  cases. Kenya reported one confirmed indigenous case while the rest were imported from Sudan and Uganda.

Both categories saw reductions by half in Mali from the previous year's totals. Mauritania's declines over the year were minimal as a new area of endemicity was discovered in August in the Adrar Region. As the EC with the third most incidents of GWD, Niger reported declines in both categories. However, an end-of-year evaluation discovered shortcomings in material supplies, supervision, and surveillance suggesting the national GWEP needed to reevaluate its approach. The second most EC, Nigeria saw a significant decline in total cases over the past year, but the rate of decline was much smaller for the number localities that reported  $\geq 1$  cases of GWD. Enugu was the State with the highest endemicity reporting 11,510 cases; 28.94% of the national total in 1994 (CDC, 1996c).

Senegal reported reductions in both categories of over 70% compared to 1993. With the improvement in surveillance, Sudan's GWEP provided the clearest picture to date of the real extent of GWD in the country. As a result, it became the most EC involved in GDEC. Togo recorded a decline in total incidents as well as in the number localities that reported  $\geq 1$  cases of GWD. However, the significance was much less pronounced in the latter. Though Uganda experienced security problems in some of its endemic Districts, compared to 1993, the national



GWEP still managed to reduce incidents by three-quarters and localities that reported  $\geq 1$  cases of GWD fell by more than 60%.

India enumerated 371 cases in 70 localities that reported  $\geq 1$  cases of GWD in 1994. Karnataka State recorded ten cases found in two ELs. Five ELs reported 13 cases in Madhya Pradesh State. Rajasthan continued to be the most endemic of the three remaining States still endemic for GWD with 348 cases of GWD enumerated from 63 ELs. Not a single case was confirmed in Pakistan, however, surveillance activities continued. The newest country in GDEC was Yemen, which after completing a nationwide case search recorded 106 cases found in 17 ELs in two Districts of two Governorates.

#### **4.16. 1995**

General Touré attended Togo's "Guinea Worm Eradication Day" celebration on 18 February in Notsie, the capital city of Haho Prefecture, Plateaux Region (CDC, 1995d).

President Carter and his wife were accompanied by the wife of Nigeria's President to visit an EL in Enugu State on 22 March as part of a national mobilization campaign. Following a tour of the EL, President Carter headed to the Enugu State capital to celebrate the country's "Guinea Worm Eradication Day." While in Nigeria, President Carter travelled to the national capital, Abuja, and met with the Nigerian President and other high level government officials to promote the eradication campaign (CDC, 1995b).

An outbreak of ethnic clashes continued in Ghana's Northern Region from March through April centered in Bimbilla, Nanumba District and areas adjacent to Kpatinga in Gushiegu-Karaga District (Jönsson, 2009).

Most notable in 1995 was the two-month long cease-fire negotiated by President Carter between the Sudan People's Liberation Movement (SPLM) and South Sudan Independence Movement (SSIM) with the government of Sudan (GoS) that went into effect at midnight on 29 March. Announcement of the "Guinea Worm Cease-Fire," was made 27 March, during the country's first *National Conference on Guinea Worm Eradication*. The main purpose of the cease-fire was to step-up southern Sudan's eradication efforts in conjunction with programs to administer childhood vaccines, distribute vitamin A, and promote onchocerciasis treatment during a respite in the conflict that began in 1983 between the GoS and rebel forces in southern Sudan (CDC, 1995b).

Beginning in late April and continuing through mid-June, 2,028 localities were visited in Sudan; 651 of which GWD was recorded as present for the first time. Additionally, workers enumerated 8,922 incidents and passed out 87,703 cloth filters to households in ELs. Anti-GWD interventions were expanded substantially from earlier levels and control measures were provided to roughly half of all known ELs. The rebel forces of southern Sudan and the GoS agreed to extend the cease-fire through late July on 25 May (CDC, 1995f).

Niger's GWEP started to implement case containment in April (CDC, 1996f). A "Guinea Worm Education Week" was celebrated in India from 24-30 April (CDC, 1995b).

Togo hosted the third gathering of *National Program Coordinators of Guinea Worm Eradication Programs* in Lomé, from 18-21 April. All ECs with the exception of Sudan and Kenya were represented among the crowd of over 100 which included General Touré. Program Coordinators gave an overview of their respective country's GWEP's activities for 1994 through April 1995. Sessions were held that covered case containment, national strategies for 1995, and VC (CDC, 1995b).

“Guinea Worm Eradication Day” was celebrated on 25 April in the endemic Francophone African countries of Benin, Mali, and Niger (CDC, 1995c, 1995d).

On 12 May, the WHO established the *International Commission for the Certification of Dracunculiasis Eradication* (ICCDE). This independent *Commission* of 12 public health experts from all the WHO Regions was charged to provide counsel to the WHO “on the validity of the information of former endemic countries claiming that cases of indigenous dracunculiasis no longer exist” (CDC, 1995c, p. 12).

Political support was bolstered for Senegal’s GWEP on 17 May when General Touré joined the Senegalese President and other government officials on a visit to the endemic Bakel Department of Tambacounda Region in eastern Senegal which borders the ECs of Mali and Mauritania. General Touré continued to mobilize on behalf of Mali’s GWEP by visiting each endemic Cercle of Kayes Region from 30 May to 6 June with national media following him along the way (CDC, 1995c).

Uganda’s GWEP met for the annual national *Program Review* from June 12-13 in the country’s capital, Kampala. The final day of the *Review* coincided with the celebration of Uganda’s “Guinea Worm Eradication Day” (CDC, 1995c).

President Carter and his wife travelled to Sudan to see the progress made as a result of the cease-fire. The two were joined by the national GWEP Coordinator, Minister of Health, an envoy from UNICEF, and journalists from various international media, on a 20 July trip to Juba, the capital of Bahr al-Jabal State. From there they travelled by motor vehicle to an EL west of Juba where they witnessed dozens of people being treated for GWD and a LBW exhibiting the proper use of cloth filters to inhabitants of the locality. By the end of July, more than 150,000

cloth filters had been handed out in nearly 2,500 ELs since the negotiated break in fighting (CDC, 1995d).

Sudan hosted the annual *Program Review* for endemic Anglophone countries in Khartoum from 17-21 September. Guinea reported one case determined to have been imported from Ivory Coast in September. In October, conflict in areas of southern Sudan recommenced (CDC, 1995e).

By September, Benin's Minister of Health had visited one EL in every one of the country's six Departments (CDC, 1995e).

Chad celebrated its first national "Guinea Worm Eradication Day" on 15 October (CDC, 1996a).

General Touré attended the annual *Program Review* for the endemic Francophone African countries hosted by Cameroon in Yaoundé, from 18-24 October (CDC, 1995e).

Sponsored by Global 2000, Inc., CDC sent an external evaluation team to Ghana to lead an appraisal of the country's four most endemic Regions from 22 October to 10 November and recommended more stringent management of LBWs and make improvements in case containment (CDC, 1996a).

A celebration hosted by USAID in Washington, D.C. on 4 December for the "near eradication" of GWD was led by President Carter and included delegates from ECs, and members of the international coalition that supports GDEC. The gathering received media attention from various broadcast and print sources. Next morning, President Carter and General Touré took part in a televised live interactive event where questions were asked about GDEC from audiences in Kenya, Mali, and Niger. Paralleling the broadcast, Niger celebrated "National Guinea Worm Day" and an external evaluation of the country's GWEP the following week

concluded that direction of LBWs was too lax and measures for controlling GWD transmission in ELs that surround larger ELs needed to be implemented (CDC, 1996a).

An external evaluation team assessed India's GWEP from 11-20 December. With only 60 cases of GWD reported for the year at the time the evaluation began, the evaluators recommended the national GWEP introduce and promote a national reward for reporting cases of GWD (CDC, 1996a).

A grant to Yemen's GWEP was provided by Global 2000, Inc. for the purchase of a vehicle, the completion of the nationwide case search, and to put case containment measures in place before the country's GWD transmission season started (CDC, 1995a). The Japanese coalition known as "Keidanren," donated 40, four-wheel drive vehicles and 72 motorcycles valued at nearly \$1.5 million on 27 March, to Global 2000, Inc., in support of African GWEPs. Stock certificates worth \$400,000 were given to Global 2000, Inc. in support of GWD eradication activities by Henry McConnon. The Dutch government awarded \$800,000 to TCC for the *Sudan Cease-Fire Health Initiative* (CDC, 1995b).

1995

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 1994	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1994
Benin	2,273	0	-47.16	773	0.34	491	16.90
Burkina Faso	6,281	0	-8.45	3,643	0.58	516	7.72
Cameroon	15	7	-50.00	12	0.80	8	-55.56
CAR	18	10	N/A	ND	N/A	10	N/A
Chad	149	0	-76.72	49	0.33	38	-69.84
Ethiopia	514	11	-58.95	427	0.83	77	-22.22
Ghana	8,894	6	5.48	6,582	0.74	1,057	-4.00
India	60	0	-83.83	58	0.97	24	-65.71
Ivory Coast	3,801	0	-24.90	76	0.02	252	3.28
Kenya	23	23	-56.60	1	0.04	ND	N/A
Mali	4,218	0	-24.42	2,320	0.55	534	-17.47
Mauritania	1,762	0	-64.96	846	0.48	255	-39.29
Niger	13,821	0	-25.54	9,398	0.68	750	-13.39
Nigeria	16,374	0	-58.83	5,567	0.34	1,846	-40.51
Pakistan	0	N/A	N/A	N/A	N/A	N/A	N/A
Senegal	76	1	-61.03	75	0.99	15	-69.39
Sudan	64,608	0	21.28	2,584	0.04	1,932	148.01
Togo	2,073	0	-58.90	1,617	0.78	302	-40.55
Uganda	4,810	11	-53.86	2,453	0.51	810	-21.13
Yemen	82	0	-12.77	18	0.22	21	23.53
<b>Totals</b>	<b>129,852</b>	<b>69</b>	<b>-21.29%</b>	<b>36,499</b>	<b>0.28</b>	<b>8,938</b>	<b>-10.49%</b>

**Table 16.** Case totals, number of imported cases, percent change in total cases compared to 1994, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 1994 (CDC, 1995e, 1996a; WHO, 1996c, 1997b).

Led by TCC, the devoted collaboration of the CDC, UNICEF, and the WHO, national GWEPs had been established in each of the 20 ECs by the end of the year. A total of 129,852 cases of GWD were recorded in 8,938 localities that reported  $\geq 1$  cases of GWD in 1995; decreases of 21.29% and 10.49%, respectively, compared to 1994. Case containment rates (CCR) were made available for each country reporting incidents of GWD for the first time. Overall, national GWEPs managed to contain 36,499 of all global cases reported for a 0.28 CCR. Despite the progress that had been made in the previous 15 years of GDEC, the eradication date set for 31 December 1995, was not to be.

Benin experienced a significant decrease in total incidents while the number of localities that reported  $\geq 1$  cases increased by 71 compared to 1994. Burkina Faso's GWEP reported a small drop in cases and a slight increase in localities that reported  $\geq 1$  cases from the previous year. Incidents peaked in July with 1,761 reported: a 46.14% increase than recorded in July 1994. The national GWEP had a 0.58 CCR even though it was beleaguered by a hold up in funds targeted for case containment in addition to an inefficient method of distributing cloth filters (CDC, 1995e).

Significant decreases in incidents and ELs were recorded by Cameroon's GWEP. A total of seven cases were imported from two ECs: one from Niger and six from Nigeria. Six cases were enumerated in a previously unknown EL of Sirlawe in the Mayo Kani Department, Extreme North Province between October and November (CDC, 1996a). Eight cases considered indigenous were reported from CAR in addition to ten imports (WHO, 1997b). Chad experienced large declines in both incidents and ELs compared to 1994. The most endemic Sub-prefectures were Fianga in Mayo Kebbi Prefecture and Kyabe of Moyen Chari Prefecture (CDC, 1995e). The endemic Akobo Woreda of Ethiopia's Gambela Region continued to be largely

inaccessible due to insecurity. Reductions were recorded in both incidents and ELs compared to the previous year. Among the country's case total were 11 imported from Sudan. The national GWEP reportedly achieved a 0.83 CCR.

A consequence of the ethnic violence that occurred in Ghana's Northern Region in 1994 was the 258.07% increase in incidents recorded in the Region during January, February, March, and April compared to the same four months the previous year (CDC, 1994e, 1996b). Six cases were imported from four other ECs: One each from Benin, Burkina Faso, and Niger and three from Togo.

Ivory Coast enumerated fewer incidents recorded in more localities that reported  $\geq 1$  cases compared to 1994. The national GWEP only managed a 0.02 CCR. Over three-quarters of cases recorded in Ivory Coast came from the Departments of Bondoukou, Bouaflé, and Séguéla (WHO, 1996c). Kenya was only EC to report zero indigenous incidents in 1995. However, the cases enumerated were all imported from other ECs: three from Uganda and 20 from Sudan. The national GWEP reported that only one case was contained. Though Mali's GWEP experienced reductions in both total incidents and ELs compared to 1994, comprehensive case searches had yet to be completed in the Regions of the country's northern portion.

Mauritania saw much higher reductions in incidents and ELs from the previous year. Of the 409 cases reported by the GWEP in December, 401 were obtained from a retrospective survey in Gorgol Region conducted from September through December. Reductions in Niger's recorded incidents fell at nearly the same rate seen the year before. However, the decrease in ELs was less substantial over the same period. Nigeria experienced significant reductions in both cases and ELs compared to the previous year. Enugu State, which recorded 5,026 cases of GWD, or 30.70% of the national case total in 1995, was the most significant contributor to the decline



in incidents by reducing its total 56.33% compared to 1994 (CDC, 1996c). Senegal continued to report dramatic declines in incidents and ELs. One case was found to be imported from Mauritania.

With the brief respite in fighting, Sudan's GWEP was able to access many of the previously inaccessible localities. However, areas that had been known to be endemic were still not reached during the cease-fire (WHO, 1996c). Due to increased coverage of southern Sudan, the number of incidents and localities that reported  $\geq 1$  cases rose substantially. In fact, Sudan alone was responsible for 49.76% of the global case total 21.62% of all localities that reported  $\geq 1$  cases of GWD in 1995.

Togo saw large reductions in incidents and ELs compared to 1994. The rate of reduction in incidents and ELs reported by Uganda were not as great as seen the year before. However, both continued to decline. Incidents were found amongst Sudanese refugees that were responsible for 11 cases classified as imports (CDC, 1995e).

Rajasthan was the only State in India to report incidents of GWD. In that State alone, the case total fell 82.76% and the number of ELs dropped 61.91%, compared to 1994. India's GWEP managed to contain all but two cases for a reported 0.97 CCR. For the second consecutive year, Pakistan recorded zero incidents. Yemen's GWEP reported fewer incidents compared to 1994, but also identified new localities that reported  $\geq 1$  cases of GWD in 1995.

In 1995, ECs had established national *Secretariats*, prepared national *Plans of Action*, and all but Mali and Sudan had successfully conducted nationwide active case searches. National GWEPs had begun the shift to GDEC's next stage. The priorities shifted to enhancing case containment methods, improving management and supervision of all personnel, intensifying

active surveillance, and increasing national awareness about the disease and its prevention (CDC, 1995e).

#### **4.17. 1996**

Kenya started its first year in the Precertification Phase and implemented a reward scheme for the reporting of GWD incidents as part of its GWEP's surveillance system (Cattand, Maiga, & Sang, 1999).

Yemen began to implement HE and distribute cloth filters in the 21 known ELs at the beginning of the year (CDC, 1996h).

Mali's GWEP met for its annual *Program Review* in Bamako from 4-5 January (CDC, 1996b).

The *Coordination Group* for Sudan's GWEP met from 15-17 January in Nairobi to discuss national efforts to eradicate GWD, examine technical issues, and organize strategies to be carried out during the year (CDC, 1996b).

On 5 March, the ICCDE held its first meeting at WHO headquarters. Criteria and strategies were confirmed that countries needed to complete in order to be certified free of GW transmission as well as for national and global certification of eradication (WHO, 1996b). The ICCDE was charged to evaluate evidence presented by areas, countries, and territories that profess themselves free of GW transmission seeking certification of eradication from the WHO. An International Certification Team (ICT) of consultants and advisors would be sent to applicant countries after receiving evidence submitted that exhibits GW transmission has been interrupted. Certification criteria classified countries by one of three groups (WHO, 1996a):

- 1) Group A (Endemic Countries): Countries where transmission of GW occurs and where surveillance and control operations are essential and there is no immediate concern for certification.
- 2) Group B (Countries in the Precertification Phase): Countries that recently achieved zero cases reported and maintain a reliable and extensive system of surveillance. At this phase, surveillance activities are required to be uninterrupted for three years complete years.
- 3) Group C (Countries in the Certification Phase): Countries where transmission no longer occurs, which are free of GWD, and can be certified immediately. These countries may be granted certification of eradication once satisfactory documentation has been provided that residual foci do not exist. Group C was divided further into Subgroups:
  - i. Subgroup I: Countries where information obtained is not sufficiently clear to ascertain transmission has been definitely interrupted and require in-depth verification by an external team to confirm the absence of GW transmission.
  - ii. Subgroup II: Countries in which it is well-known to have had no transmission for many decades or where exceptional transmission has occurred in the past.

Definitions provided at the informal consultation on certification criteria in 1990 were changed to replace “elimination” with “eradication” and provide scales of eradication, but kept essentially the same meanings. “Local eradication of dracunculiasis,” replaced “elimination of dracunculiasis” as “the confirmed absence of clinical illness, indicating the interruption of transmission of *Dracunculus medinensis* in man, for three years or longer, from a sizeable geographical unit such as a country, with such a low risk of reintroduction of the parasite that preventive measures could be reduced to a strict minimum. “Eradication of dracunculiasis” was

replaced with “World-wide eradication of dracunculiasis” defined as “the confirmed absence of clinical manifestations, indicating the interruption of transmission of *Dracunculus medinensis* in man, for three years or longer world-wide” (WHO, 1996a, p. 2).

During the meeting, PAHO presented a preliminary report on the “Absence of Dracunculiasis Transmission in the Americas” that summarized the status of GWD in Brazil, Cuba, the Dominican Republic, and Trinidad and Tobago. It concluded that each had evaluated the status of GWD in their respective country and officially verified the cessation in GW transmission (CDC, 1996c). Though Cuba’s last known case of endemic GWD was recorded in 1864, between 1980 and 1992 cases were found amongst non-resident sub-Saharan Africans. Because of this, the Commission asked that a field visit be made to conduct a detailed assessment of the country’s DW supply (WHO, 1997c).

“Guinea Worm Eradication Day” was celebrated in Nigeria on 20 March (CDC, 1996f).

Ghana hosted the sixth *Regional Conference on Dracunculiasis in Africa* from 26-28 March, in the national capital, Accra. The theme, “Detect Every Case, Contain Every Worm” emphasized the importance of successful containment methods for GWEPs as measures of their efficiency. Aside from Chad, Mauritania, and Senegal, delegates from all other ECs of the African continent were in attendance as well as Yemen. Ghana’s President Rawlings spoke at the opening ceremony. He told the audience he intended to celebrate both the eradication of GWD from his country and the 40th anniversary of national independence on 6 March 1997. In addition, he issued a challenge to neighboring ECs to join Ghana in “the race to eradication.” Also speaking at the opening ceremony was General Touré who was part of the more than 150 attendees. Some of the key recommendations made during the *Conference* were the reporting of

imported cases to the WHO in addition to the country of origin and strengthening surveillance of migrant and refugee populations from other ECs (CDC, 1996f).

Pakistan's GWEP increased its reward for reporting a case of GWD to ~\$850. Benin's GWEP hosted an assembly with personnel from the national GWEPs of Burkina Faso and Togo to discuss GWD-related issues in the shared border areas from 2-3 May in Natitingou, Atakora Department (CDC, 1996f).

The first border meeting between Niger and Nigeria was hosted by the former from 22-23 May in the city of Maradi, Maradi Department of Maradi Region with support from the CDC, Global 2000, Inc., UNICEF, and the WHO. Personnel from both GWEPs exchanged and discussed epidemiologic information that was conveyed in English, French, and Hausa (CDC, 1996e).

Nigeria's GWEP underwent an evaluation that concentrated on case containment, supervision, and surveillance activities from 10-28 June. Four teams of three worked in one of the country's four Zones where the two most endemic States were visited in addition to the two most endemic LGAs of those States that resulted in 56 localities being seen by one of the teams. The evaluators found weaknesses in supervision frequency and quality at all administrative-levels. It was recommended that the Nigerian GWEP improve supervision in order to make progress with case containment and surveillance (CDC, 1996g).

A *Review Meeting* was held for Sudan's GWEP in Kartoum, 24-26 June followed by a gathering of the *Coordination Group*, 27-28 June (CDC, 1996f).

Uganda celebrated its annual "Guinea Worm Eradication Day" on 22 July, the first day of its two-day *Program Review* in the national capital, Kampala (CDC, 1996g).

Ghana hosted a cross border meeting with Togo from 7-8 August in the Volta Region (CDC, 1996g).

An external evaluation of Benin's GWEP was conducted in July by OCCGE (CDC, 1996h).

On 11 August, Ivory Coast celebrated national "Guinea Worm Eradication Day" in the country's most endemic locality: Kouassi-Datékro in Bondoukou Department. Control measures were strengthened and health personnel retrained in Ivory Coast's most endemic Departments with WHO support the same month (CDC, 1996h).

An ICT visited Pakistan from 7 September to 7 October to verify the cessation of GW transmission as the last known indigenous case was reported in October 1993. Each of the three previously endemic Provinces was investigated by a group from the ICT. A total of 65 localities were visited and members of the ICT conducted interviews with 276 inhabitants. No evidence of GWD was discovered in the areas affected over the previous three years. An evaluation was made of the systems in place for reporting and surveillance. Inspections of case containment files and rumor registries were carried out in addition to the results of investigated rumors of GWD cases. Methods of advertising the reward scheme, modes in which HE was conducted, and the status of temephos applications were thoroughly examined. Interviews with inhabitants found them to be knowledgeable of GWD and preventive methods and they were aware of the incentive offered for reporting of a case (Nadim, Hajar, & Meyer-Lassen, 1996).

The annual *Program Review* for endemic Anglophone countries was held in Nairobi, Kenya, 23-26 September. Affiliates from Ethiopia, Ghana, Kenya, Nigeria, Sudan, Uganda, and Yemen presented synopses of their respective GWEP up to July. One concern was the drop in case containment that occurred in Ghana's Northern Region from more than three-quarters in

January to merely half of all cases in August. Ethiopia claimed remarkable progress was being made in the provision of safe sources of DW as well as temephos treatment in South Omo Province. It was noted that more could be done in Sudan even with the problems of security in many endemic areas if more funding was available (CDC, 1996h).

On 1 October, Nigeria became 36 States and the FCT with the addition of Ebonyi, Bayelsa, Nassarawa, Gombe, Zamfara, and Ekiti (Law, 1999).

Nigeria's Ebonyi State's GWEP led an intensive mobilization effort in 553 localities of its four most endemic LGAs from 14-24 October. Ebonyi was the most endemic State in the SE Zone as well as all of Nigeria with its peak transmission period beginning in October and lasting through March. The goal was to make the greatest impact by inundating ELs with each anti-GWD intervention at the beginning of the transmission season (CDC, 1996i).

Mauritania hosted the annual *Program Review* for endemic Francophone countries of Africa in the national capital, Nouakchott from 27-31 October. Representatives of GWEPs from Benin, Burkina Faso, Chad, Ivory Coast, Mali, Niger, Senegal, and Togo were present.

Cameroon was the only country of the group that did not attend. General Touré presided at the opening ceremony. Status updates were presented for each country (CDC, 1996i). Burkina Faso reported that the statuses of interventions were on hold due to an outbreak of meningitis that began earlier in the year (CDC, 1996f, 1996g) in addition to funds being delayed. Mali was still in the process of confirming the endemic status in the far northern portion of Kidal Region.

Mauritania claimed reporting was delayed in the country's three most endemic Regions: Assaba, Guidimaka, and Gorgol (CDC, 1996i).

Since Ghana began monthly reporting, seven of its ten Regions reported zero indigenous cases of GWD for the first time in October: Ashanti, Brong Ahafo, Eastern, Greater Accra, Upper East, Upper West, and Western (CDC, 1996j).

At the 4 November meeting of the ICGDE in Atlanta, the U.S. Peace Corps announced plans to intensify its anti-GWD activities in Benin, Burkina Faso, Cameroon, Chad, Ghana, Ivory Coast, Mali, Mauritania, Niger, and Togo (CDC, 1996i).

A consultant from the WHO evaluated Cuba's DW supply from 11-16 November. This was a follow up on the report submitted by PAHO earlier in the year as an additional step before certifying the country free from GW transmission as it was reported that between 1980-1992, cases had been discovered amongst non-resident Africans which may have led to importation of GW (WHO, 1997c). An ICT visited Iran from 17 November to 7 October to confirm the cessation of GW transmission. After intensive study of documentation provided and field visits to verify the absence of GWD, the ICT determined that there was no proof to suggest that any incidents had occurred in the previous ten years (CDC, 1997a).

Representatives from the GWEPs of Niger and Nigeria held a cross-border meeting from 26-27 November in Kano State, Nigeria where they discussed cross-border reporting and HE (CDC, 1996j).

The OLS Southern Sector of Sudan's GWEP met in Lokichokio, Kenya 27-28 November. Identified was the need to prioritize the training of health workers in the southern States (CDC, 1996j). Sudan's national budget for 1997 included for the first time a line item specifying ~\$276,000 for the national GWEP (CDC, 1997c).



Three teams from Ivory Coast's GWEP initiated a two-week long expedition through all endemic Regions of the country with a focus on the 53 most ELs that started in early December, just before the start of the peak transmission season (CDC, 1996j).

Ghana's GWEP began to offer a reward of ~\$1.17 in December for reporting cases of GWD and advertised the scheme via radio as part of its broadcasted HE messages (CDC, 1997a).

From 9-16 December, an evaluation of Niger's GWEP was conducted in all five endemic Departments (second-level administrative division) by six teams that visited 67 ELs and 52 supposed non-endemic localities (CDC, 1997a).

Spain provided a grant worth \$10,000 to Mauritania for first aid kits to treat patients with GWD and for the preparation of cloth filters (CDC, 1996c). In March, UNICEF installed a new well for source DW in the locality of Hollom III, Fianga Sub-prefecture, Mayo Kebbi Prefecture, Chad (CDC, 1996i). Spain's *Agency for International Cooperation* donated ~\$212,000 for Mauritania's GWEP on 22 April. The money was to be allocated for improving case containment, staff supervision, and surveillance activities (CDC, 1996d).

In June, Japan contributed \$200,000 to the WHO for assistance with certification of eradication activities for the year. To support case containment activities for GDEC, OPEC-FID provided the WHO with \$150,000 that same month (CDC, 1996g). Pakistan's GWEP received \$20,000 from the WHO to conduct field visits of supervisors. On 1 July, Yemen's GWEP received \$10,000 from the Netherlands to protect sources of DW for ELs in the Dhamar Governate (CDC, 1996f).

Norway's Royal Ministry of Foreign Affairs donated the equivalent of \$2.7 million for eradication activities to UNICEF missions in Benin (1997-1998), Burkina Faso (1996-1997), Mali (1997), and Niger (1996) in August. The *Norwegian Agency for Development* reached an

agreement with UNICEF in September to allocate \$1.03 million to Uganda's GWEP for 1996-1997. A contribution to UNICEF was made by CIDA for the GWEPs of Ethiopia (\$29,197), Kenya (\$29,197), and Uganda (\$656,934). Global 2000, Inc. received an additional \$475,000 in stock donated by Henry McConnon for GDEC (CDC, 1996h).

A grant for \$2,000 from HDI went to Senegal's GWEP to launch a reward scheme for reporting cases (CDC, 1996i). The U.K.'s *Overseas Development Administration* released \$50,000 of the \$113,000 grant to Ghana's GWEP in November to assist with field operations. Cash and materials worth \$80,000 were donated to Sudan's GWEP from UNICEF which included a boat for accessing ELs of Upper Nile State (CDC, 1996j).

1996

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 1995	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1995
Benin	1,427	16	-37.22	1,003	0.70	325	-33.81
Burkina Faso	3,241	11	-48.40	2,119	0.65	348	-32.56
Cameroon	17	9	13.33	17	1.00	13	62.50
CAR	9	0	-50.00	9	1.00	7	-30.00
Chad	127	0	-14.77	118	0.93	12	-68.42
Ethiopia	371	0	-27.82	315	0.85	57	-25.97
Ghana	4,877	4	-45.17	3,558	0.73	602	-43.05
India	9	0	-85.00	9	1.00	3	-87.50
Ivory Coast	2,794	4	-26.49	1,606	0.57	216	-14.29
Kenya	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	2,402	5	-43.05	1,388	0.58	430	-19.48
Mauritania	562	0	-68.10	354	0.63	143	-43.92
Niger	2,956	7	-78.61	1,726	0.58	416	-44.53
Nigeria	12,282	7	-24.99	9,288	0.76	1,357	-26.49
Pakistan	0	N/A	N/A	N/A	N/A	N/A	N/A
Senegal	19	1	-75.00	10	0.53	7	-53.33
Sudan	118,578	0	83.53	37,665	0.32	5,466	182.92
Togo	1,626	15	-21.56	1,428	0.88	249	-17.55
Uganda	1,455	4	-69.75	1,191	0.82	326	-59.75
Yemen	62	0	-24.39	51	0.82	7	-66.67
<b>Totals</b>	<b>152,814</b>	<b>83</b>	<b>17.68%</b>	<b>61,855</b>	<b>0.40</b>	<b>9,984</b>	<b>11.70%</b>

**Table 17.** Case totals, number of imported cases, percent change in total cases compared to 1995, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 1995 (CDC, 1997c; Hopkins, Ruiz-Tiben, & Ruebush, 1997; WHO, 1997b, 1998c).

As the global case total continued to decline, the campaign entered a juncture where the prompt and prudent investigation of all alleged cases of GWD was critical. Additionally, the proper classification of cases suspected to be imported from another country or from within the same country from a separate locality became increasingly imperative to investigate (CDC, 1996e). National GWEPs enumerated 152,814 incidents, of which 83 were imported from other ECs, found in 9,984 localities that reported  $\geq 1$  cases of GWD in 1996; an increase of 17.68% in the former and 11.70% in the latter, respectively, compared to 1995. Of the reported global case total, 61,855 of all cases were contained for an overall 0.40 CCR.

Benin continued to record declines in total cases and ELs. The Province of Zou was responsible for 1,205 or 84.44% of the country's 1,427 incidents in 1996. Sixteen cases recorded between January and August were imports from neighboring ECs: eleven from Nigeria and five from Togo. Declines in total incidents and ELs were recorded in Burkina Faso though a meningitis epidemic accompanied by a change in the national health infrastructure reduced anti-GWD activities of the national GWEP. A total of 11 cases were found to be imported from four bordering ECs: one in March and two in May from Ghana; one in both February and May from Ivory Coast; one in both July and September from Mali; and two in August and one in both October and November from Niger. Ninety-six of the localities that reported  $\geq 1$  cases were classified as newly infected.

Nine of Cameroon's 17 cases were imports from Nigeria and all cases were reportedly contained. The national GWEP enumerated incidents in five more localities that reported  $\geq 1$  cases compared to 1995. Nine indigenous cases of GWD were discovered amongst localities that reported  $\geq 1$  cases in CAR recorded and contained. Chad and Ethiopia's GWEPs continued to report declines in total incidents and ELs. However, their rates of decrease in incidents were

lower than the previous year's. Declines in total cases and ELs dropped significantly in Ghana compared to 1995. Three cases in June and one in November were imports from Togo.

Ivory Coast continued to see case numbers fall. Less significant was the rate of decrease in the number of localities that reported  $\geq 1$  cases compared to 1995 as 42 were newly infected. A total of four cases were imported from four ECs: Burkina Faso in June; Mali in February; Niger in August; and Togo in September. Ivory Coast's GWEP managed to contain just over half of all cases. No incidents of GWD were reported from Kenya in 1996. Mali experienced a higher rate of decrease in total cases while the decline in ELs stayed relatively unchanged compared to 1995. A total of five cases were imported from two adjacent ECs: one from Niger in September; three from Senegal in June and one in August.

Impressive reductions were sustained in Mauritania in both incidents as well as ELs. The most significant reduction in reported cases compared to the previous year was seen in Niger which also experienced an impressive decrease in ELs over the same period of time. Seven cases were imported from three neighboring ECs: two in August, one in October, and one in November from Burkina Faso; two from Niger in June; and one in September from Mali. Nigeria continued to reduce its number of incidents and ELs, but their rates of the declines were not as intense as those seen in 1995. A total of seven imported cases were documented: five in August from Benin; and two from Niger in June. One of Senegal's cases was imported from Mali in September, but the national GWEP still saw a 75.00% reduction in incidents compared to 1995 recorded in only seven ELs.

Sudan was the EC responsible for the global increases seen in both total cases and localities that reported  $\geq 1$  cases from the previous year. These overall increases reflected Sudan's increased surveillance sensitivity and success of a more comprehensive nationwide case

search. Alone, Sudan claimed 77.60% of all global case total and 54.75% of all localities that reported  $\geq 1$  cases in 1996. Health workers managed to hand out 617,289 cloth filters in Sudan during 1996 (Hopkins et al., 1997).

Reductions in both incidents and ELs continued in Togo. However, the rate in which the numbers fell was lower than experienced in 1995. A total of 15 cases were found to be imported from two ECs: nine in January, one in February, three in July, and one in November from Ghana; and one from Nigeria in February. The national GWEP reportedly managed an impressive 0.88 CCR. Uganda recorded noteworthy reductions in both the number of incidents and localities that reported  $\geq 1$  cases compared to the previous year. However, 71 newly infected localities were discovered in 1996. Four cases were classified as imports from Sudan: three in May and one in July. The national GWEP reported a 0.82 CCR.

India's nine incidents were recorded in three localities that reported  $\geq 1$  cases of GWD from the country's last endemic State, Rajasthan in the Jodhpur District (CDC, 1997g). The national GWEP reportedly contained all nine cases. No incidents of GWD were reported from Pakistan for the third consecutive year. Yemen experienced a drop in total cases compared to 1995 and reduced its number of ELs to seven. The national GWEP claimed a 0.82 CCR in 1996. The progress recorded in the three aforementioned countries resulted in 71 cases reported outside the African continent.

The sum of the global case total, the total number of localities that reported  $\geq 1$  cases, and the overall CCR for all ECs not including Sudan was 34,236, 4,518, and 0.71, respectively, in 1996. Reductions were recorded in each of these countries except Cameroon of which the increases were minimal. There were 209 newly infected localities identified which emphasized

how imperative a strong method of surveillance be maintained in each EL, previously EL, and localities at risk of becoming infected.

#### **4.18. 1997**

Burkina Faso added 15 new Provinces for a total of 45 in January (Law, 1999).

A second assembly of the ICCDE took place at WHO headquarters from 23-24 January. Twenty-two candidate countries submitted proposals to be certified free of GW transmission. The first group consisted of countries that were once endemic or had documented recent cases of GWD: Cuba, Iran, and Pakistan. The other 19 countries claimed endemic transmission of GW never occurred or if the country was once endemic, no residual foci existed:

- Americas: Barbados, Brazil, Colombia, Cuba, Dominican Republic, and Trinidad and Tobago.
- Eastern Mediterranean: Egypt, Iran, and Pakistan
- European: Austria, Belgium, Bulgaria, Finland, Romania, and Switzerland
- Western Pacific: the Cook Islands, Kiribati, Mongolia, Papua New Guinea, Singapore, the Solomon Islands, and Vanuatu.

Based on reports submitted and the requisite criteria documentation provided, the *Commission* declared all but Egypt free of GW transmission. It was requested that more detailed information be provided by Egypt and to have an ICT visit the country due to the countries southern border with highly endemic Sudan (WHO, 1997c). Most significant was the certification of Pakistan making it the first EC involved with GDEC to do so since the campaign began (WHO, 1997a).

India's *Task Force* met from 29-30 January (CDC, 1997a).

An eight-day visit to the five most endemic Districts' capitals of Ghana's Northern Region was carried out by Regional health authorities and external supporters of the national GWEP in January. The majority of cases had been occurring in the main localities of the Region as a result in the interruption of DW supplies and flood of refugees from more remote areas as a result of the ethnic clashes that occurred in 1994 and 1995. Evidence of the positive impact that Ghana's cash reward scheme unveiled the previous December was the 175.78% increase in cases reported during the month of January compared to the same month in 1996. The cases were documented at earlier stages GW emergence and would have been reported at a later time. Throughout Ghana's endemic Regions, the national GWEP distributed 20,000 posters printed with HE messages and information on the reward scheme (CDC, 1997b). In February, Ghana's GWEP detected 47 additional ELs in Volta Region while investigating the origin of cases imported to other areas of the country (CDC, 1997c).

Benin's national GWEP Coordinator was assigned to another position earlier in the year by the government which left the post vacated until a replacement was appointed by the MoH in February (CDC, 1997b).

Niger hosted the fourth meeting of *National Program Coordinators of Guinea Worm Eradication Programs* in Niamey, from 24-26 March, with more than 100 in attendance including representatives from all national GWEPs, CDC, Global 2000, Inc., UNICEF, and WHO. Summaries of national GWEPs and confirmed data for 1996 were presented by each respective Program Coordinator as well as data through February 1997. Some of the key recommendations made by attendees for national GWEPs included: increase efforts to implement the strategy of case containment in addition to enforcing stricter supervision of LBW



and paying close attention to cases confirmed in newly endemic localities; assure comprehensive investigation of all cases found to be imported and their immediate cross notification to the country of origin, collaborating agencies and/or partners, and the WHO; step up efforts to secure the financial resources required to avoid delays in funding; address nomadism and the transmission of GW in the ECs where this particular population may pose an issue; and in recognition of Sudan's endemic status and insecurity resultant of the ongoing civil war, more appeals for funding which reflect the needs of eradication for both GWEP: the GoS in the north and OLS in the south (CDC, 1997c).

On 10 April, two County (second-level administrative division) supervisors from Uganda's GWEP were ambushed and killed while returning from a meeting on GWD in Moroto District. President Carter and his wife visited Sudan in April for discussions on health initiatives and consult with both sides involved in the civil war on peace related efforts. A course on the correct use of temephos was in Sudan from 15-17 April.

National "Guinea Worm Eradication Day" was celebrated in Ivory Coast on 25 April. The Minister of Health attended a ceremony held in Bouaflé, the capital of Bouaflé District, where he paid visits to six ELs in the District over a three day period (CDC, 1997d). Cameroon and Chad held their first joint cross border meeting in April (CDC, 1997e). On 6 May, Nigeria hosted a cross border meeting with Niger in Jigawa State's Babura LGA.

Further support for the eradication of GWD was once again shown during the Fiftieth WHA, with the adoption of Resolution WHA 50.35 on 14 May that appealed to "all Member States, international and nongovernmental organizations and other appropriate entities to continue to ensure political support and the availability of much-needed resources for completion

of eradication of dracunculiasis as quickly as technically feasible and for the International Commission for the Certification of Dracunculiasis Eradication and its work” (WHA, 1997).

A border meeting between Mali and Senegal was held from 26-27 May in Senegal (CDC, 1997e).

A two-week review of Burkina Faso’s GWEP carried out by the MoH in collaboration with Global 2000, Inc., UNICEF, and WHO was completed on 10 June. Anti-GWD activities implemented at all levels in the national GWEP were examined and discussed. Problems discovered were brought to the attention of the MoH along with possible remedies. The main issues identified were the lack of access to funding specifically earmarked for the national GWEP by the World Bank from the federal government in addition to grants provided by UNICEF; recurrent absence of a national Program Coordinator; too much emphasis on decentralization and integration of services that contribute to poor management and supervision at national, Regional, and District levels; and inadequate surveillance, reporting, and documentation of cases (CDC, 1997f).

At the behest of OLS, Global 2000, Inc. formally took over the GWEP in southern Sudan in June. A Program Review was conducted for Ethiopia’s South Omo Zone from 16-18 June and Gambela Wereda on 27 June. President Carter attended a meeting in Nigeria to discuss the national GWEP’s status in addition to the OCP’s with the Nigerian President and Minister of Health on 30 June (CDC, 1997f).

Senegal commemorated national “Guinea Worm Eradication Day” on 21 August with a celebration held in the locality of Apé Diaobé, Matam District (CDC, 1997h).

A cross border meeting was held in the locality of Magaria in Niger’s Zinder Department with GWEPs of Nigeria’s Jigawa and Kano States on 26 August (CDC, 1997h).

Upon investigating the origin of cases believed to have been imported from Ivory Coast in September, Burkina Faso's GWEP detected another previously unknown EL (CDC, 1997j).

The annual *Program Review* for endemic Anglophone countries was hosted by Yemen in the national capital of Sana'a, from 29 September to 2 October. In addition to Yemen, representatives of national GWEPs from Ethiopia, Ghana, Kenya, Nigeria, Sudan, and Uganda were in attendance (CDC, 1997i).

President Rawlings launched the "final phase" in Ghana's national campaign to eradicate GWD on 17 October from Gushiegu, the District capital of Gushiegu-Karaga, Northern Region—the country's most endemic District. The President made a plea to report every case before the GW emerged. An external assessment of Ghana's GWEP was made by a seven person evaluation team from 20-31 October in the Regions of Ashanti, Brong-Ahafo, Eastern, Northern, and Volta. Thirty ELs and nine non-endemic localities were visited over the 11 day period. The team determined guidelines that had been produced worked well when they were adhered to. In addition, no evidence was found to suggest ELs were overlooked by the national surveillance system (CDC, 1997j).

Burkina Faso's GWEP hosted an assembly with personnel from the national GWEPs of Mali and Niger in the Provincial capital of Séno to discuss border issues associated with the implementation of anti-GWD measures amongst nomadic populations and imported cases originating from Burkina Faso (CDC, 1997j).

Ivory Coast hosted the yearly *Program Review* for endemic Francophone countries in Bouaké, from 20-24 October. In addition to the host country, representatives of nine other ECs in the region were in attendance: Benin, Burkina Faso, Cameroon, Chad, Mali, Mauritania, Niger, Senegal, and Togo (CDC, 1997j).

A meeting of the ICGDE was hosted by TCC in Atlanta on 2 December to go over the annual *Program Reviews* held in 1997; problems and solutions in some ECs; and plans for WHO/AFRO's Regional Conference in 1998 (CDC, 1997k).

The GWEP of Nigeria's NE Zone held at cross-border meeting with Cameroon on 3 December in the locality Banki, Bama LGA, Borno State (CDC, 1998a).

In Nairobi, Kenya, officials from the GoS and TCC's GWEP in southern Sudan met from 12-16 December and reviewed Sudan's GWEP activities and data for the year and to organize for 1998 (CDC, 1998a).

Nylon cloth donations made by DuPont Corporation and PFG to TCC that permitted national GWEPs to hand out filters assembled with the donated cloth at almost no cost concluded in December (CDC, 1999g).

The Royal Netherlands Embassy awarded Global 2000, Inc. a "Small Embassy Project" grant of nearly \$9,500 to aide Nigeria with the provision of 24 wells to localities within the States of Niger, Ogun, and Oyo (CDC, 1997a). Niger's GWEP received a "Small Scale Grant" from the government of Japan for ~\$100,000 to be used toward the purchase of two four-wheel drive vehicles and other supplies (CDC, 1997b). In March, the WHO allocated \$100,000 to Sudan's government to be used in its national GWEP (CDC, 1997c) and provided an additional \$121,000 two months later. Under its *Grant Assistance for Grassroots Projects*, the Japanese Embassy in Ghana awarded ~\$60,000 to Global 2000, Inc. to purchase filter material for the country's GWEP (CDC, 1997e). The *Guinea Worm Eradication Trust Fund* was established by the World Bank with TCC designated as the executive organization (CDC, 1997h).

USAID awarded \$400,000 to TCC for Mali's GWEP in September. Japan's government provided ~\$6.5 million to Niger for a safe DW project in Mirriah Arrondissement (third-level

administrative division) of Zinder Department. The OPEC-FID awarded TCC \$150,000 to be distributed over the period 1997-2000 in support of eradication efforts (CDC, 1997i). Nigeria's SE Zone received a \$7,000 supplemental grant from Global 2000, Inc. to assist with measures to control GWD transmission. On 4 December, the United Kingdom's (U.K.) *Department for International Development* (DfID) made a donation of nearly \$833,000 to Global 2000, Inc. for GDEC activities (CDC, 1997k). That same month, Chad's GWEP acquired a \$10,000 grant from HDI to support field office tasks and surveillance activities in 1998. Ethiopia's GWEP received a supplemental grant for \$10,000 from Global 2000, Inc. to pay for materials used in HE sessions and various GWEP-related costs. DANIDA provided TCC with ~\$600,000 to be used for Niger's GWEP in 1998-1999. Finland's Department for International Development Cooperation awarded TCC ~\$145,000 to be used toward Sudan's GWEP in 1998 (CDC, 1998a). A donation of \$500,000 was given to TCC for its programs in Sudan with most of it allocated for the country's GWEP. In December, CIDA's project in the Gushiegu/Karaga District, Northern Region, Ghana, managed to drill three borehole wells that provided more than enough safe DW for residents of the District capital, Gushiegu (CDC, 1998b). Burkina Faso's GWEP gave out 3,600 bolts of the "Guinea Worm Cloth" made by Faso Fani (CDC, 1998c).

1997

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 1996	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1996
Benin	857	15	-40.08	729	0.85	212	-34.77
Burkina Faso	2,475	2	-23.57	764	0.31	211	-39.37
Cameroon	19	18	11.76	18	0.95	7	-46.15
CAR	5	0	-44.44	ND	N/A	3	-57.14
Chad	25	0	-80.31	22	0.88	10	-16.67
Ethiopia	451	12	21.56	392	0.87	45	-21.05
Ghana	8,921	7	82.92	6,589	0.74	843	40.03
India	0	N/A	N/A	N/A	N/A	N/A	N/A
Ivory Coast	1,254	7	-55.12	1,081	0.86	115	-46.76
Kenya	6	6	N/A	5	0.83	ND	N/A
Mali	1,099	19	-54.25	696	0.63	269	-37.44
Mauritania	388	0	-30.96	300	0.77	83	-41.96
Niger	3,030	16	2.50	1,613	0.53	396	-4.81
Nigeria	12,590	1	2.51	10,380	0.82	1,136	-16.29
Senegal	4	0	-78.95	4	1.00	1	-85.71
Sudan	43,596	0	-63.23	24,033	0.55	5,744	5.09
Togo	1,762	7	8.36	820	0.47	204	-18.07
Uganda	1,374	15	-5.57	822	0.60	244	-25.15
Yemen	7	0	-88.71	4	0.57	5	-28.57
<b>Totals</b>	<b>77,863</b>	<b>125</b>	<b>-49.05%</b>	<b>48,272</b>	<b>0.62</b>	<b>9,528</b>	<b>-4.57%</b>

**Table 18.** Case totals, number of imported cases, percent change in total cases compared to 1996, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 1996 (CDC, 1998c; WHO, 1998c, 1999a).

There were 77,863 cases reported from 9,522 localities that reported  $\geq 1$  cases of GWD in 1997; both were reductions of 49.05% in the former and 4.57% in the latter, compared to 1996. Sudan alone was responsible for 55.99% of the global case total and 60.29% of all localities that reported  $\geq 1$  cases. A total of 125 cases were determined to have been imported from one country to another.

The interruption in GWEP activities due to the brief absence of and change in Benin's National Program Coordinator at the peak transmission season may have led to underreporting (CDC, 1997j). Zou Province was the most endemic responsible for 637 cases while the second most endemic Province was Ouémé with 110 incidents enumerated (CDC, 1999b).

Only one indigenous case was reported by Cameroon's GWEP. It was enumerated in October from the EL of Sirlawe, Mayo Kani Department. Mayo Sava Department counted 18 cases that were all imports from Nigeria's Borno State in six localities that reported  $\geq 1$  cases (CDC, 1998a). Both Departments are part of Extreme North Province. Eleven imported cases were reported in Amchide, Mayo Sava Department and found to be from the Nigerian locality of Chachile in Bama LGA (CDC, 1998e). The other locality in Nigeria to export cases was Borwashe, also part of Bama LGA (CDC, 1998a). Nigeria's NE Zone's zonal facilitator claimed that one of these seven was actually seen by the Program Coordinator of Bama LGA's GWEP but refused treatment stating he would go to Cameroon for treatment in order to collect the ~\$45 reward the country offered. There was no offer of a reward from the Nigerian GWEP at the time (CDC, 1997h). The Cameroonian GWEP claimed all but one case was contained.

Ghana was the third most EC with 8,921 cases recorded in 843 localities that reported  $\geq 1$  cases of GWD in 1997. Both were increases of 82.92% and 40.03%, respectively, compared to 1996. Cited as the cause for such increases were the cash incentives to report cases, the ethnic

violence in Northern Region that occurred in 1994 which led to the contamination of DW sources in many District Capitals, previous years of delayed and/or underfunding, and complacency (CDC, 1997d). The only months in which Ghana reported fewer cases than in 1996 were June, August, and September with slight differences of 10, 3, and 18, respectively.

All six cases reported from Kenya were found to be imported and five were contained. One of the cases fled before a full investigation could be carried out (WHO, 1999a). Nineteen cases were determined by Mali to be imported: one from Burkina Faso in October; two from Mauritania in October; one from Niger in October (CDC, 1997k). Niger's increases in 1997 were partly attributable to the financial shortcomings experienced in 1996 which delayed full implementation of anti-GWD interventions early that year. More proficient surveillance was cited as being on partially attributable to the higher number (CDC, 1997g).

A distant second, Nigeria reported 12,590 incidents in 1,136 localities that reported  $\geq 1$  cases of GWD in 1997; a slight increase of 2.51% in the former and a decrease of 16.29% in the latter, compared to 1996. Nigeria's GWEP managed a CCR of 0.82. Nigeria was the origin of 37 exported cases. Senegal recorded all four of its incidents in one EL and the national GWEP reportedly contained each one.

Sudan recorded 43,596 cases in 5,744 localities that reported  $\geq 1$  cases of GWD in 1997; a huge decline of 63.23% in the former and a slight increase of 5.09% in the latter, compared to 1996. Due to insecurity resultant of increased civil strife, incomplete surveillance led to an inaccurate nationwide case count, thus, the numbers reported were not a true reflection of the country's endemicity. Across the country, 589,096 filters were distributed (CDC, 1998c).

In Togo, Hakedji, Zio Prefecture of Maritime Region was the most heavily EL responsible for 115 (6.53%) of the country's total incidents in 1997 (CDC, 1998f). Uganda



reported cases from only three Districts in 1997. Insecurity in Kitgum District limited activities of the GWEP during the year. Uganda's GWEP began to offer rewards of ~\$7 to each reported patient and when applicable the same amount to the informer and ~\$2.80 to the LBW in Kitgum and other at-risk Districts (CDC, 1999c).

India reported zero cases of GWD for all of 1997. In addition to sustained active surveillance, the national GWEP continued to offer a cash reward for any cases reported. The only country outside the African continent to report cases during the year was Yemen. Only seven incidents were found in five localities that reported  $\geq 1$  cases. However, one of the localities was classified as newly infected and one of the three uncontained cases was from it. The two other cases that were not contained were from a known EL where the VV abandoned their station, unbeknownst to the national GWEP (WHO, 1998c).

#### **4.19. 1998**

Cameroon and India began the year in the Precertification Phase to join Kenya. Starting in 1998, GWEPs or their sponsors had to purchase nylon cloth filters from retailers for ~\$4 per square meter (CDC, 1999g).

In January, the *Steering Committee* of Nigeria's GWEP convened for the first time in the Enugu State Capital, Enugu. This was followed by an assembly of the SE Zone Guinea Worm *Task Force*. Representatives of Nigeria's GWEP from the NE Zone held a border assembly on GW eradication with Cameroon on 4 February (CDC, 1998b).

The GWEP of Ethiopia's South Omo Zone, SNNPR, convened a meeting in the Zonal capital of Jinka from 10-11 February (CDC, 1998b).

The ICCDE convened for the third time at WHO Headquarters from 19-20 February. Applications were received from 93 countries and territories in all six WHO Regions (WHO, 1998b):

- Africa: Botswana, Gambia, Guinea, Guinea-Bissau, the Seychelles, and Zimbabwe.
- Americas: Bolivia, Canada, Dominica, El Salvador, Grenada, Jamaica, Mexico, Nicaragua, Panama, Saint Kitts and Nevis, and Saint Lucia.
- Eastern Mediterranean: Bahrain, Cyprus, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Syria, Tunisia, and the United Arab Emirates (UAE).
- Europe: Albania, Andorra, Armenia, Azerbaijan, Belarus, Croatia, Czech Republic, Denmark, Estonia, France (included the Departments of Guadeloupe, French Guiana, Martinique, and Réunion; the Territories of French Polynesia, New Caledonia, and Wallis and Futuna; and the Territorial Collectivities of Saint Pierre and Miquelon, Mayotte, and the French Southern and Antarctic Lands), Germany, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Malta, Moldova, Monaco, Netherlands, Norway, Poland, Russia, San Marino, Slovakia, Slovenia, Spain, Sweden, Turkey, Turkmenistan, Ukraine, U.K. (included Great Britain and Northern Ireland), and Uzbekistan.
- Southeast Asia: Bangladesh, Bhutan, Indonesia, the Maldives, Myanmar, Nepal, South Korea, Sri Lanka, and Thailand.
- Western Pacific: American Samoa, Fiji, Guam, Hong Kong, Japan, Laos, Macau, Malaysia, Micronesia, Niue, the Philippines, Samoa, Tonga, Tuvalu, and Vietnam.

After reviewing the requests and based on criteria for certification, analyses of data submitted by the applicants and ICTs, the ICCDE proposed the all applicants except Djibouti, Gambia, Guinea, Guinea Bissau, Morocco, Thailand, Turkey, Turkmenistan, and Uzbekistan be certified free of GW transmission, the ICCDE proposed 81 countries and territories from six WHO Regions for certification which were subsequently confirmed free of GW transmission by the Director-General of the WHO (WHO, 1998b).

Cameroon conducted a cross-border assembly with Chad on 16 March in the capital of Mayo-Danai Department, Yagoua (CDC, 1998c).

In late March, Nigeria's *Steering Committee* conducted its second session of the year followed by the celebration of "National Guinea Worm Eradication Day" on 25 March (CDC, 1998c).

Mali hosted the seventh *Regional Conference on Dracunculiasis in Africa* from 31 March to 3 April, in the national capital, Bamako, cosponsored by the CDC, TCC, UNICEF, and WHO. Representatives from all EC of the African continent were in attendance except Kenya and each made presentations on the status of their national GWEPs. Workshops were held on case detection and containment amongst nomadic populations. Volunteers of the U.S. Peace Corps from nine ECs were present and wanted to find a way to increase its participation in GDEC. General Touré addressed attendees on the final day of the *Conference* with an emphasis on progress made and his confidence in the successful eradication of GWD. Attendees were in agreement that GDEC should focus on halting GW transmission in all ECs outside of Sudan by the year 2000. Some of the key recommendations made for ECs included intensified interventions to interrupt GW transmission in all affected localities; enhance surveillance sensitivity particularly in nomadic communities and national border areas and participate in

information exchange between countries regarding imported cases; hasten the process of georeferencing localities and water sources in all endemic areas; carry out research to advance interventions in nomadic populations; and ensure scheduled distribution of necessary resources so the implementation anti-GWD activities occur in a timely manner. One of the hallmarks of the *Conference* was the extensive international media coverage it received (CDC, 1998c).

The first national *Program Review* for Nigeria's GWEP convened from 27-28 May in the national capital, Abuja with nearly 150 attendees. Goals of the meeting were to assess the nationwide status of GWD, identify problems and needs, and devise a strategy to redouble efforts to end GW transmission by the year 2000. Topics were discussed that focused on case containment, funding, integration into other health programs, provision of DW sources, supervision of field staff, supplementary interventions, and surveillance. Lack of financial resources and political support, easement of intervention and surveillance activities too soon, as well as inadequacies in mobilization and supervision at all levels were the key problems identified. Remedial recommendations were made to address these issues (CDC, 1998e).

Sudan's GWEP held a *Coordination Meeting* with the southern sector GWEP in Khartoum from 24-25 June where each side presented status updates for the first five months of the year. It was also reported that as a result of the national polio eradication effort's National Immunization Day (NID) activity earlier in the year, 310 ELs were discovered that had up until then been unknown and/or inaccessible to either of the two GWEPs operating in Sudan (CDC, 1998f).

On 10 July, Ivory Coast celebrated national "Guinea Worm Eradication Day" with the main ceremony led by the Minister of Health in Bangoua Sub-prefecture, Agnibilékrou Department (CDC, 1998g).

Nigeria's GWEP met with Cameroon's GWEP for a scheduled cross border conference on 11 July. The festivities were covered by Ivorian newspapers, radio, and television. At the event, a UNICEF representative furnished LBVs with machetes and sharpeners, soap, and cooking oil as incentives for their efforts. In addition, LBVs also received first aid kits from *MAP International*.

In mid-July, four teams made trips to seven of Mauritania's eight endemic Regions where they visited 32 ELs to assess the national GWEP (CDC, 1998g).

National "Guinea Worm Eradication Day" was observed in Uganda on 21 July. A celebration was held in the country's most endemic County, Bokora of Moroto District, led by the Prime Minister and attended by more than 1,000 people. Following the celebration, the Prime Minister visited three ELs in the County (CDC, 1998g).

Hosted by USAID, the ICGDE met on 31 July in Washington, D.C. In continuation of the suggestion made at Bamako earlier in the spring, target dates were given for ending GW transmission for all ECs outside Sudan: 31 December 1999 for Benin, Ethiopia, Mali, Mauritania, and Uganda; and 31 December 2000 for Burkina Faso, Ghana, Ivory Coast, Niger, Nigeria, and Togo. This was based on the notion that Cameroon, Chad, India, Kenya, Senegal, and Yemen had either already ended transmission or would during 1998 (CDC, 1998g).

Niger's Minister of Health toured the six Districts (second-level administrative division) of Tillabéri Department (first-level administrative division) from 10-19 August to discuss health related topics of which GWD was central. He emphasized the government's pledge to eradicate GWD from Niger and appealed for support of the national GWEP from residents and local authorities (CDC, 1998h).

At the end of August, Senegal had officially reported zero cases of GWD for over a year (CDC, 1998i).

Burkinabe President Compaoré travelled to TCC on 24 September to discuss the status of Burkina Faso's GWEP and his intent to take the necessary measures to strengthen it (CDC, 1998i).

From 24-25 September, both components of Sudan's GWEP met for a *Coordination Meeting* in Nairobi, Kenya to go over the national status of GWD and organize plans for 1999. A decline in reports during the year was discussed and attributed to increased insecurity, lack of access in the southern States, decreases funding, and a famine that affected the State of Bahr al Ghazal. A target date to end transmission of GWD in the northern States was set for the end of 1999. Key recommendations made at the end of the meeting suggested Sudan's GWEP generate case-registries/line-listings for the eight endemic northern States; investigate uncontained cases to determine why they were not contained; generate and distribute supervisory checklists that also provide guidelines to evaluate filter usage; produce an inventory of safe DW sources in all accessible ELs (CDC, 1998i).

An external *Program Review* for Ethiopia's GWEP met in Nairobi on 25 September. The potentially endemic areas of Gambela Region and SNNPR that were still inaccessible due to insecurity were of concern. Recommendations made for the national GWEP at the end of the Review included: all anti-GWD activities and operational support be ready to function by the next GW transmission season in South Omo Zone; bring in outside consultants to visit all endemic and at-risk localities to verify the existence of interventions and the preparedness for the next GW transmission season; arrange case search and anti-GWD activities with Sudan's GWEPs along the international border; seek assistance from the Ethiopian military in order to

conduct case searches in Akobo Wereda of Gambela Region and implement appropriate interventions (CDC, 1998i).

Ghana's GWEP held a national *Program Review* in Accra from 28-29 September where the country's Vice President spoke at the opening ceremony. His speech emphasized the importance of ending GW transmission by the end of 1999. Many high-level government and lead health officials were in attendance marking the first time such authorities from around the country met together in a single venue to plan and discuss GWD. The status of GWD and interventions in each of the country's ten Regions was presented. Some of the recommendations to improve Ghana's GWEP were made and included: the need to observe the globally recognized definition of case containment; improve the quality of supervision at all levels; identify all EL and implement anti-GWD measures by the end of the year; draft a new supervisory checklist to improve feedback and put it to use immediately; increase the amount of offered for the reward scheme; intensify the surveillance system; better documentation at all levels; use the official form provided by the WHO to reported imported cases; provide a safe source of DW as soon as possible to Savelugu, the District capital of Savelugu-Nanton District of Northern Region; assess sources of DW in all ELs; promote inter-sectoral collaboration; pursue additional funding; supply every EL with enough filters to ensure complete coverage by 1 November 1998 (CDC, 1998i).

Togo's GWEP *Program Review* was held in Accra, Ghana on 30 September. Cross-border matters were addressed with the officials of host country's GWEP. Some of the recommendations made at the end of the Review for the national GWEP were: follow the globally recognized definition of case containment; strengthen supervision and make checklists available for all supervisors that lists all the tasks they are to carry out while on a supervisory

visit; promptly generate a list of all ELs to be sent to potential donors to expedite the provision of safe DW sources; improve the distribution of filters to migrant populations; collaborate with bordering ECs to schedule monthly cross border meetings; create case-registries/line-listings for all administrative subdivisions up to the Regional level (CDC, 1998i).

A seminar on GWD surveillance was arranged by the WHO in Niamey, Niger from 5-16 October for the endemic Francophone countries of Africa. The 11-day workshop was for Program Coordinators and Data Managers of national GWEPs. Attendees were introduced to the *HealthMap* GIS and trained to use the software's two interfaces: data manager and *HealthMapper*. The main objectives of the seminar were to review systems of surveillance in ECs; find solutions to strengthen national surveillance systems; provide and train participants with the WHO/UNICEF *HealthMap* GIS; and evaluate and suggest modifications to *HealthMap* that met surveillance requirements (WHO, 1998a).

After deliberating on the various indicators and terms used for classification purposes by national GWEPs, a more functional method to define localities under surveillance was identified. Since a locality's history of GW transmission determined what interventions would be put in place, especially the method of surveillance, localities were grouped into one of three categories based on their endemic status:

- Currently endemic locality: Presence of active cases during the previous year;
- Formerly endemic locality at risk of local transmission: Absence of active cases for less than three consecutive years<sup>4</sup>;

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<sup>4</sup> The GWD transmission period can last for up to 16 months which is why surveillance is required during the whole transmission period. Because all cases may not be detected and contained during this period (false zero case reporting), before local surveillance is suspended, two consecutive transmission periods (32 months) should be covered and further extended to three years (January-December) because most national GWEPs report based on the calendar year (WHO, 1998a).



- Formerly endemic locality at risk of reinfestation: Absence of active cases for more than three consecutive years.

These new definitions for surveillance purposes were to be used in all countries reporting on GWD (WHO, 1998a).

Ghana's GWEP increased the amount offered as a reward for patients that elect to have their GWs contained by use of a bandage manual or surgical extraction to ~\$2.12 with funds provided by HDI (CDC, 1998k).

Uganda's MoH designated 11 members to a *National Steering Committee for the Guinea Worm Eradication Program* which met for the first time on 6 October. The *Steering Committee* was tasked to help the national GWEP cease GW transmission by the end of 1999 and oversee activities of the Precertification Phase until Uganda is officially certified free of GWD. Also addressed was the increase in incidents reported from Kitgum District as well as insecurity in Kotido and Moroto Districts (CDC, 1998i).

A combined *Program Review* for all health programs in Nigeria assisted by Global 2000, Inc. was held in the Nigerian capital, Abuja from 28-30 October. This venue provided the first opportunity in the country for multiple parasitic disease programs to meet and discuss related issues. On the first day of the *Review*, it was announced that former Nigerian Head of State, General Yakubu Gowon had agreed to assist the national GWEP. Under an arrangement made by the *Yakubu Gowon Center* and TCC following a visit with President Carter in September, General Gowon pledged to intensify social mobilization and advocacy efforts aimed at ending GW transmission in Nigeria by the end of 2000 target date. Recommendations were made for all four GWEP Zones: collaboration with the national PHC system; integrate GWD surveillance into

all national health programs; transportation for supervisors provided by State and LGAs to ensure monthly visits to ELs; investigate the role nomadic populations have in GW transmission; maintain full coverage of filters to all households of ELs; implement and adhere to the globally recognized definition of case containment; mobilize government officials from the LGA and State level to visit ELs (CDC, 1998j).

A cross border meeting was hosted by Cameroon's GWEP in Amchide, Mayo Sava Department with the GWEP of Nigeria's Borno State on 29 October. On 3 November, Nigeria's Kano State GWEP hosted a cross border meeting with Niger's GWEP (CDC, 1998j).

On 9 November, Ethiopia held a *Review Meeting* for the Gambela Region's GWEP where it was noted that case containment measures had been more reliable than in previous years (CDC, 1999a).

Togo's Minister of Health toured the previously EL of Tsito and the previously EL of Atikoloe in the Zio Prefecture of Maritime Region on 12 November. The first stop was Tsito, where the Minister congratulated the inhabitants on stopping GW transmission. Next was Atikoloe which became an EL in 1991 when new cases were first documented. While there, people suffering with GWD were cared for; the treatment of DW sources with temephos and the surgical extraction of a GW were demonstrated; cloth filters were distributed and GWEP t-shirts were handed out. The mobilization efforts were covered by Togolese newspapers, radio, and television (CDC, 1998k).

General Touré made promotional trips to Mali's Regions of Gao, Kidal, Mopti, Segou, and Timbucktu from 12-15 November. He met with each Region's governor and intersectoral GWEP group to mobilize efforts to stop GW transmission by the end of December 2000 (CDC, 1998k).

Niger's GWEP held an assembly for Department Program Coordinators from 16-18 November in Zinder Department (CDC, 1998k).

A *Coordination Meeting* for Sudan's GWEP was put together by Global 2000, Inc. with NGO's that operated under OLS at Lokichokio, Kenya from 16-18 November. Participants were involved in discussions about changes in program implementation; problems typically encountered; and concerns about the organizations' roles in Sudan's GWEP were addressed (CDC, 1998k).

Burkina Faso's GWEP met for a *Regional Workshop* from 19-20 November in Ouahigouya Department, Yatenga Province on the border of Mali's endemic Mopti Region. The focus was to expand distribution of cloth filters and first aid kits, improve training and supervision, work to resolve interruptions to accessibility of financial resources, and issues associated with implementation of interventions in small and newly ELs (CDC, 1998k).

Ivory Coast's Minister of Health continued to promote national GWD eradication with visits to ten localities in Kounahiri Sub-prefecture, Mankono Department, from 21-23 November. The locality of Boahia in Kouassi-Datèkro Sub-prefecture of Ivory Coast's Bondoukou Department was visited by the Minister of Health on 3 December as part of the national mobilization tour (CDC, 1998k).

A cross-border meeting was hosted by Mali's GWEP in Kayes Cercle of Kayes Region with Mauritania and Senegal from 17-18 December. The GWEPs of each country presented the status of GWD in their respective country and discussed movements of nomadic populations across their shared borders and ways to disseminate more effective communication about GWD to such groups (CDC, 1999a).

President Carter announced new financial contributions to GDEC through the newly established *World Bank Trust Fund for Guinea Worm Eradication*, notably \$2.5 million pledged by Japan and \$500,000 contributed by Henry McConnon during the final day of the *Regional Conference on Dracunculiasis in Africa* on 3 April. Global 2000, Inc. received ~\$93,000 from the Japanese Embassy for Ethiopia's GWEP (CDC, 1998c). A donation of 15 motorcycles was announced by the *A.G. Leventis Foundation* to TCC for Nigeria's GWEP. A grant worth \$2.8 million was received by UNICEF for GWEPs in Africa from the United Nations Foundation in May that would be distributed over a three year period. Ethiopia's GWEP was provided \$39,600 for 1998 by the WHO (CDC, 1998e).

American Home Products (previously American Cyanamid) agreed to donate 30,000 liters of temephos for GDEC to TCC over 1998-2000 (CDC, 1998f). The U.K.'s DfID provided TCC with a three year grant worth \$2.5 million to support GDEC activities. A donation of 3,000 square meters of filter material was contributed by Vestergaard-Frandsen to TCC that included the cost of shipping to Africa for national GWEPs. Seven new tractors were donated by AGCO Cooperation for Sudan's GWEP to help personnel access remote ELs during the rainy season. A grant of ~\$500,000 was made to TCC for Sudan's GWEP by the Dutch Embassy in Khartoum (CDC, 1998j).

With funds provided earlier in the year by HDI, Benin, Ivory Coast, and Togo had received technical consultations and helped cover expenditures for critical operation expenses that amounted to \$230,000 by the end of 1998. Chad's GWEP received \$20,000 for HDI during the year to support the national Secretariat and anti-GWD activities (CDC, 1998k). Business executive and philanthropist, Michael Ashcroft donated \$100,000 to GDEC after he attended the *Regional Conference on Dracunculiasis in Africa* in Bamako earlier in the year (CDC, 1999a).

1998

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 1997	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1997
Benin	695	27	-18.90	622	0.89	179	-15.57
Burkina Faso	2,227	0	-10.02	495	0.22	236	11.85
Cameroon	23	23	21.05	22	0.96	ND	N/A
CAR	34	0	580.00	ND	N/A	16	433.33
Chad	3	0	-88.00	3	1.00	2	-80.00
Ethiopia	366	6	-18.85	352	0.96	46	2.22
Ghana	5,473	15	-38.65	4,180	0.76	629	-25.39
India	0	N/A	N/A	N/A	N/A	N/A	N/A
Ivory Coast	1,414	7	12.76	848	0.60	154	33.91
Kenya	7	7	16.67	7	1.00	ND	N/A
Mali	650	5	-40.86	355	0.55	177	-34.20
Mauritania	379	0	-2.32	187	0.49	60	-27.71
Niger	2,700	20	-10.89	1,803	0.67	280	-29.29
Nigeria	13,420	1	6.59	10,184	0.76	1,067	-6.07
Senegal	0	N/A	N/A	N/A	N/A	N/A	N/A
Sudan	47,977	0	10.05	26,225	0.55	6,494	13.06
Togo	2,128	3	20.77	1,034	0.49	198	-2.94
Uganda	1,061	162	-22.78	833	0.79	164	-32.79
Yemen	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>78,557</b>	<b>276</b>	<b>0.89%</b>	<b>47,150</b>	<b>0.60</b>	<b>9,702</b>	<b>1.89%</b>

**Table 19.** Case totals, number of imported cases, percent change in total cases compared to 1997, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 1997 (CDC, 1999d; WHO, 1999a).

Sixteen ECs reported 78,557 cases reported from 9,702 localities that reported  $\geq 1$  cases of GWD in 1998; marginal increases of only 0.89% in the former and 1.89% in the latter, compared to 1997. Cases imported from one country to another numbered 276; a 120.80% increase from the previous year. An overall 0.60 CCR was reported in 1998.

Cameroon, India, Kenya, Senegal, and Yemen finished the year with zero indigenous cases. The 23 incidents reported by Cameroon were imported from Borno State, Nigeria and all but one was contained. Kenya's seven imported cases of GWD were patients from Sudan that were treated at the International Committee of the Red Cross (ICRC) Lopiding Hospital, near Lokichokio in Turkana County (second-level administrative division), Rift Valley Province (first-level administrative division; CDC, 1999b).

Benin reported reductions in total cases and ELs compared to 1997 and managed a 0.89 CCR. Of the ELs, 92 had only one case of GWD (CDC, 1999d). Zou Province was responsible for 85.18% of the country's total cases with 592 incidents; only 45 less (-7.06%) than the previous year (CDC, 1999b).

A study conducted by the WHO in Burkina Faso earlier in the year of 51 localities found 19 that were believed to be non-endemic for GWD were actually EL, but not properly recorded as such by the GWEP. The information led to consideration of underreporting as a result of lax surveillance (CDC, 1998k).

Ethiopia's GWEP reported zero cases for a whole month in November for the first time since its national GWEP program began. One of the greatest challenges for the Ethiopian GWEP was lack of surveillance due to insecurity in Akobo Wereda of Gambela Region and South Omo Zone of SNNPR (CDC, 1999a).

Ghana's revised national budget that began on 1 January cut funds from preventative health services and completely eliminated financial resources previously allocated for the national GWEP. This happened at the peak of Ghana's GW transmission season (CDC, 1998b). No indigenous cases were reported from the Regions of Ashanti, Greater Accra, Upper East, and Western for the year (CDC, 1999b).

Since the inception of Mali's GWEP in 1993, zero cases of GWD were reported for an entire month in March (CDC, 1998d). The relatively low 0.55 CCR reported Mali's GWEP was likely due to difficulties in assuring supervisory visits over the vast distances within a short time after each case was reported (CDC, 1998k).

One locality in Mauritania's Hodh ech Chargui Region reported 119, or 31.40% of the country's total incidents in 1998 (CDC, 1999b).

An external evaluation of Nigeria's SE Zone conducted from October through November found failure to periodically verify and cross-check samples from reports submitted to supervisors was the main flaw that led to discrepancies in case containment, filter distribution, surveillance, and temephos applications recorded in the two most endemic States of Nigeria: Ebonyi and Benue (CDC, 1998k).

Evacuations of staff affiliated with Sudan's GWEP numbered 48 during the year (CDC, 1999j).

#### **4.20. 1999**

Senegal and Yemen started 1999 in their first year of the Precertification Phase joining Cameroon, India, and Kenya. A meeting of the ICGDE was held at the World Bank's headquarters in Washington, D.C. on 13 January. Issues related to ECs were reviewed and the

status of activities for countries in the Certification and Precertification Phases was provided (CDC, 1999a).

In January, Benin's six first-level administrative divisions, Provinces, were split into 12 and reassigned as Departments and second-level administrative divisions, Districts, were renamed Communes (Law, 1999).

An external evaluation of Senegal's GWEP was carried out by a team provided by the WHO from 23 January through 9 February. After the initial stop at the national GWEP's central office in the capital of Dakar, the team visited each formerly endemic Departments, 17 health facilities, and all 160 localities that had been kept under active surveillance since 1991. The surveillance system was deemed adequate, but it was suggested that monthly data reporting be improved and to extend surveillance record keeping at the local and Department levels. In addition, the team advised the national GWEP to institute "rumor registries" to record inquiries of all suspected cases reported (CDC, 1999e).

The *Steering Committee* of Nigeria's GWEP met on 1 February in Jos, the administrative capital of Plateau State. Plans and anti-GWD activities that had been undertaken in the SE and SW Zones during the peak GW transmission season in the southern portion of the country were reviewed. Two versions of Nigeria's "Guinea Worm Cloth" were unveiled. Funds for the cloth came from Global 2000, Inc. which covered pattern conception and the first 10,000 meters of material (CDC, 1999b).

With support from the *Conrad N. Hilton Foundation*, World Vision began drilling for water in the District capital of Savelugu-Nanton District, Savelugu, of Ghana's Northern Region in early February (CDC, 1999b).



A *Review Meeting* of Ethiopia's GWEP in South Omo Zone of SNNPR was conducted on 9 February in the Zone's administrative capital, Jinka. Discussed was a lack of progress and what was being prepared for the next GW transmission season (CDC, 1999b).

Uganda's GWEP arranged an assembly from 15-16 February with health officials of the last five endemic Districts of the country (Arua, Gulu, Kitgum, Kotida, and Moroto) to discuss strategies for interrupting GW transmission by the end of the year (CDC, 1999b).

A seminar was held from 10-11 March for Burkina Faso's GWEP, its donors, and collaborating organizations to discuss a new *Plan of Action* for ending GW transmission by the end of 2000 in addition to resources needed to reach that goal (CDC, 1999d).

Two volunteers from Ethiopia's GWEP were reported to have successfully reached Mount Naita area in South Omo Zone, SNNPR which borders Eastern Equatoria State, Sudan. The volunteers found healthcare workers from the Catholic Diocese of Torit, Sudan had been conducting HE on GWD prevention (CDC, 1999d).

On his first tour as an official representative of Nigeria's GWEP, General Gowon met with Ebonyi State authorities on 11 March. Following the meeting, a stop was made in Ugbodo, the most EL in the State and the administrative capital of Ebonyi LGA. Another locality was visited where a hand dug well was examined (CDC, 1999c). Nigeria observed national "Guinea Worm Eradication Day" on 18 March (CDC, 1999f).

Uganda's Kitgum District did not record a single incident of GWD for the entire month of March; the first month of zero cases reported in the District since the national GWEP began (CDC, 1999e).

Senegal hosted the annual *Program Review* for endemic Francophone countries of Africa in the national capital, Dakar from 6-9 April. Representatives from the host country as well as

Benin, Burkina Faso, Cameroon, CAR, Chad, Guinea, Ivory Coast, Mali, Mauritania, Niger, and Togo were in attendance. Updates on the status of national GWEPs for each country were shared as well as presentations on the surveillance of nomadic populations in Mali and Niger. After the Review, the ICGDE met at a nearby hotel to discuss strategies to secure funding from external donors requested by national GWEP personnel that were in attendance (CDC, 1999d).

General Gowon continued his national mobilization efforts with a tour of the SW Zone's Oyo State from 12-14 April. After meeting with State authorities he travelled to Ibarapa North LGA, where he visited the locality of Igangan. His final stop was Daodu locality of Orire LGA. General Gowon's next leg of the national tour was the NE Zone's Borno State from 23-25 April, where he made stops in three ELs of the highly endemic Bama LGA: Borwashe, Morodo, and Chachile. From 19-21 May, General Gowon visited Zamfara State on the NW Zone. After meeting with State authorities, he met with inhabitants from the locality of Yankaba in Kaura Namoda LGA and the Nassarawa Mailayi locality of Birnin Magaji LGA (CDC, 1999f).

Sudan's GWEP met for a *Coordination Meeting* in Nairobi from 19-20 April. A guide was drafted to help standardize the training of NGOs affiliated with OLS. "Pond Care Takers" were put in place in Uganda's three endemic Districts to act as sentries to ensure people with an emerging worm do not enter these DW sources (CDC, 1999e).

Nigeria hosted the annual *Program Review* for endemic Anglophone countries in Abuja, from 26-28 April with funding provided by the WHO. In addition to Nigeria, representatives from the national GWEPs of Ethiopia, Gambia, Ghana, Kenya, and Uganda were present. Recommendations made for each of the national GWEPs that attended were to bolster HE, case containment, and retrain LBWs; strengthen and enhance supervision down to the locality level;

continue active surveillance in all previously ELs for three successive years after the last case reported (CDC, 1999e).

Ghana's GWEP held a meeting for Regional Program Coordinators on 29 April to discuss the status of the national GWEP. Concerns were raised regarding "integration" with other health programs hampering the performance of some workers in the GWEP as some of the District-level health authorities were not giving anti-GWD activities the level of priority required and not providing enough financial resources for their implementation. It was noted that such occurrences were not in occurrence with the priority for eradication set forth by President Rawlings (CDC, 1999e).

The Program Coordinator for Northern Region discussed the establishment of a rule that required all cases reported must promptly be followed up by personnel at the supervisory level. Another issue involved to need to enhance supervision of locality-based volunteers and implementation of case containment. A checklist was developed for supervisory visits of LBWs (paid and volunteer) that would be handed out to all levels of GWEP personnel. Addressing case containment, a new definition was approved to make sure it is carried out in a consistent proper manner. Ghana's GWEP stated every case of GWD is either contained by surgical extraction or bandaging. A case that was successfully contained via surgical extraction required a GW's detection before eruption through the skin. To be contained successfully via bandaging required case detection before or within 24 hours of a GW's eruption through the skin and each GW bandaged and followed up until completely removed from the patient's body. Each was to include completion of the extraction technique, provision of HE on how to prevent GW transmission and investigate whether or not the patient contaminated any DW sources, and case

confirmation at the supervisory level. If a case failed to meet the criteria of either of the two methods, then it could not be considered contained (CDC, 1999e).

Week-long mobilization campaigns were conducted in Niger during the month of May by 50 teams made up of members from U.S. Peace Corps, Japan's Overseas Cooperation Volunteers, and Niger's GWEP. From 1-7 May, 20 teams visited the 20 most ELs in Tillabéri Department and talked to inhabitants about GWD and its prevention and handed out nearly 5,000 filters. In late May, 30 teams did the same thing in Zinder Department (CDC, 1999f).

From 12-13 July, Niger's Minister of Health led a mobilization effort for the national GWEP in Zinder Department with local government and health authorities, the national Program Coordinator, and representatives from JICA and Global 2000, Inc. The two-day tour received national coverage via radio and television (CDC, 1999g).

General Gowon continued his tour of Nigeria's endemic States with a stop Gombe of the NE Zone from 15-16 July. After meeting with the governor, he travelled to Dukku LGA and visited the localities of Walla Kahi and Malalye. During the trip, General Gowon met the Emir of Gombe and the Chair of the LGA. Next was a return trip to Borno State's Bama LGA where General Gowon visited the localities of Chur-Chur and Malaire. A second mobilization effort was carried out by Niger's Minister of Health on 30 July in Tillabéri Department with the addition of a delegate from World Vision (CDC, 1999h).

Yemen's last incident of GWD was recorded in October 1997. As part of the three-year Precertification Phase, a two-person team from the WHO was sent to evaluate the surveillance system in place for case detection and provide counsel to the national GWEP on the required steps that need to be taken in order to achieve certification of eradication. The team arrived in Sana'a, the national capital, on 22 July. Their first stop was the MoH which housed the national

GWEP where they reviewed documents with three members of Yemen's GWEP on the recent history of GWD in the country, the structure of the surveillance system and the methods, quality, and regularity of reporting. From 27 July to 30 July the WHO team was accompanied by the three members of the national GWEP on visits to 17 localities in three Governorates: Dhamar, Ibb, and Taiz. The team returned to Sana'a on 30 July where they attended meetings, workshops on surveillance, and wrote reports through 5 August. During the 3 August Workshop it was announced a new offer of 20,000 Yemeni Rials would be awarded for reporting a case of GWD in an effort to increase surveillance sensitivity. The team from the WHO returned left Sana'a on 6 August (Karam & Tayeh, 1999).

General Gowon's advocacy tour brought him to Kano State where he visited from 16-18 August and then to Niger State on 20 August (CDC, 1999i).

The ICGDE met at TCC on 26 August and talked about the increase in incidents reported during the year in Ghana and Nigeria as well as the continuous difficulties that had impeded the GWEP in Burkina Faso (CDC, 1999i).

A cross border meeting was hosted by Benin in Savalou, Savalou Commune, Collines Department with Togo's GWEP from 9-10 September. Aims of the meeting were to coordinate anti-GWD activities between the bordering second-level administrative divisions that shared borders between the two countries; agree on the same kind of award to be offered in a reward scheme; get both governments' approvals to allow unimpeded access for GWEP officials across both borders; and identify all sources of DW along the border area and coordinate temephos treatments (CDC, 1999i).

Ghana's MoH conducted a *Review Meeting* of Regional GWEPs from 9-10 September in Accra (CDC, 1999i). Three Districts of Ghana each received the assistance of a consultant

provided by Global 2000, Inc. during September and October: Atebubu, Brong Ahafo Region; East Gonja, Northern Region; and Kete Krachi, Volta Region (CDC, 1999j).

General Gowon kept up his advocacy journey when in stopped in Oyo State for the second time and paid his first visit to Ogun State during 13-16 September. From 20-25 September, he toured Benue and Cross River States for the first time and made his second visit to Ebonyi State (CDC, 1999j).

With financial support and technical assistance from the WHO, Kenya's MoH held an assembly to review all the activities of the national GWEP from 13-24 September. Evaluations were carried out in three of the Rift Valley Province's Districts: Trans-Nzoia, Turkana, and West Pokot. Each District shares their western border with Uganda and Turkana's northern border is shared with Sudan. Members of the WHO and Kenya's MoH work in teams to verify the absence of GW transmission in each District; the ability of each District's surveillance system to detect and contain incidents of GWD in a prompt and efficient manner; review documentation used to record surveillance activities; and counsel the national GWEP on steps to prepare for GWD eradication certification. The teams found the system of surveillance that was in place was inefficient and local knowledge of the reward scheme was found to be inadequate (Cattand et al., 1999).

Recommendations made as a result of the evaluation included: the MoH declare GWD a nationally notifiable disease and mandate all administrative levels of government submit monthly reports to the MoH which then provides the data to the WHO; in collaboration with external partners, the MoH should provide adequate support to District level GWEPs as well as the national GWEP to implement a more efficient system of surveillance in order to satisfy the requirements to achieve certification of eradication; improve the quality of surveillance by

providing additional training and more stringent supervision and publicize the reward scheme nationwide; create a rumor registry and be sure each suspected case is fully investigated; make it a goal of the national GWEP to draft and distribute the proper documentation forms needed for regular reporting and a checklist of instructions to ensure anti-GWD interventions are implemented in the appropriate manner; endorse inter-District and cross border meetings; strengthen the participation of PHC in surveillance (Cattand et al., 1999).

*A Program Review* was held in Nairobi, Kenya for the GWEPs of Ethiopia, Sudan, and Uganda from 28-30 September. Among the more than 60 people in attendance which included members of the three GWEPs, representatives from the CDC, TCC, UNICEF, and the WHO were present in addition to 20 of the NGOs involved with the national GWEPs. Updates on the interventions in place for each country were presented along with a brief report on surveillance activities by an official from Kenya. Sudan reported GWEP activities had been encumbered by civil war-related violence throughout the year, most notably in the highly endemic southern States of Eastern Equatoria, Jongoli, Northern Bahr al-Ghazal, Warap, and Western Bahr al-Ghazal. Up to the time of the Review, there had been 71 evacuations of staff involved with eradication activities during 1999. It was reported that localities in the Nuba Mountains of South Kordofan State were still not accessible and areas of Blue Nile State had yet to be reached because of insecurity. In Uganda, security was still an issue in some of the endemic areas of Kitgum District. Ethiopia purported that a severe drought which occurred in South Omo Zone, may have impeded GW transmission for the year and that Gambela Region's Akobo Wereda had become accessible and surveillance was in progress (CDC, 1999j).

Another mobilization trip was taken by General Gowon with a stop in Kastina State and a second visit to Zamfara State, both of the NW Zone from 4-9 October. The trip to Kastina was covered by the BBC (CDC, 1999j).

At a Global 2000, Inc. workshop on agriculture in Mali on 14 October, President Carter joined General Touré for a presentation on the status of the country's GWEP (CDC, 1999j).

A workshop on surveillance for coordinators and data managers of Nigeria's GWEP was put on by the WHO in Lagos from 25-29 October. Attendees were trained on the use of the *HealthMap* GIS (CDC, 1999k).

Togo hosted a cross border meeting with Benin in Ogou Prefecture, Plateaux Region from 11-12 November (CDC, 1999k).

General Touré celebrated Mali's national "Guinea Worm Eradication Day" with festivities in Mopti Region (CDC, 1999k).

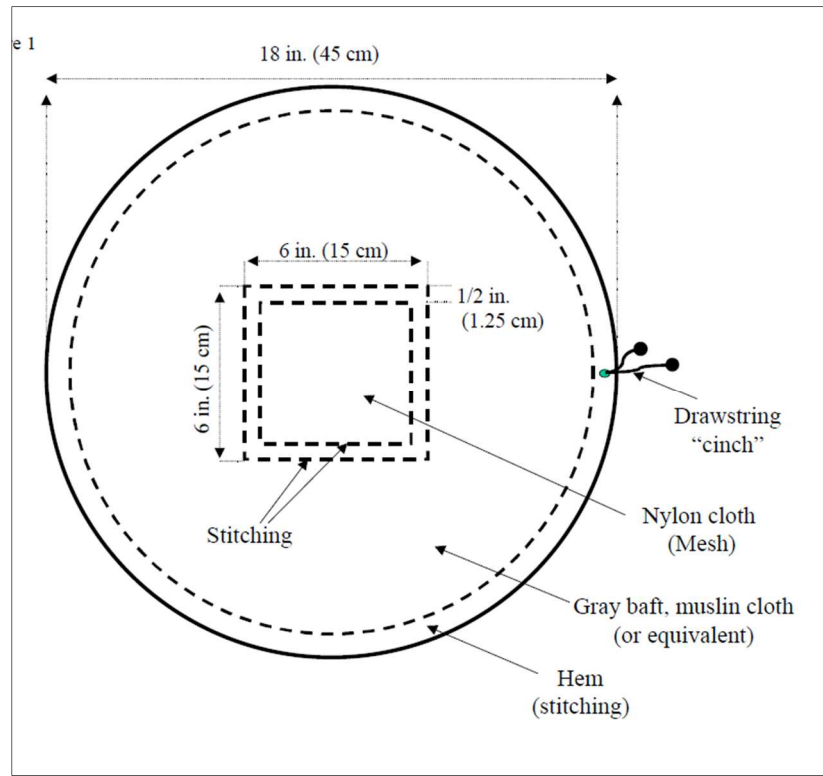
From 16-18 November, Niger's GWEP assembled for a *Review Meeting* in Tahoua, Tahoua Arrondissement, Tahoua Department. A decision was made to give priority to the five endemic Departments of Bouza, Mirriah, Tahoua, Tera, and Tillabéri focus on ELs only. Responsibility GWD surveillance for all previously ELs was delegated to other disease control programs (CDC, 2000a).

An ICT visited India from 8-27 November. After meeting with the national Certification Team, the ICT decided to keep the focus on five of the previously endemic States: Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, and Rajasthan (Nadim, Karam, & Hajar, 1999).

With the end of nylon material donations, it was necessary to develop a method to manufacture filters at a lower cost. Filters made entirely of nylon cloth became financially prohibitive as the wholesale cost of a single piece of the material measuring 18-20 inches was



~\$1.00 not including labor to produce a functional product. A design that cut the costs associated with manufacturing filters had already been implemented in Ghana and Nigeria (Figure 16). These GWEPs stitched a swatch of nylon cloth measuring six squares inches in the center of a larger piece of cotton muslin or other high quality cotton material with a large enough section cut out to accommodate the nylon allowing the water to pass through the sieve unobstructed and secured with two rows of stitching. From one square meter of nylon cloth, approximately 40 six square inch pieces can be taken whereas the previous practice only yielded four filters. The estimated savings to national GWEPs was 40-65% based on the manufacturing costs in both Ghana and Nigeria (CDC, 1999g). Ghana's GWEP reported it successfully manufactured 81,950 cotton-nylon cloth filters (see Figure 16) using only 1,844 square meters of nylon material for a total cost of \$0.58 per filter (CDC, 1999j).



**Figure 16.** Schematic of the filter used in Ghana and Nigeria (CDC, 1999g).

General Gowon's advocacy tour continued with stops in Kebbi and Sokoto States from 22-26 November. A cross border meeting was held between Nigeria and Niger during the visit to Sokoto which General Gowon attended. The meeting was broadcast by the BBC (CDC, 2000a).

A *Coordination Meeting* of Sudan's GWEP was held from 6-8 December in Khartoum. Ghana's District capital of Savelugu-Nanton, Savelugu had finally been provided with a safe source of DW on 15 December as a result of the *Conrad N. Hilton Foundation* and World Vision's successful drilling project that located enough underground wells to produce 150,000 gallons of DW daily to Savelugu. Niger hosted a cross border meeting with Mali's GWEP in Ayorou, Ayorou Arrondissement of Tillabéri Department from 20-21 December (CDC, 2000a).

Nigeria's NE Zone's GWEP received a \$7,700 grant from UNICEF. USAID awarded \$4,500 to Global 2000, Inc. for cloth filters and supplies for case containment in Niger's GWEP. Michael Ashcroft donated \$150,000 to TCC to support Mali's GWEP (CDC, 1999a). Due to financial delays, Global 2000, Inc. provided Togo's GWEP \$30,000 in emergency funds in January and February (CDC, 1999b). Denmark contributed ~\$1.5 million to GDEC through TCC to be distributed over 1999-2001 to ECs of Africa. Four grants totaling ~\$305,000 were provided to TCC under Japan's *Grant Assistance for Grassroots Projects* for allocation to the four Zonal GWEPs of Nigeria on 10 March. A total of \$1.1 million was provided by UNICEF for the national GWEPs of Benin, CAR, Chad, Ivory Coast, Mali, Niger, and Yemen (CDC, 1999c).

Ghana was allocated \$45,000 by the WHO for the purchase of motorbikes and to train female volunteers in the Northern Region in addition to retrain approximately 960 other volunteers of the national GWEP. A pledge of \$11 million to the improvement of water supplies in Sudan was made by Saudi Arabia. Norway made a donation of ~\$1 million and USAID \$500,000 to TCC for GWEP activities (CDC, 1999e).

Japan's *Grant Assistance for Grassroots Projects* committed another \$150,000 to TCC for Sudan's GWEP on 10 June. Emergency funding from the WHO for \$50,000 was provided to Burkina Faso's GWEP to hire 14 additional health workers and a motorbike for each that were appointed to the most endemic Provinces of the country. Additional support for Benin, Cameroon, Chad, Ivory Coast, Niger, Senegal, and Togo was secured by a \$500,000 grant provided by HDI. The Netherlands committed \$250,000 to TCC for Sudan's GWEP during 1999-2000. Almost 22,000 square yards of nylon filter material valued at ~\$87,000 was purchased by the CDC for Ghana's GWEP (CDC, 1999f).

A comic book on GWD developed by the WHO for school children in Benin was to be evaluated at schools in the Departments of Atlantique, Mono, Ouémé, and Zou. Benin's GWEP received \$20,000 from the WHO to carry out the evaluation. Burkina Faso received \$5,000 in emergency funds from the WHO for temephos treatment of unprotected DW sources during the transmission season. Ivory Coast's GWEP was granted \$14,400 to fund teams for temephos treatment, \$3,500 for a vehicle repair, and nearly ~\$8,000 to buy 2,000 square yards of nylon filter material. The GWEP of Mauritania received \$20,000 from the WHO to strengthen surveillance, train and retrain VVs, and assess GW transmission in nomadic populations. Nigeria's Federal government allocated \$1 million to TCC for the national GWEP (CDC, 1999g). The governor of Kastina State, Nigeria, issued ~\$23,000 to its GWEP to implement anti-GWD interventions (CDC, 1999i).

In September, Global 2000, Inc. procured 30 bicycles for the GWEP of Ghana's Volta Region. Three of Ghana's Regional GWEP's were provided financial assistance from UNICEF in October: Brong Ahafo, ~\$66,207; Northern, ~\$69,741; and Volta, ~\$71,581. Northern Region was also provided with 16 motorbikes and 83 bicycles (CDC, 1999j). By the end of 1999, JICA had drilled 44 borehole wells in 37 ELs and localities under surveillance for GWD and repaired 51 borehole wells in 40 throughout Ghana (CDC, 2000b).

1999

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 1998	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1998
Benin	492	19	-29.21	421	0.86	135	-24.58
Burkina Faso	2,184	2	-1.93	1,001	0.46	198	-16.10
Cameroon	8	8	-65.22	8	1.00	0	0.00
CAR	26	2	-23.53	12	0.46	15	-6.25
Chad	1	1	-66.67	1	1.00	1	-50.00
Ethiopia	249	0	-31.97	238	0.96	38	-17.39
Ghana	9,027	16	64.94	5,544	0.61	934	48.49
India	0	N/A	N/A	N/A	N/A	N/A	N/A
Ivory Coast	476	9	-66.34	359	0.75	89	-42.21
Kenya	1	1	-85.71	1	1.00	0	N/A
Mali	410	7	-36.92	258	0.63	114	-35.59
Mauritania	255	0	-32.72	113	0.44	41	-31.67
Niger	1,920	8	-28.89	916	0.48	170	-39.29
Nigeria	13,237	0	-1.36	8,462	0.64	1,059	-0.75
Senegal	0	N/A	N/A	N/A	N/A	N/A	N/A
Sudan	66,097	0	37.77	33,523	0.51	3,824	-41.11
Togo	1,589	4	-25.33	972	0.61	164	-17.17
Uganda	321	5	-69.75	300	0.93	111	-32.32
Yemen	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>96,293</b>	<b>82</b>	<b>22.58%</b>	<b>52,129</b>	<b>0.54</b>	<b>6,893</b>	<b>-28.95%</b>

**Table 20.** Case totals, number of imported cases, percent change in total cases compared to 1998, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 1998 (CDC, 2000c; WHO, 2000b).

The *HealthMapper* was tailored for public health applications from local to global scales. It was made up of a user-friendly mapping and database management interface and included a database that contained georeferenced data of national, “regional” (first-level administrative divisions), “district” (second-level administrative divisions), and “subdistrict” (third-level administrative divisions) boundary maps, localities, roadways, water features, and other cultural features related to health (WHO, 1999b).

Sixteen sub-Saharan African countries reported a global case total of 96,293 from 6,893 localities for an increase of 22.58% in the former and a decrease of 28.95% in the latter. Less internationally imported cases occurred as only 82 were classified as such. A global 0.54 CCR was reported but, when all countries together outside of Sudan resulted in 0.62 CCR. For the second consecutive year, India, Senegal, and Yemen each reported zero incidents of GWD while Sudan claimed 68.64% of the global total. Altogether, Ghana, Nigeria, and Sudan accounted for 88,361 or 91.76% of the global case total for 1999; an increase of 32.14% compared to 1998. The other ECs reported a collective total of 7,932 or 8.24% of all cases; a decline of 32.130% from 1998.

Chad had not recorded an indigenous case of GWD since September 1998. However, in September 1999, one case imported from Nigeria’s Borno State was discovered in Mandélie, the capital of Mandélie Sub-prefecture, Chari-Baguirmi Prefecture (CDC, 1999j). Low rates of containment during the peak transmission season and the postponement of training for LBVs due to a hold up in funding before the transmission season were two weaknesses that hampered Niger’s GWEP during the year (CDC, 2000b).

After four straight years of reductions, Ghana’s GWEP counted 9,027 cases of GWD from 934 ELs in 1999; both increases from 1998 by 64.94% and 48.49%, respectively. Three of

Ghana's ten Regions reported 93.45% (8,436) of the country's cases for the year: Brong Ahafo, 1,727; Northern, 4,386; Volta 2,323 (WHO, 2000b).

Nigeria continued to be the second most EC after Sudan in 1999. The national GWEP enumerated 13,237 cases from 1,059 ELs; only 183 less cases in eight fewer ELs than 1998. States with the highest endemicity in each Zone were: Borno (NE Zone), 1,094; Oyo (SW Zone), 1,197; Zamfara (NW Zone), 2,414; Ebonyi (SE Zone), 3,502 (WHO, 2000b).

Sudan's national increase of 37.77% from the previous year's GWD case total was credited by Sudan's GWEP to strengthened surveillance in various ELs and a higher reporting rate. Efforts were focused on ending GW transmission in the eight northern endemic States due to their unrestricted access to the affected populations. Out of 7,329 known ELs in Sudan, 2,206 were not accessible to the GWEP for various security reasons. The States of northern Sudan reported a total of 292 cases in 1999; of these, 178 were indigenous and 114 were internally imported from the southern States. The WHO continued to provide technical and operational assistance as well as oversee financial support to various NGOs that operated in the southern States under OLS (WHO, 2000b).

#### **4.21. 2000**

Chad began its first year in the Precertification Phase joining Cameroon, Kenya, Senegal, and Yemen. Nigeria's GWEP *Steering Committee* met from 24-25 January in Abuja. Three subcommittees were tasked to draft a national *Plan of Action* for the year, plan "Guinea Worm Eradication Day" festivities, and propose an appropriate cash reward for reporting cases of GWD (CDC, 2000b).

A *Review Meeting* for Ethiopia's GWEP was held in Addis Ababa on 25 January (CDC, 2000b). Shortly after, the national GWEP increased the cash offer for reporting cases of GWD to ~\$12 (CDC, 2000d).

The ICCDE convened for the fourth time at WHO Headquarters from 15-17 February. Applications were received from 55 countries and territories in all six WHO Regions. After reviewing the requests and based on criteria for certification, analyses of data submitted by the applicants and ICTs, the ICCDE proposed 42 of the applicants be certified free of GW transmission:

- Africa: Burundi, Lesotho, Malawi, and Namibia
- Americas: Antigua and Bermuda, Argentina, Aruba, Bahamas, Belize, Chile, Costa Rica, Ecuador, Guatemala, Guyana, Haiti, Honduras, Paraguay, Peru, Puerto Rico, Saint Vincent and the Grenadines, Suriname, the United States of America (included U.S. Virgin Islands), and Venezuela
- Eastern Mediterranean: Libya, Morocco, and Saudi Arabia
- Europe: Georgia, Greece, Portugal (included Azores and Madeira), Tajikistan, Turkey, Turkmenistan, and Uzbekistan
- Southeast Asia: India, South Korea, and Thailand
- Western Pacific: Australia (included its territories), China, Marshall Islands, Nauru, New Zealand, Northern Mariana Islands, and Tokelau

Each was subsequently confirmed free of GW transmission by the Director-General of the WHO (WHO, 2000a). With India certified, the entire Southeast Asia Region of WHO was certified free from transmission of GW (WHO, 2000b).



During a Parliamentary meeting in Ghana, President Rawlings openly shared his disappointment in the recent regressions of the national GWEP. As a result, anti-GWD activities were reportedly boosted in the endemic Districts shortly after. On 10 February, the national Program Coordinator attended a public ceremony to reinvigorate the GWEP of Volta Region's Kete-Krachi District (CDC, 2000c).

A delegation from the TCC and Global 2000, Inc. visited Niger to tour some of the ELs located in Mirriah Arrondissement of Zinder Region. While there, the delegation visited with the country's newly elected President Tanja. General Touré traveled to Benin from 18-22 February where he met with the President Kerekou to encourage him to make the eradication of GWD from his country a personal goal. A delivery of 400 bicycles purchased for Benin's GWEP took place during General Touré's stop and he participated in a ceremony to mark their arrival and distribution (CDC, 2000c).

Burkina Faso hosted the fifth assembly of *National Program Coordinators of Guinea Worm Eradication Programs*, from 6-9 March, in Ouagadougou. There were nearly 100 attendees including representatives of national GWEPs from Benin, Burkina Faso, Cameroon, CAR, Chad, Ethiopia, Ghana, Guinea, Ivory Coast, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, Togo, and Uganda. Nigeria's General Gowon and Mali's General Touré were also present and the event was the first international GWD-related assembly attended by the former. Later on, both Generals were joined by associates from Global 2000, Inc., UNICEF, and WHO for a meeting with Ghana's President Compaoré to go over his country's GWEP. Each national GWEP made presentations on their respective GWEPs. A whole day was devoted to discussions broken into groupings of countries in the Precertification Phase, endemic Anglophone countries, and endemic Francophone countries. Participants also heard presentations from Ghana and

Nigeria followed by exchanges over the two countries national GWEPs' recent deficiencies (CDC, 2000c).

The national *Steering Committee* of Uganda's GWEP held their second meeting on 14 March. Copies of the WHO's criteria for certification of GWD eradication were passed out to each member to familiarize themselves with in preparation for the next meeting. Intensification of active surveillance amongst all previously EL and a larger cash offer for the reward scheme were agreed upon unanimously by the Committee (CDC, 2000c).

The ICGDE met on 24 March at the CDC with personnel from the CDC, TCC, UNICEF, the WHO, and the World Bank. Subjects discussed were based on the outcomes of the assembly of National Program Coordinators in March. Attendees agreed that a more thorough investigation into the extent of GWD in CAR was necessary to promote the implementation of anti-GWD interventions. Members of the ICDGE also delegated tasks for the main organizations involved with GDEC. The WHO would concentrate on Certification and Precertification Phase affairs and lead GWD-related activities for the GWEP in CAR; UNICEF was charged with the provision of safe sources of DW and the rehabilitation of present, but nonfunctional sources of DW, oversee safe DW supply efforts by all agencies involved, and lead the GWEPs of Mauritania and Uganda. The rest of the ECs were to be led by TCC (CDC, 2000d).

Volunteers from the U.S. Peace Corps in Ivory Coast along with government health workers took part in "Worm Week" held 27-30 March Kouassi-Datèkro Sub-prefecture, Bondoukou Department, Zanzan Region. Nine ELs were visited over the four day period (CDC, 2000d).

From 28-29 March, Uganda's GWEP held an inter-District meeting in Moroto District. The national GWEP agreed to raise the cash reward for reporting cases of GWD to ~\$13 (CDC, 2000d).

An increase in the reward offered for reporting cases was also increased by Mali's GWEP to ~\$7 shared amongst the patient, the informer, and the health worker responsible for containing the case. A cross bordering meeting was hosted by Mali in Bankass, the administrative center of Bankass Cercle, Mopti Region with representatives of Burkina Faso's GWEP from 12-14 April (CDC, 2000d).

Return trips were made by General Gowon to Nigeria's Ogun and Oyo States from 10-12 April (CDC, 2000d). Cameroon hosted a cross border meeting with the GWEP of Nigeria's NE Zone on 2 May (CDC, 2000f). On 9 May, Nigeria's GWEP arranged a convention on the eradication of GWD in Abuja (CDC, 2000e).

The definition of "case containment" was printed for the first time in Guinea Worm Wrap-Up issue #101. A case of GWD was considered contained if the following conditions had been met (CDC, 2000e, p. 11):

- The patient is detected before or within 24 hours of GW emergence; and
- The patient has not entered any water source since the GW emerged; and
- The LBV has properly managed the case, by cleaning and bandaging until the GW is fully removed, and by giving health education to discourage the patient from contaminating any water source (if two or more emerging GWs are present, the case is not contained until the last GW is pulled out); and
- The case is verified by a supervisor within 7 days of GW emergence (to confirm it is a GW and that it has been properly contained).

From 6-9 June, a team from the WHO visited Cameroon to go over requirements for the Precertification Phase with the National Program Coordinator. Trips were made to ten localities throughout the Extreme Nord Province as well as associated health facilities (CDC, 2000g).

A team from the CDC travelled to CAR from 8 July through 4 August to help the MoH determine the country's true endemic status. Near the northeastern border of the Democratic Republic of the Congo and southwestern border of Sudan, twenty-nine of 32 localities in southeastern CAR that had reported suspected cases of GWD were investigated including a camp for Sudanese refugees. The team found active surveillance in the area to be almost non-existent and there was and differentiating between GWD and onchocerciasis was often overlooked. Recommendations were made to the MoH including another investigation during the next peak GW transmission season as the team was unable to conclude the actual extent of GWD at the time (CDC, 2000g).

Nigeria's General Gowon revisited the States of Enugu and Nasarawa and met with political and health leaders from 15-16 August (CDC, 2000h).

The GWEP of Nigeria's SE Zone was sent an emergency shipment of 5,000 square meters of nylon filter material from TCC in January. In a collaborative effort with TCC, UNICEF secured \$200,000 from the *U.N. Foundation* for the provision and restoration of DW supplies for ELs of Nigeria. Benin's National Secretariat received \$16,000 from Global 2000, Inc. to support the national GWEP (CDC, 2000b). Vestergaard-Frandsen, committed to provide 3,000 square meters of nylon filter cloth to GDEC through TCC including all associated shipping costs to the African continent (CDC, 2000f).

During the Fifty-third WHA, the *Bill & Melinda Gates Foundation* made \$28.5 million available to GDEC on 16 May. The funds would be distributed through the *World Bank Trust*

*Fund for Guinea Worm Eradication* to four of GDEC's major partners: TCC over 2000-2002 (\$15 million), the World Bank (\$8.5 million), and WHO (\$5 million). Under the grant's division of labor agreement, TCC was given lead responsibility for assisting programs in countries that report  $\geq 100$  cases annually; WHO was delegated to manage countries with  $< 100$  annual cases, as well as activities related to the Certification and Precertification Phases; UNICEF was tasked to assist selected ECs with procuring financial resources, and emphasize support for the provision safe DW for all GWD-affected communities (CDC, 2000e).

2000

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 1999	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 1999
Benin	186	20	-62.20	150	0.81	61	-54.81
Burkina Faso	1,956	3	-10.44	1,282	0.66	352	77.78
Cameroon	5	5	-37.50	5	1.00	3	300.00
CAR	35	2	-34.62	0	0.00	22	46.67
Chad	3	0	200.00	3	1.00	1	0.00
Ethiopia	60	6	-75.90	57	0.95	18	-52.63
Ghana	7,402	1	-18.00	5,905	0.80	981	5.03
Ivory Coast	297	12	-37.61	208	0.70	54	39.33
Kenya	4	4	300.00	4	1.00	1	100.00
Mali	290	8	-29.27	166	0.57	61	-46.49
Mauritania	136	0	-46.67	78	0.57	22	-46.34
Niger	1,166	10	-39.27	729	0.63	95	-44.12
Nigeria	7,869	0	-40.55	4,589	0.58	906	-14.45
Senegal	0	N/A	N/A	N/A	N/A	N/A	N/A
Sudan	54,890	0	-16.96	23,143	0.42	4,775	24.87
Togo	828	17	-47.89	595	0.72	147	-10.367
Uganda	96	4	-70.09	76	0.79	42	-62.16
Yemen	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>75,223</b>	<b>92</b>	<b>-21.88%</b>	<b>36,990</b>	<b>0.49</b>	<b>7,541</b>	<b>9.40%</b>

**Table 21.** Case totals, number of imported cases, percent change in total cases compared to 1999, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 1999 (CDC, 2001a, 2001b; WHO, 2001b).

Sixteen sub-Saharan African countries recorded 75,223 cases of GWD in 7,541 localities that reported  $\geq 1$  cases in 2000. While the global case total fell by 21.88% compared to 1999, the number localities that reported  $\geq 1$  cases of increased by 9.40% in the same time. Imported cases increased from 82 in 1999 to 92 in 2000. With 72.97% of all incidents recorded in Sudan, the country continued to be responsible for the greatest portion of the global case total. Ghana and Nigeria reported the second and third highest national totals, respectively, together accounting for 20.30% of the global total. Combined, national GWEPs reported a 0.49 CCR. However, with Sudan removed the metric becomes 0.68 CCR.

Again, Ghana was the third most EC in 2000 with 7,402 incidents recorded in 981 localities that reported  $\geq 1$  cases of GWD. This was a decline of 18.00% in total cases compared to 1999, but the number of localities that reported  $\geq 1$  cases of GWD increased by 5.03% within the same time frame. All but one case was determined to be indigenous, which was a reduction from the 16 cases that Ghana imported in 1999. Brong-Ahafo, Northern, and Volta Regions were responsible for 95.73% of all the country's cases (WHO, 2001b). The most endemic District in Ghana was Atebubu of Brong Ahafo Region that alone claimed 1,891 (25.55%) of Ghana's GWD cases for the year (CDC, 2002a).

January was the first time in Ivory Coast's GWEP that Zuénoula Department in Marahoué Region had an entire month without a recorded incident (CDC, 2000b).

Nigeria continued to be the second most EC after Sudan in 2000 with 7,869 cases enumerated from 906 localities that reported  $\geq 1$  cases of GWD. Both were reductions compared to 1999 of 40.55% and 14.45%, respectively. Four States of the SE Zone (Benue, Cross River, Ebonyi, and Enugo) reported 59.03% of all the Nigeria's GWD cases in 2000.

The most EC, Sudan enumerated 54,890 incidents reported from 4,775 localities that reported  $\geq 1$  cases of GWD in 2000. While the total number of cases fell by 16.96% compared to 1999, the number of localities that reported  $\geq 1$  cases increased by 24.87% in the same period. Three States from the south reported 81.00% of the country's case total: Lakes, 8,227; Jongoloi, 17,744; Warrap, 18,490. Only 90 cases were reported from the ten northern, 49 of which were determined to be imports from the south while the indigenous cases were from 12 ELs (WHO, 2001b). The northern States reportedly managed to achieve a 0.81 CCR (CDC, 2000i).

#### **4.22. 2001**

The year began CAR's first in the Precertification Phase joining Chad, Kenya, Senegal, and Yemen. In February, a team from the WHO travelled to Chad for a joint evaluation with members of the national GWEP. The WHO team was informed of three incidents of GWD had gone unreported in 2000 in a locality of Guéra Department in August and September 2000. The cases were documented by a health worker and subsequently confirmed by a supervisor. However, these occurred during the rainy season which isolated this particular village. As a result, the Department-level supervisor did not receive notification of these occurrences until October. Notification of these instances never made it to the national Program Coordinator (WHO, 2001a).

Togo hosted the sixth gathering of *National Program Coordinators of Guinea Worm Eradication Programs* in Lome, from 26-29 March. Each Program Coordinator reported on the status of their GWEPs, including several African countries in the Precertification Phase, and Yemen. Also in attendance was General Gowon who presented a speech on his nationwide mobilization campaign to bring safe sources of DW to all localities in Nigeria and spread



messages about GWD prevention. A workshop for ECs addressed methods for enhancing surveillance and case containment and another shared ideas on tracking data related to and management of interventions in a more effective manner. For countries in the Precertification Phase, a workshop on certification criteria and requirements, rewards for reporting cases of GWD, and integrating GWD surveillance with NIDs was held. It was reiterated that all anti-GWD interventions should be monitored monthly (CDC, 2001a).

Burkina Faso's 45 Provinces were grouped into 13 Regions on 2 July. Niger's first-level administrative divisions changed from Departments to Regions on 10 August. Departments were reassigned as second-level administrative divisions (Law, 2015).

Benin hosted the annual *Program Review* for endemic Francophone countries in Cotonou from 29-31 October. Joining the Program Coordinators from the national GWEPs of Benin, Burkina Faso, CAR, Chad, Ivory Coast, Mali, Mauritania, Niger, and Togo were representatives from TCC, UNICEF, and the WHO (WHO, 2002a) in addition to General Touré (CDC, 2001d). Epidemiological data and the status of interventions for the first nine months of 2001 were presented by each respective country's GWEP Program Coordinator. Mali was the only country to report an increase in incidents compared to the same nine months of 2000 (WHO, 2002a).

Starting with issue #119, the *Guinea Worm Wrap-Up* was to include updates on the status of interventions for each EC on a monthly basis (CDC, 2001e).

**2001**

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 2000	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2000
Benin	172	16	-7.53	164	0.95	39	-36.07
Burkina Faso	1,032	11	-47.24	754	0.73	202	-42.61
Cameroon	5	5	0.00	5	1.00	2	-33.33
CAR	36	2	2.86	21	0.58	22	0.00
Chad	0	N/A	-100.00	N/A	N/A	N/A	-100.00
Ethiopia	29	19	-51.67	20	0.69	10	-44.44
Ghana	4,739	1	-35.98	3,227	0.68	779	-20.59
Ivory Coast	231	5	-22.22	128	0.55	28	-48.15
Kenya	8	8	100.00	8	1.00	2	100.00
Mali	718	10	147.59	366	0.51	120	96.72
Mauritania	94	0	-30.88	49	0.52	25	13.64
Niger	417	12	-64.24	237	0.57	50	-47.37
Nigeria	5,355	0	-31.95	7,869	0.65	733	-19.09
Senegal	1	1	N/A	1	1.00	1	N/A
Sudan	49,471	0	-9.87	24,241	0.49	3,921	-17.88
Togo	1,354	14	63.53	838	0.62	180	22.45
Uganda	55	4	-42.71	35	0.64	9	-78.57
Yemen	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>63,717</b>	<b>108</b>	<b>-15.30%</b>	<b>33,597</b>	<b>0.53</b>	<b>6,123</b>	<b>-18.80%</b>

**Table 22.** Case totals, number of imported cases, percent change in total cases compared to 2000, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD and percent change in the number of localities that reported ≥ 1 cases compared to 2000 (CDC, 2002b; WHO, 2002b, 2003b).

Sixteen countries recorded 63,717 cases from 6,122 localities that reported  $\geq 1$  cases of GWD in 2001; reductions of 15.30% and 18.82%, respectively, compared to 2000. Outside Sudan, there were 14,246 cases enumerated from 2,201 localities that reported  $\geq 1$  cases; reductions of 29.94% and 20.43%, respectively, compared to 2000. Sudan alone was responsible for 77.64% of the global total. Ghana and Nigeria, the two most ECs after Sudan, claimed 15.84% of the global case total for reductions of 33.90% from the previous year. When combined, the two countries comprised 70.85% of the global total outside Sudan. Cases of GWD imported to one country from another numbered 108; 16 more than 2000. Chad and Senegal claimed zero incidents of GWD for the year.

National GWEPs reported an overall 0.53 CCR for the year. Compared to data from 2000, reductions in the number of ELs was greater than the decrease in cases of GWD for Benin, Ivory Coast, and Uganda by 36.07% and 7.53%, 48.15% and 22.22%, and 78.57% and 42.71%, respectively. Conversely, Mauritania experienced a drop in incidents by 30.88% while the number of ELs increased by 13.64% within the same time period.

Ghana was the third most endemic country, after Sudan and Nigeria, with a total of 4,739 cases (one case imported from Togo) recorded in 779 localities that reported  $\geq 1$  cases of GWD in 2001. Of the case total, 92.51% came from the three Regions: Brong-Ahafo, Northern, and Volta (WHO, 2002b). India's Embassy donated 31 Mark II hand pumps for completed borehole wells drilled by the Church of Christ in Northern Region's Saboba-Chereponi and Yendi Districts. Of 44 ELs in Brong-Ahafo Region's Atebubu District, 15 received new or rehabilitated wells in 2001 as a result of the *Gates Foundation* grant (see CDC, 2000e) and a donation from the Heisa Company (CDC, 2001c, 2002a).

Nigeria continued to be the second most EC with 5,355 cases counted in 733 localities that reported  $\geq 1$  cases of GWD in 2001. Four Zones were responsible for 74.59% of all the country's GWD case total found among five States: Ebonyi, 2,092; Sokoto, 603; Benue, 602; Enugu, 357; Oyo, 340 (WHO, 2002b).

Sudan enumerated 49,471 cases in 3,921 localities that reported  $\geq 1$  cases of GWD in 2001. The States of northern Sudan recorded 132 cases of GWD for an increase of 46.67% compared to 2000. Forty-seven of the cases were determined to be internal imports from the southern States while the other 85 were endemic cases from 10 ELs. A 0.79 CCR was reported from the northern States. The southern States reported 49,339 cases of GWD with 63.80% found in the States of Jonglei (17,025) and Warrap (14,454). Although this was a decrease in GWD cases by 9.97% from 2000, it could not be regarded as a true drop in cases since many ELs of the southern states still were not accessible, therefore, their status was unknown. The conflict in southern Sudan continued to be the principal barrier in the overall success of GDEC in 2001 (WHO, 2002b).

#### **4.23. 2002**

The seventh meeting of *National Program Coordinators of Guinea Worm Eradication Programs* was held in Khartoum, Sudan, from 4-7 March. Thirteen ECs and five in the Precertification Phase were represented. Also in attendance were President Carter and General Gowon along with many NGOs and international sponsors. The aim was to reinvigorate interest, political support, and participation by other advocates involved with GDEC (CDC, 2002b). Sudan was chosen as the host country to concentrate international attention to its continued position as the most EC and the fact that it was still responsible for the majority of all GWD

cases reported annually (Hopkins, Ruiz-Tiben, Diallo, Withers Jr., & Maguire, 2002). The format for the presentation by national program coordinators of their country's situation was changed from previous meetings. Each presented their epidemiologic situation, the status of each intervention, and individual plans to intensify interventions were described separately (CDC, 2002b). Concurrent with the *Meeting*, a workshop was held for data managers of 18 GWEPs to train them on an updated version of the *HealthMap* GIS (WHO, 2002c).

On the first day of the *Meeting*, Ministers of Health from the ECs of Benin, Burkina Faso, CAR, Ethiopia, Ghana, Ivory Coast, Niger, Sudan, and Uganda, along with three in the Precertification Phase (Cameroon, Chad, and Yemen), participated in a two-hour round table organized by the WHO on a quicker approach to interrupt GW transmission and steps towards certification. At the discussion, participants reiterated their pledge to hasten the eradication effort and adopted the "Khartoum Declaration"; a reaffirmation of their commitment to achieve eradication as soon as possible (WHO, 2002c).

The utilization of female volunteers from Ghana's Red Cross Society women's club was approved by the country's Interagency Coordinating Committee on 9 July to aide LBVs operating in Ghana's 15 most endemic Districts (CDC, 2002c).

Mauritania hosted the annual *Program Review* for endemic Francophone countries from 28-30 October in the national capital, Nouakchott. Representatives from the GWEPs of Benin, CAR, Ivory Coast, Mali, Mauritania, Niger, and Togo were present. Presentations were made on the status of each country's GWEP during the first nine months of the year. While the Program Review was in session, the WHO organized a technical support session on the *HealthMap* GIS at a separate venue for data managers of national GWEPs (WHO, 2003a).

**2002**

Country that Reported Cases of GWD	Case Totals	Number of Imported Cases	% Change in Case Totals Compared to 2001	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2001
Benin	181	24	5.23	170	0.94	31	-20.51
Burkina Faso	591	11	-42.73	444	0.75	133	-34.52
Cameroon	3	3	-40.00	3	1.00	0	N/A
CAR	ND	N/A	N/A	N/A	N/A	N/A	N/A
Chad	0	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	47	23	62.07	40	0.85	12	20.00
Ghana	5	5,611	18.40	3,711	0.66	739	-5.14
Ivory Coast	198	6	-14.29	188	0.95	25	-10.71
Kenya	17	17	112.50	17	1.00	ND	N/A
Mali	861	3	19.92	501	0.58	183	52.50
Mauritania	42	0	-55.32	25	0.60	18	-28.00
Niger	248	15	-40.53	150	0.60	77	54.00
Nigeria	3,820	0	-28.66	2,566	0.67	557	-24.01
Senegal	0	N/A	-100.00	N/A	N/A	N/A	N/A
Sudan	41,493	0	-16.13	21,401	0.52	4,233	7.96
Togo	1,502	30	10.93	933	0.62	228	26.67
Uganda	24	18	-56.36	18	0.75	19	111.11
Yemen	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>54,638</b>	<b>155</b>	<b>-14.25%</b>	<b>30,167</b>	<b>0.55</b>	<b>6,255</b>	<b>2.17%</b>

**Table 23.** Case totals, number of imported cases, percent change in total cases compared to 2001, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, and percent change in the number of localities that reported ≥ 1 cases compared to 2001 (CDC, 2003b; WHO, 2003b).

Seventeen countries recorded 54,638 incidents from 6,255 localities that reported  $\geq 1$  cases of GWD in 2002. While this was a reduction of 14.25% in the former there was a slight increase of 2.17% in the latter, compared to 2001. Sudan alone was responsible for 75.94% of the global case total. Ghana and Nigeria were the second and third most endemic countries after Sudan, with 10.27% and 6.99% of the global case total, respectively. Combined, these three ECs made up 93.20% of all reported incidents. A total of 155 incidents were determined to be imported from one country to another in 2002. Cameroon and Kenya, both in the Precertification Phase claimed internationally imported cases only.

Localities that reported  $\geq 1$  cases of GWD outside of Sudan fell by 8.13% from the previous year to 2,022. Benin and Ghana experienced an increase in incidents from 2001 by 5.23% in the former and 18.40%, respectively, while the number of localities that reported  $\geq 1$  cases fell by 20.51% in the former and 5.14% in the latter. Togo was the only EC to report increases in both incidents and localities that reported  $\geq 1$  cases of GWD. Niger, Sudan, and Uganda experienced reductions in incidents but increases in localities that reported  $\geq 1$  cases. No reports were submitted by CAR for the year. Overall, a 0.55 CCR was reported, however, outside of Sudan, a combined 0.67 CCR was achieved.

Ethiopia reported 47 incidents from 12 localities that reported  $\geq 1$  cases of GWD in 2002, for increases of 62.07% and 20.00%, respectively, compared to 2001. It was determined that 23 of the 47 cases were imported from Sudan. A 0.85 CCR was achieved by Ethiopia's GWEP which reportedly confined 33 of the 40 contained cases (82.50% of contained cases and 70.21% of the case total) in case containment centers. All of the indigenous cases came from three Weredas of Gambela Region: Gog, 21, Etang, 1, and Jikawo, 2. Insecurity attributable to ethnic

conflict continued to be an issue in areas of Gambela Region's Akobo, Gog, Etang, and Jikawo Weredas (CDC, 2003b).

Mali recorded 861 cases were from 183 localities that reported  $\geq 1$  cases in 2002, for an increase of 19.92% in the former and 52.50% in the latter, compared to 2001. Three cases were determined to have been imports from Niger. Three Cercles in two Regions claimed 817, or 94.89% of all Mali's cases for the year:

- Gao Region: Ansongo, 299 and Gao, 327.
- Timbuktu Region: Gourma-Rharous, 191.

Nigeria recorded 3,820 cases from 557 localities that reported  $\geq 1$  cases of GWD in 2002, for reductions of 28.67% and 24.01% respectively, compared to 2001. The majority of cases, 71.94%, were found in four States: Benue, 988, Ebonyi, 632, Niger, 368, and Oyo, 760 (WHO, 2003b). Eighty-two of the country's 774 LGAs reported incidents during the year (CDC, 2003b).

Ghana surpassed Nigeria to become the second most EC in 2002 with 5,611 cases of GWD counted in 739 localities that reported  $\geq 1$  cases of GWD. This was an 18.40% increase in cases from 5.14% fewer localities, compared to 2001. Five cases were international imports: Niger, 1 and Togo, 4. Of the 739 localities that reported  $\geq 1$  cases in 2002, 351 were classified as reinfected or a new EL. Northern continued to be the most endemic Region, responsible for 76.15% of the country's case total (WHO, 2003b).

Sudan recorded 41,493 incidents found in 4,233 localities that reported  $\geq 1$  cases of GWD in 2002. While the number of incidents decreased 16.13%, the number of localities that reported  $\geq 1$  cases rose 7.96%, compared to 2001. Three of the southern States claimed 78.21% of all Sudan's cases in 2002: Lakes, 5,244; Jonglei, 10,124; and Warrap, 17,084. The northern



States reported 90 cases, 30 of which were imported from the southern States (WHO, 2003b). Sudan's GWEP in the north also and claimed to have successfully contained 69 of the 90 cases (0.77 CCR) with 22 of them confined in case containment centers (CDC, 2003b). Areas of southern Sudan served by OLS managed to contain 18,765 of 35,787 known cases for a 0.52 CCR while areas of the south covered by the GoS contained 2,626 of its known 5,706 cases for a 0.46 CCR. Continued civil strife in southern Sudan was cited as the main barrier to the success of GDEC (WHO, 2003b).

#### **4.24. 2003**

Organized by the WHO in Dori, the capital of Burkina Faso's Sahel Region, a workshop on GWD surveillance among the nomadic populations of Burkina Faso, Mali, and Niger took place from 26-28 February. The workshop sought to find a way to follow these populations as they migrated within and between each of the three countries. Nomadic migration patterns were studied and mapped to depict the main routes of travel and identify nomadic zones and periods of mobility (CDC, 2003a).

Uganda hosted the eighth assembly of National Program Coordinators of Guinea Worm Eradication Programs in Kampala, from 1-4 April. Program Coordinators from 12 ECs presented the final results of their national GWEPs for 2002. General Gowon was also in attendance (CDC, 2003b). In concurrence with the assembly, national data managers of the same 12 ECs attended a workshop on the use of the *HealthMap* GIS (WHO, 2003b).

The ICGDE convened from 14-15 May to discuss GDEC and best practices for establishing GWD surveillance in portions of Burkina Faso, Ghana, Mali, Nigeria, and Togo that had been deemed free of GWD as well as modifying definitions and performance indicators to

meet the needs of all national GWEPs and create a standard meaning for each. Operational definitions that distinguished indigenous cases of GWD from imported cases and classifications for localities based on transmission status were devised. Outcomes on how operational definitions would be defined from henceforth in GDEC are provided below. Some of the wording has been changed in order to stay consistent with the language used throughout this thesis otherwise they are quoted as written (WHO, 2003c, pp. 323-325):

- A case of GWD: An individual exhibiting a skin lesion or lesions with emergence of one or more GWs (each individual should be counted only once in a calendar year).
- An imported case of GWD: A case of GWD that was acquired in a place other than the locality where it was detected and reported.
- Endemic locality: A locality with one or more active indigenous cases during the previous and/or current calendar year.
- Reinfected locality: A previously EL reporting indigenous cases after at least one calendar year of reporting zero cases, where interventions need to be reinstated.
- New endemic locality: A locality appearing on the list of ELs for the first time since records have been kept, where intervention and surveillance activities need to be initiated.
- At-risk locality: A locality is considered to be at risk of local transmission if at least two of the following risk factors are associated: past history of endemic transmission; absence of a safe source of DW and proximity to ELs; unsafe source of DW shared with a neighboring ELs; established degree of links/movement of population within ELs.

The ICGDE assembly agreed that a case of GWD was based on the individual once per calendar year regardless of the number of emerged GWs. As the number of localities that

reported  $\geq 1$  cases had shrunk to a manageable level, the ICGDE felt it necessary to differentiate them based on the presence of GW transmission. Cases of GWD reported in one locality did not automatically classify that locality as endemic. Rather, the locality of origin would be considered an EL so long as it could be proven GW transmission occurred there and not the reporting locality. Localities that had reported zero cases in a single calendar year but recorded cases in subsequent years were to be considered reinfected. This emphasized the necessity of keeping localities that report zero cases under active surveillance for no less than three consecutive years after the last case was reported. Localities that reported indigenous cases for the first time in the span of their respective national GWEPs indicated the need to implement anti-GWD activities and surveillance. To classify a locality as at-risk required an environment favorable to GW transmission and determined as likely to obtain an imported case. Individual GWEPs were obliged to determine the degree of risk before implementing deciding if anti-GWD activities should be implemented and the level of surveillance the GWEP deemed appropriate (WHO, 2003c).

Surveillance levels varied in ECs and were determined by the GW transmission status of localities. Differences in levels of surveillance were to be based on a locality's endemic status which was decided by ICGDE as follows (WHO, 2003c, p. 325):

- In currently ELs: Locality health workers (LHWs)/LBVs visit households regularly all year, and at least weekly' there is monthly reporting and monthly supervision.  
(LHWs/LBVs are active in surveillance and intervention in ELs)
- In previously ELs (three consecutive years reporting zero cases of GWD): Surveillance during the peak transmission season should be conducted with the same frequency as in

ELs. During the non-transmission period, surveillance is passive, reporting is monthly, and supervision is quarterly.

- In previously ELs where there is continuous risk of transmission: Surveillance should be more proactive during the peak transmission season on a country-by-country basis.

Standard definitions were also put in place for performance indicators; the indicators that reflected the success or failure in surveillance and anti-GWD interventions implemented by national GWEPs. The ICGDE believed it was necessary for these indicators to be standardized in order to make comparisons nationally and internationally. The performance indicators were revised as follows (WHO, 2003c):

- Percentage of ELs reporting monthly
- Percentage of ELs where there are LHWs/LBVs who have been trained/retrained in the previous calendar year
- Percentage of ELs provided with specific monthly HE interventions
- Percentage of ELs where all households, as defined by the national GWEP, have filters for DW
- Percentage of ELs with access to  $\geq 1$  functioning safe source of DW
- Percentage of ELs where all eligible surface water sources were treated with temephos in a month
- Percentage of cases contained each month, according to the standard case containment definition

Treating surface water sources with temephos every four weeks starting one month prior to the estimated onset of the first case of GWD during the peak transmission season and ending one month after the season ends or when a water source dries out was suggested along with an inventory of all such sources used as DW. The definition of case containment was modified to include criteria that need to be carried out before a case of GWD could be considered contained. For a case to be successfully contained, it required the following conditions to be met (WHO, 2003c, pp. 327-328):

- The patient is detected before or within 24 hours of a GW's emergence; and
- The patient has not entered any water sources since the GW emerged; and
- The LHW/LBV has properly managed the case by cleaning and bandaging the site of emergence until the GW is completely removed, providing HE on prevention that discourages the patient from contaminating any water source (if there are more than one emerging GWs, the case has not been contained until the last GW is removed); and
- The process of containment, including verification of GWD, is validated by a supervisor within seven days of a GW's emergence.

Noted by the ICGDE was the difficulty of getting cases confirmed by a supervisor within seven days of a GW's emergence due to the distances supervisors would be required to travel in many areas and methods of communication available to request the supervisor for verification (WHO, 2003c).

A *Program Review* for the three most endemic countries of Ghana, Nigeria, and Sudan was held in Atlanta and TCC from 22-25 September. Over 70 participants were present including President Carter and General Gowon. The reason the *Program Review* was held for these three

countries separately was an effort to provide focus on the need of procuring additional financial resources and reinforcing technical effectiveness and political support (CDC, 2003c).

The annual *Program Review* for the endemic Francophone countries was held by Burkina Faso in the national capital, Ouagadougou from 20-22 October. In addition to the host country, representatives from the GWEPs of Benin, Ivory Coast, Mali, Mauritania, Niger, and Togo were present (CDC, 2003d).

The annual *Program Review* for the endemic Francophone countries was held by Burkina Faso in the national capital, Ouagadougou from 20-22 October. In addition to the host country, representatives from the GWEPs of Benin, Ivory Coast, Mali, Mauritania, Niger, and Togo were present (CDC, 2003d).

On 10 September, Vestergaard-Frandsen provided an in-kind donation to TCC for filter cloth and the costs of shipping valued at \$12,000. At the end of September, TCC received a \$500,000 grant from the *Kuwait Fund for Arab Economic Development* in support of GDEC to be used for 2004-2005. Medical students from four medical schools in Norway raised nearly \$208,000 to purchase roughly 7,000 medical kits for GWD treatment in Sudan to aid in the peak of the 2004 transmission season (CDC, 2003c)

2003

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2002	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2002
Benin	30	4	-83.43	30	1.00	13	ND	-58.06
Burkina Faso	203	28	-65.65	119	0.59	69	ND	-48.12
Cameroon	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CAR	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chad	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	28	15	-40.43	27	0.96	12	2	0.00
Ghana	8,290	5	47.75	4,866	0.59	975	425	31.94
Ivory Coast	42	0	-78.79	19	0.45	12	ND	-52.00
Kenya	12	12	-29.41	0	0.00	3	ND	N/A
Mali	829	5	-3.72	444	0.54	188	95	2.73
Mauritania	13	0	-69.05	10	0.77	9	ND	-50.00
Niger	293	14	18.15	145	0.49	88	36	14.29
Nigeria	1,459	0	-61.81	1,079	0.74	280	224	-49.71
Senegal	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sudan	20,299	0	-51.08	3,680	0.18	3,407	ND	-19.51
Togo	669	47	-55.46	496	0.74	158	ND	-30.70
Uganda	26	13	8.33	19	0.73	8	1	-57.89
Yemen	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>32,193</b>	<b>114</b>	<b>-41.08%</b>	<b>10,934</b>	<b>0.34</b>	<b>5,222</b>	<b>783</b>	<b>-16.51%</b>

**Table 24.** Case totals, number of internationally imported cases, percent change in total cases compared to 2002, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2002 (CDC, 2003e; WHO, 2004b).

Twelve ECs and one in the Precertification Phase (Kenya) counted 32,193 incidents from 5,222 localities that reported  $\geq 1$  cases of GWD in 2003; both were reductions compared to 2002 by 41.08% in the former and 16.52% in the latter. Cases determined to have been internationally imported numbered 143. An overall 0.34 CCR was reported for the year, which was quite a decline from the 0.55 CCR achieved in 2002. Although Benin, Ethiopia, Ivory Coast, Mauritania, and Uganda each reported less than 100 cases in 2003, three saw an increase in their numbers from 2002: Ghana, 47.79%, Niger, 19.74%, and Uganda, 116.67%. Sudan accounted for 63.05% of the global case total and 65.24% of all localities that reported  $\geq 1$  cases of GWD in 2003. However, 2003 was the first year since Sudan began its GWEP that zero indigenous cases were reported from the northern States. Ghana and Nigeria were the second and third most ECs, respectively, for the eighth consecutive year. While Ghana reported an increase in cases of GWD for the second successive year, Nigeria experienced its fifth continuous year of a decline (WHO, 2004b).

Nigeria enumerated 1,459 incidents from 280 localities that reported  $\geq 1$  cases of GWD in 2003. Both were reductions of 61.81% in the former and 49.73% in the latter, compared to 2002. However, it remained the third most EC after Sudan and Ghana. Only 56 of the country's LGAs reported cases in 2003. The four States of Benue, Ebonyi, Niger, and Oyo were responsible for 85.20% of all the country's cases in 2003 (WHO, 2004b).

Ghana counted 8,290 (8,285 indigenous and 5 imported) cases from 975 localities that reported  $\geq 1$  cases of GWD in 2003. Both were substantial increases compared with 2002 of 47.75% in the former and 31.94% in the latter. The increase in the number of cases was attributed to improved surveillance, detection of new outbreaks, and inadequate interventions the



year before. Northern was the most endemic Region of the country, accountable for 72.36% of all cases reported in 2003 (WHO, 2004b).

Sudan reported 20,299 incidents from 3,407 localities that reported  $\geq 1$  cases in 2003 for decreases of 51.08% in the former and 19.51% in the latter, compared to 2002. Transmission was interrupted in the northern States where 29 cases were reported in 2003, but they were determined to have been imported from the southern States. Three States of southern Sudan were responsible for 86.42% of the national total: Warrap: 8,360; Jonglei: 6,374; Bahr al-Jabal: 2,808. Overall, Sudan's GWEP claimed a CCR of 0.18. The reason cited for such a low rate of containment was the national GWEP's late adoption of the strict definition for case containment (WHO, 2004b).

#### **4.25. 2004**

The ICCDE convened for the fifth time at WHO Headquarters from 9-11 March. Applications were received from countries and territories of four WHO Regions. After reviewing the requests and based on criteria for certification, analyses of data submitted by the applicants and ICTs, the ICCDE proposed 17 countries and territories be certified free of GW transmission:

- Africa: Cape Verde, Comoros, Congo, Equatorial Guinea, Gambia, Guinea-Bissau, Madagascar, Mauritius, Rwanda, Sao Tome and Principe, and Senegal
- Americas: Uruguay
- Eastern Mediterranean: West Bank and Gaza Strip and Yemen
- Europe: Israel, Macedonia, and Serbia and Montenegro

Each was subsequently confirmed free of GW transmission by the Director-General of the WHO. Both Senegal and Yemen were previously ECs. This brought the total to 164 countries and territories certified (WHO, 2004a).

The ninth gathering of *National Program Coordinators of Guinea Worm Eradication Programs* was held in Bamako, Mali, from 29 March to 1 April. National Program Coordinators from Benin, Burkina Faso, Ethiopia, Ghana, Ivory Coast, Benin, Mali, Mauritania, Niger, Nigeria, Sudan, Togo, and Uganda attended as did General Touré, whom gave the opening address. Each Program Coordinator reported on the latest status of their respective GWEP. The main topic discussed was surveillance issues in previously endemic areas (CDC, 2004d).

On 19 May, during the Fifty-seventh WHA, the “Geneva Declaration for the Eradication of Dracunculiasis by 2009” was signed. It committed signatories to intensifying activities with the goal of GWD eradication. Supporters included Ministers of Health from the 12 ECs that remained, along with the WHO, UNICEF, and TCC (CDC, 2004e; WHO, 2004c).

The annual *Program Review* for endemic Francophone countries was held in Accra, from 18-20 August. Representatives from the national GWEPs of Benin, Burkina Faso, Ivory Coast, Mali, Mauritania, and Togo attended and each provided a status reports on their respective GWEPs and performance indicators (CDC, 2004g).

Uganda hosted the *Program Review* for endemic Anglophone countries in Entebbe, from 1-4 November. In addition to the host country, representatives from the national GWEPs of Ethiopia, Kenya, and Sudan were present and each gave an overview of their national GWEP in addition to performance indicators (CDC, 2004i).

Numerous donations were received by GDEC in 2004. TCC received a contribution of \$469,000 from Henry McConnon to be used for GDEC activities (CDC, 2004a). Japan provided

TCC \$100,000 to be used to for Togo's GWEP in order to train health workers, open case containment centers, purchase and distribute cloth filters, and treat DW sources with temephos (CDC, 2004b).

USAID granted TCC \$96,000 for anti-GWD interventions and Norsk Hydro donated roughly \$87,000 to HDI to procure pipe filters for efforts in southern Sudan (CDC, 2004c). Japan's Grassroots Grant Assistance Program awarded \$80,000 to TCC in March to purchase filter material for Sudan's GWEP (CDC, 2004d). A pledge of \$1 million over a two year period was made to TCC from the Sultanate of Oman for GDEC activities. The *U.N. Foundation's* affiliate, the *Better World Fund*, granted \$325,550 to TCC for the provision of technical assistance to Ghana's GWEP (CDC, 2004e).

Johnson & Johnson donated supplies for the assembly of 30,000 medical kits to be used by the national GWEPs of Ghana, Nigeria, and Sudan that were put together at TCC from 13-30 July. Each kit permits health workers enough supplies to provide care for ten patients suffering from GWD (CDC, 2004f). Saudi Arabia pledged \$1 million to TCC to be distributed over a five year period for GDEC (CDC, 2004g).

USAID pledged \$2 million over two years to TCC for Ghana's GWEP to be used for ELs that still lingered and for the maintain efforts in Sudan. TCC also received nearly \$1 million from the Norwegian Ministry of Foreign Affairs for Sudan's GWEP to be distributed during 2004-2005 (CDC, 2004h). In October, Vestergaard-Frandsen donated filters to TCC and agreed to pay the costs to ship them which totaled \$12,000 (CDC, 2004i). HDI was the recipient of a \$300,000 grant awarded by the *Conrad N. Hilton Foundation* to be used for the national GWEPs of Mali and Niger during 2005-2007 (CDC, 2004j).

2004

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2003	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2003
Benin	3	0	-90.00	3	1.00	1	1	-92.31
Burkina Faso	60	25	-70.44	39	0.65	33	14	-52.17
Cameroon	0	N/A	0.00	N/A	N/A	N/A	N/A	N/A
CAR	0	N/A	0.00	N/A	N/A	N/A	N/A	N/A
Chad	0	N/A	0.00	N/A	N/A	N/A	N/A	N/A
Ethiopia	17	14	-39.29	15	0.88	13	4	8.33
Ghana	7,275	7	-12.24	4,801	0.66	1,017	514	4.31
Ivory Coast	21	1	-50.00	6	0.29	8	3	-33.33
Kenya	7	7	-41.67	7	1.00	ND	N/A	N/A
Mali	357	3	-59.94	237	0.66	121	102	-35.64
Mauritania	3	0	-76.92	3	1.00	3	1	-66.67
Niger	240	7	-18.09	174	0.73	75	45	-14.77
Nigeria	495	0	-66.07	421	0.85	106	85	-62.14
Sudan	7,266	0	-64.21	898	0.12	2,145	2,137	-37.04
Togo	278	46	-58.45	200	0.72	100	46	-36.71
Uganda	4	4	-84.62	4	1.00	3	0	-62.50
<b>Totals</b>	<b>16,026</b>	<b>114</b>	<b>-50.22%</b>	<b>6,808</b>	<b>0.42</b>	<b>3,625</b>	<b>783</b>	<b>-30.58%</b>

**Table 25.** Case totals, number of internationally imported cases, percent change in total cases compared to 2003, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2003 (CDC, 2005b; WHO, 2005b).

By the end of 2004, four countries were in the Precertification Phase, Uganda reported only imported cases, limiting GW transmission to 11 ECs—all located in sub-Saharan Africa. Thirteen countries—12 ECs and one in the Precertification Phase (Kenya)—recorded 16,026 cases from 3,625 localities that reported  $\geq 1$  cases of GWD. Both were reductions from 2003 by 50.22% in the former and 30.60% in the latter. None of the ECs reported a case increase for the first time since GDEC began. Ghana claimed 45.39% of the global case total in 2004 surpassing Sudan to become the most EC. A total of 114 cases were imported, down from 143 in 2003. An overall 0.42 CCR was achieved, but outside of Sudan the other 12 countries combined for a considerably higher 0.68 CCR.

Nigeria remained the third most endemic country after Ghana and Sudan, with 495 cases reported from 106 localities that reported  $\geq 1$  cases of GWD; reductions of 66.07% in the former and 62.14% in the latter, compared to 2003. Of these, 81.19% were from three LGAs located in two states: Ado, 147 and Obi, 50, in Benue State and Agaie, 49, in Niger State. Nigeria's GWEP achieved a 0.85 CCR for the year (WHO, 2005b).

Sudan reported 7,266 cases from 2,145 localities that reported  $\geq 1$  cases of GWD in 2004, a reduction of 64.21% in the former and 37.04% in the latter, compared to 2003. Overall, the national GWEP only managed a 0.12 CCR. However, areas controlled by the GoS reported a higher CCR (0.54) than areas overseen by OLS (0.05). The six most endemic States, all in the south, claimed 93.68% of Sudan's case total in 2004: Warrap, 2,306; Jonglei, 1,468; Bahr al-Jabal, 939; East Equatoria, 817; West Bahr al-Gazal, 662; Lakes/Buheirat, 615. While zero indigenous cases were enumerated in the northern States, eleven imports from the southern States were reported and contained (WHO, 2005b).

After two successive years of increases, Ghana became the most EC in 2004, reporting 7,275 total incidents (7,268 indigenous and seven imported) from 1,017 localities that reported  $\geq 1$  cases of GWD; a 12.24% reduction in the former, but an increase by 4.31% in the latter, compared to 2003. Six of the imported cases were traced to Togo and the other was from Niger. Of the 1,017 localities that reported  $\geq 1$  cases of GWD in 2004, 673 were ELs. A total of 1,602 cases were enumerated from 344 localities that were classified as either reinfected or newly infected. The two most endemic Districts claimed 34.72% of all cases recorded in 2004: Nkwanta of Volta Region, 1,266 and Tolon-Kumbungu of Northern Region, 1,260 (WHO, 2005b).

The main challenges that faced GDEC at the end of 2004 included civil unrest in Sudan, movement of populations across and within countries, such as nomads in Burkina Faso, Mali, and Niger (WHO, 2005b).

#### **4.26. 2005**

Benin and Uganda entered 2005 in the Precertification Phase to join Cameroon, CAR, Chad, and Kenya. The year began with the signing of a Comprehensive Peace Agreement (CPA) between the GoS and SPLM in Nairobi, Kenya on 9 January to mark and official end to Sudan's second (and longest) civil war. President Carter was essential to this negotiation through his advocacy efforts (CDC, 2005a).

A *Program Review* for Mali's GWEP was held from 13-15 January, in the national capital, Bamako. On the final day of the assembly, it was announced that UNICEF/Mali received \$305,000 from the *Gates Grant Contingency Fund* for projects to provide safe sources of DW to

ELs in Gourma-Rharous Cercle of Timbuktu Region, and the Cercles of Ansongo and Gao, Gao Region (CDC, 2005a).

Ghana hosted the tenth meeting of *National Program Coordinators of Guinea Worm Eradication Programs*, in Accra from 5-7 April. Program Managers presented their national statistics for 2004 and for the first time since these meetings began, each national GWEP presented significant reductions in cases of GWD. Most notable to occur was the announcement at the opening ceremony of a \$25 million challenge grant awarded to TCC by the *Bill & Melinda Gates Foundation* which also included an initial gift of \$5 million. Before the opening ceremony ended, pledges by CIDA (\$5 million) and the *Conrad N. Hilton Foundation* (\$1 million) were made (CDC, 2005b).

A *Program Review* for Ghana's GWEP met in Accra from 15-16 August. The National Program Coordinator noted the 55.72% reduction of GWD cases achieved in the first half of 2005 compared to the first half of 2004 (CDC, 2005d).

Benin hosted the annual *Program Review* for GWEPs of endemic Francophone countries of Africa from 18-19 August in Contou, the country's most populous city. Benin's GWEP had not identified a single indigenous case since April 2005 and at the conference the country announced it had interrupted transmission of GWD (CDC, 2005d).

A *Program Review* for Sudan's GWEP was hosted by TCC in Atlanta from 16-17 November. Noted was access to areas that were previously isolated from SGWEP since the CPA was signed earlier in the year. Discussed were issues that Sudan's GWEP would be faced with in southern Sudan such continued insecurity and potential setbacks associated with a reorganization of health services (CDC, 2005g).

In April, TCC received \$3.35 million to be distributed over a three year period for its programs in Africa related to GWD and onchocerciasis from the *Diana, Princess of Wales Memorial Fund* and the owners of the Franklin Mint (CDC, 2005c). On 9 September, the European Commission awarded ~\$41.4 million to UNICEF for water and sanitation projects in Niger's States of Abia, Cross River, Gombe, Kebbi, Osun, and Plateau to be distributed over four years (CDC, 2005e). A "Small Scale Grant" for ~\$96,000 from Japan was made to Niger's GWEP for health education activities and to purchase cloth filters (CDC, 2005f).



2005

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2004	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2004
Benin	1	1	-66.67	1	1.00	1	0	0.00
Burkina Faso	30	6	-50.00	21	0.70	12	4	-63.64
Cameroon	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CAR	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Chad	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	37	8	117.65	32	0.86	12	7	0.00
Ghana	3,981	4	-45.28	2,405	0.60	734	422	-27.83
Ivory Coast	10	1	-52.38	4	0.40	5	2	-37.50
Kenya	2	2	-71.43	2	1.00	1	0	N/A
Mali	659	3	84.59	508	0.77	140	91	15.70
Mauritania	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
Niger	183	8	-23.75	163	0.89	59	30	-21.33
Nigeria	120	0	-75.76	78	0.65	40	33	-62.26
Sudan	5,569	0	-23.36	198	0.04	1,087	1,085	-49.32
Togo	73	3	-73.74	58	0.79	26	11	-74.00
Uganda	9	9	125.00	9	1.00	3	0	0.00
<b>Totals</b>	<b>10,674</b>	<b>45</b>	<b>-33.40%</b>	<b>3,479</b>	<b>0.33</b>	<b>2,120</b>	<b>1,685</b>	<b>-41.52%</b>

**Table 26.** Case totals, number of internationally imported cases, percent change in total cases compared to 2004, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2004 (CDC, 2006b; WHO, 2006).

A total of 10,674 cases of GWD were enumerated in 2,120 localities that reported  $\geq 1$  cases of GWD in 2005; reductions of 33.40% and 41.52%, respectively, compared to 2004. Three countries in the Precertification Phase claimed 12 imported cases: Benin, 1; Kenya, 2; and Uganda, 9. National GWEPs achieved a combined 0.33 CCR. Sudan had a significant role in this decline as its GWEP reported a low 0.04 CCR. Otherwise, the CCR was higher in countries outside Sudan at 0.64 (WHO, 2006).

The three countries in the Precertification Phase that reported  $\geq 1$  cases of GWD came from five localities, two of which were refugee camps: Benin, one locality; Kenya, Kakuma Refugee Camp; and Uganda, two localities plus Bama Refugee Camp. Overall, 45 imported cases were reported by ten countries in 2005, which was significantly less compared to 114 imported cases recorded in 2004. Sudan exported eight cases to Ethiopia, two to Kenya, and nine to Uganda, both countries in the Precertification Phase (WHO, 2006).

Mali became the third most EC for the first time since the start of GDEC with 659 cases (656 indigenous and three imported), from 140 localities that reported  $\geq 1$  cases of GWD in 2005. Both were increases of 84.59% and 15.70%, respectively, compared to 2004. The three imported cases were from Ansongo Cercle of Gao Region and traced back to Niger's Tillabéri Region. An overall CCR of 0.77 was reported by Mali's GWEP. Various localities throughout Mopti Region experienced the reintroduction of GWD in 2005 while areas of conflict restricted access to Mali's GWEP, especially the Communes (third-level administrative division) of Tin-Hama and Ouattagouna of Ansongo Cercle, Gao Region. The three most endemic Regions of Mali in 2005, in order of endemicity were: Gao, 523; Mopti, 91; and Timbuktu, 33. Three of the four Cercles that make up Gao Region reported cases of GWD in 2005: Ansongo, 360, Bourem, 5, and Gao, 158 (WHO, 2006).

Ghana continued to be the second most EC after Sudan in 2005 as the national GWEP recorded 3,981 cases (37.30% of the global case total) in 734 localities that reported  $\geq 1$  cases of GWD. Both were reductions of 45.28% and 27.83%, respectively, compared to 2004. Four cases were exported to Ghana from three other ECs: Burkina Faso, 2, Niger, 1, and Togo, 1. Out of the localities that reported  $\geq 1$  cases in 2005, 422 were ELs. The majority of cases (74.88%) continued to be from Northern Region, where Ghana's three most endemic Districts were located in 2005: Tolon-Kumbungu, 905, Savelugu-Nanton, 428, and East Gonja, 374. After Northern Region, in terms of endemicity were the Regions of Upper West, 333; (300 in Wa District alone), Brong-Ahafo, 293, and Volta, 286 (WHO, 2006).

Sudan accounted for 51.27% of the global case total in 2005 and continued to be the most EC as Sudan's GWEP reported 5,569 cases from 1,085 localities that reported  $\geq 1$  cases of GWD, a reduction of 23.36% in the former and 49.32% in the latter, compared to 2004. A total of four cases, each determined to have been imported from the southern States, were recorded in the northern States in 2005 and each was reportedly contained. The four most endemic Payams (third-level administrative division) of southern Sudan were responsible for 68.25% of the 2005 case total. The four Payams were found in four counties of three southern States. The Payams and case totals are preceded by their home County (second-level administrative division) and listed below by State:

- Eastern Equatoria State: Kapoeta North, Riwoto Payam, 2,605; Kapoeta East, Kwauto Payam, 398
- Lakes State: Aweirial, Aweirial Payam, 601
- Warrap State: Tonj, Ananatak Payam, 197

The continued peace allowed Sudan's GWEP access to more endemic areas and strengthened surveillance and anti-GWD interventions throughout the country. Overall, Sudan's GWEP submitted an extremely low 0.04 CCR (WHO, 2006).

#### **4.27. 2006**

Mauritania began 2006 in the Precertification Phase joining Benin, Cameroon, CAR, Chad, Kenya, and Uganda. The eleventh assembly of National Program Coordinators of Guinea Worm Eradication Programs convened in Niamey, Niger, from 29-31 March (CDC, 2006b).

After the 2005 CPA, the Government of Southern Sudan (GoSS) assumed charge of GWD eradication efforts in the ten southern States and appointed the Southern Sudan Ministry of Health with the task (Hopkins et al., 2007). Thus, in early 2006, the South Sudan GWEP was formed (CDC, 2007c). Throughout the year, 14 sub-offices and 43 storage facilities in endemic Counties of the southern States were opened (CDC, 2007d). Aided by 10,745 trained local volunteers, the South Sudan GWEP was able to reach previously inaccessible areas and improve surveillance activities (Hopkins et al., 2007).

In January, the YKK Corporation contributed \$1 million to TCC for GDEC activities over a four year period covering 2006-2009, to be matched by the *Bill & Melinda Gates Foundation* (CDC, 2006a). The *Kuwait Fund for Arab Economic Development* informed TCC of a renewal grant of \$500,000 for GDEC for 2006-2007 to be matched 1:1 by funds from the *Bill & Melinda Gates Foundation* (CDC, 2006c).

2006

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2005	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2005
Benin	0	0	-100.00	N/A	N/A	N/A	N/A	N/A
Burkina Faso	5	2	-83.33	3	0.60	4	2	-66.67
Cameroon	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CAR	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Chad	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	3	2	-91.89	3	1.00	3	1	-76.92
Ghana	4,136	2	3.89	3,086	0.75	606	346	-17.44
Ivory Coast	5	0	-50.00	5	1.00	1	1	-80.00
Kenya	0	0	-100.00	N/A	N/A	N/A	N/A	N/A
Mali	329	6	-50.08	271	0.82	88	67	-37.14
Mauritania	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Niger	110	2	-39.89	91	0.83	34	18	-42.37
Nigeria	16	0	-86.67	11	0.69	10	7	-75.00
Sudan	20,582	2	269.58	10,126	0.49	3,346	3,137	207.82
Togo	29	4	-60.27	23	0.79	10	4	-61.54
Uganda	2	2	-77.78	2	1.00	2	0	-33.33
<b>Totals</b>	<b>25,217</b>	<b>22</b>	<b>136.25%</b>	<b>13,621</b>	<b>0.54</b>	<b>4,104</b>	<b>3,583</b>	<b>93.49%</b>

**Table 27.** Case totals, number of internationally imported cases, percent change in total cases compared to 2005, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2005 (Hopkins et al., 2007; WHO, 2007a).

Cases of GWD were reported from all nine ECs and one in the Precertification Phase (Uganda) for a combined total of 25,217 incidents counted in 4,104 localities that reported  $\geq 1$  cases of GWD in 2006; increases of 136.25% and 93.49%, respectively, compared to 2005. Sudan was the main culprit in the increase and responsible for 86.62% of the 2006 global case total. Together, Ghana and Sudan accounted for 98.02% of the 2006 global case total. Outside Ghana and Sudan, all other countries combined reported only 499 incidents of GWD, down 55.60% from 2005. Only 22 cases of GWD were imported from one country to another which was less than half that recorded in 2005. National GWEPs reported a combined CCR of 0.54 in 2006.

Mali continued to be the third most EC in with 329 cases recorded in 88 localities that reported  $\geq 1$  cases of GWD in 2006 ; decreases of 50.08% and 37.14%, respectively, compared to 2005. Six of the 329 cases were imports from Niger (CDC, 2007c). Mali's GWEP achieved a CCR of 0.82. A major concern was the lack of safe sources of DW in the 20 most ELs in 2006 (CDC, 2007c). Three adjoining Cercles from the Regions of Gao and Timbuktu were responsible for 89.97% of all Mali's cases. Four Cercles from the three northern Regions reported incidents of GWD for the year (WHO, 2007a):

- Gao Region: Ansongo, 178 and Gao, 103
- Mopti Region: Mopti, 16
- Timbuktu Region: Gourma-Rharous, 15

Ghana remained the second most endemic country with 4,136 cases (4,134 indigenous and two imported from Mali), or 16.40% of the global total, found in 606 localities that reported  $\geq 1$  cases of GWD in 2006; a slight increase by 3.89% in the former and a decline of 17.44% in

the latter, compared to 2005. Of the 606 localities that reported  $\geq 1$  cases, 346 were ELs.

Northern Region was responsible for 88.95% of Ghana's case total in 2006. The five most endemic Districts of Northern Region reported 85.404% of the Region's total and are listed in order of endemicity: Savelugu-Nanton, 1,182; Tolon-Kumbungu, 827; Tamale Metropolitan, 416; East Gonja, 382; Yendi, 335 (WHO, 2007a).

Moreover, Savelugu-Nanton District was home to the country's two most ELs in 2006: Diare, 298 and Savelugu, 411 (CDC, 2007a). The next three most endemic Regions, in order of endemicity were Brong-Ahafo, 204, Upper West, 93, and Volta, 86 (WHO, 2007a). In March 2006, a malfunction occurred in the municipal water supply of Tamale, the Northern Region's capital, which also disrupted the water supply piped in to the town of Savelugu, to the north. Before the error was noticed, city water vendors unknowingly sold the contaminated water to households in both of the aforementioned towns (CDC, 2007b). In September, the government declared GWD to be a national emergency in the Northern Region and increased funds for the GWEP and launched a multimedia campaign aimed at residents that promoted prevention and publicized free medical treatment for those infected (Hopkins et al., 2007).

Sudan (programs from the north and south) reported 20,582 cases (81.62% of the global case total) from 3,346 localities that reported  $\geq 1$  cases of GWD in 2006; an increase of 269.58% in the former and 207.82% in the latter, compared to 2005. The case total included two imports from Ethiopia's Gambela Region. Only one case was recorded in the northern States and it was determined to have been imported from southern Sudan (CDC, 2007c). Of the 3,346 localities that reported  $\geq 1$  cases of GWD in 2006, 3,137 of them were ELs. The three southern States of Eastern Equatoria, Jonglei, and Warrap were home to the five most endemic Counties in Sudan, responsible for 80.09% of all cases recorded in 2006 (WHO, 2007a):

- Eastern Equatoria: Kapoeta East, 4,606, Kapoeta North, 7,849, and Kapoeta South, 1,219
- Jonglei: Ayod, 1,079
- Warrap: Gogrial East, 1,732

In addition to increased access, improved surveillance, and the ability to implement more interventions as a result of the 2005 CPA, Sudan's eradication programs also gained additional financial assistance, human resources, and greater political commitment (WHO, 2007a). At the first *Program Review* of the Southern Sudan GWEP in December, the Program Coordinator claimed that 20,042 localities were under surveillance by the end of October and that nearly 1.4 million pipe filters had been distributed throughout the year. By the end of 2006, UNICEF had finished drilling eight borehole wells in the country's most endemic County, Kapoeta of Eastern Equatoria State (CDC, 2006d).

#### **4.28. 2007**

The ICCDE convened for the sixth time at WHO Headquarters from 5-7 March.

Applications were received from 12 countries in two WHO Regions:

- Africa: Algeria, Cameroon, CAR, Gabon, Liberia, Mozambique, Sierra Leone, Swaziland, Tanzania, and Zambia.
- Eastern Mediterranean: Afghanistan and Djibouti.

After reviewing the requests and based on criteria for certification, analyses of data submitted by the applicants and ICTs, the ICCDE proposed the all applicants except be certified free of GW



transmission, the ICCDE proposed 12 countries and territories from two WHO Regions for certification. Cameroon and CAR were formerly ECs (WHO, 2007b).

The twelfth gathering of *National Program Coordinators of Guinea Worm Eradication Programs* was hosted by Burkina Faso in the capital city of Ouagadougou from 27-29 March (CDC, 2007c).

2007

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2006	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2006
Benin	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Burkina Faso	3	3	-40.00	1	0.33	3	0	-25.00
Chad	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	3	3	0.00	3	1.00	3	0	0.00
Ghana	3,358	0	-18.81	2,837	0.84	406	180	-33.00
Ivory Coast	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	313	0	-4.86	110	0.35	71	62	-19.32
Mauritania	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Niger	14	3	-87.27	13	0.93	9	6	-75.53
Nigeria	73	0	356.25	44	0.60	4	3	-60.00
Sudan	5,815	0	-71.75	2,876	0.49	1,998	1,765	-40.29
Togo	2	2	-93.10	1	0.50	2	0	-80.00
Uganda	4	4	100.00	4	1.00	3	0	50.00
<b>Totals</b>	<b>9,585</b>	<b>15</b>	<b>-61.99%</b>	<b>5,889</b>	<b>0.61</b>	<b>2,499</b>	<b>2,016</b>	<b>-39.11%</b>

**Table 28.** Case totals, number of internationally imported cases, percent change in total cases compared to 2006, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2006 (CDC, 2009c; Hopkins, Ruiz-Tiben, Eberhard, & Roy, 2008; WHO, 2008).

Eight of nine ECs and one in the Precertification Phase (Uganda) recorded a global case total of 9,585, from 2,497 localities that reported  $\geq 1$  cases of GWD in 2007; reductions of 61.99% in the former and 39.16% in the latter, compared to 2006. Ghana and Sudan claimed 95.70% of the global case total. Even though the two countries proportion of the global case total constitutes the vast majority of all cases, their combined total fell by 62.89% compared to 2006. Ghana, Mali, and Sudan were responsible for the exportation of fifteen cases to other countries in 2007: Ghana exported three to Burkina Faso and two to Togo; Mali exported three to Niger; and Sudan exported three to Ethiopia and four to Uganda. Zero incidents of GWD were reported by Ivory Coast while Burkina Faso, Ethiopia, Togo, and Uganda claimed only imported cases. Only Ghana, Mali, Niger, Nigeria, and Sudan remained endemic at the end of 2007. National GWEPs reported an overall CCR of 0.61 (WHO, 2008). Sudan continued to have the majority of localities to report  $\geq 1$  cases of GWD with 80.02% of the global total (Hopkins, Ruiz-Tiben, Eberhard, et al., 2008; WHO, 2008).

Nigeria experienced a setback in 2007 after a resident of Ezza Nkwubor locality in Enugu East LGA, Enugu State, appeared at a public health clinic for treatment of GWD in January. The clinic subsequently informed Nigeria's GWEP and upon investigation, the GWEP discovered 30 active cases in Ezza Nkwubor, which had not previously been known to be an EL. It was also discovered that the locality did not have a safe source of DW. Two of the patients resided in the nearby locality of Ezza Ogwuomu, however, it was determined that the origin of infection was Ezza Nkwubor, as inhabitants of Ezza Ogwuomu rely on two fast flowing rivers for their DW (CDC, 2007b).

Mali's GWEP reported 313 cases from 71 localities that reported  $\geq 1$  cases of GWD in 2007; reductions of 4.86% and 19.32%, respectively, compared to 2006. Four of Mali's eight

Regions (Kayes, Koulikoro, Ségou, and Sikasso) were free from GWD transmission for the year. The country was confronted with two unanticipated outbreaks in 2007. The first occurred in June, when GWs began to emerge from local residents in a locality of Tessalit Cercle, Kidal Region (WHO, 2008). Local health authorities failed to notify Mali's GWEP until early August. By then, too much time had passed to contain any of the 86 cases (Hopkins, Ruiz-Tiben, Downs, Withers Jr., & Roy, 2008). Staff of the national GWEP visited the area shortly after the news was received. However, insecurity generated by rebel Tuaregs rendered the area dangerous to all GWEP staff. The outbreak was traced to a Koranic scholar from a locality in Gao Cercle of Gao Region, that had traveled to Algeria, in August 2006. It was reported that the man had contaminated water sources in attempts to extract GWs that had emerged on several occasions (CDC, 2008a).

The second outbreak of 68 cases of GWD took place in three previously ELs of Ansongo Cercle in Gao Region. Mali's GWEP was made aware only after Niger's GWEP informed them of two imported cases they traced back to Mali (Hopkins, Ruiz-Tiben, Downs, et al., 2008). Due to the delayed detection and late response to these outbreaks, Mali's GWEP only achieved a 0.35 CCR in 2007. The number of cases recorded by each Cercle in the four endemic Regions of Mali is listed by order of endemicity (WHO, 2008):

- Gao Region (197): Asongo, 135 and Gao, 62
- Kidal Region (85): Tessalit, 85
- Timbuktu Region (16): Gourma-Rharous, 16
- Mopti Region (15): Douentza, 3; Djenné, 2; Mopti, 8; Tenekou, 1

Ghana's GWEP enumerated 3,358 cases from 406 localities that reported  $\geq 1$  cases of GWD, for reductions of 18.81% in the former and 33.00% in the latter, compared to 2006. The Northern Region was responsible for 96.40% of all Ghana's cases of GWD. A disruption of Tamale's municipal water supply in March 2006 led to a huge outbreak of GWD in Savelugu, a town to the north that used the same water supply, which peaked in January 2007 when 1,005 cases were reported (WHO, 2008).

In 2007, Sudan reported 5,815 cases from 1,998 localities that reported  $\geq 1$  cases of GWD for reductions of 71.75% in the former and 40.29% in the latter, compared to 2006. Active surveillance took place in 22,322 localities (CDC, 2010g). The northern States of Sudan claimed four imported cases from the south. Of the localities that reported cases of GWD, 11.66% reported only imported cases from another locality. Three of the southern states were home to the six most endemic Counties with 4,129 or 71.00% of all Sudan's cases in 2007. Each County is listed by State (WHO, 2008):

- Eastern Equatoria State: Kapoeta East, 1,703, Kapoeta North 1,004, and Kapoeta South, 344
- Warrap State: Tonj East, 364 and Tonj North, 307
- Jonglei State: Ayod, 407

#### **4.29. 2008**

Burkina Faso, Ivory Coast, and Togo began their first year in the Precertification Phase joining Benin, Chad, Kenya, Mauritania, and Uganda. For the first time, President Carter, Malian President Touré, and General Yakubu Gowon of Nigeria appeared together at the eighth

*Regional Conference on Dracunculiasis in Africa*, held in Abuja, Nigeria, from 2-4 April, sponsored by TCC, UNICEF, and the WHO (CDC, 2008b).

On 28 November, Ghana's President unveiled the *Tamale Water Expansion Project*, to repair the Tamale Metropolitan District's municipal water supply which Savelugu, the capital of Savelugu-Nanton District, also utilized. In 2008, the Tamale Metropolitan District and Savelugu had a combined total of 94 cases of GWD (CDC, 2009a).

A team of representatives from the CDC, TCC, and the WHO travelled to Ethiopia's Gambela Region from 3-7 December to evaluate the status of the national GWEP. The team found weaknesses in supervision and surveillance and recommended immediate remedies.

An ICT visited Chad from 1-19 December to verify the national GWEP's claim to have interrupted GW transmission in the country (CDC, 2009a).

From 12-13 December, the annual *Program Review* of the Southern Sudan GWEP met in Juba (CDC, 2009a).

Google.org provided a grant in the amount of \$1.45 million to TCC to assist Ghana's GWEP and was matched 1:1 by TCC (CDC, 2008a). Two new commitments to TCC and the WHO for GDEC were announced by President Carter on 5 December. The first was from the *Bill & Melinda Gates Foundation* with an outright contribution of \$8 million along with a \$32 million grant set aside and contributed as part of a one-to-one match challenge from other donor organizations. The second pledge was from the DfID for approximately \$14.8 million that was subsequently matched (CDC, 2009a).

2008

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2007	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2007
Benin	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Burkina Faso	1	1	-66.67	1	1.00	1	0	-66.67
Chad	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	41	4	1266.67	32	0.78	9	7	800.00
Ghana	501	0	-85.08	428	0.85	131	46	-67.73
Ivory Coast	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	417	0	33.23	354	0.85	69	26	-2.82
Mauritania	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Niger	3	1	-78.57	2	0.67	3	2	-66.67
Nigeria	38	0	-47.95	38	1.00	5	2	25.00
Sudan	3,618	0	-37.78	1,781	0.49	1,243	947	-37.79
Togo	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
Uganda	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
<b>Totals</b>	<b>4,619</b>	<b>6</b>	<b>-51.81%</b>	<b>2,636</b>	<b>0.57</b>	<b>1,461</b>	<b>1,030</b>	<b>-41.49%</b>

**Table 29.** Case totals, number of internationally imported cases, percent change in total cases compared to 2007, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2007 (CDC, 2009c; Hopkins, Ruiz-Tiben, Eberhard, & Roy, 2009; WHO, 2009).

In 2008, 4,619 incidents were recorded in 1,461 localities that reported  $\geq 1$  cases of GWD; reductions of 51.81% and 41.49%, respectively, compared to 2007. Sudan was again responsible for the majority of the global total in 2008 with 78.33% of all cases. Conversely, Niger and Nigeria saw decreases in case totals by 78.57% and 47.95%, respectively, during the same period. Only six cases of GWD were classified as imports from one country to another in 2008. The seven national GWEPs that recorded cases in 2008 managed an overall 0.57 CCR. However, when Sudan was removed from the equation, the CCR improved to 0.85.

Ethiopia's GWEP reported 41 incidents from nine localities that reported  $\geq 1$  cases of GWD in 2008; a substantial increase of 1266.67% in the former and 800.00% in the latter, compared to 2007. Four of the cases reported by Ethiopia's GWEP were determined to be imports from southern Sudan (WHO, 2009).

Mali enumerated 417 instances from 69 localities that reported  $\geq 1$  cases of GWD in 2008; a 33.23% increase in the number of cases from two fewer localities, compared to 2007. Four of Mali's eight Regions recorded cases: Gao, Kidal, Ségou, and Timbuktu. Three of the Regions reported indigenous transmission while all six cases reported in Ségou Region were of an undetermined origin and only three were effectively contained. Information at lower administrative levels for Ségou Region was not found. Affected Cercles and the number of recorded incidents are listed below by Region:

- Gao Region: Ansongo, 78 and Gao, 35
- Kidal Region: Kidal, 65 and Tessalit, 201
- Ségou Region: 6
- Timbuktu Region: Gourma-Rharous, 31



The eruption of GWD in Kidal Region from the previous year spread to other localities within the Region throughout 2008 and due to insecurity, the establishment of surveillance and containment measures were negatively affected. Unanticipated episodes of GW transmission appeared in Ansongo Cercle of Gao Region that were linked to newly established nomadic camps. Mali's GWEP speculated cases from Kidal Region possibly travelled to Algeria and contacted the Algerian MoH, which reported to the WHO that no confirmed cases had been encountered in the country during the year (WHO, 2009).

Ghana recorded 501 incidents from 131 localities that reported  $\geq 1$  cases of GWD in 2008; reductions of 85.08% in the former and 67.73% in the latter, compared to 2007. It was determined that 114 cases were internal imports from 96 other locations. Of the 131 localities that reported  $\geq 1$  cases of GWD 85 claimed only imports from other localities. Eight of Ghana's ten Regions reported incidents with the majority again from Northern (95.61%) and in a distant second, Brong-Ahafo (2.20%). A total of 11 incidents of GWD were reported from the Regions of Ashanti, Central, Eastern, Upper East, Upper West, and Volta (WHO, 2009).

Sudan reported 3,618 incidents from 1,243 localities that reported  $\geq 1$  cases of GWD in 2008; reductions of 37.78% in the former and 37.79% in the latter, compared to 2007. The six most endemic Counties were found in three southern States (WHO, 2009):

- Eastern Equatoria: Kapoeta East, 512, Kapoeta North, 406, and Kapoeta South, 430
- Warrap: Tonj East, 418 and Tonj North 577
- Lakes: Aweirial, 375

#### 4.30. 2009

Mali hosted the thirteenth meeting of *National Program Coordinators of Guinea Worm Eradication Programs* from 4-6 March in Bamako (CDC, 2009c).

Two workshops were conducted by the WHO to train GWEP data managers and workers associated with tracking surveillance on a new data management application called the “Guinea Worm Information Management System.” One for endemic Francophone countries held in Bamako, Mali from 7-9 April and from 20-22 April for endemic Anglophone countries in Addis Ababa, Ethiopia (CDC, 2009d).

The ICCDE convened for the seventh time at WHO Headquarters from 21-23 October. Applications were received from 8 countries from two WHO Regions:

- Africa: Benin, Chad, Guinea, Mauritania, and Uganda.
- Western Pacific: Cambodia, the Marshall Islands, and Palau.

After reviewing the requests and based on criteria for certification, analyses of data submitted by the applicants and ICTs, the ICCDE proposed all applicants except Chad be certified free of GW transmission. Benin, Mauritania, and Uganda were once ECs. This brought the total to 187 countries and territories to be certified free of GW transmission (WHO, 2010b).

November marked the first month of zero incidents documented in Ghana since the establishment of the national GWEP in 1988. In December, after 13 successive months without a confirmed case of GWD, Nigeria interrupted transmission of GW. By the end of 2009, General Gowon had visited 135 ELs across 18 endemic States in Nigeria since he began to advocate for Nigeria’s GWEP (CDC, 2010a).

2009

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2008	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2008
Burkina Faso	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
Chad	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Ethiopia	24	0	-41.46	19	0.88	9	3	0.00
Ghana	242	0	-51.70	225	0.93	52	19	-60.31
Ivory Coast	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	186	0	-55.40	135	0.73	52	23	-24.64
Niger	5	5	66.67	2	0.40	5	0	66.67
Nigeria	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
Sudan	2,733	0	-24.46	2,134	0.78	1,011	584	-18.66
Togo	0	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>3,190</b>	<b>5</b>	<b>-30.94%</b>	<b>2,515</b>	<b>0.79</b>	<b>1,129</b>	<b>629</b>	<b>-22.72%</b>

**Table 30.** Case totals, number of internationally imported cases, percent change in total cases compared to 2008, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2008 (CDC, 2010h; Hopkins et al., 2010; WHO, 2010a).

Five countries recorded 3,190 incidents from 1,129 localities that reported  $\geq 1$  cases of GWD in 2009; reductions of 30.94% in the former and 22.72% in the latter, compared to 2008. Niger and Nigeria claimed zero indigenous cases for the first time in a full calendar year since establishing national GWEPs. International imports were discovered in Niger only: one from Ghana, four from Mali. Mali experienced the greatest reduction in incidents from the previous year with a 55.40% decline. Responsible for 85.67% of the global case total, Sudan continued to be the most affected of all ECs. Of the 1,129 localities that reported  $\geq 1$  cases of GWD, 495 claimed only internally imported incidents. National GWEPs were alerted to a total of 7,716 rumors which, upon investigation, 95 were confirmed cases of GWD (WHO, 2010a). An overall 0.79 CCR was reached in 2009.

Ethiopia's GWEP counted 24 incidents from nine localities that reported  $\geq 1$  cases of GWD in 2009; a decrease 41.46% in the former and no change in the latter, compared to the previous year. All cases were recorded in Gambela Region from Abobo and Gog Weredas of Anuak Zone and Itang Special Wereda. Seven cases were confirmed to be indigenous to three of the localities while the other 17 were determined to have been internally imported from other localities (WHO, 2010a).

Ghana's GWEP enumerated 242 incidents from 52 localities that reported  $\geq 1$  cases of GWD in 2009; reductions of 51.70% and 60.31%, respectively, from 2008. One-hundred ninety-four of all cases were found to be indigenous to 19 of the localities that reported  $\geq 1$  cases while 48 incidents were classified as internal imports into the other 33 localities. Northern was again Ghana's most endemic Region, responsible for 237, or 97.93% of the country's total incidents. In the Region's Central Gonja District, 120 cases, or 49.59% of Ghana's total, were reported from the locality of Fufulso, the epicenter of an outbreak in January when 21 cases were discovered

(CDC, 2009b). Moreover, of the 48 cases the national GWEP determined to be internally imported, 46 of them originated in Ffulso. Ghana's other five cases were distributed amongst the Regions of Ashanti, Brong-Ahafo, and Eastern. The national GWEP notified of 5,327 case rumors in 2009, and with five of them confirmed to be cases GWD (WHO, 2010a).

Mali recorded 186 incidents from 52 localities that reported  $\geq 1$  cases of GWD in 2009; reductions of 55.40% and 24.64%, respectively, compared to the year before. Seven Cercles in five Regions reported indigenous cases as listed below (information at lower administrative levels for Ségou Region was not found):

- Gao Region: Ansongo, 40 and Gao, 40
- Kidal Region: Kidal, 26 and Tessalit, 9
- Mopti Region: Ténenkou, 4
- Ségou Region: 3
- Timbuktu Region: Gourma-Rharous, 24

Ansongo Cercle saw a 48.72% reduction in incidents compared to 2008 while Gao Cercle experienced an increase of 128.57% in cases within the same period. Local transmission of GW was reestablished in two localities of Ténenkou Cercle after the discovery of four indigenous cases. The two localities had reportedly not had an incident of GWD since 1974. Ségou Region cut its case total in half from 2008. Gourma-Rharous Cercle experienced a 22.58% decline from the previous year. Twenty-nine non-endemic localities reported 91 internally imported cases. Mali's GWEP was informed of 107 rumored cases during the year, investigated each claim, and confirmed 45 to be GWD (WHO, 2010a).

Southern Sudan's GWEP counted 2,733 incidents from 1,011 localities that reported  $\geq 1$  cases of GWD in 2009; reductions of 24.46% in the former and 18.66% in the latter, compared to 2008. Incidents were reported for the first time from 121 localities and 427 localities claimed only imports. A total of 861 localities that were endemic in 2008 reported zero cases in 2009. Listed by State, the seven most endemic Counties accounted for 87.89% of all Sudan's cases in 2009:

- Central Equatoria: Terekeka, 243
- Eastern Equatoria: Kapoeta East, 249, Kapoeta North, 323, Kapoeta South, 103
- Lakes: Awerial, 415
- Warrap: Tonj North, 704, Tonj East, 365

Southern Sudan's GWEP was informed of 1,732 rumors which, upon investigation, 43 were confirmed as GWD (WHO, 2010a).

The goal set forth under Resolution WHA 57.9—"The Geneva Declaration for the Eradication of Dracunculiasis"—during the Fifty-Seventh WHA in May 2004 to achieve eradication of GWD by the end of 2009 was not to be. However, of the 12 ECs that signed the Resolution, by the end of 2009 three had been certified free of GW transmission, five were in the Precertification Phase, and only four were still considered endemic.

#### **4.31. 2010**

Niger and Nigeria began 2010 year in the Precertification Phase to join Burkina Faso, Chad, Ivory Coast, Kenya, and Togo. Ethiopia's GWEP initiated surveillance in 71 populated localities of Gog Wereda in January (Hopkins, Ruiz-Tiben, Eberhard, & Roy, 2011).

The fourteenth assembly of *National Program Coordinators of Guinea Worm Eradication Programs* convened at TCC on 27 March. Presentations were made by Ethiopia, Ghana, Mali, Niger, Nigeria, and Sudan (CDC, 2010c).

On 15 May, Ethiopia began offering a reward of ~\$37 for reports of GWD to the patient as well as the informant (CDC, 2010e).

A two-hour informal assembly was organized by the WHO on 19 May during the Sixty-third WHA to meet with Ministers of Health from the countries affected by GWD. More than 70 people attended including delegates from major partners and donors (CDC, 2010d).

A meeting for countries in Africa that had been certified free of GW transmission was held in Cotonou, Benin from 1-4 June. These were countries considered to be at-risk for cases imported from nearby ECs. Participants from Benin, Cameroon, CAR, Guinea, Liberia, Mauritania, Senegal, Sierra Leone, and Uganda were present. After a review of the surveillance status for each of these countries, suggestions were made for improvements. One outcome was an approved set of standardized operating procedures for reporting and surveillance of GWD (CDC, 2010e).

During a Review of Ghana's GWEP from 27-28 July, it was agreed to make the reward for reporting a case of GWD ~\$22 (CDC, 2010e).

From 15-30 September, an external evaluation was conducted to substantiate Niger's claim to have interrupted GW transmission since its last indigenous case was reported in 2008. The evaluators did not find any indications to suggest local GW transmission continued and concluded that Niger should begin the Pre-certification Phase.

Burkina Faso was visited by an ICT from 18-29 October after three years in the Pre-certification Phase to verify its national report submitted to the WHO on the absence of GW

transmission since last occurrence of an indigenous in 2006. A report of the ICT's investigation was subsequently submitted to the ICCDE to be reviewed for the next assembly (CDC, 2010g).

The Sultan of Oman provided a grant for \$1 million to TCC on 23 February in support of GDEC activities covering fiscal years 2011-2013 and was matched by the *Bill & Melinda Gates Foundation* (CDC, 2010b). In July, the *Arab Fund for Economic and Social Development* provided nearly \$1 million to TCC in support of eradication activities in southern Sudan (CDC, 2010f).



2010

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2009	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2009
Burkina Faso	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Chad	10	0	N/A	0	0.00	8	8	N/A
Ethiopia	21	1	-12.50	19	0.90	10	5	11.11
Ghana	8	0	-96.69	8	1.00	4	4	-92.31
Ivory Coast	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	57	0	-69.35	44	0.77	22	19	-57.69
Niger	3	3	-40.00	2	0.67	3	0	-40.00
Nigeria	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Sudan	1,698	0	-37.87	1,264	0.74	732	227	-27.60
Togo	0	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>1,797</b>	<b>4</b>	<b>-43.67%</b>	<b>1,337</b>	<b>0.74</b>	<b>779</b>	<b>262</b>	<b>-31.00%</b>

**Table 31.** Case totals, number of internationally imported cases, percent change in total cases compared to 2009, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2009 (WHO, 2011a).

Five ECs and Precertification Phase Niger enumerated 1,797 incidents from 779 localities that reported  $\geq 1$  cases of GWD in 2010; decreases of 43.67% and 31.00%, respectively, compared to 2009. Four cases were found to be international imports: Ethiopia, 1 from Sudan and Niger, 3 from Mali. Of the localities that reported  $\geq 1$  cases, 516 claimed imports only. National GWEPs were alerted to 3,314 case rumors in Burkina Faso, Chad, Ethiopia, Ghana, Ivory Coast, Kenya, Mali, Niger, Nigeria, Sudan, and Togo. Ten years after the last indigenous case was recorded and GW transmission was considered to have been interrupted, Chad's GWEP reported ten indigenous cases in 2010 (WHO, 2011a).

Between April and June, rumors of two cases were brought to the attention of Chad's GWEP. Upon investigation, the rumors were confirmed positive for GWD which subsequently led the MoH to carry out an active case search in collaboration with the WHO. By October, eight additional incidents were discovered (Djidina et al., 2011). The ten incidents were found in eight localities that reported  $\geq 1$  cases in five Communes (third-level administrative division) of four Departments (second-level administrative division) from four Regions (first-level administrative division):

- Chari-Baguirmi Region: Chari Department's Mandélie Commune, 1; Baguirmi Department's Massenya Commune, 2
- Guéra Region: Barh Signaka Department's Méfi Commune, 2
- Mayo-Kebbi Est Region: Mayo-Lémié Department's Guélandeng Commune, 4
- Moyen-Chari Region: Barh Kôh Department's Sarh Commune, 1

Six of the localities were located along the Chari River, a key transportation route that is frequently traversed by nomads that journey through Chad and regularly interact with settled

populations and share the same water sources (Djidina et al., 2011). Only three of eight localities that reported  $\geq 1$  cases had at least one source of safe DW in 2010 (WHO, 2012). None of the cases were contained and none had a travel history outside Chad within a 10-14 month period before the GW(s) emerged. These were indications indigenous GW transmission had continued to occur after Chad claimed its last indigenous case in 2000. After the outbreak, 30 localities were set up for active surveillance. A total of 205 rumors of incidents were received and investigated by Chad's GWEP during 2010 (WHO, 2011a).

Ghana's GWEP reported eight incidents from four ELs in 2010 for substantial declines compared to 2009 of 96.69% and 92.31%, respectively. Each case was indigenous to the locality from which it was recorded from three Districts of Northern Region: East Gonja, 1; Karaga, 1; and Savelugu-Nanton, 6. All eight cases were successfully isolated in a case containment center, thus the national GWEP achieved a 1.00 CCR. There were 1,582 rumor cases reported during the year and subsequently investigated with none found to be a positive occurrence of GWD. The last case recorded in Ghana for the year occurred in May (WHO, 2011a).

Ethiopia's GWEP recorded 21 incidents from ten localities that reported  $\geq 1$  cases of GWD in 2010; a reduction of 12.50% in the former enumerated in one more locality compared to 2009. One case found in Nyangatom Wereda of South Omo Zone, SNNPR, was imported from Sudan. Other than the case imported from Sudan, GW transmission was limited to nine localities in Gog Wereda of Agnewak Zone, Gambela Region. The other 20 incidents were indigenous to Ethiopia with nine reported from localities that claimed only internal imports. Ethiopia's GWEP responded to 316 rumors in 2010 with one positively identified as GWD (WHO, 2011a). Eight of the localities that reported  $\geq 1$  cases had at least one source of safe DW in 2010 (WHO, 2012).

Mali's GWEP counted 57 incidents from 22 localities that reported  $\geq 1$  cases of GWD in 2010; reductions of 69.35% and 57.69%, respectively, compared to the previous year. Fifty-three incidents were indigenous to 19 ELs while the other four cases were internally imported to three localities. Neither Doutenza nor Mopti Cercles reported incidents in 2009, but one case occurred in a locality from each in 2010. The 22 localities that reported  $\geq 1$  cases were spread out amongst eight Cercles of five Regions:

- Gao Region: Gao, 26 and Ansongo, 11
- Kidal Region: Kidal, 5 and Tessalit, 1
- Mopti Region: Douentza, 1 and Mopti, 1
- Ségou Region: Tominian, 2
- Timbuktu Region: and Gourma-Rharous, 10

Mali's GWEP was alerted to 35 rumored cases and responded to each. Six were confirmed as GWD (WHO, 2011a).

Sudan's GWEP enumerated 1,698 incidents from 732 localities that reported  $\geq 1$  cases of GWD in 2010, all from Southern Sudan; reductions of 37.87% in the former and 27.60% in the latter, compared with 2009. Indigenous cases were recorded in 227 ELs while 505 localities claimed only internally imported cases. A total of 269 localities that reported  $\geq 1$  cases were reinfected after claiming zero incidents the year before while 87 reported cases of GWD for the first time since the establishment of Sudan's GWEP. The eight most endemic Counties were spread over four continuous States and responsible for 95.47% of all cases in country's incidents 2010:

- Central Equatoria State: Terekeka, 39

- Eastern Equatoria State: Kapoeta East, 478, Kapoeta North, 155, and Kapoeta South, 31
- Lakes State: Awerial, 262
- Warrap State: Tonj East, 265, Tonj North, 314, and Tonj South, 77

Southern Sudan's GWEP received 588 rumor reports and upon investigation, 13 were confirmed to be positive for GWD. The GWEP of the northern States were alerted to six rumored cases and subsequently looked into each with none being positive confirmations. There were 6,049 localities under active surveillance with 98.05% submitting data on time throughout the year (WHO, 2011a). There were 20 incidents that compromised the security of staff involved with Southern Sudan's GWEP which disrupted anti-GWD activities throughout the year (CDC, 2011a).

Widespread violence in southern Sudan continued to be the greatest challenge to GDEC as coherent surveillance and the successful provision of safe DW was not achieved leaving intermittent care to medical humanitarian organizations (Fabiansen, Harboe, & Christensen, 2010).

#### **4.32. 2011**

On 7 February, it was announced that Southern Sudan's referendum for independence in January resulted in 98.83% of the population voting for secession from Sudan (Anonymous, 2011a).

Hosted by TCC in Atlanta, the fifteenth gathering of National Program Coordinators of Guinea Worm Eradication Programs convened from 15-18 February in Atlanta. National GWEP

Program Coordinators from Burkina, Chad, Ethiopia, Ghana, Ivory Coast, Kenya, Mali, Niger, Nigeria, Sudan, and Togo were part of the crowd of over 400 in attendance. Results were presented from each country on data from 2010 followed by recommendations for individual GWEPS. Officials from Ghana and Sudan met with representatives from TCC, the CDC, HDI, the ICCDE, UNICEF, and the WHO during the *Gathering* to approve criteria to declare the establishment or reestablishment of GWD endemicity to a country in addition to a standard definition for a rumor case of GWD. The criteria agreed on and approved for declaring a country's establishment or reestablishment of GWD endemicity required no confirmed indigenous cases recorded for three or more years followed by a confirmed case indicating indigenous GW transmission has occurred in the country for three or more sequential calendar years. A rumor case of GWD was defined as "Information about an alleged case of Guinea worm disease obtained from any source" (CDC, 2011b).

A two-hour informal meeting on GWD eradication was held during the Sixty-fourth WHA on 18 May. Nearly 100 participated including Ministers of Health from Chad, Ghana, Mali, Mauritania, Niger, and Southern Sudan in addition to MoH representatives from Benin, Burkina Faso, Cameroon, Ivory Coast, Nigeria, Togo, Uganda, and Yemen. However, there was no one present for Ethiopia. Updates on GDEC's status were provided with particular attention on Chad's new status as well as the results of failed surveillance in Ethiopia and Mali (CDC, 2011c).

On 24 May, the final day of the WHA, a new decree on GWD eradication that had been proposed earlier by the WHO was adopted. Resolution 64.16 endorsed the strategies of "intensified surveillance, case containment, use of cloth and pipe filters, vector control, access to safe drinking-water, health education and community mobilization;" called on ECs to "intensify

their eradication efforts, including active surveillance in villages where the disease is endemic and surveillance in dracunculiasis-free areas, prevention measures and political support at the highest levels” and countries and territories that had already been certified free of GW transmission and those in the Precertification Phase “to intensify surveillance for the disease and report the results regularly, and to notify WHO within 24 hours of any case detected and the alleged country of origin of the case;” and requested that the Director-General of the WHO “closely monitor the implementation of” the Resolution and “report progress through the Executive Board” to the WHA “every year until eradication of dracunculiasis is certified” (WHA, 2011, pp. 1-2).

Sudan officially split into two independent countries on 9 July 2011. Thus, the Republic of South Sudan became the newest independent country in the world (Anonymous, 2011b).

A ceremony marking the interruption of indigenous GW transmission in Ghana was held in the capital of Northern Region, Tamale, on 28 July, fourteen months after recording its last case of GWD. During the event, the Minister of Health publicized the new cash reward of ~\$130 for a reporting a confirmed case of GWD (CDC, 2011d).

The ICCDE convened for the eighth time at WHO Headquarters from 29 November to 1 December. After reviewing the requests and based on criteria for certification, analyses of data submitted by the applicants and ICTs, the ICCDE proposed the five applicants below be “certified as being free of” GWD:

- Africa: Burkina Faso, Eritrea, and Togo.
- Europe: Bosnia and Herzegovina.
- Western Pacific: Brunei.

This brought the total to 192 countries and territories “certified free of” GWD (WHO, 2012).

From 8-9 December, the South Sudan GWEP met for its first annual *Program Review* in Juba, the new national capital. The Program Coordinator of the national GWEP gave a provisional summary of progress made since 2010 (CDC, 2012a).

A \$1 million challenge grant was provided to TCC by the *John P. Hussman Foundation* to support GDEC (CDC, 2011b). In October at a press conference in London, DfID announced its pledge of nearly \$31 million in the form of a challenge grant to TCC for assisting GDEC in the remaining ECs (CDC, 2011e).



2011

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2010	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2010
Burkina Faso	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Chad	10	0	0.00	4	0.40	9	8	12.50
Ethiopia	8	2	-61.90	7	0.88	5	3	-50.00
Ghana	0	0	-100.00	N/A	N/A	N/A	N/A	N/A
Ivory Coast	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	12	0	-78.95	5	0.42	6	6	-72.73
Niger	0	0	-100.00	N/A	N/A	N/A	N/A	-100.00
Nigeria	0	0	N/A	N/A	N/A	N/A	N/A	N/A
South Sudan	1,028	0	(-39.46)	763	0.74	463	125	-36.75
Sudan	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Togo	0	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>1,058</b>	<b>2</b>	<b>-41.12%</b>	<b>779</b>	<b>0.74</b>	<b>483</b>	<b>142</b>	<b>-38.00%</b>

**Table 32.** Case totals, number of internationally imported cases, percent change in total cases compared to 2010, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2010 (WHO, 2012). *Note: Parentheses indicate that South Sudan was still reported under Sudan's indicators in 2010.*

Four sub-Saharan African countries enumerated 1,058 incidents from 483 localities that reported  $\geq 1$  cases of GWD in 2011; decreases of 41.12% and 38.00%, respectively, compared to 2010. Only Ethiopia claimed internationally imported cases, both from South Sudan, which alone was responsible for 97.16% of all incidents and 95.86% of all localities that reported  $\geq 1$  cases for the year. Ghana's GWEP reported zero cases during 2011 marking the first time the country did not record an incident for an entire calendar year since launching its national GWEP in 1988. Of the localities to report  $\geq 1$  cases, 142 were ELs while the rest claimed only imports of which all but two were internally imported. Reinfected and/or newly infected localities totaled 285. There were 1,345 rumored cases were reported in ten countries with 21 confirmed positive for GWD. Ninety-five, or 19.67% of the localities that reported  $\geq 1$  cases of GWD in 2011 lacked a safe source of DW (WHO, 2012).

Ethiopia counted eight incidents in five localities that reported  $\geq 1$  cases of GWD in 2011; significant reductions of 61.90% and 50.00%, respectively, compared with 2010. Two cases were imported from South Sudan into SNNPR: Nakriaman, Nyangatom Wereda, South Omo Zone and Anjo, Surma Wereda, Bench Maji Zone. The other six were indigenous to Gog Wereda, Agnewak Zone, Gambela Region. Ethiopia's GWEP responded to 316 rumored cases with one found to be positive for GWD. Four of the five localities that reported  $\geq 1$  cases of GWD in 2011 had at least one source of safe DW (WHO, 2012).

Chad recorded ten incidents from nine localities that reported  $\geq 1$  cases of GWD in 2011; the same number of incidents from one more locality compared to 2010. Cases were reported from localities distributed amongst three Communes in three Departments of two Regions:

- Chari Baguirmi Region: Loug Chari Department's Bousso Commune, 5; Chari Department's Mandélia Commune, 4

- Tandjilé Region: Tandjilé Ouest Department's Béré Commune, 1

Eight ELs reported nine incidents while one case classified as an internal import. The ten incidents recorded were part of 98 rumors received and followed-up by Chad's GWEP. Of the nine localities that reported  $\geq 1$  cases in 2011, only one had a safe source of DW (WHO, 2012).

As the only EC of West Africa in 2011, Mali enumerated 12 incidents from six localities that reported  $\geq 1$  cases of GWD; reductions of a 78.95% and 72.73%, respectively, compared to 2010. Incidents were recorded from localities in six Cercles of five Regions:

- Gao Region: Gao, 1
- Kidal Region: Kidal, 5
- Mopti Region: Mopti, 1
- Ségou Region: Barouéli, 1 and Tominian, 2
- Timbuktu Region: Gourma-Rharous, 2

There was no change in the number of incidents for Kidal Cercle from the previous year while Gourma-Rharous Cercle saw an 80.00% decline. Mali's GWEP received and responded to 63 rumored cases of which two were confirmed as GWD. All incidents were indigenous to the locality from which they were reported (WHO, 2012).

South Sudan's GWEP submitted epidemiological data for 2011 as an independent country for the first time. The official tallies for the year were 1,028 incidents found in 463 localities that reported  $\geq 1$  cases of GWD. The northern States claimed zero incidents during the previous year and all throughout 2011. Therefore, the comparisons below use epidemiological data reported from a unified Sudan as a whole in 2010 and the first half of 2011 to contrast data

from South Sudan in 2011. South Sudan's GWEP experienced reductions of 39.46% in the number of incidents and 36.75% in the number localities that reported  $\geq 1$  cases of GWD compared to the previous year. Of the 463 localities that reported  $\geq 1$  cases, 274 were classified as reinfected or newly infected; 125 were ELs; 338 claimed 507 cases that were internally imported; and 60 localities reported cases for the first time since Sudan started its national GWEP (WHO, 2012).

Thirteen Counties in six States reported incidents of GWD in South Sudan for the year (CDC, 2012b):

- Central Equatoria: Juba, 3 and Terekeka, 9
- Eastern Equatoria: Kapoeta East, 590, Kapoeta North, 153, and Kapoeta South, 32
- Jongei: Pibor, 62
- Lakes: Awerial, 58 and Cuibet, 1
- Warrap: Gorgial East, 9, Tonj East, 47, Tonj North, 49, and Tonj South, 11
- Western Bahr Al Ghazal: Jur River, 4

Eastern Equatoria State was responsible for 75.39% of South Sudan's case total for 2011. Pibor County in Jonglei State only managed to contain 14 of its cases for a low 0.23 CCR. Overall, South Sudan's GWEP contained 600 cases in one of 18 case containment centers (CCC; CDC, 2012b). Of South Sudan's 463 localities that reported  $\geq 1$  cases of GWD in 2011, only 19 had at least one source of safe DW (WHO, 2012). The first time case totals for South Sudan were reported separately from Sudan by the WHO (2011b) was in the 25 November 2011 issue of the Weekly Epidemiological Record article, "Monthly report on dracunculiasis cases, January-September 2011."

The year ended with 192 countries and territories officially “certified free” of GWD; Chad, Ghana, Ivory Coast, Kenya, Nigeria, Niger, and Sudan in the Precertification Phase; and Ethiopia, Mali, and South Sudan were the sole ECs (WHO, 2012).

#### **4.33. 2012**

Ghana and Sudan began 2012 in the Precertification Phase joining Chad, Ivory Coast, Kenya, Niger, and Nigeria.

The sixteenth meeting of *National Program Coordinators of Guinea Worm Eradication Programs* was carried out in two segments for 2012. The first was hosted by TCC in Atlanta from 1-2 March. In addition to national Program Coordinator, delegates from the four ECs of Chad, Ethiopia, Mali, and South Sudan MoH plus various national officials, the CDC, TCC, UNICEF, the WHO as well as various partners involved in GDEC (CDC, 2012b).

Mali experienced a coup d'état that began on 21 March which ousted president Touré.

The final segment of the sixteenth meeting *National Program Coordinators of Guinea Worm Eradication Programs* was held in Addis Ababa, Ethiopia from 26-29 March. Nearly 50 representatives from endemic, previously endemic, and never endemic countries attended. Recommendations were made that coincided with suggestions from the assembly of Program Managers in March. General recommendations were made for the countries still reporting cases of GWD during the first meeting while the latter's addressed these countries individually (CDC, 2012c).

From 20 April to 23 May, TCC and the CDC each sent a representative to assist Chad in the continuance of its investigation into the occurrences of GWD in 2010-2011. At the time of the visit, Chad's MoH and TCC-trained volunteers and supervisory staff were functional in

77.48% of 937 localities linked to the GWD cases from 2010-2011. In collaboration with the WHO, Chad's GWEP accomplished active case searches, HE sessions, and provided information about monetary incentives for information that leads to the confirmation of GWD cases in various localities of Kyabé Commune, Lac Iro Department of Moyen Chari Region and of Haraze and Mangueigne Communes, Haraze Mangueigne Department of Salamat Region from 2-18 May (CDC, 2012d).

During the Sixty-Fifth WHA, a two-hour informal meeting on GWD eradication was convened on 23 May and attended by more participants than previous meetings. Representatives of each of the four EC presented updates on their national GWEPs. A summary update of GDEC as well as the status of national precertification and certification activities was presented (CDC, 2012d).

A member of the ICCDE traveled to Ethiopia to appraise the national GWEP from 9-20 May and met with the *National Certification Committee* on 17 May to discuss issues in need of improvement (CDC, 2012d).

The annual *Program Review* of South Sudan's GWEP was held in the capital city, Juba, from 11-12 December (CDC, 2013a).

On 30 January, GDEC secured the estimated monetary support needed to achieve eradication of GWD from new pledges of \$40 million given by the *Bill & Melinda Gates Foundation* (\$23.3 million), the President of the UAE (\$10 million), and the *Children's Investment Fund Foundation* (\$6.7 million). Combined with the 2011 grant from DfID (see CDC, 2011e), the projected funds necessary for TCC to assist Chad, Ethiopia, Mali, and South Sudan interrupt transmission as well as continue surveillance support from the WHO, both during and after interruption and for eradication certification was secured (CDC, 2012b). BASF

donated 1,100 liters of temephos larvicide to TCC for GDEC use in Chad, Ethiopia, Mali, and South Sudan (CDC, 2012e). All pipe and cloth filters required for the prevention of GWD in 2012 were donated by Vestergaard-Frandsen. First-aid kits for GDEC were provided by Johnson & Johnson and used in South Sudan and Chad (CDC, 2013a).

2012

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2011	Number of Cases Contained	CCR	Number of Localities that Reported ≥ 1 Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported ≥ 1 Cases Compared to 2011
Chad	10	0	0.00	4	0.40	9	7	0.00
Ethiopia	4	0	-50.00	2	0.50	4	2	-20.00
Ghana	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Ivory Coast	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	4	0	-66.67	3	0.57	3	3	-50.00
Niger	3	3	300.00	3	1.00	1	0	100.00
Nigeria	0	0	N/A	N/A	N/A	N/A	N/A	N/A
South Sudan	521	0	-49.32	336	0.65	255	89	-44.92
Sudan	0	0	N/A	N/A	N/A	N/A	N/A	N/A
<b>Totals</b>	<b>542</b>	<b>229</b>	<b>-48.77%</b>	<b>345</b>	<b>0.64</b>	<b>272</b>	<b>101</b>	<b>-43.69%</b>

**Table 33.** Case totals, number of internationally imported cases, percent change in total cases compared to 2011, number of cases contained, and CCR; number of localities that reported ≥ 1 cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported ≥ 1 cases compared to 2011 (WHO, 2013).



Four ECs plus Niger, a country in the Precertification Phase, counted 542 incidents from 272 localities that reported  $\geq 1$  cases of GWD in 2012; reductions of 48.77% and 43.69%, respectively, compared to 2011. Niger was the only country to reported cases that were imported internationally; all three of which came from Mali. Niger discovered three imported cases of GWD in the locality of Tillabéri, Tillabéri Department, Tillabéri Region, alleged to have originated from Gao Region, Mali. South Sudan was again the most endemic of all countries responsible for 96.13% of the global case total. By the end of the year, the WHO had certified 192 countries, territories, and areas free from GW transmission. Ghana, Ivory Coast, Kenya, Niger, Nigeria, and Sudan were in the Precertification Phase (WHO, 2013).

After three years of continuous transmission reported from Chad, the country met the definition for the reestablishment of endemic transmission of GWD. The first case of GWD reported by Chad came in June, which marked three consecutive years that the presence of GWD was confirmed in the country. As a result, Chad was once again declared to be an EC (CDC, 2012f). Overall, Chad recorded ten indigenous cases of GWD found in nine localities spread over seven Communes in five Departments of four Regions, which was the same number of localities that localities that reported  $\geq 1$  cases of GWD in 2011. Four of the cases were contained and only two of the localities (Mossio and Akoum-Mabaye) were endemic the previous year (WHO, 2013). Cases of GWD distributed by Region were as follows (CDC, 2013a):

- Chari Baguirmi Region: Loug Chari Department , Bousso Commune, 2; Kouno Commune, 1; Chari Department, Mandélie Commune, 2; Baguirmi Department, Massenya Commune, 1
- Mayo Kebbi Est Region: Mayo-Lémié Department, Guelendeng Commune, 1

- Moyen-Chari Region: Lac Iro Department, Kyabé Commune, 1; Barh Köh Department, Sarh Commune, 1
- Salamat Region: Aboudeïa Department, Aboudeïa Commune, 1

The case from Salamat was the first recorded in the Region since indigenous GW transmission was confirmed once again in Chad. Active surveillance was carried out in 765 localities of 23 at-risk Communes that covered nine Departments. A total of 617 rumors were reported and upon investigation led to all ten confirmed cases of GWD found in 2012. Of the nine localities that reported cases in 2012, five did not have a safe source of DW (WHO, 2013).

After nine consecutive months without an incident of GWD, Ethiopia reported its first case of 2012 in April. Four incidents were counted in four localities that reported  $\geq 1$  cases of GWD within two Weredas from the Gambela Region. Gog Wereda had one case in both the Utuyu and Agenga. Abobo Wereda had one case in each of the localities of Terkudi and Uma. Only two of the four cases were successfully contained. There were 1,158 rumors reported and each was investigated. All but one was investigated within 24 hours. Of the four ELs, Utuyu was the only one without a safe source of DW (WHO, 2013).

Mali continued to be the only country in West Africa where GWD transmission was still endemic. The coup d'état that occurred in March created a substantial hindrance to the national GWEP. Subsequently, reports were only obtained from four of the country's southern Regions and the GWEP stopped operations in the three endemic northern Regions (Gao, Kidal, and Timbuktu) in April (Ruiz-Tiben et al., 2012). Four indigenous cases were reported from three localities in three Cercles of three Regions that reported  $\geq 1$  cases of GWD in 2012 (WHO, 2013):

- Kidal Region: Kidal, 2
- Mopti Region: Djenné, 1
- Ségou Region: Macina, 1

Only the case in Macina Cercle was contained by Mali's GWEP and all four were determined to be indigenous to the locality of detection. One of the cases from Kidal Cercle was identified by Belgium's *Médecins du Monde*, the only active NGO that functioned in the Region at the time. In September, Niger's GWEP discovered three cases of GWD in the Tillabéri Department. All three cases were contained and traced to Ouattagouna Commune, of Ansongo Cercle in Gao Region (CDC, 2012f). Thirty-two rumors were reported and each was subsequently investigated. One of the three localities that reported  $\geq 1$  cases of GWD in 2012 lacked a safe source of DW (WHO, 2013). Mali's GWEP was not fully operational in the endemic north that included the Regions of Gao, Kidal, and Timbuktu due to security concerns resultant of the coup d'état in March (Hopkins et al., 2013).

South Sudan's GWEP enumerated 521 incidents in 255 localities that reported  $\geq 1$  cases of GWD in 2012; reductions of 49.32% and 44.92%, compared with 2011, respectively. Incidents occurred in nine Counties over five States. Just over half of all cases (521) reported from 166 localities were deemed to have been internally imported. There were 336 localities that reported  $\geq 1$  cases in 2011 claimed zero in 2012 while 99 localities that reported  $\geq 1$  cases in 2012 claimed zero in 2011; 53 of which had not reported incidents in the history of GDEC (WHO, 2013). Counties that recorded incidents in 2012 are listed below by State in order of endemicity (CDC, 2013a):

- Eastern Equatoria: Kapoeta East, 420, Kapoeta North, 28, Kapoeta South, 4

- Warab: Tonj North, 6, Tonj South, 1, Gorgrial East, 30
- Jonglei: Pibor, 24
- Lakes: Awerial, 7
- Western Bahr Al Ghazal: Jur River, 1

Eastern Equatoria State counted 452 total cases which was 41.68% less than the previous year.

The most endemic County in the State continued to be Kapoeta East with 80.61% of Eastern Equatoria's cases and 80.61% of South Sudan's total cases of GWD in 2012. However, Kapoeta East did see a decline in cases of 28.81% compared to 2011. More significant were the declines in cases of GWD compared to 2011 found in the States of Jonglei, 61.29%, Lakes, 88.14%, Warab, 68.10%, and Western Bahr Al Ghazal, 75.00%.

All 6,410 localities under active surveillance in 2012 submitted reports when they were due. There were 742 rumors recorded of which 705 (95.01%) were investigated, all within 24 hours; four were confirmed as GWD (WHO, 2013). The peak transmission season in South Sudan lasted from March through July. Seasonal population movements of gardens, farms, bull cattle camps, milk cow cattle camps, and areas to graze smaller livestock, in addition to random dislodgments due to interethnic cattle rustling raids continued to plague the South Sudan GWEP. At the end of 2012, South Sudan was the only one of the four ECs that had yet to implement a reward system for reported cases of GWD (Hopkins et al., 2013).

By the end of 2012, the WHO had certified 192 countries and territories free of GW transmission. Cited as the main obstacle to GDEC were the conflicts that continued to make certain areas unreachable, thus interrupting efforts of national GWEPs because of insecurity (WHO, 2013).

#### 4.34. 2013

As 2013 began, the sub-Saharan African countries of Chad, Ethiopia, Mali, and South Sudan were the only EC foci left worldwide. Insecurity in endemic areas of South Sudan continued to imperil the national GWEP. Mali's coup d'état impeded the country's GWEP activities in the northern Regions. Both posed the greatest risk to the success of GDEC.

Burkina Faso hosted the seventeenth assembly of *National Program Coordinators of Guinea Worm Eradication Programs* in its capital city, Ouagadougou from 9-12 April. Recommendations were made for the four ECs, countries in the Precertification Phase, and countries yet to be certified free of GWD (CDC, 2013b).

At the Sixty-sixth WHA, an informal meeting with delegates from GW affected countries was arranged by the WHO on 22 May. Objectives included a status review of GDEC, ensure the commitment of MoH and program partners to ensure eradication occurs as soon as possible (CDC, 2013b).

On 15 May, the EL of Utuyu in Ethiopia's Gog Wereda, Gambela Region obtained a functional borehole well through the aide of government water authorities and UNICEF (CDC, 2013c).

In August, a WHO representative visited Chad's Regions of N'Djamena and Mayo Kebbi Est to review GWD-related activities in unaffected areas (CDC, 2013c).

WHO/AFRO arranged a cross-border assembly of GWEP representatives from Ethiopia, Kenya, South Sudan, and Uganda from 28-31 October in Nairobi, Kenya. In addition, a Review Meeting was held in Bamako, Mali from 26-29 November for ECs and countries in the Precertification Phase (CDC, 2013e).

The cash reward for reporting a case of GWD was increased by Kenya's GWEP to the equivalent of U.S. \$1,500.00 (CDC, 2013e).

The ICCDE met for the ninth time from 3-5 December and announced that together with Somalia and South Africa, the previously ECs of Ivory Coast, Niger, and Nigeria were certified free of GW transmission (CDC, 2013e).

TCC's country representative interviewed 67 residents in the locality of Elia in Etang Special Wereda, Gambela Region, Ethiopia on 20 December to determine their knowledge of the transmission and prevention of GWD as well the awareness level of the cash reward for reporting a case. Only ten of the 67 interviewees (14.93%) understood how GWD was transmitted while the recognition of various methods of prevention ranged from three (4.48%) to 21 (31.34%) and (76.12%) were aware of the cash reward. A *Technical Working Group* meeting was organized by Ethiopia's GWEP in Addis Ababa on 30 December to examine the program's interventions and additional activities organized in Gambela Region's Etang Special Wereda and Agnewak Zone's Abobo Wereda. In collaboration with TCC, Ethiopia's GWEP had trained 123 locality-based volunteers in active surveillance and GWD-related events for 58 localities of Abobo Wereda by the end of the year (CDC, 2014a). The 72 localities in Gog Wereda continued active based surveillance in addition to the 77 localities of Abobo Wereda by the end of the year (WHO, 2014).

A Donation of temephos was secured for 2014 and 2015 as BASF extended their donation to GDEC (CDC, 2013b).

2013

Country that Reported Cases of GWD	Case Totals	Number of Internationally Imported Cases	% Change in Case Totals Compared to 2012	Number of Cases Contained	CCR	Number of Localities that Reported $\geq 1$ Cases of GWD	Number of Localities that Reported Indigenous Cases	% Change in Number of Localities that Reported $\geq 1$ Cases Compared to 2012
Chad	14	0	40.00	8	0.57	10	10	11.11
Ethiopia	7	3	75.00	4	0.57	5	2	25.00
Ghana	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Kenya	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Mali	11	1	175.00	7	0.64	8	7	166.67
South Sudan	113	48	-78.31	76	0.67	79	39	-69.02
Sudan	3	0	N/A	3	1.00	1	1	N/A
<b>Totals</b>	<b>148</b>	<b>52</b>	<b>-72.69%</b>	<b>98</b>	<b>0.66</b>	<b>103</b>	<b>59</b>	<b>-62.13%</b>

**Table 34.** Case totals, number of internationally imported cases, percent change in total cases compared to 2012; number of cases contained, and CCR; number of localities that reported  $\geq 1$  cases of GWD, number of localities that reported indigenous cases, and percent change in the number of localities that reported  $\geq 1$  cases compared to 2012 (WHO, 2014).

Five countries reported cases of GWD in 2013, one of which was in the Precertification Phase, Sudan, for a total of 148 incidents counted in 103 localities that reported  $\geq 1$  cases of GWD. Both of these indicators represented decreases of 72.69% in the former and a 62.13% in the latter compared to 2012. The one-year decline in case numbers was proportionally the largest reduction seen since the 1986 WHA resolution that called for the “elimination” of GWD. Once again, South Sudan claimed the majority of the global case total, responsible for 76.35% of all cases of GWD in 2013. Forty-four (42.72%) of the 103 localities that reported  $\geq 1$  cases claimed imports only and 72 (69.90%) of them lacked a safe source of DW (WHO, 2014).

Though the overall global decrease in case numbers was significant, South Sudan was the only EC to record a decline while Chad, Ethiopia, and Mali saw their numbers increase. Sudan, which is in the Precertification Phase, reported three cases of GWD on its border with South Sudan. The country had not reported an indigenous case since 2002 and its last imported case occurred in 2007 (WHO, 2014). All three patients were detected in their home locality of Kafia Kingi in El Radom District (second-level administrative division), South Darfur Wilayat (first-level administrative division). As a result, Sudan’s GWEP established surveillance in nearby areas (CDC, 2013e). Overall, global GWD surveillance was present in 7,537 localities in 2013 and 4,200 rumors were reported with 4,065 (96.79%) of them investigated within 24 hours (WHO, 2014).

Ethiopia’s GWEP seven incidents were recorded in five localities that reported  $\geq 1$  cases of GWD in 2013; both increases by 75.00% and 25.00%, respectively, compared to 2012. All seven cases were reported from five localities found in three adjacent Weredas of two Zones from Gambela Region:

- Agnewak Zone: Abobo Wereda, Batpulo, 3, Terchiru, 1, Umaha, 1; Gog Wereda, 1



- Etang Special Wereda: Ojworn, 1

Five of the patients resided in Baptulo, where an uncontained case of GWD was recorded in April 2012 and was subsequently linked to Utuyu in Gog Wereda, Agnewak Zone. In December 2012, one GW emerged from a patient in the locality of Ojworn in Etang Special Wereda and another emerged in January 2013 while in Umaha. Each patient entered a CCC, but only four were successfully contained (0.57 CCR). Baptulo was the only affected locality in 2013 that did not have a safe source of DW. A total of 893 rumors were reported and subsequently investigated in 2013; all but two within 24 hours (WHO, 2014).

Ethiopia's GWEP continued to intensify surveillance, escalate awareness of the cash reward offered for reporting of a case of GWD, and enforce case containment compliance measures, particularly on the South Sudan border. Existence of the cash reward was conveyed over the radio and through in-person contact. Sampling surveys to ascertain the general population's awareness level of the cash reward offer were conducted in endemic Weredas, formerly endemic Weredas, and Weredas that have never been classified endemic. Of 435 residents surveyed in endemic Weredas, 79.54% were aware of the reward. In formerly endemic Weredas, 65.68% of the 1,952 inhabitants questioned had heard of the offer. Out of 24,469 people surveyed in never endemic Weredas, familiarity of the cash reward was 12.53%. Surveillance activities were coordinated to coincide with national public health interventions in place such as neglected tropical disease mapping, NIDs, poliomyelitis programs in the South Omo Zone of SNNPR, Mass Drug Administration (MDA) of ivermectin for onchocerciasis in SNNPR and Oromia Region, as well as the Malaria Control Program in Amhara Region (WHO, 2014).

Chad's GWEP enumerated 14 cases discovered in ten localities that reported  $\geq 1$  cases of GWD in 2013 for increases of 40.00% in the former and 11.11% in the latter, compared to 2012. Communes affected by GWD are listed below with their Department by Region (WHO, 2014):

- Chari Baguirmi Region: Chari Department, Mandélie Commune, 4; Baguirmi Department, Massenya Commune, 2; Loug Chari Department, Bousso Commune, 1, Bogomoro Commune, 1
- Moyen Chari Region: Barh Kôh Department, Sarh Commune, 5
- Mayo Kebi Est Region: Mayo-Lémié Department, Guélandeng Commune, 2

All 14 patients were confined in a CCC, but only eight of them met the criteria for successful containment (0.57 CCR). The five cases from Sarh Commune failed to be contained even though the area was under passive surveillance. None of the localities that reported  $\geq 1$  cases of GWD in 2013 recorded a single case in 2012. Four of the ten localities that reported  $\geq 1$  cases lacked a safe source of DW and none of the potential drinking water sources for these localities were treated with temephos. A total of 1,464 rumors were reported and investigated in 2013, of which 1,408 were seen to within 24 hours of initial notification, and 14 were confirmed to be GWD.

By the end of the year, over 700 localities had implemented active surveillance measures. Chad's national surveillance included GWD as a reportable disease and case searches are conducted as part of NID activities where rumors are recorded and subsequently verified (WHO, 2014). To assess levels of reward awareness in localities under active GWD surveillance, a survey was conducted among 366 people and found 83.06% of them were knowledgeable of the cash reward. In six localities of Sarh Commune, Barh Kôh Department of Moyen Chari Region

where GWD surveillance was not present, a survey of 2,334 residents showed the level of reward awareness was 59.98%. Technical assistance to strengthen and implement surveillance and spread awareness of the cash reward was also provided by the WHO via mass media, “town criers” in markets and different populated places, and in-person communication (WHO, 2014).

A peculiar observation in the epidemiology of GWD in the country has not been documented before in Chad, other ECs, or previously ECs. Due to the manifestation of a large number of dogs infected with GWD in the same areas that human cases have occurred makes a potential linkage between humans and dogs a probability not before studied. It is unknown whether there is association shared by people and dogs, if dogs now act as a reservoir for human GWD, or if the dogs were infected with another species of *Dracunculus* that is contracted by humans in a zoonotic fashion. In 2013, 54 dogs from 38 localities were documented. Four of the localities that reported  $\geq 1$  human cases of GWD counted infected dogs (Eberhard et al., 2014). Surveillance for dogs infected with GWD was made part of the national surveillance effort (WHO, 2014).

Mali recorded 11 cases from eight localities that reported  $\geq 1$  cases of GWD in 2013 which were increases of 175.00% and 166.67%, respectively, compared to 2012. The eight affected localities were found in four Cercles of four Regions:

- Gao Region: Ansongo, 6
- Kidal Region: Kidal, 3
- Mopti Region: Djenné, 1
- Timbuktu Region: Gourma-Rharous, 1

Mali's GWEP managed a 0.64 CCR as four incidents were not successfully contained (WHO, 2014).

Six of the eight localities that reported  $\geq 1$  cases of GWD in 2013 received cloth and pipe filters; four lacked a safe source of DW while six received monthly treatments of temephos for unsafe water sources. The national cash reward scheme for reporting cases of GWD was increased to ~\$40 (CDC, 2014b). Mali's GWEP intensified awareness of its cash reward campaign through radio broadcasts and in-person communication efforts. A survey carried out in conjunction with poliomyelitis NIDs found familiarity of the cash reward was 56.00% of 600 residents interviewed in endemic Cercles and 43.00% amongst 5,400 inhabitants in non-endemic Cercles. Fifty-six rumors were reported and subsequently investigated in 2013; 55 of them seen to within 24 hours. GWD surveillance was intensified for Malian refugee camps in Burkina Faso, Mauritania, and Niger (WHO, 2014a).

The only EC of West Africa, efforts to implement interventions and strengthen surveillance for GWD were underway as safety improved in the northern Regions of Gao, Mopti, and Timbuktu (CDC, 2013b). Security remained arduous in Kidal Region, thus, Mali's GWEP continued to rely on U.N. humanitarian efforts to conduct sporadic surveillance activities (WHO, 2014). Along with a representative from TCC, the National Coordinator of Mali's GWEP visited Ouattagouna Commune, Ansongo Cercle, Gao Region in November. While there, they learned cases of GWD had been hidden by residents in 2009, 2011, and 2012 out of fear of forced removal to CCCs as well as unease about their security and the inability to tend to their farm activities (CDC, 2013e).

South Sudan's GWEP enumerated 113 incidents in 79 localities that reported  $\geq 1$  cases of GWD in 2013; decreases in both compared to the previous year of 78.31% and 69.02%, respectively. Incidents were recorded in ten Counties within six States (CDC, 2014b):

- Eastern Equatoria State: Kapoeta East, 77, Kapoeta North, 5, Kapoeta South, 3
- Jonglei State: Nyirol, 1, Pibor, 12, Uror, 1
- Lakes State: Awerial, 9
- Northern Bahr al Ghazal State: Aweil West, 1
- Warrab State: Gogrial East, 3, Tonj East, 1

Eastern Equatoria State was the most endemic State with 85 cases recorded in three Counties responsible for 75.22% of South Sudan's cases with 68.14% found in Kapoeta East County alone. Overall, the State reported a decrease in incidents of GWD by 81.20% compared to 2012 as did the endemic Counties of Kapoeta East, Kapoeta North, and Kapoeta South by 81.67%, 82.14%, and 25.00%, respectively. Jonglei State reduced its total case number by 41.67% compared to 2012 with a 50.00% reduction in Pibor County alone. However, the Counties of Nyirol and Uror recorded one case each after zero cases were reported in 2012. The only endemic County in Lakes State, Awerial increased its case total from seven to nine cases (28.57%) in 2013. Northern Bahr al Ghazal reported one case in Aweil West County after the State recorded zero cases the previous year. The State of Warab saw an overall decrease of 89.19% in total cases with the majority of that reduction attributable to the 90.00% decline recorded in Gorgrial East County. However, the County of Tonj East enumerated a single case of GWD after none were reported in 2012 (CDC, 2014b).

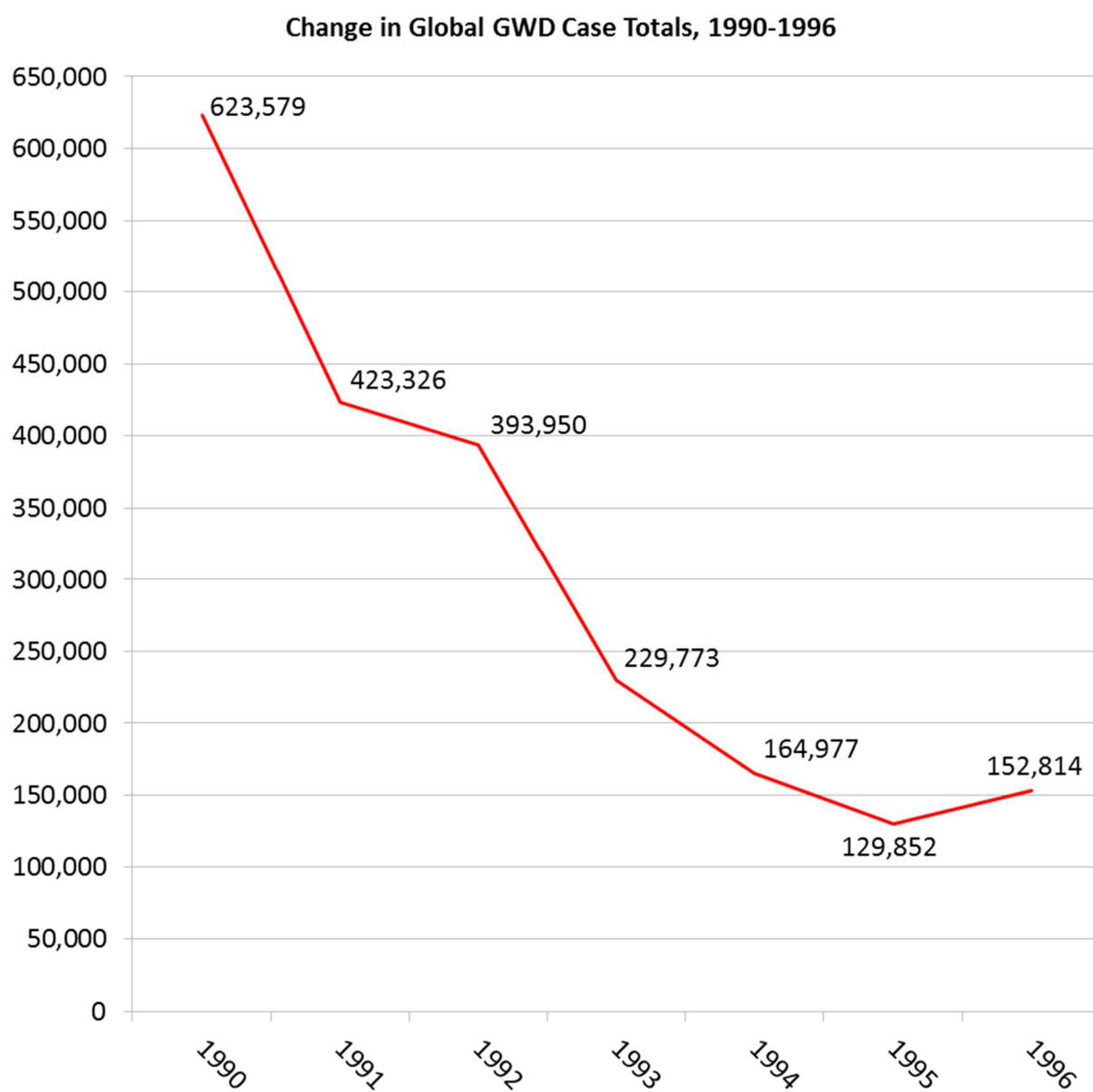
Seventy-six cases met the criteria for successful case containment and of those, 59 (77.63%) were isolated in a CCC. Of the 113 recorded incidents, 49 were determined to be internally imported in 40 of the 79 localities that reported  $\geq 1$  cases of GWD. There were 226 localities that reported  $\geq 1$  cases of GWD in 2012 that did not record any in 2013 while 50 reported zero the year before. Only 17 of the 79 localities that reported  $\geq 1$  cases had at least one safe source of DW. All 13 endemic Counties submitted at least nine of twelve monthly reports in addition to 63 of 67 (94.03%) non-endemic Counties in compliance even when there were no cases of GWD to report. There were 578 rumors reported and investigated in 2013 with 97.58% of them seen to within 24 hours. A total of 418 rumors came from non-endemic Counties and three of the rumors from endemic Counties were confirmed to be cases of GWD (WHO, 2014).

#### **4.35. Summary**

Political support at the local, national, and international levels is essential to the eradication campaign. With the ratification of Resolution 34.25 in 1981 by the WHO's highest-level decision making body, the WHA, recognized the IDWSSD as a special opportunity to "control" GWD, providing the impetus for an eradication campaign. Initial skepticism about eradication hindered the momentum needed to procure monetary resources to get GDEC off the ground (Henderson, 1987). This international body also has the power to mandate GW transmission free certification in countries. In 1986, Resolution 39.21 elicited support for national efforts to "eliminate" GWD; two months later this was promoted at the first *Regional Conference on Dracunculiasis in Africa*. During the Thirty-eighth annual meeting of WHO/AFRO in September 1988, the governing committee, composed of national delegates and Ministers of Health, proposed and passed Resolution AFR/RC38/R13 which endorsed the

“eradication” of GWD in the 17 ECs of the Region (Sudan is part of the WHO/EMRO) by 1995. The African Region was the first body of the WHO to use “eradication” as an objective rather than “elimination” and the first partner of the international coalition to propose a target date for eradication. Soon after, Cameroon, Ghana, and Nigeria commenced nationwide active case searches to determine the extent of GWD in their countries.

Nearly three years after the WHO/AFRO endorsement of “eradication” of GWD from the Region, the Forty-fourth WHA adopted Resolution 44.5 that committed to achieve eradication by the end of 1995, solidifying the goal, internationally. As 1995 passed without achieving the goal of eradication, international resolve was not lost. The highest global case total was recorded in 1989 reflecting the momentum that had been building as a result of mobilization efforts behind GDEC. Many positive events occurred between 1990 and 1996 that, while none led to eradication, they did lead to the establishment of a national GWEP in all ECs. Perhaps the most significant event was the 1995 “Guinea worm ceasefire” in Sudan.

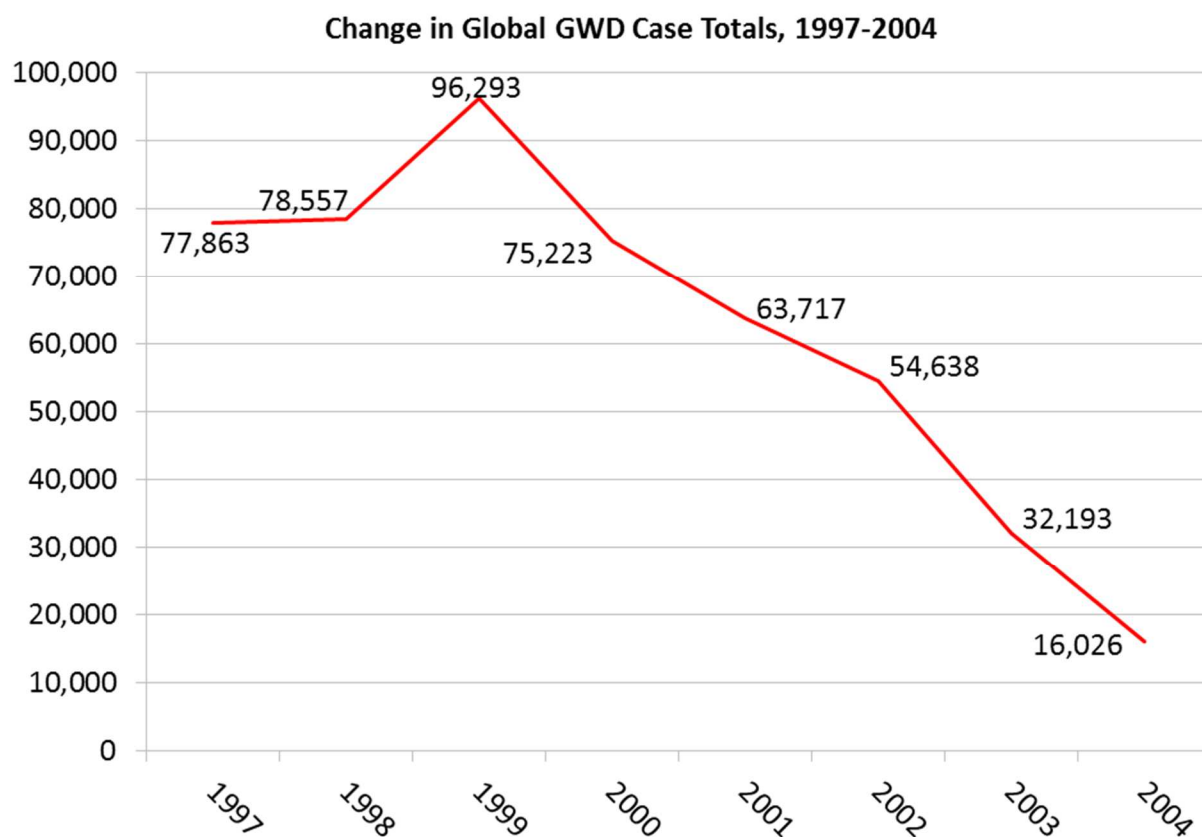


**Figure 17.** Change in global GWD case totals, 1990-1996.

The continued backing of the international community was evidenced by Resolution 50.35 passed at the Fiftieth WHA in 1997, which appealed for continued support aimed at eradicating GWD “as quickly as possible.” Seven years would pass before the next WHA Resolution pertaining to GDEC. In the meantime, the global case total increased as a result of



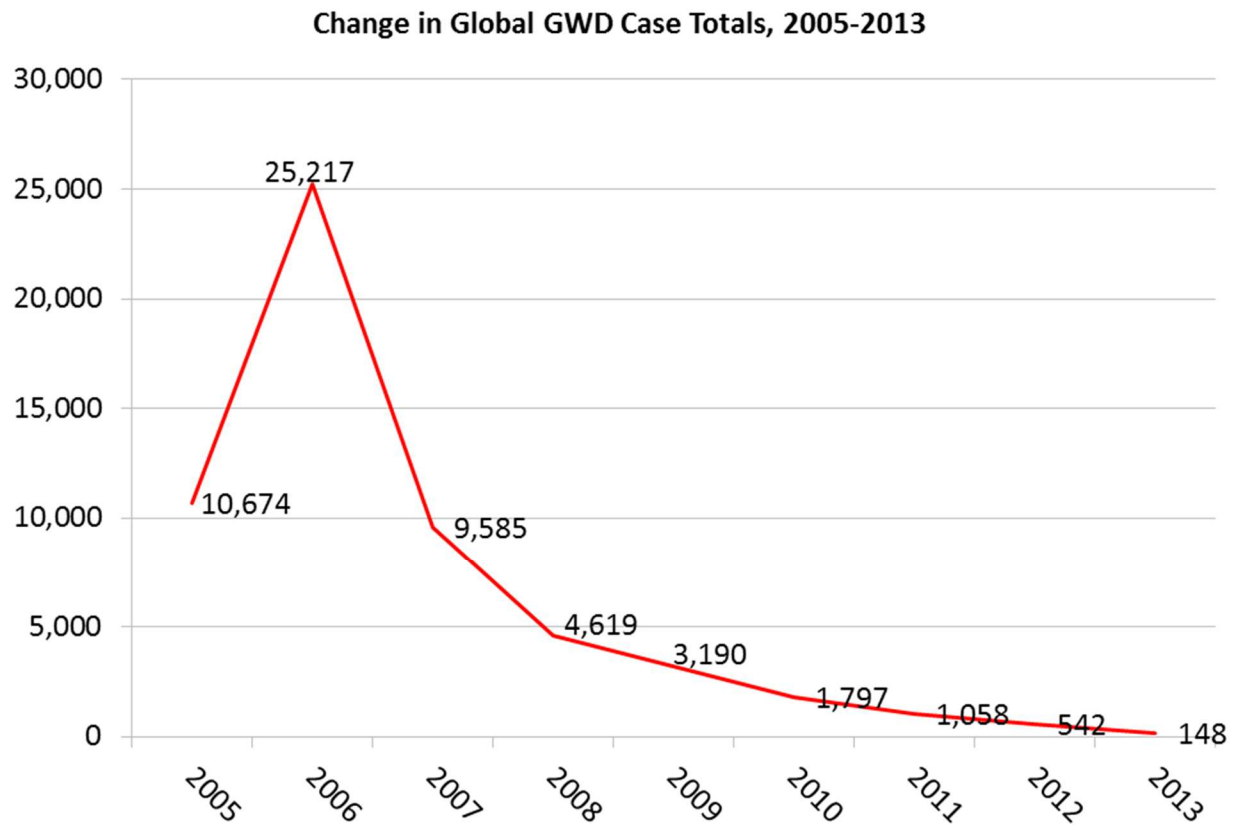
Sudan's cease fire in which allowed the national GWEP's two components to access areas previously off limits due to insecurity and finally began to reflect the true extent of GWD in the country. Another factor was the lax surveillance that occurred in Ghana during 1996-1997 followed by delayed funding for the national GWEP in 1998. All of the issues affected implementation of appropriate anti-GWD activities and surveillance which hindered the country's progress for several more years. Incidents reported from Sudan continued to push up the global case total through 2000 when GDEC finally began experiencing an overall case decline once again. The most significant reduction seen since the 1997 WHA came in 2003 when the global case total declined 41.08% from the number recorded in 2002 (Figure 18).



**Figure 18.** Change in global GWD case totals, 1997-2004.

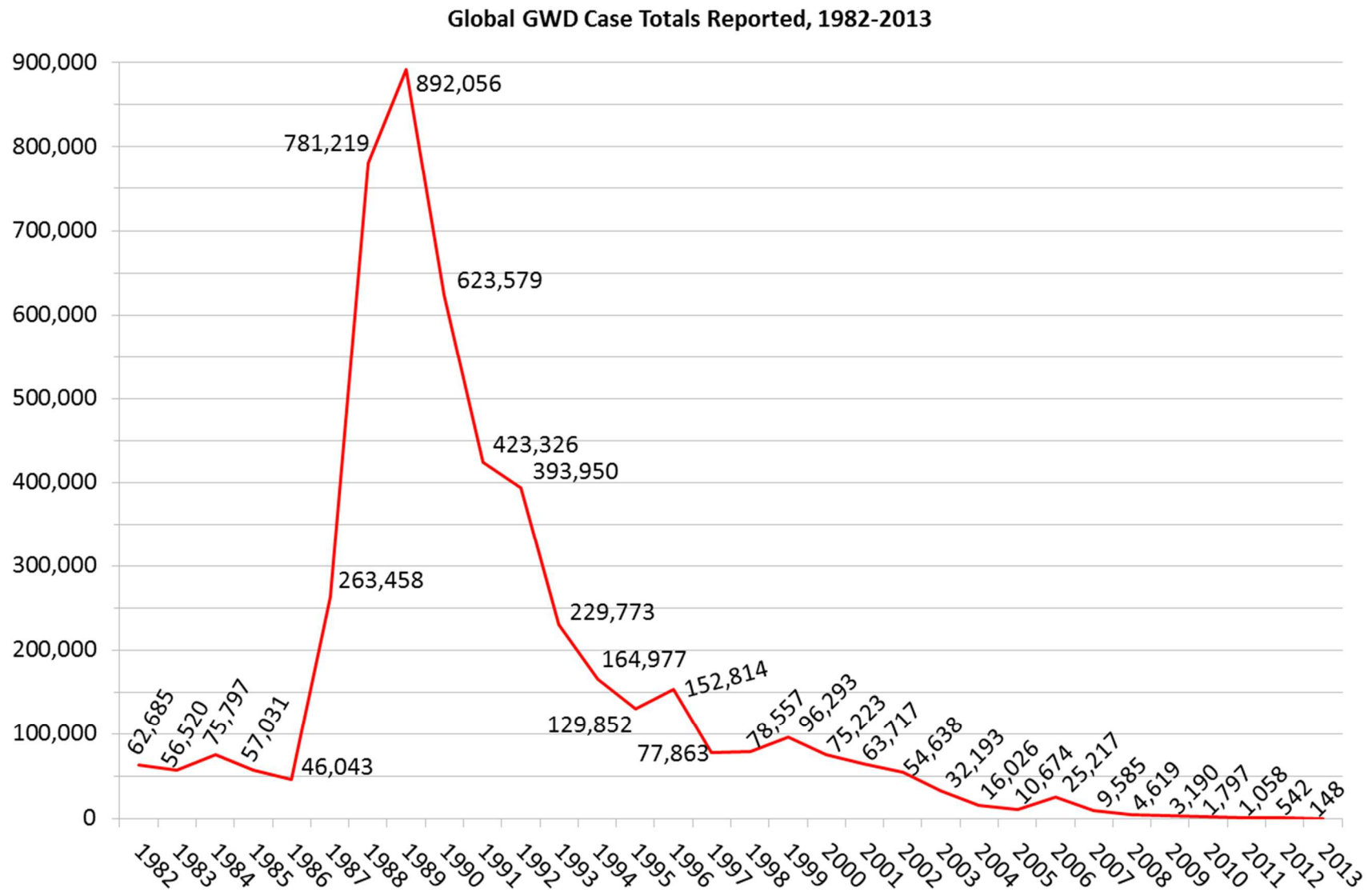
By March 2004, four previously ECs had been certified free of GW transmission. This was recognized at the WHA in May with the passing of Resolution 57.9, known as the “Geneva Declaration,” which urged all remaining ECs to intensify surveillance and prevention measures and set the end of 2009 as the new target date for eradication. Ratification of WHA57.9 may have been the impetus needed to boost the morale of national GWEPs. Evidence to suggest this can be seen in the reduction of the global case total in 2004 by half compared to 2003 as shown in Figure 18.

The 2005 CPA between GOS and the SPLM allowed Sudan’s GWEP access to more endemic areas and strengthened surveillance and anti-GWD interventions throughout the country. As a result, an increase of 269.58% more cases recorded in Sudan compared to 2005 led to the 136.25% increase in the global case total. Though eradication was not achieved by the end of 2009, five more ECs had been certified free of GW transmission since the ratification of WHA 57.9 leaving 2010 to start with only 11 ECs. The latest Resolution related to GDEC ratified by the WHA was 64.16 in 2011. It appealed to end transmission of GW in the last four ECs as soon as possible in collaboration with the international coalition engaged in GDEC until the certification of eradication is achieved. From 2007 on, the global case total continued a stable decline as shown in Figure 19.



**Figure 19.** Change in global GWD case totals, 2005-2013.

Understanding the persistence of the disease in these last four ECs is of utmost importance for the global eradication of GWD. By the end of 2013, 197 countries, areas, and territories were officially certified free of GW transmission by the WHO (WHO, 2014). The current challenge is keeping these countries free of GWD while continuing to monitor and intervene in the four remaining ECs of Chad, Ethiopia, Mali, and South Sudan. A discussion of these findings follows.



**Figure 20.** Graph of global GWD case totals reported, 1982-2013.

## 5. DISCUSSION

### 5.1. Research Goals

This thesis reconstructed the Global Dracunculiasis Eradication Campaign (GDEC) from its conception through 2013. The goal of this research was to understand why this “easily eradicable” disease still occurs in only four countries of sub-Saharan Africa after more than 30 years of interventions focused on its eradication. A thorough review of GDEC-related literature related was conducted to answer the following questions:

**5.1.1. Question 1: What are the most effective prevention and control measures that have led to the successful interruption of Guinea worm transmission in previously endemic countries?** Prior to the launch of GDEC, national surveillance for Guinea worm disease (GWD), where present, was based on passive reporting, at best. In 1981, 25 countries around the world were either known or suspected to be endemic for GWD or suspected. By 1994, endemic transmission of Guinea worm (GW) had been confirmed in 20 countries of sub-Saharan Africa and Southwest Asia. National GWD disease surveillance systems were enhanced through the implementation of locality-based active case reporting and awareness brought to healthcare facilities that may have only been passively reporting cases of GWD. Overall, disease surveillance has two primary roles. First, it provides national health authorities with epidemiological data at various administrative levels to mobilize financial and political support and target interventions. Second disease surveillance allows countries to monitor the progress of interventions put in place (Richards & Hopkins, 1989). Establishing nationwide GWD surveillance was the first step in the eradication campaign.

Once a country was identified as endemic for GW transmission, a series of activities followed. Generally, a Regional or County-specific conference or meeting was held to gather stakeholders and discuss the problem. Plans to implement prevention and control measures and the allocation of financial resources would be discussed and the implementation of anti-GWD initiatives followed. The ultimate goal has been to provide sources of uninterrupted clean DW to every endemic locality (EL). Even though GWD was to be used as an indicator of progress during the International Drinking Water Supply and Sanitation Decade (IDWSSD), noticeable progress in providing safe DW was lacking and led to increased cynicism amongst endemic countries (ECs). Before long, it was recognized that GDEC's priority would require a shift from the provision of safe DW supplies to prevention of GW transmission. At the core of GDEC, health education (HE) centered on teaching inhabitants in endemic and at-risk localities the importance of filtering their DW and avoiding further contamination of DW sources. Such behavioral changes have demonstrated that eradication is possible through basic interventions that can be implemented at little financial cost in the world's poorest countries.

Other key interventions included the continuation of locality-based monthly surveillance reports that would be collected by supervisors and turned in to National GWEP Coordinators; case containment and where applicable isolation of patients in case containment centers; treating unsecured sources of DW with temephos (Hopkins, 2013; Ruiz-Tiben & Hopkins, 2006). Cairncross et al. (2002) believe future eradication campaigns will benefit as a result of lessons learned during the course of GDEC. The role of locality-based volunteers (LBVs) has been crucial for national GWEPs. Recruitment of LBVs to assist in a campaign to control, eliminate, or eradicate a disease was established by GDEC. The tasks relegated to LBVs were monthly case reporting, HE sessions, distribution of filters, case containment of patients with emerging GWs,

and therefore, have been critical to national GWEPs. The inclusion of LBVs as part of GDEC has also contributed to the establishment of primary health care (PHC) in many ELs for the first time (Richards, Ruiz-Tiben, & Hopkins, 2011) and should be encouraged to continue.

Ensuring timely disbursement of earmarked funds to national GWEPs is paramount. The aftermath of Ghana's revised national budget that began in 1998 is a case in point. As funds were slashed from preventative health services, money previously allocated for the national GWEP was completely eliminated at a time that coincided at the peak of the country's GW transmission season. The result was a national increase in cases from 1998 to 1999 of 64.94%. Actions to mitigate the escalation were not noticeable until 2001 when Ghana's GWEP reported its first decrease since 1998.

Importantly, national GWEPs gather line-listings from ELs that specify the containment status of patients. Based on this information, GWEPs were able to make better informed estimates of where incidents of GWD were more likely to occur during subsequent GW transmission seasons. This helped focus where the provision of safe DW sources should be prioritized and where HE, filter distribution, surveillance activities, and temephos treatment of DW sources need to be targeted.

National scale assemblies on GWD were held in India before the official launch of the country's GWEP in 1983. Nigeria's *National Conference on Dracunculiasis* in March 1985 was the first of what would become many national conferences put on by ECs of the African continent. These national level assemblies were fundamental in maintaining political support. In addition, they brought together all levels of national GWEPs in a single venue, at least annually, to analyze, compare, and discuss updates as well as share experiences that benefitted their level of the GWEP.

Pakistan was the first EC of GDEC to achieve “free from dracunculiasis” certification by the WHO. According to Hopkins, Azam, Ruiz-Tiben, & Kappus (1995), key lessons learned as a result of Pakistan’s GWEP were the early implementation of case containment, concentration of resources first to the most endemic localities, and community mobilization. By implementing case containment early, workers involved in national GWEPs had time to learn and become as familiar as possible with the methods required to ensure successful case containment. Since localities with the greatest number of GWD cases had the highest likelihood for contaminating DW sources, reducing case numbers in those localities first decreased the risk of further GW transmission. Community mobilization built momentum among residents to act to improve their own lives by helping them understand how GWD is transmitted via DW and what can be done to end the cycle. Furthermore, conferences and annual evaluations of Pakistan’s GWEP were vital to its victory (Hopkins et al., 1995).

Perhaps the most significant contribution to GDEC occurred when former U.S. President Jimmy Carter got involved in late 1986. In November, during a visit to Pakistan, President Carter managed to convince President General Zia-ul-Haq to launch a national GWEP with help from Global 2000, Inc. of the Carter Center (TCC). Soon after, TCC was charged with procuring technical and financial support for GDEC. This was the first time a non-governmental organization would have a lead role in a global eradication campaign (Richards et al., 2011).

In early September 1992, President Carter visited five endemic Francophone countries of western sub-Saharan Africa. During the tour, he enlisted General Touré of Mali who pledged to lead eradication efforts in his home country as well as advocate for the cause in the endemic Francophone countries of Africa. After retiring from the army in 2001, General Touré was elected President of Mali in 2002 and held that office until a coup d’état forced him out of office



in March 2012. President of Burkina Faso, Blaise Compaoré, was the first Head of State from a host country to preside at the opening ceremonies of a *Regional Conference on Dracunculiasis in Africa* in 1994.

President Carter's mobilization efforts led to the recruitment of former Nigerian Head of State, General Yakubu Gowon in October 1998. General Gowon agreed to assist Nigeria's GWEP after stagnation in case reductions and the slight increase of 2.51% in the national case total from 1996 to 1997. This was the first rise in annual incidents since completion of the initial nationwide case search in 1988. By 1998, cases were up 9.27% compared to 1996. A significant decline would not been seen until 2000. The onus was partially a result of sporadic insecurity and the ineffectiveness of Nigeria's second military junta that ended in 1998. General Gowon's pledge to intensify social mobilization and advocacy efforts led to tours of well over 100 ELs in 18 States and subsequent returns to evaluate progress. During these visits, he would appeal to local medical, political, and traditional leaders to strengthen measures to stop GW transmission which included making ELs priority for the provision of safe sources of DW (Hopkins & Ruiz-Tiben, 2011). This stirred political support at the national level for Nigeria's GWEP.

**5.1.2. Question 2: What methods are available to ensure previously endemic and at-risk countries prevent the (re)introduction of Guinea worm disease?** An outcome of GDEC has been the inclusion of GWD as mandatorily reportable in national disease surveillance systems. In addition to active surveillance being maintained for a minimum of three years following the last reported indigenous cases during the Precertification Phase, national reward schemes have been implemented in all endemic, previously endemic, and at-risk countries for reporting cases of GWD as a means to enhance surveillance sensitivity. Another method has

been the incorporation of GWD surveillance into other national public health-related campaigns such as national immunization days and poliomyelitis eradication.

Nigeria's unexpected outbreak in Ezza Nkwubor, Enugu East LGA, Enugu State in 2007 is one example of why surveillance sensitivity is crucial. After a patient attended a public health clinic for treatment of an emerging GW in January, Nigeria's GWEP was notified and upon investigation discovered 30 cases of GWD in Ezza Nkwubor, which was not previously known to be endemic. What's more, the locality did not have a single source of safe DW.

Another example of inadequate surveillance occurred in Mali. The first occurred in June 2007, when GWs began to emerge from local residents in a locality of Tessalit Cercle, Kidal Region. Local health authorities did not report the outbreak to Mali's GWEP until early August. By then, too much time had passed to contain any of the 86 cases. Staff from Mali's GWEP visited the area shortly after the news was received. However, insecurity generated by rebel Tuaregs rendered the area dangerous to all GWEP staff. Later, the outbreak was traced to a Koranic scholar from a locality in Gao Cercle of Gao Region, that had traveled to Algeria, in August 2006. It was reported that the man had contaminated DW sources in attempts to extract emerging GWs on several occasions. The second outbreak of 68 cases took place in three previously ELs of Ansongo Cercle in Gao Region. Mali's GWEP was made aware only after Niger's GWEP informed them of two imported cases they traced back to Mali.

The importance of continued surveillance was demonstrated by Chad in 2010 with recurrence of indigenous incidents recorded after a decade of zero cases reported cases. Transmission of GW continued and in 2012 the country was officially declared endemic once again. Most recently, the outbreak of indigenous cases discovered at the southern border of

Sudan, which was in the Precertification Phase. This border is shared with the EC of South Sudan, thus, a more sensitive system of surveillance should have been of paramount importance.

The first global public health campaign to collect, store, and retrieve epidemiological data utilizing GIS was GDEC (Cairncross et al., 2002). One of the recommendations made during sixteenth meeting of national *Guinea Worm Eradication Program Coordinators* was for GWEPs to “conduct risk assessments and prioritize resources to ensure quality surveillance in at-risk areas” (CDC, 2012c, p. 9). Through the inclusion of GIS, raster and vector data can be generated to create geospatial models to predict areas with the highest risk for (re)establishing GW transmission.

**5.1.3. Question 3: What factors do the last four endemic countries share in common that allow the transmission of Guinea worm to continue?** Insecurity and erratic violence are human factors that continue to hinder the progress of GDEC in the four remaining ECs of Chad, Ethiopia, Mali, and South Sudan. These countries are some of the poorest in the world and politically unstable. Inadequate disease surveillance sensitivity is another factor that has hampered eradication efforts in each of these countries throughout the history of their national GWEPs. As mentioned earlier, endemic transmission of GW is an indicator of extreme poverty. Every inhabitant of an EL is at risk for acquiring GWD. It is an underlying cause of morbidity that contributes to the cycle of poverty. This vicious cycle of disease and poverty leads to conflict and political instability.

The UNDP’s Human Development Index (HDI) is a composite index that measures average achievement in three basic aspects of human development: 1) a long and healthy life; 2) knowledge; and 3) a decent standard of living. The UNDP’s Human Development Index (HDI)

for 2013 classified each of the four ECs as Low Human Development (UNDP, 2014). Table 35 below, provides rankings for Chad, Ethiopia, Mali, and South Sudan for 2013.

Human Development Index and its Components						
Country	HDI 2013	HDI Rank (of 187)	Life Expectancy at Birth 2013 (Years)	Mean Years of Schooling 2012	Expected Years of Schooling 2012	GNI Per Capita 2013 (2011 PPP \$)
Chad	0.372	184	51.2	1.5	7.4	1,622
Ethiopia	0.435	173	63.6	2.4	8.5	1,303
Mali	0.407	176	55.0	2.0	8.6	1,499
South Sudan*	0.473	166	55.3^	3.1	7.3	1,450^

\* Data for South Sudan is actually for Sudan except where indicated (^)

**Table 35.** 2013 Human Development Index and its components for Chad, Ethiopia, Mali, and South Sudan.

Published on the WHO's website, *Fact Sheet No. 359* lists some of the challenges that GDEC continues to face. It is assumed the last case of GWD will likely occur in a desolate locality of limited accessibility making this the most pressing and expensive part to achieving the goal of eradication especially with the impediment in accessing ELs of insecure areas in the four remaining ECs; the peculiar epidemiology amongst dogs with emerged GWs that are genetically indistinguishable from those in humans most recently observed in Chad; and the known potential for apathy that can lead to reductions in financial and political support once case numbers fall to low levels (WHO, 2015).

Confronting the many facets of extreme poverty such as disease, exclusion, hunger, income poverty, and lack of adequate shelter, the U.N.'s Millennium Development Goals (MDGs), listed below in Table 36, seek to eliminate these causes while promoting education, environmental sustainability, and gender equality to ensure the basic human rights of education,

health, security, and shelter to everyone (U.N., 2006). The countries of the G8 and G20 agreed to reach the MDGs by 2015. Efforts associated with GDEC attribute directly to achieving six of the MDGs.

Millennium Development Goals
<b>MDG 1:</b> Eradicate Extreme Hunger and Poverty
<b>MDG 2:</b> Achieve Universal Primary Education
<b>MDG 3:</b> Promote Gender Equality and Empower Women
<b>MDG 4:</b> Reduce Child Mortality
<b>MDG 5:</b> Improve Maternal Health
<b>MDG 6:</b> Combat HIV/AIDs, Malaria, and Other Diseases
<b>MDG 7:</b> Ensure Environmental Sustainability
<b>MDG 8:</b> Develop a Global Partnership for Development

**Table 36.** The U.N.’s eight Millennium Development Goals (U.N., 2006).

The first MDG calls for the eradication of extreme hunger and poverty. Not only is endemic GWD an indicator of poverty, it is one of the neglected tropical diseases (NTDs) and NTDs promote poverty while poverty promotes NTDs (Fenwick, 2012). Communities that are free from GWD are able to tend their farms leading to greater agricultural productivity which helps fight hunger and can be used to generate income. Children that are stricken with GWD are often unable to attend school due to the disabling pain caused by emerging GWs. In highly ELs, children that have been lucky enough not to contract GWD are burdened with the task of planting crops or bringing in the harvest when many of the working age population are too incapacitated to perform these duties. When school age children are no longer burdened with the responsibility of food production they are able to attend school, helping to achieve MDG 2. Without education, the cycle of poverty continues.

According to Callahan (2013), nearly half the LBVs of national GWEPs were women in 2008. In 2002, volunteers from Ghana’s Red Cross Society women’s club began working with

LBVs to aide with HE and GWD surveillance activities adding thousands of additional workers to the national GWEP. With leading roles in communities they served, women are better equipped to achieve equality through empowerment (MDG 3). Maternal health is improved when an expecting mother is able to care for her own needs and attend health clinics for prenatal care (MDG 5). Furthermore, by achieving MDG 1 pregnant women are provided access to better nutrition. The “other diseases” of MDG 6 includes NTDs (Fenwick, 2012). Therefore, GDEC directly contributes to fighting “other diseases.” In addition, GDEC is responsible for bringing PHC into many affected communities for the first time. Through the enlistment of politicians, steadfast donor support, commitment of affected communities, technical innovations, and a widespread coalition of international agencies, philanthropists, non-governmental organizations, and private sector businesses, GDEC may be a model for collaborative worldwide development (MDG 8).

## 6. CONCLUSION AND RECOMMENDATIONS

The following quote from Henderson (1987) reflects the success of the Global Dracunculiasis Eradication Campaign (GDEC), “[e]xtraordinary achievements are possible when countries throughout the world pursue common goals within the structure provided by an international organization” (1987, p. 545). Eradicating Guinea worm disease (GWD) from the world is a real possibility. What is required to ensure this becomes a reality is continued mobilization of political support while case totals dwindle in order to eliminate apathy. Timely, effective distribution of resources must not be hampered by government or donor squabbling. According to Cairncross, Tayeh, and Korkor (2012), had adequate resources been available to ensure all interventions were performed successfully and surveillance sustained in localities that were no longer endemic, eradication of GWD could have been achieved as early as 2002. When appropriate levels of surveillance sensitivity and other necessary interventions cannot be implemented to coincide with Guinea worm (GW) transmission seasons, the risk for an outbreak of GWD the following year is almost inevitable. When such an instance occurs, the announcement of eradication is set back by at least an additional four years. Furthermore, during the span of GDEC, accessing many of the world’s poorest populations in the most desolate and politically isolated communities is an example of how resolute national Guinea Worm Eradication Programs (GWEPs) have been in alleviating suffering from the domino effect caused by GWD.

Eradication of a parasitic disease is synonymous with the extinction of the biological agent (Dowdle & Cochi, 2011). One person with GWD can potentially infect and/or reinfect unsecured sources of drinking water (DW) wherever ecological conditions provide a suitable

habitat for intermediate hosts as each emerging GW can release up to three million larvae. Thus, until the GW is confirmed extinct, the only way to avoid the (re)establishment of endemic transmission is through the provision of safe, accessible, and uninterrupted sources of DW, continued health education, and widespread advertisement of rewards for reporting suspected cases as a means to enhancing surveillance sensitivity.

Throughout the literature, numerous names are used for both international and national level eradication campaigns. These include, but are not limited to “Dracunculiasis Eradication Campaign,” “Dracunculiasis Eradication Program,” “Guinea Worm Eradication Campaign,” “Guinea Worm Eradication Program.” As a means to provide consistency, I narrowed down the various names used for the global campaign and national programs to rid the world of GWD forever. The international goal is aimed at eradicating GWD. In order to achieve this goal, the objective is to stop indigenous transmission of GW in all countries and prevent the importation of exogenous cases. Thus, I referred to national campaigns universally as “Guinea Worm Eradication Programs” whose aim is the annihilation of every GW from within their borders. Each country that reaches this status contributes to the objective of GDEC. When every country affected by GWD has ended transmission of GW and the World Health Organization (WHO) has verified its extinction, the goal of GDEC will be reached.

As the global body in charge of GDEC, the WHO is the only agency with the power to mandate certification. It is confusing, to say the least, what the actual title of the status achieved by country’s that have applied for certification are through the literature. Countries are stated to be certified “free of dracunculiasis,” “free of dracunculiasis transmission,” or “free of Guinea worm transmission.” Applicant countries have “interrupted transmission of Guinea worm,” “interrupted dracunculiasis transmission,” of the “absence of transmission” has been verified.



From my research, I have concluded that ridding the world of GWD by rendering the GW extinct is the ultimate goal of the international campaign. Once a country reports zero indigenous cases of GWD for 14 successive months, it is deemed to have interrupted indigenous transmission of GW and enters the three-year long Precertification Phase. If after three years no indigenous cases are reported, the country becomes eligible to apply for certification to be declared “free of GW transmission.”

One recommendation is to solve the inconsistency with nominal data reported by the Centers for Disease Control and Prevention (CDC) and the WHO. For example, in the WHO’s 13 May 2011 issue of the *Weekly Epidemiological Record* (WER), Table 3, column two is named “Total no. of districts<sup>b</sup>.” The superscript’s meaning is denoted below the table: “Woredas in Ethiopia, local government authorities in Nigeria and counties in southern Sudan are referred to as districts in this table” (WHO, 2011a, p. 193). This does not follow the convention of second-level administrative divisions for Ethiopia as Wereda’s are third-level administrative divisions. Zones and Special Wereda’s were classified as second-level administrative divisions in Ethiopia as early as 1995 (Law, 2015).

These discrepancies continue in the 9 May 2014 issue of the WER in Table 4 with the use of “district” as the universal name for second-level administrative divisions. Under the heading “Dracunculiasis-endemic countries,” the portion on Chad, in the latter part of the final sentence of the first paragraph reads “...14 cases were found in 6 districts in 3/24 regions.” However, in the ensuing paragraphs the names of the misclassified “districts” are actually the names of Communes, third-level administrative divisions. Second-level administrative divisions for Chad are called Departments (Law, 2015). The data for Ethiopia begins by referring to administrative divisions as “districts” but the final sentence uses “woredas” with “districts” in parentheses to

portray what is meant by “districts.” Still, throughout the section on Ethiopia, the wording interchanges between “district” and “woreda.” Second-level administrative division is the tier of governmental unit that these reports are supposed to present and a “woreda” is actually a third-level administrative division that comes after Mali’s second-level administrative divisions are called “Cercles.” This is the only country which uses the term, “district” in a consistent manner. South Sudan’s second-level administrative divisions are counties and are referred to appropriately as such except in Table 4 as discussed above.

My recommendation for consistency also applies to defining an “imported case” of GWD as the definition employed by the CDC in the 1 October 2010 edition of the *Morbidity and Mortality Weekly Report* (MMWR; see Table 1, Hopkins et al., 2010, p. 1240) differs from that utilized by the WHO in the 7 May 2010 edition of the WER (see Table 1, WHO, 2010a, p. 168). The total number of cases reported in the MMWR is 3,190, five of which were noted to have been imported. The same number is reported in the WER article as an overall total. However, the WER lists the number of indigenous cases as 2,250 meaning 940 were classified as imports. These imported cases include those from another country as well as internal imports from another locality within the same country. An explanation of this indicator is not given in the article. One universal definition should be used that does not occlude the difference between internally imported and internationally imported cases and described to eliminate potential confusion. Both the CDC and the WHO should be using the same indicators in the same manner.

In the WER article, “Dracunculiasis eradication—Global surveillance summary, 2011” published on 11 May 2012, “Table 3” reports a total of 341 under column six, “No. of communities reporting only imported cases.” Three footnotes are included for the totals provided in Chad, 1a, Ethiopia, 2b, and South Sudan, 338c. Chad’s footnote (a) states, “One case imported

from another village within Chad”; Ethiopia’s (b), “Two cases were imported into Ethiopia from South Sudan”; and South Sudan’s (c), “The 338 cases were imported from other villages within South Sudan.” Ethiopia had two cases deemed internationally imported, but the article also states two incidents “were reported as internally imported cases within Gog *woreda*” (WHO, 2012, p. 182). Table 1 of the article, “Progress Toward Global Eradication of Dracunculiasis—January 2011-June 2012” published in the CDC’s 26 October 2012 issue of the MMWR, under the third column, “Villages under active surveillance in 2011,” sub-column four, “Reporting only imported cases†,” the table footnotes define “†” as “Imported from another country or from another in-country disease-endemic village.” A total of 340 localities are provided as the sum of the four countries included: Sudan, 338, Mali, 0, Chad, 0, and Ethiopia, 2. Note that Sudan is reported rather than South Sudan. However, a table footnote denotes the separation into two independent countries that occurred in July 2011 (Ruiz-Tiben et al., 2012, p. 856).

Adherence to consistency requires data to be reported with maximum accuracy. The data collection process and the units displayed should be easy to follow by readers. Furthermore, maintaining a consistent data format benefits future research projects by eliminating potential confusion (Gatrell, Bierly, & Jensen, 2005).

The four remaining endemic countries share several similar barriers to interrupting transmission of GW within their respective borders. Poverty, political instability, and government apathy are the three most significant factors confronting Chad, Ethiopia, Mali, and South Sudan. As the last strongholds for GWD, each of these four countries should continue with active surveillance in all at-risk areas and possibly even heighten the sensitivity of their surveillance system as the number of incidents continues to dwindle. So long as the international

coalition involved with GDEC persists, there is good reason to believe the last recorded case of GWD will soon be a reality.

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