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Epidemiological Support for a Neonatal Tetanus Mortality Survey and for EPI-Target Disease Surveillance, Kenya

2 February - 9 March 1989

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The helpful guidance of Ms. Molly Gingerich (USAID), close involvement and interest of Drs. Mutie and Sang (MOH), and administrative attention of Mrs. Josephine Kariuki (REACH) contributed to a busy and satisfying consultancy.

ACRONYMS and ABBREVIATIONS

AMREF	African Medical and Research Foundation
ANC	Ante-natal Clinic
ARI	Acute Respiratory Infection
BCG	Bacillus Calmette-Guerin
CBR	Crude Birth Rate
CBS	Central Bureau of Statistics
CDD	Control of Diarrheal Diseases
CEIS	Computerized EPI Information System
CFR	Case Fatality Rate
COSAS	Computer Software for EPI Coverage Surveys
DANIDA	Danish International Development Agency
DPT	Diphtheria-Pertussis-Tetanus Vaccine
EPI	Expanded Program on Immunization
FP	Family Planning Project
FPPS	Family Planning Private Sector Programme
GFR	General Fertility Rate
HIS	Health Information System
Idd al Haj	Moslem holiday
IMR	Infant Mortality Rate
IPS	Information Planning Systems
KANU	Kenyan African National Union
KAP	Knowledge, Attitude and Practices
KEMRI	Kenya Medical Research Institute
KEPI	Kenya Expanded Program on Immunization
MOH	Ministry of Health
NGO	Non-governmental Organization
NNT	Neonatal Tetanus
OPV	Oral Polio Vaccine
PHC	Primary Health Care
PRITECH	Technologies for Primary Health Care Project
SSS	Sentinel Surveillance System
TBA	Traditional Birth Attendant
TDY	Tour of Duty
TT	Tetanus Toxoid
USAID	United States Agency for International Development
VE	Vaccine Efficacy
WHO	World Health Organization

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I. EXECUTIVE SUMMARY

Supplemented with central funds, REACH has a two-year buy-in from USAID/Nairobi until September 1990 to strengthen four areas of the Kenya Expanded Program on Immunization (KEPI).

The thematic areas are:

- surveillance of immuno-preventable diseases, including sentinel surveillance systems (SSS) and computerized EPI information systems (CEIS);

- social mobilization to strengthen demand for immunization;

- operations research to identify program constraints, remedies, and innovative approaches to improve service delivery; and

- training, including development of improved EPI materials for the medical curriculum and a series of lectures to pediatric and medical societies.

The USAID strategy complements other donor assistance for KEPI and is scheduled to last five years.

From 2 February to 9 March, REACH provided epidemiological and most of the financial support, including this consultant's services and local costs, for a 30-cluster neonatal tetanus (NNT) mortality survey in Kilifi District. As a step towards strengthening control activities, such community surveys help to determine the magnitude of NNT as a public health problem and to alert decision-makers about its importance.

The Ministry of Health (MOH) provided survey teams and KEPI, the Danish International Development Agency (DANIDA) and UNICEF supplied additional staff and resources. The survey data will be fully analyzed and results reported by REACH. Preliminary data from the first 10 completed clusters and accelerated NNT control policies and strategies are presented in this paper.

An integrated surveillance system, based on sentinel sites with a history of reliable diagnosis and regular reporting, is being established and will initially include measles and diarrheal diseases. Sentinel surveillance is needed for more focused, timely and accurate data for EPI to guide disease control activities. The surveillance objectives concerning measles are to measure the impact of KEPI on disease incidence over time and by age groups, and to determine vaccine efficacy by age. Additional epidemiological features, such as seasonality, will be defined. The SSS will also be used to assess the degree of underreporting in defined catchment areas.

A 3-day workshop on SSS was conducted from 20-22 February with the participation of staff from Health Information Systems (HIS), KEPI, Control of Diarrhea Diseases (CDD), CHANIS and Family Planning (FP) programs. The workshop objectives included:

- defining the role of SSS and data in the context of the overall health information system

- planning the strategies for implementing the KEPI-CDD SSS, including management and training issues.

The consultant assisted Information Planning Systems (IPS) staff in designing the workshop content and preparing lecture materials.

A SSS is an inexpensive attempt to improve the quality of data available for program managers. It should be kept as simple as possible so as not to overwhelm the ability of the central level to manage the system in a timely fashion. Several points are presented which need to be clarified by the key users of the information in the MOH in order to increase the likelihood of success. Once this is done, this consultant does not see any insurmountable constraints, although the general shortage of epidemiological skills at all levels suggests that periodic technical assistance will continue to be required.

In keeping with REACH's global role in developing and refining computerized EPI information systems, the KEPI CEIS was reviewed. Detailed suggestions are presented in this paper for its further adaptation during a follow-up REACH consultancy to meet the needs of potential users.

A national REACH Communications Specialist was hired to develop and manage a long-term social mobilization strategy for KEPI, which focuses on increasing demand for sustainable immunization services. She will coordinate inter-agency efforts in social communication with most costs borne by UNICEF.

A list of possible REACH operations research topics was collaboratively drawn up. In support of the routine immunization services, KEPI, REACH and UNICEF are interested in developing child-to-child social mobilization efforts in selected districts to educate school children, inform the public and raise coverage.

An annual series of five EPI lectures for medical students and orientation seminars for medical societies is being designed.

A debriefing session was arranged for the consultant by Ms. Molly Gingerich (Health and Population Development Officer, USAID/Nairobi) with Drs. Mutie (Division of Family Health) and Sang (KEPI).

II. PURPOSE OF VISIT

The scope of work for this assignment was as follows:

1. To participate in the design of the field methods and questionnaire; to train interviewers and supervisors; to provide field supervision of preliminary clusters; to supervise preliminary data analysis and eventual report write-up in connection with first neonatal tetanus survey.

2. To assist in the review and design of systems for surveillance of EPI diseases and for the monitoring of routine service statistics and key operational indicators, including design of the forms used at various levels of the health service for routine and sentinel EPI data collection.

3. To deliver a lecture to the pediatric society, including residents, post-graduates and private pediatricians on a subject identified under the curriculum development component (e.g. missed opportunities for vaccination and role of physicians in screening, referral and vaccination).

4. To follow-up with the Department of Pediatrics in planning the content of future lectures on EPI for post-graduate students.

5. To supervise resident REACH staff.

It was not possible to deliver a lecture (point number 3 above), as the timing of planned pediatric and medical society meetings did not coincide with the consultant's visit.

III. BACKGROUND

REACH has a two-year buy-in from USAID/Nairobi until September 1990 to strengthen four areas of EPI in Kenya. These thematic areas were identified during several visits to Kenya by REACH staff and after discussions with KEPI and the major EPI donor agencies.

The thematic areas are:

- surveillance of immuno-preventable diseases, including computerized EPI information and sentinel surveillance systems;

- social mobilization to strengthen demand for immunization;

- operations research to identify program constraints, remedies and innovative approaches to improve service delivery; and

- training, including development of improved EPI materials for the medical curriculum and a series of lectures to pediatric and medical societies.

The USAID strategy complements other KEPI activities and is scheduled to last five years. Besides the USAID buy-in to REACH, central REACH funds also will be used until September 1990, particularly to support a resident Kenyan communications specialist and to provide technical and administrative backstopping.

IV. TRIP ACTIVITIES

Approximately 50% of this TDY was spent with HIS and KEPI staff on NNT survey planning, training, execution, and analysis. This included eleven days spent in Kilifi District.

Another 30% of the TDY was involved with the USAID-funded IPS project on planning for and participating in a sentinel surveillance system workshop. The consultant also reviewed the status of the SSS, the computerized EPI Information System, and of routine reporting forms. A follow-on scope of work for a visit by a management information system specialist was prepared.

The remaining time was used:

- discussing progress in and sharing materials for the revised medical school EPI curriculum;

- briefing the candidate for REACH Communications Specialist;

- discussing social mobilization and operations research plans in a joint USAID/UNICEF/REACH meeting;

- exchanging program indicators with AMREF; and

- supervising resident REACH staff.

A very useful debriefing session was arranged for the consultant by Ms. Molly Gingerich (USAID) with Drs. Mutie (Division of Family Health) and Sang (KEPI).

V. METHODOLOGY AND APPROACHES

A wealth of published and unpublished epidemiological and KEPI information exists in Kenya. These materials were reveiwed, as well as TDY reports from previous REACH consultancies, relevant USAID documents, technical materials prepared by the IPS project, and plans and budgets from other donor agencies.

The exact methodologies and approaches are presented in detail in the following sections.

VI. RESULTS AND CONCLUSIONS

A. Neonatal Tetanus

1. Kilifi District NNT Mortality Survey

In 1984-1985, house-to-house neonatal tetanus mortality surveys were conducted in three districts using the standard WHO 30-cluster survey methodology. NNT mortality rates ranged from 6 to 16 per 1000 live births. When these results were extrapolated to the rest of Kenya, it was estimated that between 8000 and 12000 newborns die annually from this preventable disease.

Surveys are needed to determine the magnitude of NNT as a public health problem and to alert decision-makers about its importance. The 1988 DANIDA evaluation of KEPI recommended that additional NNT surveys were needed to stimulate strengthened control activities, principally vaccination of pregnant women with TT. In addition to the above objectives, the NNT survey in Kilifi will determine the efficacy of TT and obstetrical delivery at a health facility.

District Profile and Selection

Using 1979 national census data, the MOH presumed that the Coastal Region would be an area of higher NNT incidence. Kilifi District in Coastal Province was selected for the next NNT survey. Although the national infant mortality rate (IMR) is about 80 per 1000 live births, Kilifi was found on the 1979 census to have an IMR of 149. Kilifi District had a population of 435,510 in 1979 and a population projected at a 3.92% annual growth rate to be 632,018 in 1988 (Central Bureau of Statistics). In 1987 approximately 27,000 births are estimated to have occurred in a population of 593,000 (Coast Province Annual Report, 1987). An antenatal care coverage of 85% (22,722) for first visits was the highest of the six districts in the Province. There were an additional 2.8 antenatal revisits on average for each registered first visit. Coverage of pregnant women with TT2 and Booster was estimated based on routine reports to be 74% for 1987. An immunization survey conducted in 1987 found coverage to be 84%

based mostly on mother's recall of TT received only during the last two pregnancies. Despite the high coverage with antenatal care, only 15% of births are delivered in health facilities.

Access to childhood immunization is extremely high, as measured by 90% for BCG and 95% for DPT1 on the 1987 Kilifi District coverage survey (according to card and history by 12 months of age). Third dose coverage at 81% and 83% for DPT and Polio, respectively, is high. Since KEPI began in the District, the percentage of fully immunized infants increased from 27% (1981) to 52% (1987 survey).

Fifty-five cases of tetanus were reported by outpatient departments in the District in 1987 (Coast Province Annual Report). Assuming that one-half of the cases were in neonates, the neonatal tetanus mortality rate was 1 per 1000 live births. However, routine reporting characteristically underestimates the true incidence in many countries, sometimes by a factor of 20-50.

The number of NNT and non-neonatal tetanus cases and deaths reported by year from Kilifi District Hospital and the number of hospital admissions appears in Annex 2. The incidence of NNT, the NNT incidence rate per 1000 live births, and the proportion of NNT to pediatric admissions have steadily declined over the past six years for which data are available. Approximately three-quarters of all hospitalized tetanus is NNT and this proportion is nearly constant over the years. The case fatality rates are lower than expected. This is due probably to the frequency with which terminal patients leave the hospital against medical advice but are recorded as live discharges.

Of the ten 30-cluster EPI coverage evaluation surveys conducted by KEPI in 1987, Kilifi District had the highest rate of home deliveries (77%) and lowest levels of formal education among mothers of children 0-23 months old (65%). However, Kilifi also had the highest rate of mothers of children 0-23 months old receiving two or more doses of TT during the last two pregnancies.

NNT is a disease of "peculiar quietness." It predominantly occurs at home and is seen infrequently by health facilities. Routine disease surveillance systems in most developing countries pick up only a small fraction of cases. In Kenya, NNT is not reported separately from all cases of tetanus. One of KEPI's targets is to reduce the level of NNT to less than 5 per 1000 live births by 1993.

Survey Methodology

REACH provided the technical and financial support, including local costs and the consultant's services, for the Kilifi District NNT mortality survey.

Prior to the consultant's visit, 30 clusters had been identified with the chance of selection proportionate to population size. The consultant confirmed that the universe consisted of all sub-locations in Kilifi

District and that sampling had been properly done. Most of the logistical arrangements had been competently made prior to the consultant's visit by HIS staff.

The survey questionnaires appear in Annexes 3 and 4. The pre-existing questionnaires had been revised to incorporate most of the consultant's suggestions (Annex 5). The top of Form A was filled out for each household visited and the lower part was used to record details of any live birth during 1988. Form B was filled out for any neonatal death identified on Form A.

The sample size of 2550 live births (85 in each of 30 clusters) had previously been calculated by a WHO consultant and is consistent with the expectation of a NNT mortality rate of 10 per 1000 live births in this highly immunized population. The consultant has recalculated the sample in Annex 6.

All selected clusters were visited by an advance team which discussed the purpose and organization of the survey with local chiefs. In most clusters, the chief identified a local guide who could accompany the teams.

Each of the 10 teams consisted of a MOH staff member from Nairobi, who was experienced in field surveys, and a locally-recruited person. The latter were either public health technicians (4) or recent secondary school graduates (7) able to communicate in the local languages.

During the training session, it became apparent that field supervision would need strengthening. Three local MOH staff were assigned to complement two supervisors from Nairobi. This allowed for close supervision of each team every second day.

Vehicles were provided by KEPI (2), DANIDA (1), and for one week by UNICEF (1).

Survey Training

Training began on 6 February and had originally been scheduled before the consultant's visit to last two days. However, the trainers agreed to extend the session for a total of four days. Trainers included the HIS supervisors (Kimani and Kanyette), a pediatrician serving as survey medical supervisor (Mjomba), the KEPI Senior Technical Advisor from DANIDA (Bjerregaard) and the consultant. The latter prepared the training materials.

The training program (Annex 7) included role playing exercises, small group discussions, and a one-half day field practice. A video produced by UNICEF in New Delhi called "Recognize the Disease," which showed a baby suffering from tetanus, was shown. Some sample role playing exercises used in small groups appear in Annex 8.

The training stressed the importance of not looking for living children. A script of questions (Annex 9) was prepared and discussed line by line by the entire group to reach a consensus on how the questions

should be phrased in the local languages. Interviewers were trained to ask the respondent if she had been pregnant during the past two years, so that the outcome of each pregnancy could be determined. A guideline on how to complete each of the forms was reviewed (Annex 10).

Much time was devoted to using a local events calendar (Annex 11) to assist in determining dates of birth and death. Only live births during 1988 were eligible for inclusion. The recall period covered the previous 13-14 months. As the survey began in the first week of February, all children born in December 1988 had either survived or died during the neonatal period prior to the survey's start.

Forms A and B needed to be slightly revised after the field practice. The choice of "Yes" or "No" on page 2 of Form B was replaced by a line on which to record the answer. Rather than circle the "Yes" or "No," some surveyors had ticked "Yes" to mean "Yes" and other surveyors ticked (or put a line through) "No" to signify "Yes."

Surveyors were instructed to select a point in the geographic center of the cluster (sub-location) and to use the last two digits on a currency note to select the direction and the number of the first house to be visited. From there, surveyors were to proceed to the nearest unvisited household within the same sub-location.

Some material on clinical signs of NNT was distributed to the two part-time medical supervisors (Drs. Mjomba and Orinda). Their role (Annex 12) was to review the forms relating to any neonatal deaths and conduct investigations as indicated. The consultant prepared a line listing form (Annex 13) on which the salient points for each neonatal death could be recorded.

The KEPI Senior Technical Advisor (DANIDA), a physician based in Nairobi, also blindly reviewed all Form B's without benefit of the medical supervisors' comments. He was able to call for an investigation of any neonatal death. Such an investigation was mandatory in case of conflicting diagnoses.

Preliminary Partial Survey Results

The survey began on 10 February with work in 10 clusters simultaneously. Field work was completed 5 March.

The consultant prepared a worksheet (Annex 14) on which the HIS supervisor and himself were able to review data by cluster on a daily basis to spot any out-of-range demographic values. The consultant supervised field work during the first week and prepared a preliminary analysis of the first 10 completed clusters (Annex 15). These clusters may not be representative of the entire district, as the initial 10 clusters were purposefully chosen from among the 30 clusters for their proximity to the survey base in Kilifi. Access to medical care and health services in these nearby communities is better than the district average.

Many of the demographic indicators derived from an analysis of the first 10 clusters are as expected: for example, the number of occupants per household (7.3 versus 5.6 on the 1979 census), the almost even split between male and female births and infant deaths, and the crude birth rate of 54.5 per 1000 population. (The 1979 census found a CBR of 55 per 1000 for Kilifi District.) The neonatal deaths are evenly distributed throughout the recall period.

The overall neonatal mortality rate (21.7 per 1000 live births) is much lower than expected. The supervisors are satisfied that the interviewers were skilled enough in their questioning to have elicited any neonatal deaths which might have occurred. Assuming that 40% of all infant deaths occur in the neonatal period (1979 census), then infant mortality can be indirectly estimated to be 52.7 per 1000 live births.

Only one confirmed case of NNT was found in the first 10 clusters. Another three suspect cases were excluded upon medical investigation. Hospital records were located for one excluded child who died of septicemia at five days of age. Another excluded child died at six days of age either from jaundice or from meningitis due to septicemia. A 21-day old excluded child died of sepsis leading to diarrhea, vomiting and pneumonia. Of the 18 neonatal deaths, 9 (50%) occurred on the first day of life and 16 (89%) in the first week of life.

The second 10 clusters were two-thirds completed at the time of preparing this preliminary draft. In these 10 clusters, the neonatal mortality rate had increased to 30/1000 and IMR to 75/1000. Three additional cases of NNT had been confirmed.

Data will be entered by HIS staff onto a specially-prepared computer program and will be analyzed by REACH. A draft report will be prepared during April.

Results of the survey should be widely publicized within the MOH. The consequences of the survey in terms of new policy and operational initiatives should be assessed before consideration is given to funding any additional NNT survey. UNICEF, which also has funds available for a NNT survey, shares these views.

2. Other Observations

A visit in July 1988 by a WHO staff member, Dr. S. Robertson, provided a useful review of NNT in Kenya. Her suggestions for improved NNT control deserve the attention of the MOH and are expanded and modified here as follows:

- NNT should be reported separately from all tetanus.

- a durable tetanus protection card, to be retained by each woman, with the TT schedule and space for recording all primary and booster doses of TT, is needed. An example is in Annex 16.

- coverage surveys should include questions on TT following new procedures outlined in the revised (December 1988) WHO coverage survey modules, which the consultant left with the KEPI Manager.

- missed opportunity surveys at antenatal clinics are needed to evaluate the degree to which national TT schedules are efficiently implemented.

- in districts with low reported TT coverage due to low ANC coverage, consider accelerating NNT control by expanding the eligible age group to include all women of childbearing age. This should be carefully studied before implementation. Five properly spaced doses (Annex 17) provide lifelong immunity. The series can begin even before the woman's first pregnancy during any visit to a health facility for whatever reason, and will require fewer doses over the woman's lifetime than the current schedule.

- in districts with high ANC and TT coverage and low NNT incidence, the current ANC-based delivery of TT can continue.

- in all districts - but especially where TT coverage is low and NNT incidence is presumed high - greater attention is needed to vaccinate female students in the early grades before attrition, and to record these vaccinations on tetanus protection cards. This will help solve the NNT problem in the long run, since women will enter their childbearing years with greater immunity and need fewer doses.

- on the next revision of the "road to child health" card, include information on the woman's TT vaccination status (Annex 18). This will increase the likelihood that health workers will screen the women for TT status and vaccinate (or refer) them as necessary.

B. Sentinel Surveillance System and Workshop

The ultimate aim of immunization programs is to reduce disease incidence and mortality. However, the routine disease surveillance system managed by HIS is presently unable to provide data on the EPI - target diseases which have sufficient completeness, reliability, timeliness or usefulness for KEPI managers. Furthermore, only 50% of expected routine reports of vaccinations administered were received at the central level of HIS for 1987.

KEPI has established specific disease reduction targets for 1990 which include:

- reduction of NNT incidence by 50%;

- elimination of endemic poliomyelitis; and

- control and virtual elimination of infant mortality from measles.

These diseases lend themselves to effective surveillance since they are easy to diagnose clinically, are responsible for the largest portion of preventable disability and mortality, and are controllable in the short term through effective immunization programs.

Among the major infectious diseases, including diarrheal diseases and malaria, measles was reported to be the leading cause of death in 1984 among children. It is fitting that KEPI has selected measles morbidity to be the single most useful indicator of program impact.

Measles coverage in ten 30-cluster district coverage surveys in 1987 was seen to lag considerably behind coverage with other antigens and was the principle factor reducing the proportion of "fully immunized." Sixty percent of children 12-23 months of age were immunized up to the date of the survey against measles according to vaccination card (44%) and parental recall (16%). By comparison, 95% of children had received at least one vaccination, and coverage with polio 3rd dose was 75%. A slide listing the frequent reasons in many countries why measles immunization coverage is below that for other antigens is in Annex 19.

A surveillance system, based on sentinel sites with a history of reliable diagnosis and regular reporting, is being established by the MOH and will initially include measles and diarrheal diseases. Reasons for integrating various disease surveillance systems as part of a total epidemiological surveillance system appear in Annex 20. The surveillance objectives concerning measles are to measure the impact of KEPI on disease incidence over time and by age groups, and to determine vaccine efficacy by age. Additional epidemiological features, such as seasonality, will be defined. The SSS can also be used to assess the degree of underreporting in defined catchment areas.

A 3-day workshop on SSS was conducted from 20-22 February with the participation of staff from HIS, KEPI, CDD, CHANIS and FP programs. The workshop objectives included:

- defining the role of SSS and data in the context of the overall health information system

- planning the strategies for implementing the KEPI-CDD SSS, including management and training issues.

The consultant assisted IPS staff in designing the workshop content and preparing lecture materials. Handouts were included in the workshop folders; others were available for reference (Annex 21); others were adapted and new materials developed and used by himself and other presenters. An outline of the agenda for the workshop is in Annex 22.

Lecture outlines appear in Annex 23. Slides prepared by this consultant and generally presented by him (or, in a few cases, presented by other lecturers) appear in Annex 24.

Individual exercises from the module "Conduct Disease Surveillance" from the WHO EPI Midlevel Manager's Training Course were used in small groups to demonstrate effectively the relative quality of data generated by sentinel versus routine reporting systems.

Special attention was given to the issue of vaccine efficacy (VE). Apparently, HIS is currently tracking the proportion of measles cases occurring in vaccinated individuals in districts where data are reported. This proportion is then presented in bar graph form. However, the essential second step needed for valid interpretation is not taken: this proportion is not related to the vaccination coverage in the respective districts to determine VE.

The identical proportion of cases occurring in vaccinated children in two different districts could signify, depending on the vaccination coverage level in those districts, very different levels of VE. For example, with the same proportion of cases occurring in vaccinees (50%), VE could range from 40% (if vaccination coverage was only 62%) to 95% (if vaccination coverage was 95%). The higher the vaccination coverage, the higher is the proportion of cases which occur among vaccinated children. Since this is somewhat counter-intuitive, it was necessary to prepare two slides (Annexes 25 and 26) and a handout. These slides should be used for further training within HIS and KEPI once the SSS is started.

HIS and KEPI in the future should use the graph and formula to determine VE. (Annex 27) They should not display as a bar graph the proportion of cases occurring in vaccinated children, since this should be considered only as an intermediate step for determining VE. Without considering percent of population vaccinated, it would be easy to jump to the wrong conclusion if the proportion of cases in vaccinees were to increase. When applying the formula, HIS/KEPI need to be careful to compare cases and coverage within the same age groups. (Coverage data are available from 30-cluster surveys for many districts for ages 0-11 and 12-23 months.) If VE is found to be low (e.g., below 80%), an investigation is needed to determine and correct the reasons.

Another area of some doubt on the part of the workshop participants concerns the utility of SSS in generating incidence rates. Sites should be purposefully selected depending on the objectives of the system. The SSS is intentionally incomplete. If one is trying to document the impact of EPI, then it is logical to place a sentinel site in an area of high coverage, preferably one where a retrospective baseline can also be established. Incidence rates can be determined with better accuracy (see

page 10 of Annex 24) from sentinel sites than through the incomplete reports of the routine system. Sophisticated sampling methods to select sentinel sites representative of the entire country are not required. To illustrate further, if one were interested in the incidence of shark attacks, one would clearly not establish sentinel sites in the interior cities of Kisumu or Lodwar, but would purposefully select sites on the coast.

Much progress has been made on the implementation of a SSS. A WHO EPI Associate Expert had established a system covering three districts (Murang'a, Kilifi and Kakamega) for measles cases. However, since his departure about one year ago, the system has not been maintained. No recent reports or feedback are available.

The measles form has since been improved. However, the diarrheal diseases reporting form still needs to be worked on by resident PRITECH staff, together with HIS and IPS.

A continuing problem has been the turnover of staff who needed to be brought up to speed on the purpose and nature of a SSS.

Some of the mechanics of the SSS still have to be decided by the concerned MOH staff. The MOH will continue to need on-going technical support by resident IPS staff to facilitate establishment of the SSS. A SSS Working Group composed of the heads of the Division of Family Health, KEPI, CDD and HIS (or their designated representatives) should meet periodically. Their functions should be to:

- identify resources needed to initiate the SSS (e.g. training, printing, distribution of forms, report summaries, etc.),
- establish target dates for completing initial steps: and
- prepare a simple summary of objectives, procedures, forms and case definitions to be used as a SSS manual.

Specific points that still need to be worked out by this SSS Working Group include:

a) responsibilities at central level

- clarify roles of KEPI vs. CDD vs. HIS regarding data tabulation, analysis, feedback and dissemination, soliciting late and "nil" reports, monitoring regularity of reports, action, and commitment of resources.
- finalize channels (and numbers of copies) for speedy flow of information.
- define target dates by which data will be handled each month.

b) peripheral-level responsibilities

- design simple "summary sheets" and "pre-drawn graphs" so that individual sites can track their own data.

- determine "focal point" for reporting and for taking action at each site.

c) selection of sites

- finalize selection of in-patient and out-patient sites within the few districts already identified. Initially, the total number of sites should probably not exceed 10-15 to increase the likelihood of success. Sites should be considered if interested staff exist, there is a history of regular and timely reporting, good supervision is likely, control programs are active, the expected volume of cases is reasonably high, and a catchment population can be determined. The existence of retrospective data in a site would be a positive reason for its selection.

- determine criteria for dropping sites, if necessary, and for expansion of the system (no. of sites, diseases, forms, types of data to collect). For example, it would be very simple to select the rehabilitation hospitals in Nairobi and Mombasa as polio sentinel sites. This may also be politically desirable, given eradication goals, since retrospective data likely exist and current levels of polio vaccination are high enough to have reduced polio incidence.

d) forms

- finalize diarrhea diseases form

- measles form (Annex 28) should be revised to include number of pediatric admissions and number of pediatric out-patient visits. This will allow the proportion attributable to measles to be calculated and tracked. This indicator controls for the fact that measles cases may go up or down as a function of total visits, access during certain seasons, etc. Also, the last age column on the form should coincide with the current definition of the upper age limit of "pediatric" -- "24 - 59" or possibly "24 or more". In any event, "pediatric" needs to be standardized among the sentinel sites.

e) periodicity of reporting and feedback

- monthly is best.

f) case definitions

- use and circulate to all sites the measles definition already recommended by Dr. Bo Burstrom for the pilot SSS:

- generalized rash for three or more days and
- history of fever (38°C or more, if measured), and
- any of the following:
  - cough
  - coryza (runny nose)
  - conjunctivitis (red eyes)

g) supervision

- consider possible role of provincial MOH staff.
- determine a "focal point" within HIS, CDD and KEPI.

h) training

- conduct a simple one-day orientation on SSS in selected districts for staff, including medical records statisticians or equivalent.

i) catchment populations

- define so that sentinel data can be used to estimate rates, not simply case counts. Also routine service statistics can then be used to calculate coverage rates. Rates are more important than case counts, especially if the number of sentinel sites will change over time.

A SSS is an inexpensive attempt to improve the quality of data available for program managers. It should be kept as simple as possible so as not to overwhelm the ability of the central level to manage the system in a timely fashion. The above points need to be clarified by the key users of the information in the MOH in order to increase the likelihood of success. Once this is done, this consultant does not see any insurmountable constraints, although the general shortage of epidemiological skills at all levels suggests that periodic technical assistance will continue to be required.

Once the needed decisions are made, REACH funds can be accessed to support the system.

Additional points concerning SSS can be found under the section concerning EPI Health Information Systems.

C. EPI Health Information Systems

REACH funds are available to provide technical assistance requested by the KEPI through USAID in the areas of development of sentinel surveillance systems (see Section B above), institutionalization of EPI management information systems and programming for coverage survey analysis. REACH has already funded training for and implementation of a NNT mortality survey in Kilifi District.

1. Computerized EPI Information System (previously known as EPIIS)

REACH has been instrumental in developing and refining Computerized EPI Information Systems (CEIS). Working closely with WHO, REACH has strengthened CEIS at regional and country levels throughout the world, and now plans to extend it further to provincial levels within selected countries.

In Kenya, the CEIS installed by DTS in late 1988 at HIS and KEPI needs to be improved and customized for the users as follows:

a) Sentinel Surveillance System

- graphs and tables consist presently only of case counts (numerator data); in addition, incidence rates should be monitored, especially since sites may be added or dropped and also since the population size changes yearly.

- measles pediatric cases as a proportion of all pediatric out-patient visits, and measles pediatric admissions as a proportion of all pediatric admissions, should be monitored by sentinel site.

- something called "deaths proportions (deaths versus cases)" is being monitored. Presumably, this indicator is redundant, since case fatality rates are already being monitored.

- Measles vaccine efficacy should automatically be generated for infants on a yearly basis by sentinel site by incorporating into the software the formula $VE=1 - \frac{(PCV)\ (1-PPV)}{(1-PCV)\ (PPV)}$, where PCV is the proportion of measles cases in vaccinated infants and PPV is the proportion of the infant population vaccinated against measles. Without this calculation, the CEIS data on "cases and deaths proportions by age and status" could be misinterpreted. Whenever infant measles VE falls below 80%, the computer program should automatically highlight the finding and should request an investigation.

b) Vaccinations Performed

This screen display should include "fully immunized" to be in agreement with routine service statistics forms 702 and 710 (Annex 29).

c) Cases and Deaths

Change the order and names of the categories to correspond with the new measles sentinel surveillance form: "Unpro," "Vacc" and "unk." This will reduce the likelihood of data entry errors. The present category "unvaccinated" on the screen display carries a different meaning than "unprotected" on the form.

d) Coverage Survey

This display screen is no longer "state-of-the-art" but can be used only to report data already analyzed elsewhere. All coverage survey data should henceforth be entered into and analyzed with COSAS-p and COSAS-t softwar , which should be installed separately. An instruction on the screen referring the user to COSAS for data analysis and more detailed findings would be useful.

e) Stock Control and Inventory

This should be customized with KEPI in mind.

f) Stock Types

Again, customize this to meet KEPI requirements.

g) Performance Reports/Coverage Reports Menu

Additional indicators should be added for each district.

- Missed Immunization Opportunities:

$$\frac{\text{No. of Children 12 mos. or older vaccinated for measles}}{\text{No. of Children 12 mos. or older vaccinated with DPT1}} \times 100$$

- Early Starters:

$$\frac{\text{No. of children less than 12 mos. vaccinated with DPT1}}{\text{No. of children of all ages vaccinated with DPT1}} \times 100$$

- Access:

$$\frac{\text{No. of children less than 12 mos. vaccinated with DPT1}}{\text{No. of live births}} \times 100$$

In Kenya, as in most countries, measles immunization coverage lags considerably behind coverage with other antigens. All children 12 months or older who are eligible for DPT1 (denominator) are also eligible to receive measles vaccination (numerator). Many children receiving DPT2 or DPT3 also need measles vaccination. Therefore, if the top indicator above is less than 100%, there is a problem of missed measles immunization opportunities.

The next indicator monitors the EPI's ability to attract children early in life. The number of infants receiving DPT1 (numerator) is compared to all children receiving DPT1 (denominator). Evidence in Kenya suggests that most districts do not have a problem attracting children before 12 months of age.

Finally, access to immunization is monitored by comparing infants receiving the higher of either DPT1 or OPV1 (numerator) to all live births (denominator).

Immunization coverage graphs should be generated for each district and not only for the country as a whole.

Since district monthly infant targets (which should equal all newborns minus infant mortality, as given on the screen entitled "population denominator") will now appear on form 710, it would be appropriate to monitor monthly for each district the cumulative progress towards those yearly infant DPT 3, measles and "fully immunized" coverage targets by graphically displaying the Immunization "Road to Health" Monitor (Annex 30). Targets should equal 100% of the eligibles.

A district summary of infant coverage by antigen and by "fully immunized" should be generated annually which lists total number of districts with coverage "less than 25%," "25% to 49%," "50% to 74%," and "75% or more." A second listing should include the actual names of the districts falling under each category.

The changes recommended above will be entered into CEIS during the upcoming TDY of a REACH computer specialist in consultation with MOH and other health information systems staff.

2. <u>Forms 702 and 710 for Routine Service Statistics</u>

Examples of these new forms are in Annex 29.

Two changes are recommended:

- "period from ___ to ___" should be replaced by "month" and "year," since these forms are meant to be filled monthly. Also some staff will invariably write "March to April" to signify a single month (March), while others will write the same "March to April" to signify two months.

replace "TT boosters" with separate lines for TT3, TT4, and TT5. Regardless of whether or not KEPI soon introduces a policy change of vaccinating women of childbearing age, only five doses with the proper intervals are needed for lifelong protection. Many women are being hyper-immunized at present with TT (1 or even 2 doses of TT) in each subsequent pregnancy. This change in the form should only be introduced once a TT protection card is in use.

Once these forms are introduced, training is needed to demonstrate how to block off each day's tally on the tally sheet, so that the number can be entered without confusion (double-counting or under-counting) on the summary sheet.

In sentinel sites with defined catchment populations, these forms will help in routinely calculating current infant measles vaccination coverage, which can then be related to the proportion of measles cases currently occurring in infant vaccinees to determine VE among infants. Without such routine data, one would unacceptably have to calculate VE by occasionally using outdated district-wide survey data for children 12-23 months old and the current year's measles cases in vaccinees 12-23 months old in a defined sentinel area.

3. 1990 Targets of 60% Coverage in Each District

KEPI has a coverage target of at least 60% in all districts by 1990. This is a useful monitoring tool. However, KEPI should reconsider its method of designating "critical areas" to reflect the fact that, for example, a coverage of 60% in Nairobi (1.2 million population) is more important than 60% in Mandera (.13 million). Annex 31 gives a hypothetical example. Using the present system, district #2 would be identified as a "critical area." However, district #1, with its larger population, contains more than half of the non-vaccinated population in the province and nearly twice as many non-vaccinated as in district #2.

Identification of critical areas should be expanded beyond calculation of percent coverage to include also analysis of the number of non-vaccinated persons. This is especially important in regions where each district exceeds 60% coverage, since under the present system (based on percent coverage) no districts would be identified at regional level for extra attention.

4. Other Activities Relating to Health Information Systems

Other activities relating to health information systems undertaken by the consultant concerning disease surveillance and monitoring of routine service statistics include:

- The Immunization "Road to Health" Monitor (Annex 30) form was shared with staff of KEPI, AMREF and IPS with the recommendation that it be introduced for use at health facilities and districts with known catchment populations.

- Copies of approximately 10-15 articles covering epidemiological studies conducted in the past 15 years in Kenya on EPI-target diseases (mostly measles and pertussis) were given to KEPI, IPS, and Dr. Orinda (Department of Pediatrics).

- COSAS-p and COSAS-t computer programs and manuals were given to KEPI and IPS (for HIS) for use in analyzing future coverage evaluation surveys. EPI INFO programs and manuals developed by the U.S. Centers for Disease Control were also given to KEPI.

- Routine process indicators developed on a TDY in Bolivia -- including measures of missed opportunities, early start, and access -- were shared with IPS and AMREF.

D. Social Mobilization

Recruitment and hiring of a full-time Kenyan Communications Specialist is near completion. The candidate is expected to begin work by the end of March 1989. She will be responsible for developing and managing a long-term social mobilization strategy for KEPI, which focuses on increasing demand for sustainable immunization services. Emphasis will be placed on measles and TT and on the need to complete all infant immunizations before 12 months of age. Campaigns to increase immunization coverage in the short-term without regard for sustaining services are not required. Instead, demand for services which can be provided over the long-term by the routine KEPI, which already reaches 95% of the infants with at least one dose, will be stressed. An algorithm for health education and sample messages are in Annex 32.

The Communications Specialist will sit at KEPI and be a part of the KEPI management team. She will also be part of a social mobilization and information committee which includes a newly-hired KEPI health educator. She will coordinate inter-agency efforts in printed materials and broadcast public education activities, with most of the costs borne by UNICEF. (UNICEF has nearly a half million dollars in noted funds from the Canadian Public Health Association available for social mobilization.) She will also strengthen linkages within the MOH, between Ministries, and with the political party KANU.

The document "Battling the Six Immunizable Diseases" can be used as a starting point in planning for social mobilization.

The list of possible Operations Research topics for which REACH funds can be requested appears in Section E. The list has been prioritized with the participation of a REACH Communications Specialist in mind. Factors influencing immunization acceptability have already been studied as a prerequisite for planning and implementation of effective social mobilization efforts.

E. Operations Research

Funds for operations research to improve EPI effectiveness are included in the REACH, UNICEF, and IPS budgets. AN EPI Collaborative Research Group has been formed and includes members from KEPI (Drs. Sang, Mjomba and Bjerregaard), KEMRI (Dr. Garteru), and the Department of Pediatrics of the medical school (Dr. Orinda).

Given the number of available researchers, an extremely ambitious list of research topics has been prepared by KEPI. In its draft Plan of Action for January 1989 to June 1990, UNICEF lists the following activities, planned by KEPI, for which it has funds available:

- NNT survey	Kilifi (already executed with REACH funds) Bungoma District
- Coverage surveys Nyanza	Nyeri, Meru, Samburu, Laikipia, Elgeyo, Marakwet, and South Districts
- KAP surveys	Busia and Samburu Districts
- Missed Opportunity Survey	Kilifi District
- Clinic Performance Survey	Kilifi District
- Support for Medical Students in Identifying Opportunities for Increased Coverage	

To this list can be added missed opportunity studies planned by KEPI in Busia (May), Nakuru (July), Nairobi (August), Kiambu (September), Machakos (October), Kisii (November), Kericho (January 1990) and Narok (February 1990). Some KAP and missed opportunity surveys have already been done, although results from the latter have not yet been reported.

In a Kitui District KAP study in 1988, it was found that mothers were very knowledgeable about immunization. The major area needing attention was the perception that ill children should not receive vaccinations. The questionnaire used was well-designed, and the results well written.

With such an impressive list of planned research topics and the existence of sufficient funds, there is real concern that a shortage of researchers will become the limiting factor in the execution of these studies. The design, execution, analysis, write-up, distribution and discussion of findings is a time-consuming activity for persons who are already fully engaged in other duties.

The KEPI Management Unit and EPI Collaborative Research Group need to prioritize their research plans, given the above concerns. Any request for REACH funds should be submitted along with the study protocol to USAID/Nairobi, who will share it with REACH, for technical review and approval.

The list which appears in Annex 33 prioritizes from the REACH perspective research topics currently being considered, given the level of REACH funds, potential involvement of a REACH communications specialist stationed in Nairobi, the likelihood of attracting additional needed funds from other donors, the likelihood of successfully providing an important impetus to KEPI operations and coverage, the interest of persons interviewed and technical self-sufficiency.

F. Medical School Curriculum Development

Dr. V. Orinda has been contracted by REACH to develop an annual series of five EPI lectures for medical students and orientation seminars for medical societies. A broad outline of the presentations appears in the REACH TDY report of Dr. Didier Patte.

Dr. Orinda has requested some materials from REACH and will begin preparation of the lectures during March. He has offered to keep REACH informed of his progress by means of a report at the end of March. REACH will provide Dr. Orinda with assistance as needed.

He has contacted the medical society in Eldoret which is interested in a seminar. The date has not yet been fixed. Dr. Orinda also plans to offer the seminar at one of the weekly meetings of the medical society in Mombassa and at a monthly meeting in Kisumu. Dates and content of lectures/society meeting presentations should be communicated well in advance to REACH, so that planned consultancies can be timed accordingly.

The consultant suggested some materials which would be useful to Dr. Orinda, including "Recognize the Disease" slides and video, and photocopied a file on contra-indications for him (which was also given to the KEPI Manager). Practice in screening children for immunization and in giving health education to parents will be included in the prepared materials.

The consultant estimated prevented cases and deaths from four EPI-target diseases at current (1987) and targeted (1990) vaccination coverage levels and per 10,000 vaccinations administered in Kenya (Annex 34). This might be useful for the medical school curriculum and for MOH decision makers and epidemiologists. The greatest number of deaths are

prevented from measles and NNT. For every 10,000 vaccinations administered against tetanus, measles, polio and pertussis, nearly 500 deaths will be prevented.

Annual scientific meetings of the following organizations present an opportunity for USAID/REACH EPI work to be presented:

Kenya Medical Research Institute:	February
Kenya Medical Women's Association:	March
Kenya Medical Association:	April
Kenya Pediatric Association:	May

The Kenya Pediatric Society Annual Conference in May has a theme of "Immunizable Diseases of Children." It is an excellent opportunity for USAID and REACH to publicize the results of the Kilifi District NNT Mortality Survey. Dr. Orinda has agreed to present the paper (Annex 35).

In addition, the next scientific conference of the Union of African Pediatric Societies and Associations is scheduled to be conducted in Nairobi as a joint conference with the International Pediatric Association in mid-March 1990. Dr. Orinda will send information about this conference and about abstract submission.

Within the REACH budget allocation under "Training," some staff development is anticipated. A suitable opportunity will be for REACH to fund participation of an appropriate person to the fourth WHO NNT Workshop, taking place in Nairobi from 10-18 April 1989. This person would be in addition to the participants already funded by WHO.

VII. RECOMMENDATIONS

Neonatal Tetanus (NNT)

1. Publicize the final NNT mortality survey results widely within the MOH. The consequences of the survey (e.g. in terms of new policy and operational initiatives) need to be evaluated before additional surveys are funded.

2. In districts with low reported TT coverage due to low antenatal clinic (ANC) coverage, accelerate NNT control by expanding the eligible age group to include all women of childbearing age. This should be carefully studied before implementation. Five properly spaced doses provide immunity at least throughout the reproductive years. The series can begin even before the woman's first pregnancy during any visit to a health facility for whatever reason, and will require fewer doses over the woman's lifetime than the current schedule.

3. In districts with high utilization of ANC, high coverage with TT, and low NNT incidence, the current ANC-based delivery of TT can continue. TT should be offered as early as possible during the pregnancy on the first ANC visit.

4. In all districts - but especially where TT coverage is low and NNT incidence is presumed high - greater attention is needed to vaccinate female students in the early grades before attrition. This will help solve the NNT problem in the long run, since women will enter their childbearing years with greater immunity and need fewer doses.

5. Missed opportunity surveys at antenatal clinics are needed to evaluate the degree to which national TT schedules are efficiently implemented.

6. A durable tetanus protection card, to be retained by the woman, with the TT schedule and space for recording all primary and booster doses of TT, is needed.

7. NNT should be reported separately from all tetanus.

8. A TT vial should be opened even if only a single woman is to be immunized.

9. On the next revision of the "road to child health" card, include information on the woman's TT vaccination status. This will increase the likelihood that health workers will screen women for TT status and vaccinate (or refer) them as necessary.

Sentinel Surveillance System (SSS)

1. A SSS Working Group composed of the heads or delegates of the Division of Family Health, KEPI, HIS, and Control of Diarrhea Diseases (CDD) should be formed and meet periodically to:

   - identify resources needed to initiate the SSS (e.g. training, printing, distribution of forms, report summaries, etc.);

   - establish target dates for completing initial steps; and

   - prepare a simple summary of objectives, procedures, forms and case definitions to be used as a SSS manual.

2. Key operational points need to be clarified by this SSS Working Group in order to increase the likelihood of success. These points are discussed in detail in the report (see pages 13-15) under the headings:

   - responsibilities at central level
   - peripheral level responsibilities
   - selection of sites
   - forms
   - periodicity of reporting and feedback
   - case definitions

- supervision
- training
- catchment populations

REACH funds can be accessed in support of the SSS once the above points are decided.

3. The SSS should be kept as simple as possible so as not to overwhelm the ability of the central level to manage the system in a timely fashion.

4. Health Information Systems (HIS) and KEPI should calculate vaccine efficacy (VE) in sentinel sites by using the formula or graph included in this report to compare cases and coverage within the same age group. They should discontinue displaying the proportion of cases occurring in vaccinated children, since this is only an intermediate step for determining VE, which on its own is subject to invalid interpretation. If VE is low, investigate to determine and correct the reasons.

EPI Health Information Systems

1. The Computerized EPI Information System (CEIS) installed by DTS in late 1988 at HIS and KEPI needs to be improved and customized for the users in Kenya. This report enumerates detailed recommendations (see pages 16-18) under the headings SSS, vaccinations performed, cases and deaths, coverage survey, stock control and inventory, stock types, and performance reports/coverage reports menu.

2. A supplement to the excellent KEPI analysis of the ten 1987 coverage surveys should be prepared by re-analyzing the survey data using newly-developed COSAS computer software. REACH funds can be used.

3. Form numbers 702 and 710 for recording and reporting routine service statistics should be slightly amended as listed in this report.

4. Since district monthly infant targets will now appear on form 710, it would be appropriate to monitor monthly for each district (and, where catchment populations are known, for each health facility) the cumulative progress towards those yearly infant DPT 3, measles and "fully immunized" coverage targets. The Immunization "Road to Health" Monitor (Annex 30) should be used for graphically displaying this. Targets should equal 100% of the eligibles.

5. Identification of critical areas should be expanded beyond calculation of percent coverage to include also determination of the number of non-vaccinated persons.

Operations Research

1. Since the operations research design, execution, analysis, write-up, distribution and discussion of findings is a time-consuming activity for persons who are already fully engaged in other duties, the KEPI

Management Unit and EPI Collaborative Research Group need to prioritize their research plans. (See Annex 33 for a suggested list.) Any request for REACH funds should be submitted along with the study protocol to USAID/Nairobi, who will share it with REACH, for technical review and approval.

2. Results from missed opportunity studies already conducted with funds from other donors need to be reported. REACH assistance can be accessed by the MOH for this purpose.

3. Since the potential policy implications of a planned measles serology study are already recommended by WHO and since a new measles vaccine which can be given from 6 months of age will soon be available, funds earmarked for this study can be spent more productively on other Operations Research topics.

VIII. FOLLOW-UP ACTION REQUIRED

1. REACH will draft implementation plans for each of four program categories (social mobilization, operations research, surveillance and training), as specified in the contract amendments.

2. NNT mortality survey data will be entered by HIS staff onto a specially-prepared SPSS computer program to be analyzed and reported by REACH. The computer program will be shared with WHO.

3. Results of the NNT survey will be sent to Dr. V. Orinda in time for him to present them at the Kenya Pediatric Association Conference in early May.

4. IPS resident staff will provide ongoing technical support to the MOH, in coordination with REACH, to establish and maintain a SSS.

5. A REACH specialist on management information systems will visit Kenya to customize computerized EPI data systems and train users.

6. A REACH Communications Specialist will be hired in Kenya.

7. REACH will send key technical documents to appropriate staff in Kenya on NNT policies, social mobilization, and use of school children to increase immunization coverage.

8. As agreed, Dr. Orinda will submit a report to REACH by the end of March on his progress in developing medical school curricula on EPI. He will coordinate with curricula development efforts being undertaken elsewhere (e.g., in nursing schools by the MEDEX program). REACH will provide assistance as needed.

9. So that planned consultancies can be timed appropriately, Dr. Orinda will keep REACH informed well in advance regarding the dates and content of proposed lectures/society meeting presentations.

10. Dr. Orinda will send REACH any information on abstract submission for the next scientific conference of the Union of African Pediatric Societies and Associations, which is scheduled to be held in Nairobi in March 1990 as a joint conference with the International Pediatric Association.

ANNEX 1

PERSONS VISITED

Mr. David Alnwick	Senior Project Officer, UNICEF, Nairobi
Dr. John Alwar	Advisor (CDD), PRITECH, Nairobi
Dr. Peter Bjerregaard	Senior Technical Advisor, KEPI (DANIDA), Nairobi
Dr. R. Black	Chairman, International Health Department The Johns Hopkins School of Hygiene and Public Health, Baltimore, MD
Dr. Lynne Gaffikin	HIS Advisor, Information Planning Systems
Ms. Molly Gingerich	H/P Dev. Officer, USAID Nairobi
Ms. Grace Kagondo	Communications Specialist, Nairobi
Mr. S.M. Kamau	Logistics Officer, KEPI, Nairobi
Mr. Stephen Kanyette	Medical Records Officer, HIS, Nairobi
Ms. Josephine Kariuki	Secretary, REACH Nairobi
Dr. A. Kielmann	Professor, University of Nairobi
Mr. Geoffrey Kimani	Statistician, HIS, Nairobi
Mr. H.M. Kodo	Health Educator, KEPI, Nairobi
Dr. Eric Krystall	Director, FPPS, Nairobi
Mr. John Kweri	Team Leader, Information Planning Systems, Nairobi
Ms. Linda Lankenau	H/P Dev. Officer, USAID Nairobi
Ms. Aoko Midiwo	Consultant, REACH Nairobi
Dr. Mary Mjomba	Pediatrician, MOH Mombasa
Dr. D.M. Mutie	Director, Division of Family Health, Nairobi
Ms. M.N. Mwangi	Trainer KEPI, Nairobi
Dr. Vincent Orinda	Dept. of Pediatrics, University of Nairobi
Dr. N.M. Peshu	Medical Officer of Health, Kilifi
Ms. Joan Robertson	Consultant, FPPS, Nairobi
Dr. R.K.M. Sang	Manager, KEPI, Nairobi
Dr. Claudio Schuftan	Planning Advisor, Information Planning Systems
Dr. Ron Schwarz	Training Advisor, Information Planning Systems
Dr. J. Snow	Epidemiologist, KEMRI, Kilifi
Dr. J. Paget Stanfield	Director, Community Health, AMREF, Nairobi
Mr. H.C. Wamubeyi	District Commissioner, Kilifi
Dr. Joseph Wangombe	Senior Lecturer, University of Nairobi

ANNEX 2

Neonatal & Non-neonatal Tetanus Cases & Deaths, Kilifi District Hospital

	YEAR						
	1983	1984	1985	1986	1987	1988	TOTAL
Neonatal Tetanus							
cases	63	69	48	40	40	29	289
deaths	35	41	38	15	31	21	181
Case Fatality Rate	56%	59%	79%	38%	78%	72%	63%
non-neonatal tetanus							
cases	13	30	17	15	17	11	103
deaths	4	8	6	6	5	6	35
case fatality rate	31%	27%	35%	40%	29%	55%	34%
neonatal tetanus as proportion of all tetanus	83%	70%	74%	73%	70%	73%	74%
district population [a] (xooo)	508	528	549	571	593	616	
live births [b] (xooo)	27.9	29.0	30.2	31.4	32.6	33.9	185.1
neonatal tetanus incidence per 1000 live births	2.3	2.4	1.6	1.3	1.2	0.9	1.6
total admissions		6308	5772	6876	6278	5927	31161
pediatric admissions		2318	1828	2535	2476	2298	11455
neonatal tetanus as proportion of pediatric admissions		3.0%	2.6%	1.6%	1.6%	1.3%	2.0%
all tetanus as proportion of all admissions		1.6%	1.1%	.8%	.9%	.7%	1.0%
non-neonatal tetanus as proportion of non-pediatric admissions		0.8%	0.4%	0.4%	0.5%	0.3%	0.5%

a = 1979 census population projected at 3.92% annual rate of population increase (CBS)
b = CBR = 55/1000 (CBS)

KEPI NEONATAL TETANUS MORTALITY SURVEY: FORM A

CLUSTER NO. _____

KILIFI DISTRICT 1989

Village _____

Interviewer _____

Date _____

Sublocation _____

No. of occupants in households visited _____ _____ _____ _____ _____ _____ _____ _____

NO.	MOTHER'S Initials	MOTHER'S age	MOTHER'S alive/still alive	Baby's sex	Date Born	Date Died	age at Death	Delivery at home	Delivery at health facility	Attendant at Delivery nurse midw DR	Attendant at Delivery TBA Train	Attendant at Delivery TBA UnTr	Attendant at Delivery Other Untr	Cord cutting Asep-tic	Cord cutting Inf-ect	Corddressing Asep-tic	Corddressing Inf-ect	Corddressing none	Number TT doses this preg mem-ory	Number TT doses this preg card	Number TT doses prev preg mem-ory	Number TT doses prev preg card	Number visits this preg. Ante-Natal	Number visits this preg. other	Death in 1st month (tick)
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									

FORM B. KEPI NEONATAL TETANUS MORTALITY SURVEY

NOTE: A separate Form B should be completed for each infant who died in the first month of life.

Sublocation _____ Cluster No. _____

Village _____ Serial No. (Form A) _____

Interviewer _____ Date: _____

A. BACKGROUND INFORMATION ON NEONATAL DEATH

A1. Name of child: _____

A2. Sex of child: Male ☐ Female ☐

A3. Date of birth: _____

A4. Date of Death: _____

A5. Age of Death in Days: _____

A6. Name of Mother _____

A7. Name of Father: _____

A8. Residence (draw a simple map, if necessary)

_____

A9. Person interviewed: _____

A10. Relationship to child: _____

A11. Name of nearest elder _____

A12. Name of guide _____

(TO BE FILLED BY SUPERVISOR)

A13. Was mother adequately immunized with TT (form A)? YES NO

If NO, specify why not.

_____

B. CLINICAL HISTORY

B1. Was the infant able to suck soon after birth? _____

B2. Did the infant stop sucking when it became ill? _____

B3. How old was the baby when it became ill? _____ days

B4. Did the infant's body become rigid (stiff)? _____

B5. Did the infant have convulsions (fits)? _____

B6. Circumcision: _____ days old

B7. Ear piercing: _____ days old

B8. What does the mother say the child died from?

(local name) _____

B9. How does she know the cause of death?

B10. When the child became ill, who treated the child?

No Treatment ____

Traditional Healer _____

Medical Professional _____

Name/Location Health Facility _____

COMMENTS:

_____

TO BE FILLED IN BY THE SUPERVISOR:

CAUSE OF NEONATAL DEATH:

_____ Neonatal Tetanus

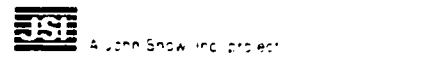
_____ Other

_____ _____

Medical Officer's Signature Date

CHANGES RECOMMENDED ON NNT QUESTIONNAIRES

Resources for Child Health
REACH



January 10, 1989

Dear Dr. Bjerregaard,

Thank you for sharing the two NNT survey forms which have clearly been prepared with careful thought and attention to details. I look forward to assisting KEPI with the survey and expect to arrive on February 2 in the early morning. Hopefully, local WHO and UNICEF officers can also be involved in the field in the early days of the survey.

I assume that work is progressing on collecting population data by smallest administrative division in Kilifi District and that a line listing with individual and cumulative populations is being prepared to permit selection of the 30 clusters.

It is our desire that the forms not be finalized until my visit. Finalization and printing can be done within a few days of my arrival, with training to begin immediately thereafter. Training will need to stress, in the event that no live births are reported in a house, the ascertainment of any pregnancies (and outcomes) occurring after the birth of the youngest child.

I am curious to know what will be the recall period and how densely settled is the district, since this will affect total time and cost of the survey.

Below please find my comments on the two forms which Aoko faxed to me. We can discuss the proposed changes and my comments further in Nairobi.

Form A should be in two parts. The top brief part should be a tally of households visited and number of persons by each household. This will provide some basis for confidence that the demographic variables were as expected and that the survey was not subject to potential bias. Specifically, a crude birth rate can be calculated with this information. The direction above part two on Form A should read: Was a baby born alive in the household between __ and __? If yes, circle the household above and complete a line below for each live birth.

The lower part of Form 1 should be completed by household in which live births occurred (as already prepared by KEPI) with some additional information to be collected which is potentially important for future EPI operations and policy decisions:

- after name of mother, ask about her <u>age</u> and <u>parity</u>. (In many areas, younger and lower parity women avoid TT for fear of family planning. Are these women perhaps being reached disproportionately by EPI?) Also ask about her <u>years of schooling</u>. (Do opportunities exist to raise TT immunity significantly by

vaccinating females in early years of school, so that they enter their childbearing years with some protection and require fewer subsequent doses of TT?)

- after attendant at delivery, ask about cord cutting instrument: aseptic, infect., none.

- replace "date of death" with "alive? (tick) or date(age) at death." Of course, dates are preferred but may not always be available.

- revise number of antenatal visits to read:

In this preg, no. of visits	
antenatal	other

This will indicate whether opportunities for TT are missed not only antenatally but at the time of other health facility visits.

- is "this pregnancy" and "last pregnancy" under "number of TT doses" clear? Or is "last pregnancy" and "previous pregnancy" better understood?

- WHO/Geneva has revised in 10/88 its EPI coverage survey module for mid-level managers. If TT or maternal cards have been provided for many years and are generally retained by women, the TT section on the form could be changed to include also lifetime doses and dates of TT. I will bring a copy of the module.

Comments on Form B are as follow:

- between A4 and A5, insert another question: "age at death in days"

- replace A10 with:
  Mother's immunization history:
  - no. of TT doses mother received during this (or - see my notes above - last) pregnancy? _____
  - no. of TT doses mother received before this pregnancy? _____
  - When did mother receive last TT before this pregnancy? _____

  The interval between TT and delivery is especially important in those instances where TT was received before but not during the latest pregnancy. Based on the above responses, the determination of whether the child was born to a protected mother should be left to the supervisor.

- in B1 and B2 remove the word "milk" and in B1 also replace "at" with "after." Some interviewers during a survey in North Yemen answered "No" to B1 because the newborn sucked colostrum, not milk!

- eliminate B6 entirely since fever is not a necessary symptom of NNT. The question is useful only if you want to correlate method of cord cutting or dressing with occurrence of septicemia.

- B7 and B8 are interesting questions although I doubt the numbers of non-tetanus and tetanus neonatal deaths will be large enough to detect statistical differences, if there are any.

- B11 - The choice of answers should be "no treatment", "traditional healer", or "medical professional" (or equivalent culturally understood term). "Name/location of health facility" is useful.

Please review these comments with other members of the committee planning the survey. I will telephone you on Wednesday 11 January during mid-afternoon at your office, sowe can discuss comments further.

Regards from Pierre and Ann.

Sincerely yours,

Robert Steinglass

Robert Steinglass
Senior Technical Officer
REACH

ANNEX 6

RECALCULATION OF NNT SURVEY SAMPLE SIZE

$$n_0 = \frac{z^2pq}{d^2} = \frac{1.96^2 \times .010 \times .990}{.005^2} = 1521$$

where: n_0 is sample size
z is normal deviate
p is true rate, and q is 1-p
d is precision of estimate

Sample size corrected for district population size:

$$n = \frac{n_0}{1 + \frac{n_0}{N}} = \frac{1521}{1 + \frac{1521}{657668}} = 1517$$

where n is corrected sample size
N is district population being sampled.

Assuming the design effect is 1.7, then:

Sample size = 1517 x 1.7 = 2579

[based on WHO/EPI/GEN/86/8 by A. Galazka and G. Stroh]

ANNEX 7
(2 pages)

KILIFI NEONATAL TETANUS MORTALITY SURVEY
KENYA EXPANDED PROGRAM ON IMMUNIZATION

TRAINING PROGRAM (6-8 February 1989, Kilifi)

Monday, 6 Feb.	10:00-10:15	OVERVIEW OF SURVEY AND NEONATAL TETANUS IN KENYA -NNT in Kenya -need and purpose of survey -past survey results, Kenya	Dr. Peter Bjerregaard DANIDA (lecture, questions and answers)
	10:15-11:15	ORGANIZATION OF SURVEY -staff roles, team assignments -field logistics, vehicles -hours, days of work -per diem, lunch money -local guides	Mr. Kimani and Mr. Kanyette, HIS, MOH (lecture, questions and answers)
	11:15-12:30	SELECTING HOUSES WITHIN CLUSTERS -selecting random starting house -reducing sources of bias -determining next house -when to stop	Mr. Kimani and Mr. Kanyette, HIS, MOH (lecture, exercise, group discussion, questions & answers)
	12:30-2:00	LUNCH BREAK	
	2:00-5:00	SURVEY FORMS -step-by-step instructions -reducing bias -how to fill forms -using local events calendar -symptoms of NNT	Mr. Robert Steinglass REACH (lecture, role play, exercise, handouts, group discussion, small groups, video, questions & answers)

Tuesday, 7 Feb.	8:30-12:30	SURVEY FORMS (continued)	(continued)
	12:30-2:00	LUNCH BREAK	
	2:00-6:00	FIELD PRACTICE -field-testing forms -10 household interviews using Form A for each surveyor	Dr. Mary Mjomba, MOH Dr. P. Bjerregaard, DANIDA Mr. Kimani and Mr. Kanyette, HIS, MOH Mr. R. Steinglass, REACH (supervised practice)
Wednesday, 8 Feb.	8:30-12:00	REVIEW OF FIELD PRACTICE -clarifications -changes -feedback from supervisors -interview technique -results	same as previous day (group discussions, individual feedback, questions & answers)
	12:00-2:00	LUNCH BREAK	
	2:00-4:30	FINAL PREPARATIONS -logistics -forms -vehicles	Mr. Kimani and Mr. Kanyette, HIS, MOH

NOTE: Training was extended for a fourth day to concentrate on survey forms, particularly on how to ask the questions in the local languages. Additional role-playing exercises on using the local events calendar were included.

ANNEX 8
(2 pages)

KILIFI NEONATAL TETANUS MORTALITY SURVEY
KENYA EXPANDED PROGRAM ON IMMUNIZATION

ROLE PLAYING EXERCISES IN SMALL GROUPS

Situation #1:

The woman has a 3-year old child and has had a pregnancy in past 2 years. No records exist.

- date child born: mother says: "one year ago"
- date child died: mother says: "one year ago"
  If further asked in relation to local events, she says: "two weeks after school began"
- age at death mother says: "one month"
  If further asked, mother says: "two weeks"
  If further asked, mother says: "between one and two weeks"

[Correct answers on Form A:
- date of birth: "1/88"
- date of death: "1/88"
- age at death: "11 days"
- Record number of occupants in the woman's household on top of Form A and all other information about this birth.]

Situation #2:

The woman has no child, but has had a pregnancy during last 2 years. No records exist. Pregnancy resulted in a stillbirth - a baby who never moved, cried, or breathed.

[Correct response:
- Do not fill Form A for live birth in 1988.
- Record number of occupants in the woman's household on top of Form A.]

Situation #3

The woman has a 3-year old and has been pregnant "recently." No records exist.

- date child born: Woman says: "one year ago."
  If further asked in relation to local events, she says: "around Independence Day just before Christmas"

- date child died: Woman says: "3 months ago."
- age at death: Woman says: "one year."
  If asked further, she says: "almost one year."

[Correct response: - Do not fill Form A for live birth in 1988.
- Record number of occupants in the woman's household on top of Form A.]

Situation #4:

Woman has a 2-year old and was pregnant in the past 2 years. No records exist.

- date child born: Woman says: "recently."
  If further asked in relation to local events, she says: "after Christmas soon after school resumed."
- date child died: Woman says: "a month ago."
  If further asked in relation to local events, she says: "after school resumed."
- age at death: Woman says: "one week."

[Correct response: - Do not fill Form A for live birth in 1988.
- Record number of occupants in the woman's household on top of Form A.]

Situation #5

Woman has no children but has been pregnant in past 2 years.

- date child born: Woman does not know.
  If asked "How long ago was the child born," she says: "6 months ago."
  If further asked in relation to local events, she says: "child was born a few weeks before the Idd al Haj."
- date child died: Woman says: "about 6 months ago."
  If further asked in relation to local events, she says: "during the harvest."
- age at death: Woman says: "one month."
  If further asked, she says: "more than one month."

[Correct answers on Form A:
- date of birth: "7/88"
- date of death: "8/88"
- age at death: "5-9 weeks"
- Record number of occupants in the woman's household on top of Form A and all other information about this birth.]

ANNEX 9
(2 pages)

KILIFI NEONATAL TETANUS MORTALITY SURVEY
KENYA EXPANDED PROGRAM ON IMMUNIZATION

HOW TO ASK THE QUESTIONS DURING THE INTERVIEW

Form A: To complete "the number of occupants" in the household without missing any births or deaths, you must ask some or all of the following:

- Hello. We would like to speak with your mother.
- We are from the MOH and are trying to improve services in this area. We must ask you a few questions.

- How old is your youngest child?
  - You don't have any children?
  - Have you been pregnant during the past 2 years?
  - Where is the baby?
  - Did you have a stillborn baby or lose the pregnancy?

- Were you pregnant after this child?
  - Where is the child now?
  - Did the baby move or cry or breath after delivery?

- When was the child born?
  - When did the child die?

- How long ago was the child born?
  - How long ago did the child die?
  - How old was the child when it died?

- How many people usually eat with you from the same pot?
- Are there any other adult women living here who share the same pot with you? I need to ask her some questions.
- She is absent? I will ask you the questions about her.

Form A: For each child born alive in 1988, you must ask <u>all</u> of following:

- How many live babies have you ever delivered?
  - How many are still alive?

- Is/was this child born in 1988 a boy or girl?

- Where was the baby born?

- Who helped you during the delivery?

- With what was the cord cut?
  - new unopened razor blade?

- What was applied to the cord stump in the health facility and later at home?
  - spirit?

- During this pregnancy or previous pregnancies, did you receive any injection?
  - What was it for? What was it called?
  - How many in each pregnancy?
  - Do you have any medical records?
  - Did you receive this injection because you were ill? Did you receive injection in the arm?
  - Where did you receive the injections - at the antenatal clinic or elsewhere?

- During the pregnancy, did you visit any antenatal clinic? Any other health facility? How many times?

- Are you sure the child died/did not die during the 1st month of life?

Form B: If baby died during the 1st month, you must ask all the following:

- Describe the child's illness before it died.

- Was the infant able to suck soon after birth?

- Did the infant stop sucking when it became ill?

- Did it have difficulty swallowing or opening its mouth?

- How old was the baby when it became ill?

- Did the infant's body become rigid (stiff)?

- Did the infant have convulsions (fits)?

- Was the infant circumcised?

- Were its ears pierced?

- Was there any other penetration of the skin or wound before the illness began?

- What do you believe the child died from?

- How do you know the cause of death?

- When the child became ill, who treated it and where?

ANNEX 10
(3 pages)

KILIFI NEONATAL TETANUS MORTALITY SURVEY
KENYA EXPANDED PROGRAM ON IMMUNIZATION

HOW TO COMPLETE FORM A

1. Fill the top of the form.

2. Ask in each residence:

"occupants in households visited"
- "household" means those persons eating from same pot. Write number of persons on the small line.
- some "houses" may have more than one household.
- households can only exist in buildings in which people live.
- do not include household if you do not speak to an adult informant. Put an "X" on the small line.
- do not include house which is vacant or deserted. Put "X" on the small line.
- do not include building in which no one live (schools, churches, police stations, stores, etc.). Put "X" on line.

3. For each child born alive in 1988, circle the household on the small line and question the mother (if possible) or other reliable member of the same household:

"mother's initials" - write initials of baby's mother
"mother's age" - write her exact age in years, or estimate
"born alive/still alive" - write no. of babies ever born alive and no. still alive (e.g., 7 ever born and 6 still alive: 7/6)
"baby's sex" - write "M" (male) or "F" (female).
"date born" - write exact date if known: for example, 16-2-88 for 16 February 1988
- if exact date is unknown, refer to the calendar to calculate month and year of birth and write, for example, 2-88 for February 1988.

"date died" - same as for "date born"

"age at death"

If informant's response is:	Then:
"one month"	determine if more or less than one month
"less than one month"	write exact no. of days
"_____ weeks"	write exact no. of days
"more than one month"	write "5-9 weeks"
"2 months"	write "2 months"
"3 months"	write "3 months"
"4 months"	write "4 months"
"5 months"	write "5 months"
"6 months"	write "6 months"

	"7 months"	write "7 months"
	"8 months"	write "8 months"
	"9 months"	write "9 months"
	"10 months"	write "10 months"
	"11 months"	write "11 months"
	"one year"	determine if more or less than one year
	"less than one year"	write exact no. of months
	"more than one year"	write "12 (or more) months"

"delivered at" - tick appropriate answer

"delivered by" - tick appropriate answer: "nurse, midw, dr." includes any formally-trained clinician, "TBA trained" is a TBA who received formal initial or in-service training by government or other project. If unknown, put "?" under most likely answer.

"cord cutting"
- tick one answer only in the appropriate column
- "aseptic" includes new unopened razor blade or sterilized knife
- "infectious" includes all other implements

"cord dressing"
- tick one answer only
- "aseptic" includes spirit
- "infectious" includes anything else
- "none" means nothing was placed on the cord stump

"no. TT doses"
- Ask to see any health, antenatal, or vaccination records and look for proof that TT was given.
- Write the no. of TT doses or "0" under either "memory" or "card". Ask about this pregnancy and the one before that. Make it clear you are not asking about the current pregnancy, in case she is now pregnant again.
- If there was no previous pregnancy, write "N/A" (not applicable) in both columns.
- Determine whether injections received were probably TT or were possibly treatment for an illness.
- If there are no records, and the mother is unavailable to inform you herself, write "?."

"no. visits this pregnancy"
- Write no. of visits (0,1,2,3,4 or 5+) during the pregnancy to antenatal clinics and to other government or project or mission health facilities.
- If there are no records, and the mother is unavailable to inform you herself, write "?."

"death in 1st month"
- If the same child died during the 1st month (30 days), put a check mark and complete Form B.
- If the child is still alive or died at greater than one month of age (more than 30 days), leave blank.

4. Review all information for accuracy and completeness before you leave the household.

HOW TO COMPLETE FORM B

1. Fill the top of the form for each infant who died in the 1st month of life. "Serial No." refers to the number of the left-hand column of Form A.

2. Background information:

A2 to A5	- same as on Form A
A6 and A7	- write complete names of mother and father of child so house can be located again if necessary
A8	- map should include any special landmarks, street names or house numbers
A9	- name of adult member of household supplying the information
A10	- for example, mother, father, sister
A11	- Write name of nearest elder
A12	- Write name of guide
A13	- This is to be filled by Supervisors based on information on Form A.

This pregnancy's TT		previous pregnancy TT		TT status
2 doses	+	any answer	=	adequate*
1 dose	+	1 or more doses	=	adequate*
1 dose	+	0 doses	=	inadequate
0 doses	+	0 or 1 dose	=	inadequate
0 doses	+	2 or more doses	=	unknown

*Adequate is further broken down into "adequate card" or "adequate memory" depending on whether or not records were present.

3. Clinical History:

B1 to B5	- Ask mother or informant to name the symptoms preceding death. Afterwards, ask her if the child had any of the listed symptoms.
B6 to B7	- If there was any other wound or penetration before the illness began, write details under "Comments" below.
B8	- Write local name.
B9	- Who diagnosed cause of death? On what basis?
B10	- Write name/location if child was taken to any health professional .

4. Review all information for accuracy and completeness before you leave the household.

KILIFI NEONATAL TETANUS MORTALITY SURVEY
KENYA EXPANDED PROGRAMME ON IMMUNIZATION

Calendar for Determining Month and Year

FOR USE IN FEBRUARY 1989

acceptable dates of birth

Feb 89	Jan 89	Dec 88	Nov 88	Oct 88	Sep 88	Aug 88	Jul 88	Jun 88	May 88	Apr 88	Mar 88	Feb 88	Jan 88	Dec 87
0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14
	-school begins-	-Christmas-	-Independence Day-	-school ends-		-harvest-	-Idd al Haj- 23 July 1988		-Ramadan ended- 15 May 1988	-Ramadan began- 16 April 1988			-school begins-	-Christmas-
	-New Years-												-New Year-	

FOR USE IN MARCH 1989

acceptable dates of birth

Mar 89	Feb 89	Jan 89	Dec 88	Nov 88	Oct 88	Sep 88	Aug 88	Jul 88	Jun 88	May 88	Apr 88	Mar 88	Feb 88	Jan 88	Dec 87
0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15

If it is not possible to get exact dates of birth, use this calendar to determine month and year.

Other important events:

1961 floods
1963 uhuru
1972 Galla killed

ANNEX 12

KILIFI NEONATAL TETANUS MORTALITY SURVEY
KENYA EXPANDED PROGRAM ON IMMUNIZATION

JOB DESCRIPTION FOR MEDICAL SUPERVISOR

1. Participate in training sessions and field practice exercises for the complete duration of the training, lasting up to four days.

2. Serve as a field supervisor and medical supervisor during the first four days of the survey and weekly thereafter for 2-3 days up to a total of 12 days.

3. Review each completed Form B for completeness and accuracy and determine whether death was due to neonatal tetanus or other cause. Discuss each Form B with the appropriate interviewers and field supervisor. Complete the question concerning adequacy of TT immunity.

4. In case there is doubt as to the cause of death or suspicion that a death which might have been tetanus has been missed, visit the concerned household and interview an adult member (preferably the mother of the dead child). Ask the questions on Form B and any other questions to establish a diagnosis. Visit health facilities, if appropriate, in case the child had been admitted.

5. Visit at least 30% of all reported neonatal deaths.

6. Maintain a line listing of each neonatal death, indicating the result of the review of the records and of the investigation, if conducted.

7. Share photocopies of Form B's with Dr. Peter Bjerregaard, KEPI, for independent review of each neonatal death. Blind him as to the results of any field investigation. Include results of his subsequent analysis on the line listing form and investigate any deaths for which the record review results in conflicting diagnoses.

8. Describe local birth practices, including cord cutting and dressing and other factors potentially influencing the incidence of neonatal tetanus.

ANNEX 13

LINE LISTING OF NEONATAL DEATHS

number	name of child	cluster no.	serial no. (Form A)	age at death	TT adequate? (Y, N, unknown)	sucked at birth?	stopped sucking?	age at illness onset	body rigid?	convulsions?	name of health facility seeing child	Field Medical Supervisor's Diagnosis based on record review	Blind second opinion diagnosis and recommendations	Detailed findings of field investigation or reason investigation not conducted	Final Diagnosis

ANNEX 14

Kilifi NNT Mortality Survey
Kenya Expanded Program of Immunization

WORKSHEET

Cluster no._____

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Final Total
1. no. households visited								
2. no. occupants in households								
3. average household size (2/1)								
4. no. births								
- male								
- female								
5. crude birth rate (4/2 x 1000)								
6. no. births in 1st quarter 1988	x	x	x	x	x	x	x	
in 2nd quarter 1988	x	x	x	x	x	x	x	
in 3rd quarter 1988	x	x	x	x	x	x	x	
in 4th quarter 1988	x	x	x	x	x	x	x	
7. no. infant deaths	x	x	x	x	x	x	x	
- male	x	x	x	x	x	x	x	
- female	x	x	x	x	x	x	x	
8. no. infant deaths in 1st quarter 1988	x	x	x	x	x	x	x	
in 2nd quarter 1988	x	x	x	x	x	x	x	
in 3rd quarter 1988	x	x	x	x	x	x	x	
in 4th quarter 1988	x	x	x	x	x	x	x	
9. no. neonatal deaths	x	x	x	x	x	x	x	
- male	x	x	x	x	x	x	x	
- female	x	x	x	x	x	x	x	
10. no. neonatal deaths in 1st quarter 1988	x	x	x	x	x	x	x	
in 2nd quarter 1988	x	x	x	x	x	x	x	
in 3rd quarter 1988	x	x	x	x	x	x	x	
in 4th quarter 1988	x	x	x	x	x	x	x	
11. neonatal mortality rate (9/4 x 1000)	x	x	x	x	x	x	x	
12. infant mortality rate (11/.4)	x	x	x	x	x	x	x	
13. no. neonatal tetanus deaths	x	x	x	x	x	x	x	
- male	x	x	x	x	x	x	x	
- female	x	x	x	x	x	x	x	
14. no. neonatal tetanus deaths on day 0-3	x	x	x	x	x	x	x	
on day 4-14	x	x	x	x	x	x	x	
on day 15-20	x	x	x	x	x	x	x	
on day 21-30	x	x	x	x	x	x	x	

ANNEX 15

Preliminary Partial Findings from Completed Clusters (10 of 30), Kilifi District Neonatal Tetanus Mortality Survey, February - March 1989

	Totals	Range per cluster
No. of occupied households surveyed:	2136	143 - 298
No. of occupants	15661	1177 - 2158
No. of occupants per household:	7.3	5.1 - 10.8
No. of births:	854	85 - 88
- male	425	38 - 46
- female	429	39 - 48
Crude birth rate:	54.5	39.5 - 72.2
No. of infant deaths:	31	0 - 6
-male	15	0 - 5
-female	16	0 - 3
No. of neonatal deaths:	18	0 - 5
-male	11	0 - 4
-female	7	0 - 3
Seasonality of neonatal deaths:	18	
-Jan.-Mar. 1988	5	0 - 3
-Apr.-Jun. 1988	5	0 - 2
-Jul.-Sept. 1988	5	0 - 1
-Oct. 1988-Jan. 1989	3	0 - 1
Neonatal mortality rate	21.1	0 - 58.8
Infant mortality rate*	52.7	0 - 147.0

*derived from neonatal mortality rate by assuming 40% of infant mortality occurs in neonatal period

TETANUS PROTECTION CARD

Family Name _____

First Name _____ Year of Birth _____

Address _____

District _____

State _____

CHILDHOOD DPT/DT IMMUNIZATION

Number of Doses _____

No information _____

ADULT TETANUS TOXOID

	DATE		
	Day	Month	Year
1st DOSE	/	/	
2nd DOSE	/	/	
3rd DOSE	/	/	
4th DOSE	/	/	
5th DOSE	/	/	

If you did not receive immunization before, you need two doses of tetanus toxoid (with four weeks interval between) and one dose in any future pregnancy.

Source: Update: Neonatal Tetanus, WHO, Geneva, September 1986.

Annex 17

TT Immunization Schedule for Women

Dose	When to give TT	Percent Protected	Duration of Protection
TT-1	at first contact or as early as possible in pregnancy	Nil	None
TT-2	at least four weeks after TT-1	80	3 years
TT-3	at least 6 months after TT-2 or during subsequent pregnancy	95	5 years
TT-4	at least one year after TT-3 or during subsequent pregnancy	99	10 years
TT-5	at least one year after TT-4 or during subsequent pregnancy	99	for life

Source: Update: Neonatal Tetanus, WHO, Geneva, September 1988.

NOTES

Date _____ Symptoms _____ Treatment

NOTES

Date _____ Symptoms _____ Treatment

Has the mother had her tetanus vaccine?

	DATE Day	Month	Year
1st DOSE	/	/	
2nd DOSE	/	/	
3rd DOSE	/	/	
4th DOSE	/	/	
5th DOSE	/	/	

BRING THE CHILD TO CLINIC EVERY MONTH

EVERY CHILD MUST HAVE A BIRTH CERTIFICATE

MOH 508

CHILD HEALTH CARD (FRONT ONLY)

MINISTRY OF HEALTH, KENYA

HEALTH FACILITY NAME	
CHILD'S NAME	SEX
CHILD CLINIC NO	DATE FIRST SEEN
DATE OF BIRTH	BIRTH ORDER
FATHER'S NAME	
MOTHER'S NAME	
DISTRICT	
LOCATION	
SUB LOCATION/VILLAGE	

SIBLINGS

(BROTHERS & SISTERS)

	NAME	YEAR OF BIRTH	SEX	ALIVE/ DIED
1				
2				
3				
4				
5				
6				
7				
8				

SHOW THIS CARD ON EVERY VISIT

IMMUNIZATIONS PROTECT YOUR CHILD

TUBERCULOSIS (BCG – VACCINE) at birth	DATE GIVEN	
BCG – SCAR	DATE CHECKED	PRESENT / ABSENT

DIPTHERIA/WHOOPING COUGH/ TETANUS (DPT VACCINE)	
DOSE	DATE GIVEN
1st dose at 6 weeks	
2nd dose	
3rd dose	

POLIOMYELITIS (ORAL POLIO VACCINE)	
DOSE	DATE GIVEN
1st dose at birth	
2nd dose at 6 weeks	
3rd dose	
4th dose	

MEASLES VACCINE	DATE GIVEN
give at 9 months	

ENTER DATE NEXT VISIT

HAVE YOUR CHILD WEIGHED EVERY MONTH

ANNEX 19

(2 pages)

COMMON REASONS FOR LOW MEASLES IMMUNIZATION COVERAGE:

- PARENTS UNAWARE OF IMPORTANCE OF IMMUNIZATION
- PARENTS UNAWARE WHERE AND WHEN IMMUNIZATION AVAILABLE
- INSUFFICIENT CONTACT WITH HEALTH SYSTEM
- MISSED OPPORTUNITIES FOR MEASLES IMMUNIZATION

IMPROVE MEASLES IMMUNIZATION COVERAGE BY:

- SYSTEMATIC SCREENING/VACCINATION/REFERRAL
- VACCINATING ELIGIBLE CHILD WITH ALL ANTIGENS
- VACCINATING AT 1ST OPPORTUNITY AT 9 MONTHS AGE
- VACCINATING DESPITE LOW FEVER, DIARRHEA, MILD ARI, MALNUTRITION
- OPENING MEASLES VIAL FOR EVEN 1 CHILD
- IMMUNIZING ADMISSIONS TO HOSPITAL
- INCLUDING MEASLES VACCINE IN NATIONAL IMMUNIZATION DAYS
- VACCINATING IN ABSENCE OF DOCUMENTED MEASLES VACCINATION OR MEASLES DISEASE (DO NOT ACCEPT PARENT'S VERBAL HISTORY)

ANNEX 20

REASONS FOR INTEGRATING VARIOUS DISEASE SURVEILLANCE SYSTEMS AS A PART OF A TOTAL EPIDEMIOLOGICAL SURVEILLANCE SYSTEM

- There is overlap between many of the program's overall goals (i.e. reduced child morbidity) and even some of the target diseases (e.g. measles is often complicated by diarrhea).

- The target age groups for programme activities are similar or overlapping.

- The same health facilities often see or admit cases of the various target diseases.

- There is a trend towards integrating the disease control programs into the national primary health care activities and therefore health care staff at lower levels often have responsibility for all of the diseases.

- A combined approach to surveillance can often be made for a very small increase in cost over that of a single control program's target disease surveillance system.

- Integration for a number of target diseases will ultimately lead to a strengthening of the entire epidemiological surveillance system.

(From Consultative Meeting on Epidemiological Surveillance, Colombo, Sri Lanka, December 1985, WHO document SEA/EPI/64).

ANNEX 21

ADDITIONAL LITERATURE AVAILABLE FOR REFERENCE:

1) Report of the Intercountry Consultative Meeting on Epidemiological Surveillance - Colombo, Sri Lanka, 17-20 December, 1985: World Health Organization SEA/EPI/64

2) National Consultative Workshop on Epidemiological Surveillance, Nepal: Assignment Report by Dr. Eric Brenner, (WHO Consultant - 27 November - 18 December, 1986) SEA/EPI/68

3) EPI Target Disease Surveillance and Disease Reduction Targets by Dr. Timothy Dondero, WHO Short Term Consultant, July 1983 EPI/GEN/84/6

4) EPI Sentinel Surveillance in the South-East Asia Region: National Programme Managers Consultative Meeting - New Delhi, India 30 April - 3 May, 1985 SEA/EPI MEET 85/8

5) Sentinel Surveillance in India by Dr. R.N. Basu

6) EPI Sentinel Surveillance for Lagos

7) A Proposal for Local Area Monitoring (LAM) by World Health Organization SEA/SURV MEET 85/3

8) Community-based PHC, Management Information System -- Guidelines for a Model System

9) Management Information Support for District Health Systems Based on Primary Health Care

10) Cost Analysis in Primary Health Care Management Information Systems

(Items 1-7 were provided by the consultant)

ANNEX 22

(3 pages)

AGENDA

HEALTH PLANNING AND INFORMATION SYSTEMS:

THE SENTINEL SURVEILLANCE SYSTEM APPROACH

A WORKSHOP

PARTICIPANTS: THE DIVISION OF FAMILY HEALTH
THE HEALTH INFORMATION SECTION OF THE MOH
THE PLANNING SECTION OF THE MOH
THE INFORMATION AND PLANNING SYSTEMS (IPS) PROJECT

VENUE: Safari Park Hotel

DATES: 10:00 AM Monday, February 20, 1989 to;
4:30 PM Wednesday, February 22, 1989.

DAY 1: MORNING

10:00 AM Introduction: Objectives, agenda, logistics, distribution of materials

10:30 AM Discussion of what the workshop should accomplish (Groups and plenary session)

11:00 AM Description/overview of The "Division" of Planning and Development and the Information and Planning Systems (IPS) Project.

11:30 AM Planning and the uses of data (Overview).

12:15 PM LUNCH

DAY 1: AFTERNOON

1:30 PM Description/overview of the programmes and organization of the Division of Family Health.

1:50 PM Presentations on the information systems and planning activities of each programme of the Division of Family Health (KEPI, CDD, Family Planning and Nutrition).

2:45 PM Components of Health Information Systems

3:00 PM TEA BREAK

3:15 PM EXERCISE (4 GROUPS) Inventory of data elements

4:00 PM Lecture/discussion: Critical issues in the use of information for health planning

4:30 PM END OF DAY ONE

DAY 2: MORNING

8:30 AM Presentation and discussion of work plans of each programme (KEPI, CDD, Family Planning and Nutrition).

9:45 AM Strategies to assess current information and planning systems and their management

10:15 AM Group exercise/discussion on assessement. Focus on the effectiveness and efficiency of the current systems in each programme (data elements, management aspects, uses of data in planning, gaps in information, etc.)

[TEA BREAK DURING THE GROUP WORK]

11:00 AM Reading time

11:20 AM Feedback on assessments: Plenary session

12:30 PM LUNCH

DAY 2: AFTERNOON

1:30 PM Group discussion: revisions of annual work plans plus details for next three months. Use of a general planning framework.

2:45 PM CASE STUDY MODEL OF EPI: description of events beginning with the identification of need, assessment, planning, training, management of operations, budgeting, monitoring and evaluation.

3:30 PM Exercise on Sentinal Surveillance: individual and in small groups.

4:30 PM END OF DAY TWO

DAY 3: MORNING

8:30 AM Review of major concepts and elements of the SSS approach (focus on KEPI and CDD).

9:00 AM Discussion of the objectives, components and approach of a Sentinal Surveillance System

9:15 AM SSS working groups for KEPI-CDD: implementation planning.

Resources needed, responsibilities, priorities, planning for the training needed to move to implementation, training of trainers, budgets etc.

10:30 AM TEA BREAK

10:45 AM Continuation: SSS working groups for KEPI-CDD

12:30 PM LUNCH

DAY 3: AFTERNOON

1:30 PM Continuation: SSS working groups for KEPI-CDD

3:00 PM TEA BREAK

3:15 PM Continuation: SSS working groups for KEPI-CDD

4:00 PM Plenary session

4:30 PM END OF WORKSHOP

ANNEX 23 (2 pages)
Lecture Outline*

Use (and occasional mis-use) of data:

- Disraeli: lies, damned lies, statistics
- % of eligibles vs. % of targets
- by age, by dose
- characteristics and examples of good data: timely, accurate, valid, complete, useful
- measurable? (thermometer properly calibrated?)
- training and supervision
- output (#s vaccinated) vs outcome/impact (disease reduction) example of "smallpox zero" target and surveillance/containment vs. mass vaccination
- Kenyan serological data on measles vaccination at 9 mos. important for global EPI policy formulation
- who needs data: program managers, politicians, donors, Ministry of Finance, peripheral staff for action

Case Study of EPI Data Requirements: (supplemented by overhead slides)

Purpose	Data Methods and Requirements
Identification of need	studies and surveys of disease magnitude and epidemiology (e.g. measles serology in Kenya)
Planning and strategies	no. health facilities and staff, location, catchment
Training	who? where? turn-over?
Managing operations	vaccine utilization/wastage temperature records vaccine re-ordering
Monitoring output	nos. vaccinated by dose and age indicators: coverage rates drop-out rates identifying critical areas by low percent coverage versus nos. of non-vaccinated 30 cluster survey

*Supplemented by slides (see Annex 24).

census of 100 households nearest health facility

the immunization "road to health" monitor

Evaluation

outcome (not predicted by output)
- impotent vaccine
- vaccinating old children
- nnt control with zero TT2 coverage (Kuwait)
- high TT2 coverage in old women, so little nnt control

focus on morbidity and mortality by disease surveillance

epidemiologic shift

Disease Surveillance in EPI

Definition: continued watchfulness - who, where, when, why

Elements: collection, tabulation, analysis, etc ... for action

Sources of data

Methods of collection: routine (active, passive) reporting
sentinel
surveys
outbreak investigations

Typical problems of routine reporting systems

Purpose and methods of EPI disease surveillance by stage of EPI
- early (low coverage)
- expansion (medium coverage)
- maintenance (high coverage)

Cases/deaths averted at varying coverage levels

Interpretation of data: be careful!

Sentinel surveillance system used to determine:

EPI disease incidence rates and proportion of hospital admissions in defined population over time.

epidemiologic shift to older ages

high risk age groups

seasonality

degree of under-reporting of routine system

vaccine efficacy (compare proportion of cases in vaccinees to proportion of population vaccinated)

ANNEX 24
(13 pages)

SLIDE SET FOR SENTINEL SURVEILLANCE SYSTEM WORKSHOP

Disease Surveillance

= Dynamic, close, continued watchfulness over distribution and trends of disease occurrence.

- who gets disease?
- where?
- when?
- why?

Elements of Disease Surveillance:

- collection of data
- tabulation of data
- analysis of data
- interpretation of data
- dissemination of information
- action for prevention and control

INFORMATION FOR ACTION

Sources of data

birth/death registers

outpatient registers

individual patient records

tally sheets

lab reports

drug utilization

other

Passive Routine Disease Surveillance System: Findings from the Nepal EPI Review, 1985

- reporting: incomplete, slow, uneven reliability
- reported information: not focused for EPI needs (age groups)
- limited and delayed analysis, feedback, and sharing of data at or between any level
- neonatal tetanus not reported separately
- no standardized case definitions
- outpatient diagnosis not reported for hospitals
- information reported by health posts is classified by symptomology, which makes reporting by diagnostic category difficult

Recommendation:

Sentinel surveillance needed for more focused, timely and accurate data for EPI to guide disease control activities.

PURPOSE AND METHOD OF EPI DISEASE SURVEILLANCE BY STAGE OF EPI

Stage of Programme	Surveillance Needed To:	Surveillance Method
Early (low coverage)	Assess public health importance of diseases & priorities Identify target ages/areas. Baseline levels. Set disease reduction targets. Attract funds.	Special surveys
Expansion (medium coverage)	Assess/demonstrate impact. Determine epidemiology. Identify/solve implementation problems. Vaccine efficacy. Identify outbreaks.	Sentinel surveillance system. Surveys.
Maintenance (high coverage)	Assess impact. Vaccine efficacy. Determine case fatality rates, age-specific attack rates.	Outbreak investigations. Strenthened routine surveillance. Sentinel surveillance system.

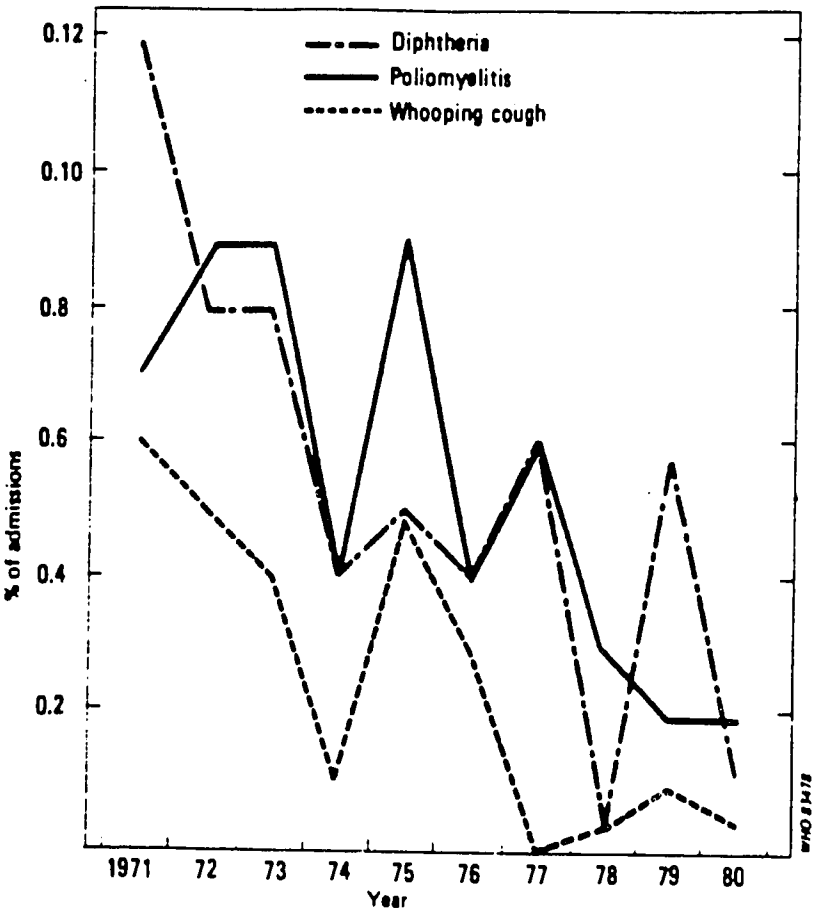
Essential Components of a Sentinel System

- monitoring regularity and timeliness of reports
- active soliciting of late reports
- "Nil" reporting
- local tabulation, sharing, analysis and use of data. (Data collection and tabulation is not sufficient to sustain interest.)
- regular feedback

Use of Data

: to document incidence rates and monitor trends

Proportion of hospital admissions for diphtheria, poliomyelitis and whooping cough as a percentage of all hospitalized children from 0 to 13 years, the University Hospital Centre, Rabat, Morocco, 1971-1980

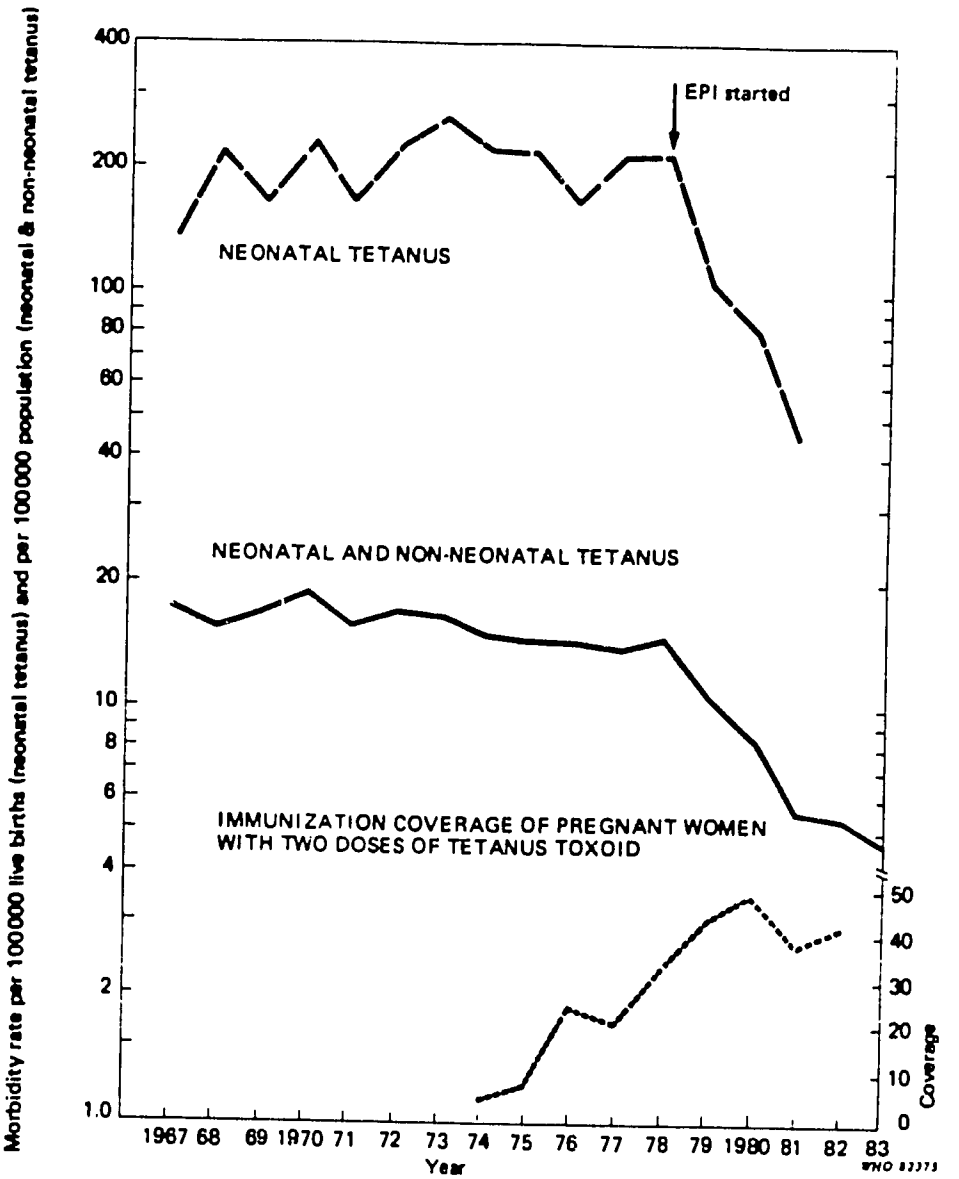


Source: World Health Statistics Annual, 1984

Use of Data

: to monitor incidence rates in defined catchment areas and document trends

Incidence of tetanus and neonatal tetanus and immunization coverage of pregnant women, Sri Lanka, 1967-1983

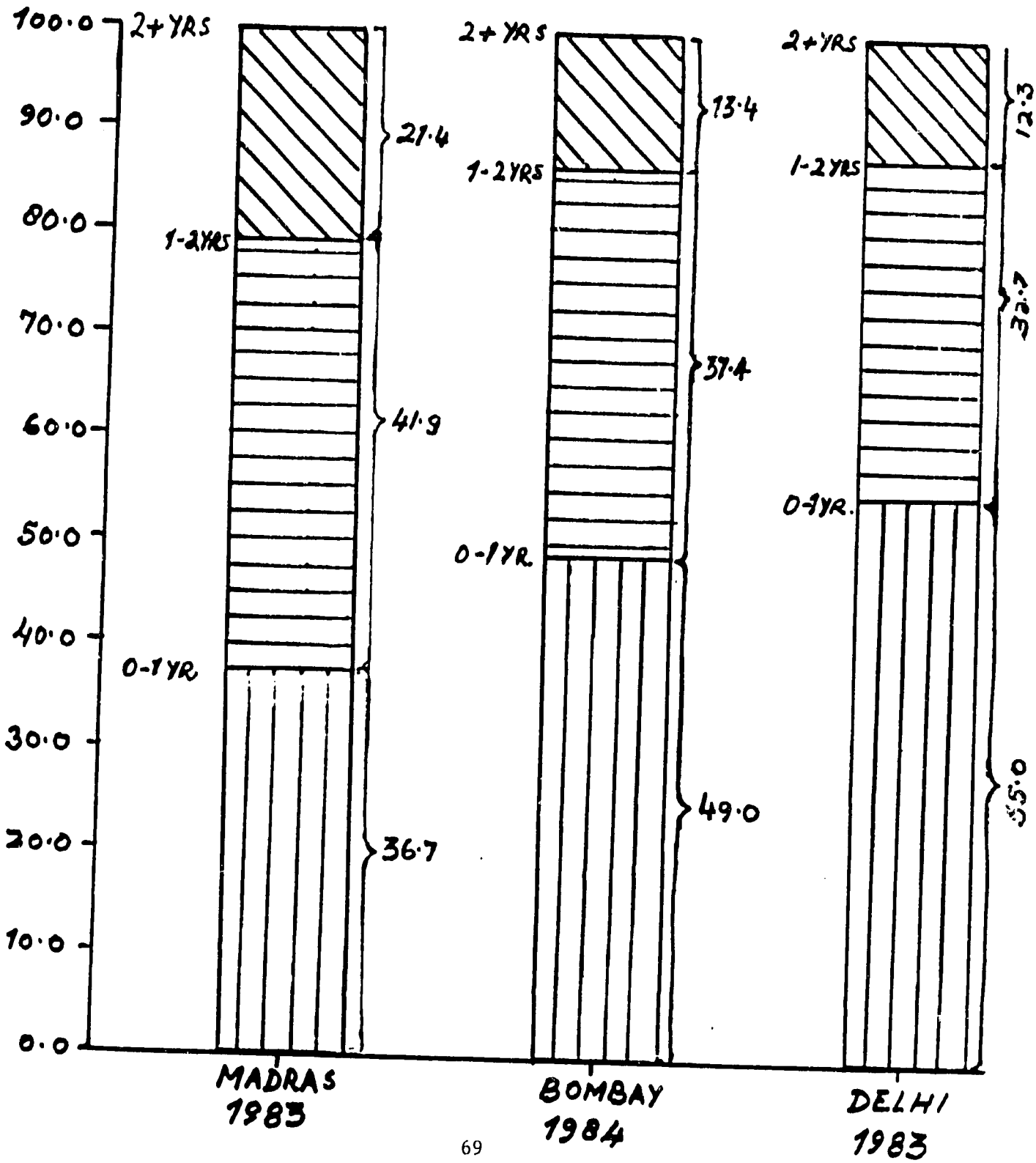


Source: World Health Statistics Annual, 1984

Use of Data

: to identify high risk groups
: to determine target ages

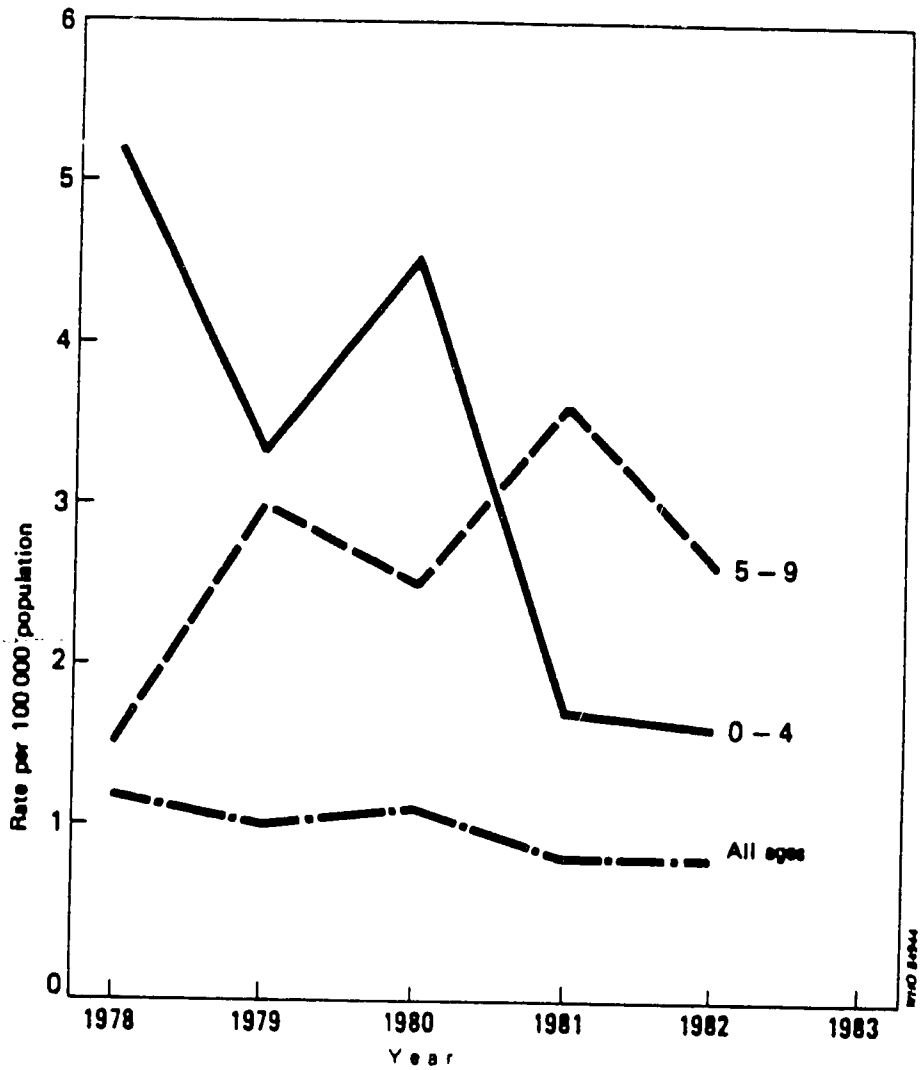
Cumulative % Affected by Polio
By Age Group



Use of Data

: to document impact on specific age groups (epidemiological shift)

Age-specific morbidity rates from diphtheria, Yogyakarta, Indonesia, 1978-1982

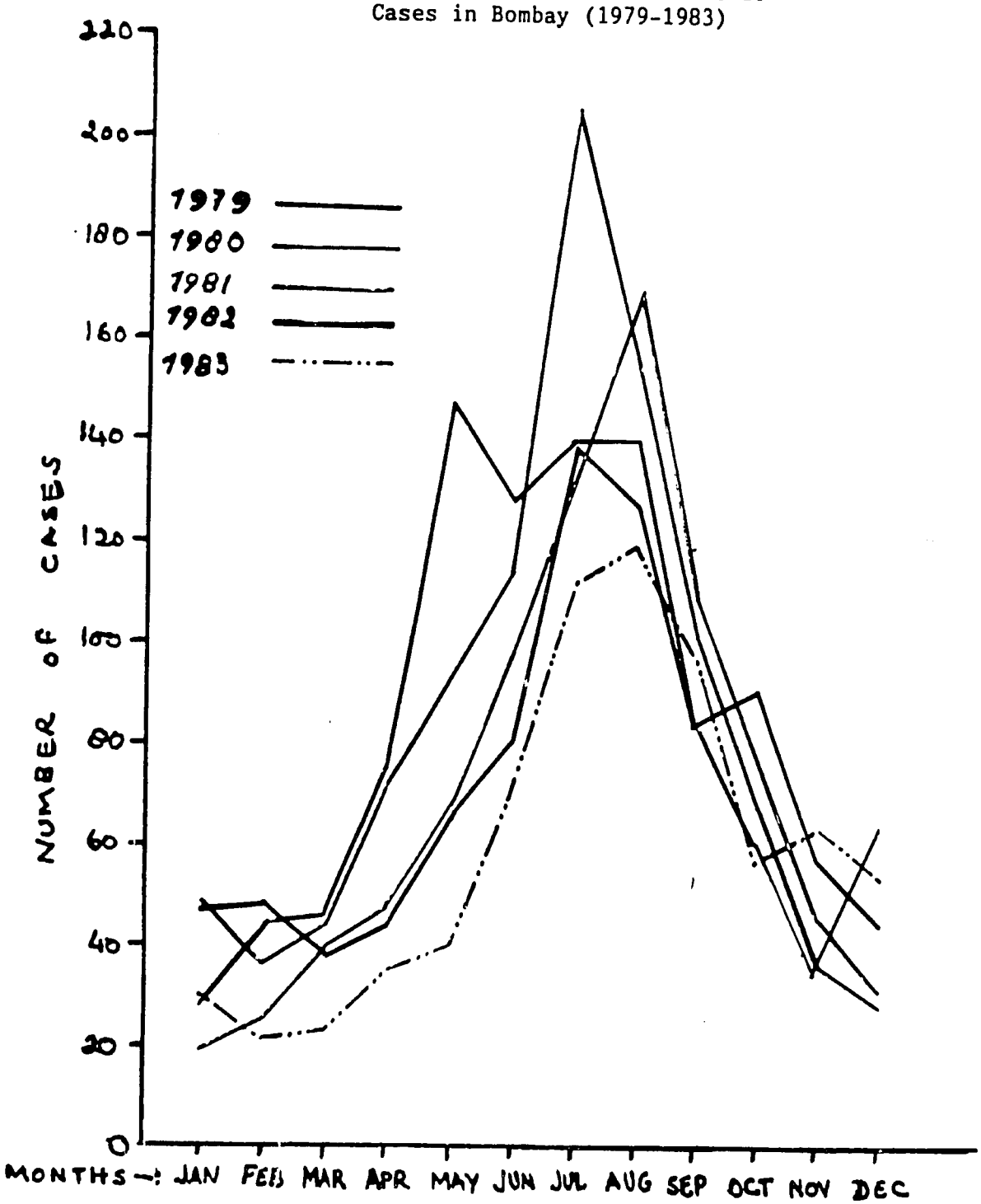


Source: World Health Statistics Annual, 1984

Use of Data

: to define seasonality to time special acceleration efforts

Month-Wise Distribution of Polio Cases in Bombay (1979-1983)



Source: SEA/EPI/MEET/85.8

Use of Sentinel Data

: to assess degree of underreporting of routine system in a defined area

Information on Estimates of Incidence Rates for EPI Target Diseases Based on Sentinel Surveillance Compared to the Routine Hospital Monthly Reporting System, Indonesia, 1983

Incidence Rate per 100,000 population

Disease	Sentinel Surveillance[1]	Routine Reporting[2]
tetanus (neonatal)	0.56*	0.11
measles	215.7	3.03
polio	1.5	0.04

*rate is per 1000 live births

[1] total catchment population = 2 million

[2] total population = 154 million

Source: SEA/EPI/MEET/85.8

Criteria for Selection of Limited Number of Sentinel Sites

- staff willingness to record, report, tabulate, compile, use data
- diagnostic capability
- area of EPI activity where reduction of incidence likely
- high volume of expected cases
- geographic representativeness
- presence of past data to establish retrospective baselines

Criteria for Disease Selection

- easy to diagnose at all levels
- early to be influenced by increased immunization
- immunization is only widely available intervention at present to reduce incidence
- limit number of diseases to improve compliance with reporting

INTERPRETATION OF DATA
BE CAREFUL!!!!

Is change in incidence real?

Or is it due to:

- change in catchment population
- change in procedure for diagnosing/recording/reporting
- change in case definition
- seasonal change in access to services
- incomplete reports
- cyclical disease patterns
- improving or worsening surveillance

If the change seems real:

is it because of <u>our</u> intervention?

Practical Guidance Needed on Sentinel Surveillance System

- channels and responsibility for reporting, tabulating, analyzing, supervising, feedback and action
- actual selection of sites
- forms to be used
- standard case definitions
- operational linkages between programs at various levels
- degree of integration to be aimed for between EPI, CDD, ARI, and epidemiology division.
- plan for implementing system
- extension of system:
  - no. of sites
  - no. of diseases
  - no. of types of data to collect
  - no. of forms to be used
- means of encouraging local use of data
- training needs

ANNEX 25

FIELD VACCINE EFFICACY (VE)

Precise formula:

$$VE = \frac{\text{attack rate in unvaccinated} - \text{attack rate in vaccinated}}{\text{attack rate in unvaccinated}} \times 100$$

or

$$VE\ (\text{measles}) = 1 - \frac{(PCV)\ (1-PPV)}{(1-PCV)\ (PPV)}$$

where PCV = proportion of measles cases vaccinated

PPV = proportion of the population vaccinated against measles (i.e. immunization coverage)

Approximate Calculation:

Use graph (see Annex 27) to determine VE when PCV and PPV are known. The age group for which PPV and PCV data are available should be the same.

Lesson:

A 50% PCV in 2 different districts must be interpreted in light of PPV to determine VE, which may differ greatly between the 2 districts. In one district with high coverage (PPV = 90%), VE would be an acceptable 89%; and in the other district with lower coverage (PPV = 80%), VE would be only 75% - which should call for an investigation.

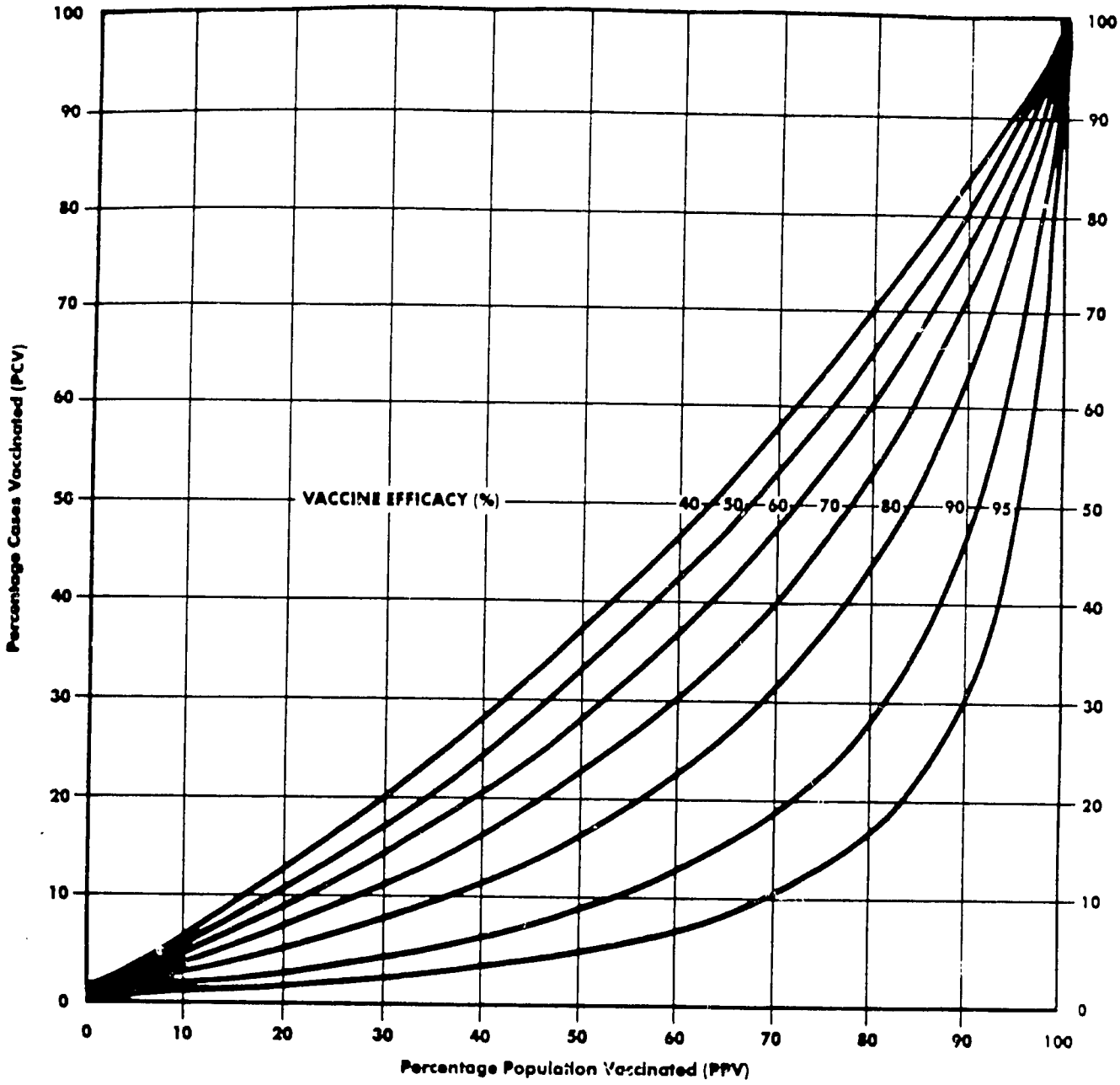
ANNEX 26

Measles Incidence Expected in Two Districts With Varying Vaccination Coverage Levels and Constant Vaccine Efficacy

	District A	District B
child population	100,000	100,000
measles vacination coverage levels	90%	60%
no. vaccinated	90,000 (100,000 X .9)	60,000 (100,000 x .6)
field vaccine efficacy	80%	80%
no. immune vaccinated children	72,000 (90,000 x .8)	48,000 (60,000 x .8)
no. non-immune vac. children	18,000 (90,000-72,000)	12,000 (60,000-48,000)
no. of measles cases in non-immune vaccinated children, if 90% eventually get measles	16,200 (18,000 x .9)	10,800 (12,000 x .9)
no. children not vaccinated	10,000 (100,000-90,000)	40,000 (100,000-60,000)
no measles cases in non-vaccinated children, if 90% eventually get measles	9,000 (10,000 x .9)	36,000 (40,000 x .9)
total measles cases	25,200 (16,200 + 9,000)	46,800 (10,800 + 36,000)
proportion of all measles cases which occur among vaccinated children	64% $\frac{16,200}{25,200}$	23% $\frac{10,800}{46,800}$

Lesson: The higher the vaccination coverage, the higher is the proportion of cases which occur among vaccinated children. The proportion of cases occurring in vaccinees must be related to vaccination coverage for proper interpretation.

GRAPH TO ESTIMATE VACCINE EFFICACY



Source: Field Evaluation of Vaccine Efficacy, W.A. Orenstein, et al. Bull WHO 63(6):1055-1068, 1985.

Formula for determining vaccine efficacy

$$VE = 1 - \frac{(PCV)\ (1 - PPV)}{(1 - PCV)\ (PPV)},$$

where PPV is percentage population vaccinated
PCV is percentage cases vaccinated

Vaccine Efficacy

Not all persons who receive polio vaccine are necessarily protected against the disease, since no vaccine is 100% effective. The best way to decide if too many cases are occurring in unimmunized individuals is to calculate vaccine efficacy. *Low vaccine efficacy (for example, less than 80%), may indicate either failures in the cold chain or problems in the manufacture of the vaccine.*

There are several approaches to calculating vaccine efficacy, including use of coverage data and case-control studies. These methods are too detailed for presentation in this manual, however, a quick estimate of vaccine efficacy can be made if the following two variables are known:

1) Percentage Cases Vaccinated (PCV):
The proportion of cases occurring in completely vaccinated individuals in a particular age group.

2) Percentage Population Vaccinated (PPV):
The total proportion of the population in the same age group which has been completely vaccinated.

For purposes of vaccine efficacy estimation, cases who received one or two doses (or whose vaccination history is unknown) are excluded from the calculations, and vaccination coverage percentages are calculated for only two categories: those who received three or more doses, and those who received no doses.

If both PCV and PPV are known, the graph shown in Figure 3 and Appendix F can be used to estimate whether vaccine efficacy falls within the expected limits. The curves on the graph indicate the theoretical proportion of cases that can be expected to have a history of vaccination for different levels of vaccine efficacy. The known values are plotted on the graph and their point of intersection is compared to the point on the nearest curve. For example, if 50% of cases are occurring in completely vaccinated children less than 5 years of age, and 60% of all children less than 5 have been completely vaccinated, then vaccine efficacy is less than 40%. Such a situation would call for further investigation and remedial action.

Source: Polio Eradication Field Guide, EPI/PAHO, 1988.

E X A M P L E

Consider an outbreak of 49 cases of paralytic poliomyelitis in children less than 5 years of age, 20 of whom have received three or more doses of OPV

Vaccination history of children less than 5 years of age with confirmed cases of poliomyelitis

Number of doses of OPV	Number of polio cases less than 5 years of age (%)
0	14 (41.2%)
3 or more	20 (58.8%)
SUBTOTAL	34 (100%)
1, 2 or unknown	15
TOTAL	49

Vaccination coverage in children less than 5 years of age

Number of doses of OPV	Number of children less than 5 years of age (%)
0	2,800 (25%)
3 or more	8,400 (75%)
SUBTOTAL	11,200 (100%)
1, 2 or unknown	3,380
TOTAL	14,580

CALCULATIONS AND INTERPRETATIONS

$$PCV = \frac{\text{Polio cases with} \geq 3 \text{ doses OPV}}{\text{Polio cases with} \geq 3 \text{ doses OPV} + \text{Polio cases with 0 doses OPV}}$$

$$PCV = \frac{20}{20 + 14} = \frac{20}{34} = 58.8\%$$

$$PPV = \frac{\text{Children with} \geq 3 \text{ doses OPV}}{\text{Children with} \geq 3 \text{ doses OPV} + \text{Children with 0 doses OPV}}$$

$$PPV = \frac{8{,}400}{8{,}400 + 2{,}800} = \frac{8{,}400}{11{,}200} = 75\%$$

The proportion of cases with three or more doses of polio vaccine (PCV) is 58.8%. Data from prior coverage assessments show that the proportion of the population at risk (less than 5 years of age) which has been completely vaccinated (PPV) is 75%.

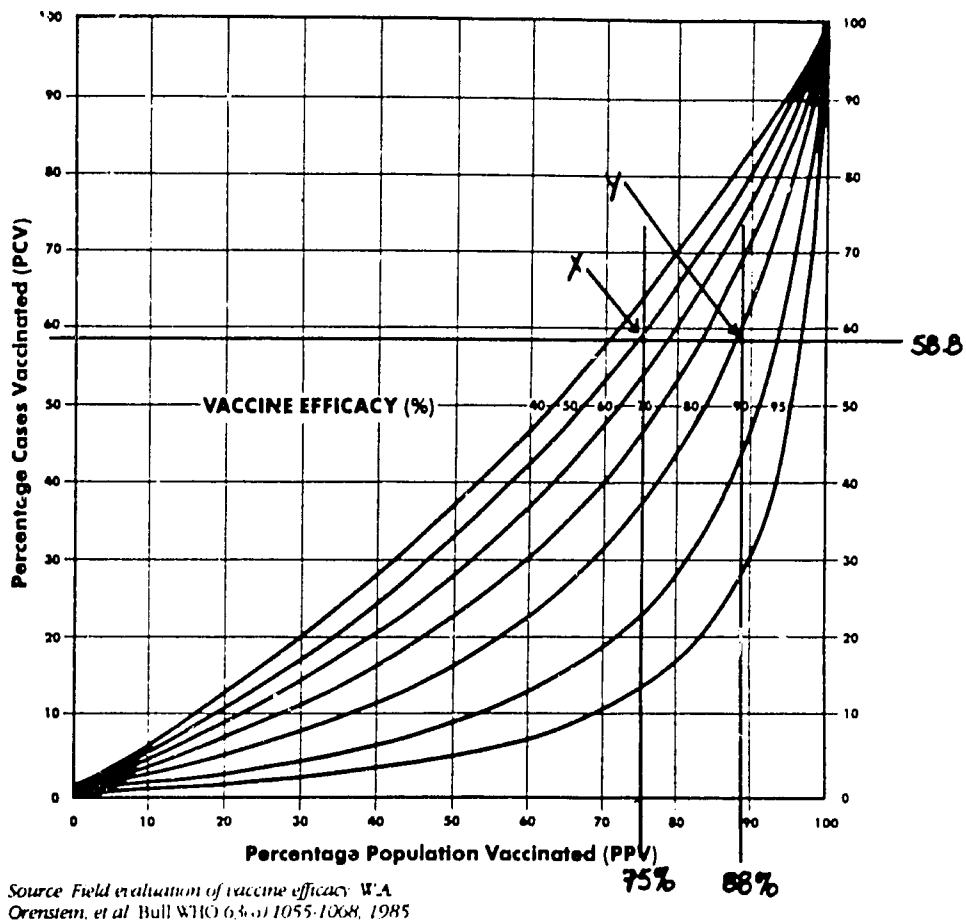
Using a ruler, the value of PCV is located on the vertical axis, and the value of PPV on the horizontal axis. The intersection of the two lines (noted with an "X" on the graph) indicates the approximate value of vaccine efficacy. In the example, X is to the left of the 60% curve, therefore the vaccine efficacy is estimated to be less than 60%.

On the other hand, if the same proportion of cases (PCV = 58.8%) occurred in a population with 88% coverage (PPV), then the intersection of the two lines (shown as "Y" on the graph) indicates a vaccine efficacy greater than 80%.

This method does not provide precise calculations of vaccine efficacy, but it is a good way to make a quick estimation in order to see if further evaluation is necessary.

FIGURE 3.

SAMPLE OF THE GRAPH TO ESTIMATE VACCINE EFFICACY



Source Field evaluation of vaccine efficacy W.A. Orenstein, et al Bull WHO 63(1) 1055-1068, 1985

MINISTRY OF HEALTH

SENTINEL SURVEILLENCE FOR MEASLES AND DIARRHOEA+

HEALTH FACILITY _____ DISTRICT _____

MONTH _____ YEAR _____

MEASLES CASES & DEATHS DURING THE MONTH, BY AGE & VACCINATION STATUS:

	VACCINATION STATUS	AGE OF CHILD (IN MONTHS) AT ONSET OF DISEASE				
		0 - 8	9 - 11	12 - 23	24 - 59	TOTAL
CASES	UNPROTECTED*					
	VACCINATED**					
	UNKNOWN***					
	TOTAL					
DEATHS	UNPROTECTED*					
	VACCINATED**					
	UNKNOWN***					
	TOTAL					

* Unprotected refers to unvaccinated children and children vaccinated before 8 months of age.

** Vaccinated refers to children vaccinated at 8 months of age, or thereafter, with verification.

*** Unknown vaccination status including children with no verification.

\+ Diarrhoea form is on a separate page.

ANNEX 29
(2 pages)

MINISTRY OF HEALTH : EPI FORMS

MOH 702

IMMUNIZATION TALLY SHEET

HEALTH INSTITUTION _____ PERIOD FROM _____ TO _____

BCG	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
DPT 1ST DOSE	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
DPT 2ND DOSE	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
DPT 3RD DOSE	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
*ORAL POLIO BIRTH DOSE	BEFORE 6 WEEKS	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
*ORAL POLIO 1ST DOSE	AFTER 6 WEEKS AND UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
*ORAL POLIO 2ND DOSE	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
*ORAL POLIO 3RD DOSE	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
MEASLES	UNDER ONE YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
No. of children completed schedule	UNDER 1 YEAR	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	1 YEAR AND ABOVE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
TETANUS TOXOID FOR PREGNANT WOMEN	1ST DOSE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	2ND DOSE	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000
	BOOSTERS	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000	00000 00000

* IF NO DOSE IS GIVEN BEFORE 6 WEEKS OF AGE, A TOTAL OF THREE DOSES ONLY SHOULD BE GIVEN.

MINISTRY OF HEALTH

MOH 710

NAME OF DISTRICT / HEALTH FACILITY______________________________

IMMUNIZATION SUMMARY SHEET

PERIOD FROM_______________ TO _______________

NAME OF INSTITUTION																											TOTAL	MONTHLY TARGET **
DAYS OF THE MONTH																												
BCG	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
DPT 1ST DOSE	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
DPT 2ND DOSE	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
DPT 3RD DOSE	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
* ORAL POLIO	BIRTH DOSE < 6 WKS																											
* ORAL POLIO 1ST DOSE	> 6WKS & < 1YR																											
	1 YEAR & ABOVE																											
* ORAL POLIO 2ND DOSE	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
* ORAL POLIO 3RD DOSE	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
MEASLES	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
No. of children completed schedule	UNDER 1 YEAR																											
	1 YEAR & ABOVE																											
TETANUS TOXOID FOR PREGNANT WOMEN	1ST DOSE																											
	2ND DOSE																											
	BOOSTERS																											

FORM SUBMITTED ON _______________ 19 ______ BY _______________

* IF NO DOSE IS GIVEN BEFORE 6 WEEKS OF AGE, A TOTAL OF THREE DOSES ONLY SHOULD BE GIVEN

** NO. OF CHILDREN TO BE VACCINATED EACH MONTH IN ORDER TO MEET THE ANNUAL TARGET

HEALTH INSTITUTION : SEND TO DISTRICT MOH BY THE 5TH OF EVERY MONTH

DISTRICT SUMMARY : SEND TO H.I.S. P.O. BOX 20781, NAIROBI

Ax. 29-2

GRAPH TO MONITOR IMMUNIZATION COVERAGE OF CHILDREN UNDER 1 YEAR OF AGE

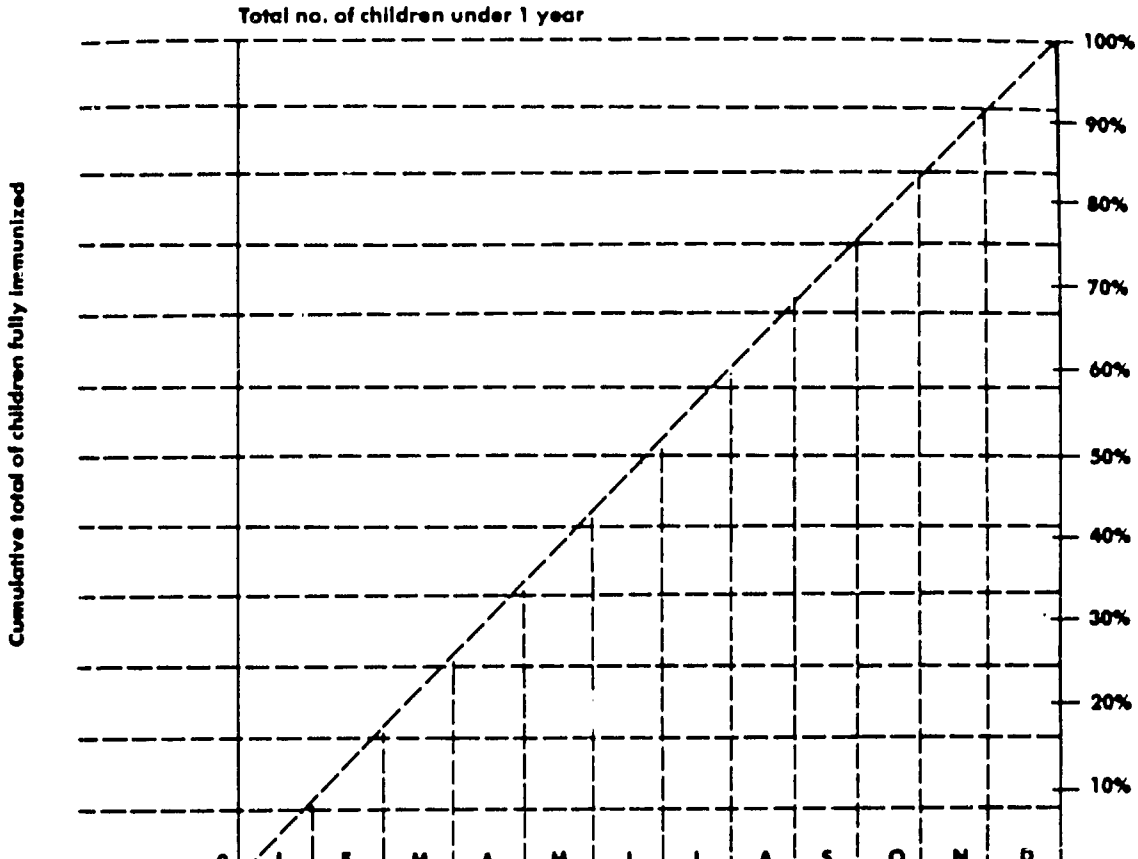
Area (District or Municipality) _____

Year _____

VACCINE _____

(FULL IMMUNIZATION = _____ DOSES)

Total no. of children under 1 year _____



(A) No. fully immunized during month													No. in month
													Cum. for year

1. Enter in box "A" the number of children fully immunized during that month, and the cumulative total for the month.

2. Plot monthly progress on the graph by marking "x" for the cumulative total at the end of each month and join with a solid line.

ANNEX 31

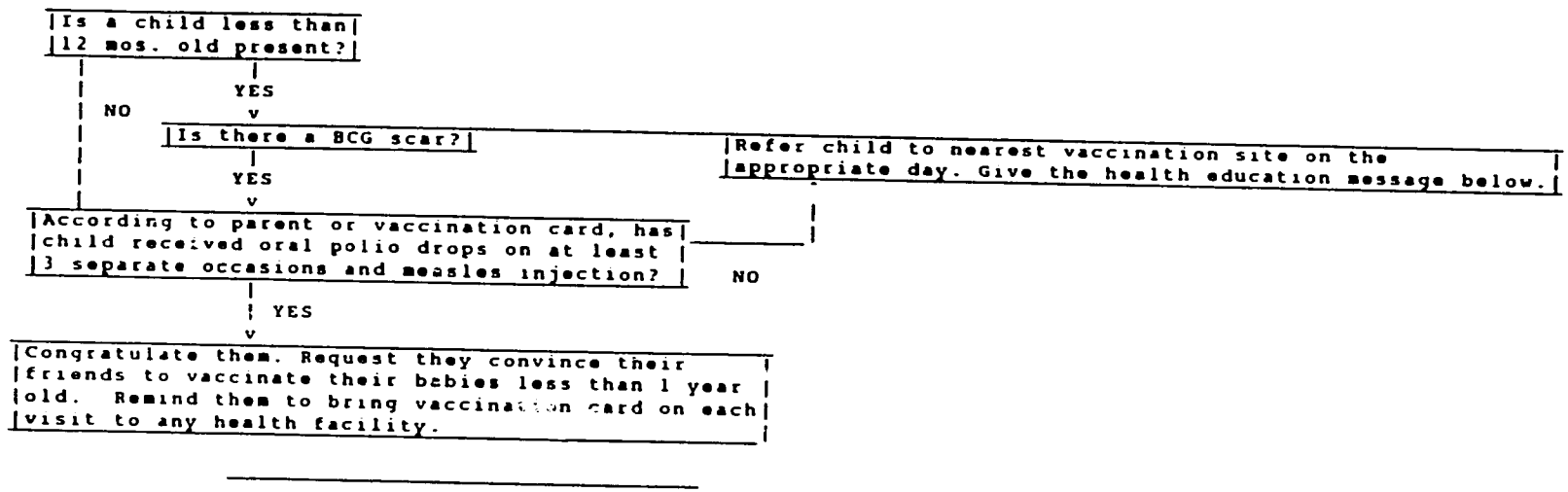
HYPOTHETICAL COVERAGE BY DISTRICTS WITHIN A REGION

	Population	% Coverage	Number Vaccinated	Number Not Vaccinated
district 1	20,000	50	10,000	10,000
district 2	10,000	45	4,500	5,500
district 3	10,000	80	8,000	2,000
district 4	7,000	70	4,900	2,100
	---	---	---	---
	47,000 (100%)		27,400 (58%)	19,600 (42%)

ANNEX 32

ROLE OF HEALTH FACILITIES IN HEALTH EDUCATION AND IMMUNIZATION OF CHILDREN

All health facilities should offer immunization to children and to women aged 15-44 years old on a regular basis (daily, weekly, monthly). During registration, staff should screen each patient and refer eligible ones for vaccination. Staff must learn the immunization schedule and the days immunization is offered in their own health facilities and in health facilities nearby. Regardless of whether or not the health facility is vaccinating, staff can use the following flow chart to give health education to each adult.



Health education message to be told to each adult:

1. Immunization can save children's lives.
2. Vaccinations protect against measles, polio, whooping cough, TB, tetanus, and diphtheria. (Use local names for these diseases. Without these vaccinations, your children will likely suffer and could die from some of these diseases. Women aged 15-44 years old need injections to protect their future babies against neonatal tetanus.
3. Three or four visits are needed to complete all the childhood vaccinations, with intervals between visits of 4 weeks.
4. Babies need vaccinations starting at birth, so that they can be protected before the diseases strike.
5. Mild fever and soreness lasting a day is common and normal following vaccinations. Do not worry.
6. Keep vaccination card(s) safely and bring them on each visit to any health facility even if you are no also bringing the children. This way I will be able to tell you whether additional vaccinations are needed.
7. You can get yourself and your children vaccinated every ____ at ____. Vaccinations are free of charge.
8. You can help fight these diseases: Tell you neighbors: Immunization can save children's lives.

ANNEX 33
(3 pages)

SUGGESTED OPERATIONS RESEARCH TOPICS IN ORDER OF PRIORITY

1. Child-to-Child Social Mobilization for EPI:

Schools are more widely distributed than health facilities and attendance is high. In selected low coverage/high mortality areas (especially in Western districts, sparsely populated districts, and urban areas) harness the natural competitiveness of children by having schools (or classes within the same school) compete for the highest number of infant referrals to the normal service delivery points.

Simple lesson plans for teachers can be prepared and students required to give coded "appointment slips" to nearby houses with infants. The class (or school) contributing the highest number of referral slips at the service delivery points over a one-month period wins. Results should be posted weekly at schools to stimulate participation. Students get badges, winning school class gets trophy, principal (teacher) gets new desk or similar idea. This attempt to educate schoolchildren, inform the public and raise coverage should be in support of and non-disruptive to the routine sustainable EPI service.

- The new REACH communications/social mobilization specialist will be involved.
- Materials developed by local NGOs (e.g. Pied Crow comic book by CARE) should be reviewed for appropriateness and used.
- The experience of local NGO's and AMREF may be instructive.

2. Missed Opportunities for Immunization (Especially Measles and TT):

- In-country technical ability and a good protocol exists.
- Results of surveys already conducted should be written up before additional surveys are funded.
- A plan for using the results of these surveys should be prepared.
- The questionnaire for children (form A) for question #11 can be improved. (See Appendix)

3. Surveys of Parental Knowledge on EPI During Exit Interviews:

- In districts with low coverage, how well are health workers at the immunization site and at other contacts informing mothers face-to-face? A form based partially on the Kitui District KAP survey and the Appendix could be developed. The local names of the diseases could be determined and areas needing improvement in face-to--face health education could be identified. Alternatively, these questions can be included on the missed opportunity survey protocol, which also relies on exit interviews.

- The new REACH communications/social mobilization specialist could be involved.

4. Coverage Surveys in 100 Households Nearest the Health Facility:

- As a tool to motivate health workers to monitor their own immunization coverage in the immediate vicinity, these surveys are very inexpensive and require a one-day training within the district.

5. 30-Cluster Coverage Surveys:

- Should be conducted in districts with low coverage.

- Local persons should use the COSAS program to analyze the data.

- Local experience exists.

6. Cultural Perceptions of NNT/Measles and Immunization Acceptability:

- This is different from a KAP study.

- The study done by REACH in Bolivia has been shared by WHO EPI (Geneva) with UNICEF/Kenya as a model using in-depth qualitative methods. UNICEF is awaiting MOH approval on a similar study by Cynthia Palmer (anthropologist from Harvard University).

- This study has the potential to identify and tailor appropriate health education messages to a few ethnic groups to improve acceptability of TT vaccinations. It can also help determine whether NNT is known and recognized by different ethnic groups. Technical assistance to KEPI is required by a trained anthropologist. The new REACH communications/social mobilization specialist should be actively involved in this research.

7. Model NNT Control in Few Selected Districts:

- We can anticipate a resurgence of interest in NNT. Kenyan participants in an upcoming WHO NNT Workshop will be exposed to many new developments and policy and strategy options. They will draft an action plan for NNT elimination and will want to test new approaches in selected districts. A high degree of continuous technical assistance will be required.

8. NNT Survey, Bungoma:

- The consequences of the Kilifi NNT survey in terms of new policy and operational initiatives should be evaluated before additional surveys are conducted.

- The district selected should be one, unlike Kilifi, where TT coverage is extremely low and NNT incidence is presumed to be very high.

- Technical ability exists in-country for survey execution.

9. Vehicle Use Management:

- High degree of technical assistance required as protocol does not exist to study factors leading to a well-run transportation system, particularly at district level.

10. Measles Serological Study:

- Since the potential policy implications of this study are already recommended by WHO and since a new measles vaccine which can be given from 6 months of age will soon be available, this study is no longer needed. Earmarked funds can be spent on other Operations Research topics above.

APPENDIX TO ANNEX 33

Exit Interviews

Privately asked to women one by one as they leave the facility.

	Woman answers: Correctly	Incorrectly
1. Can you tell me why we give vaccinations?	_____( )	_____( )
2. Can you name 3 diseases that can be prevented by vaccination?	_____( )	_____( )
3. Do you know all the diseases against which your child has been vaccinated?	_____( )	_____( )
4. Does your child need any vaccinations?	_____( )	_____( )
5. Where and when can your child receive his next vaccinations?	_____( )	_____( )

ANNEX 34

Estimated[a] Prevented Cases and Deaths from Four EPI-Target Diseases at Current (1987) and Targeted (1990) Vaccination Coverage Levels and Per 10,000 Vaccinations Administered, Kenya

level of program activity	disease	cases prevented	deaths prevented
1987 (coverage)	measles[b] (60%)	626,800	27,860
	neonatal tetanus[c] (60%)	25,900	21,980
	pertussis[d] (74%)	610,800	7,940
	paralytic polio[e] (75%)	4,350	650
1990 (target)	measles[b] (80%)	835,700	33,430
	neonatal tetanus[c] (80%)	34,500	29,300
	pertussis[d] (80%)	660,300	8,580
	paralytic polio[e] (80%)	4,640	700
Per 10,000 vaccinations (dose)	measles[b]	8,100	324
	neonatal tetanus[c] (TT2+B)	92	78
	pertussis[d] (DPT3)	6,400	83
	paralytic polio[e] (OPV3)	45	7

[a]The total 1989 population is estimated at 23,900,000 and crude birth rate is 54/1000. Coverage levels are based on 10 district vaccination coverage surveys conducted in 1987. Morbidity and mortality due to each disease is calculated separately without regard for deaths attributable to other causes.

[b]assumes 90% vaccine efficacy; all immunizations are given to susceptible children; 90% of unimmunized children will develop measles; no herd immunity effect; CFR of 4.0%.

[c]assumes 95% vaccine efficacy; GFR of 275/1000; 3 years average duration of protection; and neonatal tetanus mortality rate of 10/1000 live births, with CFR of 85%.

[d]assumes vaccine efficacy of 3 doses is 80%; all immunizations are given to susceptible children; 80% of unimmunized children will develop pertussis; no benefit from less than 3 doses; no herd immunity effect; CFR is 1.3%.

[e]assumes vaccine efficacy of 3 doses is 90%; paralytic polio incidence in absence of immunization is .005; CFR is 15%; all immunizations are given to susceptible children; no benefit from less than 3 doses; no herd immunity effect.

Note well: Most of the EPI target diseases occur in the first five years of life. In the example above, 10,000 pertussis vaccinations (DPT 3rd dose) will avert 83 deaths in this and future years. Deaths from pertussis averted in the current year depend on immunizations performed in the current as well as past years.

The same children at risk of dying from EPI Target diseases are also at greater risk of dying from other illnesses. Therefore, each death prevented above does not represent an additional child who will survive beyond five years age. The above number of cases and deaths may therefore be overestimates. However, other factors may partially correct the overestimate: delayed mortality due to measles and pertussis, the effect of herd immunity, and the benefits of immunizing children more than 12 months old and benefits from less than 3 doses of DPT.

*Calculations available from author.

ANNEX 35

KENYA PEDIATRIC SOCIETY ANNUAL CONFERENCE

Nairobi
May 3-5, 1989

Theme: Immunizable Diseases of Children

Title: NEONATAL TETANUS MORTALITY IN KILIFI DISTRICT: RESULTS OF A COMMUNITY SURVEY, 1989

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