Health Information

Health information systems – making them work
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A health services model based on different concentration levels between the centre and the periphery, each with particular resources, responsibilities and management functions, provides a framework on which health information systems can be built or rebuilt so as to accelerate progress towards the health-for-all goals.

Information on which to base decisions is needed by policy-makers, managers and care providers. Unfortunately, health information systems in most countries fail to provide adequate support. Most health care providers are obliged to deliver vast amounts of information on patients and diseases without receiving feedback. Information systems tend to be data-driven instead of action-driven, and act as obstacles to rather than tools of management.

■ Much of the information recorded by health workers is not relevant to the tasks they perform. Data collection tends to focus on disease reporting and only partially addresses service function at the health unit or patient/client level.

■ Requirements for recording or reporting data are frequently drawn up without reference to the technical skills of the personnel concerned or to the diagnostic equipment in peripheral health facilities. At the first level of care, for example, auxiliary staff without laboratory or X-ray facilities may be required to report on diseases such as leishmaniasis, diphtheria and peptic ulcer. Furthermore, health workers receive little or no training in methods of data collection.

■ Duplication and waste exist in multiple parallel health information systems. Designed as vertical structures, national programmes have often replaced line managers with programme directors who manage specialist personnel, deliver specialized training programmes, and have created separate programme information systems focusing on single disease categories, specialized services or management subsystems, instead of addressing management functions comprehensively. The result is that

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health workers are often overwhelmed by having to prepare monthly overlapping reports. A considerable amount of time is spent on the collection of redundant information because the data are not cross-referenced between different systems.

■ The process of transmitting, compiling, analysing and presenting data is so protracted that they are often obsolete by the time a feedback report is prepared, and decisions are consequently made without any information input. Furthermore, in strong vertical programmes the transmission of data does not follow hierarchical lines of communication, with the result that reports often fail to reach line managers, particularly at the district level.

■ Although some good data are available, managers and care providers rely primarily on intuition when making ad hoc decisions rather than using pertinent information, especially at the district, health centre and community levels. This makes it harder to decentralize decision-making and build capacity at the district level.

Developing a systems approach

The development of rationally structured routine information systems, closely adapted to the needs of health services at national, district, health centre and community levels, contributes to the overall improvement of health service management. Changing the procedures by which information is gathered, processed and used for decision-making implies altering the way in which an organization operates.

It has been argued that health information systems are peculiar to the countries that develop them and that no models can be universally applied (I). A system in a very urbanized country with a high literacy rate, a GNP per capita of more than US$ 1000 and mostly private health services is bound to differ from one in an extremely poor country with widespread illiteracy and predominantly state-run health services. Clearly, each country has to develop or restructure its own health information system in accordance with national socio-economic, political and administrative conditions.

However, certain basic principles can be applied in order to create more effective and efficient systems. Each health information system has an information-generating process in which a more or less organized structure involves people interacting with resources, such as data-collection instruments, or with machines, such as computers. How can these common elements be combined so that information becomes a real resource for solving health problems at all levels of the health services system?

A health information system comprises an information process and a management structure (Fig. 1). Designing or redesigning a health information system requires systematic attention to each component of both the information process and the management structure, the aim being to provide specific information support for the decision-making process in the health services system at large.
All data recorded and reported at a service facility should be relevant to the management of patients and health units. The monitoring and provision of services at the district, province and central levels can then be based on data known to be complete and valid because they have been used by the originators.

The management structure ensures that quality information is produced. The resources part of the structure includes people (such as planners, managers, statisticians, epidemiologists and data collectors), hardware (such as telephones, computers), software (such as data-processing programs) and finance. In addition there are organizational rules, such as procedures for supply management and computer maintenance, and definitions of staff responsibilities, aimed at ensuring the efficient use of the resources.

**Relationship between information and services**

A health information system cannot exist by itself: it is a functional entity within the health services framework. Its structure should permit the generation of information allowing rational decision-making at each level of the health services system from the centre to the periphery. Each level of a health services system has its own management functions, health service responsibilities and resources. To the greatest possible extent, services and resources should be available at the periphery so as to make them as accessible as possible to those who need them. However, there are limits concerning:

- the degree of decentralization related to the provision of technical competence;
- the efficient use of equipment;
- the distribution of responsibility.

Through the information process, raw data or inputs are transformed into information that can be used in decision-making, i.e. outputs. The information process involves:

- data collection, transmission, processing and analysis;

- the production of information for use in the planning and management of health services.
For example it is neither possible nor desirable that every patient with a urinary infection should be treated by a urologist, or that every first-level care clinic should have ultrasound equipment.

Three concentration levels can be identified. The primary level is usually the first point of contact between the system and the population receiving care. The secondary, or district, and the tertiary levels provide specialized services and support for planning and management. In many countries the tertiary level is divided into regional, or provincial, and central levels.

Each level has specific functions, including decision-making, which lead to improved health in the population (Fig. 2). They relate to the management of:

- patients/clients;
- health units;
- the system.

The first two are directly related to the delivery of health care to the population, while the third provides coordination and management support at the service delivery levels. The decisions that have to be made in the first two categories are operational, whereas those concerning the system have to do with strategic planning or management control.

**Patient/client management functions**

The main function in this category is the provision of quality diagnosis and care to patients and clients. The curative, preventive and health promotional areas are all covered at both the first and referral levels. At the first level, quality care is comprehensive, integrated and continuous, focusing on patients/clients in their immediate sociocultural environment. At the referral level it is more dependent on the input of human and technical resources, and is therefore defined in terms of technical excellence.

The users of information at the patient/client level are doctors, health auxiliaries, midwives, community health workers.
and traditional birth attendants. A well-designed health information system can be a major tool for improving the quality of care delivered, through the generation of information that care providers need in order to make decisions, as in the following examples.

- Continuity of care: the date, findings and treatments prescribed during the last visit help the care provider to make better decisions for a tuberculosis patient visiting a rural health centre.

- Integration of care: a child aged two years has a skin rash and diarrhoea, and the care provider needs information on whether the child has had measles or has been vaccinated.

- Referral care: the timely transmission of accurate pathology results for a biopsy specimen of the cervix helps the surgeon to decide on the type of surgery to be performed.

- Community information: district health officers need to compare the availability of safe water supplies with the occurrence of diarrhoea cases.

**Health unit management functions**

The general management objective of a health unit is to provide care for a defined population in the unit’s catchment area with a given amount of resources. Health units can be classified as first-level or referral-level units according to the level of concentration of resources. There are specific functions for each type of health unit.

First-level care units provide general health care. The setting varies greatly, and the units may be dispensaries, clinics, health centres, first-aid posts, community health posts, and the like. These different facilities may cover differences in functions and activities, based on country-specific standards. It has been suggested (2) that at least the following should be provided:

- prenatal and delivery care;
- family planning services;
- management of sick children;
- tuberculosis treatment;
- case management of sexually transmitted diseases.

At the referral level, hospitals and specialist outpatient clinics provide services and techniques for which the technical complexity and cost are not justifiable in first-level units. The district hospital is the first referral unit or secondary-care unit. Provincial and national hospitals are mostly tertiary-care units. The services and techniques offered at a given level vary between countries or regions. For example, district hospitals may or may not offer ophthalmological surgery.

Supporting the service delivery functions, health units also have administrative functions such as personnel management and training, financial management, drug and supply management, and information management. The functions increase in size and complexity with the size of the facilities.
Starting from the functions and activities of the different types of health unit in a health service system it is possible to begin to identify the information required for decision-making, as the following examples illustrate.

- A health centre provides prenatal care to all pregnant women in the catchment area and refers those at risk for delivery to the district hospital. When several maternal deaths are reported from surrounding villages, the officer in charge and the midwife need to know how many women have received prenatal care and were assisted during pregnancy, the causes of the deaths, what prenatal and delivery care was given, and what the total number of expected pregnancies was during the period concerned. This information helps the midwife to reorganize maternal health activities.

- A district hospital with 200 beds provides inpatient care for a population of 200,000 people. For about a year it has been necessary to use improvised beds on the floor. The superintendent needs to know the average length of stay in each department in order to decide if more beds are required or if changes in admission and discharge procedures could solve the problem.

- A tertiary hospital with a defined yearly budget needs to monitor expenditure in various cost centres so that departmental allocations can be made on a rational basis.

**System management functions**

The objective of system management functions is to coordinate and provide planning and management support at the service delivery levels. The functions include:

- establishment of health policies and legislation;
- intersectoral coordination;
- strategic planning and coordination;
- budgeting and financial resource allocation;
- organization of the system, including referral mechanisms;
- manpower development, including continuing education;
- distribution and management of equipment, supplies and drugs;
- disease surveillance and outbreak control;
- supervision of health services.

The distribution of these functions, and consequently of decision-making authority, depends on the administrative organization of the health system. For example, budgeting and decisions on financial resource allocation are made at the national level in a centralized health system, whereas in other systems these functions are delegated to the district level. WHO has promoted decentralized health systems based on primary care, with community participation and extensive decision-making power at the district level.

**Implications for the strengthening of health information systems**

A health information system should provide information support for decision-making at all levels of health services, and should therefore fit into the overall management structure of the health services system. How can inadequate routine health information systems be transformed into effective management tools?
Failures are commoner than successes in attempts to strengthen health information systems. In addition to purely methodological factors, the political, sociocultural and administrative context can influence outcome (3).

The proposed health services model based on concentration levels with different management functions (Fig. 2) is a framework on which to build or rebuild health information systems. Throughout the restructuring process this model provides a conceptual basis for the different steps that have to be taken.

Restructuring rarely involves a total overhaul of a health information system in a particular country or region. Indeed, attempts at comprehensive restructuring often fail. The focus should be on the least functional aspects of the system, or restructuring should be planned in connection with continuing reforms of the health system. For example, reform of the financial management of the health services requires particular attention to restructuring the part of the health information system which deals with financial data. A health information system can be divided into subsystems dealing with:

- epidemiological surveillance for notifiable infectious diseases, certain environmental conditions and risk factors;
- routine service reporting from the basic health services at community level, health centres, first referral hospitals and tertiary hospitals;
- reporting systems for special programmes such as tuberculosis control, leprosy control or AIDS prevention;
- administration, covering health care financing, health care personnel, drugs, logistics, financial management, training, research, documentation management, and other areas;
- registration of births, deaths and migratory movements (4).

A careful assessment is required before restructuring is undertaken, in order to identify those subsystems that need immediate attention, having regard to inherent weaknesses of the system and to country priorities. The restructuring process can be broken down into four steps dealing with the development of the information-generating process and two steps related to the establishment of the management structure for the generation and use of information:

- identifying information needs and indicators;
- defining data sources and improving data generation instruments;
- developing data transmission and processing procedures;
- ensuring that information is used;
- planning for required resources;
- developing organizational rules.

Each strengthening step should be carefully tailored to the health service system. Within the chosen subsystem and for each restructuring step, particular attention should be given to ensuring that information can be made available and is used for
### Restructuring for routine services reporting system

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<td>1. Identifying information needs and indicators</td>
<td>* Select essential health indicators for overall health monitoring system</td>
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<td></td>
<td>* Identify information needs for follow-up of pregnant women in primary-level clinic</td>
<td>Primary</td>
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<td></td>
<td>* Identify indicators to ensure efficient drug management in referral hospital</td>
<td>Secondary</td>
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<td></td>
<td>* Identify indicators to monitor quality of supervision by district management team</td>
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<td>2. Defining data sources and improving data generation instruments</td>
<td>* Develop record form for follow-up of haemodialysis patients in tertiary care hospital</td>
<td>Tertiary</td>
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<td></td>
<td>* Develop monthly reporting form for activities in primary-level clinic</td>
<td>Primary</td>
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<td>* Define data sources for situational analysis at district level</td>
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<td>* Structure information flow on pregnant women between traditional birth attendant and midwife in health centre</td>
<td>Primary</td>
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<td></td>
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<td>Secondary</td>
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<td>4. Ensuring that information is used</td>
<td>* Develop user-friendly feedback formats for regional managers on utilization of inpatient services in region</td>
<td>Tertiary</td>
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<td>* Train health auxiliaries in follow-up procedures for hypertensive patients using standard record form</td>
<td>Primary</td>
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<td>5. Planning for required resources</td>
<td>* Create positions of computer operators in case data-processing at district level is computerized</td>
<td>Secondary</td>
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<td></td>
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<td>Tertiary</td>
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<td>6. Developing organizational rules</td>
<td>* Change job description of doctor in case restructuring requires additional data collection on patient/client management</td>
<td>Primary</td>
<td>Patient/client</td>
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<tr>
<td></td>
<td>* Develop instruction manual for computer operators</td>
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decision-making at the appropriate concentration level and for the identified management functions. Restructuring does not necessarily address all concentration levels or all management functions. An initial assessment should reveal the required focus of restructuring. If, for example, assessment of the epidemiological surveillance system shows that case-finding is functioning satisfactorily, restructuring can be limited to improving the transmission and processing of case information from health units to the national level. The tasks performed at each stage of restructuring (see table on page 183) are intended to ensure that the health information system fits in with the health services system.

The proposed approach to restructuring can be adapted to the information requirements of health services at different strategic planning and operational levels, particularly in respect of care providers. If information is provided which is directly useful for the management of patients/clients and health units, care providers can be expected to be motivated to improve the quality of data collected for transmission to higher levels.

The approach permits the development of an action-oriented health information system in support of the whole health service rather than fragments of it supporting disease-oriented special programmes. This is a comparatively effective way of obtaining a continuous two-way flow of information between health service levels and thus of providing a basis for systems of patient referral and counter-referral, supervision, management support, and strategic planning. The improved information process and management structure allow information to be produced which is more relevant to requirements, of higher quality, and more likely to be used in decision-making at all levels than would otherwise be the case.

Dedication

This article is dedicated to Professor Hans Jochen Diesfeld on the occasion of his 65th birthday.

References


Two further articles to be published in World Health Forum will deal with the development of health information system indicators and the use of information.