

A global view of immunisation

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In looking at the present worldwide state of immunisation, I will concentrate on the progress being made in the control of six diseases mainly affecting young children, using the vaccines and equipment now at our disposal. These diseases are measles, pertussis, diphtheria, tetanus, poliomyelitis and tuberculosis.

Today's vaccines are safe, effective and available. The equipment required for storing and transporting vaccines, and for administering them, is available and adequate. The current status of vaccine coverage throughout the world is shown in Table 1.

The major problems to be solved concern:

1. The availability of management skills to ensure that adequate amounts of potent vaccine are delivered to susceptible infants, at the right times;
2. The availability of funds to pay for this system of delivery over the next few decades.

The world divides itself in two on many issues. The degree to which children are protected through immunisation is no exception. In the South, in the developing countries of the world, the six diseases referred to above are still responsible for considerable mortality and morbidity, particularly in very young children. Measles,

pertussis and neonatal tetanus together are responsible for more than three million deaths of young children each year [1]. At the same time, an equal number of children are permanently disabled through blindness, deafness, paralysis and/or mental retardation by these six diseases. In addition, over 250,000 children are crippled by poliomyelitis every year [1]. In other words, every two seconds one child dies from a vaccine-preventable disease, and one child is permanently disabled.

In most of the industrialised countries of the North, there has been a dramatic decline in mortality from the six diseases. Of course, this decline is not solely due to the availability of vaccines. Better nutrition and housing, availability of water, sanitation and educational facilities have all contributed to the control of infectious disease.

Put simply, infectious disease kills the rich less often than it kills the poor. But it will be some time before the majority of the people living in the developing countries of the world will benefit from real economic development. Indeed, in the current state of the global economy the prospects are not encouraging. For the last six years, per capita income has been falling in almost every one of the developing countries [2].

Table 1. Estimated immunisation coverage with BCG, DPT, OPV, measles and tetanus toxoid vaccines in some selected countries, based on data available to WHO in August 1986.

Country	Surviving infants (millions)	Immunisation coverage (%)				
		BCG	DPT3	OPV3	Measles	Pregnant women TT2
India	22.60	24	44	35	NA	37
Indonesia	4.62	68	16	14	16	26
Bangladesh	3.05	3	2	2	1	3
Brazil	2.63	58	62	86	63	NA
Iran	2.17	64	51	51	51	18
Vietnam	1.72	42	29	25	10	NA
Philippines	1.69	76	59	61	55	55
Ethiopia	1.55	14	8	8	16	4
Turkey	1.46	50	67	67	72	NA
Sudan	0.88	12	8	8	6	4
Developing countries (excluding China)	88.31	39	38	36	25	20
China	17.99	67	74*	84	83	NA
Developed countries	17.36	56	62	66	76	0
Global total	118.66	46	47	48	41	14

These figures are based on either coverage data estimated from vaccines given compared to target population, or following cluster surveys using standard 30 cluster methodology. NA = No information available. Two doses only.

The expanded programme on immunisation (EPI)

The idea of co-ordinating and promoting worldwide efforts to protect children from disease through vaccination was conceived by the World Health Organisation (WHO) in 1974 as the Expanded Programme on Immunisation. General policies, including the goal of providing immunisation for all of the world's children by the year 1990, were approved in 1977, the year that saw the last case of smallpox.

At the time that EPI was conceived, probably less than 5 per cent of infants in the developing world received a third dose of DPT or polio vaccine. Measles was thought to be a problem only in Africa. Poliomyelitis was not thought to be a problem in the developing countries and neonatal tetanus was not even considered. Today, more than a third of infants in the developing world receive a third dose of DPT or polio vaccine, although only about 20 per cent receive measles vaccine. So there has been progress, but not enough if the global target is to be reached.

Regional review

The vaccine coverage estimates for the regions reviewed are shown in Fig. 1.

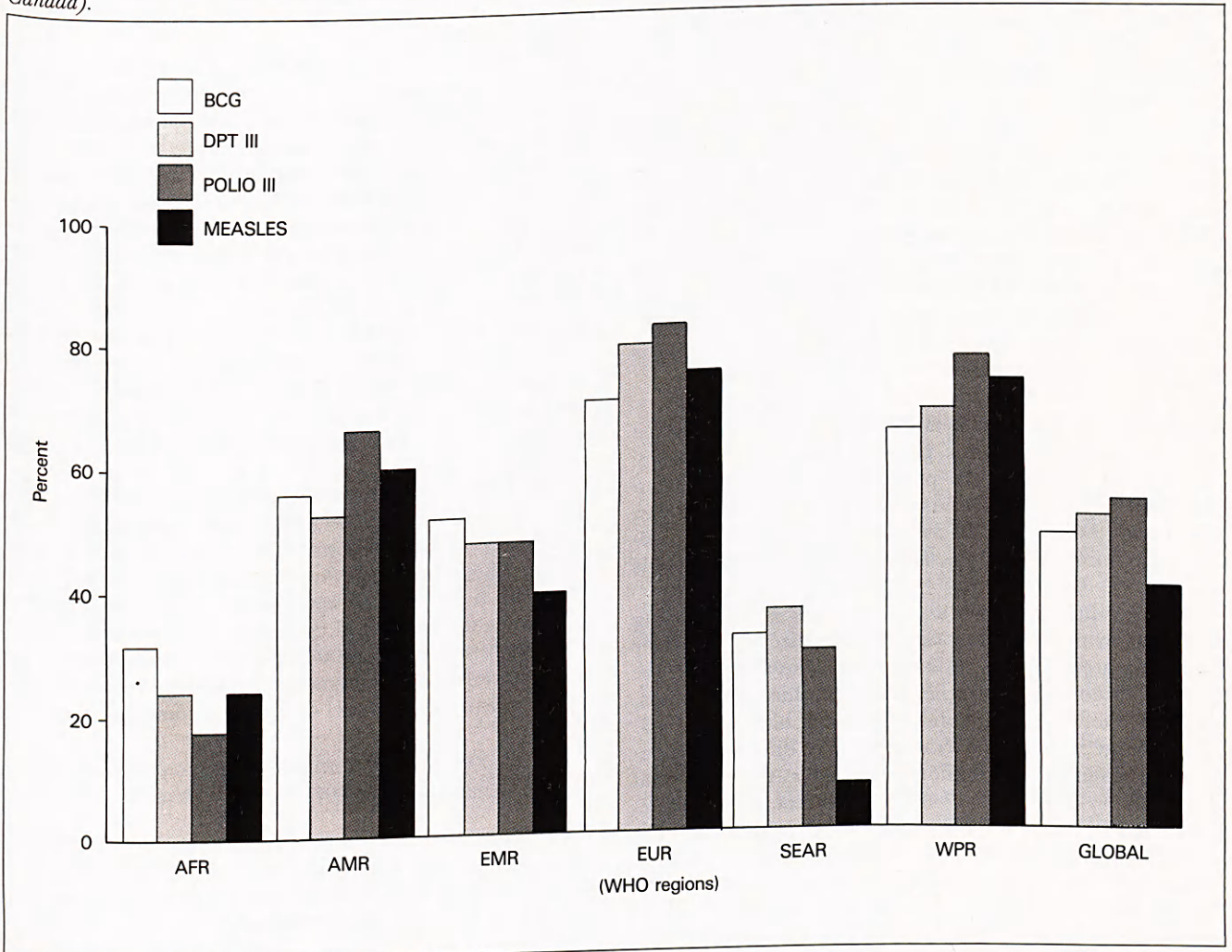
The European region

With the exception of measles, the target diseases have been brought under control in most of the European Region, and eradication targets have been set for the end of the century. In addition, there is wide use of vaccines against other diseases of importance to public health including rubella, mumps, hepatitis B, influenza, pneumococcal and meningococcal infections.

Despite considerable progress, certain problems remain particularly with regard to measles, pertussis and poliomyelitis.

Measles. Czechoslovakia and Hungary are close to eradication of this disease, and Albania has officially declared that no case has occurred in the country since 1980.

Fig. 1. Immunisation coverage of infants under 12 months — by WHO region, August 1986. (American region excludes USA and Canada).



Several other countries have declared eradication targets.

In the UK, however, national coverage is only about 55 per cent with considerable geographical variation that reflects the enthusiasm of local health personnel for immunisation. In France, coverage is reported to be about 15 per cent, while in Italy it is only around 5 per cent. This reflects a considerable difference in attitude towards the importance of measles as a community disease.

In fact, measles continues to cause hundreds of deaths each year in the region, and hundreds of thousands of cases of acute illness. In addition, permanent disability may follow as a consequence of the complications of measles, for example otitis media, pneumonia, or encephalitis. Subacute sclerosing panencephalitis (SSPE), a late and rare complication of measles, also continues to occur, causing severe disability and death.

Measles is highly contagious, and, since there is considerable movement within the European Region, any programme designed to eradicate the disease must be co-ordinated at regional level.

Pertussis. Immunisation programmes in Albania, Austria, Bulgaria, Czechoslovakia, France, the German Democratic Republic, Hungary, the Netherlands and Poland, have shown a considerable impact of the vaccine on the incidence of this disease [3]. On the other hand, several countries where coverage rates declined, subsequently experienced a rise in both morbidity and mortality from the disease [3].

In the UK, DPT coverage rates declined rapidly by 30 per cent in the early 70s, following newspaper reports of a risk of encephalitis after pertussis immunisation. Epidemics of the disease have followed. It is possible that a risk of encephalitis exists following pertussis immunisation [4]. However, the risk is greater following the disease itself. Certainly in the developing countries of the world, pertussis remains a common cause of death and disability, and the potential risks of the vaccine are far outweighed by the benefits.

Poliomyelitis. This disease is effectively controlled in the European region with the possible exception of Turkey and Morocco (which are part of the WHO European Region). The extensive use of either the live Sabin vaccine or the inactivated Salk vaccine, or, in some cases a combination of both [5], is largely responsible for this success.

Poliomyelitis is a disease that changes from being endemic, with sporadic cases mostly affecting the very young in areas where sanitation and water supplies are poor, to becoming epidemic, affecting older age groups, in areas where socio-economic conditions have improved. This change is to some extent dependent on the improvement in water and sanitation which alters the pattern of transmission of the 'wild' virus. As a result, first infections tend to occur at a later age, when paralysis is more likely, and epidemics occur. Immunisation of a high proportion of children must go hand in hand with improvements in living standards.

Outbreaks in some countries with good vaccine cover-

age are a reminder of the need for long-term vigilance [6,7]. High levels of coverage must be maintained for many years to come, and high risk unimmunised groups must be actively sought out. There is concern at the moment that in some parts of the UK, coverage with a third dose of polio vaccine is less than 40 per cent. In Europe, there has been a declining interest in immunisation by both the community and, in some cases, the health professionals. This can be attributed to two things. First, the declining incidence of the target diseases, and, second, the increasing awareness of the community of the potential, though very rare, risks of the vaccines.

Provision of relevant and accurate information on the risks and benefits of immunisation is urgently needed for health professionals and the community. In particular, paediatricians, doctors, nurses, teachers and the media must be properly informed. They all play a vital role in communication with the community. Without this communication, it is unlikely that the European goal of 'no indigenous measles, polio, neonatal tetanus, congenital rubella, and diphtheria, . . . by the year 2000' can be reached. The developing countries of the South will be looking to Europe and North America for the lead in the control and eventual eradication of these infectious diseases.

The African region (AFR)

This is the poorest region, beset by drought, famine and conflict. Of all the regions, Africa has the highest mortality and morbidity rates for the target diseases. Educational opportunities are poor and per capita income has declined. Despite this, there has been some progress in EPI. In 1983, 10 countries achieved fully immunised rates of 45-87 per cent of their target population.

One of the priorities for this region is the upgrading of the management skills of the health workers involved in EPI. To date, more than 25,000 health personnel have been trained in management, logistics and refrigerator maintenance and repair. Disease surveillance and reporting are as yet inadequate to document any large-scale impact of EPI, but in some countries there is good evidence of disease reduction in localised areas.

One of the major constraints in this region is the need for a good 'cold chain' to ensure that vaccines are stored and transported within the safe range of temperatures to prevent loss of potency. Once again, the need is to ensure adequate training and supervision of health staff, and to guarantee the funding of the programme in the short and the long term. 1986 has been designated the African Year of Immunisation. All countries in the region are committed to raising their levels of coverage, and to sustaining them.

The American region (AMR)

In this region, 26 countries are considered to have achieved control of paralytic poliomyelitis (defined as a reported incidence of less than 0.1 per 100,000 population for five or more years).

This region has seen several innovative ideas on EPI.

Rapid acceleration of coverage has been achieved in Brazil, and Colombia through the use of national immunisation days. Several other countries, including Bolivia, Ecuador, El Salvador, the Dominican Republic, Mexico and Nicaragua, are adopting similar strategies. The region has also pioneered the introduction of revolving funds for its bulk purchase of vaccines. To date, vaccines worth more than US\$ 19 million have been bought. This has ensured that adequate supplies of good quality vaccines are available when required in all countries. An EPI newsletter, published by the Pan American Health Organisation (PAHO), provides up-to-date information on all aspects of EPI to more than 10,000 health workers in the region.

The South East Asian region (SEAR)

There has been a slow but steady increase in coverage for all antigens except BCG and measles. This reflects the belief, until recently, that measles was not a serious disease in the region. At the same time, the conflicting data on BCG efficacy is responsible for the relatively low uptake of this vaccine.

In Sri Lanka and Thailand, surveillance systems have been able to document a reduction in disease, thus demonstrating the impact of EPI.

The Western Pacific region (WPR)

This region includes the largest and the smallest countries of the world. Levels of development, vaccine coverage and disease incidence show a similar range.

Seventy-five per cent of the infants in this region are in China and this country has made considerable progress in immunisation coverage since starting the programme 20 years ago. In China, the incidence of paralytic poliomyelitis in 1984 was estimated to be 0.16 per 100,000 population. The major constraints in this Region are similar to other regions: lack of management skills as well as financial resources.

Eastern Mediterranean region (EMR)

This region includes many of the oil rich nations. There is great variation in socio-economic status between countries. Drought, famine and civil unrest constitute major problems in many countries. Despite this, progress has been made, as can be seen from the data in Fig. 1.

This summary of the status of EPI clearly indicates the need for acceleration of EPI activities to meet the 1990 goal.

Some alternative strategies for the acceleration of EPI activities

The priority must be to ensure optimum use of existing fixed centres, to use every opportunity to immunise susceptible infants and women of child bearing age, and to provide adequate quantities of vaccine and supplies at every health facility.

For many people, the health centre will be too far from their homes. Health staff must be prepared to go to the community, and so offer health services at prearranged times in prearranged sites at the convenience of that community. This will improve contact and increase vaccine coverage. It will also cost money and require more effort in training and supervision. These 'outreach' services can be conducted within a single day, and can extend the services from the health centre to a range of 5-10 kilometres. Mobile services may be considered for the more inaccessible populations. This will involve travel, usually by vehicle over greater distances, and often an overnight stay. This involves even greater expense, and is seldom justified in the long term.

Specific strategies aimed at reaching a large proportion of infants in a short space of time include the use of national immunisation days. These have been used with great success in Cuba and Brazil. Many other countries have followed this example with varying degrees of success for there are certain risks inherent in the strategy. For example, it is possible to achieve 80 per cent coverage of the under-five-year-old population without giving any vaccine at all to the most vulnerable group of infants under one year old.

Mass campaigns are subject to the same potential risks. They have been used, again with varying degrees of success, in Colombia, Burkina Faso, Turkey, and several other countries. It is vital that such campaigns are not seen as a single event, but that they serve to create a system which can be sustained. In Vellore, India, a variation on the theme of immunisation days has been used with great success by Professor Jacob John. He calls it the 'pulse' technique where the community are immunised on three separate occasions one month apart to ensure high levels of coverage and subsequent interruption of transmission of the 'wild' organism [8].

There are three major considerations in all of these strategies.

1. The initial costs are relatively high. Can they be paid?
2. Can the existing EPI services within the country sustain the increased coverage levels?
3. Can the recurrent costs be paid over the subsequent years?

There are many choices open to health planners to increase their EPI coverage. Decisions taken at the outset of a programme can have far reaching and long lasting effects, both good and bad. It is imperative that the correct judgement is made according to the needs of the individual programme, and this judgement should not be influenced by the offer of large capital sums from external sources, however attractive the proposition.

External resources are, and will be, required for many years to come. The donor carries a great responsibility for the deployment of these resources. Whilst the success of a project may in part depend upon external resources, the provision of external resources does not guarantee that success. Donors should take great care to define strategies in the closest co-operation with the health staff and health planners within a country.

No one would deny that the sooner susceptible infants throughout the world are protected against the six target

diseases the better. The question is how to go about achieving that state, and, more importantly, how to maintain it for several decades. The answer is that no one solution or strategy will apply in every country and in every situation, but that a carefully designed mix of strategies will be required.

Indications for and contra-indications to vaccination

The risks of any health intervention must be weighed against the risk of the disease that one is seeking to prevent or cure. In Europe and North America, the risks of the target EPI diseases are relatively small. At the same time, susceptible children are easily contacted and reminded when vaccines are due.

Children in the developing world are at greater risk of infection and death from the target diseases. They are less accessible, and it is necessary to take every available opportunity to immunise them. Low-grade fever, mild respiratory infection or diarrhoea should not be considered contra-indications to immunisation in this situation, and undernutrition should be considered as a prime indication for immunisation as it is these children who are at greatest risk from the diseases [9].

Children requiring hospital admission for whatever reason are at great risk of hospital-acquired measles in many developing countries. Measles immunisation on admission can significantly reduce the rate of hospital-acquired disease without affecting the outcome of the disease for which the child was admitted [9].

Community education for EPI

Although today less than 40 per cent of infants in developing countries have received a third dose of either DPT or polio vaccine, 60 per cent received a first dose. The reasons behind these high 'drop-out' rates are complex, but are often due to our failure to communicate with parents and guardians, and to provide them with relevant and accurate information in an acceptable way. Many techniques are available to improve this process of communication, including story-telling [10], popular theatre [11], the use of puppets, the use of mass media, and many others.

The school child is potentially a most valuable resource, both as an important point of contact with the community, and as a future parent. The school curriculum offers an opportunity to provide up-to-date information on many aspects of health care including immunisation. Many countries have already embarked on programmes of health education through schools as a result of interministerial co-operation.

Research in EPI

Simple action-orientated research designed to raise coverage levels has been a feature of EPI from its inception. Examples of this include:

1. The development of an extensive range of 'cold chain' equipment to protect vaccines in all situations [12].

2. The improvement of survey methodologies to identify target disease incidence [13].
3. Publishing of data showing that children who are ill and/or undernourished can and should be immunised [9].
4. Publishing of data showing that oral polio vaccine can be given at birth, and that DPT can be given as early as six weeks of age [14].
5. The development of a range of plastic re-usable syringes which can be steam-sterilised up to 200 times. This avoids the problems of the expense of disposable syringes and the fragility of glass syringes. The use of one sterile syringe and needle for each injection is even more vital today in view of the potential risks of virus transmission, particularly hepatitis B and HIV.

The cost of EPI

Estimates of external donor costs of reaching the 1990 objective have been estimated to be between US\$ 100–150 million annually for the next five years [15]. These are modest requirements when considering the cost of armaments. The cost of 12 hours world spending on arms equals the cost of EPI world wide for one year [16]. Enthusiasm for EPI is shared by many international agencies today, including WHO and UNICEF, and financial resources are available for the initial costs in most countries.

This enthusiasm is more than welcome, but it must be tempered by a sensitive appreciation of the strengths and weaknesses of existing programmes and resources in each country. Large-scale, though possibly short-term external support may benefit a programme that has already developed a sound infrastructure, but can harm a programme whose infrastructure is poorly developed or too fragile to support sudden acceleration.

The problem of recurrent costs has yet to be solved especially in the long term. Donors need to consider their future role in funding these recurrent costs, especially when the initial excitement of raising coverage levels is over, and the real work of sustaining these high levels begins.

Conclusion

Immunisation is one of the most cost-effective health services available to us. It is also one of our most powerful tools. At the same time, it lends itself to evaluation and monitoring which makes it particularly attractive to health workers, donors, politicians, epidemiologists and the community alike.

One great strength of EPI lies in its ability to establish a system for the delivery not only of vaccines but also of other health services. Once such an infrastructure for vaccine delivery has been established, the opportunity must not be missed of taking full advantage of the contact between appropriately trained health workers and the community to provide a fully comprehensive health service. Indeed, if this is not done, it is likely that although the immunisable diseases will be prevented, the overall childhood mortality may not be altered [17].

Much needs to be done if the 1990 goal is to be

reached. Today there is reason to be optimistic. It remains to be seen whether we will be able to sustain the effort and to provide sufficient funds and trained staff to ensure that the programme continues, and that the six target diseases are eventually controlled, and then eradicated.

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The opinions expressed in this paper are those of the author.

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