Editorial: Dracunculiasis eradication by 2009: will endemic countries meet the target?

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Introduction

As the global campaign for eradication of poliomyelitis encounters delays and difficulties (Fine & Griffiths 2007), some eyes are turning to the eradication of dracunculiasis (Guinea worm disease) as the ‘other’ prospect offering a potential high-profile success for public health in the next few years (Al-Awadi et al. 2007). Certainly, dracunculiasis eradication has come a long way in two decades, eliminating the disease from Asia, more than halving the number of endemic countries, and reducing the annual incidence from an estimated 3.5 million in 1986 to only 25 000 today (Hopkins et al. 2005; Barry 2006). The impact of Guinea worm disease on agricultural productivity in some parts of Nigeria was once so powerful and widespread that it could be seen from space (Ahearn & de Rooy 1996); now there are whole countries in Africa where the disease is no more than a fading memory, and a small scar on the legs of the middle-aged. And this has been achieved in some of the most remote and undeveloped communities in some of the poorest countries on the planet.

The remarkable success of the initiative over the last two decades can be judged from Figure 1, showing the trend in reported cases of the disease over the years, for eight of the countries which have interrupted transmission. Note the logarithmic scale. The dotted line to the right of the figure shows that most countries have achieved a reduction in incidence by 50% or better in a typical year, and sustained that rate of decline over a protracted period of time.

The good progress made so far, and the need to maintain optimism among field staff and funders, has inspired the setting of target dates for eradication, which have suffered from wishful thinking over the years (Fine & Griffiths 2007). Some countries have interrupted transmission, but the disease continues to be a serious problem in some areas. The impact of Guinea worm disease on agricultural productivity in some parts of Nigeria was once so powerful and widespread that it could be seen from space (Ahearn & de Rooy 1996); now there are whole countries in Africa where the disease is no more than a fading memory, and a small scar on the legs of the middle-aged. And this has been achieved in some of the most remote and undeveloped communities in some of the poorest countries on the planet.

The need for evidence, and for evidence-based strategy

Ideally, setting a realistic target, as well as defining a strategy to reach it, should be guided by evidence-based estimates of the impact of interventions. This has proven difficult because of unreliable intervention data and a lack of rigorous impact evaluations. Since the early study in four villages of Burkina Faso, which set the model for most national eradication programmes (Guiguêmé 1985), only a few published studies have estimated the impact of the main interventions; for example, Huttly et al. (1990) showed the impact of provision of safe water supply on reduction of guinea worm cases in endemic areas of Nigeria, and Tayeh et al. (1996) measured the impact of health education and use of cloth filters on the reduction of dracunculiasis incidence in Ghana. But those were small scale studies involving only a few villages and covering only one year or little more.

In the early 1990s, UNICEF sponsored the Dracunculiasis Operational Research Network, which supported five small projects in endemic countries in West Africa. Several of these projects provided the pilot models for the full-scale national eradication programmes which soon followed, but the spirit of enquiry they engendered was not sustained in the subsequent years, with a few exceptions (Cairncross et al. 1999).

Increasing effort and resources have been devoted in recent years to the early detection and containment of cases. Inspired by the success of the surveillance and
containment or ‘search and contain’ strategy in the smallpox eradication campaign (Foège et al. 1975), this additional activity increases the cost of the programme significantly (Cairncross et al. 1996), but no detailed evaluation of its effectiveness has been published. A superficial examination of national data suggests that it may have undermined the efficacy of the programme as a whole (Cairncross et al. 2002), by diverting attention from the basic preventive interventions. In some countries, cash rewards for the early reporting of cases have been introduced in support of case containment, but the results have been mixed. An evaluation in Ghana found anecdotal evidence of their effectiveness in some settings (WHO 1997), but shortly thereafter Ghana’s programme abandoned the measure.

Such decisions have often been made on the basis of strongly held opinions, rather than careful weighing of the evidence. Contrary to widespread belief, the need for objective operational research, and for a normative body to make evidence-based recommendations on strategy, does not diminish as the eradication campaign moves toward its goal; if anything, the need increases. The global Guinea worm eradication initiative suffers from the lack of both.

An important form of operational research is the external evaluation of national programmes. These have not always been carried out as often as would be desirable, and the resulting recommendations have not always been implemented. Pakistan’s successful eradication programme was evaluated every year except 1990 (K. Kappus, personal communication), and its performance in 1990–91 was significantly poorer than usual; the curve for Pakistan in Figure 1 clearly shows the cost of failing to evaluate.

**Setting a target date**

An evidence-based approach to choosing a target date, more feasible now than in the past, is to examine the experience of those countries which have interrupted transmission in recent years, and how long it took them to do this, in relation to the initial number of cases. Table 1 shows the data for the 11 countries that have interrupted dracunculiasis transmission so far (Benin, Cameroon, Central African Republic, Chad, India, Kenya, Mauritania, Pakistan, Senegal, Uganda and Yemen), taken from reports in the WHO Weekly Epidemiological Record. India and Pakistan started their eradication programmes relatively early (1985 and 1987 respectively) while the remaining countries started between 1989 and 1993. The nine countries which are still endemic, also shown in Table 1, have been pursuing eradication activities for 15 years or more, with the exception of Togo (13 years) and Sudan (10 years), which arguably took its national eradication effort to full scale only a year ago, after the signing of the peace accord.

For the successful countries, the initial number of cases (Usually the maximum reported by the programme after it was taken to full scale) is plotted against the number of years needed to be disease-free in Figure 2. For example, although Benin may have started its eradication activities for 15 years or more, with the exception of Togo (13 years) and Sudan (10 years), which arguably took its national eradication effort to full scale only a year ago, after the signing of the peace accord.

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Although Chad reported zero indigenous cases in 1999, a WHO evaluation (WHO 2001a) revealed that three cases occurred in 2000 but were not reported to the national level because of difficult access during the rainy season. Thus, it was considered as endemic to the end of 2000.

As Figure 2 shows, the more cases were reported by a country at the beginning of its campaign, the longer it took to eliminate the disease. Again, the number of cases is represented on a logarithmic scale, which corresponds to the experience of the endemic countries. For example, it took only four years for Uganda to reduce the annual incidence of dracunculiasis from 126,369 cases to 1,455, but double that time (8 years) to reduce the incidence from 1,455 to zero cases. If each country reduced its cases each year by a constant proportion, such as 50%, the relationship would be linear on a log scale.

Four countries (Mauritania, Benin, India and Uganda) started with more than five thousand cases each. Each required from 11 to 12 years to reach zero cases. A further group of countries each reported relatively low initial numbers, ranging from 871 cases for Cameroon to 2,400 cases for Pakistan. These countries needed 6–9 years to eliminate the disease. Finally, there were three countries which started with less than 100 cases, and took 4 years or less to eliminate the disease.

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As well as the country data points, Figure 2 shows the regression line for the dataset as a whole. The correlation was significant on Pearson Correlation ($\chi^2 = 0.455$, $p = 0.160$), with a slope corresponding to a reduction of 42% per year. Countries above the line performed better than average – achieving zero cases in less time, or starting
from a higher initial incidence, than the others. From that point of view Pakistan and Uganda, at different points along the graph, can be considered as examples of best practice in guinea worm eradication. The currently endemic countries are unlikely to do better than them without substantially increased resources – and resources bring their own problems, as discussed below.

Prognosis

What of the nine countries that were still endemic at the end of 2006? All but two of them had less than 400 cases, and five of them had less than 30 cases each. The shaky progress of three of them, Ghana, Mali and Sudan, is shown in Figure 3. Nigeria fits the pattern seen in Figure 2; having started with an unusually large number of cases (over 640 000 in 1989), it is on track to reach zero in a year or two. Sudan, as mentioned, did not take its programme to scale until last year, because of conflict, and conflict in parts of Mali and Niger has also delayed progress in those countries.

Problems in Ghana have been more complex. Ten years ago an ethnic conflict did affect Ghana’s Northern Region, where most of the country’s cases occur, but the programme’s stagnation over the last decade has also been blamed on discontinuities of funding, and the transfer of staff and resources between ministries and between departments (WHO 2005). Part of the problem – not only in Ghana – has been the lack of a sense of ownership, at district level, of a programme which for many years has been largely driven by external funding and at times by expatriate staff employed by external agencies.

Different endemic countries have had varying degrees of success in putting preventive interventions in place, and sustaining them over the years, even by their own accounts. Table 2 shows the proportion of endemic villages with each of the main interventions. It is understandable that Sudan should not yet have achieved full coverage; but the other eight endemic countries have been pursuing the eradication goal for more than a decade, in an ever-diminishing number of endemic villages.

It is clear that the endemic countries are unlikely to interrupt transmission much faster than other countries have performed so far, for a given initial number of cases. Thus Sudan, with more than 20 000 cases in 2006, is unlikely to take much less than ten years, and Ghana, with more than 4000 cases, is likely to require at least another 8 years, even if from now on both countries match the performance of Pakistan and Uganda. There is reason to believe that there is underreporting of cases in Sudan and Ghana; if so, the current incidence is even higher than reported, and so interruption of transmission is likely to take correspondingly longer. For example, a recent evaluation of Ghana’s programme (WHO 2005) found that only 56% of the cases found had been recorded by the community-based surveillance system; that would suggest that the real national total in 2006 was closer to 7400 than the reported 4100 cases.

Some questions for operational research

The need to assess the effectiveness of case containment and of cash rewards – particularly debatable in countries which still have many cases – has already been mentioned. There seems to be considerable churning in the list of endemic villages from year to year, more than the 30% observed in the early years of the campaign (Cairncross et al. 1996). For example, in Ghana 43% or 426 villages were re-infected out of 981 villages that reported cases in 2000. How many of the apparently new endemic villages

Figure 3 Annual number of dracunculiasis cases reported in Ghana, Mali and Sudan comparison with line representing 50% annual reduction.
are previously endemic, which were dropped from the list prematurely?

Some national programmes focus selectively on ‘highly endemic’ villages with more than five cases; how wise is this?

A number of countries and districts claim to have distributed filters to the entire population at risk for years, but still have cases. What are the limits and constraints to the use of cloth filters? In countries where coverage of safe water supply is low, is it realistic to depend upon distribution of filters to interrupt transmission?

Treatment of water sources with Abate® to kill cyclops, the worm’s intermediate host, has proven to be very effective in several countries, including India. In one district (Dhar) in Madhya Pradesh State in India, which reported 13 guinea worm cases in 1994, the programme used 2044 l of Abate® in that year. This compares with Ghana’s use of only 4000–5000 l of Abate® in 2005 when it had 3981 guinea worm cases. There are fewer water sources per village in most of West Africa than in India, but there are a number of challenges to the use of cyclopicide in African settings (Cairncross 1993). How much does it add to a programme’s effectiveness?

In some countries, the disease appears to have been moving from one village to another in a relatively small area. Are there advantages to using the sub-district, rather than the village, as unit of surveillance and interventions?

Table 2 Number of cases, endemic villages (i.e. villages with cases), and percentage of endemic villages where interventions were applied 2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of cases in 2006</th>
<th>Number of villages reporting cases</th>
<th>% Cases contained</th>
<th>Village volunteer</th>
<th>Health education</th>
<th>Filter distribution</th>
<th>Abate application</th>
<th>Safe water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudan</td>
<td>20 582</td>
<td>3346</td>
<td>49</td>
<td>82</td>
<td>71</td>
<td>47</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Ghana</td>
<td>4136</td>
<td>606</td>
<td>75</td>
<td>100</td>
<td>98</td>
<td>95</td>
<td>66</td>
<td>47</td>
</tr>
<tr>
<td>Mali</td>
<td>329</td>
<td>88</td>
<td>82</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>92</td>
<td>24</td>
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<tr>
<td>Niger</td>
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<td>34</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>11</td>
</tr>
<tr>
<td>Nigeria</td>
<td>16</td>
<td>7</td>
<td>69</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>49</td>
<td>51</td>
</tr>
<tr>
<td>Togo</td>
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<td>79</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>67</td>
<td>50</td>
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<tr>
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<td>100</td>
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<td>100</td>
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</tr>
<tr>
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<td>4</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

Sources: Country reports presented during Dracunculiasis Eradication Review Meeting for Programme Managers, Ouagadougou, Burkina Faso from 27 to 29 March 2007.

Conclusion: some lessons from experience

Clear eradication will take quite a few years yet, although it would be possible to eliminate the disease from seven countries in a couple of years, leaving only two endemic countries – Sudan and Ghana. One lesson to be drawn, from the problems of local ownership and the experience of cash rewards, is that there are dangers in throwing money at the problem. While the eradication initiative badly needs additional resources (Al-Awadi et al. 2007), it needs them at such a level and managed in such a way that they do not distort the priorities of the health care system, or exceed the capacity of local staff to manage them. The amounts needed are not large, but their continuity and flexibility is important. Given the highly seasonal transmission of dracunculiasis, the resources must be available at very specific times of the year, which is not always achieved under the Sector Wide Approach (SWAp), or Poverty Reduction Strategic Plan (PRSP) funding arrangements. Some of those resources must be set aside for regular programme evaluations and operational research.

Disclaimer

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