



Summary of the Twenty-Third Meeting of the International Task Force for Disease Eradication (II) April 28, 2015

The twenty-third meeting of the International Task Force for Disease Eradication (ITFDE) was convened at The Carter Center from 8:30 am to 5:00 pm on April 28, 2015 to discuss the global campaign to eradicate Guinea worm disease (dracunculiasis). The Task Force members at the time of this meeting were Sir George Alleyne, Johns Hopkins University; Dr. Stephen Blount, The Carter Center; Dr. Mickey Chopra, UNICEF; Dr. Dirk Engels, World Health Organization (WHO); Dr. Donald Hopkins, The Carter Center (Chair); Dr. Julie Jacobson, Bill & Melinda Gates Foundation; Dr. Adetokunbo Lucas, Harvard University; Dr. Montserrat Meiro-Lorenzo, The World Bank; Professor David Molyneux, Liverpool School of Tropical Medicine (retired); Dr. Mark Rosenberg, Task Force for Global Health; Dr. Laurence Slutsker, Centers for Disease Control and Prevention (CDC); Dr. Harrison Spencer, Association of Schools of Public Health; Dr. Roberto Tapia, Carlos Slim Foundation; Dr. Ricardo Thompson, National Institute of Health (Mozambique), and Dr. Dyann Wirth, Harvard School of Public Health. Six Task Force members (Blount, Jacobson, Lucas, Rosenberg, Slutsker, Thompson) attended this meeting (Hopkins participated by telephone), and one was represented by an alternate (Dr. Gautam Biswas for Engels).

Presenters at the meeting, which was chaired by Dr. Julie Jacobson, included Dr. Mark Eberhard, Centers for Disease Control and Prevention (retired); Dr. Dieudonne Sankara, World Health Organization; Dr. Donald Hopkins, Dr. Ernesto Ruiz-Tiben and Mr. Adam Weiss of the Carter Center.

The ITFDE reviewed the status of the global Guinea Worm Eradication Program twice previously, in 2003 and 2008.

Global Overview of the Eradication Program and Certification of Eradication

Guinea worm disease (dracunculiasis) is caused by the parasite *Dracunculus medinensis*, which infects people who drink stagnant water from open ponds or wells containing immature stages of the parasite that have been ingested by tiny copepods (water fleas). After one year without any symptoms, the thin two to three foot long mature female worms emerge slowly and painfully through the skin of infected people. There is no curative treatment or vaccine for the illness, which can, however, be prevented by filtering drinking water through a fine cloth, teaching people to avoid entering sources of drinking water when the worms are emerging, by treating contaminated water with a mild insecticide, ABATE®, or by providing safe drinking water from borehole wells, for example. Prompt palliative treatment and bandaging of wounds caused by

the emerging parasites (case containment) is another means to prevent contamination of drinking water sources by infected persons. Two important biologic constraints are a one year long incubation period and a potential reproductive rate of over 80. Formerly widespread in parts of Asia and Africa, an estimated 3.5 million persons were infected by the disease in 1986.¹

The global campaign to eradicate Guinea worm disease began at the Centers for Disease Control and Prevention (CDC) in 1980, and has been led by The Carter Center since 1986, in close cooperation with the CDC, World Health Organization, UNICEF, and ministries of health of affected countries. The campaign is based on intensive community engagement led by village volunteers to encourage behavioral change. The Carter Center is primarily responsible for assisting national Guinea Worm Eradication Programs (GWEPs) to interrupt transmission of the disease, and maintain surveillance for three years after the last indigenous case, while WHO is responsible for certification of Guinea worm-free status and assisting countries with maintaining optimum surveillance during the pre- and post-certification stages. Insecurity has been a serious constraint at one time or another during the campaign in most of the endemic and formerly endemic countries, but the global GWEP has deployed several innovations in strategies, tactics and interventions.

As of the end of 2014, the number of endemic countries had been reduced from 21 (including South Sudan, which came into being in 2011) to 4 (Chad, Ethiopia, Mali, South Sudan), the number of endemic villages had been reduced from 23,735 in 1993 to 30, and the number of cases had been reduced to 126. Whereas 154 cases of the disease were exported from one country to another in 2002, no internationally exported cases occurred in 2013 or 2014. The overall reduction in cases between 2013 and 2014 was only 15% (from 148 to 126), due mainly to small outbreaks in 2014 in Mali (39 cases in September-November) and South Sudan (43 cases in July-August).²

Only three cases of Guinea worm disease (GWD) have been confirmed in 2015 worldwide as of the end of April, all three of which were reported from Chad, which is a 73% decrease compared to 11 cases reported worldwide during the same period of 2014. However 99 (79%) of the 126 cases in 2014 occurred in July-December.

All four remaining endemic countries now offer cash rewards equivalent to about US\$100 for reporting a case of GWD. In 2014, knowledge of the cash reward by sampled members of the public ranged from 63% in Chad to 66% in Ethiopia to 92% in Mali and in South Sudan. Monthly reporting rates from fixed health units were 62% in South Sudan, 89% in Mali, 90% in Ethiopia and 92% in Chad. Over 88% of rumors of cases were investigated within 24 hours in each of the four countries (range: 88%-100%), but the average number of rumors reported per 1000 population was less than 1 (range: 0.010-0.735) in all four countries, compared to an expected background rate of similar lesions of at least 20 per 1000.

¹ Watts SJ. Dracunculiasis in Africa in 1986: its geographic extent, incidence, and at-risk population. *Am J Trop Med Hyg*, 1987; 37:119–125.

² Anonymous. Dracunculiasis eradication: global surveillance summary, 2014. *Wkly Epidemiol Rec*, 2015; 90(19):201—216.

By the end of its Tenth Meeting in January 2015, the International Commission for the Certification of Dracunculiasis (ICCDE) had recommended, and WHO had formally certified, 198 countries and territories as free of Guinea worm disease. Only eight countries remain to be certified: the 4 countries that are still endemic (Chad, Ethiopia, Mali, South Sudan), 2 countries in the pre-certification stage (Kenya, Sudan), and 2 countries not known to have had endemic dracunculiasis since the eradication program began in 1980 (Angola, Democratic Republic of Congo). WHO requires at least three years with zero indigenous cases before a country is eligible to be considered for certification.

South Sudan

Although some interventions against GWD were implemented in the area that is now the Republic of South Sudan starting in 1995 with the “Guinea Worm Cease-Fire” during the Sudanese civil war, South Sudan’s Guinea Worm Eradication Program (SSGWEP) got underway after the Comprehensive Peace Agreement was signed to end the war in 2005. The program reported 20,582 cases during its national case search in 2006, in 3,137 villages, which included some over-reporting. 5,817 cases were reported in 2007, as village-based interventions were being put in place. Despite poor infrastructure, an exceptionally mobile population (moving among villages, farms, pastures and cattle camps), a long rainy season, and frequent incidents of insecurity, the SSGWEP has steadily reduced the numbers of endemic counties, endemic villages and cases of GWD from 28 (of 79 counties), 947, and 3,618 in 2008 to 4 endemic counties, 13 endemic villages, and 70 cases in 2014 (67% contained). The total number of Guinea worms emerged from patients has also fallen dramatically, from 1,647 worms emerged from the 1,028 patients in 2011 to 103 worms from the 70 patients in 2014. Kapoeta East County in Eastern Equatoria State accounted for 57 (81%) of the 70 cases reported in 2014; 43 (61%) of South Sudan’s 70 cases were reported in July-August. The SSGWEP has reported zero cases for five consecutive months, November 2014 to March 2015.

South Sudan launched its cash reward of 500 South Sudanese Pounds (~US\$125) in April 2014 and achieved 82% reward awareness by the end of the year. Each of the 47 villages that had one or more GW cases in 2013-2014 were provided with health education about GWD, had cloth filters in all households, were protected with ABATE® Larvicide, and implemented monthly reporting. 40% of those villages had at least one source of safe drinking water. This program has enjoyed strong, consistent political support from South Sudan’s political and public health leaders, which was exemplified during the SSGWEPs Annual Review Meeting in Juba in January 2015. The review meeting was opened by the Vice President of South Sudan and attended by the governor of Eastern Equatoria State, 3 national ministers (health, water, cabinet affairs), 6 state ministers of health (including Eastern Equatoria) and 4 county commissioners (including Kapoeta East County), among others.

Mali

Mali counted 16,024 cases of GWD during its nationwide case search in 1991. Systematic interventions began in 1993. Despite the active support of a Malian former head of state as well as of a current Malian member of the ICCDE, this is currently the longest operating GWEP and the only remaining focus of the disease in West Africa. A large unexpected outbreak in a

previously unaffected area, Kidal, in 2007 was a major setback that was compounded by inadequate support for the program at peripheral levels and by insecurity before and especially after a *coup d'état* in 2012. Currently, the northern regions of Kidal, Timbuktu, and Gao are extremely insecure, while Mopti and Segou are moderately insecure and Kayes, Koulikoro and Sikasso regions are relatively secure.

Mali doubled the amount of its cash reward for reporting a case to the equivalent of US\$100 in October 2014, and awareness of the reward averaged over 90% of persons sampled in 2014. A few NGOs and UN/WHO humanitarian missions have helped conduct some surveillance for GWD in parts of the insecure regions. A total of 574 villages are under active surveillance nationwide. At the time of this meeting, this program had not established a national task force or interagency group to help coordinate activities and support of various government ministries and external partners. Mali hosted the annual meeting of National Program Managers in February 2015.

Mali reported 40 cases of GWD in 2014, 88% of which were reportedly contained, all but one of whom were nomadic black Tuaregs, and all of which occurred in August-November. The cases in 2014 were in only three localities: Tanzikratene (in Ansongo district of Gao Region) reported 29 cases, of which 28 were contained; Nanguaye (in Gourma Rharous district of Timbuktu Region) reported 10 cases and contained 7 of them; and Fion (in Tominian district of Segou Region) reported one uncontained case. Water sources in all three localities were treated with Abate just after the occurrence of cases, all had cloth filters distributed to 100% of households, and all received health education about preventing and reporting GWD. Tanzikratene currently has no source of safe drinking water, as their small town water system is broken and has not been repaired due to insecurity in the area. Nanguaye also has no source of safe water, while Fion has one functioning and two non-functioning boreholes. Tanzikratene and Nanguaye are both populated by seasonal nomads. Mali has reported no cases in January-March 2015. Despite the insecurity causing population displacements no cases of GWD were detected in neighboring countries during 2013 and 2014.

Chad

Chad reported zero cases of GWD for nine consecutive years (2001-2009) before new cases were discovered in villages along the Chari River in 2010. The Carter Center helped re-establish village-based surveillance starting early in 2012. From 2010 to 2014, a total of 10-14 cases have been reported each year, most of which occurred as single cases in different villages, with very few villages reporting cases in more than one year. There have been no “outbreaks” of several cases in one village in the same year. Moreover, since 2012 more domestic dogs have been discovered with Guinea worm infections in Chad than humans, and the numbers of infections in dogs have increased from year to year. During 2014, the average number of worms per infected human in Chad was 1.15 (15/13), whereas the average number of worms per infected dog was 1.52 (172/113). Extensive genetic analysis has detected no differences between the Guinea worms removed from humans and from dogs in Chad. Chad reported three cases in humans in January-March 2015 (the same number reported in January-March 2014), and 64 Guinea worm infections in dogs (vs. 14 infections in dogs in January-March 2014).

Extensive studies conducted by the ministry of health with assistance of The Carter Center, WHO and CDC suggest an unusual epidemiological pattern of Guinea worm infections in Chad that has not been seen in any other endemic country nor in Chad itself before the current outbreak. The lack of clusters of cases in a village in the same year makes it very unlikely that the disease is being transmitted to people via drinking water, which would result in a common source of infection. It appears that dogs are being infected by eating discarded raw entrails from fish mainly during intensive fishing and cleaning of fish at the end of the dry season, and that humans are infected sporadically by eating under-cooked fish.³ It is suspected that larvae from infected copepods that are ingested by fish (or other aquatic animal) become dormant and may resume development in a definitive host if they are not killed by cooking or drying before any such fish is consumed by dogs or humans.

In October 2013 the program began enhanced education of villagers at risk to urge them to cook or smoke their fish thoroughly, to bury or incinerate fish entrails, and not allow dogs to eat discarded entrails from fish. During the first two months of 2015, 66% of 260 households that were sampled randomly were burying fish entrails. Efforts to tether dogs with emerging Guinea worms until the worms are fully emerged in order to prevent contamination of water sources began in February 2014. 40% of 113 infected dogs were contained by this means in 2014; 68% of 88 infected dogs between January and April 2015 were contained. Chad has had a cash reward of about US\$100 for reporting cases of GWD in humans since before 2010. A cash reward of US\$20 for reporting and tethering an infected dog was introduced in February 2015. Since the lagoons that occur along the river as the dry season advances are much too large to treat with Abate® Larvicide, the program introduced an innovative technique to apply Abate to smaller cordoned sections of the lagoons in August 2014. Portable barriers were used in applying Abate to protect 19 villages in 2014 and 7 villages in the first four months of 2015. Of 127 “priority villages” that had an infected human and/or dog in 2014-2015, at the end of April 2015, 81 (64%) had at least one safe source of drinking water. Accompanied by health officials, reporters and television film crews, Chad’s minister of health visited 7 villages, a fish market and conducted town hall meetings in endemic areas on March 28-30, 2015.

The Carter Center and the WHO Collaborating Center for Dracunculiasis Eradication, Training and Research at CDC have supported considerable research to help understand the “peculiar epidemiology” of the current dracunculiasis outbreak in Chad. This includes on-going molecular studies of dog and human Guinea worms in Chad; review of the literature regarding paratenic hosts of *Dracunculus*, copepod species, recent ecological changes in the Chari River basin, and reports of wild carnivores present in Chad; speciation of copepods collected in Chad; studies to assess whether fish that ingest infected copepods become infected and to document the longevity of viable L3 larvae of *D. medinensis* in fish; and studies to determine whether options exist for treating infected dogs with ivermectin. WHO convened a scientific meeting in Geneva on January 12-13, 2015 to identify additional priority areas for research to help address the unusual epidemiological situation in Chad.

³ Eberhard ML, Ruiz-Tiben E, Hopkins DR, Farrell C, Toe F, Weiss A, Withers Jr. PC, Jenks MH, Thiele EA, Cotton JA, Hance Z, Holroyd N, Cama VA, Tahir MA, Mounda T. The Peculiar Epidemiology of Dracunculiasis in Chad. *Am J Trop Med Hyg*, 2014; 90(1):61—70.

Ethiopia

Ethiopia counted 1,120 cases of GWD in 113 villages during its active case search in 1993. The cases were distributed in two endemic areas: one in South Omo (SNNP Region) and the other in Gambella Region. The focus in South Omo was eliminated in 2001 and has remained free of the disease since then. Gambella Region has reported less than 50 cases per year for the past 14 years. Since October 2013, the Ethiopia Dracunculiasis Eradication Program (EDEP) has had 173 villages under active surveillance in three recently endemic districts of Gambella: Gog, Abobo, and Itang. Ethiopia increased the amount of its cash reward for reporting a case of GWD to the equivalent of US\$100 in October 2014. Reward awareness averaged 59% overall in 2014 but was significantly higher in the recently endemic districts.

The EDEP reported only 3 cases in humans in 2014: 2 in June, both of which were contained, and 1 uncontained case in December. In addition, the program reported 3 infected dogs and 1 infected baboon in June-August 2014, and another infected dog in January 2015, but no human infections in January-March 2015. All human and animal infections reported in 2014-2015 were resident in or near four villages located along the same road in Gog district within about 6 miles (10 kilometers) of each other. Abate was applied to the water sources associated with all of these infections within 7 days of the respective infection. All four villages have received health education, two of the villages have cloth filters in all households, and three of the villages have at least one source of safe drinking water. In December 2014 the national program coordinator for the EDEP and the coordinator for Gambella Region departed the country suddenly for three month tours of duty to combat Ebola in West Africa. The national program coordinator has extended his tour another three months.

Discussion

The progress of the global GWEP to date is inspiring, but there is need to balance messaging about the perceived threat posed by GWD with the expected imminent victory in order to motivate the remaining endemic countries and donors to provide the political and financial support needed to finish the job. Attention to details about each of the final cases of GWD such as the source of infection and associated sources of drinking water is increasingly important. Analysis and correction of reasons why cases are uncontained is also critical at this end stage of the program. The combined impact of all interventions in place, not just the reported rate of case containment, determines the rate at which cases are reduced.

Strengthened surveillance is extremely important and all opportunities for redundant surveillance for GWD by collaborating with other activities such as seasonal malaria chemoprevention, immunization, and mass drug administration should be encouraged. This collaboration can also serve to promote active consideration of ways to use the infrastructure developed by GWEPs for implementing other health programs after the GWEP ends. WHO and the United Nations High Commission for Refugees (UNHCR) are conducting surveillance for GWD among South Sudanese refugees in Ethiopia, and among refugees from Mali in neighboring countries. Sharing best surveillance practices such as the South Sudan GWEP's follow up visits monthly or weekly to patients from the year before is another good idea. WHO is pushing for nationwide surveys

using existing public health programs (e.g. immunization, mass drug administration) to rapidly assess the possible presence or not of GWD in Angola and the Democratic Republic of Congo.

The increase in cash rewards in Ethiopia and Mali may have improved reporting there in 2014. It was noted that WHO expects to introduce a global cash reward for reporting a case of GWD that is larger than the rewards currently offered by individual endemic countries, starting in 2016. During its tenth meeting in January 2015, the ICCDE discussed whether a global reward should only be announced one year after the last case, and the relation of such a global reward to existing national rewards.

The excellent progress being made by the SSGWEP is remarkable, given the special challenges in South Sudan. Great concern was expressed, however, about the deteriorating political-economic climate and resurgent insecurity in the country.

Mali's GWEP is handicapped by severe insecurity in much of the country, including to some extent all of the known endemic areas remaining, as well as by weak political support of the program by political and public health authorities at all levels. During 2014 and 2015 insecurity prevented provision or repair of mechanized safe water sources in Tanzikratene locality (29 cases), while there is no source of safe drinking water in Nanguaye locality (10 cases) (the two villages with all but one of the cases reported in 2014), as well as a ministerial visit to an endemic area. Inadequate political will has prevented both formation of an interagency task force to support and coordinate program activities, as well as holding peripheral authorities accountable for their performance.

It is not clear why GWD reappeared in Chad in 2010, or why *D. medinensis* infections began occurring so frequently among domestic dogs in Chad. Potential explanations that have been put forward include the unusually intense fishing industry along the Chari River, ecological changes in prevalence of local fish and flora associated with climate change, and reported reduction in use of agricultural pesticides in areas along the river. The year-to-year increases in numbers of infected dogs in Chad in 2012-2015 is real and not due to more sensitive surveillance. It is known from older literature that about half of dogs exposed to infective *D. medinensis* larvae experimentally became infected. It seems likely that *D. medinensis* larvae in fish are not as hardy as some other larval parasites, such as encysted *Trichinella* larvae in other animals. Concern was expressed about one case that occurred in 2014 in a Chadian resident near the border with the Central African Republic.

The long delay in stopping transmission of GWD in Ethiopia may be because cases of the disease were relatively few in number and occurred among remote marginalized populations in a region with especially weak peripheral health services in a federal public health system. The lack of political support now threatens the stringent preparations that Ethiopia (and other still-endemic countries) will be required to undertake in order to eventually be certified as free of GWD. WHO, The Carter Center and the Bill & Melinda Gates Foundation all have offices in Addis Ababa that may advocate with the Federal Ministry of Health.

Conclusions and Recommendations

1. The Task Force applauds the great progress since its previous review of the global GWEP. It is also acutely aware of the distinct challenges to completing eradication in each of the four endemic countries remaining. The Task Force expects these last four endemic countries to receive greater scrutiny by the ICCDE, so the documentation supporting elimination of Guinea worm in each country is expected to be much more rigorous. This is now the pivotal end stage of the global campaign, which will require increased and sustained political support and financial resources for the final push to eradication.
2. Endemic countries and their partners are urged to intensify surveillance for GWD, including increasing awareness of the cash rewards for reporting, increasing redundancy of surveillance methods used, and increasing the rates of reported rumors and suspected cases, as well as monitoring the status of surveillance indices. Endemic countries, The Carter Center and WHO should work with additional partners to take advantage of redundancy opportunities with other programs such as polio, disease mapping, and mass drug administration. GWEPs should consider reporting of rumors as an indicator of the completeness of reporting in their surveillance system, similar to how polio eradication programs monitor reports of acute flaccid paralysis.
3. Each reported case from now on must be investigated and documented thoroughly, including apparent source of the infection, timing of the case's discovery and interventions, and laboratory confirmation that the worm is *D. medinensis*.
4. The ITFDE commends the excellent technical leadership and strong political support that are the basis of the SSGWEP's rapid, uninterrupted progress. Sporadic insecurity is an important constraint to successful completion of this effort in South Sudan.
5. Insecurity in the remaining endemic areas is a major barrier to the GWEP in Mali. Inadequate political support at national and regional levels is another important constraint. Priorities should include establishing a functional interagency group or task force of relevant governmental agencies and partners, provision of safe water to 2 of the 3 endemic localities remaining (security permitting), and a presidential or ministerial visit to an endemic area (security permitting).
6. Chad is now the greatest challenge to how soon global eradication of GWD will be achieved. The minister of health's recent visit to several endemic communities is a useful indication of support for the program, although much more political support is needed, given the atypical epidemiology of Guinea worm transmission in Chad.
7. Domestic dogs, not humans, appear to be the overwhelming source of Guinea worm larvae released into the environment in Chad, and evidence to date suggests drinking water is not the main mode of transmission in Chad. The Task Force recommends that special attention be given to increasing the proportion of infected dogs that are contained to prevent them from contaminating water sources, to increasing the proportion of fish entrails properly disposed, and to increasing the proportion of Chadians who cook their fish well before consumption. Professional assistance with disseminating messages to the public seems advisable. The impact of these and any other measures should be reviewed regularly, with the ongoing research.

8. The Task Force applauds the rapid implementation of several operational and laboratory research activities already undertaken and/or underway in relation to the “peculiar epidemiology” of Guinea worm transmission in Chad and strongly recommends continuation of such research. Research results should be applied quickly, just as relevant program observations should be tested promptly by research.
9. Ethiopia is apparently on the verge of stopping transmission of GWD if it has not stopped transmission already. Any new infections of humans or animals with *D. medinensis* in Ethiopia should be investigated immediately and treated similarly and aggressively, including use of Abate in local sources of surface water. Unlike Chad, the occasional infection of animals in Ethiopia is very similar to that seen in several other formerly endemic countries before they eliminated the disease.
10. The EDEP needs a full time national coordinator, a national secretariat, a dedicated data manager, and more political support from government officials at all levels. Even if it interrupts transmission, Ethiopia will not achieve certification of Guinea worm elimination with the apparent inattention to the EDEP. WHO, The Carter Center and other stakeholders should push for action on this.
11. WHO and UNHCR are commended for implementing surveillance for GWD among refugees from Mali and South Sudan and urged to continue doing so. Authorities in Angola and the Democratic Republic of Congo are urged to use existing public health programs to conduct nationwide surveys and document the absence or presence of endemic transmission of GWD in their country quickly.