

## DRACUNCULIASIS ERADICATION: DELAYED, NOT DENIED

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**Abstract.** By the end of 1998, Asia was free of dracunculiasis (Guinea worm disease), with Pakistan, India, and Yemen having interrupted transmission in 1993, 1996, and 1997, respectively. Transmission of the disease was also interrupted in Cameroon and Senegal during 1997. Chad reported only 3 cases during 1998. Dracunculiasis is now confined to only 13 countries in Africa. The overall number of cases has been reduced by more than 97% from the 3.2 million cases estimated to have occurred in 1986 to 78,557 cases reported in 1998. Because the civil war in Sudan remains the major impediment to eradication of dracunculiasis, the interim goal is to stop all transmission outside that country by the end of 2000. The most important operational need now is for national programs to improve the frequency and quality of supervision of village-based health workers in order to enhance the sensitivity of surveillance and effectiveness of case containment.

This paper summarizes the current status of the campaign to eradicate dracunculiasis (Guinea worm disease) as of July 1999. It updates the review that was published in this journal in 1997.<sup>1</sup>

Humans become infected with the parasite *Dracunculus medinensis* by drinking water from contaminated stagnant sources such as ponds, which contain immature forms of the parasite in the gut of tiny crustaceans (copepods). After one year, the mature adult female worms, each up to one meter long, emerge through the skin on any part of the body. If that part of the body is immersed in water, the worm ejects hundreds of thousands of immature larvae into the water to begin the cycle anew. Patients are incapacitated for periods averaging 10–11 weeks because of pain caused by the primary wound at the exit point of the worms and by associated secondary infections.<sup>2</sup> An estimated 0.5% of patients may become permanently crippled by scarring and contractures at knee or ankle joints. Patients acquire no immunity to the infection, and up to half or more of a village's population may be affected simultaneously. Since the Guinea worm season often coincides with the harvest or planting season of peak demand for agricultural labor, the disease has a severe adverse impact on agricultural productivity, in addition to reducing school attendance.

There is no cure for the infection, but each infection only lasts one year in humans. It can, however, be prevented, by teaching people to use cloth filters to remove the parasite from their drinking water, by boiling the water, or by applying Abate® (American Home Products, Parsippany, NJ) (temephos) monthly to kill the intermediate host in contaminated sources of drinking water such as ponds. The ideal preventive measure, but also the slowest and most expensive, is to provide safe sources of drinking water, such as from borehole wells. This infection is only transmitted to humans by drinking contaminated water. There is no animal reservoir of *D. medinensis*.

The early phase of this eradication campaign has been described previously.<sup>1,3</sup> After originating in an initiative taken at the Centers for Disease Control and Prevention (CDC) in 1980, the then unpopular cause of dracunculiasis eradication was taken up in 1986 by former United States President Jimmy Carter and The Carter Center (Global 2000). Working closely with CDC, UNICEF, and the World Health

Organization (WHO), The Carter Center has led the campaign ever since. By visiting all but two of the endemic countries to speak with political and medical leaders, writing political leaders, enlisting other major donors and allies, raising tens of millions of dollars, generating substantial publicity for the campaign, and negotiating a four-month long “Guinea worm cease-fire” in Sudan in 1995, former President Carter personally forged the “Grand Alliance” of people in endemic countries, development organizations, and private companies which now is poised to complete the eradication of this 3,000-year-old scourge.

**Current status of the campaign.** By the end of 1998, Asia was free of dracunculiasis, with Yemen having interrupted transmission of the infection in September 1997 (Figure 1).<sup>4</sup> Dracunculiasis is now confined to 12 or 13 countries in Africa, down from 19–20 countries in Africa and Asia seven years ago (Figure 2). Among those, Chad detected only 3 cases in 1998, and the status of the disease in Central African Republic and the northeastern part of the Democratic Republic of Congo is still uncertain because of inadequate investigation of suspect cases due to civil unrest and armed conflicts, respectively. Outside of Sudan, the number of endemic villages has been reduced from more than 23,000 in 1993 to just more than 3,200 in 1998 (Figure 3), while the number of cases reported outside of Sudan has been reduced from 218,071 to 30,546 during the same period. Since some 3.2 million cases were estimated to occur in 1986, the overall number of cases has been reduced by more than 97% (Table 1).<sup>5</sup>

Sudan remains the major challenge to eradication. It reported 61% of global cases in 1998, which was the fourth straight year that this worn-torn country reported half or more of all cases. The 10 northern states of Sudan, which are aiming to halt transmission of dracunculiasis by December 1999, reported only 132 cases (63 of which were not indigenous, i.e., were imported from southern Sudan) during January–July 1999, a reduction of 62% from the 349 cases reported during the same period in 1998.

As of July 1999, the endemic countries outside of Sudan, Nigeria, and Ghana have reduced their numbers of cases reported by 38% to 3,995, compared with 6,436 cases reported by the same countries in the same period of 1998 (Figure 4). Ghana and Nigeria have reported increases of

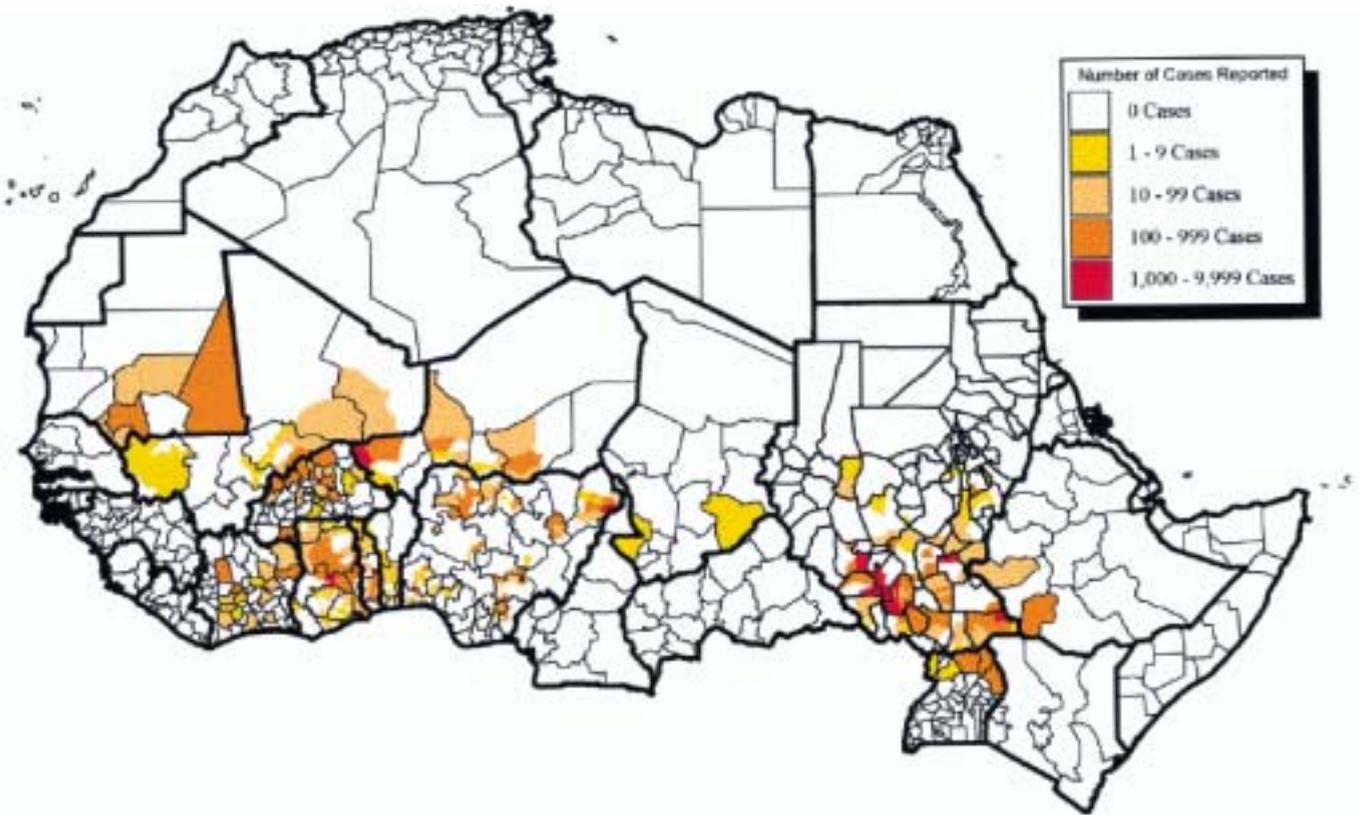


FIGURE 1. Distribution in Africa of 78,557 cases of dracunculiasis reported during 1998 by level of cases reported.

48%, and 5% in cases, respectively during January–July 1999, compared with the same period of 1998, whereas Sudan reported an increase of 31% during January–July 1999, compared with the same months in 1998.

Meanwhile, more than twice as many cases were documented as having been imported/exported from one country to another in 1998: 276 cases (of which 168 were exported from Sudan), as compared with 124 such cases in 1997. In 1998, Cameroon, Chad, Ethiopia, Ghana, Uganda, and Yemen were offering small cash rewards for reporting of a case to increase the sensitivity of their reporting systems. During 1999, other countries, e.g., Benin, Niger, and Togo, were also considering instituting small cash rewards for reporting of cases. The use of rewards for reporting of cases, a strategy used during the eradication of smallpox, requires proper management (i.e., supervision and fiscal accounting) to minimize abuses, but so far it has proven to be effective in improving the sensitivity of surveillance of dracunculiasis, and there are no reported untoward happenings to date. Political leaders participated in program events in at least seven endemic countries in 1998, including visits to endemic villages by ministers of health in Cote d'Ivoire, Niger, and Togo. Former heads of state of Mali (General Amadou Toumani Toure) and the United States (Jimmy Carter) addressed the Seventh African Regional Conference on Dracunculiasis, which was convened in Bamako, Mali early the same year, and another former head of state, General Yakubu Gowon, agreed to assist in the final stages of the eradication program in Nigeria.

The International Commission for the Certification of Dra-

cunculiasis Eradication met for the third time at WHO headquarters in February 1998, and recommended an additional 88 countries or territories to be certified, thus increasing the total number of countries certified so far to 109.<sup>4</sup> The Commission will hold its fourth meeting in 2000.

#### DISCUSSION

The plateau in reduction of the total number of cases globally since 1995 (Table 1) is due to several problems, among which under-funding, and inadequate focus on specific control measures and supervision were perhaps the most relevant, in addition to the on-going war in Sudan. Other country-specific factors were also involved in Ghana (ethnic clashes, delayed funding) and Nigeria (ethnic clashes, under-funding, fuel shortages, strikes). As stated previously, only four endemic countries were conducting national dracunculiasis eradication campaigns as of 1990.<sup>1</sup>

In Sudan, the number of cases increased dramatically in 1995–1996 as a result of the greater access and program activity that began with and followed the “Guinea Worm Cease-Fire” in 1995. Since then, cases have fluctuated, depending on the vagaries of the war: lack of access, sporadic evacuations of international staff from endemic areas because of insecurity and restored access. Inadequate funding is also a serious problem for the program in Sudan because of donor concerns and recognition that only so much can be done so long as the civil war continues.

The apparent impasse in Ghana since 1994 is due to several factors: ethnic conflict in the highest endemic area of

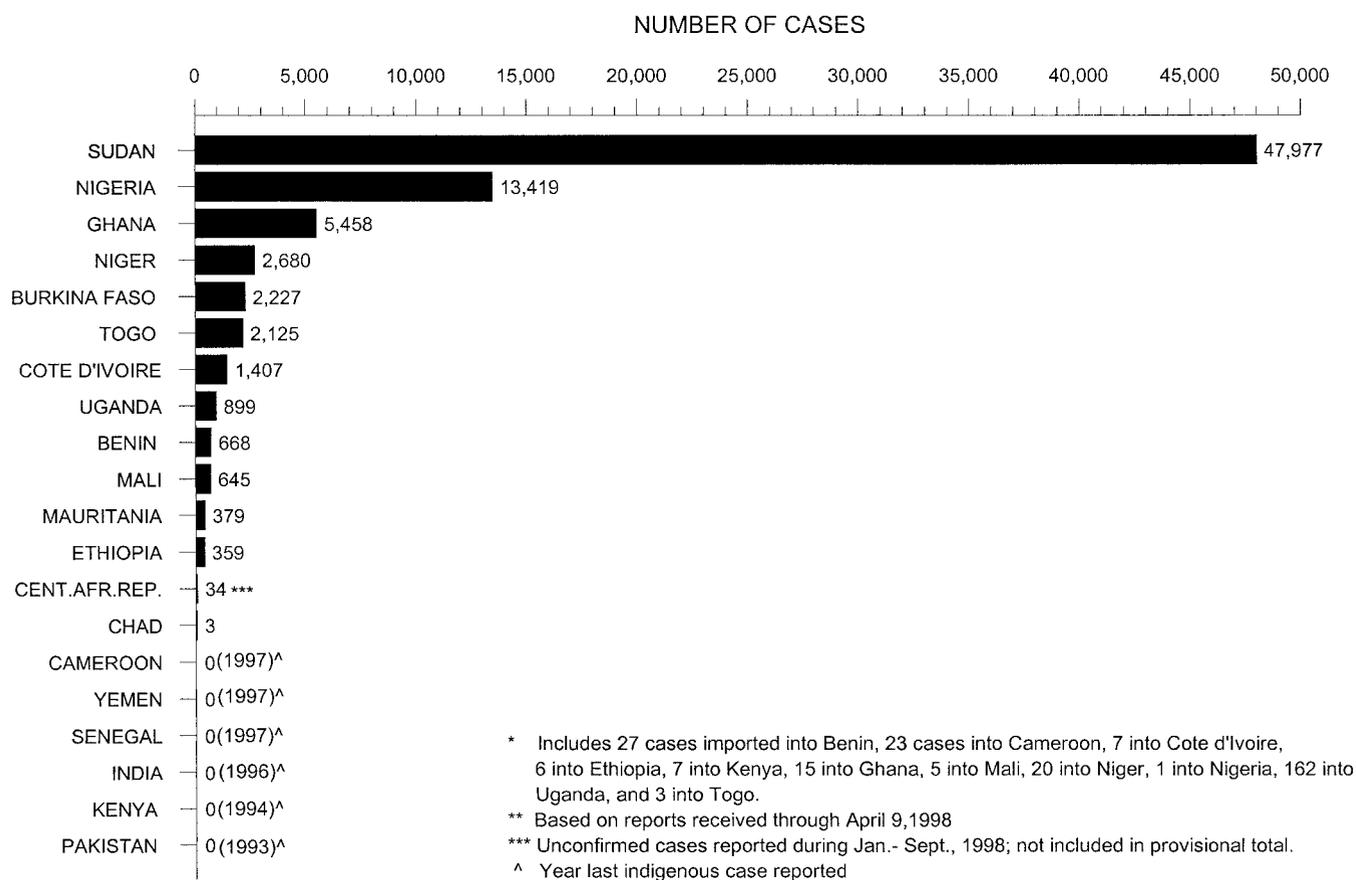


FIGURE 2. Distribution by country of 78,522\* cases of dracunculiasis reported during 1998.\*\*

the country during the peak transmission periods in 1994 and 1995, inadequate funding in 1994–1997, delayed funding in 1997–1998, shortages of Abate®, distraction due to introduction of a new surveillance system with an over-sensitive case definition (resulting in the program needing to check numerous unconfirmed case reports), inadequate supplies of filter material, great energy spent doing surgical extractions of worms instead of on less labor-intensive means of preventing infections, and poor supervision of village-based health workers. The Government of Ghana, The Carter Center, UNICEF and WHO began working to eliminate these problems in September 1998.

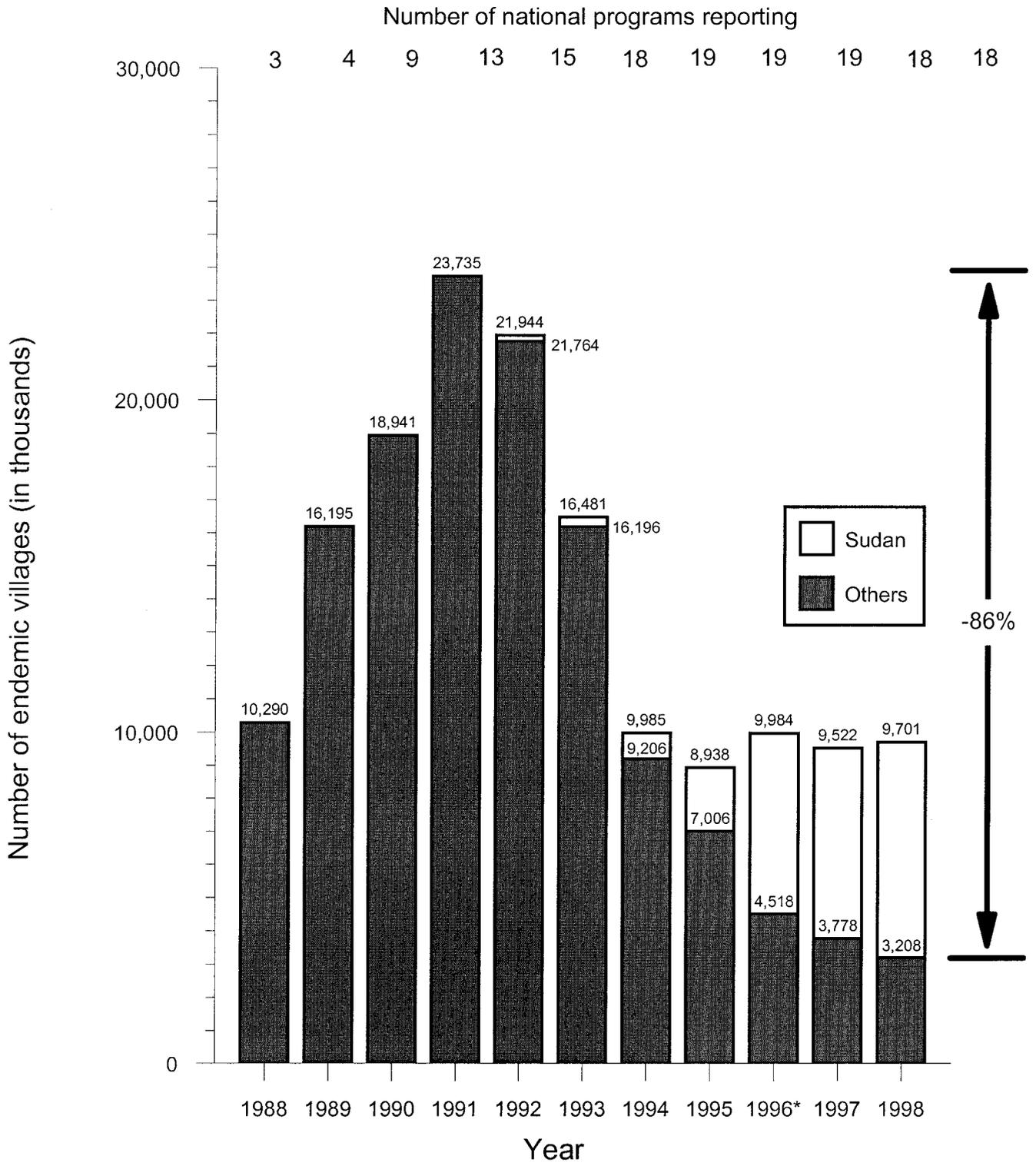
The Nigerian program has suffered in recent years from ethnic clashes, under-funding, inadequate supplies of filter material, and from fuel shortages, strikes, and official neglect associated with political disturbances over the past two years. The Federal Government of Nigeria and its major external partners have corrected these problems in 1999 by providing more funding and political support, assignment of new personnel, enlistment of General Gowon, and provision of short-term consultants to help ensure optimal supervision of village-based health workers in the highest-endemic areas.

Although we are now well past the original target date of December 1995 for interrupting transmission of dracunculiasis, re-mobilization for the final push began at the Seventh Regional Conference in Bamako in March/April 1998, and funding for the campaign has also improved substantially since the previous review in this journal. Data from the first

half of 1999, as cited above, indicate that most countries are again making substantial progress. Several specific additional measures (e.g., increased technical consultations, transportation, and supplies; enlistment of General Gowon) are also underway to turn the tide in Ghana and Nigeria, which pose the greatest remaining challenges outside of Sudan. However, the impact of those activities will not be evident until later in 1999 because of the one-year incubation period of the disease. In Burkina Faso, current levels of reporting and interventions are low and the program is being reorganized.

The economic benefits from eradication of dracunculiasis have been estimated in a World Bank study by comparing the increases in agricultural productivity resulting from the prevention of cases.<sup>6</sup> Using a project horizon of 1987–1998 and conservative assumptions (5 weeks) regarding the average duration of incapacitation caused by dracunculiasis, the economic rate of return (ERR) is 29%. Institutions such as The World Bank consider ERRs in excess of 10% to represent a sound economic investment. These economic benefits hold if the campaign is achieved within 3 years beyond 1998, i.e., by 2001. The longer it takes for eradication, the lower the projected economic returns.

The main interim goal now, agreed at Bamako in 1998, is to stop all transmission of dracunculiasis outside of Sudan by the end of 2000. Programs will need to make special efforts to reach affected nomadic populations, and infected persons in scattered hamlets. The most important operational



\* WHO certifies the absence of dracunculiasis from Pakistan

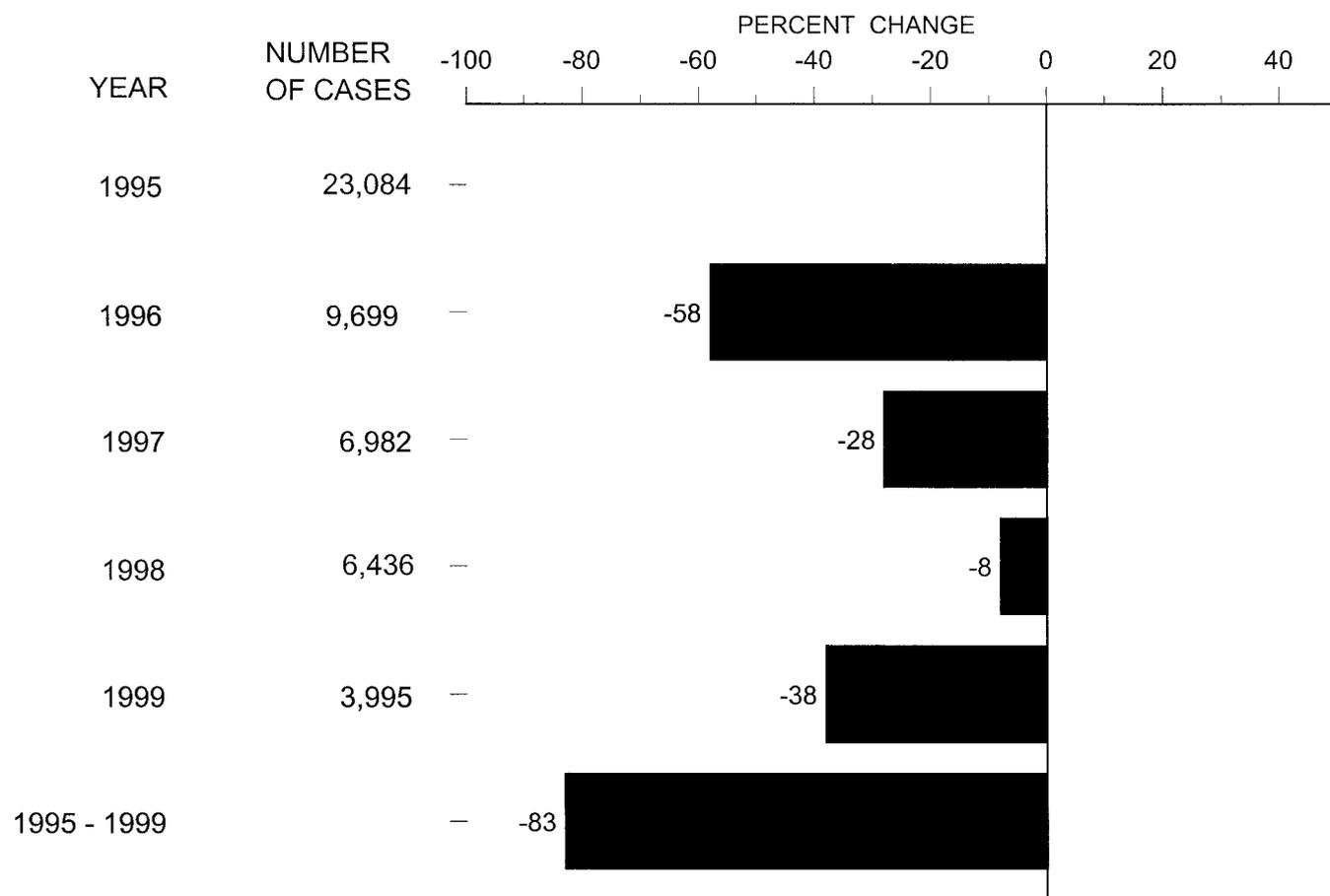
FIGURE 3. Number of national programs, and number of endemic villages reporting cases of dracunculiasis in 1988–1998. WHO = World Health Organization.

TABLE 1  
Number of cases of dracunculiasis reported by country: 1990–1998\*

| Country                   | Year and number of cases reported |         |         |         |         |         |         |        |        |
|---------------------------|-----------------------------------|---------|---------|---------|---------|---------|---------|--------|--------|
|                           | 1990                              | 1991    | 1992    | 1993    | 1994    | 1995    | 1996    | 1997   | 1998   |
| Benin                     | 37,414                            | 4,006   | 4,315   | 13,887  | 4,302   | 2,273   | 1,427   | 855    | 695    |
| Burkina Faso              | 42,187                            | NR      | 11,784  | 8,281   | 6,861   | 6,281   | 3,241   | 2,477  | 2,227  |
| Cameroon                  | 742                               | 393     | 127     | 72      | 30      | 15      | 17      | 19     | 23     |
| Central African Republic† | 10                                | NR      | NR      | NR      | NR      | NR      | 9       | 5      | 34     |
| Chad                      | NR                                | NR      | 156     | 1,231   | 640     | 149     | 127     | 25     | 3      |
| Cote d'Ivoire             | 1,360                             | 12,690  | NR      | 8,034   | 5,061   | 3,801   | 2,794   | 1,254  | 1,414  |
| Ethiopia                  | 2,333                             | NR      | 303     | 1,120   | 1,252   | 514     | 371     | 451    | 366    |
| Ghana                     | 123,793                           | 66,697  | 33,464  | 17,918  | 8,432   | 8,894   | 4,877   | 8,921  | 5,473  |
| India                     | 4,798                             | 2,185   | 1,081   | 755     | 371     | 60      | 9       | 0      | 0      |
| Kenya                     | 6                                 | NR      | NR      | 35      | 37      | 23      | 0       | 6      | 7      |
| Mali                      | 884                               | 16,024  | NR      | 12,011  | 5,581   | 4,218   | 2,402   | 1,099  | 650    |
| Mauritania                | 8,036                             | NR      | 1,557   | 3,533   | 5,029   | 1,762   | 562     | 388    | 379    |
| Niger                     | NR                                | 32,829  | 500     | 21,564  | 18,562  | 13,821  | 2,956   | 3,030  | 2,700  |
| Nigeria                   | 394,082                           | 281,937 | 183,169 | 75,752  | 39,774  | 16,374  | 12,282  | 12,590 | 13,420 |
| Pakistan                  | 160                               | 106     | 23      | 2       | 0       | 0       | 0       | ~      | ~      |
| Senegal                   | 38                                | 1,341   | 728     | 630     | 195     | 76      | 19      | 4      | 0      |
| Sudan                     | NR                                | NR      | 2,447   | 2,984   | 53,271  | 64,608  | 118,578 | 43,596 | 47,977 |
| Togo                      | 3,042                             | 5,118   | 8,179   | 10,394  | 5,044   | 2,073   | 1,626   | 1,762  | 2,128  |
| Uganda                    | 4,704                             | NR      | 126,369 | 42,852  | 10,425  | 4,840   | 1,455   | 1,374  | 1,061  |
| Yemen                     | NR                                | NR      | NR      | NR      | 106     | 82      | 62      | 7      | 0      |
| Total                     | 623,579                           | 423,326 | 374,202 | 221,055 | 164,973 | 129,834 | 152,805 | 77,858 | 78,523 |

\* NR = no report.

† Reported 10, 9, 5, and 34 alleged (unconfirmed) cases of dracunculiasis in 1990, 1996, 1997, and 1998, respectively. Not included in totals.



\* Provisional

FIGURE 4. Percent change in number of cases of dracunculiasis reported in countries outside Ghana, Nigeria, and Sudan: January–July 1995 to January–July 1999.\*

need now is to improve the quality and frequency of supervision of village-based health workers, so as to help them improve active surveillance for cases and tighten case-containment measures. The next most important need is to advocate for a solution to the civil war in Sudan, so that the final battle against dracunculiasis can be intensified and extended to all endemic areas of that large country.

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