

# **Routine Health Information Systems: The Glue of a Unified Health System**

Theo Lippeveld  
Vice President of International Division  
John Snow Inc.

## **Abstract**

Individual health interventions and public health interventions are complementary and interdependent in improving the health status of individuals and populations. While this principle is well documented and widely disseminated, fragmentation of the health system is a common phenomenon worldwide, and is even worsening due to the growing competition for decreasing health resources.

Routine health information systems have the potential to play a major role in facilitating integration between individual health and public health interventions. Since both individual health care services and public health functions are being carried out within the health services system, the routine health unit-based health information system is the main information source for both type of interventions. While performing their daily health care activities, care providers within the health unit record data for patient/client and health unit management. Routine health unit-based data can also be aggregated to generate information on services provided to the population, for disease surveillance, and for other public health functions.

Yet most experts agree that routine health information systems in most countries, industrialized as well as third world countries, are woefully inadequate to provide the necessary information support to individual care and public health activities. In fact, poor use of information for evidence-based decision making is probably one of the main causes of the current lack of linkages between individual care and public health systems. At least four reasons are reported consistently in the literature:

1. Data on individual health care activities are irrelevant and of poor quality.
2. Information on health care interventions is not linked to a reference population.
3. Information system management is often heavily centralized.
4. Health information system infrastructure is inadequate in most developing countries.

The transformation of existing routine health information systems into effective and efficient management tools, facilitating integration of individual care and public health functions into a unified health services system, will require a multipronged approach and the involvement of all main stakeholders. Recent experiences have shown that *decentralization of information management toward the district level* is an effective strategy to improve the use of routine information. The district level is also the most appropriate level to link routine and nonroutine data collection methods.

A second strategy is *to carefully manage the routine health information system restructuring process*. The guiding principles for effective health information system restructuring are:

1. to adapt information needs to well-defined management functions at all levels of the health system;
2. to improve data collection procedures, data transmission, data analysis, and data presentation to generate quality and timely information;
3. to provide sufficient and appropriate physical and human resources for HIS management; and
4. to create an “information culture” geared toward use of information for decision making, by using a participatory and consensus-building process.

Finally, for the long term, we propose involving communities directly in health services planning and information system management. Communities can provide most of the information for management of essential public health functions. Examples include reporting births and deaths; notification of cases of infectious diseases and outbreaks; identification of high-risk children, pregnant women, and families; coverage and defaulters of critical services; coverage of households with safe water supply and sanitation; and monitoring air, water, land, and noise pollution.

Although these are clearly ambitious and long-term efforts, district-managed, and at least partially community-managed HIS could provide the glue to bind together individual and community health interventions. Further research and experience is required to expand and scale up existing projects. First, a comprehensive review study should be set up to gather existing scientific evidence that decentralized routine HISs contribute to more effective and efficient integration of individual and community health interventions.

Some other important questions need to be answered to establish information systems responsive to the health needs of individuals and populations:

- How can service providers and, particularly communities, as key information users, be more actively involved in HIS development efforts?
- What is the ideal process and level for development of interdisciplinary social information systems, through which interaction among health, education, and economic development can be identified in an action-oriented manner?
- Given the benefits of a population-based community health information system, how can it be linked effectively to a routine health unit-based HIS?
- What structural interventions could better link routine service statistics with nonroutine data collection systems (surveys, vital events registration, rapid assessments methods, etc.)?
- What is the relationship between the format in which information is displayed (maps, action oriented graphs, etc.) and its use in management?
- How can training in information use effectively improve the actual use of information for health services planning and management?
- What is an efficient strategy for designing and testing computer support for integrated management of individual health and public health?

## **Introduction**

One of the main objectives of this unique and important workshop on routine health information systems in developing countries is to reach a common understanding among decision makers and health professionals on the rationale for increasing investment in routine health information system development. While routine health unit-generated information is obviously essential for evidence-based decision making related to both individual health care interventions and public health interventions, routine health information systems potentially have a broader mission: to glue them together into a unified health system.

The ultimate goal of the health system is to improve the health status of individuals in a population. Health status is determined by at least four main factors: (1) biological assets, (2) personal lifestyle, (3) the environment, and (4) the health care system. Obviously, interrelations exist among these groups of factors. Biological and environmental factors can influence personal behavior. The potential impact of interventions within each of these groups can be debated, but

several authors have stressed that the contribution of the individual health care system alone is marginal, compared to the potential impact of interventions on personal lifestyle and the environment<sup>1</sup>. While public health interventions to affect the first three groups of factors mainly prevent ill health, individual health care interventions are often the last stage in a chain of events leading to disease and, therefore, mainly restorative in nature. Clearly, individual and public health interventions are complementary and interdependent.

While these principles are well documented and widely disseminated, fragmentation of the health system is a common phenomenon worldwide, and is worsening due to the growing competition for decreasing health resources. As Boelen states: “Significant divisions exist and sometimes widen between individual health and community health services, between economic and social aspects of health, biomedical and psychosocial models, curative and preventive care, services provided by generalists and by specialists, public and private sectors, health services providers and consumers.”<sup>2</sup> Recently, a group of health professionals and advocates, coordinated by the World Health Organization, developed a project called “Towards Unity for Health” (TUFH) to study and promote efforts to integrate individual health and public health interventions. Five principal partners or stakeholders (“the pentagon”) have been identified that are essential in creating this movement toward unity for health: (1) policymakers, (2) health managers, (3) health professionals, (4) academic institutions, and (5) communities. For health services to facilitate the integration between medicine and public health, three essential features should be present: a focus on a reference population and a defined geographical area in the context of a decentralized health system; an attempt to develop organizational models for supporting coordination and integration processes; and use of a comprehensive health information system.<sup>3</sup>

The thesis of my presentation is that routine health information systems, in particular, can play a major role in facilitating integration between individual and public health interventions. First, I clarify the conceptual linkage between routine health information systems and the health system. Following this conceptual model, various problems and constraints in existing routine health information systems are presented that could explain why information is often not used for evidence-based decision making, in both individual care and public health information systems. Finally, mechanisms are proposed to improve routine health information systems as a means to ensure better integration between individual health and public health.

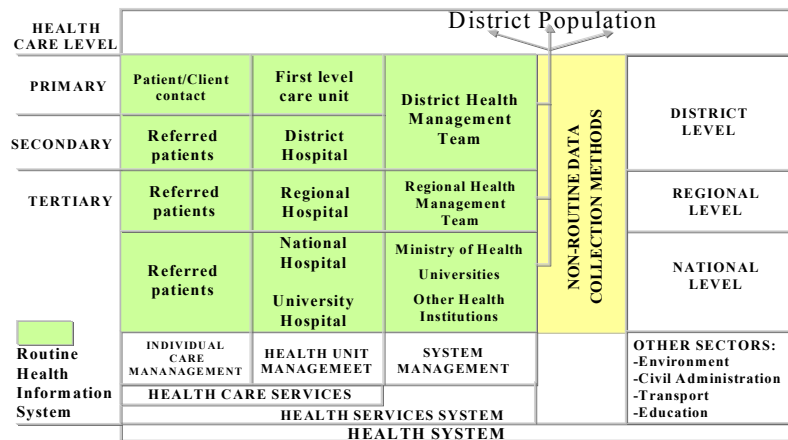
### **The relationship between routine health information systems and the health system at large**

A health information system (HIS) cannot exist by itself, but is a functional entity within the framework of a comprehensive health system to improve the health of individuals and the population. As such it is a *management information system*. Although many definitions of a management information system have been proposed, we propose the one by Hurtubise: “a system that provides specific information support to the decision-making process at each level of an organization”.<sup>4</sup>

The HIS structure should permit generation of the necessary information for rational decision making at each level of the health system, from local all the way up to national. Each of these levels has specific functions that require specific decisions to be made, to ultimately improve the

health status of the population. From a management perspective, functions can be grouped into three types of *management functions* related to (1) individual care management, (2) health unit management, and (3) health system management (see figure 1).

**Figure 1**  
Relationship between the Routine Health Information System and the Health System



Individual care management functions are directly related to the delivery of quality care to individuals consulting with the health services system. Services to individuals can be curative, preventive, or health promotional in nature, at the first level and at the referral level.

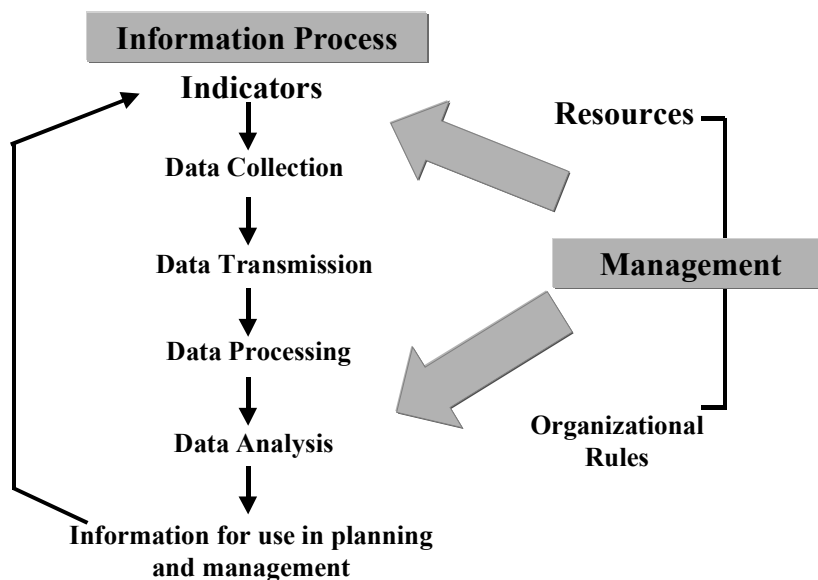
The general management objective of a health unit is to provide health care to a defined population in the catchment area surrounding the health unit with a given amount of resources. Health units can be classified according to the level of concentration of resources: first-level care units and referral-level care units. Management functions are specific for each type of health unit. They can be subdivided further into service delivery functions and administrative functions. First-level care units provide a package of general health care services. Based on the strategy of primary health care, a minimum package of essential health care, including curative, preventive, and promotional activities, should be provided to as large a segment of the population as possible.

In addition to coordination and management support for delivery of health care delivery services, health system management functions include a set of public health functions for a particular reference population, such as protection of the environment; prevention and control of disease; health promotion and education; health legislation and regulation; and specific public health services, such as school health, occupational health, veterinary health services, and public health laboratories.

*To be relevant, a health information system must fit into the organization of the health system for which it generates information.* Based on clearly defined management functions, identifying the information needed to make appropriate decisions at each management level is relatively easy. The next question is how to obtain this information in the most effective, efficient way.

To answer this question, it is important to understand the health information system structure. HIS, like every system, has an organized set of interrelating components that can be grouped under two entities: *information process*, and *HIS management structure* (see figure 2). Through the *information process*, raw data (inputs) are transformed into information in a "usable" form for management decision making (outputs). The information process can be broken down in the following components: (1) data collection, (2) data transmission, (3) data processing, (4) data analysis, and (5) presentation of information for use in patient care and health services management decisions.

**Figure 2**  
**Components of a Health Information System**



To make the information process efficient, a *HIS management structure* is required to ensure that resources are used in such a way that high-quality information is produced in a timely fashion. This structure can be broken down further into two components: (1) HIS resources and (2) a set of organizational rules. HIS resources include persons (e.g., planners, managers, statisticians, epidemiologists, and data collectors); hardware (e.g., registers, communication technology, and computers); software (e.g., carbon paper, report forms, data processing programs); and financial resources. Organizational rules (e.g., the use of diagnostic and treatment standards, definition of staff responsibilities, supply management procedures, and computer maintenance procedures) ensure efficient use of health information system resources.

Monitoring and evaluation of the process ensures that the right mixture of inputs produces the right type of outputs in a timely fashion. For example, the information needed changes continuously with changing planning and management needs. This, in turn, affects the data collection and other components of the information process. A health information system can

generate adequate and relevant information only insofar as each of the components of the information process has been adequately structured.

Data collection is the first step of the information process, so health information systems are often classified according to data collection method. We have found it useful to classify these methods into two groups: *routine and nonroutine data collection methods*. Routine health unit-managed data collection is the classic form of routine data collection. Data are collected based on patient/client encounters in the health facility or through outreach. Routine data collection, as we mention later, can also be managed directly by the community. Vital events registration is another form of routine data collection. Nonroutine methods of health data collection include surveys, quantitative and qualitative rapid assessment methods, and other special studies.

No single data source can provide all of the information required for planning and management of health services. A national health information system in support of health services always uses a combination of data collection methods, depending on the nature and the use of the information for which data need to be collected. Routine health unit data collection is particularly geared toward provision of health care to individuals and, therefore, provides information on the health of those individuals who use the regular health services. This can be a problem in countries where access to or use of health services is low. For a more comprehensive understanding of health problems in low-access communities, other methods of data collection are needed, such as population-based sample surveys or, as we discuss below, health unit data collection needs to be expanded to include community data. Mortality data can be obtained from hospitals and civil registration systems, but often must be generated through other methods, such as prospective studies of communities or retrospective demographic surveys.

Available routine or survey-based data sets are often not sufficient to understand underlying causes of problems, particularly at the district and local levels. Informal investigations<sup>5</sup> and “soft” information obtained through meetings with individuals and groups<sup>6</sup> can be important sources of information to answer such questions. Also, information from other sectors such as education, agriculture, and economics can contribute in major ways to improved decision making, particularly for health policy formulation and planning of primary health care-based health services.<sup>7</sup> In this presentation we focus more particularly on use of routine versus nonroutine data collection methods, and how this influences the relevance, effectiveness, and efficiency of the current health information systems.

### **What is wrong with existing routine health information systems?**

Since both individual health care services and public health functions are being carried out within the health services system, it seems obvious that the main information source for integration of both types of intervention should be the routine health unit-based health information system. This is the most obvious mechanism of collecting data for patient/client and health unit management. Care providers within the health unit record data while performing their daily health care activities. Routine health unit-based data can also be aggregated to generate information on services provided to the population, for disease surveillance, and for other public health functions.

Yet most experts agree that routine health information systems in most countries, industrialized as well as third world countries, are woefully inadequate to provide this integrated management support between individual care and public health activities. In fact, poor use of information for evidence-based decision making is probably one of the main causes of the current lack of linkages between individual care and public health systems. According to Neame and Boelen: "The health care environment is bursting with information, but the sector lacks the capacity to find, communicate or use it effectively."<sup>8</sup> Or as Chambers notes rather sarcastically: "[Most data] remains unprocessed, or, if processed, unanalyzed, or, if analyzed, not read, or, if read, not used or acted upon."<sup>9</sup> Literature review provides us with several explanations, which I have tentatively grouped under four headings:

*Irrelevancy and poor quality of the data on individual health care activities*

According to a WHO Expert Committee, "many of the data recorded and reported by the health service staff are not needed for the tasks the staff perform."<sup>10</sup> Data collection tends to focus on disease reporting and only partially addresses management objectives at the health unit or individual care level. Yet data that are needed frequently are not collected. For example, indicators to monitor continuity of care to patients or clients are rarely included in HIS. The common characteristic of these two observations is a lack of a consensus between producers and users of data at each level of the health care system regarding the information needed.

Data quality is low for several reasons. Care providers receive little if any training in data collection methods, and they rarely are given standardized instructions on how to collect the data. They are poorly motivated to produce quality data, because most data collected are irrelevant to their own information needs. They rarely receive feedback on the data reported to higher levels, so they have little incentive to ensure quality of the collected data and comply with reporting requirements.

The main problem obviously is low use of the data, specifically by health care providers. If the main function of individual health care is provision of comprehensive, integrated, and continuous care, providers do not use easily available information to make their daily treatment decisions. A child is treated for chronic diarrhea, without taking into account his malnutrition problem as evidenced by a low weight-for-height measure. Tuberculosis patients abandon treatment, although a simple message or home visit could have brought them back into treatment. Specialists ask for a full set of laboratory tests and provide expensive treatments without knowing what kind of assessment and treatment was provided at the first level.

*Individual health care is not linked to a reference population*

One of the main criticisms of routine health unit-based information systems has been that the aggregated information is not representative of the population at large. This is certainly the case in countries with low utilization rates of the health services, or, in general, for those segments of the population known to underuse health services: periurban slum areas, geographically isolated populations, and marginal high-risk groups in the community. This problem is not necessarily inherent to health unit-based systems; it lies more in the organization of the system and in the motivation of its users.

Most health care providers do not know their catchment area population, either in numeric terms, or in terms of its members' health status, sociocultural norms, and environmental threats. This is especially the case for hospital-based staff. Health care institutions generally are not aware of those who do not visit the facility and certainly do not try to reach them. Also, at higher levels of the health system, aggregated service utilization data are rarely linked to a population denominator, or, if they are, they are not used to identify underserved populations in the community and focus public health interventions on those most in need.

#### *Centralization of information management*

Routine health information systems in most countries are centrally planned and managed. Indicators, data collection instruments, and reporting forms usually have been designed by centrally located epidemiologists, statisticians, and administrators (called *data people*), with minimal involvement of lower-level line managers and providers of the health services (called *action people*). The cultural differences between the two groups are often so huge that Dunn speaks of the “two communities metaphor.”<sup>11</sup>

Data processing and analysis are mainly the responsibility of a centrally located office. Complex data transmission and compiling systems slow down the production of feedback in such a way that, by the time a feedback report is received at lower levels, the information is frequently obsolete for decision making. Planners and managers face deadlines and time constraints in their daily decision making. Outdated information, even of high quality, is of low value to them.

The main result of this centralization is that information use is weakest at the district level, where the main public health interventions are planned, implemented, and monitored, and at the health unit level, where individual health decisions are made.

#### *Poor and inadequately used health information system infrastructure*

Finally, as was pointed out before, no HIS can function effectively without adequate human, physical, and financial resources. Yet most developing countries have an environment in which the most essential resources are lacking. Health units are staffed by poorly trained clinical staff, have no water or electricity supply, and lack the most essential HIS supplies such as printed forms or registers. Many countries have introduced computer equipment at the district level, but have no qualified staff to maintain software and hardware. Basic supplies such as printer cartridges and paper are often out of stock. Often the most essential communication technology is lacking, such as a telephone line between the health unit and the district headquarters.

This resource problem is not as acute in developed countries; although all the information and communications technology is readily available, it is used poorly by decision makers at all levels of the health services system. Provision of computer equipment is determined more often by vendors than by health services managers, resulting in an enormous waste of resources that could have been used for the health care activities the HIS was intended to support.

These shortcomings in routine health unit-based health information systems result in a real block between individual care and public health information systems. Irrelevant and poor-quality routine data limit use of the data by health unit managers and planning and management staff at

the district level who rely primarily on gut feelings to formulate ad hoc decisions. At higher levels, many government agencies and donors tend to organize costly general and special-purpose surveys to capture data that should be part of routine reporting. Survey results are not linked to the individual health information system. In addition, lack of information exchange between first-level care staff and the community creates a major communication problem between health services and the community. It completes the total isolation of the individual health care system from any form of community health intervention.

A second result of deficient and centralized information management has been fragmentation of the health information system. National programs in many countries have created separate *program information systems* that tended to focus on one specific disease (e.g., diarrheal diseases), a specialized service (e.g., family planning information systems), or a management subsystem (e.g., drug management information system) instead of addressing management functions in a comprehensive way. These program information systems have existed side by side with the general routine health information system that is considered to be insufficient and incapable of delivering the data needed for program management. While these separate systems could provide real information support for programmatic decisions, and the quality of information they generate tends to be better than that of the general information system<sup>12</sup>, the net result has been that routine health information systems became even more chaotic and bothersome, due to redundant data collection, multiple report forms, and data transmission problems. Most of all, these systems, by their disease-oriented approach, have endangered further the holistic perspective of individual and community health care.

### **Proposed actions to improve information management within a health services system, integrating individual and community health interventions**

It is obvious from this situational analysis that the transformation of existing routine health information systems into effective and efficient management tools to facilitate integration of individual care and public health functions into a unified health services system will require a multipronged approach and the involvement of all major stakeholders. Fortunately, many national policymakers in developed and developing countries have decided to attack the information problem at the roots and have planned for a more integrated approach to improving health information systems. Bolivia, Cameroon, Eritrea, Morocco, New Zealand, Niger, Pakistan, Philippines, and South Africa are examples where comprehensive HIS restructuring efforts have taken place recently or are still underway.

One of the more consistent findings of these experiences is that *decentralization of information management toward the district level is an effective strategy to improve routine information systems*. According to the now classical WHO definition,

a district health system based on primary health care is a more or less self-contained segment of the national health system. It comprises first and foremost a well-defined population living within a clearly delineated administrative and geographical area. It includes all the relevant health care activities in the area, whether governmental or otherwise. It therefore consists of a large variety of interrelated elements that contribute to health in homes, schools, workplaces,

communities, the health sector and related social and economic sectors. It includes self-care and all health care personnel and facilities, up to and including the hospital at the first referral level...”<sup>13</sup>

Also, in this decentralized health system, most public health functions can be carried out by the health district management team, in collaboration with and with the active involvement of the community. Therefore, delegation of information system management responsibilities to the district level is a major step toward integrating individual and community health information systems.

*The district level seems to be the most appropriate level to link routine and nonroutine information systems.*

Even the best-functioning routine system cannot provide all the information necessary for individual and community health, but it can become the starting point for additional data collection, using surveys or other nonroutine methods. Nonroutine methods can help managers to address questions that the routine system cannot answer; mortality levels, health beliefs, and client satisfaction are some examples. These questions do not all need to be answered through expensive national surveys. In the last two decades, more and more managers have started using “rapid assessment procedures” (RAP). These rapid assessment procedures comprise a variety of methods used primarily in social research, such as formal and informal interviews, focus group discussions, and document analysis. In addition to being less costly, these methods are particularly suitable at the district level because they use simple methodologies, have a short timeframe between data collection and presentation of results, and are action-oriented. They permit involvement of the clients in analysis of the data, so they are well suited for community health information.

Within the limited time of this presentation, I can put forward only general principles on how to implement health information system restructuring toward decentralized health services management. These principles are based on the three premises of an effective management information system: (1) information needs are based on the management functions at each level of the health services; (2) each of the components of the information-generating process has been adequately structured; and (3) sufficient HIS resources are available and are used in such a way that high-quality information is produced in a timely fashion. I will add a fourth principle that is inherent to the reform process: HIS reform, a complex organizational intervention, requires a carefully managed change process resulting in the creation of a *new information culture*.

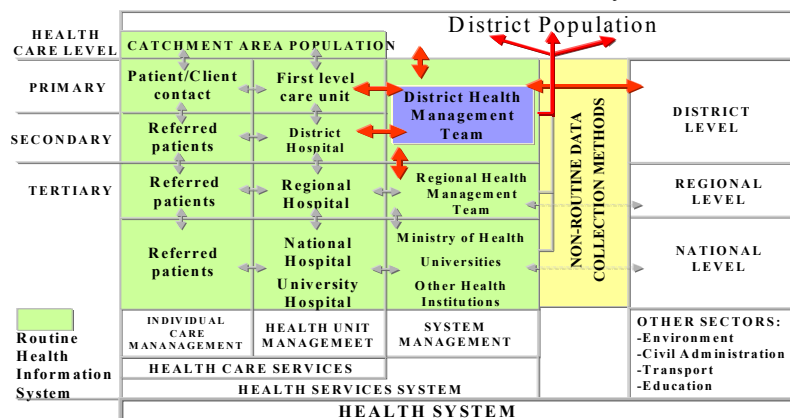
### **Defining information needs and indicators**

If the final outcome of HIS restructuring is to ensure better information support to the health services system, then the first requirement for any HIS designer is to have a clear understanding of how a health services system is structured and which management functions are involved. According to the proposed framework, management functions of the health services can be categorized into three groups: individual care, health unit, and system management. Management functions vary further, according to the health system level: from periphery to center. They address curative, preventive, promotional, personal care, and public health services. Based on a

conceptually sound health system model, information support can be translated more easily into relevant and appropriate indicators.

The main focus of redefining information needs and indicators should be on individual care and health unit management at the first level of the health services system. First-level care by definition is holistic and should take into account the sociocultural context of an individual visiting the health unit. A first-level care unit can be made responsible for a well-defined geographical or functional catchment area population, so it is the ideal locus for integration between individual and public health activities (see figure 3). Once a denominator is defined (the catchment area population), the quantity of health services offered by the health care unit can be transformed more meaningfully into coverage rates, measuring services provided (or not provided) to the catchment area population. As a simple example, a first-level care unit responsible for a population of 6,000, with an estimated birthrate of 25 per thousand, has as an objective to vaccinate the approximately 150 expected births every year. If, at the end of a given year, immunization services were provided to 100 children, the coverage rate for vaccination services is calculated to be 67 percent. It also shows that about one-third of all children did not receive immunization. Such denominator-based analysis, therefore, permits combining individual health and public health action.

Figure 3  
District Managed  
Routine Health Information Systems



### The information-generating process

Once information needs have been defined according to management objectives, a well-structured information-generating process can help in using the data for decision making at various levels in the health services system and the community.

#### Data collection

One should never forget that the main data collectors in a routine health unit-based system are the care providers themselves. Data collection instruments, therefore, should be adapted and restricted to the daily decisions the providers have to make to provide quality care to their patients and clients. Since poor-quality data are not useful, all efforts should be made to improve the quality of data at the data collection level. Golden rules include keeping data collection

instruments as simple as possible; involving users in the design; standardizing definitions and procedures and including them in a user's manual; developing an appropriate incentive structure; and—most important—training care providers as data collectors.

#### *Data transmission*

Streamlining data transmission should address the two main flows of information within the health services system:

##### *(1) within the individual health care system*

Data transmission should promote continuity of care and permit easy follow-up by individual patients and clients. Special attention should be given to the communication between first-level and referral-level care.

##### *(2) from health unit to system management levels*

Effective data flows between health unit and system management levels are crucial for integration of individual care and public health action. The most obvious example is reporting on epidemic diseases. The main principle is to keep reporting requirements by the care provider at a minimum.

Data transmission increasingly uses newer communication technology, such as computer diskettes, e-mail, and Internet connections. It is hoped that in the near future this technology can eliminate the reams of paper required to operate health services systems. The most advanced form is a *wide area network* in which health units are connected to a central data bank through modems. These networks are very attractive because of the speed of data transmission and the possibility of making processed information available instantaneously to all decision makers connected to the database. Wide area networks can also become major tools for integration of individual health and public health information. The central databank can be linked further to databases from other sectors such as education, water and sanitation, and agriculture, and to community databases. However, because of technical and cost constraints, this technology will not be available to most developing countries for some years to come.

#### *Data processing and analysis*

Data processing and analysis range from simple manual computations to sophisticated computerized processing and analysis that transforms the data into useful variables. The challenge in the coming years will be to achieve the right mix of computer and manual systems, and to ensure that they are integrated fully. The large amount of health data, combined with time constraints, make computerized data processing generally the preferred option. Recent developments in computer technology have greatly facilitated data processing and analysis. High-level programming environments permit the creation of user friendly data entry and processing applications. Fortunately, powerful computer equipment has become increasingly affordable, so that these data processing systems can be used even in low-income countries.

#### *Data presentation and use of the information*

Anecdotal evidence shows that health managers and care providers do not use information for most of their decisions. Assuming that use of appropriate information does improve decision making, how can we improve information use? At least five mechanisms are suggested<sup>14</sup>:

1. Ownership and relevance of the information must be felt among all potential users of the information, through active participation in the system design.
2. Data need to be of appropriate quality, aggregated at the right level, and produced in a timely manner.
3. Performance-based management systems tend to increase use of information for decision making (easier to achieve in private health services).
4. Cultural differences between data people and action people can be decreased through consensus building, teamwork, and training.
5. Data presentation and communication (feedback) should be customized for users at all levels. Good feedback is based on meaningful comparisons: time comparisons, geographical comparisons, or comparison of actual versus mean or planned performance.

As Neame and Boelen rightly state, “it is only when those providing the data begin to receive meaningful and useful feedback that they will begin to appreciate the value of data and will therefore take appropriate steps to improve the quality, timeliness and quantity of the data they provide.”<sup>15</sup>

### **Information system resources**

HIS resource problems, including the lack of such basic infrastructure as reliable electricity, will remain a serious constraint in low-income countries for some time to come. It is often difficult for governments to put scarce resources into paper, pencils, registers, and computer equipment. Cost-effectiveness studies on the potential benefits of routine information systems eventually might convince decision makers to invest more resources in the generation of useful information.

Another important resource management question concerns appropriateness of computerization and at what level. While most health units in industrialized countries now have access to computer equipment, in many developing countries computers are still not available at the district level. Yet rapidly developing computer technology will make health information systems increasingly effective and powerful management tools for the health services. Computer equipment is becoming more affordable. Database management and geographical information system software applications can improve the use of information for decision making in both individual and community health matters.

However, introducing computer technology is not necessarily the silver bullet that creates effectiveness and efficiency in health services. On the contrary, lack of appropriately trained staff and hardware and software problems sometimes result in the decay and obsolescence of expensive computer equipment, without any gains in decision making.

### **Changing information culture**

Even if a perfectly relevant, well-organized, and technologically sound routine health information system were readily available, it would not be possible to introduce it immediately.

The main issue is that information systems are managed and used by people who have certain beliefs, attitudes, and practices, and changing them will take time. Most care providers feel threatened by a system that leads to objective decision making and are suspicious of automation; health care consumers feel that more accessible information systems are threats to confidentiality; and there is a lack of mutual understanding between data people and action people.

Based on our experience, and confirmed by other researchers, the task of health information system reform is both formidable and complex, particularly in the context of government bureaucracies in developing countries. As Helfenbein et al. put it: “Changing the way information is gathered, processed, and used for decision-making implies changes in the way an organization operates. Producing and utilizing information more effectively will affect the behavior and motivation of all personnel. It is therefore important for those in charge of HIS restructuring to have a full understanding of what is at stake for each of the actors involved in the projected changes.”<sup>16</sup>

In their analysis of information systems for primary health care, Sandiford et al. identify at least three groups of actors strongly in favor of improved health information systems: health services managers, public health specialists, and information technology experts.<sup>17</sup> However, each group has different expectations. Health services managers expect increased efficiency; public health specialists are interested in both improved effectiveness and equity; and information technology experts hope that computerized systems will eliminate “the drudgery of form-filling.” But these objectives of improved effectiveness, efficiency, and equity are not necessarily supported by other influential groups: vertical program managers may oppose efforts to integrate information systems; the introduction of computers can mean loss of jobs for certain employees; and care providers often show little interest in improved information simply because it is not part of their professional culture.

To implement health information system reform in these complex and potentially resistant environments, at least two conditions have repeatedly been shown to be crucial: leadership and consensus building. Peterson, in their analysis of the implementation of a computerized personnel information system in an African bureaucracy, describes *leadership* as a “saint” who manages the “demons.”<sup>18</sup> The “saint” is a progressive senior government official, who is willing to shoulder the reform effort, while the “demons” are government staff or other concerned actors resisting the reform. As for *consensus building*, it is clearly impossible to involve everyone in the health sector in all aspects of the health information system reform effort, but active participation of key actors early on in the design process will foster their understanding and their ultimate support during the implementation.

### **Future perspectives and research agenda**

While the development of *population-based district managed health information systems* will definitely contribute to the integration of individual health and community health interventions, we would like to finish this presentation with an even more ambitious and long-term perspective of health information system management: *community health and information systems*.

As pointed out by Marsh in his excellent article on this topic, population-based community health systems and the information systems that support them stress local participation in responding to the health needs of all in the defined population, through household and neighborhood level services, including health promotion and disease prevention activities.<sup>19</sup> Community members, often volunteers, complement health personnel. Such community health systems are necessarily linked to referral services for curative and rehabilitative care. Thus, the district health model is an integral part of the population-based community health system. The focus shifts, however, from the peripheral facility to the catchment areas, the communities they serve. The community adds another management level to the system, with its own information needs.

The community level can provide most of the information for management of essential public health functions. Examples include reporting births and deaths; notification of cases of infectious diseases and outbreaks; identification of high-risk children, pregnant women, and families; coverage and defaulters of critical services; coverage of households with safe water supply and sanitation; monitoring air, water, land, and noise pollution; coverage of disadvantaged populations with health and social services; availability of functioning service facilities and staff; and availability of essential drugs.

The population-based community approach is common in research settings (for example, Matlab [Bangladesh], Kasongo [Zaire], and Aga Khan University [Pakistan]), and in development programs (for example, private voluntary or nongovernmental organizations in numerous developing countries). But some developed countries have initiatives as well. Goldfield proposes community-oriented health status management (COHSM) as a means to integrate community planning with the individual planning characteristic of the traditional doctor-patient relationship.<sup>20</sup> COHSM requires the identification and involvement of community elites. It focuses on vulnerable populations, such as low-income households or chronically ill patients, who often are excluded from participation in traditionally managed care organizations. Only a few large-scale examples exist linking communities to the health services system, such as the Health and Management Information System in the Philippines, and the Vital Horoscope in Iran.

Although they are clearly ambitious and long-term efforts, district-managed and at least partially community-managed HIS could provide the glue needed to bind together individual and community health interventions. Further research and experience is required to expand and scale up existing projects.

First, a comprehensive review study should be set up to gather existing scientific evidence that decentralized routine HISs contribute to more effective and efficient integration of individual and community health interventions. We also invite the research community to help answer the following list of questions, which is certainly not exhaustive, but, we hope, will contribute further to the establishment of information systems responsive to the health needs of both individuals and populations:

- How can service providers and communities in particular, as key information users, be involved more actively in HIS development efforts?

- What is the ideal process and level for development of interdisciplinary social information systems, through which interactions among health, education, and economic development can be identified in an action-oriented manner?
- Given the benefits of a population-based community health information system, how can it be linked effectively to a routine health unit-based HIS?
- How can qualitative information be tracked in a routine health information system (for example, the quality of interpersonal relations between the care providers and the patients)?
- What structural interventions could better link routine service statistics with other data collection systems (surveys, vital events registration, rapid assessments methods, etc.)?
- What is the feasibility of involving communities directly in vital events registration?
- What is the relationship between the format in which information is displayed (maps, action-oriented graphs, etc.) and its use in management?
- How can training in information use improve the actual use of information for health services planning and management?
- Is there an approach for determining when computerization is likely to pay the greatest dividends?
- What is an efficient strategy for designing and testing computer support for integrated management of individual and public health?
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