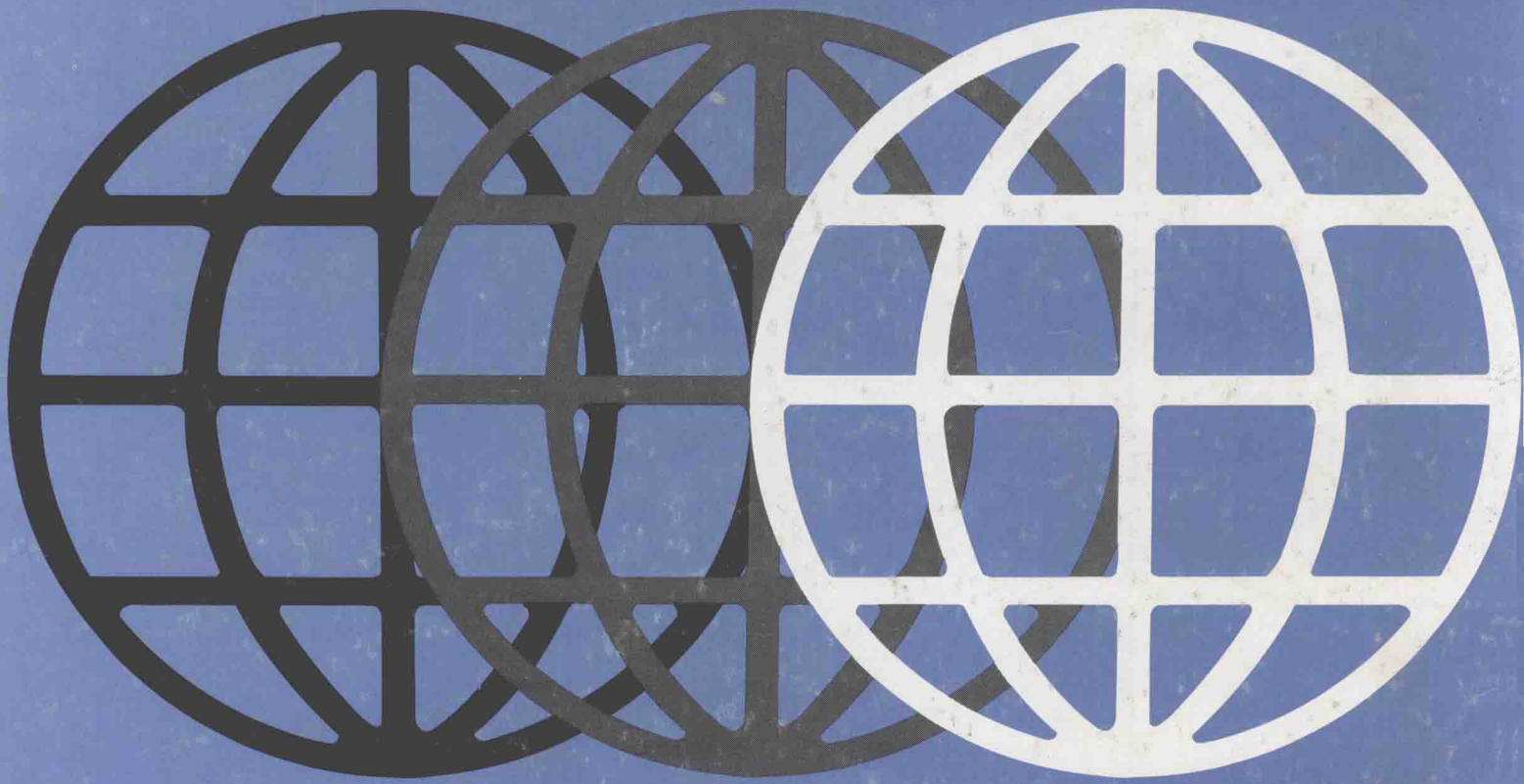
STRATEGIES FOR PRIMARY HEALTH CARE

Technologies Appropriate for the Control of Disease in the Developing World



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The University of Chicago Press
Chicago and London

Most of the material presented in this volume originally appeared in various issues of *Reviews of Infectious Diseases.* Acknowledgments of the original publication date can be found on the first page of each paper.

The University of Chicago Press, Chicago 60637
The University of Chicago Press, Ltd., London

Printed in the United States of America
95 94 93 92 91 90 89 88 87 86 5 4 3 2 1

LIBRARY OF CONGRESS CATALOG CARD NUMBER: 86-50118
INTERNATIONAL STANDARD BOOK NUMBER: 0-226-87207-6

STRATEGIES FOR PRIMARY HEALTH CARE

Studies in Infectious Disease Research

Edward H. Kass, M.D., General Editor

Foreword

When the World Health Assembly, the supreme policy organ of the World Health Organization, endorsed the declaration of Alma-Ata, it reconfirmed that primary health care is the key to the attainment by all the people of the world by the year 2000 of a level of health that will permit them to lead socially and economically productive lives, a concept popularly known as "Health for All by the Year 2000." The attainment of this goal with the accent on "all" depends on equal opportunities to improve and maintain health. Most of the people in the developing countries are far from having the same opportunities to live healthy lives as the more fortunate people in the developed countries.

One of the greatest scourges in the developing countries is the wide range of communicable diseases that create havoc with the health of individuals and communities and impede their social and economic development. These diseases result and persist because of a combination of adverse socioeconomic and environmental conditions, undernutrition, lack of understanding of the determinants of health and ill health, social apathy, and highly inadequate health services. The control of these diseases, which is one of the essential elements of primary health care, requires attention to all of these factors. However, even the most carefully planned health system that deals with those factors will only succeed if it establishes a well-organized health infrastructure based on primary health care and defines technology for the control of each disease that is appropriate under the local circumstances and that can be delivered by the health infrastructure. Such technology includes not only technical measures but also social and behavioral ones.

I should like to congratulate the editors and authors of this book for having brought together under one cover up-to-date information on the most prevalent communicable diseases in the developing countries and on modern technology for controlling them. I hope that the book will be used widely and that the information it contains will be studied carefully. This should help each country concerned to decide, in the spirit of self-reliance that characterizes primary health care, which diseases deserve priority attention and what measures are most appropriate to control them under the local circumstances. I am sure that in so doing they will find it useful to recall WHO's definition of appropriate technology for health, namely, that it is not only scientifically and technically sound, but that it is also acceptable to those on whom it is used as well as to those who use it and that it can be afforded by people, by the community of which they form a part, and by the country as a whole.

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13 September 1985

Introduction

In Alma-Ata, USSR, on 6–12 September 1978, under the aegis of the World Health Organization and the United Nations Children's Fund, one of the great events in global health occurred – the elucidation of the role of primary health care. This crucial initiative was described as "essential health care made universally accessible to individuals and families in the community by means acceptable to them, through their full participation and at a cost that the community and country can afford" [1]. This was soon followed by a meeting, *Health and Population in Development*, convened by Dr. John Knowles, then president of the Rockefeller Foundation, at the Villa Serbelloni in Bellagio, Italy, in 1979. Knowles was concerned with the policy options within the health sector, specifically, "those that will succeed" [2]. At Bellagio the editors of this volume proposed an interim strategy for disease control in developing countries – selective primary health care. A modified version of that paper was published in the *New England Journal of Medicine* [3] prior to its publication in the proceedings of the meeting [4].

The strategy involved developing priorities among the great diseases of the developing world, which are largely infectious, on the basis of prevalence, mortality, and morbidity. Establishment of priorities was followed by the crucial step of determining feasibility of control on the basis of both effectiveness and cost. On these bases it was determined that the most cost-effective strategy for most developing countries should include four interventions: immunization of children and pregnant women, encouragement of long-term breast feeding, administration of antimalarial drugs for febrile episodes in children less than three years of age in malarious areas, and the promotion of oral rehydration [3, 4].

Three years later the United Nations Children's Fund (UNICEF) announced "A Revolution for Children" to control the massive morbidity and mortality of infants and children throughout the developing world [5]. Four basic activities were recommended: growth monitoring using child growth charts, oral rehydration therapy, promotion of breast feeding, and expanded immunization. In March of 1984, UNICEF, in collaboration with the World Health Organization, the United Nations Development Program, the World Bank, and the Rockefeller Foundation, held a meeting at Bellagio entitled *Protecting the World's Children: Vaccines and Immunization Within Primary Health Care* [6]. It was recommended that particular emphasis be placed on the immunization phase of these programs, with the expected addition of the other phases – beginning with oral rehydration – as soon as was reasonably possible.

Since 1979, many discussions have been held with the World Health Organization on the general approach of targeting interim control efforts on high priority diseases for which cost-effective interventions are available. Among these was a working meeting held in Bellagio in February 1983 entitled *Control of Communicable Diseases Within Primary Health Care*. A consensus report was prepared, the conclusion of which was "primary health care should respond to all of the health needs of the community, but priority should be given to those interventions that will rapidly reduce mortality and morbidity at the least possible cost. The strengthening of an infrastructure capable of responding to the priority problems offers a particular challenge for bringing us closer to the goal of health for all." Thus, the concepts originally presented in the 1979 paper have evolved to coincide with the World Health Organization's long-term strategies for primary health care developed in Alma-Ata in 1978.

During this period, the present book was being produced chapter by chapter in *Reviews of Infectious Diseases*, beginning in the May–June 1982 issue. Written by experts, each chapter deals with one of the 24 major infectious diseases or disease complexes of the developing world, ordered by prevalence, morbidity, and mortality as listed in 1979 in table 1 of "Selective Primary Health Care: An Interim Strategy for Disease Control in Developing Countries" [3], which is reproduced here.

Each of these diseases is presented via a standardized format, beginning with *Understanding the Problem* in terms of the biology of the infectious agents, their effects on the individual host, and their effects on populations. Then *Points of Attack* are briefly listed. This is followed by a detailed exposition of the *Methods of Attack*, including their effectiveness and cost. Then a *Strategic Plan* is suggested. Where necessary, research is prescribed to improve the cost-effectiveness of the strategic plan. All of the earlier papers have been updated by ad-

Table 1. Prevalence, mortality, and morbidity of the major infectious diseases of Africa, Asia, and Latin America, 1977–1978.

Infection	Infections (thousands/year)	Deaths (thousands/year)	Disease (thousands of cases/year)	Average no. of days of life lost (per case)	Relative personal disability*
Diarrheas	3–5,000,000	5–10,000	3–5,000,000	3–5	2
Respiratory infections		4–5000		5–7	2–3
Malaria	800,000	1200	150,000	3–5	2
Measles	85,000	900	80,000	10–14	2
Schistosomiasis	200,000	500–1000	20,000	600–1000	3–4
Whooping cough	70,000	250–450	20,000	21–28	2
Tuberculosis	1,000,000	400	7000	200–400	3
Neonatal tetanus	120–180	100–150	120–180	7–10	1
Diphtheria	40,000	50–60	700–900	7–10	3
Hookworm	7–900,000	50–60	1500	100	4
South American trypanosomiasis	12,000	60	1200	600	2
Onchocerciasis					
Skin disease		Low	2–5000	3000	3
	30,000				
River blindness		20–50	200–500	3000	1–2
Meningitis	150	30	150	7–10	1
Amebiasis	400,000	30	1500	7–10	3
Ascariasis	800,000–1,000,000	20	1000	7–10	3
Poliomyelitis	80,000	10–20	2000	3000+	2
Typhoid	1000	25	500	14–28	2
Leishmaniasis	12,000	5	12,000	100–200	3
African trypanosomiasis	1000	5	10	150	1
Leprosy		Very low	12,000	500–3000	2–3
Trichuriasis	500,000	Low	100	7–10	3
Filariasis	250,000	Low	2–3000	1000	3
Giardiasis	200,000	Very low	500	5–7	3
Dengue	3–4000	0.1	1–2000	5–7	2
Malnutrition	5–800,000	2000			

NOTE. Reproduced with permission from the *New England Journal of Medicine* [3]. Data are based on estimates from the World Health Organization and its Special Programme for Research and Training in Tropical Diseases, confirmed or modified by extrapolations from published epidemiologic studies performed in well-defined populations. Figures do not always match those officially reported because underreporting is great.

* 1 denotes bedridden, 2 able to function on own to some extent, 3 ambulatory, and 4 minor.

denda prepared just prior to publication. An opening chapter has been added on the methodologies involved in this approach to disease control, and the book closes with a summary chapter by two experts on global health. The book as a whole has undergone a metamorphosis based on our fruitful discussions with the World Health Organization. The title has been changed to *Strategies for Primary Health Care: Technologies Appropriate for the Control of Disease in the Developing World.* This underlines the primary purpose of the book, which is to provide technical information on the relative importance of the great infectious diseases of the developing world, the effectiveness of present means of controlling them, and the crucial element of cost in order to help governments and health experts to make rational decisions on their country's priorities for primary health care.

The authors would like to acknowledge fruitful discussions and exchange of ideas with Drs. Halfdan Mahler, Joshua Cohen, Aleya Hammad, Patricia Rosenfield, and Fakhry Assaad of the World Health Organization, Dr. Jon Rohde of Management Sciences for Health, and Dr. James Grant of the United Nations Children's Fund. Dr. Edward H. Kass, editor of *Reviews of Infectious Diseases*, played an integral role in ensuring the quality of this endeavor. Not only was each paper reviewed by the

editors, but each was examined critically and in depth by at least two reviewers for the journal. We are grateful to the University of Chicago Press for their cooperation in this unique endeavor.

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15 November 1985

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Contents

Prioritizing for Primary Health Care: Methods For Data Collection and Analysis

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Acute shortages in manpower, facilities, equipment, and finances acutely limit the ability of many countries to achieve the stated goal of "Health for All by the Year 2000." To use these scarce resources most appropriately to reduce the burden of sickness and death, health services should concentrate on providing cost-effective and feasible interventions for those diseases causing the largest burden of illness. This chapter discusses methods for assessing the causes of diseases and death in a population, presents cost-effectiveness analysis, and reviews some examples of successful primary health care systems.

I. Introduction

In 1978, representatives of 134 governments, the United Nations Children's Fund (UNICEF), and the World Health Organization (WHO) prepared the Alma-Ata declaration with the goal of "Health for All by the year 2000" through concentration on primary health care [1]. This declaration sought to promote political commitment to improve the health status of all people, particularly those poorest and most deprived. It recognized the acute limitations on resources needed to achieve this goal, particularly in developing countries. These limited resources include manpower, facilities, equipment, and finances [1].

> The time has come for all levels of the health system to review critically their methods, techniques, equipment and drugs, with the aim of using only those technologies that have really proved their worth and can be afforded. . . . National strategies should take into account socio-economic factors and policies, available resources, and the particular health problems and needs of the population with initial emphasis on the underserved.

Most countries of the world spend between 2% and 8% of their budgets on health [2]. However, up to 50% of this budget may be committed for the maintenance of central hospitals and other institutions that are accessible only to a small proportion of the population. Within this context difficult decisions must be made concerning priorities for developing health services. This chapter will present a method to utilize cost-effectiveness analysis for planning health services with the primary goal of reducing the burden of sickness and death as efficiently as possible using the available resources. The primary factors involved are analysis for each disease of its prevalence, mortality, morbidity, and feasibility and cost of control.

To some extent, UNICEF used this method to identify objectives for its child survival program. UNICEF promotes the worldwide use of four inexpensive interventions that, if used effectively, can potentially improve child survival enormously. These are growth monitoring, oral rehydration, breast feeding, and immunization (GOBI). Also important, but more difficult to implement, are food supplementation, female literacy, and family planning (GOBI-FFF). UNICEF encourages governments to undertake nationwide programs to provide one or more of these interventions to all families [3]. Only the cost-effectiveness of oral rehydration and immuni-

zation have been demonstrated and vigorously quantified, as will be discussed in this chapter.

Decisions concerning the use of health care resources can be influenced by many factors. A particular disease may reduce economic activities such as tourism, agriculture, livestock production, or development in a particular area. Consequently, the control of this illness may become a priority. Political considerations and community groups may influence priorities. Donor agencies and international organizations may offer only specific programs.

The analytical methods presented below may be valuable in comparing program options. The goal is the identification of strategies to maximize the reduction of morbidity and mortality with the use of minimal resources. The method may be applicable to other goals, for example, to analyze strategies for reduction of morbidity and mortality within a particular target group, such as the economically active age group.

Initially, the causes of death and disease should be analyzed. This chapter presents methods for the collection of data concerning causes of illness and death for the purpose of creating a system of continuing disease surveillance. A continuing system is important for several reasons. Aside from diagnosing the present disease problems, it will help to evaluate the effectiveness of the health services for allaying these diseases and will eventually help to define directions for future improvements in the health systems.

This chapter discusses the general methods of intervention now available to cure or prevent infectious diseases of importance in tropical countries. The rest of the chapters in this volume present the individual diseases and discuss the distinct interventions in more detail. Last, the procedure for assessing these diverse interventions by cost-effectiveness analysis is presented.

II. Data Collection

Planners should consider exactly what data are needed. Ideally, one should concentrate on collecting and verifying data on burden of illness for those diseases that can be efficaciously, easily, and cheaply treated or prevented. This series concentrates on infectious diseases, because as a group, these are more easily and cheaply prevented or treated through an array of immunologic and therapeutic techniques than are chronic diseases, such as cardiac and cerebral vascular diseases, cancer, diabetes, arthritis, and mental disorders prevalent in developed countries. Only a small proportion of the interventions available for these chronic conditions are of proven effectiveness, and the benefits gained from intensive care for those terminally ill are, at best, marginal.

If not already within the health division, the data required for able health system planning may be available through a variety of organizations and institutions. Several sources of data needed for health planning will be discussed below.

A. Present Reporting System

In essentially all countries, data are already collected by health workers in health centers or subcenters for the self-selected population coming to them. Some of the information may be transmitted to the district, regional, provincial, and/or national level. Village officials, health workers, or other civil officials may be recording population and vital events information, which is submitted to the governmental units.

Data on reported cases of disease collected through these methods should be viewed with skepticism unless one can assure the accuracy of the assessment of the incidence and prevalence. Lack of uniform case definition, reporting only the cases within the purview of the governmental health centers and hospitals, and exclusion of those cared for by other practitioners (including traditional healers), failures or delays in transmission of data to central authorities, and varying enthusiasm to report a disease may prevent accurate ascertainment and compilation. As a result, the reported cases may represent underreporting or overreporting and minimize or aggrandize the numbers of cases actually ocurring.

For example, since the eradication of smallpox, several episodes of pox-like illnesses have been reported as smallpox to WHO [4]. After investigation, none of these have been found to be smallpox; most have resulted from chickenpox (herpes zoster varicella) or other pox-producing viruses usually found in animals. In another example, serologic data indicate that, in areas without measles vaccine, practically all individuals have had the disease by adolescence. In contrast to this large number of cases occurring annually, only a small number are reported.

During an epidemic, case reporting usually increases both because of the actual increased inci-

dence and also because similar illnesses from other causes and cases usually not part of the routine reporting catchment area are noted.

WHO has demonstrated the discrepancies in reporting even in those cases cared for by the health system by comparing numbers of reported cases with discharge records and survey results [5]. In the United States, only 35% of selected, notifiable communicable diseases were officially reported. In The Netherlands, only 3% of measles cases were reported. Thirteen neonatal tetanus surveys and 13 poliomyelitis surveys in various countries revealed that only 2%–5% of all tetanus cases were detected and reported through the routine surveillance system, whereas reporting completeness for poliomyelitis ranged from 1%–26% [5].

Yearly, the United Nations collects the nationally reported cases of disease into the *World Health Statistics Annual* [6]. Only a proportion of the countries of the world report diseases to them. Even then, reporting may be delayed for several years. For some diseases, only a small number of countries report, depending on disease endemicity and epidemicity and on diseases selected for national surveillance. Since the number of cases reported here reflects both disease occurrence and the effectiveness of the surveillance system, comparison of rates of occurrence between countries are not valid.

In conclusion, present routine surveillance systems generally have marked deficiencies. In order to obtain accurate information on disease occurrence, this routine data should be supplemented from other sources.

B. Surveys of the Population

More accurate determination of the disease incidence and prevalence can be obtained from carefully conducted surveys. Before carrying out a survey, one should consider several questions about each of the illnesses for which data will be collected [7]:

(*1*) Are efficacious treatments or preventive methods available? For example, for measles, diphtheria, pertussis, and tetanus there are inexpensive, cost-effective vaccines; for mucocutaneous leishmaniasis, however, there are only poorly effective and toxic drugs.

(*2*) Do initial estimates of the current burden of suffering warrant a survey? Initial indications may suggest that the infection does not exist in this area; therefore, it may not be valuable to survey for it.

(*3*) Will better estimates change policy? Or, will a survey help in evaluation of existing health services?

(*4*) Is there a good survey test? One should consider the rate of false-positives and false-negatives and sensitivity and specificity of the test that will be used. Table 1 demonstrates how the number of false-negatives and false-positives will increase as the prevalence of the disease decreases. When only 10% of the population have a disease, an abnormal test with a sensitivity of 80% and a specificity of 90% will accurately predict disease status only 47% of the time. When the prevalence is 80% then the predictive value is 97% [7].

(*5*) Will the survey and subsequent control programs reach those who could benefit?

(*6*) Can the health system cope with the survey and the subsequent control programs? In some health systems, health workers are already overburdened with discouraging, long lists of duties and responsibilities. In order to undertake this survey and subsequent control program, the planners may have to consider the reorganization of the responsibilities of the health workers and the availability of other resources necessary to institute an effective scheme.

(*7*) Will those who might benefit comply with subsequent interventions? If a population is known for noncompliance, health care planners may wish to consider whether to provide the intervention at all or whether to build in a component to try to improve community support and compliance.

If an affirmative answer can be given to these questions, then a survey should be considered. In preparing for a survey, the following issues should be addressed: careful definition of the problem, definition of the population to be surveyed, identification of present data sources for this population, determination of sample size, rigorous random sampling techniques, and methods for data collection and analysis.

The chapters in this book describe methods for determining frequency of occurrence of the major infectious causes of morbidity and mortality in developing countries. Another reference source for methods is a tropical medicine text such as that by Warren and Mahmoud, *Tropical and Geographical Medicine* [8].

The type of survey performed can also influence completeness of the assessment of incidence and prevalence. For example, in a comparison of estimated incidence of poliomyelitis by three survey

Table 1. The effect of prevalence on the predictive value of a survey test (hypothetical sensitivity = 80%, specificity = 90%).

	Prevalence								
	Low (10%)			Moderate (30%)			High (80%)		
	Definitive diagnosis of disorder								
Test result	Yes	No	Total no.	Yes	No	Total no.	Yes	No	Total no.
Abnormal	80	90	170	240	70	310	640	20	660
Normal	20	810	830	60	630	690	160	180	340
Total	100	900	1,000	300	700	1,000	800	200	1,000
Predictive value of an abnormal test									
	$80/170 \times 100\% = 47\%$			$240/310 \times 100\% = 77\%$			$640/660 \times 100\% = 90\%$		

methods in different regions of the Cameroon, a house-to-house survey in a rural area demonstrated a higher incidence than did a survey of school children [9, 10]. However, in urban Yaounde both methods resulted in similar estimates. A review of hospital and clinic registers for acute disease in the same three areas resulted in even lower estimates than the school lameness survey. The house-to-house survey seemed to be the most sensitive method. Low attendance in school and a shortage of clinics and hospitals in the rural area probably accounted for the discrepancies. On the other hand, the house-to-house method costs 15–50 times more person-hours to complete than do the school and hospital and clinic register methods [11]. Another example of comparative reliability of various poliomyelitis surveillance systems comes from Vellore, a small city in south India, with a relatively high rate of school attendance. An annual survey of incoming grade 1 school children was the cheapest, easiest, and relatively most sensitive method compared with a surveillance and reporting system using physicians and other practitioners, a school survey covering grades 1–12, and a house-to-house questionnaire survey [11].

The WHO's Expanded Programme on Immunization developed a standardized cluster sampling method for evaluating immunization uptake, but increasingly this format has been applied for surveying for other diseases [12, 13]. The technique involves (*1*) identification of a geographic area(s) of interest and age groups of interest; (*2*) random selection of 30 sites, called "clusters," within the geographic area; (*3*) random selection of a starting point (usually a household) within each cluster; and (*4*) selection of seven individuals of the appropriate age within each of the clusters [12]. Those interviewed are examined for particular diseases and samples of blood, urine, feces, or skin snips—depending on diseases under study—can be obtained. During the interview, one can obtain information about measles or pertussis within the past year or lifetime (both usually have recognizable and memorable clinical features), diarrhea within the past two weeks, births, deaths, respiratory systems, and other topics. During the examination the health worker can assess nutritional status—by the use of arm-circumference tapes or height, weight, age charts—assess BCG scars, polio-induced lameness, and skin lesions of leishmaniasis or leprosy. Specimens can be obtained or skin tests can be applied, such as IPPD or BCG followed by IPPD for tuberculosis [14].

The planning and implementation of surveys provide valuable field training for health workers. Rohde and Sadjimin describe how such an exercise requires three to four days of field and classroom work but applies a wide range of epidemiologic principles [15]. Such a field exercise helps point out the deficiencies in data normally reported through the health system. The data that are analyzed can be used to design improved surveillance systems for outbreaks, for evaluation of health service utilization and effectiveness, and for investigation and control of epidemics.

In conclusion, carefully done surveys are a powerful tool for determining incidence and prevalence of various diseases and for teaching epidemiologic principles but require careful planning and may require substantial manpower.

C. Hospital and Clinic Records

Hospital and outpatient records of mortality and morbidity will also provide some information on the relative importance of diseases. However, hospital patients and clinic visitors represent a biased popu-

lation—those who can afford the time and money to obtain care there. Usually only those who live within a short distance (two to five kilometers) of these facilities actually utilize the services. Other factors affecting utilization and, therefore, the completeness of the records as measures of disease occurrence include population density; proximity of other hospitals, clinics, and other practitioners; and cost of care. The discrepancy between results of house-to-house surveys and hospital records for poliomyelitis lameness in rural Cambodia mentioned previously illustrates the importance of these factors.

Hospital and outpatient records and clinic visits may also be used for evaluating the effectiveness of interventions targeted for particular population groups. For example, if pregnant women were identified for a specific health program, a review of the age, sex, and other characteristics of the patients seen in the hospital or clinic may reveal whether this high risk group is receiving care.

D. Vertical Programs

Another source of information on diseases is prior or current vertical or categorical programs aimed at control or treatment of particular diseases, such as mobile programs for yaws, Gambian sleeping sickness, meningitis, or malaria control programs. These may provide information on incidence and prevalence of the particular disease in various regions of the country and on its seasonality.

E. Sources Outside the Governmental Health Sector

Other sources of information outside the governmental health sector include donor agencies who have studied or instituted programs in areas or regions of the country. Medical schools within the country may have pursued studies on particular diseases and have information of value. Veterinary institutions may provide information on zoonoses, such as leishmaniasis, trypanosomiasis, rabies, and plague.

F. Surveillance Systems

To develop an effective surveillance system for ongoing reporting and collecting information, it is imperative to define priorities. The recording and reporting system must be as simple as possible in order to encourage participation by busy health workers. Data should be collected to provide information that is essential for making decisions and should follow standardized case definitions. For example, an individual having an episode of illness should not be confused with an asymptomatic carrier (malaria, amebiasis, cholera, typhoid, and others). Decisions should be delegated to the people responsible for implementing them and for gathering the data upon which the decision is based. The further the data gatherers become removed from responsibility, the less likely they will collect the required data in a useful manner. Regular reporting and feedback, that is, distribution and publication of the data collected and response, will encourage careful habits. In addition, response to an increase in incidence of illness should be defined so that those reporting realize that if an outbreak occurs this information will be acted upon.

Sentinel sites. In addition to the routine reporting system, sentinel surveillance and community diagnosis systems have been useful, particularly for monitoring progress in the Expanded Programme on Immunization [16]. Because of the simple procedures and low incremental cost of the sentinel site, this system can be integrated into the activities of busy health personnel. A small number of health facilities are provided with additional manpower to carefully report data on a small number of target diseases.

Not all of the target diseases are equally convenient for sentinel surveillance. Infrequently occurring diseases, those occurring predominantly in rural areas with few health facilities, or those that require special diagnostic facilities are missed. Sentinel surveillance monitors measles well and pertussis somewhat less efficiently. Since lameness occurs less frequently, poliomyelitis surveillance requires referral centers, such as large pediatric hospitals or rehabilitation centers. Diphtheria surveillance requires pediatric hospitals and access to laboratory diagnostic facilities [16].

Sentinel posts should be chosen to represent health facilities of the geographic area under surveillance and should include both urban and rural facilities. In major cities, sentinel posts should be located in different parts of the city. Other population concentrations should have at least one site. An effort should be made to include sentinel posts in areas suspected to have problems with program implementation in order to monitor the worst situation. Governmental and nongovernmental facilities should be

involved where each serves an appreciable proportion of the population. In addition to geographic representativeness, the most important considerations include willingness of the facility authorities and personnel to participate, the volume of consultations or hospitalizations, and the existence of a reasonable and usable recording system (such as outpatient registers, hospitalization, or discharge registers). These records indicate the capacity of the health facility to collect and record health information but also serve as the basis for retrospective collection of baseline data and subsequent verification of reports as part of the periodic supervision. The types of facilities—outpatient, hospital, referral centers—will depend on which target diseases are included [16].

The amount and type of data collected should be limited to the essential. For example, for immunization monitoring, the most important information includes the number of new cases of the target disease seen during the reporting period, usually one month; age of the persons with cases; and their immunization status. All the data should fill no more than a simple, one-page check sheet in order to encourage regular monthly reporting. Each sentinel health facility has an individual designated as responsible and accountable for reporting surveillance information, such as the person in charge of medical records.

Since sentinel surveillance provides data on only parts of the population, regional and national incidence rates cannot be generalized from sentinel data. However, by use of estimated size and birthrate of the populations served by sentinel facilities, disease incidence rates at least for these populations can be calculated.

Use of this system of sentinel surveillance has been demonstrated, at least in the Expanded Programme on Immunization, to provide timely and high quality information that can supplement and aid in upgrading and evaluating the routine sources of surveillance [16].

Community diagnosis. This method involves the population-based monitoring of health events rather than selecting those events occurring at the specific sentinel health facilities. Community diagnosis involves an annual census plus regular reporting of health events by the community health or other workers during their routine visits to all homes in a carefully defined neighborhood. Data are aggregated centrally on births, deaths, diseases, and other health events under surveillance. In addition to providing population-based data, this system helps to insure participation of high-risk groups in public health programs since the community health or other worker knows and has identified everyone in the neighborhood. Ideally, this system could be used throughout the country, or it could be limited to a smaller number of representative communities. Programs in which this system has been used successfully exist in Haiti; Narangwal, India; Matlab, Bangladesh; Kasongo, Zaire [17–21]; and the five projects reviewed by Gwatkin et al. [22].

In conclusion, several methods exist for collecting accurate data and estimating disease incidence and prevalence. Special attention should be given to identifying high-risk population groups. Information systems, including ongoing surveillance, aid in planning for future health services and evaluating present ones.

III. Methods of Prevention

All attempts to control diseases aspire to lessen the suffering from illness and death. Most illnesses cannot be eradicated from the population, but attempts can be made to at least prevent or diminish the manifestations of disease and to limit disability. In the case of communicable diseases, several approaches for control are available. *(1) Eradication* may be attempted so that infection and disease will never again be present in the country or in the community. The investment to achieve eradication may be great, but no long-term maintenance is required. *(2) Control of infection* aims to prevent the transmission of the illness from one person to another. *(3) Control of the disease* involves the limitation of the expression of the infection in the host so that it will not produce disability. This last measure usually involves treatment of individuals who are already infected but may or may not have symptoms. Both the second and third approaches require long-term commitment of resources since disease transmission will recur if the control programs stop.

Smallpox remains the only example of a successful eradication program. In 1978 WHO declared that smallpox was eradicated [23]. As a result of smallpox eradication, each year approximately $2 billion are saved globally. The costs saved include those of vaccination (production, administration, complications, treatment), quarantine checks at international borders, and lost productivity due to premature deaths [24].