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Public health

Global health goals: lessons from the worldwide effort to eradicate poliomyelitis

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The Global Polio Eradication Initiative was launched in 1988. Assessment of the politics, production, financing, and economics of this international effort has suggested six lessons that might be pertinent to the pursuit of other global health goals. First, such goals should be based on technically sound strategies with proven operational feasibility in a large geographical area. Second, before launching an initiative, an informed collective decision must be negotiated and agreed in an appropriate international forum to keep to a minimum long-term risks in financing and implementation. Third, if substantial community engagement is envisaged, efficient deployment of sufficient resources at that level necessitates a defined, time-limited input by the community within a properly managed partnership. Fourth, although the so-called fair-share concept is arguably the best way to finance such goals, its limitations must be recognised early and alternative strategies developed for settings where it does not work. Fifth, international health goals must be designed and pursued within existing health systems if they are to secure and sustain broad support. Finally, countries, regions, or populations most likely to delay the achievement of a global health goal should be identified at the outset to ensure provision of sufficient resources and attention. The greatest threats to poliomyelitis eradication are a financing gap of US\$210 million and difficulties in strategy implementation in at most five countries.

Increasing travel and globalisation of commerce has far-reaching implications for health.^{1,2} Substantial attention has been given to the threats that globalisation poses to the management of infectious diseases, but less to its opportunities.^{1,2} Heightened international awareness of the burden and threat of many infectious diseases has spawned partnerships and alliances to coordinate additional resources for their control.

Though the most cited example of international collaboration is the Global Fund to Fight AIDS, Tuberculosis and Malaria,³ it is only the most recent. Perhaps the best example of such collaboration was the successful international effort to eradicate smallpox in the 1960s and 1970s.⁴ More recently, coordinated efforts to combat global health threats have included the Global Partnership to STOP TB,⁵ the Roll Back Malaria Initiative,⁶ and the Global Alliance for Vaccines and Immunization (GAVI).⁷ Innovative strategies have also been established to tackle non-communicable diseases, most notably through the Framework Convention on Tobacco Control.⁸

Common to these initiatives has been the conviction that coordinated international action is in the interest of all countries. It has even been argued that these initiatives are “global public goods for health”.⁹ The effort to eradicate poliomyelitis is one such initiative, since once eradication has been achieved, everyone will be protected from the virus and one person’s protection will not reduce that available to others.^{10,11} In this paper, we assess the politics, production, financing, and economics of poliomyelitis eradication to identify lessons that might be relevant to the pursuit of other global health goals.

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Politics and process

The decision to pursue eradication

The successful conclusion of the international smallpox eradication campaign in 1977 created substantial interest in further eradication efforts. However, enthusiasm was countered by concerns that targeted objectives could compromise efforts to develop strong primary health-care systems¹² and by doubts about the technical feasibility of eradicating any organism after smallpox.^{13,14} The most important factor in overcoming scientific concerns was the interruption of poliovirus transmission in large areas of the Americas by use of a four-pronged strategy.¹⁵ The leadership for launching a global poliomyelitis eradication initiative was secured at a meeting in March, 1988, at which the WHO Director-General was convinced of the merit of such an effort.^{12,16} 2 months later, the World Health Assembly, consisting of the ministers of health of all member states, unanimously adopted a poliomyelitis eradication resolution.¹⁷

The eradication goal was subsequently reviewed and endorsed by the 1990 World Summit for Children—the largest ever gathering of heads of state.¹⁸ Leaders from low-income, middle-income, and high-income countries have continued to reaffirm their commitment to poliomyelitis eradication through resolutions adopted in forums such as the Organization of African Unity, the South Asian Association for Regional Cooperation, and G8 summits.^{19–21}

Implementation of strategies

By the end of 2000, every country had introduced the WHO-recommended poliomyelitis eradication strategies or a variant thereof, but the effort required to do so was correlated inversely with countries’ incomes. In the few high-income countries in which poliomyelitis cases were reported in 1988 (eg, France and Spain) elimination of the virus was relatively straightforward because of temperate climate, higher vaccine effectiveness in such settings, high levels of sanitation, and strong health systems. By contrast, eliminating endemic poliomyelitis from low-income countries has required massive efforts sustained for 5–10 years. Implementation of National Immunisation Days (NIDs) has been a huge challenge; in China and India, for example, about 80 million and 150 million children, respectively, were immunised in a few days—the achievement was repeated 1 month later, and then annually

for more than 5 years.^{22,23} Because of the huge numbers of people and vehicles required to implement NIDs, governments of many countries have drawn heavily on the private sector, as well as on ministries of information, transport, and defence, among others, to help reach all children.²⁴

People crossing borders can transmit poliomyelitis during the interval between NIDs being held in one country and in its neighbour. Recognising this factor, many countries have synchronised their NIDs (figure 1). In Operation MECACAR for example, 18 Asian, European, and Middle Eastern countries immunised 55 million children in April and May, 1995, and repeated the activity each year for 3 years.²⁵ Similar coordination followed in south Asia, West Africa,^{20,26} and then Central Africa, where the conflict-affected countries of the Democratic Republic of the Congo, Angola, Congo, and Gabon synchronised three rounds of NIDs in July–September, 2001, to immunise 15 million children.^{26,27}

By the year 2000, all poliomyelitis-affected countries were reporting standardised data for acutely paralysed children and surveillance performance to WHO either weekly or monthly.²⁸ Central to this surveillance capacity has been a worldwide laboratory network for enterovirus diagnosis that now comprises 145 facilities.²⁷ Even in conflict-affected areas such as Afghanistan, the Democratic Republic of the Congo, and Somalia, surveillance in 2001 was nearing the international standard that will be required for poliomyelitis-free certification.²⁹

Coordination

Though poliomyelitis eradication activities have been led, coordinated, and implemented by the governments of poliomyelitis-affected countries, the support of a public-private partnership has been essential. This partnership,

spearheaded by WHO, Rotary International, the US Centers for Disease Control and Prevention (CDC), and UNICEF has facilitated the inputs of donor governments and a vast array of other organisations. The most remarkable of these partners is Rotary International, a private-sector service organisation, which will have contributed nearly US\$600 million of its own resources by the end of 2005 in addition to mobilising much of the money contributed by governments.

To coordinate this partnership, mechanisms were established at global, regional, and country levels for strategic planning, policy development and priority setting, resource mobilisation, and financing. Additional mechanisms were established to manage the laboratory network and govern the process for eventually certifying the world as free from poliomyelitis.

Financing and economics

Direct costs

A conservative estimate of the financial and in-kind expenditures in poliomyelitis-endemic countries was generated on the basis of the number of hours worked per country to implement NIDs, the most expensive and labour-intensive eradication strategy. Without wishing to diminish the broader significance of this largely volunteer effort to the success of the initiative, for the purposes of economic evaluation it has been valued by use of labour market rates from the statistical database for the year 2000 world development indicators.³⁰ On the basis of these calculations, poliomyelitis-endemic countries will have contributed at least \$2.35 billion in wages alone between 1988 and 2005.³¹ This figure does not include substantial government and private-sector resources to pay for petrol, social mobilisation, training, and other costs. Furthermore, opportunity costs have not been included. Such costs are substantial; in 2001 alone, an estimated

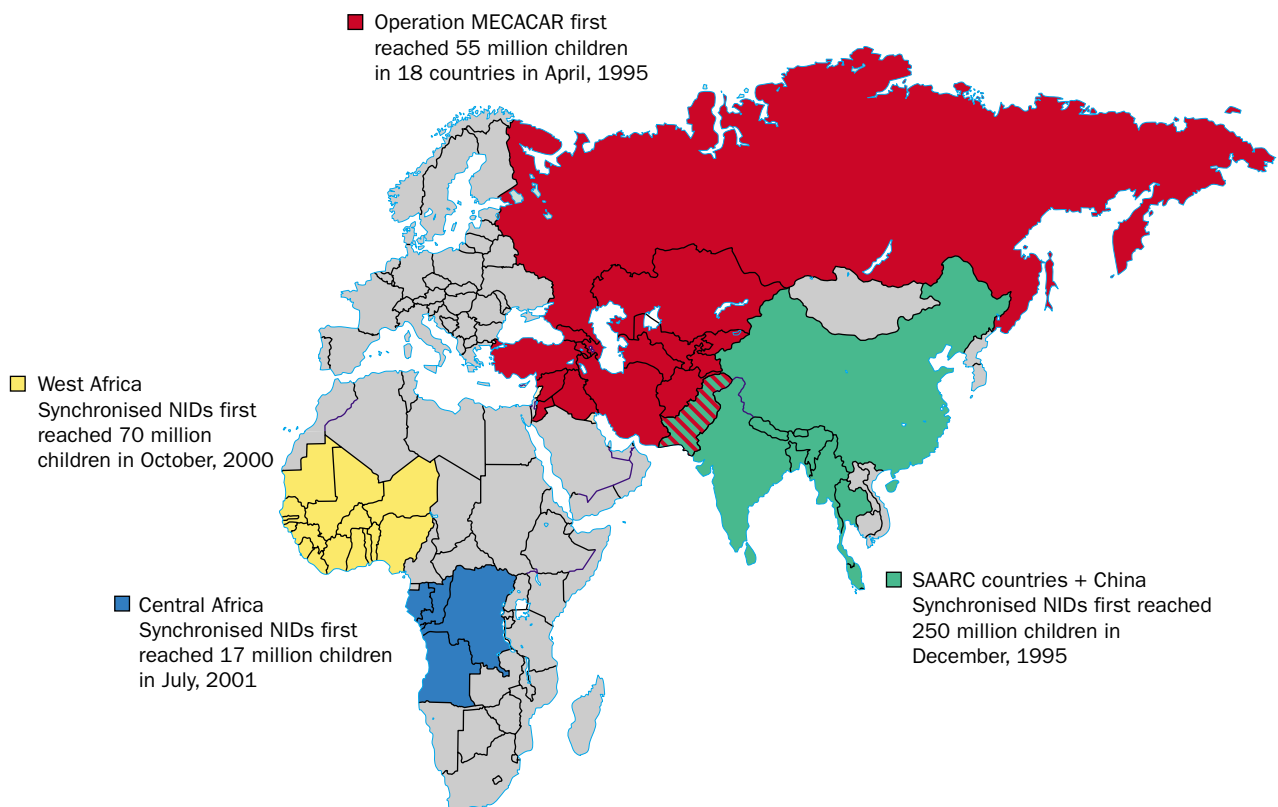


Figure 1: Examples of coordinated NIDs for poliomyelitis eradication

Contribution (US\$ million)	Public-sector partners	Intergovernmental institutions	Private-sector partners
>500	USA	None	Rotary International
250–500	UK	None	None
100–249	Japan, Netherlands	None	None
50–99	Canada, Germany	World Bank	Bill and Melinda Gates Foundation
25–49	Denmark	European Commission	UN Foundation
5–24	Australia, Belgium, Norway	American Development Bank, UNICEF, WHO	Aventis-Pasteur, International Federation of Pharmaceutical Manufacturers Association
1–4	Ireland, Italy, Luxembourg, Switzerland	None	DeBeers, Wyeth Pharmaceuticals

Table 1: Major public and private-sector donors to the Global Polio Eradication Initiative as of end-2002, including pledges to 2005

10 million people participated in the immunisation of 575 million children during poliomyelitis campaigns. Many of these people were government employees who were temporarily released from regular duties.

Between 1988 and 2005, external sources will have provided at least \$3 billion to poliomyelitis-endemic countries.³² Of more than 100 external donors to date, 26 have already contributed more than \$1 million and 12 at least \$25 million (table 1); some, such as Rotary International, are not traditional sources of overseas development assistance. Central tracking of resource requirements and funding flows, and multilateral and bilateral funding mechanisms, have enabled efficient accommodation of the needs of donors and recipient countries.³³ The total cost of poliomyelitis eradication during 1988–2005 will be more than \$5 billion.

Direct benefits

A cost-benefit analysis of the PAHO regional programme noted “. . . polio eradication appeared economically justified solely in terms of reduced treatment costs, irrespective of reduced pain, suffering and incapacitation”, calculating that the net present value of discounted savings during a 15-year period from the start of the campaign was \$62.1 million.³⁴ A similar analysis for worldwide eradication throughout 1988–2040 showed that even when including only the savings in direct costs for treatment and rehabilitation, “. . . the ‘break-even’ point at which benefits exceeded costs was the year 2007, with a saving of US\$13 600 million by the year 2040”.³⁵

The cost-effectiveness of global poliomyelitis eradication was reassessed for 2001–2040 to analyse the potential effects of poliomyelitis immunisation policies that might be adopted after worldwide certification of eradication.³⁶ From an economic perspective, the best-case scenario was assumed to be cessation of routine immunisation with the oral poliomyelitis vaccine as soon as possible after interruption of wild poliovirus. The worst-case scenario was assumed to be replacement of this vaccine by universal childhood immunisation with the more expensive inactivated poliovirus vaccine to reduce the risk of vaccine-associated paralytic poliomyelitis or poliomyelitis outbreaks due to a circulating vaccine-derived poliovirus.^{37–39} In this analysis, even in the worst-case scenario, poliomyelitis eradication would save money in all countries, apart from low-income countries where the cost per discounted disability-adjusted life-year (DALY) saved would still be low, at about \$50 (table 2).

Indirect benefits and costs

The World Health Assembly resolution that launched the Global Polio Eradication Initiative stated that eradication should be pursued in ways that strengthened the delivery of primary health-care services in general and immunisation programmes in particular.¹⁷ What has been the effect of poliomyelitis eradication activities on the delivery of specific health services or the development of health systems? Three irrefutable benefits have included widespread vitamin A distribution, enhanced global surveillance capacity, and improved worldwide cooperation between enterovirus laboratories.^{40,41} By distributing vitamin A supplements during poliomyelitis NIDs, an estimated 400 000 childhood deaths were averted during 1998–99 alone, and the value of using immunisation contacts to deliver micronutrient supplements was widely reinforced.^{42,43} The surveillance capacity developed for poliomyelitis eradication has also been used to detect and respond to outbreaks of diseases such as measles, meningitis, cholera, and yellow fever.⁴⁴ The poliomyelitis-eradication infrastructure and capacity was also used to assist in the international effort to control severe acute respiratory syndrome (SARS).

However, effects on routine immunisation services have been controversial.^{45–47} The poliomyelitis initiative has invested heavily in physical and human resources for routine immunisation. The cold chain, communications, and transport capacity have been replaced or refurbished in many low-income countries, especially in sub-Saharan Africa, and tens of thousands of people have been trained or retrained worldwide in giving vaccinations. Questions have been asked, however, as to whether short-term disruptions by NIDs in the delivery of routine immunisation and other services will have long-term consequences. Evaluation of the effect on health systems has been hampered by a lack of credible baseline data, the absence of control groups, and the concurrent implementation of major health-system reforms, such as decentralisation and sector-wide approaches.^{48,49} Most commentators agree that there are positive synergies between poliomyelitis eradication and development of health systems, but opportunities have yet to be fully exploited.^{40,50}

Status of eradication and risks to completion

When the World Health Assembly voted to eradicate poliomyelitis in 1988, more than 125 countries (defined by year 2000 geographic borders) on five continents were known or suspected to have indigenous transmission of wild poliovirus (figure 2). Though only 35 031 cases were reported worldwide that year⁵¹ it is estimated that more than 350 000 children were actually paralysed.^{52,53} More than 90% of the reported cases in 1988 were in low or lower-middle income countries and half were in the Asian subcontinent—mostly in India. Outside the Americas, few areas were free of poliomyelitis—mainly industrialised countries and small island nations.

By the end of 2001, poliomyelitis was on the brink of eradication, with only ten countries in which it was endemic and 483 virologically confirmed cases that year.⁵⁴ The absence of cases in important historical poliovirus reservoirs

Income bracket	Discounted DALYs saved	Cost-effectiveness (change in \$US)	
		Best-case scenario	Worst-case scenario
High	0	0	0
Upper middle	1 641 327	1900 million	1500 million
Lower middle	8 508 889	1290 million	1100 million
Low	46 480 358	11.4 billion	–4.2 billion (net)*

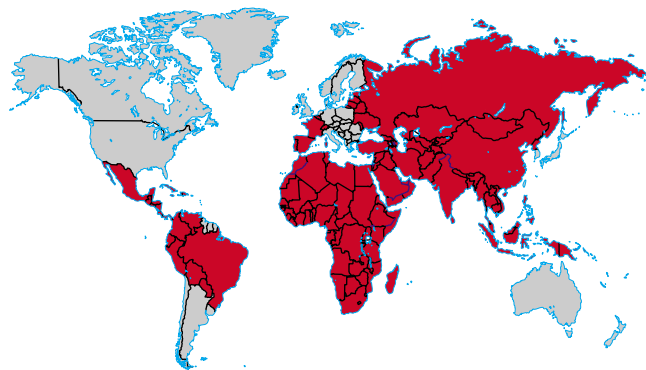
*This option yields a cost-effectiveness ratio of US\$52.50 per DALY saved.

Table 2: Projected DALYs saved and cost-effectiveness of poliomyelitis eradication, by World Bank income bracket, 2001–40

1988

>125 countries

■ Poliomyelitis endemic

**2002**

7 countries

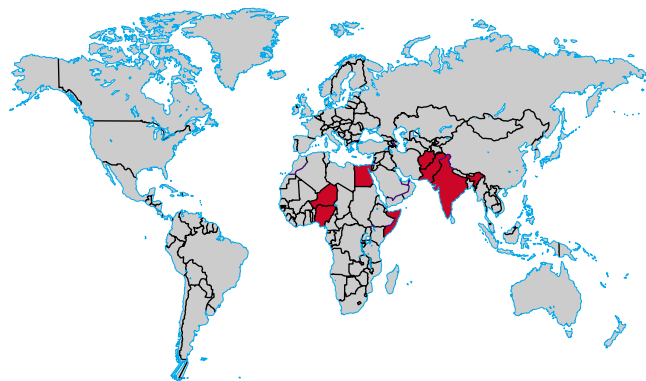


Figure 2: Distribution of endemic poliomyelitis in 1988 and at the end of 2002

such as Bangladesh and the Democratic Republic of the Congo reaffirmed the soundness of eradication strategies. On June 21, 2002, an independent commission certified the WHO region of Europe as free from poliomyelitis, bringing the total number of regions certified to three (the Americas in 1994 and the Western Pacific in 2000), comprising more than 3 billion people in 134 countries and areas. As of October, 2002, it had been 3 years since

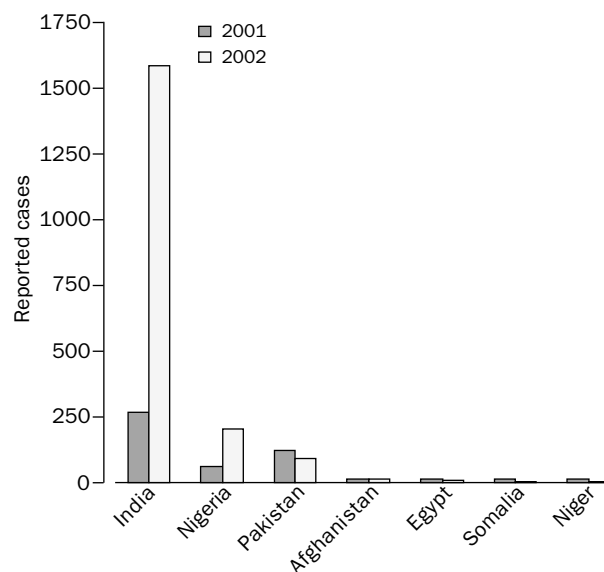


Figure 3: Comparison of virologically-confirmed poliomyelitis cases reported in 2001 and 2002, in the seven countries in which poliomyelitis was endemic at the end of 2002

indigenous transmission of type II wild poliovirus was detected anywhere in the world.⁵⁵ By the end of 2002, only seven countries—the lowest number ever—were known to have endemic poliomyelitis (figure 2).⁵⁶ The total number of cases exceeded that of 2001, however, because of marked increases in India and Nigeria (figure 3). In India, the increase was due to an epidemic that originated in the northern state of Uttar Pradesh and spread rapidly to adjoining and distant states, many of which had been free from poliomyelitis for some years. By contrast, the increase in Nigeria was largely due to improved reporting in the north of the country.

Complete eradication of poliovirus transmission will require overcoming challenges at national and international levels. At the national level, it will be essential to close gaps in the quality of supplementary immunisation activities in the six states or provinces of India, Nigeria, and Pakistan that accounted for 80% of poliomyelitis cases in 2002. Northern India in particular poses challenges, since the combination of a weak health infrastructure, fragile political alliances and, to a lesser degree, suspicion of government services by minority communities, has hampered efforts to mobilise all sectors of society and reach every child. In parts of Afghanistan, eastern Angola, and the Mogadishu area of Somalia, continued improvement in access to children is needed to break the few remaining chains of virus transmission in these areas. Internationally, the main challenge will be closing the \$210 million funding gap for activities planned for 2003–05, while maintaining political visibility of, and commitment to, the eradication of a disappearing disease.⁵⁷

Increasingly, international discussion and debate has focussed on future poliomyelitis immunisation policy. From the outset of the eradication initiative, much of the attraction of this international health goal has been the argument that its achievement would reap economic as well as humanitarian benefits. These economic benefits would accrue mainly if and when poliomyelitis immunisation could stop. That these economic benefits could accumulate in perpetuity underpinned the arguments of the champions of poliomyelitis eradication, engaged political leadership, and mobilised stakeholders, in particular those from the private sector. However, several factors have complicated the development of, and consensus on, future immunisation policy. These factors range from increasing evidence that vaccine-derived polioviruses can, albeit rarely, regain the capacity to circulate and cause outbreaks, to increasing concerns about the use of biological agents.^{36–39} Although cessation of immunisation with the oral poliovirus vaccine remains a major objective of the eradication initiative, much work is required to establish the scientific soundness, operational feasibility, and economic rationale for the strategies that have been proposed to achieve this end.³⁶

Lessons learned

In this review of the poliomyelitis eradication initiative, we have derived six lessons that could assist the planning and pursuit of worldwide health goals, whether global public goods for health or other health efforts in which international collective action might be warranted.

First, and perhaps foremost, is the need for proven tools and technically sound strategies. Additionally, their operational feasibility should be demonstrated conclusively on a large geographical scale, under as many conditions as possible, before attempting to launch a worldwide effort. International consensus on poliomyelitis eradication was achieved only after it had been shown in the Americas during the 1980s that strategies could be massively scaled

up and implemented in regions with extremely weak health systems, or that were affected by conflict, or both. Such proof is essential for obtaining and sustaining the political and financial support required for the 10–20 years needed to pursue most international health goals.

The second lesson is that any international health goal should be strongly endorsed at the highest possible level, arguably the World Health Assembly. Such endorsement will be essential for dealing with the debate and concerns that will arise as the programme is scaled up and opportunity and other costs are increasingly evident and better understood. Although prominent champions had a major role in promoting global eradication of poliomyelitis, the decision to launch the initiative followed debate at the World Health Assembly.¹² Despite consensus at that forum, an often heated debate has flared as to whether the opportunity costs of eradication outweigh benefits. Of especial concern has been whether the deployment of resources has compromised the strengthening of health systems in resource-poor countries, or limited their capacity to control other diseases. It has also been noted that some delegates to the assembly in 1988 might not have made a truly informed decision on the launching of the initiative, since there had been no clear statement on resource requirements or strategies.⁵⁸ These debates have contributed to the programme's chronic funding gap, and to the late introduction of key strategies in some countries. The cost-effectiveness analyses summarised in this paper suggest that all countries stand to benefit from this investment irrespective of income level, but this assessment is not universally accepted.

A third lesson is that efficient management is needed to achieve the necessary scale of collective action. Two major factors facilitated participation in the eradication initiative: a well defined, time-limited (1–5 days) demand on the community, and sufficient resources to enable the community to implement activities. Ensuring sufficient resources required moving beyond building an international health partnership to managing one efficiently. Critical to achieving efficiency was the use of common strategic plans, clear roles and responsibilities, and national and international forums to coordinate financing, human resources, and institutional arrangements.

Fourth, given the amount of external financing required to achieve international health goals, strategies will usually necessitate targeting political decision-makers, by means such as professional lobbying firms and international forums to establish the commitment of heads of state. Because all countries will benefit economically from poliomyelitis eradication, Rotary International, as part of its advocacy strategy, calculated so-called fair shares of the total budget to be financed by each major donor country, based on their contributions to WHO's regular budget. However, only 16 of the 22 WHO member states that traditionally give overseas development assistance had contributed to the eradication initiative by mid-2002. Of these, seven contributed the equivalent or more than their estimated fair share and nine substantially less. The six countries that did not contribute are free riders in economic terms, since they will share in the benefits. While the fair-share concept is of great value for setting resource mobilisation targets and negotiating appropriate contributions with interested donors, it has substantial limitations. Most importantly, it will not mobilise funds from donors who did not fully endorse the goal in the first place. Pursuing the fair-share argument can also unveil basic, irreconcilable disagreements on their calculation. Such limitations must be recognised early and alternate

strategies developed for settings where this argument alone is not sufficient.

Fifth, worldwide health goals should be designed so that they can be pursued within existing health systems and, ideally, contribute to the strengthening of these systems. Although proponents have stated that poliomyelitis eradication strengthens other health services, they and their detractors have used anecdotal information to argue their cases because of a lack of objective criteria and indicators. Of note, some of the largest donors to poliomyelitis eradication are those who are institutionally committed to the strengthening of health systems, but who joined the initiative after reconciliation of concerns about the effect on the delivery of other services. However, proponents of future worldwide health goals should recognise the challenge of measuring such indirect benefits, be modest in arguing their worth, and ensure there are agreed indicators and the capacity and mechanisms for their monitoring.

The final lesson is the need to identify countries, regions, or populations where strategy implementation will be particularly challenging, and to establish appropriate contingency plans. Failure in just one country could be catastrophic for an eradication effort. However, other international health goals might be similarly compromised. For example, the emergence of multidrug-resistant strains of tuberculosis in one country could hamper worldwide efforts to combat that disease.⁵⁹ Similarly, uncontrolled use of antibiotics in a few countries could seriously affect international work to contain antimicrobial resistance.⁶⁰ As the poliomyelitis eradication programme began to be implemented on a truly worldwide scale in the mid-1990s, substantial attention was given to the ten countries that had been identified as at particularly high risk for delaying global eradication. As a result of focusing additional human, financial, and political resources in these areas, five of those countries (Bangladesh, the Democratic Republic of the Congo, Sudan, Ethiopia, Angola) now seem to have eradicated poliomyelitis, and only three (India, Nigeria, Pakistan) continue to have high-intensity transmission. Although it is tempting to suggest that even greater attention earlier in the programme might have accelerated progress in these areas, the reality is that scant resources necessitated a more pragmatic approach. Other international health goals will require a similar, pragmatic approach to achieve and secure gains where possible, while developing the necessary political, financial, and human resources to address the most challenging areas.⁵⁸

Contributors

R B Aylward wrote the introductory, status, and lessons sections, and edited the manuscript. S England developed the concept and original structure and wrote the first draft of the manuscript. M Agocs did research, in particular on the background, history, and indirect benefits of poliomyelitis eradication, and wrote those sections. A Acharya did the cost-effectiveness analysis. J Linkins did the analysis of the direct national and international costs of poliomyelitis eradication and wrote the section in which they are detailed.

Conflict of interest statement

None declared.

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