Design and implementation of health information systems
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Edited by

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Foreword

This project was proposed by Theo Lippeveld and Rainer Sauerborn to address what was a huge gap in the health development literature: concepts and experiences in developing national health information systems.

The editors were able quickly to agree on the basic orientation and content of the book—to address the information needs of routine services management. The health professionals who were called upon to contribute chapters have extensive experience in health information systems development and use in many different situations.

Yet the task proved to be more daunting than we anticipated. There was, for instance, a need for a common conceptual framework. WHO has placed emphasis on addressing priority health and service problems, but emphasis on strengthening service performance—particularly at the peripheral level—proved to be a common principle among the contributors to this book. Only a few conceptual nuances, terms and styles of presentation required negotiation.

The development of health information systems is a fast-moving field. Not only is information technology changing rapidly, but concepts and methods for making the best use of existing data for managing health services and resources are quickly evolving. Efficiency in information management is becoming increasingly essential because of the concern for cost control in services and the way service staff spend their time. Approaches such as the use of health indicators are rapidly becoming the norm rather than the exception in order to reduce data handling, while increasing validity and timeliness. Efficient use of minimum data for managing cases, clinics and community health is essential, and it is toward this end that this book has been designed.

WHO is pleased to present this collection of health information system concepts, experiences and examples. We encourage public health administrators to react to these chapters and share with us, and with each other, new methods and techniques for health information system development and use that have proved effective in their countries.

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Randy Wilson, MPH, is a Systems Analyst who is currently serving as the Logistics/MIS Specialist in Madagascar with the USAID-funded APPROPOP family planning support project. Over the past 20 years, his career has combined public health work and information system development in a variety of developing countries. He is one of the principal instructors in the MIS training courses organized by MSH, Boston, MA, USA.

Marc Karam, MD, was involved in tropical diseases projects in West Africa in the 1970s, in association with the University of Paris VI, France. He joined the epidemiological evaluation unit of the Onchocerciasis Control Programme in West Africa in 1980 and carried out field epidemiological studies as well as biomedical research. He subsequently joined the WHO Global Programme on AIDS in Geneva, first in the epidemiological research unit and then in the clinical research and drug development unit. He is currently in charge of certification of elimination and eradication of diseases in the Communicable Diseases cluster at WHO.
Introduction

While information needs drive the design of health information systems—sometimes even beyond a sustainable level of sophistication—resource considerations are equally important in health information system design and implementation. As mentioned in Chapter 2, no two health information systems are alike, because needs and resources differ within every country. But conceptually, all health information systems need a management structure. This management structure includes a minimum of two components: health information system resources and organizational rules (see Fig. 19). The development of these components is country-specific and will vary in breadth and depth. Critical resources to consider include personnel, supplies, computer hardware and software, and financial resources. Organizational rules are necessary to ensure optimum use of health information system resources.

This chapter discusses health information system resources and organizational rules, including structures and procedures, essential for an effective and sustainable health information system.

Resource requirements

The design and implementation of a health information system should be driven not only by the perceived need for routine information, but also by available resources. A health information system succeeds or fails due to resource constraints at both the primary care level (the most important point of data collection in most countries) and the immediate support level (the district). Using the need for resources at the national level as a yardstick can easily result in an overly complex and ineffective system. Furthermore, donor funding, while often available for the design and implementation of a health information system, is not a reliable financial source for routine operations, and should thus not determine the complexity of a health information system.

For the same reason, prior to discussing detailed resource requirements, two resource scenarios are presented which take account of different economic means available to individual countries. The first, low-budget scenario assumes that very limited public resources are available for health information system personnel and operating costs. The second, high-budget scenario assumes that the public sector has sufficient resources to support a health information system with larger and more educated staffing at the peripheral and district levels, and extensive computer use at all support levels. In this high-budget scenario, managers and health
care planners would be prudent to emphasize more intensive use of the information provided by a health information system with a simple design, rather than trying to implement a health information system with a complex design that could ultimately use up resources and be difficult to operate effectively.

These resource scenarios determine the design and implementation of the various components of the information-generating process, such as data collection, data processing, and information feedback. Components can be scaled according to the resources (i.e. more or less staff time and training) or need not be fully implemented (i.e. routine data collection and a few rapid assessments, but no large surveys). Most countries will fit somewhere between the two extremes described by the budget scenarios. A summary of health information system resource requirements by resource level is shown in Table 30. Detailed cost calculations are provided later in this chapter in Tables 31, 32, 33, and 34.

**Staff positions, roles, and responsibilities**

In many countries, cumbersome data collection processes are typical for a health information system. Nurses can take several days to complete required reports—valuable time that could be spent caring for clients and patients. Therefore, in determining staff resources for health information system-related activities, it helps to remember that improving the health status of individuals and populations through the delivery of curative and preventative services and health promotion is the primary task of medical and paramedical personnel.

**Primary care facility**

In managing the effective delivery of curative and preventative services, clinical staff should spend only as much time as necessary on administrative tasks, including those for a health information system (Box 29). Collecting data that can and should be used by a facility to maintain and improve service delivery is an essential health information system function; collecting additional data can easily result in a waste of scarce human resources.

Facilities and offices at all support levels require staff that are responsible for health information system-related activities, but whether these activities are performed by the care providers themselves or by full-time dedicated staff depends upon the budget scenario and service characteristics (Kleinau et al., 1995). Primary care providers generally do not need dedicated staff, with the exception of large facilities. For patient/client

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**Fig. 19 Elements of health information system (HIS) management**

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<th>Basic Health Services HIS</th>
<th>Organizational rules</th>
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<td>Case definitions</td>
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<td>HIS Supplies</td>
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<td>Hospital HIS</td>
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**Table 30 Health information system resource requirements under low- and high-budget scenarios (in 1997 US$)**

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<th>High-budget scenario</th>
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<td>Annual operating budget level (normalized per facility covered by health information system, without referral level)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>without facility salary costs</td>
<td>US$ 232</td>
<td>US$ 790</td>
</tr>
<tr>
<td>district/reg./national salary</td>
<td>112</td>
<td>340</td>
</tr>
<tr>
<td>training</td>
<td>19</td>
<td>132</td>
</tr>
<tr>
<td>computers</td>
<td>6</td>
<td>108</td>
</tr>
<tr>
<td>basic operating costs†</td>
<td>47</td>
<td>210</td>
</tr>
<tr>
<td>Per capita GNP</td>
<td>US$ 300</td>
<td>US$ 1000 or higher</td>
</tr>
<tr>
<td>Staff at primary care level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Facilities have few staff (1–2) of mostly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 1 person spends 10% on record keeping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Reporting and monitoring of a few (5) key indicators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Salaries are low ($ 100/month)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff at first referral level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mostly small hospitals with 50–100 beds, low occupancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Each unit keeps their own registers</td>
<td></td>
<td></td>
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<tr>
<td>• 1 person spends 25% on basic reporting</td>
<td></td>
<td></td>
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<tr>
<td>District staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HIS functions carried out by 2 district staff with other duties at 20% (salary $300)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Compile monthly/quarterly reports from about 30 facilities, monitor key indicators, provide simple feedback, maintain simple coverage maps, participate in general supervision</td>
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<td></td>
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<tr>
<td>Regional/national staff</td>
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<tr>
<td>• HIS information flows directly to the national level; regions might exist but play no separate HIS role</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 6 national staff spend 50% on HIS activities (salary $500)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Programmes rely mainly on the HIS for information</td>
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<td></td>
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<tr>
<td>Staff training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• District and national staff have an initial 3-day training every 5 years and a 1-day refresher per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Computer training: 2 weeks initial training, 2 days annual refresher</td>
<td></td>
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</tbody>
</table>

* Facilities have a wide range of staff with senior level training (nurse, clinical officer) |
• 2 persons spend 20% on record keeping |
• Reporting and monitoring of 5 or more key indicators |
• Salaries are high ($500 per month) |
• Medium-size hospitals with 100 or more beds, central admissions |
• Units keep additional registers |
• 1–2 full-time MIS staff, since reports can be extensive (including International Classification of Diseases reporting) |
• Districts have 2 staff who spend 50% on HIS and 50% on other monitoring and evaluation activities (salary $500), a total of 3 trained in HIS |
• Thoroughly analyse 30 monthly/quarterly facility reports, maintain district profiles, complete coverage plans, data quality checks, participate in other data collection/surveys |
• HIS information might flow through regional offices (assumed 5) or directly to national level |
• 2 staff per region spend 50% and 10 national staff work full-time on HIS (salary $1000), perform detailed geographic analyses, conduct operations research |
• Programmes might have dedicated staff for monitoring and evaluation to conduct additional data collection |
• Facility staff have a 3-day initial training every 3 years plus a 1-day refresher every year |
• District, regional, and national staff have a 5-day initial training every 3 years and a 3-day annual refresher |
• Computer training: 2 weeks initial training, 5 days annual refresher, LAN administration, user support |
Management of health information systems

Table 30 (continued)

<table>
<thead>
<tr>
<th>Health information system structure</th>
<th>Low-budget scenario</th>
<th>High-budget scenario</th>
</tr>
</thead>
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<tr>
<td><strong>Data collection instruments and supplies</strong></td>
<td>• Minimum of 6 generic register books are used and adapted by hand for clinic activities • Monthly or quarterly reports cover essential data only and are preprinted with 2 duplicates (facility, district, national) • Tally sheets are either reusable or hand-drawn • Key indicators are monitored on plain or engineering paper</td>
<td>• Minimum of 6 preprinted registers or individual patient records are used for clinic activities • Monthly/quarterly reports are short and preprinted with two duplicates (facility, district, regional/national) • Tally sheets are printed and distributed • Key indicators are monitored on preprinted charts and tables</td>
</tr>
<tr>
<td><strong>Computer equipment</strong></td>
<td>• National health information system office has 4 personal computers used partly for general office tasks</td>
<td>• District offices have 2 personal computers that also do general office tasks; manual backup system exists • Regional offices have 2 computers • National level has 10 computers dedicated to HIS tasks</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td>• Software is off-the-shelf and a simple flat-file database (i.e. Epi Info) or formatted spreadsheets • Or a simple database, self-explanatory, error correcting, includes population denominator and incidence estimates, has a simple administrative/inventory module • Produces basic maps, charts, and tables by district, region, country</td>
<td>• Advanced database management software with complex programming language • Requires substantial time for software design and programming • Relational database with separate modules for service activities, demographic and incidence estimates, finance, personnel, inventory, other administrative functions • Provides basic maps, charts, and tables for district level; more complex outputs for regional/national level • Assumes skills to use additional analytic software</td>
</tr>
</tbody>
</table>

*Since HIS needs vary widely between countries, it is difficult to estimate absolute budget requirements. Instead, costs are normalized by estimating an annual US$ amount per facility covered by the HIS based on direct costs at the primary level and all support levels for staff training, supervision, district, regional and national level operations. Referral facilities have more expensive systems; therefore, costs for hospitals are calculated separately. Hospitals usually receive proportionally more resources than the primary level, some of which should be used for a simple patient management system. Detailed cost calculations are provided later in this chapter.

†Basic operating costs include all HIS supplies for manual and computer operations, telephone, fax, electronic mail, and photocopies.

MIS = management information systems; LAN = local area network; HIS = health information system.

management, clinic staff responsible for specific services can perform data recording, including daily tallies of all service activities, as a routine part of their service delivery function.

Specific clinic staff should be assigned to compile service data for monthly and quarterly reports. This responsibility includes aggregating daily tallies from different services into running totals, transferring these sums into monthly reports, and updating charts and tables to monitor key indicators. For example, depending on the size of a facility and the budget scenario, one auxiliary nurse in a small dispensary might spend 2 days per month on this task, which amounts to about 10% of 22 total work days per month. Such a small facility might have a total of three
paramedical staff, attend to 200–300 outpatients per month, immunize 20–35 children under 5 years of age for each month, have a small family planning clinic, and care for a few chronically ill patients through home visits. As a second example, a busy health centre in an urban setting could have 5 times the volume and staff, and require a total of 9 days every month to aggregate daily service tallies and to complete the monthly or quarterly report. This could be accomplished if two nurses or health technicians spend 20% of their time on the health information system task, which includes monitoring key indicators, and presenting and reviewing the information with other facility staff and management.

Referral-level facilities have very different information needs and data collection procedures, requiring more costly solutions.

District level
The district health office must provide health information system support for facility staff. The low-budget scenario might only provide for up to two part-time (20%) health technicians, nurses, or administrative staff who also have other responsibilities, while high-budget districts might afford 50% time for two staff members. Their main responsibilities would be to aggregate monthly or quarterly reports from facilities, monitor key indicators for the district and update annual district health profiles, maintain district coverage maps, and present a quarterly executive summary to the district medical offices and the district governing board (Box 30). Even though these functions could be carried out by a single staff member (40% time), this is not recommended. With two staff who can perform the same task, there is the assurance that work is completed even when one staff member is absent. District staff responsible for health information system management functions participate in facility and community support or supervisory visits, in which they verify data quality through spot checks of records and registers.

In most middle-income and in some low-income countries, data processing at the district level has been computerized. Computerized data processing tasks do not require specialized staff. With little additional training, these tasks can be performed by paramedic and administrative staff.
Regional level

As more countries follow the model proposed by WHO to decentralize health administrative functions, responsibilities and resources will shift from regions to districts. In some countries (e.g. Zambia), regions have become part of the national level organization; in others (e.g. Ethiopia, Madagascar, Pakistan), they still represent a distinct level between the district and national offices. Combining regional and national health information system functions without a separate administrative entity may be the most efficient option in the low-cost scenario, since it avoids additional staff and operating expenditures, and shortens the flow of information between the district and central offices.

In larger regions that have distinct planning and implementation functions and the necessary resources, at least two staff responsible for the health information system are justifiable for about 50% of their time. Their responsibilities would be similar to those of national health information system offices and include preparing regional coverage maps, assessing interdistrict variations for key indicators, and presenting status reports to regional governing boards to guide decision making concerning public health (Box 31).

---

Box 30  District level

**Staff time for HIS**
- At least 2 health technicians, nurses, or administrative staff for 20–50% of their time.
- In large districts with more resources, a health information officer.

**HIS responsibilities**
- Aggregate and process facility reports (with or without computer).
- Monitor key indicators and prepare district health profile.
- Prepare and update district coverage maps.
- Present information to, and discuss with, district health management team.
- Supervise HIS activities at facilities.

Box 31  Regional level

**Staff time for HIS**
- For low-budget scenario, combine regional and national level HIS functions.
- At least 2 health technicians, nurses, or administrative staff each at 50%.
- For large regions with more resources, a health information officer.

**HIS responsibilities**
- Computerize aggregation and processing of district data sets.
- Monitor key indicators and prepare regional health profile.
- Analyse variations of indicators between districts.
- Prepare and update regional coverage maps.
- Present information to, and discuss with, regional health management team.
- Perform performance audits of district HIS activities.
National level

Depending on the budget scenario, national health information system management functions are assured by a team of 6–10 professionals working 50–100% of their time (Box 32). The teams are composed of health planners, epidemiologists, statisticians, mid-level technical staff, and administrative support personnel.

Since routine health information systems in most countries have been computerized at national, regional, and even district levels, a specialized computer staff (e.g. systems analyst, local area network administrator, user support specialist, computer programmer) is required, at least at the national level. Many countries will not have the means to hire all this personnel, but some essential functions like local area network administration and user support can be carried out by administrative or technical staff who receive special short-term training. Other more specialized functions like systems analysis and computer programming are mostly needed at specific times, such as during the development phase, and could be covered by short-term consultants.

Training personnel

The effectiveness of a health information system in providing information support to decision-makers, managers, and care providers depends upon well-trained staff. Not only must the mechanics of data collection be mastered, but high familiarity with case definitions and service standards are equally important. (A more detailed description of training contents and strategies is provided below under organizational rules.) Thus, for a health information system to produce valid, reliable, and useful information, staff skills must be built and maintained through initial training, regular refresher courses, and regular follow-up with supervision.

There are several reasons why training health unit staff in health information systems should be combined with other technical and manage-

Box 32 National level

Staff time for HIS
- For low-budget scenario, a total of 6 staff for 50% on HIS (2 epidemiologists/statisticians, 2 mid-level technical staff, 2 administrative support).
- For high-budget scenario, a total of 10 staff for 100% on HIS (3 epidemiologists/statisticians, 4 mid-level technical staff, 3 administrative support).
- Team headed by health information officer.

HIS responsibilities
- Develop long- and short-term objectives and work plans for an HIS.
- Computerized aggregation and processing of district and regional data sets.
- Monitor key indicators and prepare national health profile.
- Analyse variations of indicators among districts/regions.
- Prepare and update national coverage maps.
- Assess on an ongoing basis information needs of data users and ensure adequate restructuring.
- Perform performance audits of district HIS activities.
ment topics. Not only are health information system operations very dependent on general service delivery skills, but an integrated training approach also reduces costs for transportation and course organization.

District, regional, and national level health information system personnel often might need short-term or long-term training in epidemiology, statistics, and use of computers. Computer training will vary in intensity by level. District staff in high-budget countries require at least an introduction to basic skills to use the computer for data entry and reporting, but could benefit from some exposure to word processing and spreadsheet use. These basic skills could be taught through hands-on exercises during general health information system training. Regional and especially national level staff need more intensive computer training, because they use more applications and should be able to support users in the districts and other departments of the Ministry of Health. Depending on the size of the national health information systems office and the computer technology, one or two persons should receive in-depth training in local area network administration and user support.

**Health information system supplies, procurement, and distribution**

Although a health information system might be well designed to generate relevant information and allow timely feedback at the facility, district, and national levels, it falls short of its goal if it fails to collect data at the point of service delivery, or to process data at the district, regional, or national level. To protect considerable investments in health information system restructuring, the government must budget for basic supplies at all levels to assure a functioning system. In addition, effective procurement, storage, and distribution systems are required to ensure that these supplies are available in a timely manner to the data collecting and processing staff (Box 33).

**Box 33 An illustrative list of essential HIS supplies**

- Patient/client records (under-5 cards, reproductive health cards, tuberculosis follow-up cards, etc.).
- Outpatient register and/or tally sheet.
- Inpatient register and/or tally sheet.
- Maternal care register.
- Special registers (family planning, HIV/AIDS, tuberculosis, other chronic illnesses and disabilities).
- Community outreach register.
- Coverage plan and map with communities, community-based workers, demographic data.
- Large-size paper to chart key indicators.
- Financial record forms.
- Drug stock cards.
- Health committee meeting register and facility/community action plan.
- Monthly/quarterly report forms.
- HIS user guide with templates.
- Writing utensils.
- Solar-powered calculator.
Facilities require sufficient supplies of patient/client cards, registers, and report forms. Patient/client cards, in their simplest and least expensive form, can be generated from blank notebooks. While this works well for first-level acute curative care, chronic diseases and preventive care need well-designed and preprinted record cards. In low-budget countries, blank registers can be provided to save costs. Facility staff can draw appropriate columns and titles according to templates in the health information system user guide. Countries with a high budget might opt to preprint most facility registers. This would ensure better consistency of data collection, but would increase costs substantially. Some economies can be achieved by combining information into one register rather than using separate ones. Another means of saving costs is to record data on tally sheets instead of registers, particularly for data to be aggregated. If printed on thick paper, tally sheets can even be reused if data are recorded with an erasable pencil. In order to reduce errors, report forms should always be preprinted. Sufficient quantities should be available to prepare two to three copies. More details on the format of various data collection instruments can be found in Chapter 6.

Other essential health information system supplies are writing utensils (pens, markers) and large sheets of paper to monitor key indicators such as Expanded Programme on Immunization coverage, health flags, and coverage maps. If resources are available, poster-size laminated (erasable) preprinted charts could be provided for monitoring key indicators and updating coverage maps. Each health facility should also have a user guide, both for data collection procedures, as well as for use of information. Finally, in order to reduce error rates, simple, solar-powered calculators are no longer a luxury in a first-level care facility, even in low-income countries. Their unit price has been substantially reduced in the last decade.

District supplies include tally sheets and preprinted report forms (if data processing is done manually). Districts also need to keep in stock all printed supplies required by health units.

In countries with high health information system budgets, it is worthwhile, even at the district level, to invest in communications technology, such as telephone, fax, and electronic mail. Also, a photocopier can greatly contribute to more effective and efficient data transmission. Annual operating costs for telephone calls, which includes fax and electronic mail (because they use the same phone lines), can be as high as US$ 240–1200. Except for regular telephone conversations, fax and electronic mail require stable and low-noise communications to work effectively. High-budget countries might be able to afford this technology, but since many countries will at best have only a telephone, these costs are not included in the calculations of a minimum budget in Table 31.

Even in low-income countries, national or regional health information systems offices should be equipped with modern communications technology, such as telephone, fax, and electronic mail (these costs are included in Table 31). Their responsibility to provide feedback to lower levels requires the availability of one or more heavy-duty photocopiers, or at least a stencil duplicator as a low-cost alternative. These offices are also responsible for developing, producing, and distributing guidelines and user manuals for the health information system. In addition to their availability in facilities and districts as reference materials, these
documents are also used in introductory and refresher training courses on health information systems. Countries with low health information systems budgets will probably have to obtain donor funding to produce manuals and guidelines.

**Computer hardware, software, and maintenance**

The use of personal computers slowly increased in developing countries during the 1980s, when they were mainly employed at the national level to process data and to perform other office tasks. High prices and

Table 31  **Detailed calculation of operating costs**

<table>
<thead>
<tr>
<th>Low budget</th>
<th>Costs</th>
<th>High budget</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility staff time: 1 auxiliary at 10% (= 18 hours if 22 days/month, ½ hour per day to tally = 11 hours/month, 7 hours to do monthly report)</td>
<td>US$ 120</td>
<td>Facility staff time: 2 nurses at 20% (= 71 hours if 22 days/month, 1 hour per day to tally = 22 hours/month, 16 hours to do monthly report, 16 hours on data use, mapping, charts, 15 hours for community surveillance)</td>
<td>US$ 3000</td>
</tr>
<tr>
<td>Registers*: 6 generic every 2 years, tally sheets, report (small volume) incl. carbon paper</td>
<td>40</td>
<td>Registers*: 6 printed every year, tally sheets, report (large volume) incl. carbon paper</td>
<td>180</td>
</tr>
<tr>
<td>Facility staff HIS training part of medical training (1 every 3 years)</td>
<td>10</td>
<td>Special HIS training of 2 staff per facility (3 days, 1 every 3 years)</td>
<td>100</td>
</tr>
<tr>
<td>Staff: district (2@20%), regional (0), national (6@50%)</td>
<td>40</td>
<td>Staff: district (2@50%), regional (2@50%), national (10@100%)</td>
<td>340</td>
</tr>
<tr>
<td>Staff training district (2), regional (0), national (6): 3 days initial HIS (1 every 5 years), 1 day/year refresher HIS; national/regional: 2 weeks initial computer training (1 every 5 years), 2 days annual computer refresher</td>
<td>9</td>
<td>Staff training district (3), regional (2), national (10): 5 days initial HIS (1 every 3 years), 3 days/year refresher HIS; national/regional: 2 weeks initial computer training (1 every 3 years), 5 days annual computer refresher, 4 week LAN administration (2 persons every 3 years), 2 weeks user support (2 persons every 3 years)</td>
<td>32</td>
</tr>
<tr>
<td>Supplies: district, regional, national incl. computer, photocopies, phone, electronic mail</td>
<td>7</td>
<td>Supplies: district, regional, national incl. computer, photocopies, phone, electronic mail</td>
<td>30</td>
</tr>
<tr>
<td>Manual system at district level, national level computerized, simple database for national office (5 computers with electronic mail, laser and dot matrix printer, accessories, 1 photocopier, 1 stencil duplicator, 1 fax, 5-year depreciation)</td>
<td>6</td>
<td>District, regional, and national levels computerized, relational database for district/regional/national levels (3 computers, 2 dot matrix printers per district and region, 10 for national office, and 3 laser and 3 dot matrix printers, accessories, peer-to-peer network, 6 photocopiers, 5 fax, 5 electronic mail accounts, 5-year depreciation)</td>
<td>108</td>
</tr>
<tr>
<td>Annual total per facility</td>
<td>US$ 232</td>
<td>Annual total per facility</td>
<td>US$ 3790</td>
</tr>
</tbody>
</table>

*Outpatient, inpatient, Expanded Programme on Immunization/growth monitoring, maternity, family planning, infectious/chronic diseases. LAN = local area network.
difficulties in using the technology contributed to this slow growth, and the health sector, with its proportionally small share of the national operating budget, was less likely to be able to afford office automation. In the 1990s, increased performance and user friendliness, combined with a drop in prices and increased vendor competition, resulted in personal computers becoming widely available in developing countries. They are now found at the regional level as well as in district offices, when resources make this possible.

An overview discussion on purchasing computer hardware and software, as well as on maintenance issues is provided in Chapter 11.

**Detailed health information systems budget calculations for operational expenditures**

Because health information system needs vary widely between countries, it is difficult to estimate absolute budget requirements. Instead, costs are normalized by estimating an annual US$ amount per facility covered by the health information system, based on direct costs at the primary level and all support levels for staff training, supervision, district, regional, and national level operations. Referral facilities need more expensive systems to handle the greater variety of services and the larger volume, thus costs for hospitals are calculated separately below. In low-budget countries it might be appropriate to use two to three times the costs for primary-level facilities as a rough estimate of health information system costs for very small first-level hospitals instead of the higher estimates given here. Health information system development costs, but not initial design costs, are shown separately in Table 32, but are included in Table 31 as depreciation costs over a 5-year period.

Table 31 uses the same structural health information system elements as used in Table 30 in determining annual budget requirements per health unit covered by the health information system under the two scenarios. Total operating costs depend extensively on personnel costs at the facility level, which amount to about 50% under the low-budget scenario and about 80% for high-budget countries.

Low-budget countries are assumed to have 50 districts with 30 facilities each, equalling 1500 facilities. High-budget countries are assumed to have 100 districts with 30 facilities each, equalling 3000 facilities. It is further assumed that all health programmes are integrated at facility and district levels. However, at the national level some programmes will maintain separate technical offices with special information needs that

<table>
<thead>
<tr>
<th>Table 32  Development costs for a national health information system</th>
</tr>
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<tbody>
<tr>
<td>Low budget</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Hardware regional, national</td>
</tr>
<tr>
<td>Hardware districts</td>
</tr>
<tr>
<td>Software development</td>
</tr>
<tr>
<td>Initial HIS design*</td>
</tr>
</tbody>
</table>

*Not depreciated and not included in Table 28; consists of health information system planning, consensus-building process, technical assistance, development of materials and production ( registers, reports, user manuals), general staff training (in low-budget countries health information system design is usually financed by donors).
might have to be satisfied by sources other than the health information system (i.e. the Expanded Programme on Immunization and immunization coverage surveys).

Resource requirements for a hospital health information system

Hospitals require an information system that serves primarily administrative and clinical functions and that can directly improve the quality of services (Box 34). Administrative functions include patient flow between registration and different departments, accounting and billing, and inventory control for the pharmacy. Clinical functions cover medical records, including results of diagnostic procedures, access to standard diagnostic and procedure codes (i.e. ICD-10), prompters for essential patient information (i.e. obstetric risk assessment), or automated alerts in cases of drug incompatibility and contraindications. Most of the latter functions require a computerized system. Hospital information systems monitor indicators such as financial status, quality of care, type and volume of services provided to referred and nonreferred patients, length of stay, case fatality rates, comorbidities, and severity of illness. How systems are implemented in specific hospitals varies greatly among the type of facility, the economic status of its client base, and the technology available to automate the system.

Box 34 First level referral facility

Staff time for HIS
- Patient reception, admission, discharge (no additional HIS staff)
- Clinical staff register patient/client data (out- and inpatients, no additional HIS staff)
- Medical records (no additional HIS staff)
- Pharmacy services (no additional HIS staff)
- Laboratory, X-ray and other diagnostic services (no additional HIS staff)
- Accounting and billing (no additional HIS staff)
- Human resources (no additional HIS staff)
- Clinical departments and ancillary services tally service data daily (no additional HIS staff)
- HIS or statistics personnel aggregate service data and compile monthly reports; in small hospitals, HIS tasks can be shared with other functions such as accounting or billing: 2 clerks, 1 HIS office manager
- Well-endowed hospitals have a computerized information system and dedicated personnel: 1 HIS office manager, 1 HIS assistant, 1 computer programmer, 1 local area network administrator, 1 user support specialist

HIS responsibilities
- Monitor essential hospital operations (admissions, length of stay, mortality, waiting and service times).
- Monitor the financial viability of clinical care and other services (cost recovery).
- Assess the functioning of the referral system.
- Present information to, and discuss with, hospital management.
- Use information for continuous quality improvement.
In many countries, referral hospitals have more extensive reporting requirements than do primary care facilities. For example, instead of reporting volume by broad disease categories, hospitals in Eritrea, Ethiopia, Madagascar, and Zambia submit case counts by ICD category (Kleinau, 1995a; 1995b). This seems feasible because hospitals usually have more human and financial resources to support extensive reporting, even though some of this information reported through a health information system might be of little direct use to the hospital (i.e. just providing an exhaustive list of rare diseases without any reference population).

To estimate resource requirements for a hospital information system, the following elements are considered: staff dedicated to health information system functions, training, system supplies, computer equipment and software, and financial resources. Resources and costs are estimated for a secondary hospital with about a 100–150 bed capacity and a volume of 4000–5000 discharges per year and 2000–3000 outpatients per month. A health information system in a tertiary facility would require about three to five times the resources and costs of a secondary facility.

**Staff**

All recording functions are routinely maintained by clinical and administrative staff, though data aggregation and reporting to hospital management and districts is done by dedicated health information system staff. All essential administrative and clinical services are listed because they provide the data for the system, but they do not require any special information system personnel. Health information system functions should be carried out by a separate hospital health information system office which reports directly to the hospital director.

**Training**

The validity and reliability of data collected by the hospital health information system depend on how well staff are trained in case definitions and proper registration of cases (for a more in-depth discussion, see the section on organizational rules). Trainees include staff from clinical services, ancillary services, and finance and administration. Training accounts for the large part of the health information system budget because of the large number of staff involved. Costs can be reduced if senior hospital staff themselves provide the training. Training should be in short sessions of less than a day, in order not to disrupt patient care.

**Supplies**

Registers, medical records, and index card systems are necessary for a patient/client management system, whether kept manually or computer-based, and they are essential to any useful hospital health information system that ties into a national system. Therefore, costs are estimated for all patient management and health information system supplies. Direct health information system costs include general supplies of stationery, data tally sheets, and monthly reports.

**Computers and software**

It would be unlikely for most smaller rural hospitals with low operating budgets and not much revenue from patient payments to use computers.
Some facilities might be able to afford a few computers to improve patient registration, medical record retrieval and administrative tasks. Patient registration still requires developing a simple database program because of the large volume. Development time should not be more than 2 months.

Hospitals with much greater resources and substantial cost recovery, which could include private and public facilities, might be able to afford a complete computer-based patient management system. This system is built around local area network technology that allows all clinical, ancillary, and administrative services to access the same patient/client information. In addition it helps to improve quality of care by standardizing diagnoses through instant access to diagnostic categories, physician reminders to complete essential assessments, or alerts in cases of drug contraindications. Extensive computer use offers many benefits, but it comes at a high cost and requires appropriate infrastructure and support personnel. Patient management software is expensive, too, and takes time to develop (3 months to a year) if an off-the-shelf computer program is not acceptable.

**Detailed hospital health information system cost calculations**

Tables 33 and 34 provide some rough estimates of annual costs for a hospital health information system. The first table only considers costs related to manual operations without computer technology and development costs. As for a basic health services health information system, personnel amounts to the largest cost item, followed by supplies. If all hospital staff need some refresher training in the case definitions and administrative tasks that are prerequisites for good data collection, then these training costs are much higher than training specifically targeted to a few health information system staff.

The design and development costs of a hospital health information system are estimated at US$ 20,000 in a low-budget country and US$ 50,000 in a high-budget one for both manual and computerized

<table>
<thead>
<tr>
<th>Table 33</th>
<th>Detailed calculation of operating costs for a hospital health information system</th>
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<tbody>
<tr>
<td><strong>Low budget</strong></td>
<td>Costs (US$)</td>
</tr>
<tr>
<td>Staff time: 1 HIS manager at 50% ($200/m), 2 clerks at 100% ($100/m)</td>
<td>3600</td>
</tr>
<tr>
<td>Registers, tally sheets, report (small volume) incl. carbon paper, medical records</td>
<td>1200</td>
</tr>
<tr>
<td>Facility staff training in case definitions, administrative tasks, data collection</td>
<td>1000</td>
</tr>
<tr>
<td>HIS staff trained in reporting, analysis, interpretation, feedback</td>
<td>300</td>
</tr>
<tr>
<td>Annual total per hospital</td>
<td>6100</td>
</tr>
</tbody>
</table>
systems. They include health information system planning, short-term technical assistance, development and production of data collection instruments, and general staff training. These costs are in addition to the development costs for the national system (see Table 32).

In some countries, a new hospital, especially if privately owned, might want to adopt computer technology on a small or large scale over the coming years. For these facilities, hardware, computer staff, and computer training are shown in Table 34, including systems design and development costs. Table 34 contains costs for a 5-year implementation period to account for the fact that computer equipment lasts at least 5 years, and that design and development efforts are only justifiable over a longer time frame. Any computer-related costs need to be added to the operating costs shown in Table 33.

Organizational rules

The mere availability of health information system resources as described in previous sections is not sufficient. A set of organizational rules is required in order to ensure optimum use of resources in support of the information-generating process. The following paragraphs present an overview of organizational rules for various health information system components.

**Overall health information system management**

One of the first decisions that countries face when reorganizing or strengthening their health information system is where to place the

### Table 34 Development and implementation costs for a hospital health information system (HIS)

<table>
<thead>
<tr>
<th></th>
<th>Small computerized HIS Costs (US$)</th>
<th>Large computerized HIS Costs (US$)</th>
</tr>
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<tbody>
<tr>
<td>Minimum hardware</td>
<td>8,000</td>
<td>LAN-based hospital HIS*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>Complete hospital LAN*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80,000</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>Computer staff: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>programmer ($750/m),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 LAN administrator ($750/m),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 user support ($500/m)*</td>
</tr>
<tr>
<td></td>
<td>80,000</td>
<td></td>
</tr>
<tr>
<td>Staff training in computer use</td>
<td>2,000</td>
<td>Staff training in computer use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25,000</td>
</tr>
<tr>
<td>Software development†</td>
<td>20,000</td>
<td>Software development†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80,000</td>
</tr>
<tr>
<td>Initial hospital HIS design†</td>
<td>20,000</td>
<td>Initial hospital HIS design†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50,000</td>
</tr>
<tr>
<td>Annual average per hospital‡</td>
<td>2,160</td>
<td>Annual average complete LAN‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45,260</td>
</tr>
</tbody>
</table>

*Costs are estimated over a period of 5 years. Hardware, staff, and training are per hospital.

†Software and initial HIS design are one-time costs. None of these costs are depreciated. Initial HIS design consists of hospital HIS planning, short-term technical assistance, development of materials and production (registers, reports, user manuals), and general staff training. The same design and software can be used in hospitals on the same level.

‡Annual average costs per hospital exclude initial HIS design. Countries with a small computerized hospital HIS are assumed to have 50 hospitals. Countries with a larger computerized and local area network based hospital HIS are assumed to have 100 hospitals.
responsibility for managing it. The locus of health information system responsibility in the health care system determines the importance attributed to the information function of public health services and its leadership role. Most countries have a dedicated health information system service, division, or department within the ministry of health. In countries where the health information system unit reports directly to the secretary-general (or the equivalent highest decisional level) of the ministry, its cross-cutting role and leadership responsibility are clear. Where the health information system unit is attached to a technical service, for example disease control and prevention, the epidemiological surveillance function might be emphasized, but its leadership role in information management could be weakened vis-à-vis other services and programmes.

Experience from several countries has shown that placing health information system management on the highest level within the health sector hierarchy does express the importance of information in strategic planning and policy making. In Zambia the health management information systems unit is part of the Central Board of Health and thus plays a key role in health sector reform (Health Management Information Development Team, 1997). This and a participatory approach led to a clear vision for the role of the health information system and to a systematic and well-documented implementation process.

Overall health information system design and direction should be provided by a multidisciplinary committee to meet the needs of various users of information. A health information system steering committee has to set the long-term goals for a health information system and needs to decide which key indicators should be measured and which data are necessary. To be effective, data collectors as well as users at various levels should be represented on this committee. The role of the committee is to provide overall recommendations, to set general health information system policies, and to support the health information system manager, but its role is not to micromanage health information system functions. Examples of countries that opted for directing health information system development and implementation through a steering committee are Eritrea, Madagascar, Pakistan, and Zambia.

While the location of overall health information system management is primarily an issue on the national level, the management role at the district level is of crucial importance, as discussed in other paragraphs of this section. District health teams not only produce information but are also users. Chief medical officers need data for planning and managing district health services and for allocating resources where decentralization foresees such responsibilities. Assuring the quality of data should be a key responsibility of district health management teams because they directly control data collection by the health facilities.

Data collection standards including case definitions

Routine and nonroutine data collection instruments are described in detail in Chapters 6 and 7. Data are only comparable if they have been collected using the same approach, or if it has been validated that two approaches yield the same information. For example, indicators estimated from facility survey data will usually yield different results when evaluated with a supervision instrument. Or, procedures to calculate couple-years of protection need to be standardized in order to compare coverage for family planning services between districts.
Data collection standards include exact case definitions for clinical and other services. Dissimilar skill levels require that guidelines be adapted for all types of users. For instance, whereas in reference hospitals with experienced physicians and many diagnostic facilities case definitions can be adapted from ICD-9 or ICD-10, primary care facilities need symptom- or syndrome-based disease categories. Staff at ambulatory care facilities must know the difference between a new case and a return visit for the same illness. Further, though it might seem obvious, it is important that data be reported in the same way by all facilities. For example, if case load is reported by certain age groups, then all facilities need to comply; otherwise data cannot be analysed by age.

Data transmission, processing, and reporting rules

Data transmission and processing are described in detail in Chapter 8. Data will only be used if they are available in a timely manner. A clearly defined but realistic schedule must be developed by which all levels of the health system complete and forward reports in either paper or electronic format. Regardless of whether all points of service have provided reports on time (which in itself is one health information system performance indicator), subsequent levels must process data in conformity with the established schedule. Otherwise data arrival at other levels of the health system will be delayed as well. This becomes increasingly important as more and more levels become involved in a health information system. Experience shows that report arrival at the national level can be delayed for months, or even years, by delays at the first level.

A defined schedule is also important for regular feedback and supervisory activities, as both rely on the availability of information. While supervisory visits can take place without health information system data in hand, there is a missed opportunity for quality supervision, or for identifying where attention should be placed in quality assurance activities. Supervision and health information system feedback should be jointly planned following established schedules.

Service activities, including financial and stock reports, are generally reported on a monthly or quarterly basis. Staff inventories, equipment inventories, and reports about the physical condition of a facility can be reported annually. Whichever time period is chosen, a firm schedule should be developed and communicated to all units. If reporting intervals are long, necessary reminders must be included in the schedule.

The primary care level normally reports clinical data in less specific and far fewer disease categories than the referral level. It has to be decided whether reported case incidence statistics combine all level of care, or whether they are provided separately for primary care facilities and hospitals. If the national health information system office summarizes case reports from different types of facilities, disease categories have to be combined into broader groupings. The combination of primary care and hospital data is only appropriate if both provide similar types of care, for example ambulatory services, even though hospitals do so with more highly-qualified staff. Combining data from referred patients with data from primary care would be inappropriate.
Confidentiality and right to privacy

Clients expect that their privacy will be protected when they supply information to the service provider. Patient/client information does not leave the institution and is only divulged with patients’ or clients’ explicit knowledge and consent.

As a matter of principle, all client and patient data must be treated with confidentiality. This principle should not be broken even in the case of family members. For example, it is up to the woman to let her husband know that she uses birth control. However, there are a few exceptions where the right to privacy is superseded by the obligation to protect the public from serious health hazards. Certain illnesses with mandatory reporting fall into this category. Confidentiality requires a set of rules that can differ from country to country.

Often data gathered at the facility level are associated with research efforts. In general, it is inappropriate to use clients’ data without their expressed consent. If such consent is not obtainable, all information identifying specific individuals must be omitted or completely disguised. All research activities must follow national standards of biomedical ethics.

Training design and standards, production, and dissemination of materials

Whether redesigning an existing health information system or introducing a new system, staff require introductory training as well as regular refresher sessions. Since training is often expensive, health information system design should be simple enough to require only a minimum amount of training for personnel to collect, process, and use data.

Ideally, health information system training for health unit staff should be combined with courses that improve clinical or other service delivery skills. This may be the only feasible option under the low-budget scenario. Initial training includes at the minimum 1 day of practical exercises in filling out registers, tally sheets, monthly or quarterly reports, and monitoring key indicators. If a higher budget permits more extensive initial training, the course can be expanded to 3 days. Such intensive training will focus particularly on the use of information for decision making at the local level. Topics would include preparing population coverage maps, estimating target populations, estimating the expected incidence for key diseases, preparing indicator charts, or discussing options to improve coverage and quality of services. Whether health information system budgets are low or high, staff should regularly and at least annually attend short refresher courses. Generally 1 day of health information system topics during general management or clinical refresher training is sufficient.

Training facility staff is mainly carried out by district health information system personnel with some assistance from the regional or national levels.

Initial training of district health information system staff requires between 3 and 5 days. District managers require an in-depth understanding of data collection procedures and use of the information at the facility level for a triple purpose: to use the information for district level management, to become trainers of facility staff, and to provide supportive super-
vision to the staff. The duration of the initial training and its frequency depend on the available budget, but every 3–5 years is appropriate.

Finally, national and regional health information system staff require extensive training. First of all, in order to become expert trainers for district staff, they need to have a profound understanding of the peripheral data collection system. In addition, they need training to assume their specific responsibilities at the national or regional levels in reviewing policies and establishing norms for data collection, flow, and processing. They need to carry out detailed geographic and trend analyses, and to provide information for high-level management decisions that impact on service access, quality, and equity. The role of regional offices varies between countries. In a low-budget health information system, information should flow directly between districts and the national office, thus eliminating the need to train regional staff. Very large countries and those with high-budget health information systems could require training regional level personnel, following the same content as national level staff.

Training materials should be simple and brief, and based upon practical exercises. The health information system instruction manual, describing all data collection instruments and data collection standards, should be the main reference document. The trainer’s manual needs to be more complete and should include exercise workbooks and charts to explain key health information system concepts and information flows. All these materials are developed during the health information system design phase. Sufficient training materials should be available for refresher training and reprinted when necessary.

**Computer use**

Computer technology can greatly enhance and expedite data processing and the presentation of information in a health information system. It greatly reduces the time required for processing data at the district, regional, and national levels, as well as the number of errors inherent in a manual process. This does not mean that technology is a panacea for more fundamental health information system problems (e.g. lack of basic supplies at the point of data collection and an overly burdensome design).

Countries with a low-cost health information system use computers mainly at the national and regional levels, whereas most districts process data manually. Even countries that have the resources to computerize district offices should be prepared to process data for key indicators manually, as working conditions can be treacherous and repair services may not be readily available. If the health information system is totally reliant on computer technology, the system is likely to fail in the medium term. Therefore manual data processing should be taught at all health information system training courses.

**Procurement and distribution system for health information system equipment and supplies (including computers)**

In most countries, the general finance and/or administration offices of the ministry of health are responsible for procuring and distributing health information system equipment and supplies (computers, software, printed data collection instruments, and other supplies). Rules and
regulations for health information system equipment and supplies are therefore the same as for other equipment and supplies. International tenders can save costs, provided large quantities are ordered and the purchase is tax exempt. If donors such as the World Bank are involved in initial procurement, additional regulations may apply.

Equipment should be standardized to facilitate maintenance and upgrades (i.e. same brand, similar configuration). This provides some assurance that parts can be used interchangeably. Standardization of software packages is required in order to allow for effective staff training. The same applies to printed materials such as registers, data collection forms, and report forms.

Printed health information system supplies are best distributed through the same supply system as drugs and medical supplies. Computer supplies should be provided through different channels. In countries with district level computerization, each district office should have an annual budget to procure computer accessories. This is feasible if budget responsibilities have been decentralized. In the other cases, national and regional health information system offices should function as suppliers. Supply management procedures must be communicated clearly to all concerned staff, recipients, and suppliers.

A maintenance and replacement policy and budget should be developed, as well as a process to correct equipment failure outside major cities. This is probably the greatest challenge to maintaining a computerized health information system, since maintenance and replacement costs are generally not affordable except in countries with considerable health information system resources. Initially donors might be of some help, but the government must eventually adopt a more sustainable solution. Providing districts and regions with budget autonomy is probably the best approach. In the case of a centrally managed budget, district computers can be out of order for extended periods.

Using private sector computer vendors for maintenance seems to be the most cost-effective solution. Private vendors obtain their revenues from sales, and can provide maintenance more efficiently on an as-needed basis.

Establishing a government-owned repair shop is less cost-effective, as such facilities cannot afford highly qualified technicians due to low public sector salaries. Also the operating costs to run a repair shop are very high, and require maintaining a large inventory of parts. Maintenance contracts should be avoided, as they are very expensive for the client and very profitable for the vendor (at least 10% of the purchase price on an annual basis).

Computers should be delivered with software preinstalled, especially to district offices whose staff cannot be expected to install software themselves. Staff training should be provided immediately after delivery of computer equipment, eventually with support from commercial computer vendors and donor technical assistance. Country experience has shown that staff have great difficulties using information technology if the equipment is delivered without appropriate staff training.
Continuous quality assurance of health information system operations and data

Training personnel at facilities and on all support levels by itself will not assure data quality and compliance with regular reporting. Training must be complemented by regular support and supervisory visits to facilities by district staff, and by performance audits of districts by national or regional offices. Visits should be structured, and should assess health information system operations systematically using a checklist. Part of the audit should be a random check of registers and medical records to verify numbers in monthly and quarterly reports.

Examples of questions that could be included in a facility supervision checklist follow. Most require simple yes/no answers. Not all areas need to be addressed during each visit; rather, the team should focus on areas that need improvement.

- Are registers kept according to national norms? Compare each register with its template and check.
- Are daily tallies kept for six key services? (Define six key services).
- Does a random check of two to three clinical activities show matching numbers between registers/medical records and the monthly report?
- Is the coverage map for the health facility up to date and is appropriate demographic data used?
- Are charts that monitor key indicators up to date?
- Is there evidence that the information generated is used (e.g. appropriate action taken if the threshold is reached)?
- Are sufficient health information system supplies available for the coming 3 (or more) months?
- Did health unit staff receive health information system training?

Examples of questions that could be included in a district performance audit checklist follow. Most require only a calculation of percentages.

- What proportion of facilities submit reports as defined by national norms?
- What proportion of facilities submit reports within the time frame specified?
- What proportion of facilities received a health information system supervisory visit during the previous 3 months?
- Did district staff correctly aggregate facility data into a district report based on a small random check?
- What proportion of districts have an updated coverage map and use appropriate demographic data?
- What proportion of districts have a chart with updated key indicators?
- What proportion of districts show evidence that information generated is used (e.g. appropriate action taken if threshold is reached)?
- What proportion of districts have sufficient health information system supplies available for the coming 3 (or more) months?
- What proportion of districts have staff trained in health information systems?

Role of and interaction with the private sector (nongovernmental organizations, private practitioners)

In most developing countries, nongovernmental organizations participate in a national health information system—especially when the gov-
ernment subsidizes this sector. These facilities face the same challenges as public sector facilities, and should be given the same support and supplies. The not-for-profit sector can contribute important experience to the design and implementation of a health information system, especially when community partnerships and surveillance are involved.

Health information system involvement by the private for-profit sector varies. In most countries it does not participate in the public sector system unless private practitioners claim reimbursement through public funds, such as social security. If such payments are involved, the public sector can impose and enforce reporting requirements. Otherwise the public sector has no leverage and cannot coopt private providers into reporting. This might be possible on a voluntary basis, but results are typically poor, as experience has shown.

Conclusion

Health information system management should and does, as examples for many countries show, assume leadership in providing an information-rich environment and in promoting the strategic role that routine information plays in planning and managing health services. The basis for health information system management is a solid management structure, including affordable health information system resources and a well-established set of organizational rules.

This chapter provided guidelines on how to plan, acquire, and manage health information system resources efficiently within a given budget situation. It also outlines how to establish various organizational rules that ensure production of quality and timely information. Health information system managers at national, regional, and district levels play a key role in developing and implementing these rules and adapting them to each country’s setting.

References


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