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Nigeria's Triumph: Dracunculiasis Eradicated

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MATERIALS AND METHODS

A previous publication describes in detail the early stages

Beginning with an extensive and highly graphic cover story in the Nigerian national newsmagazine *Concord* in 1987,[9] the events in 1987ï 1989

established a nine-member National Steering Committee (consisting of one representative from the Carter Center, the National Coordinator, representing the FMOH, UNICEF, WHO, and the Federal Ministry of Science and Technology, and four zonal facilitators) that was locally responsible for driving the program and formulating and ensuring adequate compliance with policies concerning the program.

Nigerian National Youth Service Corps workers (e.g., 94 in 1992) fulfilled their mandatory year of service to the nation after finishing college by helping to supervise village volunteers. During 1992ï 1995,several U.S. Peace Corps volunteers also

sources of drinking water and in the process eliciting information about sources of water known to the children and how these sources were used by the community at different times during the year; and 4) gaining better understanding of seasonal farming activities, including visits to the farming areas, often very distant from the community, to inventory and treat sources of drinking water used by those farmers. In the later stages of the program, NIGEP workers conducted spot checks to verify the levels of copepods in ponds before and after treatment.

In Nigeria as elsewhere, village residents' most desired intervention to prevent dracunculiasis was the provision of safe sources of drinking water, usually by borehole wells or hand-dug wells. Clean drinking water prevents many other diseases such13.414

and bandaged, and in which those criteria were verified by a supervisor within seven days. Late in 2002, the program introduced the first two case-containment centers, in which patients were voluntarily isolated in existing health posts or clinics where possible, or in specially constructed temporary structures, with food provided by the program. By the end of 2003, 23 centers were in operation. Treatment in the case-containment centers helped villagers recover more quickly from wounds caused by the infection, and prevented further contamination of drinking water sources. It also helped patients avoid the traditional practice of shekiain which a hot poker was applied to treat abscesses caused by Guinea worms in some northern areas of the country. The case-containment strategy was a supplement, not a substitute for the other village-based interventions. In 2003, the Northeast Zone adapted this approach in its cultural milieu as a case confinement strategy, in which patients were voluntarily isolated in their own homes under the eyes of watchmen to ensure they would not enter any water source.

During 1989ï 1991, reductions in the numbers of cases reported in the annual case searches were the main means of monitoring the program. After village-based volunteers were introduced, program impact and interventions were monitored primarily by reviewing monthly reports that originated from each of the more than 5,000 known disease-endemic villages (all villages that reported one or more case since January 1 of the previous year), which were compiled and supplemented by the zonal facilitators before submission to the national secretariat during the first week of the following month. The monthly tallies of cases in geographic areas were compared with the number of cases reported for the same area in the same month of the previous year, and percentages of known disease-endemic villages that had a trainedvolunteer and each of the interventions were tracked assiduously.

The first Program Review for NIGEP was held in Atlanta, Georgia, in 1991. On this occasion, former President and Mrs. Carter announced the initiation of an annual Jimmy and Rosalynn Carter Award for Guinea Worm Eradication to be awarded annually to recognize and encourage exceptional contributions and innovations in the programs in Nigeria and Ghana. Subsequently, biannual reviews were conducted in Africa at an annual meeting of representatives from all disease-endemic countries in March, and at a more thorough program review for the smaller group of English-speaking disease-endemic countries each September or October. Starting in 2000, Nigeria conducted its national program reviews (except for a joint review of the big three disease-endemic countries, Sudan, Ghana, and Nigeria, in Atlanta in 2003) to facilitate participation of as many health workers in Nigeria as possible and to maximize local publicity about the status of the national program. The in-country reviews of NIGEP were also part of an annual review of all health programs being assisted by The Carter Center in Nigeria (including onchocerciasis, lymphatic

View larger version at the American Journal of Tropical Medicine and Hygiene	FIGURE 2. Former Nigerian head of state General (Dr.) Yakubu Gowon addressing a group about Guinea worm eradication.

With the support of General Gowon, the re-energized NIGEP steadily tightened interventions under the effective leadership of the newly appointed (August 1998) Carter Center resident advisor, who was from Nigeria. External consultants assisted Southeast and Southwest Zones in 1998 (4.6 person-months), and all four zones in 1999 (17.7 person months), increasing to 31.7 person-months in 2003. Operations were decentralized within successive zones in 1998ï 2000, and the four zones were restructured into five zones in 2002. As mentioned above, case-containment centers were introduced in 2002 and expanded 10-fold in 2003. Worm Weeks, periods of intensive health education, community mobilization, and demonstrations in targeted disease-endemic areas, usually in villages where the impact of interventions was weakest (an innovation first devised by a Peace Corps Volunteer in the Guinea Worm Eradication Program in Niger that involved Peace Corps Volunteers and Guinea worm program staff living in targeted villages for one week) were introduced in 6 LGAs in 2002 and implemented in 11 high-priority LGAs in 2003.

Cash incentives for reporting and isolation of new cases were introduced in Northwest Zone in 2001 (jointly with neighboring areas of Niger) and extended nationwide in 2006, with support from The Carter Center, as a way to improve the sensitivity of surveillanc

With assistance from WHO, NIGEP worked to sustain active surveillance as part of the Integrated Disease Surveillance and Reporting System in Nigeria in 50 priority Guinea wormï free villages that had reported cases since the beginning of 2005. The rate of monthly reporting from these villages via the Integrated Disease Surveillance and Reporting System increased from an annual average of 16% in 2006 to 53% in 2007, 75% in 2008, and 89% in 2009.

RESULTS

During the early years of the program, dracunculiasis was widely dispersed in Nigeria, affecting virtually every part of the nation, but unevenly (Figure 3). In 1993, for example, 7 of the then 30 states accounted for more than 75% of the reported cases[12]:

during its longer rainy season when flowing sources of surface water were unsuitable habitat for copepods, transmission was highest in the dry season when surface water sources were scarcer and more likely to be stagnant, contaminated, and contain concentrated populations of copepods. The program exploited these alternating peaks in transmission during the past decade by shifting personnel from northern to southern regions and *vice versa* during the respective periods of peak transmission.

View larger version at the American Journal of Tropical Medicine and Hygiene	FIGURE 4. Number of cases of dracunculiasis reported by month in Nigeria in 1995, 2000, and 2005.

The initial case searches and routine surveillance did not include data on age, sex, or other features of individual cases throughout most of the program. Data from published reports in various parts of the country generally documented highest incidence of cases among persons 15ï

endemic villages with at least one functioning source of safe drinking water increased slowly but steadily. Case-containment rates also increased sharply after 2000 (Table 2). Moreover, by 2003, 39% (564) of 1,490 cases in Nigeria were admitted to case-containment centers, and in 2004, 91% (449) of 495 cases were admitted to case-containment centers, although not all cases met the official criteria for case containment.

View this table at the American Journal of Tropical Medicine and Hygiene	TABLE 2 Numbers of cases and disease-endemic villages and status of interventions against dracunculiasis in Nigeria, Nigerian Guinea Worm Eradication Program 1988ï 2008

The impact of these measures on dracunculiasis in Nigeria is shown in Figures 3ï 6. After steep reductions in 1990ï 1995, there was a plateau in the numbers of cases in 1996ï 1999, after which reductions resumed and accelerated. The mid-year peak in transmission, which reflected conditions in northern Nigeria, disappeared in 2002 (Figure 4). The number of cases exported from Nigeria to Cameroon peaked at 18 cases in 1997 and 21 cases in 1998 and decreased to 3 cases in 2002 (Table 3). In 2003, Nigeria exported no cases to Cameroon (which reported its last indigenous case in 1997) in an entire calendar year for the first time since the two programs started and Cameroon began reporting imported cases. The Northwest and Northeast Zones reported their last indigenous cases in September 2004, followed by Northcentral Zone in 2005, Southwest Zone in 2006, and Southeast Zone in 2008. (Nigeria divided the four former health zones, Southeast, Southwest, Northeast, Northwest, into

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FIGURE 5. Reported indigenous cases of dracunculiasis in Nigeria, 1988ï 2009.

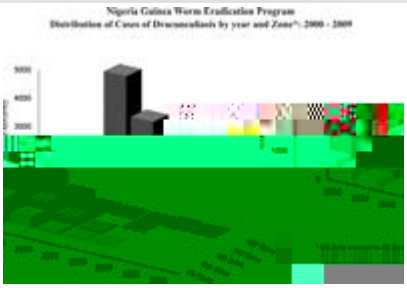

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FIGURE 6. Numbers of dracunculiasis cases reported in Nigeria by zone, 2000ï 2009.

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TABLE 3

Dracunculiasis cases exported from Nigeria, 1993ï 2008*

Nigeria appeared to be on the verge of interrupting transmission of dracunculiasis in

2007 before a surprise outbreak was discovered in two villages in Enugu State in January of that year. Investigation showed that the outbreak included 28 active cases in Ezza Nkwubor village and 2 cases in nearby Ezza Ugwuomu village (both persons were residents of Ezza Nkwubor village), and had begun in approximatelyOctober 2006, but only came to attention of health authorities when a patient sought treatment at a clinic in mid-January 2007. It was claimed that no one in the village was aware of the cash reward for reporting of a case of dracunculiasis. (A check of 2,076 randomly selected respondents from all disease-endemic zones of Nigeria in 2006 had found that 51% knew about the rewards announced through radio

$25.6 million from the government of Japan in 1988ï 1992, and the remainder from UNICEF, the government of Canada, and Rotary International, but other costs for water projects by UNICEF, the United Nations Development Program, Canada, theNetherlands, the United States, and the United Kingdom are not known.

DISCUSSION

Readers are referred to a previous report[6] that describes the critical earliest stages of this program in more detail. In retrospect, NIGEP was fortunate in the transitory coincidence of a few supportive personalities who were in key positions during this vulnerable formative phase of the program, when Guinea worm eradication was neither as obviously successful nor as popular as it is now. Chief among that early honor roll were the then Federal Minister of Health, the late Professor Olikoye Ransome-Kuti and his disease contro 13.4145 0 0 l

programs, used personal vehicles and public transportation, rode bicycles, and walked in a powerful display of determination and dedication.

The results of the first case search were incomplete to an unknown extent because not all villages were visited, and it undoubtedly also overestimated cases in some of the areas that were canvassed, given the one year retrospective nature of the search, but it served its main purpose, which was to document the geographic extent of dracunculiasis in Nigeria. We cannot know the true number of cases that still occurred in Nigeria at that time, but it may have been more than the 653,492 cases enumerated in the first case search because a similar case search in Ghana that was conducted around the same time and judged fairly accurate in limited spot checks[19] yielded a national prevalence rate (180,000 cases in a population of approximately 10 million) nearly 2.5 times as high as that in Nigeria (18 cases/1,000 versus 7.3 cases/1,000). In contrast, Nigeria had officially reported an average of only approximately 2,600 cases (range = 0ï 8,777 cases) of dracunculiasis to WHO annually during 1980ï 1986[20],[21] based on passive surveillance. Although the first qualitative indications that Guinea worm disease occurred all over Nigeria derived from the first national conference in 1985 had gotten many people's attention, the quantitative data from the first national case search, which attributed large numbers of cases to specific states and LGAs throughout the regionally sensitive federal republic, generated much more pressure, and willingness of national leaders to act.

The statistics from the first national case search fed directly into the voracious national media apparatus of Nigeria when the data were released publicly during the second national conference and the international donors conference in Lagos in March

own in 1999, but provided no additional support for them to work alongside the zonal consultants, who were supported by The Carter Center.

The disappointing plateau in numbers of cases in 1996ï 1999 reflected an unfortunate

water projects. The study by Cairncross and others[18] cited earlier documented the immediate effectiveness of providing safe drinking water to several communities in Nigeria, and health education and cloth filters eventually achieved similar reductions in prevalence of dracunculiasis two years later (without the other benefits of clean water from borehole wells). A more recent study from Ghana and Togo[22] documents the increased efficacy brought to bear by the case-containment strategy, but unfortunately, similar studies to compare the impact of different interventions (e.g., vector control, pipe filters) are generally lacking because funding (and time) for conducting such studies was usually not

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