

EXPANDED
PROGRAMME
ON IMMUNIZATION



Evaluation
and Monitoring
of National Immunization
Programmes



WORLD
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**EXPANDED PROGRAMME ON IMMUNIZATION
EVALUATION AND MONITORING OF NATIONAL IMMUNIZATION
PROGRAMMES**

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1. Introduction

Many immunization programmes in developing countries are now undergoing a period of rapid acceleration. Innovative strategies are being tried. Political visibility and enthusiasm are high. There is a strong demand to know what is working and what is not. This paper, prepared in collaboration with the Task Force on Child Survival¹, reviews some general principles of programme evaluation and provides some comment and suggestions concerning specific issues relating to the evaluation of national immunization programmes. A summary of evaluation instruments and their use in EPI is provided in Table 1.

¹The Task Force on Child Survival is comprised of representatives from WHO, UNICEF, UNDP, World Bank and Rockefeller Foundation. The contributions which have been made by Task Force reviewers are appreciated. The responsibility for errors rests with the WHO/EPI staff.

Table 1. Overview of Evaluation Instruments and their use in EPI

| Evaluation instrument | When to be used | Use of outcome |
|--|---|---|
| Routine reporting of immunizations performed | In all health units, continuously, by dose of vaccine and age group | By area, monitoring of: -performance -vaccine requirements |
| Immunization coverage survey | Particularly in administrative unit when coverage information: -absent -incomplete -doubtful (very high, very low, not matching vaccine consumption) | -Validation of routine reporting system -Identification of reasons for inadequate coverage |
| Routine reporting of morbidity | Continuously, in all health units | -Monitoring of programme impact, by area -Stimulus for outbreak investigation |
| Sentinel reporting of morbidity | Continuously, for one or more diseases, in selected areas | -Monitoring of disease trends, by age group and immunization status -Identification of health services research needs |
| Morbidity/mortality survey | Questions on the incidence of poliomyelitis or neonatal tetanus or mortality from measles | -Decisions on inclusion of antigen/population group in immunization schedule -Assessment of completeness of routine reporting -Assessment of programme impact |
| Outbreak investigation | Increase of morbidity or mortality above expected level | -Disease control -Estimation of attack rates, by age group and immunization status -Estimation of vaccine efficacy |
| Vaccine quality control | -Validate initial quality of vaccine -Questions on potency of large quantity of vaccine : =close to expiry date =history of doubtful handling | Decision on use or destruction of vaccine |

Table 1 (cont'd)

| Evaluation instrument | When to be used | Use of outcome |
|-------------------------------------|--|---|
| Cold chain and logistics evaluation | <ul style="list-style-type: none"> -Continuously: <ul style="list-style-type: none"> =qualitatively, using cold chain monitors =quantitatively, excess or shortages of vaccine -Periodically, when routine information inadequate | <ul style="list-style-type: none"> -Continuous monitoring of vaccine storage and transport -Periodic checks -Proxy measure for vaccine quality |
| Serological survey | Formulation of immunization schedule, particularly with respect to age of immunization and number of doses | Estimate of proportion of individuals with circulating antibodies from infection and/or immunization |
| Rapid assessment | Occasional, when rapid feedback is required on operational performance; especially relevant following special immunization events | <ul style="list-style-type: none"> -Provision of process data for decision making -Documentation of particular lessons learned |
| Special studies | Occasional: <ul style="list-style-type: none"> -Special immunization events -Suspected programme weakness e.g. urban slum coverage -Selected issues of critical importance e.g. communications | <ul style="list-style-type: none"> -Review of special events and sustenance of popular support -Compensation for systematic omission of particular data |
| Programme review | Assessment each 2-3 years whether programme implemented as planned and whether programme optimally designed | <ul style="list-style-type: none"> -Validation of current strategy -Redesign of programme |
| Cost analysis | Estimate cost per immunization and per fully immunized child, for each strategy in a sample of health facilities | <ul style="list-style-type: none"> -Choice of immunization strategy(ies) -Tactical managerial decisions within strategy (ies) selected |

2. General principles

WHO proposes that programmes be systematically assessed with respect to their relevance, adequacy, progress, efficiency and effectiveness (1). At this stage in most national immunization programmes, emphasis is most appropriately placed on measuring progress, as reflected in national levels of immunization coverage, and effectiveness, as reflected by reductions in morbidity and mortality from the target diseases. The question of relevance has been answered by the high priority being accorded to immunization. "Adequacy" in the above context refers to the clarity of definition of the health problem and the clarity of programme formulation. These are well defined in most programmes. "Efficiency" asks whether results could have been obtained in better or more economical ways. This remains an ongoing question for immunization programmes, and more will be said about this below.

Evaluation asks whether specified objectives are being achieved. It serves no purpose unless it results in action: redefining objectives if they are inappropriate; redefining strategies and replanning programmes if they are ineffective or inefficient; reconfirming the current programme if everything is satisfactory (a rare event indeed!). Monitoring is a part of evaluation. But it focuses on whether activities are being carried out and targets achieved as recommended, not on whether the recommendations themselves are appropriate.

Evaluation and monitoring are integral parts of routine programme management at all levels of the health service. Every person has a contribution to make. They are to programmes what sensory systems are

to living organisms. Programmes which cannot be evaluated cannot be managed.

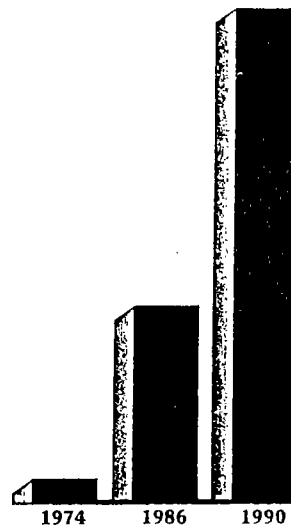
Designing programmes so they can be evaluated is a management task. This consists of defining programme objectives and activities so as to be measurable, and of measuring progress with an information system which has been designed along with the other parts of the programme rather than as an afterthought. The task also includes providing a budget adequate to support the requirements of the information system and to permit periodic special evaluations as needed.

3. Immunization coverage

At present, high visibility is being given to immunization coverage levels. This is understandable, as coverage in most of the developing world has been negligible until recently, and, without major improvements, little programme impact could have been expected (Figure 1). Coverage is also (relatively) easy to estimate. But reducing morbidity and mortality is the primary goal of immunization programmes and the importance of coverage levels should not be over-emphasized. Raising immunization coverage levels is only a means for achieving that goal.

When first assessing coverage, great precision is usually not needed. One simply seeks to estimate whether coverage in a particular area is low, medium or high. Where no other information exists, one may make at least an initial estimate of coverage from data concerning the procurement or distribution of vaccines. A maximum coverage figure can be obtained

Figure 1.
Global immunization
coverage
DPT-3 or OPV-3



by assuming that all doses were actually administered to persons in the appropriate target group and that there were no drop-outs between doses. If such assumptions result in estimates which indicate low coverage levels, one can be confident that true levels of coverage are very low indeed. This approach is less useful when such estimates reveal coverages of above 20%.

To monitor immunization coverage, data concerning the numbers of doses of the various vaccines administered, by dose and by age, need to be obtained using the routine health information system. Knowing the birth rate permits one to estimate how many newborns can be expected per year, per quarter or per month. Comparison of the number of first doses of DPT administered in a given month with the number of newborns expected per month permits an estimate to be made of coverage and of access to immunization services. Estimates of drop-out rates can be obtained by comparing the monthly number of first doses with second and third doses. This may be done on a monthly, quarterly or yearly level, in keeping with the needs of the manager using the data. Table 2 provides a prototype format for the collection of immunization data. This format can be used for reporting data from individual health facilities to more central levels as well as for reporting national data to international levels. A warning: falsely high or low estimates of

number of newborns can introduce large inaccuracies in such estimates.

Figure 2 provides an example of how such data may be used as a management tool at the point of collection. Such a figure might serve as a wall chart in a health centre and at the higher supervisory levels. Use of data in similar ways provides a direct feed-back on performance, making data collection itself a procedure of practical relevance. This is important, for if the data are not useful to those who obtain them, they lose their most important value. Not only do data used in such ways provide a direct stimulus to improving performance, but, by permitting health workers to evaluate their own performance and take pride in their own accomplishments, they serve to enhance motivation and job satisfaction.

Sample surveys are most useful where coverage estimates cannot be derived from routine reports of doses administered, or where validation of the accuracy of the routine reports is desired. The WHO/EPI frequently uses a simple and inexpensive sampling method to estimate coverage which requires that only some 210 children be selected, divided among 30 "clusters" (2, 3). The sample result has a 95% chance for being within 10 percentage points of the true value, and is adequate for most purposes.

Table 2. Number of persons immunized in relation to target population, by age and vaccine

Country/Area:.....
 Total Population:..... Period:.....

| Age Group | 0-11 months | 12-23 months | 24+ months |
|---------------------------|-------------|--------------|------------|
| Target population | | | |
| ===== | ===== | ===== | ===== |
| BCG | | | |
| ===== | ===== | ===== | ===== |
| Polio 0 ¹ | | | |
| Polio I | | | |
| Polio II | | | |
| Polio III | | | |
| Polio others | | | |
| Polio total | | | |
| ===== | ===== | ===== | ===== |
| DPT I | | | |
| DPT II | | | |
| DPT III | | | |
| DPT others | | | |
| DPT total | | | |
| ===== | ===== | ===== | ===== |
| Measles | | | |
| ===== | ===== | ===== | ===== |
| Others ² | | | |

| Target group | Pregnant women | Women of child bearing age | Others ² |
|-------------------|----------------|----------------------------|---------------------------|
| Target population | | | |
| ===== | ===== | ===== | ===== |
| Tetanus I | | | |
| Tetanus II | | | |
| Tetanus others | | | |
| Tetanus total | | | |

1) Doses of polio vaccine, given in the first 6 weeks of life.
 2) Specify.

In surveys, mothers whose children were not completely immunized can be asked why this was so. While not every reply may be valid, the EPI experience is that one is able to make a useful differentiation between lack of information, lack of motivation or specific obstacles which have accounted for missed immunization. In the more than 1 000 EPI coverage surveys reported to WHO to date, lack of information has accounted for roughly two-thirds of the missed doses. Recognition from survey results of the number of children either not brought for immunization or turned away because of illness has been an important factor leading to the WHO/EPI recommendations with respect to contraindications to immunization (4) (Panel 1).

Emphasis in the surveys should be placed on the coverage being achieved in the youngest age groups. For convenience, children of 12-23 months of age are often included. Younger children might not have had sufficient time to complete the nationally recommended schedule. An upper age limit of 23 months in rural areas and 17 months in urban

areas is selected for operational reasons: it will require on average 50 households to be visited in rural areas and 100 to be visited in urban areas to obtain the seven children needed for each cluster. This is a task that in practically all situations can be performed in one working day. A more sophisticated analysis of the results can be performed in which children receiving their immunizations before 12 months of age are counted separately, and special surveys can also be done of infants where the child is counted as immunized if it has received all the immunizations appropriate for its age (even if it is too young to have yet received all the recommended immunizations). This refinement is indicated when high levels of coverage are already being achieved. Data may also be analyzed to determine the proportion of children being immunized against measles at the first contact after reaching nine months of age. The level of missed opportunities for measles immunizations can be identified and monitored by such surveys. It then becomes worthwhile to ensure that all children are being immunized with minimal delays.

Panel 1

An evaluation in Sri Lanka in 1981 concluded that the immunization coverage could be further improved if a more efficient immunization schedule was adopted and if the number of contraindications was reduced to a rational number. Internationally this led to a study on contraindications against immunization and specific WHO recommendations. In Sri Lanka, the immunization coverage improved dramatically after implementation of these recommendations, as is illustrated in the Kurunegala Division where coverage surveys were performed in 1981 and again in 1986.

(WER 1986, no.43, pp 329-331)

Results of immunization coverage surveys in Kurunegala Division, Sri Lanka, 1981 and 1986

| | 1981 | 1986 |
|---------|------|------|
| BCG | 92 | 99 |
| DPT 1 | 91 | 99 |
| DPT 2 | 81 | 95 |
| DPT 3 | 58 | 91 |
| OPV 1 | 90 | 100 |
| OPV 2 | 79 | 95 |
| OPV 3 | 58 | 91 |
| MEASLES | * | 57 |

* Measles vaccine included in the programme only during the last 4 months of 1985

A complete national survey may not be required, and may not, in fact, be desirable. A nationwide survey can be quite expensive to perform, and, if it produces only a single average figure for the entire country, is not particularly useful. Separate surveys for defined administrative entities are preferred, as they provide a basis for taking remedial action.

In most countries, routine information can be used to permit a judgement to be made concerning where immunization coverage is good and less good. This may include the reported number of immunizations given, vaccine uptake, the density of health facilities and/or other factors. On the basis of such information, regions or provinces can be ranked and divided into three groups of approximately equal size: those thought to have the best coverage, those thought to have the worst, and an intermediate group. One administrative unit can be selected randomly from each of these three groups and a separate survey performed in each. This not only gives an idea of the range of coverage which exists in the country, but inclusion of areas thought to have the best coverage may reveal approaches which might be of relevance to areas with lower coverage.

In some countries, it may be appropriate to perform separate surveys for the urban and rural populations in each of the three areas selected. Other countries may have a major city (or two or three cities) large enough to warrant surveys of their own. This is particularly indicated if a wide variety of health facilities are providing immunizations only some of which are prepared to report to the municipal authorities.

A wide range of survey options exists and the option should be selected which best suits the needs

and resources of the programme.

Some comment on the analysis of coverage data may be useful. When analyzing the results of a coverage survey, it has become customary to calculate a figure representing the proportion of children who are "fully immunized". This indicates the proportion of children in the survey who have received all the doses of all the vaccines recommended in the national schedule, each dose being administered at an appropriate age. This is a child who is fully benefitting from the protection which the national immunization programme can confer.

But if the estimation of the proportion of "fully immunized" children is straightforward when dealing with survey data, difficulties arise when dealing with data compiled from routine reports from health centres or with data compiled from routine reports received at the international level. In these circumstances, an estimate of the proportion of "immunized" children is often made simply by equating "immunized" children with the lowest coverage for any of the vaccines. This has become a useful shorthand for the purpose of global programme monitoring, but it provides a figure which is clearly larger than the actual number of "fully immunized" children.

For example, if it were the case that children received each immunization dose in a completely random fashion and the coverage survey revealed 80% coverage for BCG, DPT-3, polio-3 and measles, one would expect that the results would reveal that only some 41% of the children would have received all of these doses ($.8 \times .8 \times .8 \times .8 = .41$). The routine health information system would report 80% coverage for each antigen, and one would simply say that 80% of the children were being "immunized".

Differences in these two figures are not as great as indicated in the example above because vaccine doses are not randomly distributed among children: those who receive one dose are likely to receive others as well. In addition, the epidemiological impact of the programme corresponds more to the coverage achieved with the individual vaccines than to their combined coverage. In the example cited above, despite the fact that only 64% (.8 X .8) of children received both a polio-3 and a measles dose, the programme impact would correspond to an 80% coverage for polio and an 80% coverage for measles.

Where survey or other data permit a calculation of the proportion of fully immunized children, this calculation should be made, as it provides useful insights concerning the uniformity of coverage within the population. Where such a calculation cannot be made, however, use of the lowest coverage for any of individual vaccines does provide an index of programme achievement.

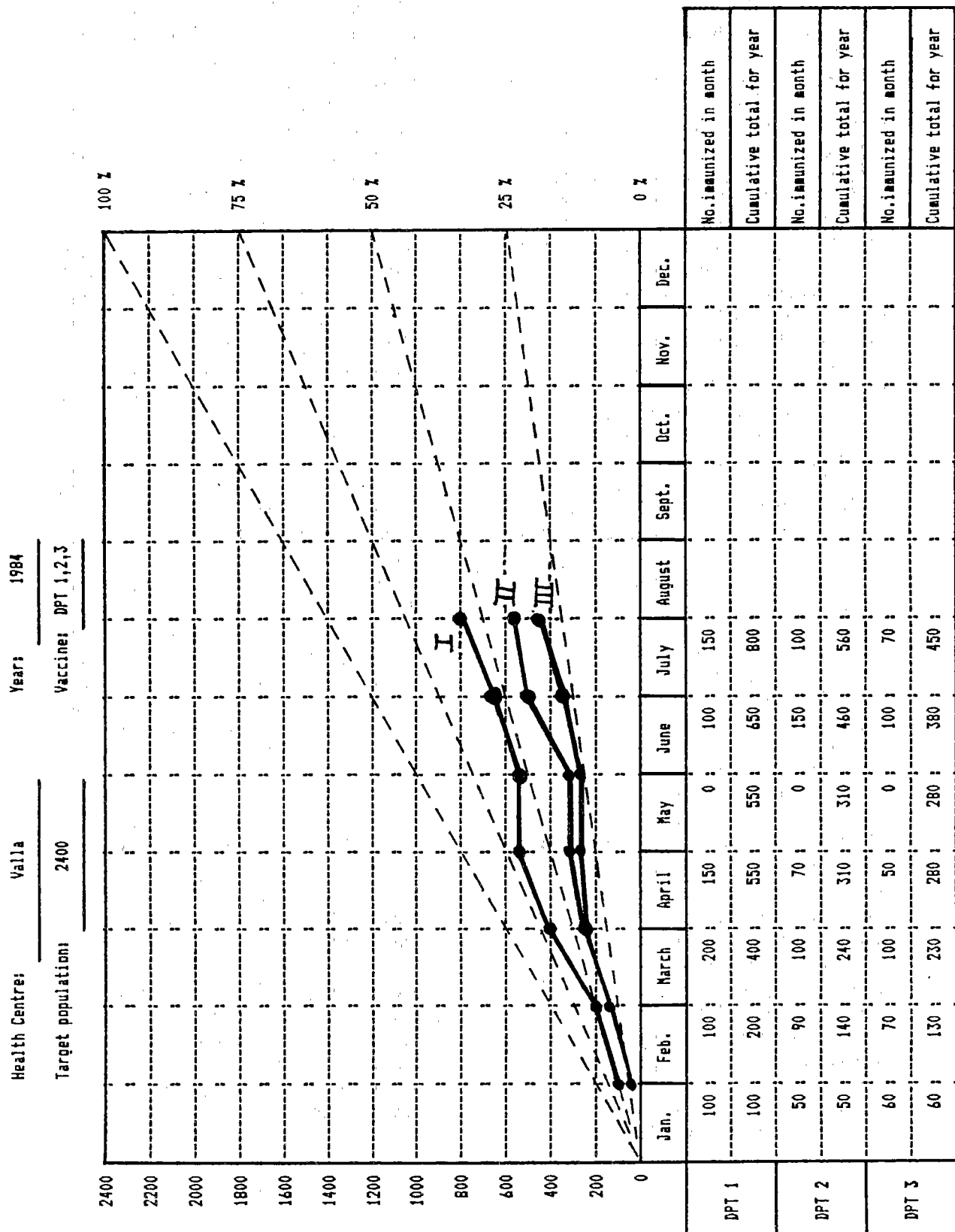
How should coverage levels be judged in relation to the Expanded Programme on Immunization (EPI) goal, established by WHO in 1977? This is to "...reduce morbidity and mortality by providing immunization (against the EPI target diseases) for all children of the world by 1990", or, as stated by UNICEF, to achieve "universal childhood immunization by 1990", or simply "UCI-1990". There is no question of the intent of this goal so far as coverage is concerned: it commits the world community to striving to bring immunization to all children. And yet, even in countries with the best programmes, a few children remain unimmunized. Some have medical contraindications and some parents refuse services for religious or other reasons. It is therefore known in advance that 100% coverage will remain a hypothetical goal.

Countries should certainly strive to attain no less than 100% coverage, but it is also fair to give some indication of what level might be judged acceptable, even if falling below the ideal. Convention dictates that the level should be set above 80%; equity considerations dictate that the level be set as far above 80% as possible. Each country will need to define for itself what level is appropriate to its own resources, epidemiological situation and aspirations.

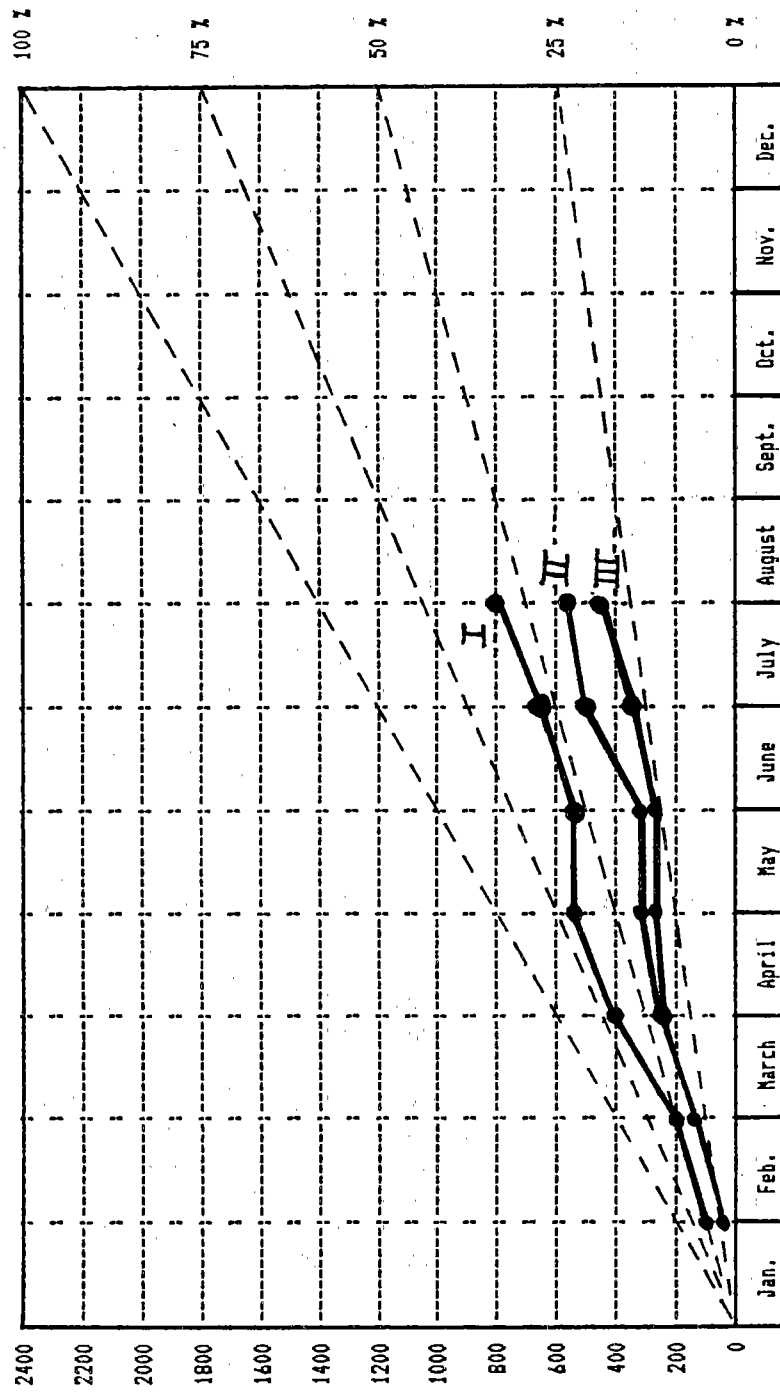
The coverage goal is understood as applying uniformly throughout a country. If this were not to be the case, the coverage achieved would have a reduced impact on preventing the diseases in question, and equity questions would arise with respect to the populations being deprived of services. To cite an extreme example, if 80% coverage in a country were to be achieved by immunizing 100% of the children in 80% of the geographic areas and 0% in the remaining 20%, the concentration of susceptibles in the latter areas would not inhibit the transmission of disease, and they would certainly be considered as being disadvantaged in comparison with the rest of the country. To reach the goal, however, efforts should be made to give first priority to covering populations at highest risk from the target diseases.

It is the concept of "herd immunity" which has made it a convention to accept immunization coverage of 80% as a minimally acceptable level. The term "herd immunity" indicates that immunity in the population as a whole is sufficient to inhibit disease transmission and to confer protection to susceptibles by shielding them from contact with infectious cases. Unfortunately, this convention has many limitations.

Figure 2. Immunization monitor



Health Centre: Valla
 Target population: 2400
 Year: 1984
 Vaccine: DPT 1,2,3



| | |
|---------------------------|--|
| No. immunized in month | |
| Cumulative total for year | |
| No. immunized in month | |
| Cumulative total for year | |
| No. immunized in month | |
| Cumulative total for year | |

Different diseases have different levels of infectiousness, and will require different immunity levels in the population before their transmission will be inhibited or prevented. Measles is among the most infectious of the communicable diseases, and in many communities, immunization levels of above 90% seem to be required before transmission ceases. Other factors are also important. Population density, living patterns, standards of hygiene and socio-cultural practices all influence the chances of a susceptible individual coming into contact with infection. High population density urban areas, even with high levels of immunization coverage, may contain a higher proportion of susceptibles per unit of living space than low density rural areas, even those not benefiting from immunization services. Disease transmission may be sustained in the former areas, and die out in the latter.

Even supposing that a level of 80% immunization coverage were sufficient to eliminate the transmission of a given disease in a given geographic area this year, it would be unlikely to do so in future years. For such a level implies that, each year, another 20% of the cohort of newborns would be added to the population as new susceptibles, and in a short time the number of susceptibles would increase to a level which will sustain transmission (often producing an explosive epidemic when the disease in question becomes re-introduced into the area).

Finally, for some diseases, the concept of "herd immunity" does not apply at all. This is the case with tetanus, which is not transmitted from person to person, but is acquired by contact with soil or other matter which contains the organism. Any susceptible person coming into contact with tetanus spores is at risk, no matter what the general

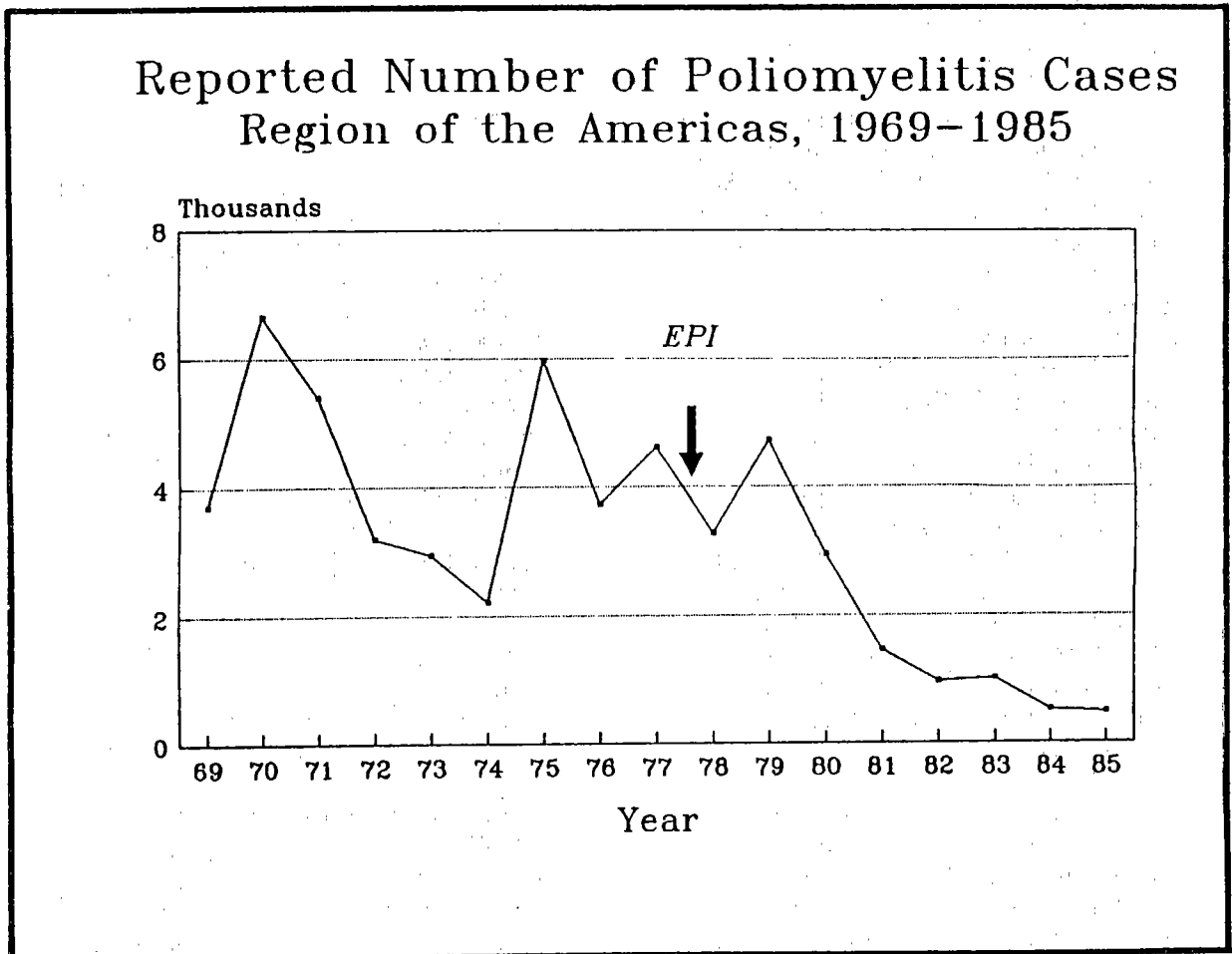
level of immunity in the population.

4. Disease incidence

The best measures of success of an immunization programme are the reductions achieved in the incidence of the target diseases. In the EPI, priority is being accorded to measuring disease incidence trends for three diseases: poliomyelitis, measles and neonatal tetanus. Quite dramatic falls in the incidence of poliomyelitis are being recorded in developing countries, even in the face of modest levels of immunization coverage (5). Successes in the American Region are already influencing a downturn in global trends, and one may reasonably expect this disease to be one of the earliest indicators of the impact of the global programme (Figure 3). Measles currently accounts for the greatest number of deaths among the EPI diseases. It is highly infectious, however, and cases and epidemics are to be expected to continue in all but the best developed of programmes. If poliomyelitis serves as an early indicator of success of the programme, measles will serve as a reminder of the additional improvements which are still required. Neonatal tetanus is second to measles as a global killer, yet remains a disease largely invisible to the health services. Because its control requires a focus on immunizing women of childbearing age and on improving delivery practices, neonatal tetanus serves as a good index of the quality of maternal care. A single case suggests multiple failures within the maternal and child health care system, and should serve to trigger corrective actions.

The impact of immunization programmes is also being seen in several countries with respect to pertussis and diphtheria. These

Figure 3



diseases are being given less priority by the EPI so far as surveillance efforts are concerned. The diagnosis of pertussis continues to pose a variety of problems and this disease often has an epidemic cycle of five to seven years, making inferences from short-term trends hazardous. Pertussis surveillance should be supported and strengthened in those countries where the existing system already permits trends to be monitored, and should be initiated in all countries once satisfactory surveillance exists for poliomyelitis, measles and neonatal tetanus. Diphtheria incidence is very uneven in developing countries and does not serve as a good global indicator of impact, although it may be a very good indicator in some

individual countries. BCG reduces the incidence of miliary tuberculosis and tuberculosis meningitis in children. But these conditions are not very frequent, and their diagnosis in developing countries is difficult. Surveillance of these forms of tuberculosis is most suitable in special institutions in selected countries where reliable data can be obtained, but is not considered a global priority.

Reductions in disease incidence are not always easy to measure. Before an effective immunization programme is introduced, there may be little incentive for reporting cases. For some common diseases, the cases may be so frequent

that reporting represents a significant burden. As an immunization programme is introduced, measures should be taken to improve the diagnosis and reporting systems. These include developing standard case definitions, simplifying the reporting system, providing training and supervision on diagnosis and reporting and, most important, providing regular feedback of the data which have been reported. But such improvements are likely to mask the real impact of the programme in reducing disease incidence. Examples of this were seen in the smallpox eradication programme where better reporting made it appear that epidemics were occurring when in fact true incidence was declining.

Routine reports are needed to monitor trends (done on a weekly or monthly basis in most national programmes) as well as to identify outbreaks and other unusual patterns of incidence. Table 3 provides a prototype format for the collection of disease incidence data. As with the prototype concerning immunization coverage, this may be used both within a country and for providing reports internationally. At the health centre and district level, it is recommended that the monthly incidence of new cases diagnosed be graphed and displayed on a wall chart, providing feedback to the health workers and a stimulus for remedial action. This should also be done at each of the more central levels of the health service.

To help counteract the biases which may arise when improving national disease surveillance, it may be useful, particularly in the early stages of a national immunization programme, to develop a series of "sentinel" reporting sites. These are a limited number of sites which are specifically chosen to provide incidence data known to be more complete and more accurate than those provided by the routine system. Caution is warranted in interpreting such data, however, as better reporting often indicates

better management in general, and disease reduction as measured by sentinel sites may overestimate the impact being achieved by the programme as a whole. WHO/EPI is currently exploring the feasibility of using major cities in the developing world as one source of data for monitoring the impact of the global programme (8).

As is the case with immunization coverage, disease incidence may be estimated using surveys, although such surveys are more costly and more complex than are coverage surveys (6,7). For diseases such as measles and pertussis, incidence rates may be crudely estimated using an alternative method, providing that immunization coverage rates against these diseases are known and are below levels likely to interfere with disease transmission. Over a period of years encompassing epidemic and non-epidemic periods (or at least one period), the average annual incidence of measles can be taken to approximate 90% of the unimmunized children completing their first year of life. The average annual incidence of pertussis approximates 80% of such children. (In these estimations the incidence of disease among vaccinees is ignored and it is assumed that immunization coverage after 12 months of age is negligible). Estimates of poliomyelitis incidence can also be derived in a similar manner, taking into account that only a small proportion of children who are infected by the polio virus will actually acquire clinical disease. Where better estimates are unavailable, a rate of 5 cases of poliomyelitis per 1000 unimmunized children may be used.

Estimates of disease incidence derived in the above manner may prove useful in assessing the completeness of the existing disease surveillance systems. Where special emphasis has not yet been placed on improving routine surveillance, it is common to find less than 10% of the cases being reported through official channels (9) (Panel 2).

Panel 2

Surveys may be used to estimate disease incidence. In this table an estimate of the reporting completeness of poliomyelitis, based on lameness surveys and reported incidence in 13 countries in the period 1978-1981.

(WER 1982, no. 47, pp 361-362)

Estimate of reporting completeness

| Country | Reported incidence* | Incidence from lameness surveys* | Percent completeness |
|-------------|---------------------|----------------------------------|----------------------|
| Bangladesh | 0.1 | 4 | 3 |
| Burma | 1.1 | 18 | 6 |
| Cameroon | 1.2 | 24 | 5 |
| Egypt | 1.8 | 7 | 26 |
| Ghana | 2.3 | 31 | 7 |
| India | 2.1 | 18 | 12 |
| Indonesia | 0.1 | 13 | 1 |
| Ivory Coast | 1.2 | 34 | 4 |
| Malawi | 1.2 | 28 | 4 |
| Nepal | 0.3 | 5 | 6 |
| Philippines | 2.1 | 19 | 11 |
| Thailand | 1.7 | 7 | 24 |
| Yemen | 3.3 | 14 | 24 |

* per 100 000 population

Other means are needed to estimate the incidence of tuberculosis, diphtheria and neonatal tetanus. Surveys may be used to assess the prevalence of tuberculosis infection, from which incidence figures may be derived. Surveys are of limited use with respect to diphtheria because in developing countries most infections are relatively innocuous, being confined to the skin. Neonatal tetanus remains a priority problem in many developing countries, but may go unrecognized as such as cases may not be brought to the attention of the health care system. The use of surveys to estimate incidence should be encouraged in geographic areas where the risk of disease exists and where the the magnitude of the problem has not been assessed.

5. Outbreak investigations

Outbreak investigations can provide useful information at any stage in an immunization programme, but they become increasingly important as the programme matures and fuller attention can be devoted to attacking specific issues which permit the continued occurrence of cases and outbreaks. In the small-pox eradication programme when disease incidence was still high, many national programmes used the number and duration of outbreaks as a way of monitoring progress. This has not yet been tried in the EPI, but may be considered as an option. It should be recognized that "Outbreaks are to be expected in unimmunized populations; and the effectiveness of control measures, particularly if applied late in an epidemic, may be negligible. Unless outbreak measures are applied selectively, there is the risk of diverting resources needed to maintain or

Under the poliomyelitis elimination initiative being undertaken by the Pan American Health Organization, every case of poliomyelitis declared in the Region is being investigated. This strategy has not yet been adopted by the European Region, which has also endorsed a poliomyelitis elimination goal, although it is being pursued by several countries within the Region.

It is hoped that most developing countries may soon be in a position to investigate every case of neonatal tetanus, and that outbreak investigations of poliomyelitis and measles will become increasingly frequent, as the number of outbreaks themselves diminishes.

6. Vaccine quality control



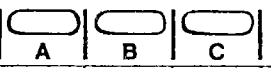

All vaccines used in a national immunization programme must be known to be safe and effective. Control of these factors begins with the manufacturer. Users of vaccines should require that proof of their safety, potency and efficacy is provided. This may be done by asking for a statement from the vaccine control authority in the country in which the vaccine is produced certifying that the vaccine meets all national standards as well as WHO requirements. WHO assures that all vaccines provided to the EPI through WHO and UNICEF have such a certificate from the relevant national control authority, and accepts certificates only from authorities whose competence to issue them is known. Countries not having their own national control authority and which are in doubt concerning the quality of the vaccine(s) they are using can request help from WHO in clarifying this issue. WHO receives support from UNDP, from national control authorities and from vaccine manufacturers to help carry out this function.

The next step is to assure that vaccines known to meet WHO requirements at the time of manufacture maintain their potency during transport and storage. In recent years, WHO and UNICEF have adopted standards for the safe shipping of vaccines. These require that vaccines are appropriately insulated during international shipment, that advance notice of the shipment is sent to the receiving authorities, and that a time/temperature monitor (also called a "cold chain monitor") is included with each 3 000 doses of vaccine (Figure 4).

When exposed to temperatures above 10°C, a blue color appears on the monitor, indicating that the "cold chain" has been broken. The monitor also provides an indication of the extent of the break and, depending on how serious the break was, suggests whether to destroy the vaccine, to have it tested before use or simply to use it within the next three months.

Assuring that no breaks occur in the cold chain requires continuous monitoring of the transport and storage conditions of vaccines. The time/temperature monitor referred to above is useful for this purpose. But it signals a problem only after it has occurred. In addition to the use of such monitors, a thermometer should be used to record temperatures in each refrigerator, freezer and cold room in the morning and in the evening, and those readings should be posted on the door. The state of the ice-packs should be checked when vaccines are transported in cold boxes or vaccine carriers to assure that the vaccines have remained cold. The EPI recommends that all vaccines taken to the field and opened for an immunization session be destroyed at the end of the day. Unopened vaccines may be used on the following day if the cold chain has remained intact.

Figure 4. Cold chain monitor

|  Vaccine Cold Chain Monitor | | | | |
|--|----------------------------|---|-------------------------|---------------------------|
| Date in | Index | Location | Date out | Index |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
|  3M INDEX/INDICE/دليل Monitor Mark U.S. Patent No. 3 954 011   | | | | |
| | If A all blue | If B all blue | If C all blue | If A & B & C & D all blue |
| Polio | Use within 3 months | | Test vaccine before use | |
| Measles | Use within 3 months | | | |
| DPT & BCG | These vaccines may be used | | Use within 3 months | |
| TT & DT | | | | |
| SUPPLIER FOURNISSEUR | | Name: _____ Nom: _____ Date of dispatch: _____ Date d'expédition: _____ Vaccine: _____ Vaccin: _____ | | |

A final check on the quality of the vaccines is provided by the proportion of cases of disease and of adverse reactions among the vaccinees. Happily, serious adverse reactions are rare with the EPI vaccines (on the order of 1 per 300 000 immunizations for pertussis, the most reactogenic of these vaccines), but this also means that without an excellent system for monitoring reactions, only a major problem with a given vaccine is likely to be recognized by the health authorities. Cases in vaccine recipients will be more frequent, and, they will be expected to increase in number as immunization coverage levels rise. Such cases may bring into question the potency of the vaccine. Health authorities need to be familiar with the procedures for estimating vaccine efficacy, and need to recognize that it is not the absolute number of cases in persons who have been immunized which is important, but their number in relation to the total number of persons who have been immunized (Panel 4). Any time more than 10%

of the immunized population contracts the disease, a potential problem exists which warrants further investigation.

If doubts arise concerning the potency of a vaccine, it should be discarded unless at least two thousand doses with a known uniform history of exposure are in question. For such quantities, testing the potency of polio and measles vaccines becomes a reasonable option. Fifty doses of each vaccine are required. It will take at least a month to obtain the results. For BCG, 20 000 doses need to be at risk, for tetanus toxoid, 50 000 doses and for DPT, 200 000 doses. For these three vaccines, 100 doses are needed for the test. Contact can be made with WHO to obtain further information on such testing.

Vaccine potency testing is sometimes suggested as a method for monitoring the quality of the cold chain. This is a possibility, but should be done very selectively. Oral polio vaccine is currently the

Panel 4

The reported number of bacteriologically and/or serologically confirmed cases of pertussis has increased considerably in recent years in the Netherlands: from 25 in 1977 to 534 in 1984. In 1984, 51% of the cases reported had received at least 3 doses of DPT. As these observations raised doubts about pertussis vaccine, a study on its efficacy was carried out. The table below shows that 3 or more doses of DPT/polio vaccine give a high degree of protection against pertussis. Also of interest is the fact that the attack rate decreases with increasing age.

(WER 1986, no.10, pp 73-74)

Attack rates (AR) of pertussis and pertussis vaccine efficacy (VE),
Netherlands, 1984

| No. of doses | Age group | | | | | |
|--------------|-----------------|---------|-----------------|---------|-----------------|---------|
| | 6-11 months | | 1-4 years | | 5-9 years | |
| | AR per 1 000 | VE % | AR per 1 000 | VE % | AR per 1 000 | VE % |
| None | 3.84 | - | 2.76 | - | 1.28 | - |
| 1 | 9.22 | -140 | 1.14 | 59 | - | - |
| 2 | 1.92 | 50 | 0.95 | 66 | - | - |
| 3 or more | 0.08 | 98 | 0.13 | 95 | 0.12 | 91 |

most heat sensitive of the vaccines used in the EPI, losing satisfactory titer after a single day of exposure to temperatures of 37°C. It is also among the easiest vaccines on which to perform potency testing. If tests of samples of polio vaccine obtained from the field show no loss of potency, it may be reasonably assumed that the other vaccines will also be potent, even though the transport and storage conditions for the other vaccines will not have been identical to those for polio. The time and expense required for vaccine potency testing precludes this from being a recommended programme evaluation tool.

7. Cold chain and logistics

The importance of cold chain evaluation cannot be over-emphasized. All programme investments are at risk if impotent vaccine is administered (Panel 5)

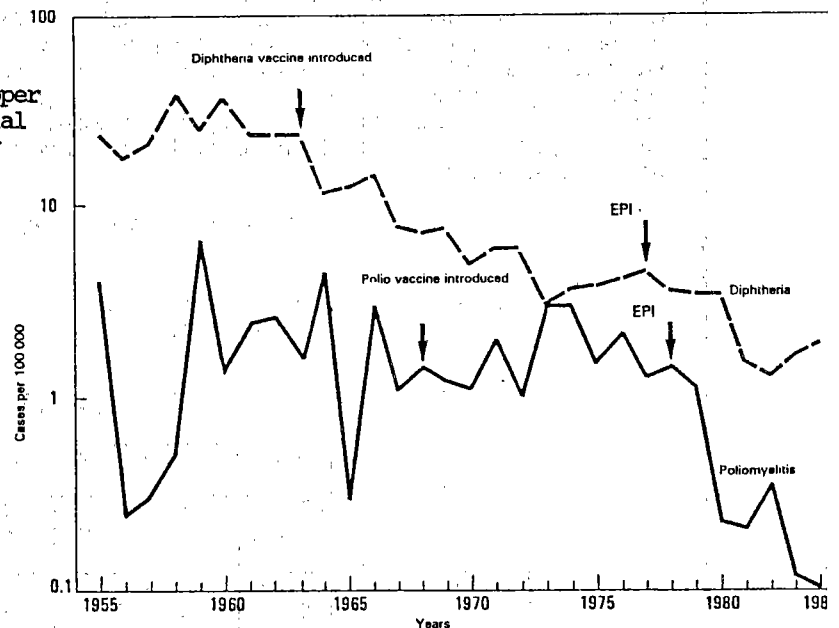
There are many ways in which cold chain and logistics systems can be evaluated. As noted above, the cold chain should be monitored by twice-daily checking of the temperature of cold rooms, freezers and refrigerators. Additional methods include using time/temperature indicators (both routinely and in special cold chain reviews) (12,13), checking on vaccine efficacy through outbreak investigations and, in selective cases, testing the potency of vaccines (especially oral polio vaccine).

Panel 5

Although oral polio vaccine became available as early as 1968, the incidence of poliomyelitis did not show a sustained decline until proper attention was given to the managerial aspects of the programme, including the cold chain.

(WER 1985, no.19, pp 141-144)

Reported incidence rates for poliomyelitis and diphtheria, Bangkok, Thailand, 1955-1984



Two critical questions, so far as the logistics system is concerned are:

- How many scheduled immunization sessions had to be canceled or postponed because of a lack of logistic support (including lack of vaccines, injection and sterilization materials, transport and fuel for refrigerators and vehicles)?

- Are all injections being given with a sterile syringe and a sterile needle?

Vaccine stocks may also be used as an index of the quality of the logistics system. Are outdated vaccines being stored? Do the actual number of doses correspond with the number as shown on the records? What is the expected time in which each of the vaccines will be utilized? Is this satisfactory so far as expiration dates and resupply schedules for the vaccines are concerned? Is there a system of stock control to ensure that vaccines are supplied by expiry date

and according to the principle "First In, First Out". Similar checks can be made with any of the items being supplied to the health centre level.

8. Serological surveys

Serological surveys may be used to assess the age distribution of infection or to assess the immune status of a population. Serological testing may also be used in controlled trials to assess the antibody response to vaccines. But serological surveys are cumbersome, expensive and time consuming and should only be considered where alternative methods for obtaining this information are unsatisfactory.

Surveys, as opposed to controlled trials, cannot be used to assess the antibody responses to vaccines, as they do not, with present methods, distinguish between immunization and infection-induced immunity. The single exception among the EPI diseases is tetanus, because the

disease itself is infrequent, and even those who have been infected may not develop antibodies. Age distribution of disease is generally apparent from the records of health facilities, and can be confirmed through outbreak investigations in communities. Serological tests in an individual patient may be helpful in confirming a diagnosis, but this is a quite different matter from applying them on a population scale.

Despite the above, the idea of doing serological surveys retains attraction for many public health administrators. The EPI experience with such surveys has not been encouraging. Obtaining the specimens has proved time-consuming, their storage and shipment to the point of analysis has required special attention and the analysis of the results has often taken a year or more to complete. Despite the hope that the results would provide helpful insights for programme use, this has not often happened, generally because the objective of the survey had not been sufficiently well thought out in advance. Some of these difficulties can be surmounted if the persons doing the survey are experienced with such methodology and if they have the institutional backup which assures that results will be made available quickly. In general, however, the use of serological surveys is discouraged.

9. Rapid assessments¹

The concepts and methods of rapid assessment have been developed over the last 10 years to supplement regular evaluations in providing decision makers with relatively rapid information about the effects

of a programme and the processes by which these were achieved. They are also useful in documenting, analyzing and communicating lessons learned to decision makers responsible for similar efforts elsewhere.

Rapid assessments ideally should combine the perspectives of several disciplines (e.g. the technical expert, the administrator, the economist, the social scientist). Emphasis is placed on such methods as open-ended and non-directed interviews, document analyses, field observation, etc., that while less rigorous and quantitative, seem to be more useful and appropriate in various decision making contexts.

Some of the fundamental characteristics of rapid assessments are:

- Emphasis on field observation of results and dialogues with key participants at all levels, from the community to senior officials
- Less structured, flexible methodologies emphasizing an understanding of process; problem oriented focus
- Brief, clearly written reports
- Objectivity of the appraisal teams
- Timeliness

The typical steps involved in a rapid assessment approach to learning from experience are outlined below:

Step 1: Defining the evaluation **problem**. Rapid assessment should be problem oriented and decision driven; hence, the process should begin with the posing and prioritization of basic questions or problems by potential users.

¹This section was contributed by UNICEF, who have introduced this approach and this term.

Step 2: Refining the problem to be addressed by the assessment. What is already known about the problem should be summarized and used to develop a set of questions in need of further investigation. These questions should focus on:

1. The problem and proposed solutions.
2. What happened?
3. What did it cost?
4. What difference did it make?
5. What worked? What did not work? Why?
6. What lessons can be gained from this experience that might be useful to those involved in related efforts elsewhere?

Step 3: Identify potentially instructive experience from which to learn. Look for recently completed efforts that through their success or the problems they encountered would be likely to produce information of relevance to issues generated by step 2.

Step 4: Identify assessment team leaders and participants. A team of not more than four should be assembled, representing the following skills: implementation; technical; social science; writing.

Step 5: Data collection and site visits. In addition to administrative records and monitoring system data, the assessment can systematically apply a range of qualitative techniques, e.g. key informant interviewing, participant observation, the sondeo or "sounding" method, and the focal group interview. Information gathering should last 2-4 weeks, including the drafting and field review of the report by its potential users.

Step 6: Prepare and disseminate the

final report. The final report should be brief (e.g. fifteen pages with a two page summary) and jargon free, with additional material included as appendices.

Step 7: Summarizing the results of comparable studies. The assessment should be linked to a specific utilization and dissemination strategy. If warranted, a meeting of those planning related efforts may be convened to go over the results and make recommendations on future improvements.

10. Special studies

Special evaluations are needed for special events (14). A good example is presented by national immunization days. The intensity of political support and visibility which is often generated by such days (or weeks, or special campaigns) is such that immediate feedback of results is demanded, often for use in the mass media, to generate further support for the efforts. Feedback which can be used by the mass media may be based on telephone reports from various sites and may include total numbers of children reached, or, in more sophisticated programmes, doses of the various vaccines administered to children in the under one year age group as well as to others.

Special evaluations, however, are by no means restricted to special events. They can and should be used to probe areas of programme weakness. If, for example, concern exists that health services are systematically missing certain populations (as, for example, nomads, or those living in the

shanty-towns of major cities), then such populations can be made the focus of a special survey. Such a survey may not be possible to do in an unbiased manner. The nomads who are included in a survey may also be those who are more likely than their companions to use the health facilities. The shanty-town inhabitants who may be most in need of health services may also be those who fear government officials and who therefore avoid being surveyed. Much can be learned even from a biased sample, however, and one should not abandon attempts to learn about problem populations because an ideal methodology cannot easily be applied.

Special evaluations can and should also be used to examine selected issues of critical importance to programme success. One such issue is the extent of social mobilization, which involves the stimulation and organization of both effective consumer demand and multi-sectoral resources to provide immunization services. Social mobilization frequently may include the involvement of national political leaders and celebrities, the mass media and less formal communication channels, community action by public and private sector organizations, and more traditional health education activities. Low rates of coverage for a first dose of vaccine or high drop-out rates between doses indicate a problem of social mobilization. Evaluation approaches include the use of surveys to obtain reasons for non-immunization (see section 3, immunization coverage), a review of official government statements in support of the programme and a review of the resources being provided (including the budgetary allowance and the number and quality of programme staff recruited). A determination should be made whether a communications plan exists, and, if it does, whether the target audiences, media and messages which

are specified, are appropriate to programme needs.

11. National programme reviews

The evaluation instruments, described so far, each look either at a special section of the programme or measure a specific outcome. None of these provides a comprehensive assessment of all programme components. Programme reviews try to provide such an assessment, asking about:

- the relationship of the individual components to each other,
- the adequacy and relevance of the programme objectives, and
- the relationship of the programme to the community and to the other health programmes.

Programme reviews try, from a national level perspective, to answer the following questions:

- How can the programme achieve better results?
- How can the programme make better use of its manpower and other resources?

The organization of a programme review is normally done in three phases: preparation, data collection, and data analysis/redesign of the programme.

Preparation for a programme review generally takes four months or more. The length of this period is largely determined by the availability of senior level staff. Major issues they must resolve include team composition, sampling strategies and finalization of the data collection instruments to be used in the programme review.

A guiding principle for decisions on the composition of the programme review team has been to include representatives from major national and international agencies which collaborate in the implementation of the programme. At the international level this usually includes WHO and UNICEF and one or more international development agencies. As voluntary and non-governmental organizations are now making an increasing contribution to the EPI, they are also being represented in a number of programme reviews.

At the national level, efforts should be made to involve persons from a variety of areas, both from within and outside the Ministry of Health, to assure that the review encompasses a broad based perspective. This also helps to assure that the recommendations receive broad based support. Examples of other areas from within the Ministry of Health include other primary health care interventions, health manpower development, health planning and community participation. The Ministries of Education and Interior, among others, may also be included in the process. Extra staff, which may be drawn from the existing health services or which may comprise medical or nursing students, may be required to assist in completing the coverage surveys. The review process serves as a powerful educational and motivational tool for all involved.

It is becoming increasingly important to include communications planning and assessment skills in the programme review team. The communications component of immunization programmes has grown in importance as attention increasingly has turned to improving utilization rates of available services, lowering drop out rates between doses, and building on immunization activities to strengthen other primary health care services. Accordingly, the role of communications in immu-

nization programmes is to stimulate the active demand for immunization services, not only among the programme's potential beneficiaries, but among all segments of the society whose support is required for the successful implementation of the programme.

A plan for coverage evaluations needs to be decided upon. In smaller countries with only a few million population, a one-stage sampling strategy can be used in which thirty villages are randomly selected. Health centres nearest to these villages can also be visited as can the district and regional health services responsible for supporting these health centres. In larger countries multi-stage sampling may be used (see section 3, immunization coverage).

In most countries, immunization services are or could be delivered together with other primary health care services, particularly those relevant to mothers and children. In such cases the access to such services may determine the access to immunization services. In these situations it is imperative to study such related services in the programme review. Also, the review process with its sampling of communities and health services at all levels can be considered as a good opportunity for the collection of information on a few other priority programmes on which additional information is required. This will increase the efficiency of the review process. Care should be taken however, to remain selective, for if reviews which are too narrow are inefficient, those which are too broad are ineffective.

Part of the data collection occurs during the preparatory phase. Several documents should be collected prior to the arrival of the full team. These include those summarizing statistics on the population of the country, on vaccine procurement and utilization, of immunizations

administered, on cases and deaths of the target diseases, and on results of coverage surveys. Additional documentation should be collected regarding the organization of the health services, training and other activities. Programme manuals and action plans should also be carefully reviewed if they exist. The collection of information by the team itself usually lasts two weeks. The first step is for the team to agree on standard instruments for data collection by the various subgroups in which the team will be divided. For this purpose WHO has prepared prototype checklists from which selections can be made for local adaptation (15).

The data collection phase of the review includes a verification of the documents obtained before the arrival of the team and on-site observation of management procedures with respect to:

- delivery of immunizations,
- vaccine procurement, storage and distribution,
- programme supervision, monitoring and evaluation,
- health education and social mobilization, and
- disease surveillance.

This on-site observation is performed at all levels of the health services in the selected areas. Similar information is collected on the other health programmes included in the review. This phase also includes the community survey(s) on immunization coverage, and of peoples' knowledge of and attitudes toward immunization and other programmes.

On return from their field work, team members collate and exchange the information they have gathered.

As a first step in the data analysis, the programme redesign needs are discussed and a list of major issues is prepared. These issues are analyzed in detail in working groups. For each issue, achievements and problems are listed and an action plan formulated, together with target dates for completion of each recommended action as well as a designation of the health unit responsible for implementation of this recommendation.

As a last part of this phase a summary report of major findings, major conclusions and major redesign needs is prepared. This report is presented to and discussed in a meeting with the senior staff of the Ministry of Health, which customarily includes the Minister of Health. Thereafter the full report can be prepared, preferably in the country itself and in the week following this senior level meeting.

It is good practice to follow-up on the recommendations of the programme review after about one year to determine the extent to which the recommendations were appropriate and to what extent they have been implemented or require re-scheduling. Such a follow-up may be part of a programme review which this time has another health programme as major focus.

12. Costing studies¹

The basic rationale for costing studies, as for other types of evaluation of immunization programmes, is to bring about action, in the form of new or modified objectives and strategies. The general procedures in costing studies involve the bringing together of appropriate measures of the resources used and of the results obtained. EPI studies have commonly summarized such information in measures of costs per immunization, or costs per fully immunized infant.

In all cost appraisals certain common procedures are recommended to encourage explicitness (and therefore assessments of the sensitivity of the results). These may be summarized as: identify the relevant resource inputs; quantify them in the most appropriate units; and value them separately.

Cost studies have a variety of applications, and different data may be needed for different applications. Analysis of the desirability of incorporating new vaccines into an existing programme will require, on the cost side, measures of the incremental cost to the programme. Analysis of performance variations within the existing programme will require summaries of total cost variations. The relevant cost taxonomy (foreign exchange components? costs to users? publicity costs?) will also depend on the purpose of the individual study.

The Programme Costing Guidelines (16) developed and field tested by EPI are intended to provide programme managers with a simple method for monitoring cost and performance. They concentrate primarily on the identification, quantification and valuation of the total financial costs of the exist-

ing programme. A matrix-type format for separately identifying costs born by the major agencies, domestic and foreign, supporting the immunization programme, is proposed (Table 4). Variations in costs per immunization and costs per fully immunized infant can be identified following the Guidelines (Panel 6), and the cost-effectiveness of differing domestic strategies co-existing within the same national programme can be appraised.

The unit of analysis proposed in the Guidelines is the health centre/ clinic where immunizations are actually offered. The sample of clinics chosen for studies should correspond to the specific questions the study is to answer. Data concerning the proportion of staff time contributed to immunization (as distinct from other functions), particularly at intermediate and peripheral levels of a programme, should be obtained from direct observation. Samples of about a dozen clinics have been costed in several countries in a period of about two weeks.

Where countries are in the process of accelerating their programmes to achieve high levels of immunization coverage, several alternative strategies, or combinations of strategies, should be considered in the search for the most efficient use of resources. For this purpose, the total costs of the existing programme, their distribution among differing domestic and foreign support agencies, and their composition by different elements, as illustrated in Table 4, are an essential starting point. In addition, the incremental costs of programme development by the identified alternative paths are required and may be tabulated in the same type of matrix. These, together with best available estimates about the additional coverage yield of the

¹Adapted from material prepared by Mr Andrew Creese, Consultant, World Bank, and author of the EPI Costing Guidelines (16).

strategies, provide the basis for informed choice about the optimum expansion path of the programme. The retrospective total cost and effectiveness analysis, normally using the previous year's financial and immunization data, may thus be employed in conjunction with prospective appraisal of incremental costs and effectiveness. In both cases, analysis of cost at the various operating levels of the programme is an essential component of cost studies for the national development of the programme.

Additional complications arise for inter-country comparison. The structure of public health services may vary, so that the rows and columns of the "flow of funds" matrix may differ substantially between countries. The relative costs of common inputs into immunization work (e.g. for the time of public health nurses employed by the Ministry of Health) will differ between countries, as indeed will the categories of workers involved in the immunization programme. The "opportunity cost" of health workers' time - the economic index of their real value - may also differ

widely between countries, and, finally, official foreign exchange rates may differ widely from country to country in their relationship to the "true" purchasing power of domestic currency. Each of these makes direct international comparisons of immunization programme cost experience difficult, and effectively limits the usefulness of international cost studies to countries whose economic structure and health sector are closely comparable.

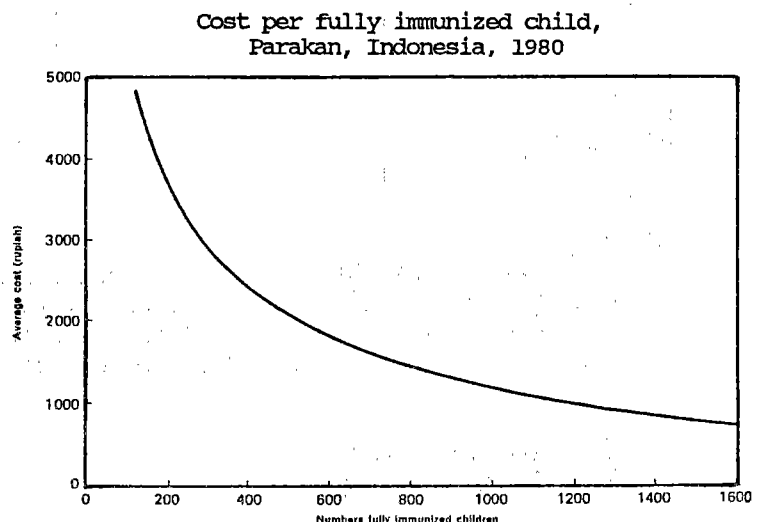
With the supporting of the longer term development of national programmes as primary objective, the following would seem a desirable set of cost studies to promote:

- "stocktaking" descriptions of existing programme total costs, by cost type and supporting agency
- prospective least-cost studies of the additional costs of alternative possible strategies for programme development, again separating cost increments by type and agency
- prospective estimates of incremental costs per fully immunized infants for each of several strategies.

Panel 6

Most of the costs of immunization are fixed, that is they do not change as activity rates change. Staff salaries, cold chain and supervision remain largely the same whether few or many immunizations are given. Only the actual vaccine costs and that share of the vaccinator's time spent on immunization change in relation to levels of immunization work. The figure shows how immunization costs change as the number of fully immunized infants increases at a health centre.

(WER 1981, no.13, pp 99-101)



13. Conclusions

Evaluation of an immunization programme can benefit other elements of the health system, particularly those which are not as amenable to objective evaluation as immunization. In this sense, immunization can serve as an indicator of the performance of the health system as a whole. An excellent immunization service does not necessarily guarantee that all the other health services will also be excellent. But it is a reasonable inference that if

problems with respect to training, supervision, logistics, monitoring and community participation exist with respect to the immunization services, which are among the easiest to provide, such problems are likely to plague other services as well. The problems revealed by an evaluation of immunization should therefore be taken as problems generic to the health services as a whole until proven otherwise. In remedying these problems for immunization, approaches which improve the health services as a whole should be sought.

Panel 7

Where immunization services are delivered together with mother and child care services, it is imperative to study such services in an EPI evaluation. Immunization coverage surveys can assess coverage with other health services as well. An example from Bhutan is shown in the table.

(WER 1986, no.4, pp 21-23)

Results of family interviews, Bhutan, 1985

| Topics | Percentage |
|--|------------|
| Mother was examined by trained health worker during pregnancy | 20 |
| Delivery was conducted | |
| — in government health institution | 2 |
| — at home | 98 |
| Delivery was attended by | |
| — trained health worker | 1 |
| — traditional birth attendant | 8 |
| — other | 91 |
| The child was examined by trained health workers | |
| — twice or more | 41 |
| — once | 15 |
| — never | 44 |
| The child has growth chart at home | 38 |
| The child was weighed at least twice | 20 |
| The child was breast-fed for at least 12 months | 97 |
| The child began to eat solid food before 6 months of age | 70 |
| Nutritional status as shown by mid-arm circumference: | |
| — satisfactory | 39 |
| — mild malnutrition | 40 |
| — frank malnutrition | 20 |
| Someone in the family has visited a health facility within the last 2 months | 43 |
| A health worker has visited the family within the last 2 months | 8 |
| Health care/first aid is available within 1 hour's walk | 40 |
| The last time any family member was ill, help/advice was sought from: | |
| — government health facility | 76 |
| — traditional healer | 12 |
| — other | 12 |
| An auxiliary nurse/midwife or basic health worker visits the village | 24 |
| If yes, the family was visited within the last 3 months | 26 |
| Someone in the family knows oral rehydration salts | |
| — and has used them | 31 |
| — but has never used them | 4 |

Evaluation of other programmes can also be included when conducting an EPI evaluation, as mentioned in section 10. Immunization coverage surveys can assess coverage with other health services as well (Panel 7). A given sentinel reporting site may be able to provide information not only on diseases of interest to the EPI, but also on those of concern to other programmes. Reviews of the vaccine cold chain and logistics systems can also assess the adequacy of the storage and supply of oral rehydration salt packets, of contraceptives and of essential drugs. Monitoring and supervision of sterilization practices has

relevance to all injectables, not only to immunization. As the evaluation process as used within the EPI is often more advanced than that being used for other health programmes, it can and should serve as an example and stimulus for them. Support given to other programmes in an EPI review is necessarily superficial, however. It may be of most benefit to those programmes, which are least developed and which have few other sources of information.

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