Epidemiology's contribution to health service management and planning in developing countries: a missing link

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Two hypotheses are examined in the light of experience and the literature: (1) health service planning requires little epidemiological information, and (2) health services rarely get useful answers to relevant epidemiological questions.

In the first hypothesis, the theoretical robustness of the concept of a minimum package of activities common to all facilities belonging to the same level of the system and the extent to which it is unaffected by variations in the frequencies of most diseases are examined. Semi-quantitative analyses and analysis of routine entries and participation suffice to adapt this package to the local context. Some of the methods which give a fundamental role to epidemiological information are criticized. With regard to the second hypothesis, the pertinent contributions epidemiology may make to health service organization are reviewed. These include identification of diseases that justify special activities (health maps and interepidemic surveillance), determination of the activities that should be added to the health centres, the political usefulness of rare impact assessments, and the relevant demographic elements. Finally an epidemiological agenda is proposed for specialized centres, districts, universities, and the central decision-making level of health ministries in developing countries.

Introduction

The problem

While health service officials in developing countries have more often to deal with polyvalent services[a] than with specialized programmes, the many epidemiological publications that are concerned with the latter contrast with the scarcity of pertinent information for the former. This article discusses this statement and shows how epidemiology might be made more useful.

The conventional approach: a link between descriptive epidemiology and health planning. "Epidemiology is concerned with the patterns of disease occurrence in human populations and of the factors that influence these factors" (*1*). It may be subdivided into descriptive, causal (or analytic), and experimental epidemiology (*2*). *Descriptive epidemiology* studies the geographic, temporal, and social variations in the frequency of morbidity. *Causal epidemiology* tries to assemble the arguments that reveal the existence of a cause-and-effect relationship with a disease (*3*). As similarities in the distributions of the supposed cause and effect are one of these arguments (indeed, Feachem (*4*) calls them "micro-epidemiology"), the boundary between these two fields is fuzzy. *Experimental epidemiology*, including therapeutic trials and quasi-experimental designs, induces changes in the environment and studies their consequences. The goal of decision analysis, which is sometimes considered an integral part of epidemiology, is to improve clinical decisions. It studies parameters such as specificity, sensitivity, and the predictive value of signs, symptoms, and test results.

Health planning is the art of projecting health service developments in the future by specifying the kinds and amounts of resources, as well as the ways they will be mobilized and distributed. A planning approach which may be considered a classic, because of its age and the number of schools that defend it (*5–8*), links descriptive epidemiology mechanically to the organization of health services. This approach postulates the following.

(1) To define a health activity one must identify the priority problems (those that are frequent and serious), using the indicators of descriptive epidemiology. Coefficients (frequency, lethality, and technical and operational vulnerability rankings) are combined by an algorithm, after which the index is ranked. This technique is derived from the one devel-

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[a] In this article, "polyvalent services" refer to health centres and general hospitals.

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oped by CENDES (*Cen*ter *De*velopment *S*tudies, Central University of Venezuela, Caracas) in the early sixties (*9*) and perfected later by:

— the Institute of Medicine's method of classifying the diseases by frequency and duration of each stage for different age classes (*10*),

— the years-of-potential-life-lost (YPLL) approach (*4, 11, 12*), emphasizing premature death, for which various methods exist (one sums up the years lost between the age of each death due to a specific cause and a cut-off point such as life expectancy, another considers only those years lost between the ages of 20 and 65 so as to concentrate on the years of potential economic activity);

— the so-called iterative-measurement-loop method (*13*), which gives decision-making a theoretical framework based on disease frequency. The steps are estimation of the health costs entailed by the disease, the development of hypotheses concerning its causes, estimation of the efficacy and efficiency of the control procedures, and evaluation of the programme's impact.

(2) Next, a cost–benefit analysis (of marginal costs and benefits (*14*)) is used to select the targets which the available resources should be able to achieve. The expected efficacy is estimated by potential impact measurements, the indicators of which are the etiological, prevented and generalized impact fractions.

(3) The priority programmes are implemented (*15*)—these are organized in practice like vertical programmes, i.e., mobile units, specialized dispensaries, pyramidal hierarchy and administrative non-integration.

(4) The evaluation measures, through a survey, the proportion of beneficiaries (coverage) (*16*) and changes in the epidemiological parameters of the target diseases (*17*); quasi-experimental designs to compare treated and untreated health areas have been proposed (*18*).

Causal epidemiology, for its part, is used in medicine (*inter alia*, to identify areas in daily life for counselling which supports treatment) and public health to control epidemics, identify risk factors and risk groups, and design health promotion programmes (*19, 20*).

Hypotheses

Two hypotheses are examined in the light of experience and information gleaned from the literature.

(1) *Health service planning requires little epidemiological information.* The structure of a health service is shaped above all by special knowledge and the resources of the country that help to define a minimum activities package for each level of the system. Semi-quantitative estimates generally suffice to adapt the latter to each context. The planning methods (summarized above) which rely on epidemiology to identify health service priorities are flawed by conceptual errors. The services' evaluations that are based on biological impact require epidemiological techniques. This type of evaluation is inefficient and has no rationale other than political.

(2) *Health services rarely get useful answers to relevant epidemiological questions.* See below.

Analysis of the hypotheses

The test for these hypotheses is examination of the rationale of these methods for the organization of polyvalent health services and analysis of the internal validity of the epidemiological planning methods.

Hypothesis 1. The need for epidemiological information for health service planning is relatively low

It will be shown that health services can function correctly without much epidemiological information, and that the epidemiological methods developed to help services set their priorities are invalidated by the conceptual errors they contain.

Health services can function correctly without much epidemiological information. The reasoning is as follows:

— if the health system is integrated, and this is advisable, its various echelons have specific tasks;

— if the echelons have their own tasks and their infrastructures are homogeneous, then it is possible to define a minimum activities package (MAP) for each of them;

— if such a package can be defined, then epidemiology's contribution to the structures in the organization is marginal.

Specificity of the echelons

Not all infrastructures are adapted to provide a given activity. Since identical care becomes increasingly expensive as one rises through the hierarchy (see, for example, ref. *21*), there must be one infrastructure that is more efficient and effective than the others for solving a given problem. The compromises among efficacy, accessibility and efficiency justify a scheme

in which each echelon is devoted to a specific type of care that excludes the types of care dispensed by the other tiers. However, combining the functions of two hospitals may be allowed in order to avoid the multiplication of urban hospital facilities. In contrast, no hospital should dispense primary care (*22, 23*) for the following reasons:

— they are too large for the staff and members of the community to know each other;

— the integration of care is hampered by the division of labour;

— the technology used in the hospital is incompatible with participatory management;

— the population covered is so large that outreach into the homes is impracticable;

— the large number of primary care cases underutilizes and demotivates the staff; and

— the infrastructure is used inefficiently.

Homogeneity of the structures of an echelon

The activities that require similar staff and equipment must be decentralized, i.e., distributed among identical facilities which together make up an echelon. If the decentralization of each technology had to be optimized the health system would comprise an infinite number of facilities, each adapted to a specific technique and population. In the name of efficiency these activities must be organized in homogeneous structures because this simplifies planning and enables the know-how of health service organization to be taken into consideration.

Minimum activities package (MAP)

If the echelons have specific functions and homogeneous infrastructures it is possible to describe a minimum set of activities common to the structures of an echelon. This is the MAP, which is established to facilitate resource planning and minimize the costs by adapting activities to the available technology. The MAP must respond to the community's demand (especially for curative care) and needs (defined by professionals), and be rooted in managerial practice, meaning that the history of the health infrastructure has gradually refined it. It is thus independent of local epidemiological profiles.

In practice, the MAPs of African health centres include first-line curative consultations, under-fives clinics, prenatal clinics, chronic patient care, nutritional rehabilitation, and family planning and participation. The district hospital MAP consists of hospitalization, referral consultations, medical and surgical emergencies, laboratory analyses and X-ray examinations. These may be compared with Morrell's proposals for the United Kingdom (*24*).

Adapting the MAP to local conditions using semi-quantitative information

Additions to the basic MAP are determined by analysing the health services' disease detection rates and popular demand (in the framework of participation). They also require information about the geographical distributions of the diseases. However, rather than drawing up a detailed epidemiological map, one can make approximations from semi-quantitative information (*25*). For example, it is rare for health centre nurses not to know the foci of schistosomiasis and trypanosomiasis in a district, even without scientific documentation.

An attempt to shed light on health service planning in Mali through a World Bank-financed comprehensive epidemiological investigation (*26*) generated complete data with a reasonable degree of accuracy. These results did not alter the preliminary classification drawn up on the basis of poor-quality data supplied by the region's health care dispensers (*27*).

Conceptual flaws in the epidemiological approach to planning. The CENDES method, which was mentioned above, has been used by the Expanded Programme on Immunization[b] for training but has come in for the following criticism (*28*):

— epidemiological information in the developing countries is patchy (for example, there is still no map of Chagas disease in Latin America). The causes of death cannot be identified, even by a special study (*29*).

— the coefficients assigned to operational vulnerability merely reflect the analysts' biases. One commentator will feel that the distribution of antibiotics to control acute respiratory infections is unrealistic because community health workers are incapable of using them correctly. The conclusion would change if this analyst considered health workers to be medical assistants.

The method is thus flawed by the low validity of its pivotal index, i.e., the product of a specific coefficient multiplied by an arbitrary coefficient generates a fairly worthless parameter. Even the precision of the method's epidemiological coefficients is questionable because they are derived from various sources of variable validity (*27*). It is even more difficult to obtain quantitative data on the health costs of diseases (the distribution of suffering, anxiety and handicaps, for example) in developing countries. This excludes the use of the iterative-measurement-loop method (see above).

[b] **WHO Expanded Programme on Immunization.** *Training course on planning and management: facilitator guide.* Geneva, 1978 (unpublished document).

The classifications that use the years of potential life lost rely on value judgments that compromise their validity. Illness days are ignored or treated as decease days and the proportion of deaths occurring very early in life is weighted much more advantageously than adults deaths (*3*). Barnum has proposed a discount technique for weighting coefficients to allow for taking into account value judgements concerning the ages of the saved lives (*30*). This procedure, which does not diminish the final classification sensitivity to such value judgements, at least enables one to render their impact on decision-making explicit. The Institute of Medicine's method (see above) meets the first objection (negligence with regard to morbidity statistics) but not the need to allow for operational vulnerability.

All of the techniques share the following paradoxes:

— They set priorities on the basis of data that are known to be limited (*4*).

— Diagnosis and treatment of the chief causes of death are included in the MAPs of the health centres and district hospitals, as attested by the analysis of the causes of death mentioned by the Ghana Health Assessment Team (*31*). In theory, malaria and pneumonia should be treated in the outpatient clinics, the treatment of tuberculosis should come under the treatment of chronic patients, measles prevention should be included in the agenda of the under-fives clinics, etc. These conclusions remain valid even if Barnum's corrections (*30*) are made to the classification scheme. In this case the prevention of perinatal trauma would be covered by the prenatal clinics and the treatment of acute malnutrition included in nutritional rehabilitation programmes.

— Longitudinal studies enable one to approach specific mortality rates but are expensive. Chen et al., for example, analysed three years of infant mortality statistics for a population of 260 000 in Bangladesh (*29*).

Feachem (*3*) has described new methods based on interviews of health centre users that can generate aggregate but not disease-specific death rates. Probably such estimates will never be achieved, since in Bangladesh, for example, Chen et al. (*29*) were unable to identify 44% of the causes of death; it is hard to see what method could improve this score, given the exceptional resources employed.

Using causal epidemiology is less problematic than descriptive epidemiology, for while causal epidemiology contributes to drawing up programmes by specifying the risk groups and etiologies, it is used little to set priorities. The only exception is the identification of health promotion actions which are excluded by organizational constraints from the health centres' MAP. This type of information would be more useful to influence society and the public powers than to orient health service action. It has, moreover, been stated that epidemiological information must be "politically digestible" (*32*). In passing we might reproach many investigators for being too ready to equate statistical correlations with causality (*33*), but these are erroneous applications rather than conceptual weaknesses (*34*).

The economic tools

These are cost-benefit analysis (CBA) and cost-efficiency analysis (CEA), which help select techniques (diagnostic techniques, for example) but do not allow the setting of a service's priorities. The CBA has not been used in programme selection for years because of the low reproducibility of the monetary worth given to health outputs. The CEA, for its part, cannot be used to set strategies without exceeding the careful limits of the technique, namely that:

— it must be based on the measurement of a simple output (*35*), which rules out comparing a programme and a service because the costs are not comparable, resource utilization is modified at the time of integration, and the non-monetary constraints cannot be taken into account; and

— it cannot avoid arbitrary coefficients, since one is always led to favour an age group, compare future and present values, estimate intangible benefits, and define the costs to consider (the organization's or the community's) (*35*).

Shortcomings of impact evaluation and surveys

Several methods for evaluating medical and health services are conceivable. They include evaluation of the inputs (such as vaccines or the cold chain), the process (vaccination), the outputs (measured by the immunization coverage rate), and the biological impact (reducing the measles specific mortality rate, for example). Evaluating the services has long been the subject of a misunderstanding. To ensure that proven techniques are applied correctly one has no need to test the efficacy of the technique each time. Those used by developing countries' services have changed little in the past 30 years. It is better to save the impact assessment for new techniques and have the service evaluations focus on the services' performances (output) rather than biological impact (*36, 37*) for the following reasons:

— large samples are necessary to measure significant differences in the frequencies of rare events (such as most diseases) (*37*);

— the impact results from a complex set of determinants; to attribute the merit of an effect to a

programme the analysis must include controls for the effects of confounding factors (*36*); such controls require an even larger sample, for the instability of a multivariate model increases with the number of variables;

— routine data, which reflect detection levels rather than real frequencies (see below), do not suffice to measure the impact;

— the measurements are complex and feedback slow;

— impact evaluations overlook interesting by-products of the organization;

— impact evaluations are like re-inventing the wheel, since one may suppose that immunization that has proven efficacy and is performed correctly will reduce the prevalence and lethality of the disease it is designed to combat;

— implementing such a scheme requires a specialized team. This takes away the responsibilities from staff in the polyvalent services.

Estimating the number of activities performed requires a denominator (the size of the target population) and a numerator obtained from the services' records (the number of services provided to the target population). As one may expect vaccination to have an impact only to the extent that the technique of administration is good and the vaccine storage conditions and titre are satisfactory, evaluation of coverage must be backed up by an evaluation of the vaccine's efficacy. Quantitative methods for this exist (see ref. *38*, for example).

Impact assessments are justified only for diseases characterized by high frequencies and few confounding factors for which specific indicators exist (for example, lipiodol vaccination) or the outputs of which are difficult to measure (e.g., the distribution of ophthalmic tetracycline for trachomas via the market places), since they will be feasible.

Surveys, which are indispensable for conducting impact evaluations, have also been advocated for evaluating coverage (by the EPI). Their usefulness in such cases is political, for by enabling people to "see" how the money has been used (*39*) the findings meet the medias' and donors' needs. Outside the EPI their reliability is low. In 1988 Pangu revealed the lack of correlation between the frequency of disorders obtained from house-to-house surveys and the figures derived from health centre's outpatient records.[c] Gynaecological disorders, which headed the health centre's list, had practically vanished during the survey. Hayes et al., on Grenada, revealed that the statements collected from home surveys inflated the outpatient consultation figures for diarrhoea, which were recorded by the services themselves, by 33–62% (*40*).

In any event, a separate survey cannot be carried out for each MAP activity, or even repeated at regular intervals, owing to the multiplicity of target populations and the resulting workload (*37*). Evaluations based on routine statistics are cheaper and permit faster feedback (*41*).

And yet, "How many more papers on matching, on covariates, on synergism and antagonism can we tolerate?" wrote Greenhouse in 1980 (*42*). Considerable space is given to survey methods in public health training and the literature alike, for the number of techniques to be learned are legion. The probability of misuse is high and the required energy expenditures enormous. One can question the relevance of teaching them to district health teams. On the other hand, summarizing and subjecting the data to epidemiological examination (biases and their expected effects, the validity, accuracy and quality of the measurements, etc.) are useful approaches for analysing the services' routine data.

Epidemiology and resource planning

Is epidemiology useful for resource planning? The methods described in staff planning manuals rely on demographic, economic, productivity and service utilization data rather than epidemiological data (*43*).

There is only one category of resources for which a need estimation method based on the epidemiological profile is advocated, and that is medication (*44*). Four methods of need estimation are described (*45*). The first is based on the epidemiological profile, the second on detection rates, the third on the number of consultations (*46*), and the fourth on past consumption.

The first method is the most complex, for it requires numerous estimations (number of episodes of illness per year, per inhabitant and per disease, the number of treatment days per episode of illness, the choice of medication and daily doses, and the utilization rate). The second dispenses with the need for epidemiological investigations but is only a more complex variant of the third one, in which the utilization of pharmaceuticals is deduced from the disease mix rather than measured directly. The last method cannot be criticized for finessing on service underutilization for it adjusts orders constantly to meet changing consumption trends. That is why in practice district health officers use retrospective consumption data for this method. If the pharmacy is new, consumption patterns in districts where the

[c] **Pangu, K.A.** *La santé pour tous, c'est possible. Expérience de planification et d'implantation des centres de santé dans la zone de Kasongo, au Zaïre.* Doctoral thesis, Free University of Brussels, 1988, pp. 84–98.

prescription of medication has been rationalized give a realistic estimate of initial needs.

Hypothesis 2. Health services rarely get useful answers to relevant epidemiological questions

The reasoning is as follows:

- It is possible to classify diseases according to the informative value of their epidemiological data for organizing health services.
- Seen from this standpoint, the diseases that convey useful information are scarce.
- As this classification is not well known, other factors play a major role in determining research choices.
- Consequently, answers to epidemiological questions that are pertinent for management and planning are rare.

Disease classification according to the value of their epidemiological data for health service organization

To plan district services planners usually request demographic and epidemiological information and the detection rates transmitted by WHO's nosological reports (*47*). In fact, infrastructure planning requires detailed demographic information only as concerns the geographic distribution of the population.[d] We have seen that the MAP is not affected by the population's breakdown by age or sex. In contrast, output evaluation requires two indices that vary nationwide (*48*) and are rarely available, namely, the crude birth rate and annual growth rate. These parameters are used to establish the denominator for the output evaluations and the population bases of the infrastructures.

Descriptive epidemiology can provide some useful information for health service organization:

(1) by describing the disease's natural history and course under treatment. The resulting "epidemiometric" models describe the frequency of states (for example, the frequency of healthy carriers) and transformations (e.g., new case index). This is useful information for designing control strategies and programmes. On the other hand, the epidemiometric models cannot be used to assign priorities to the services.

(2) by describing the frequency distributions of diseases that are underestimated by routine records, for example, diseases such as meningococcal meningitis that have such rapid courses that the patients do not reach the health service and diseases that are hidden for sociocultural reasons.

(3) by describing the frequencies of noncosmopolitan diseases ("cosmoplitan", as used here, means universal in developing countries), variations which justify special resources (such as praziquantel in the case of schistosomiasis) or training needs (for example, to treat the side-effects of arsenic compounds) (*49*).

Table 1 summarizes the disease classification by these criteria. The first group of diseases requires a homogeneous distribution of clinical resources. As this type of disease is much more widespread than the others (see below), health service planning based on epidemiological factors is not rational. Achieving a good service utilization rate must precede study of the frequencies of the diseases belonging to Groups 2 through 5.

Epidemiology can obviate the need for the analysis of cosmopolitan disease distribution. The noncosmopolitan diseases that are subject to important geographical variations and require special resources include certain deficiencies (chronic malnutrition, goitre and congenital cretinism due to iodine deficiency, etc.), endemics (trypanosomiasis, trachoma, onchocerciasis, schistosomiasis, dracunculiasis or guinea-worm infection, leprosy, and Bancroft's filariasis), and certain epidemic diseases (cholera, typhoid fever, yellow fever, meningitis, the haemor-

Table 1: **Classification of diseases, according to their pathology and informative value for health service management**

Types of pathology	Examples	Group
Universal diseases showing variations that are not likely to justify special resources	Tuberculosis, diarrhoea, measles, acute respiratory infections	1
Diseases, with geographical variations, whose frequency alters resource allocations:		
— Deficiency diseases	Iodine deficiency, acute malnutrition	2
— Endemic infectious diseases	Trypanosomiasis, schistosomiasis, onchocerciasis, leprosy	3
Diseases with important chronological variations, justifying changes in resource allocations:		
— Regular cycles	Epidemic malaria (seasonal cyles)	4
— Epidemics	Cholera, yellow fever, typhoid, meningococcal meningitis	5

[d] See footnote *c* on page 491.

rhagic fevers, etc.). Only these epidemic diseases and acute malnutrition are likely to undergo such great variations over time as to justify surveillance.

The following must be provided for the diseases of groups 2 through 5:

— inclusion of control efforts in certain health centres or in a vertical programme with limited geographical scope (Groups 2 and 3) and the intermittent study of the diseases' ranges (the methods may be semi-quantitative);

— permanent surveillance (Group 5) to facilitate early intervention (meningitis vaccinations, chlorination of drinking water to control cholera, and the treatment of cholera victims);

— intermittent activities (Group 4)—for example, the distribution of chloroquine to risk groups from June to November—based on intermittent incidence studies.

Epidemiological surveillance encompasses two separate activities, namely, surveillance between epidemics and the procedures during epidemics (*50*). Epidemic emergencies call upon the techniques of causal epidemiology, i.e., description of the disease's frequency, range, and course, laboratory analysis of suspect factors, establishment of a hypothesis and verification of the efficacy of control measures. Interepidemic surveillance, in contrast, relies upon descriptive epidemiology. It consists of the permanent monitoring of individuals and the environment for the prevention and early detection of epidemics. It includes the following tasks: mortality and morbidity study, based on case studies (the "detection rates" may be used to approximate the disease's true frequency); serological monitoring; biotope monitoring (insects, etc.); analysis of drug resistance; and anticipation of the emergence of new pathogens (e.g., monkeypox virus) (*51*).

The information used by the surveillance teams comes from mandatory reporting schemes, nosological reports and investigations. To follow changes over time one can use the so-called "sentinel health centres or hospitals", where certain detection rates are calculated as a proxy for their frequencies in the population. These services are selected on the basis of their staff's quality, large workload, and geographical distribution (they must cover the area involved).

To prove that the great majority of diseases do not affect the design and organization of polyvalent services one must show that:

— most of the diseases belong to the cosmopolitan disease group; and

— variations in the frequencies of these diseases do not change the organization of these services.

Majority of disorders belong to the cosmopolitan disease group

The clustering of the reasons for consultation around a small number of diseases is a well-documented phenomenon. At the Kipaka Health Centre in Kasongo, Zaire, the five most frequent symptoms in children (cough, diarrhoea, oedema, abdominal pain, and fever) account for 72% of the reasons for paediatric consultations and the five most frequent symptoms in adults (abdominal pain, gynaecological discharges, localized pain, upper airway disorders, and cough) account for 53.6% of the adult consultations. With the exception of schistosomiasis and cholera, the diseases underlying these complaints all belong to the "cosmopolitan" group. Few diseases are distributed uniformly within the same country, as shown by the classification (Table 2), within Groups 1 to 5 of Table 1, of diseases covered by the diagnosis/treatment decision-trees of the Kasongo project.

Insensitivity of the organization of polyvalent services to variations in the prevalences of cosmopolitan diseases

In the dispensaries, tuberculosis control requires passive detection, access to microscopy, and the early detection of drop-outs by means of scheduled appointments and home visits to ensure the continuity of treatment, whether the prevalence of tuberculosis is 2 or 7 per 1000. Similarly, measles vaccination has always had a place in dispensaries, regardless of fluctuations in the frequency of the disease.

The diagnosis/treatment flow-charts are designed relatively independently of epidemiological data. They are constructed on the basis of identification of the important, vulnerable, not-spontaneously-reversible diseases attached to the various symptoms. A method of dialogue for inter-professional use, such as the delphi, suffices to identify these diseases. The diagnostic pathways are derived from the staff's clinical practice. Decision analysis helps in designing the flow-charts, but only marginally, to test the value of the clinical information of an expensive diagnostic tool. It cannot replace the empirical development of strategies because too many data are required.

Table 2: **Percentage distribution of adults and children according to the diagnosis/treatment pathways of groups 1 to 5 in Table 1, in the Kasongo project**

	Groups				
	1	2	3	4	5
Adults	94	0	4	0.8	0.8
Children	86	5	5	1.7	1.7

Choice determinants of epidemiological research topics

In practice, investigators choose their epidemiological research topics according to their medical relevance, the possibilities for publishing the results, the availability of funding, and the possibility of using data that have become available by chance. Since classification according to their usefulness for organizing health services is a new approach, this criterion is rarely used.

Discussion

Whereas diseases likely to benefit from curative treatment account for 87–95% of health centre consultations,[e] most of the services' work is influenced little by the district's epidemiological profile. The same applies to developed countries, as shown by the very limited impact of epidemiological studies on general practice. In the final analysis, the information generated by descriptive epidemiology is truly important only for specialized programmes and prevention. As the initiative for the latter is taken by health services, there is an ethical requirement that the expected benefits should be well documented.

The opportunity costs of epidemiological research

Redirecting epidemiological research would lead to gains in efficiency in an area of sizeable importance. The Aga Khan, Ford, Rockefeller and other major Foundations spent a total of US$ 47.1 million in the health sector in 1986, of which 34% went to public health and tropical epidemiology research. Official aid to research in this sector (including biomedical research) stood at $130 million in 1986 in the developed countries (*52*) and 38 million ECU in 1991 for the European Economic Community alone, of which one-third went to organizational research.

The budget of the French-financed OCCGE research centre at Bobo Dioulasso, Burkina Faso, was $3.9 million in 1989. Close to 38% of Mexico's health research and 32% of the Philippines' health research was devoted to public health in 1986 (*52*). Nor should we overlook the huge effort made by WHO (under the EPI) to carry out the Local Area Monitoring (LAM) project (*52*).

An epidemiological agenda for health systems

Klein has lashed out against the use of methods similar to conventional planning methods "to reduce by exclusion" access to care by setting priorities on the basis of a set of methods that gives false scientific security (*53*). The alternative that we propose below enables one to specify the epidemiological responsibilities of the health system's various components.

The districts. One can organize a district's health services without prior epidemiological surveys and adapt health centres to their ecosystems using semi-quantitative data—once they are be used by the population. Additions to the MAP in some health centres may benefit from epidemiological information but the latter must not be processed by the district team, given the complexity of the methods. On the other hand, a degree of centralization of the research is advisable. The district directing teams would gain more, not from epidemiology and statistics courses (*8*), but if they were taught techniques enabling them to make good use of routine statistics. Epidemiological monitoring of 2–3 diseases requiring rapid intervention, without sophisticated information processing, can be incorporated into all health centres. These diseases warrant mandatory reporting.

Specialized services. With the total absence of epidemiological information there will be delays in spotting epidemics and ignorance about pockets of malnutrition (in the Sahel, for example). Epidemiological surveillance thus has a role to play. A more centralized unit—e.g., a regional unit—should process the information collected by the network of sentinel centres, as well as from the other ministries, conduct investigations when epidemics break out, and supervise the quantitative work done by the district directing teams.

The central level of the health ministry. Descriptive epidemiology is essential to the planner only when he is planning a single-purpose control programme, in which case the programme's organization depends on the disease involved. The central level of the Ministry of Health must coordinate and orient the work of the research units (generally the university's epidemiology department and a specialized clinic), which is likely to provide information that is relevant to the design, and then produce a vertical programme or instructions for the polyvalent services from the research findings. The responsibilities of the Ministry's epidemiology department should be to supervise and evaluate the regional units, centralize information, and participate in the planning and programming divisions' work.

Universities and research centres. University epidemiology units should:

[e] See footnote *c* on page 491.

— participate in research that is useful in designing vertical programmes and advising polyvalent services on disease control;
— analyse clinical decisions, then teach the principles to the other university departments, and participate in clinical trials;
— get involved in required laboratory work through epidemiological surveillance and the monitoring of drug resistance; and
— send staff to the regional epidemiological units to strengthen them but also to keep in touch with reality in the field.

Considering their respective skills, it is reasonable to have the Ministry's regional units focus preferably on descriptive epidemiology and the research units on causal epidemiology and epidemiometric models.

International cooperation. Timaeus et al. recently called for a major epidemiological effort in the developing countries (*54*), arguing in favour of the usefulness of an international survey to improve national information systems, confirm mortality and morbidity patterns, and reveal how health services are used. They expected such an investigation to spread data collection and analysis techniques.

The above proposal conflicts with the service utilization appraisal based on routine data, decentralization of the information system, and adjustment of epidemiological work to allow for operational needs. Rather than conducting substitution cooperation—and spreading of epidemiologically based information techniques of marginal benefit—reinforcing the technical capacities of health services should be the leading concern of cooperation strategies. Cooperation agencies should promote university/health service partnerships (*3*) and finance research objectives that are pertinent to the latter.

Conclusions

Epidemiological research for defining health interventions is not a priority, compared with investigations designed to improve the use of health services by the population. The research and assessment methods based on routine data (*55*) assume that these services are being used. Therefore, research into the organization of health services should concentrate on the reasons for their flagging popularity and on the means to reverse the trend.

Epidemiological research must be centralized. It cannot be integrated into polyvalent health services if one wants to preserve its qualities, use the district framework efficiently, and strike a balance between the available resources for research and those for the services.

Our conclusions do not agree with those of the Commission on Health for Development (*52*) which recommended recently that:

— national health action should be based on epidemiological information (e.g., "concerning AIDS, tuberculosis and diseases that may be prevented by vaccination");
— health measures should not be predetermined, but rather guided by the local epidemiology ("community-based, research-cum-action programmes... in which the exact research agenda and the exact nature of interventions to be tested would not be predetermined but would emerge from local data collection and analysis"); and
— *local* epidemiological research abilities should therefore be reinforced.

We believe that core health activities can be predetermined and MAP adapted to local conditions based on the services' routine data, dialogue with the population, and quite a few selected epidemiological data. We agree with N.G. Bruce, who perceived a conflict between academic epidemiology and the needs of "public health medicine" (*56*), that to solve this conflict it is up to epidemiology to put itself at the service of health planning and management and not the latter to adapt its methods to the supposed possibilities of epidemiology.

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Résumé

Contribution de l'épidémiologie à la gestion et la planification des services de santé dans les pays en développement: le "chaînon manquant"

L'approche classique de la planification sanitaire exige de nombreuses informations épidémiologiques. Elles sont rarement utilisées dans la pratique:

— la définition des activités des services polyvalents (dispensaires et hôpitaux) est assez insensible au profil des fréquences des pathologies locales;

— la planification des ressources (personnel, médicaments, etc.) ressort généralement de méthodologies qui ne font pas appel à l'épidémiologie descriptive mais plutôt à l'évaluation de l'utilisation passée de ces ressources;

— les algorithmes diagnostic-traitement sont construits de manière empirique plus qu'en fonction de la fréquence des symptômes;

— les évaluations utilisées en routine par les services font plus appel à la quantification des prestations qu'à l'analyse de leur impact biologique;

— la planification des infrastructures requiert des informations démographiques et géographiques.

Après avoir discuté la rationalité conceptuelle de ces pratiques empiriques, l'article souligne l'utilité de certaines techniques épidémiologiques trop rarement utilisées pour l'organisation des services polyvalents, en particulier les mesures de fréquence de certaines maladies informatives. Cette discussion permet de mieux cibler la surveillance interépidémique et permet de préciser quelles sont les cartes sanitaires pertinentes. L'article examine aussi les applications des modèles épidémiométriques et de l'analyse de décision clinique dans les pays en développement.

Les districts sanitaires peuvent fonctionner correctement sans mener de recherches épidémiologiques. Ils peuvent compléter le "paquet" minimum d'activités de leurs infrastructures en utilisant comme sources d'information: *a*) les supports de routine (analyse des cahiers de consultation par exemple); *b*) des données semi-quantitatives pour les maladies qui justifient des ressources particulières, et qui risquent d'être sous-estimées dans ces supports; *c*) le dialogue avec la population.

L'utilité de l'épidémiologie descriptive pour les services de district se réduit donc à l'objectivation de rares pathologies pour lesquelles un biais de détection pourrait exister. Il s'agit de maladies engendrant une mortalité importante avant la consultation ou encore de celles qui ne motivent que rarement une consultation pour des raisons socioculturelles.

La participation des districts aux réseaux-vigies est nécessaire. Mais on recommande que les activités épidémiologiques de recherche et de surveillance soient menées par des services spécialisés, parce qu'ils offrent des garanties de qualité technique plus importantes et parce que le coût des enquêtes, toujours élevé, s'accroît encore lorsqu'on les décentralise et qu'on en perd le contrôle à l'occasion de leur intégration. En dehors de la surveillance interépidémique, ce sont donc des services spécialisés qui devraient traiter l'information des réseaux-vigies.

Il est suggéré que les universités développent davantage l'analyse de décision clinique dans les cours de médecine et participent à la surveillance épidémiologique ainsi qu'à la surveillance des pharmacorésistances. Enfin, les agences de coopération pourraient financer un couplage entre universités et services publics de santé.

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