

The eradication of Guinea Worm Disease: a possible global public health achievement

Filippo Ciantia · Thomas Odong · Nars Oyoo-Odoch

Received: 14 August 2012 / Accepted: 7 September 2012 / Published online: 31 October 2012
© Springer-Verlag Italia 2012

Abstract Guinea worm disease, classified as a neglected tropical disease, is one of the two diseases nearing eradication. When in 2015 the world's leaders will evaluate the progresses toward the achievement of the MDGs, most likely both diseases will no longer affect humanity. GWD was eradicated in Uganda despite the country was plagued by poverty and civil unrest especially in the most affected northern regions. Keys to the success of the Uganda Guinea worm eradication programme were realist strategies of community involvement focusing on positive behavior changes. The role of motivated health workers played a crucial role, especially in understanding the lives of people and adapting culturally adequate health messages. The achievement of this public health success was based on a coordinated international support, effective national health policies, public-private partnerships, and local authorities' involvement allowed.

Keywords Guinea worm disease (GWD) · *Dracunculus medinensis* · Neglected tropical diseases (NTD) · Uganda

Introduction

In 2015, global leaders will discuss the progress towards the Millennium Development Goals (MDGs). The health MDGs seem some way from being achieved, though some progress has been made. A fundamental revision of the health global goals is underway and has been introduced to the international community during the World Summit Rio +20 [1, 2].

Neglected tropical diseases (NTDs) are diseases that affect the world's bottom billion poorest people. As such are considered in the undefined basket of "other diseases" of MDG 6.

Guinea Worm Disease [GWD], a NTD, is one of the only two diseases sanctioned by WHO for eradication, poliomyelitis being the other [3]. The progress towards eradication of polio is well known, as poliomyelitis has been a common disease in the developed world and an effective vaccination allowed extraordinary steps towards the goal's achievement. However, also GWD eradication is just few steps ahead. Guinea worm is a classic example of how much can be done with so little, one low hanging fruit has been picked and *Dracunculiasis* eradication can be a prelude to other NTDs eradication [4].

What makes the Guinea Worm program's success so impressive is that it has operated with only a fraction of the funding that polio has enjoyed. Perseverance, effective community engagement, rudimentary tools and leadership are emblematic of what has driven these efforts [5].

Dracunculiasis or GWD is a human parasitic infection caused by *Dracunculus medinensis*, one of the largest parasites. It is one of the oldest known and documented diseases of the history: "And the Lord sent fiery serpents among the people..." [6].

F. Ciantia (✉) · T. Odong · N. Oyoo-Odoch
Expo 2015 SpA, Department of International Affairs,
Via Rovello 2, 20121 Milan, Italy
e-mail: filippo.ciantia@gmail.com

T. Odong
e-mail: debenox@gmail.com

N. Oyoo-Odoch
e-mail: oyo_odoch@yahoo.com

T. Odong
WIDCO (U) Ltd., P.O. Box 40358, Kampala, Uganda

N. Oyoo-Odoch
Kitgum District Local Government,
P.O. Box 17, Kitgum, Uganda

In 1986, when about 3.5 million cases were annually occurring in 20 countries [7], the World Health Assembly (WHA) called for the elimination of GWD [8]. The 1991 WHA target was not achieved by 1995 [9]. In 2004, WHA established a new target date of 2009 for global eradication [10]. In October 2009, WHO's International Commission for the Certification of Dracunculiasis Eradication certified three more countries as being free of Guinea worm transmission: Benin, Mauritania and Uganda. A new target date for eradication has not yet been established, hoping that 2015 will be the occasion to announce the great achievement [11]. The case of Uganda's successful eradication program of Guinea Worm Disease provides some fundamental indications for Public Health Programs in a global context, characterized by an increasing complexity and declining of available resources for social services.

Guinea Worm Disease is a parasitic worm infection occurring mainly in Africa. It is also called as Dracunculiasis. People get infected when they drink standing water, containing a tiny water flea that is infected with the even tinier larvae of the Guinea Worm. Inside the human body, the larvae matures, growing as long as 120 cm. After a year, the female worm emerges through a painful blister on the skin, causing long-term suffering and sometimes disabling after-effects. A few days to hours before the worm emerges, the person might develop fever and have swelling and pain in the area where the worm is. A blister develops and then opens into a wound. When the wound is immersed in water, the worm begins to emerge. Most worms appear on the legs and feet, but they can occur anywhere on the body, as the trigger is the presence of water or humidity. After the worm emerges, the wound often becomes painfully swollen and infected. There is no cure. The only treatment is to remove the worm over many weeks by winding it around a small stick and pulling it out a tiny bit at a time. Sometimes the worm can be pulled out completely within a few days, but the process usually takes weeks or months.

No medication is available to end or prevent the infection. During the time that the worm is emerging and being removed, the affected person suffers intense pain and often cannot work or resume daily activities for months. Farmers cannot tend their crops, parents cannot care for children, and children miss school. Even after the worms are gone, people are often left with scarring and permanent crippling. Infection does not produce immunity, and many people in affected villages suffer the disease year after year.

Infection can be avoided, even in areas where the disease is very common using only water that has been filtered or obtained from a safe source, breaking the cycle of infection means keeping Guinea Worm larvae out of the drinking water.

Dracunculiasis eradication in Uganda

The history of Guinea Worm eradication in Uganda was a struggle that lasted for at least three decades. Prior to the 1980s there were no organized government efforts to address the problem of Guinea Worm infection, which was localized among the communities of Kitgum Matidi sub-county, Kitgum district in northern Uganda.

Earlier district level efforts aimed at eradication

In the early 1980s, the District Medical Officer of Kitgum district, inhabited by the Acholi tribe of the Lwo group, initiated a program supported by the international NGO (Non-governmental Organization) AVSI (<http://www.avsi.org>), funded by the Italian Government that aimed at eliminating Guinea worm from Kitgum Matidi sub-county. A team of public health staff under his leadership was deployed to carry out intensive health education in the affected communities. The Health Education Team used interactive, persuasive communication in an effort to change the people's behavior [12, 13].

At the beginning of each session, participants were asked what they knew was the cause of the disease. Their knowledge and beliefs were found to be varied. Some superstitious people thought Guinea worm was a curse from god while others thought it was due to "gemo" (Acholi word for evil spirits). Others thought it was airborne since it was affecting many people. Some believed it was worn-out nerve tissues then coming out of the body, while some were certain that it was water-borne. Following the brainstorming on causes, the health education team would then explain to the participants the known mode of transmission of the parasite. This was followed by a discussion on what the community was to do.

The interventions recommended and encouraged following the discussions, and on the basis of known control measures were boiling or filtering of drinking water, and protection of water sources. With support from the international NGO ACORD (<http://www.acordinternational.org>) filter-clothes were distributed to every household in Kitgum Matidi in 1982.

A number of challenges were faced by the programme implementers.

First, the cloth filters distributed did not serve the purpose for which it was intended; in many households it was instead used for other purposes, such as filtering locally fermented drinks.

Secondly, community members found boiling of drinking water impracticable in the busy schedules of women who were expected to play that role.

Thirdly, protection of waterholes using rudimentary local technology turned out to be ineffective since individuals

infested with Guinea worm would still wade into the water with their open wounds, thereby allowing the worms to release their larvae into the water and completing their life cycle.

Fourthly, knowledge existed of the effectiveness of the chemical *Abate*[®]—to kill the intermediate hosts of Guinea worm, namely the Cyclops, but use of the chemical could not be initiated due to the lack of an enabling government policy and limited resources. UNICEF and ACORD had been providing support in drilling boreholes and protecting shallow wells to provide safe water sources, but were limited in their coverage by the costs of these water supply technologies.

Given the outlined constraints, the successes of the control measures were limited and Guinea worm continued to spread to other 20 sub-counties in Kitgum district besides Kitgum Matidi. It also spread to several other districts in Uganda.

The Uganda National Guinea Worm Eradication Program (UGWEP)

By 1989, a National Guinea Worm Eradication Program was felt necessary. A survey conducted by the Ministry of Health in 1991 showed that Uganda had 126,369 cases of Guinea Worm in 15 out of 33 districts then, with a 12-month prevalence (January–December 1991) of 73,553 cases (58 %) and Point Prevalence (December 1991) of 52,816 cases (42 %).

The program was designed in the early 1990s under the leadership of Uganda National Task Force for Guinea Worm Eradication. Members of the Task Force were from the Guinea Worm Secretariat of the Ministry of Health, the Ministry of Local Government, the Army, the Prison Department, UNICEF, AVSI and World Vision International.

The main strategies used in the Guinea Worm Eradication Program in Uganda “focused on surveillance, case management and containment, provision and maintenance of safe drinking water supply, the application of *Abate*[®] in unsafe drinking water sources, distribution of cloth filters for straining unsafe water as well as advocacy and social mobilization, training and manpower development, programme monitoring and evaluation” [14]. The interventions were introduced sequentially in a phased manner starting in 1992 in Kitgum district, which had the highest incidence, and then scaling up to the rest of endemic districts.

Human resource capacity development specifically for the purpose of Guinea Worm eradication was the first intervention introduced. It took the form of training at the various levels of the government structure, namely national, district, sub-county and community levels from

April 1992 onwards. Appropriate training materials were developed and used for the trainings based on the generic WHO modules.

At community level Village Volunteers were trained to be able to carry out health education in their respective villages, as well as carry out case detection, case management, surveillance, and improvement of water sources. A total of 2,677 village volunteers, 64 sub-county supervisors (SCSs), all District Health Teams (DHTs), health workers in all health facilities and district political leaders of all endemic districts were trained on the implementation of program activities.

The initial program in Kitgum used health personnel from the District Medical Office to carry out health education activities in the villages. The national program instead built capacities of and used Village Volunteers for that task. Health education and social mobilization activities were carried out to ensure community involvement in the eradication of Guinea Worm and to promote adoption of preventive behaviors.

The Village Volunteers were living in their respective communities, were part and parcel of the communities in their various activities, identified with and were easily accessible to the community members. As accepted members and leaders of the community, the Village Volunteers were thus very instrumental in enlisting community participation in the program.

Cloth filters, procured with funding from the Carter Center (<http://www.cartercenter.org>), were provided to the Village Volunteers for distribution to all the households in the endemic villages. This made their health education interventions more acceptable and the proposed actions by community members feasible. People who were mobile such as the armed forces, nomadic communities in the districts of Kotido, Moroto and Nakapiripirit as well as some hunters in northern region were supplied with pipe or straw filters. The program replaced the filters every 6 months.

With these early interventions in the life of the program, the prevalence of Guinea worm dramatically decreased from 126,369 in 1992 to 42,847 in 1993 as shown in Fig. 1. The diagram shows not only the sequencing of introduction of the various interventions but also how the decline in Guinea Worm incidence resulted from the introduction of specific interventions and groups of interventions. In 1993, containment was introduced and implemented alongside the other interventions.

Case containment included the use of medical kits which were distributed to Village-Based Health Workers in October 1993 for occlusive bandaging of wounds where the active worms had emerged from so that the affected individuals would not contaminate water sources even if the wounds were immersed in water. The kits were supplied

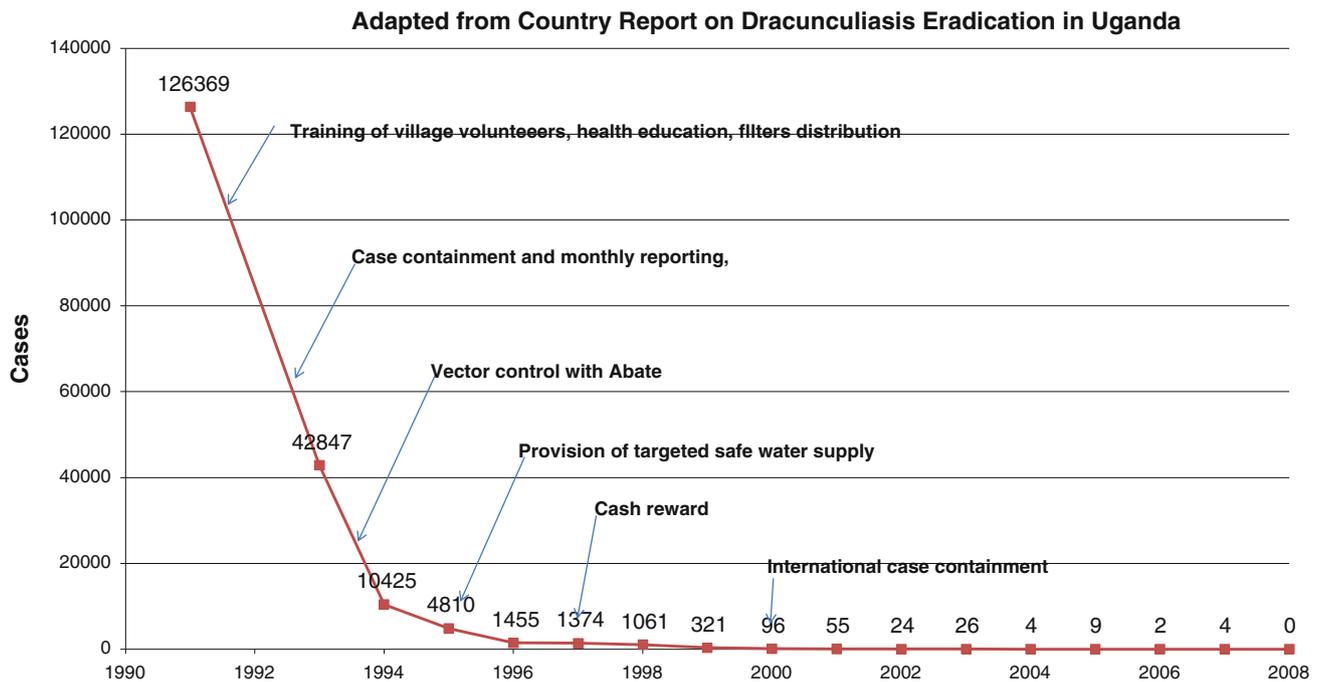


Fig. 1 Sequence of interventions and trends in incidence of Dracunculiasis in Uganda from 1991 to 2008. Adapted from country's report on Dracunculiasis eradication in Uganda

and replenished regularly under an arrangement between UGWEP and UNICEF through the respective district health offices.

A combination of the strategies of training, health education, distribution of filters case containment and monthly reporting further brought down the incidence of Guinea Worm to 10,425 by 1994 when vector control measure using the chemical *Abate*[®] was introduced. By the time efforts to provide safe drinking water sources to communities that lacked such facilities began from 1995 onwards, the number of endemic villages which stood at 2,667 in 1992 had gone down to 740. This meant that less funding was required to provide safe water sources than if the intervention had been introduced earlier in the 1990s. Provision of safe water sources was thus targeted only to the most needy populations and areas.

At the national level, advocacy activities organized to publicize and create awareness about the disease in the country resulted in a high profile accorded to Guinea Worm eradication and in the commitments of stakeholders at all levels. In particular, political commitment was high at all levels throughout the life of the program.

Dracunculiasis surveillance, supported by WHO and CDC, was done by the Village Volunteers who were able to detect and notify cases. They collected the data from every village and sent information to the sub-county supervisors who in turn submitted the data to district and national levels monthly. To date the National Guinea Worm

Eradication Secretariat continues to receive these reports from the at risk villages under surveillance and to remit monthly reports to all stakeholders.

A monetary reward system was introduced in January 1999 with funding support from UNICEF (<http://www.unicef.org>) and CDC (<http://www.cdc.gov>). It was meant to encourage active reporting of cases by patients with Guinea worm and other community members to the Village-Based Health Workers (VBHWs). It was also meant to encourage the VBHWs to manage the cases and the Sub-county Supervisors to verify the cases.

Lessons learnt

The design and implementation of the Guinea Worm Eradication Program in Uganda over the years showed the importance of learning from experience to avoid past mistakes or limitations in implementing similar programmes.

Secondly, the experience shows that health education alone is sometimes not enough to cause the necessary behavior change. Enabling and reinforcing factors need to be carefully identified and created. Uganda's experience also demonstrated that behavior change is possible when the alternative behaviors to be adopted are perceived to be both advantageous and feasible by the target population. These were demonstrated by the examples of the provision of cloth filters, bandaging wounds as a case containment measure, provision of safe drinking water

sources—especially boreholes. With all these material program inputs to the communities in the endemic villages enabling factors were created for adoption of the desired behaviors. The behaviors were reinforced by advocacy and the reward system.

Finally, the contribution of many partners as mentioned in this article was a relevant success factor. Their collective contributions ensured that the required resources were made available timely. Moreover, commitment to eradication was sustained at all levels throughout and even after the last case of Guinea Worm in Uganda was reported. The climax of commitment was noted in the districts of Northern Uganda, where despite the insecurity because of the rebel activities of the “Lord’s Resistance Army” (LRA), health personnel continued to commit themselves to the work even to the extent of being abducted and in some cases killed by the rebels.

Conclusion

The Department of International Development of United Kingdom announced a large funding to fight NTDs, last January [15]. DFID is also supporting the efforts of Carter Foundation to combat Guinea Worm [16].

Challenges faced by the program to control NTDs have been recently brilliantly addressed [17, 18].

The Ugandan experience indicates that to deal in a sustainable way with Guinea Worm and other NTDs, it is fundamental to include behavioral changes. The availability of tablets is not enough as it happened with attempts to control of Schistosomiasis and Lymphatic Filariasis and other soil-transmitted disease in Uganda and Tanzania [19, 20]. Scaling up public health interventions requires a deep understanding of the lives of people being targeted. In fact, difficulties in relying on volunteers to assist on the needed actions in the field were overcome in the district of Kitgum, involving the traditional system of Rwot kweri (hoe chief), customary recognized authorities were the main web of community-based control utilized by the Guinea Worm Eradication Program in the rural areas.

The Eradication has been possible through an international effort involving the Ministry of Health, Local and traditional authorities, International Donors such as USAID, Italian Co-operation and DFID, NGOs, such as AVSI and CUAMM, UN Agencies, WHO and UNICEF.

And above all, it has been fundamental the participation in the struggle of the people, not only rural peasants and families and villagers, but also the health workers. A wide involvement of the population and an individual commitment allowed Uganda to achieve the eradication of a waterborne disease in districts affected by conflict (Acholi region) and local chronic clashes (Karamoja region).

In conclusion the experience of Guinea Worm Eradication in Uganda is that of a successful program design and implementation distinguished by involvement of multiple stakeholders, effective partnership and capacity development at all levels of governments. At community level it demonstrates that ‘health by the people’ is possible, and that community involvement helps to make behavior change easier to achieve. For success and sustainability of interventions the best thing that technocrats can do is to support and build people’s capacities to be responsible for their own health.

Conflict of interest None.

References

- (2012) Sustainable development for health: Rio and beyond. *Lancet* 379:2117
- Haynes A, Alleyne G, Kickbusch I, Dora C (2012) From the Earth Summit to Rio +20: integration of health and sustainable development. *Lancet* 379:2189–2197
- Mohammadi D (2012) The final push for polio eradication? *Lancet* 380:460–462
- Molyneux D (2012) Eradicating Guinea worm disease—a prelude to NTD elimination. *Lancet* 376:947–948
- Strieker G (2010) Foul Water Fiery Serpent. Cielo Productions, <http://www.foulwaterfieryserpent.com> (accessed 24th June 2012)
- Numbers 21, 4–9. The Bible
- Watts SJ (1987) Dracunculiasis in Africa: its geographic extent, incidence, and at-risk population. *Am J Trop Med Hyg* 37:119–125
- World Health Assembly. Resolution WHA 39.21 (1986) Elimination of Dracunculiasis: resolution of the 39th World Health Assembly. World Health Organization, Geneva
- Ruiz-Tiben E, Hopkins DR (2006) Dracunculiasis (Guinea worm disease) eradication. *Adv Parasitol* 61:275–309
- World Health Assembly. Resolution WHA 57.9 (2004) Eradication of dracunculiasis: resolution of the 57th World Health Assembly. World Health Organization, Geneva
- MMWR Progress Toward Global Eradication of Dracunculiasis, January 2009–June 2010. Vol. 59/No. 38. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5938a4.htm?s_cid=mm5938a4_e (accessed 24th June 2012)
- Martignoni L (1984) Proposta metodologica per la valutazione dell’efficacia di un intervento sanitario contro la Dracunculiasi, nel distretto di Kitgum—Uganda. Dissertation University of Milan
- Rizzo I (1986) Epidemiologia della Dracunculiasi nel distretto di Kitgum—Uganda. Dissertation, University of Milan
- Ministry of Health, Uganda (2009) Country report on dracunculiasis eradication in Uganda
- <http://www.dfid.gov.uk/News/Latest-news/2012/Britain-to-protect-more-than-140-million-in-global-effort-to-rid-the-world-of-neglected-tropical-diseases/> (accessed 24th of June 2012)
- <http://www.dfid.gov.uk/Stories/Case-Studies/2011/Goodbye-Guinea-Worm/> (accessed 24th of June 2012)
- <http://www.youtube.com/watch?v=mj-zGSPwaS4&lr=1&feature=watch> (accessed 24th June 2012, see Prof Allen lecture at LSE)
- Allen T, Parker M (2012) Will increased funding for neglected tropical diseases really make poverty history? *Lancet* 379: 1097–1098

19. Parker M, Allen T (2011) Does mass drug administration for the integrated treatment of neglected tropical diseases really work? Assessing evidence for the control of schistosomiasis and soil-transmitted helminths in Uganda. *Health Res Pol Syst* 9:3
20. Allen T, Parker M (2011) The “other diseases” of the Millennium Development Goals: rhetoric and reality of free drug distribution to cure the poor’s parasites. *Third World Q* 32:89–115