

# HEALTH METRICS NETWORK



FRAMEWORK AND STANDARDS FOR THE DEVELOPMENT  
OF COUNTRY HEALTH INFORMATION SYSTEMS



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# PREFACE

The Health Metrics Network (HMN), launched at the World Health Assembly in May 2005, was established to help countries and partners meet the challenge of generating data for evidence-based decision-making. It is the first global health partnership that focuses on strengthening health information and statistical systems rather than on a specific disease. HMN was initially funded by the Bill and Melinda Gates Foundation. Other founding members of the Network include ministries of health and national statistics offices, multilateral agencies, global health partnerships, bilateral donors and technical experts. The Network brings together producers and users of health information in support of country-led efforts to strengthen their health information systems. The Secretariat of the Health Metrics Network is hosted by the World Health Organization. Only a strong global network is in a position to stimulate the coordination and alignment of partners around a harmonized framework for the development of country health information systems.

The goal of HMN is to increase the availability, value and use of timely and accurate health information in countries and globally. HMN will achieve this by fostering agreement on goals and coordinated investments in country health information systems. Improved coordination and coherence is made possible through the forging of consensus around the vision, standards and processes required of health information systems summarized in the present document, the *Framework and standards for the development of country health information systems* (HMN Framework). The Framework serves two broad purposes: (1) at country level, it should focus investment and technical assistance for the standardized development of health information systems (HIS), and serve as a basis for baseline HIS assessment and diagnosis and a roadmap for the development of HIS plans, and provide for ongoing monitoring and evaluation; (2) at the country and global levels, the Framework should enable access to and use of better health information. HMN support is focused on low- and middle-income countries.

The Framework is expected to evolve over time, as HMN learns from working with countries and global partners. This first edition builds upon a wealth of inputs on different aspects of health information systems, obtained through consultative meetings and country visits by the HMN partners during the period 2003–2005. The adaptation of the Framework will be an iterative process as the Network progresses and health information systems in countries mature.

Although the HMN Framework is primarily a technical document, its adoption for general use will require strong political endorsement and consensus-building. The Network is actively seeking endorsement of the Framework by key stakeholders such as the World Health Assembly, the United Nations Statistical Commission, the High Level Forum on the Health Millennium Development Goals, and the forums and board meetings of partners and alliances such as the Global Alliance for Vaccines and Immunization (GAVI) and the Global Fund to fight AIDS, tuberculosis and malaria. The generic Framework presented here will form the basis for special versions targeting specific audiences such as policy-makers, health planners and HIS

managers, the media and civil society. The Framework is not intended to replace existing manuals, guidelines and other documents that provide detailed information on specific elements of health information systems. HMN seeks to identify appropriate, existing standards and to promote them – not to invent new ones unnecessarily.

The HMN target is that, by 2011, the HMN comprehensive Framework will be the universally accepted standard for guiding the collection, reporting and use of health information by all developing countries and global agencies.

# EXECUTIVE SUMMARY

While knowledge and understanding of the global public health situation have improved since the 1990s, owing to important investments in data collection, there remains a huge gap between what public health professionals know and what they need to know to improve the health of the world population. The Health Metrics Network (HMN) is an innovative global partnership founded on the premise that better health information means better decision-making, which results in better health.

Reliable and timely health information is an essential foundation of public health action, both at the international and national levels, particularly when resources are limited and the unwise allocation of funds can mean the difference between survival and death. However, few developing countries have sufficiently strong and effective health information systems even to permit adequate monitoring of progress towards the United Nations Millennium Development Goals.

Unfortunately, it is often in those countries that have the greatest need that data are not available, owing to underinvestment in the systems for data collection, analysis, dissemination and use. It is not because countries have insufficient resources that they should forgo good health information. Indeed, they are the ones that can least afford to be without it. Even when data are available, they are often out of date, which renders the challenge of assessing trends particularly difficult. Decision-makers do not have the information required to identify problems and needs, make evidence-based decisions on health policy and allocate scarce resources in an optimal way.

The difficulties inherent in the collection of good public health data, both at the national and international levels, are not only the result of financial constraints. Measuring health is conceptually and technically complex. Statistical, public health and biomedical knowledge and expertise unique to each disease or programme area are required. Accurate measurement depends on the availability of disease-specific biometric tests, clinical diagnoses, and the feasibility of measuring the population and the health services. Thus, health statistics may vary greatly in terms of the reliability and validity of indicators, and of the usability and accuracy of measurement instruments.

Health information systems go beyond the responsibility of any single government entity. Health information is both produced and used by many different institutions, e.g. the ministry of health, the national statistics office, the private sector, civil society organizations, donors and development assistance agencies. Health information systems have thus evolved in a haphazard and fragmented way following administrative, economic, legal or donor pressures. Health information systems have been further fragmented by the demands of disease-focused programmes, often caused by the diversity of donor requirements and international initiatives directed to specific areas. The capacity of country health information systems may easily be overwhelmed by these multiple parallel information demands coupled with administrative pressures to cut costs and increase efficiency.

In the context of health sector reform and decentralization, health systems are managed as close as possible to the level of service delivery. This shift in functions between the central and peripheral levels has generated new information needs and led to a profound restructuring of information systems, with changing requirements for data collection, processing, analysis and dissemination. Health sector reforms also magnify the need for standardization and quality of information, presenting a further challenge to national health authorities. Data are often collected without being analysed critically or turned into information that can be used for day-to-day management or longer-term planning. Meanwhile, health workers are overburdened by excessive data and reporting demands from multiple, poorly coordinated subsystems.

The presentation of epidemiological data is generally aimed at specialists and other experts, and there is little effort to make the information understandable to the lay public or to non-health specialists. As a result, there is a widely established perception that health information is obscure, unclear and sometimes contradictory. The demand by the public for accountability and evidence-based decision-making is increasing, while the involvement of multiple donors in the public health sector has created a greater awareness of the need for good data to avoid the launching of misguided interventions and the resulting waste of efforts and resources, and loss of credibility.

The difficulties experienced in generating, analysing, sharing and using data are common to many countries and regions, and the objective of a health information system is the same for all: to produce relevant and quality information in support of health interventions. International organizations, countries and statistics experts therefore need to pool their knowledge and experience to achieve the best results in this technically demanding area.

Broad-based consensus-building across all sectors is a critical first step, as much of the data needed by the health sector is generated by other sectors, and the resources required for strengthening health information systems generally come from constrained national budgets. Although the inputs of external partners and donors are initially important to catalyse action, countries themselves will need to sustain the necessary investments in the longer term. The health information system should therefore respond to the needs and requirements of all the institutions concerned within one comprehensive plan, which should be developed in collaboration. The control of major diseases should also be approached in a holistic and comprehensive way, and be based on a coherent health information system that binds together individual and community health interventions.

An essential step in strengthening a health information system is to bring data production together with data use. Users comprise those delivering care as well as those responsible for the management and planning of health programmes, including those financing them, both within the country (health and finance ministries) and outside (donors, development banks and technical support agencies). Users of health-related data are not only health care professionals or statisticians. Indeed, decision-making around country health priorities necessarily involves the wider community, including civil society, as well as policy-makers at the senior levels of government. These various users of data have different needs in terms of the level of detail and technical specificity required. A good health information system should be able to present and disseminate data in appropriate formats for all these audiences. It should also be borne in mind that sound health information is a global

public good and as such needs the support of the media and the public to ensure a continued investment of resources.

Strengthening a national health information system should be based on a felt need within the country itself. It should respond to the requirements of health information users while remaining realistic about what can be achieved within available resources and capacities. There should be a comprehensive vision of health information that addresses institutional and organizational constraints, including human and financial resources, while being flexible enough to adapt in response to changing needs.

Country plans for the improvement of national health information systems can be used to bring together international organizations, governments, donor agencies, health planners and statistics experts, communities and health providers in a shared mission to create or strengthen systems that can generate the sound health information needed by all.

The goal of HMN is to increase the availability, quality, value and use of timely and accurate health information by catalysing the joint funding and development of core country health information systems. In order to achieve this, HMN has three key objectives:

1. to elaborate a harmonized framework and standards for the development of country health information systems;
2. to support developing countries in adapting and applying the framework and standards to improve their health information systems; and to provide technical support and act as a catalyst to secure funding to this end;
3. to improve the quality, value and use of, and access to health information, by developing policies and offering incentives to enhance the dissemination and use of such information by all those concerned at the local, regional and global levels.

The *Framework and standards for the development of country health information systems* consists of three parts, dealing with the following aspects: (1) background, rationale and vision; (2) the framework and relevant standards; (3) principles, processes and tools for implementation.

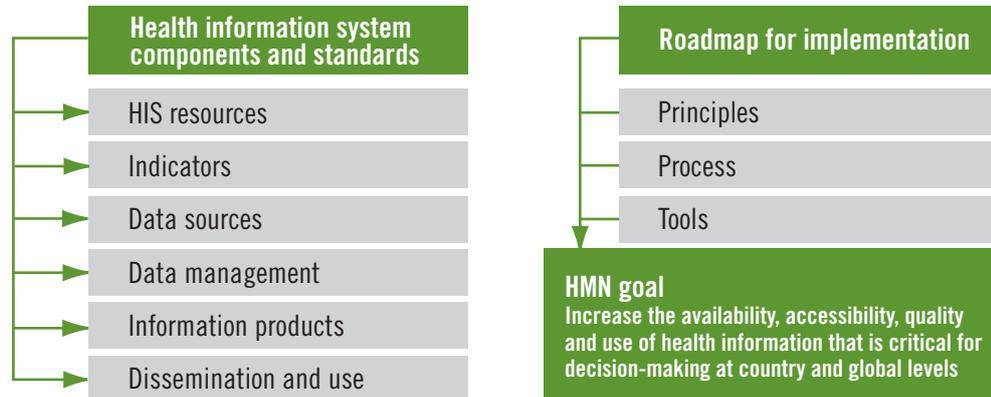
**Part 1** outlines the rationale and justification for strengthening health information systems (HIS), and reviews the issues and challenges to be faced in this respect. A new approach to HIS strengthening is described, and specific solutions to the problems identified are proposed. The key role of global health partnerships and the Health Metrics Network is discussed.

**Part 2** describes the components of a health information system, as shown in the left column of the HMN Framework diagram below, namely: HIS resources, indicators, data sources, data management, information products, dissemination and use. Desirable standards to be attained when strengthening or establishing each of the components of the health information system are comprehensively reviewed. Methods of data management are proposed, and the subsequent practical use of the information generated is discussed.

**Part 3** describes the process or roadmap for strengthening and/or building a health information system (shown in the right column of the Framework diagram below). Guiding principles for HIS development are outlined, and practical steps for implementation are proposed. Five phases of implementation are identified, namely:

(1) assessment; (2) coordination and leadership; (3) planning and priority-setting; (4) implementation of HIS strengthening activities; (5) monitoring, evaluation and reprogramming. The final sections of the document describe key HMN tools and briefly discuss the future of the HMN Framework. All users of the Framework are invited to participate in its further development.

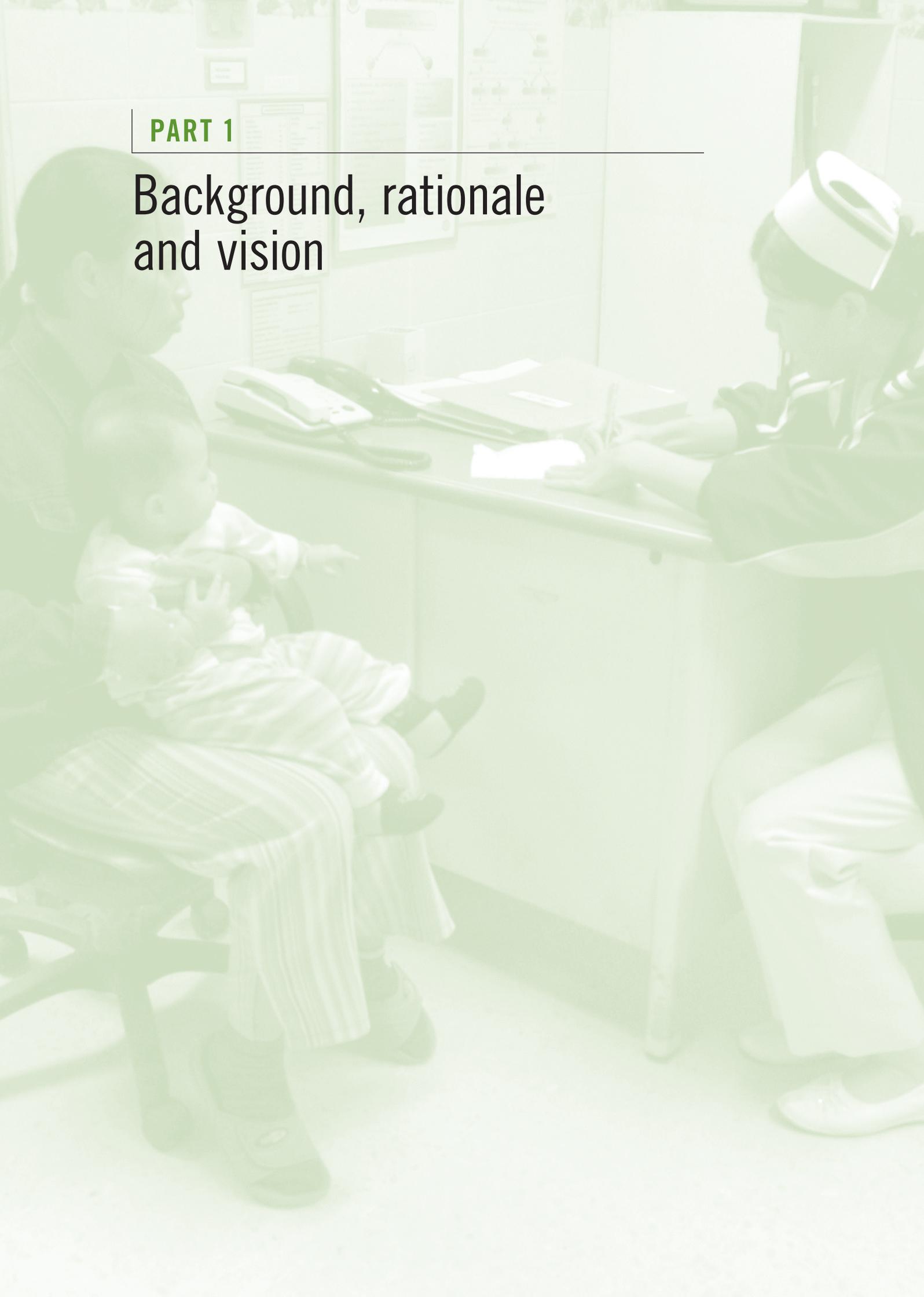
### HMN Framework



**PART 1**

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# Background, rationale and vision





## 1.1 Rationale and justification for strengthening health information systems

### 1.1.1 The importance of health information

All governments need good statistics. The need is particularly acute when resources are limited and an unwise allocation of funds can mean the difference between survival and death. Reliable and timely health information is an essential foundation of public health action. Often, however, it is not available in developing countries, owing to underinvestment in the systems for data collection, analysis, dissemination and use. As a consequence, decision-makers are unable to identify problems and needs, track progress, evaluate the impact of interventions and make evidence-based decisions on health policy, programme design and resource allocation. It is not because countries have insufficient resources that they should forgo good health information. Indeed, they are the ones that can least afford to be without it.

### 1.1.2 The challenge of measuring health

Measurement in health is conceptually and technically complex, requiring statistical, public health and biomedical knowledge and expertise unique to each disease or programme area. Accurate measurement depends on the availability of disease-specific biometric tests, clinical diagnoses, and the feasibility of measuring the population and the health services. Thus, health statistics may vary greatly in terms of the reliability and validity of indicators, and of the usability and accuracy of measurement instruments.

### 1.1.3 Poor performance of health information systems

Health information systems have evolved in a haphazard and fragmented way following administrative, economic, legal or donor pressures. Responsibility for health data is often divided among different ministries or institutions, and coordination may be difficult owing to financial and administrative constraints. For example, counting of births and deaths – a basic building block of the health information system – is generally undertaken through planning or interior ministries. Special efforts are therefore needed to ensure adequate coordination and sharing of information between the health and other sectors.

Health information systems are further fragmented by disease-focused programme demands which often relate to donor requirements and international initiatives directed to specific disease areas (e.g. malaria, HIV/AIDS or tuberculosis). There are intense pressures for the rapid availability of data to guide decisions about resource allocation. Countries risk being overwhelmed by multiple parallel information demands that may stretch their resources beyond limits.

Information systems related to the provision of health services are inadequate in many developing countries. Health workers are overburdened with excessive data and reporting demands required by multiple, poorly coordinated subsystems that are unable to deliver timely, accurate and complete data. Although a vast amount of data may be collected at the subnational level, only a small proportion is synthesized and analysed. Thus, useful information is in short supply.

The presentation of epidemiological data is frequently aimed at specialists and other experts, and little effort is made to facilitate understanding of the information by the lay public or non-health specialists. As a result, there is a widely established perception that health information is obscure, unclear and sometimes contradictory.

Data are often collected without being analysed critically or turned into information that can be used for day-to-day management or longer-term planning. There is little point in engaging in the time- and resource-consuming process of data collection if there is no commitment to analysing the data, disseminating the information produced and using it to improve the functioning of the health system.

The fragility of health information systems is compounded by increasing demands for data, coupled with pressures faced by all administrations to cut costs and increase efficiency. When data are not available in response to user needs, there may be a loss of credibility. When the public loses confidence in the reliability and integrity of the data emanating from the health information system, a vicious cycle of underinvestment and further decline ensues. Sound health information is a global public good and as such needs the support of the media and the public to ensure a continued investment of resources.

#### 1.1.4 Drivers for change

Recognition of the weaknesses of health information systems is not new. However, currently a number of forces have converged to render the push for strengthened health information systems more powerful at country and global levels.

Few countries have sufficiently strong and effective health information systems in place to permit adequate monitoring of progress towards the United Nations Millennium Development Goals. Even where data are available, they are often out of date, which renders the challenge of assessing trends particularly difficult.

Reporting on progress towards achieving specified targets for specific indicators has become more important with the introduction of performance-based disbursement by several international initiatives, such as the Global Alliance for Vaccines and Immunization (GAVI) and the Global Fund to fight AIDS, tuberculosis and malaria (GFATM), the President's Emergency Plan for AIDS Relief, Roll Back Malaria and Stop TB. More resources, coupled with the recognition of the complexity of health challenges and interventions, create a demand for better data without which there are serious risks of misguided interventions and waste of effort and resources. The efforts to control major diseases need holistic and comprehensive approaches. Health information systems can provide the "glue" that binds together individual and community health interventions.

In the context of health sector reform and decentralization, health systems are managed as close as possible to the level of service delivery. This shift in functions between the central and peripheral levels generates new information needs and calls for an in-depth restructuring of information systems, with changing data collection, processing, analysis and dissemination requirements. Health sector reforms also present major challenges to achieve standardization and quality of information, which will need to be addressed by the central level.

There is an increased demand for accountability and evidence-based decision-making. Initiated in the call for evidence-based clinical practice, it has now been extended to evidence-based policy development, planning, management and evaluation of health services, to ensure the best use of limited resources.

#### 1.1.5 Global standards and harmonization for health information

A sound health information system depends on organized processes of gathering, sharing, analysing and using health-related data for decision-making. There is

growing acknowledgement that to achieve this, it is essential to strengthen institutions and management structures through the establishment of global standards for health information and for key components of health information systems. It is equally urgent for development partners to work towards more harmonized approaches aligned with the national health information system. Hence, the HMN Framework seeks to support, facilitate and challenge vertical programmes to identify integration and standardization opportunities – e.g. in surveys, surveillance systems and measurements of health impact.

### 1.1.6 A unifying approach to HIS development

Health information systems involve complex processes and relationships that go beyond the responsibility of any single government agency. Health information is both produced and used by multiple institutions, e.g. the ministry of health, the national statistics office, the private sector, civil society organizations, donors and development assistance agencies. The development of health information systems should respond to the needs and requirements of these various institutions within one comprehensive plan, using a collaborative approach rather than being seen as the domain of a single entity.<sup>1</sup> With so many constituencies that have important stakes in health information, it is surprising that no unifying framework or standards have yet been established to facilitate the efficient coordination and joint action of all the subsystems within a health information system. The Health Metrics Network is the first attempt to develop such a framework.

## 1.2 A new approach to HIS strengthening

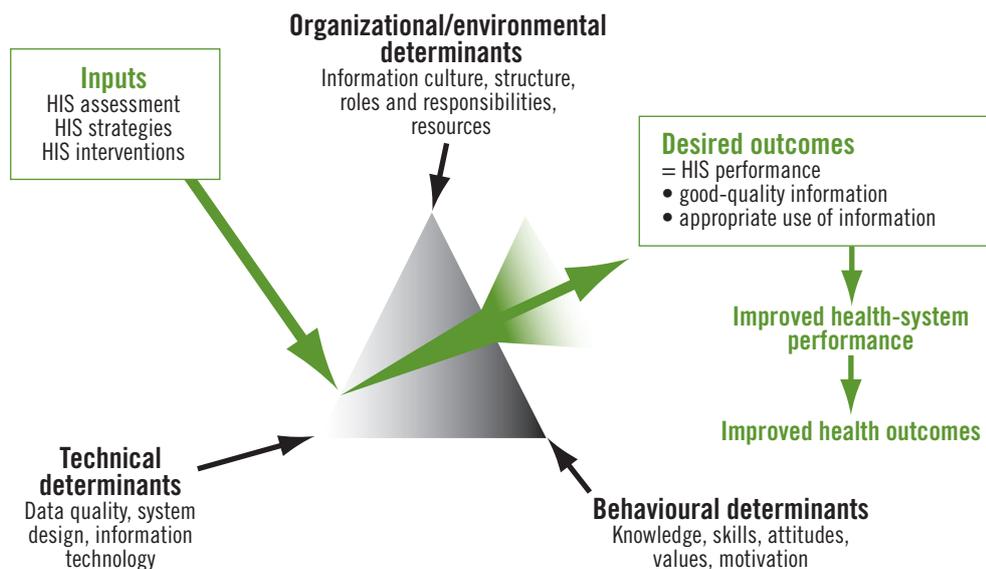
Despite the explicit and urgent demand for relevant and quality health information, as indicated above, the performance of health information systems falls consistently short of expectations. Often, the performance of a health information system is narrowly defined as the production of good-quality data. The ultimate goal of a health information system however is to enable various health system stakeholders to make transparent and evidence-based decisions. Therefore, the objective of a health information system is to produce relevant and quality information in support of health system interventions. The performance of a health information system should be measured not only on the basis of the quality of data produced, but on evidence of the continued use of these data for improving health system performance and health status. Improving health information systems in terms of data availability, quality and use often requires interventions that address a wide range of possible “determinants of performance”. Lafond & Field propose to classify these determinants in three categories: technical, environmental/organizational and behavioural determinants.<sup>2</sup> These determinants are explained in the three-point or Prism framework shown in *Fig. 1*.

The Prism framework hypothesizes that sustainable production and use of good-quality health information are affected not only by technical factors (data collection tools and processes, information technology, data analysis), but also by organiza-

<sup>1</sup> Lippeveld T. *Routine health information systems: the glue of a unified health system*. Keynote address at the workshop on issues and innovation in routine health information in developing countries, Potomac, 14–16 March 2001.

<sup>2</sup> Lafond A, Field R. *The Prism: introducing an analytical framework for understanding performance of routine health information systems in developing countries*. Presented at a workshop on enhancing the quality and use of health information at the district level. Eastern Cape Province, South Africa, 29 September–4 October 2003.

**Fig. 1 The Prism framework**



Source: MEASURE Evaluation Project, 2005.

tional and behavioural factors Motivating data collectors remains a challenge despite training on data-collection registers and questionnaires. Attitudes such as “data collection is a useless activity” or “a waste of care-provider time” are detrimental to data quality. Knowledge and skills for data processing, analysis, interpretation and problem-solving are usually not given due attention, which affects the ability to use information. Data collectors and users work within a specific environment/organization and are thus influenced by it. The perceptions and attitudes of senior management towards the design and implementation of health information systems have a determining influence on HIS performance. For example, if senior health managers do not allocate resources based on evidence and/or information, the utility of collecting information may be questioned. Or, if senior managers through their actions do not promote evidence-based decision-making and do not use information for transparency and accountability, the culture of information is unlikely to be fostered. These examples show the importance of organizational issues for better HIS performance.

The broader analysis of each of these categories of determinants for the performance of health information systems can be used to identify opportunities for and constraints to effective (and strategic) data collection and production, and to the use of information for decision-making.<sup>1,2</sup> Strategies to improve performance in this area can then be built along the same three groups of determinants.

### 1.2.1 Undertaking a performance-improvement-oriented assessment

Based on this conceptual approach, the first step in HIS strengthening is to undertake a broad-based assessment of a country’s health information systems, examining

<sup>1</sup> Hozumi D, Aqil, A, Lippeveld T. *Pakistan health information system situation analysis*. MEASURE Evaluation Project, USAID, 2002.

<sup>2</sup> Aqil A et al. *Determinants of performance of routine health information system (RHIS): evidence from Pakistan and Uganda*. Presentation at the American Public Health Association Conference, December 2005.

not only the technical aspects of the information system, but also the health system environment and organization, as well as the influence of relevant behavioural factors. It is critical to examine the perceptions, attitudes and values of senior managers and other organizational members with regard to information-related functions. Such an assessment can comprise tools from a mix of disciplines, including epidemiology, performance improvement, behaviour change and policy analysis. These tools collect both subjective and objective information and identify performance gaps between what is perceived and what actually exists, leading to the development of interventions to bridge the identified gaps.

### 1.2.2 Identifying data requirements and indicators

The many different types of data that a health information system should generate can appear overwhelming. But from the point of view of policy-makers and planners, some types of information are more important than others. One of the critical basic steps in the development of health information systems is to bring stakeholders together to identify which data are critical for management, strategic decision-making and policy development, and which therefore must be available in a timely and reliable way. Consensus is needed on a core set of indicators, all of which are action-oriented. A prerequisite for this is to identify and agree on the key strategic decisions and management functions that need information support.

### 1.2.3 Describing data requirements and tools at different levels

A key element in strengthening the health information system is to determine which data should be collected, at which levels of the system, and by whom. Decisions should be made about which data are to be reported upwards and for what purpose, bearing in mind the need for a limited set of indicators, in order to avoid overburdening the system. Summary indicators are needed at the facility and district levels for management, planning, procurement and overall supervisory purposes (*Fig. 2*). Feedback from the national to the more peripheral levels is equally important, and encourages the creation of a culture of data generation and use. In decentralized

**Fig. 2 Information tools and needs at different levels of the health-care system**

Level of data collection	Quantity of data	Information needs	Information tools
Global/regional	Less	Summary indicators for global reporting, MDGs, UNGASS <sup>a</sup>	Global/regional summary indicators
National		Summary indicators for national needs, e.g. planning, PRSP <sup>a</sup>	National summary indicators
District		Indicators for district and national reporting and planning	District summary reports
Facility		Facility management, audits, planning; drug procurement	Facility registers, logbooks
Patient		Patient management	Patient charts
Household		Understanding population burden of disease and risk, monitoring and evaluation of CBOs <sup>a</sup>	Household surveys and demographic surveillance
	More		

<sup>a</sup> MDGs = United Nations Millennium Development Goals; UNGASS = United Nations General Assembly Special Session on HIV/AIDS; PRSP = Poverty Reduction Strategy Papers; CBO = community-based organization.

systems, innovative approaches should be found to make representative and disaggregated data available at district level and below.

Another challenge is presented by data collection tools that are designed with national-level data needs in mind, such as household surveys. Very few national household surveys are of sufficient power to permit data disaggregation at peripheral levels. In general, disaggregation may be possible at regional/provincial/state levels, or for very broad categories such as urban/rural differences. As countries seek to strengthen their health information systems, they should decide which disaggregations are required for policy purposes and which data tools will be best suited to generate the necessary disaggregations efficiently.

#### 1.2.4 Matching data requirements to data sources

Matching the data item or indicator with the most appropriate and cost-effective tool for generating it is an essential function of the health information system. The range of sources for health-related data comprises service-generated data, disease and behavioural surveillance, vital statistics, financial and management information, household surveys, health-facility surveys, census, modelling, estimates and projections, and research. Each of these has its own strength or weakness in generating health information. There are many examples of the use of inappropriate methods to generate health data, and of the underutilization of some data-collection tools.

#### 1.2.5 Synthesizing, analysing and using information

Data alone do not always tell a straightforward story; meaning is acquired when they are analysed and interpreted. Data should be synthesized, analysed and interpreted within the overall context of the functioning of the health system and the delivery of health interventions. This is the way to transform data into information, evidence and knowledge for action. A critical aspect of analysis is the synthesis of data from multiple sources, the examination of inconsistencies and contradictions, and the summarizing of the health situation and trends into a consistent assessment. This includes the burden of disease, patterns of risk behaviour, health service coverage and health system metrics.

Capacity for data analysis is often lacking at peripheral levels where the data are generated, and the results need to be used for planning and management. The development of such capacity warrants careful planning and investment by multiple stakeholders.

Standards are needed to assess whether the statistics available to decision-makers are comprehensive, timely, accessible and reliable. The General Data Dissemination System (GDDS) guidelines,<sup>1</sup> developed by the International Monetary Fund (IMF), provide a comprehensive set of such standards. The GDDS framework is built around four dimensions – data characteristics, quality, access and integrity – and takes into account, across a broad range of countries, the diversity of their economies and the developmental requirements of many of their statistical systems. While not developed specifically for health-related data, its fundamental principles are applicable to health and cover issues such as coverage, periodicity (i.e. the frequency of compilation) and timeliness (i.e. the speed of dissemination).

After analysis comes the use of data for management, strategic decision-making

<sup>1</sup> <http://dsbb.imf.org/Applications/web/gdds/gddshome/>.

and policy development. Technical rigour, while essential, does not automatically lead to the appropriate use of information. There are many examples of information systems where the indicators are sound, data collection forms are well designed and data-analysis capacity available, but where neither data tools nor data are used routinely to manage the health services. Motivational factors and the organizational context may undermine evidence-based health action. For example, in health systems that use normative rather than strategic planning, decision-makers follow traditional patterns of resource allocation based on set formulas. Even the availability of accurate and timely health data cannot guarantee that evidence becomes the basis of decision-making. Effective packaging and communication of evidence for easy use by decision-makers and managers is key. For data to be used consistently, the entire health system must place a high value on health information and be structured in a way that allows evidence-based decision-making at all levels of the system.

### 1.2.6 Aligning partners, bringing data and users together

Another essential step in strengthening a health information system is to bring data production together with data use. Users comprise those delivering care as well as those responsible for the management and planning of health programmes, including those financing health-care programmes, both within the country (health and finance ministries) and outside (donors, development banks and technical support agencies). Users of health-related data are not confined to health-care professionals or statisticians. Indeed, decision-making around country health priorities necessarily involves the wider community, including civil society, and policy-makers at the senior levels of government. These different users of data have different needs in terms of the level of detail and technical specificity required. Thus the health information system should present and disseminate data in appropriate formats for the various audiences.

## 1.3 The power of partnership: Health Metrics Network

### 1.3.1 HMN vision

HMN uses the strengths of a global network to stimulate the coordination and alignment of partners around a harmonized framework for the development of country health information systems.

If the vision of what a country health information system should be able to do is relatively clear, putting the vision into practice is less so. Existing health information systems are institutionally and historically complex, with multiple partners involved in different ways and at different levels in generating, analysing, sharing and using data. Past experience has shown that smooth collaboration between the multitude of investors and local stakeholders tends to be elusive. However, there is a widespread perception of the need to do better, and an awareness that collaborative investments in health information systems might be more efficient and effective than individual initiatives. Moreover, the problems experienced seem to be common across many countries and regions.

The potential of HMN to catalyse and accelerate health information system change derives from the synergies created among partners, none of whom would

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<sup>1</sup> Partnership in Statistics for Development in the 21st Century (<http://www.paris21.org/>).

be able to undertake the task alone. The reach of different partners working on the various aspects of health information at global, national and subnational levels, is very broad. Partners include existing networks such as PARIS 21<sup>1</sup> which aims to improve statistical capacity in developing countries, the Routine Health Information Network (RHINO),<sup>1</sup> focused on improving capacities to generate and use health information derived through service-delivery systems, and the INDEPTH Network,<sup>2</sup> which is working to strengthen and harmonize methods for vital-event monitoring in resource-poor settings. International partners include the United Nations, specifically the Statistics Division, EUROSTAT, the World Bank, the United Nations Development Programme (UNDP), the United Nations Children’s Fund (UNICEF), the United Nations Population Fund (UNFPA) and the World Health Organization (WHO). The United States Agency for International Development (USAID) supports several important health information strengthening efforts, including the Measure Projects and Partnership for Health Reform Plus which focus on disease surveillance and on building health information systems through global and bilateral development programmes. Other bilateral donors also provide support to building better health information systems. Several nongovernmental organizations (NGOs) and research institutions are working to improve different aspects of health information, often pioneering innovative approaches that are more feasible and cost-effective for implementation in resource-constrained settings.

### 1.3.2 Global health partnerships and HMN

Global health partnerships (GHPs), such as initiatives for HIV/AIDS, malaria or various components of vaccine-preventable diseases, represent extraordinary opportunities for advances in public health in poor countries. However, such initiatives are typically accompanied by high expectations for rapid implementation, and are increasingly accompanied by very restrictive, disease-specific constraints on use of funding. Such constraints, and the requirements for rapid scaling up (often on the grounds of the “emergency” nature of the programme), are likely to complicate the use of a country’s general health information systems and to render more difficult technical support in implementation, as well as the monitoring and evaluation of these initiatives in countries that participate in GHPs.

Responding to such pressures from funding agencies, GHPs may pursue the option of implementing vertical, programme-specific information systems that fragment and disrupt the health information system of the host country, rather than use approaches that strengthen, adapt and then utilize them. To the extent that each host country has different technical standards and systems for health information, GHPs have virtually no way of achieving their targets through proper incorporation into national systems. This is because the technical capacity needed to adapt GHP indicators in a satisfactory manner to the particular health information systems of maybe dozens of different national systems is generally lacking. HMN offers the prospect of resolving this difficult situation thanks to the following key elements:

- establishing a comprehensive set of linked global technical standards for health information in least developed countries (LDCs), so that GHPs can define their

<sup>1</sup> Routine Health Information Network ([www.rhinonet.org](http://www.rhinonet.org)).

<sup>2</sup> International network of field sites with continuous demographic evaluation of populations and their health in developing countries (<http://www.indepth-network.org/>).

information and monitoring needs once, not repeatedly for each country in which the GHP is to function;

- promoting the incorporation of HMN technical standards into the systems and mechanisms for health information in many or most LDCs, so that incorporation of any new GHP information support and monitoring needs into the HMN is technically straightforward and relevant to a large number of countries in which the GHP will operate;
- helping to create a context in which state-of-the-art technical support will be available to each GHP for translating its specific data needs into the HMN Framework and standards;
- strengthening the underlying HIS components and systems in LDCs (including through appropriate provision of a proportion of resources from GHPs), so that such systems may function to meet the information needs of GHPs;
- defining a reasonable and transparent process, and the proportion of GHP resources that should be contributed to strengthening and utilizing the national HIS to meet the specific information and monitoring needs of the GHP;
- establishing a unified front of participating countries, donors and technical partners committed to supporting and reinforcing this model in the implementation of ongoing and new GHPs.

### 1.3.3 HMN goal and strategic objectives

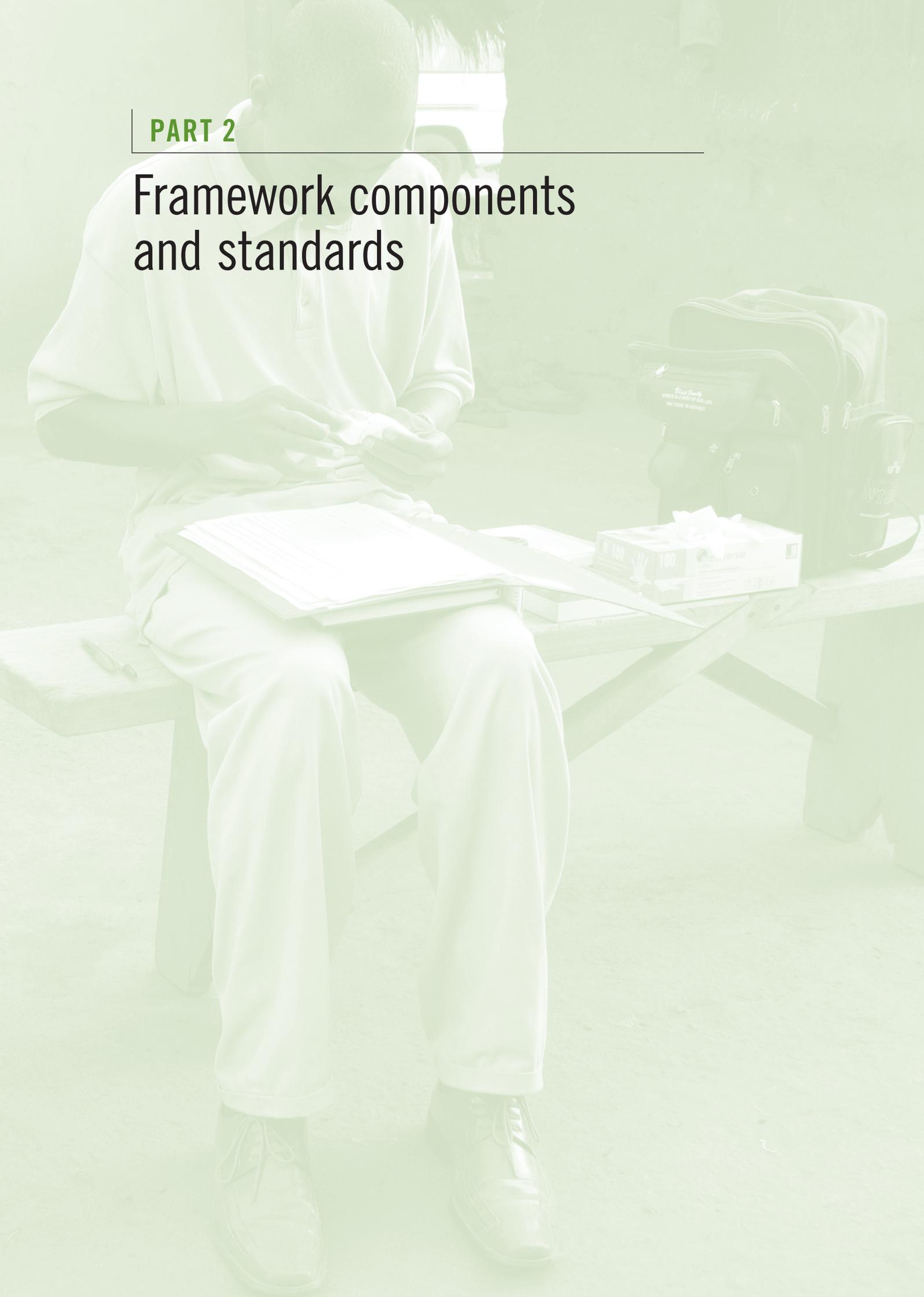
HMN has a single overarching goal – to increase the availability, quality, value and use of timely and accurate health information by catalysing the joint funding and development of core country health information systems. To achieve this goal, HMN will pursue three key objectives:

1. to elaborate a harmonized framework and standards for the development of country health information systems;
2. to support developing countries in adapting and applying the framework and standards to improve their health information systems; and to provide technical support and act as a catalyst to secure funding to this end;
3. to improve the quality, value and use of, and access to health information, by developing policies and offering incentives to enhance the dissemination and use of such information by all those concerned at the local, regional and global levels.



PART 2

# Framework components and standards





Part 2 describes the components of a health information system and discusses the standards for each one. National resources and capacities may affect the extent to which countries are able to apply the full standards and the way in which this may be achieved. In cases where standards do not exist, they are likely to evolve over time as countries adapt, use and learn from the HMN Framework. The standards for each of the individual components are not new. The novelty is rather the interaction of these components to ensure a fully functioning and efficient health information system. The added value of the HMN Framework consists in the definition of a health information system and the interaction of its components.

A health information system can be described in terms of its inputs (resources), processes (selection of indicators and data sources; data collection and management) and outputs (information products and information dissemination and use). Hence, the six components of an HIS are:

1. *HIS resources*. These include the legislative, regulatory and planning frameworks to ensure a fully functioning HIS and the resources available for health information, including human resources, logistic support, information and communications technology, and coordinating mechanisms within and between the six components.
2. *Indicators*. A minimum set of indicators and related targets, covering the main domains of health information (determinants, health system inputs and outputs, health service coverage and quality, and health status) is the basis for a health information system plan and strategy.
3. *Data sources*. There are two main types of data sources, those generating population-based estimates (census, vital statistics and household/population-based surveys and surveillance) and those that depend on health service or administrative records (disease surveillance, health-facility records, administrative records and health-facility surveys). For each data source a basic set of standards and key strategies to achieve the standard are described.
4. *Data management*. This covers all aspects of data handling from the collection, management and flow of data to its processing and analysis.
5. *Information products*. Data must be transformed into information that is the basis for evidence, and that ideally becomes knowledge to shape health action.
6. *Dissemination and use*. The value of health information can be enhanced by making it readily accessible to decision-makers and giving due attention to behavioural and organizational constraints and incentives to use.

## 2.1 HIS resources

Certain prerequisites need to be in place for a health information system to function. These include:

*Information policies*. Supportive legislative and regulatory environment.

*Financial resources*. Investment in data collection, analysis and utilization from domestic and international sources.

*Human resources*. National technical expertise and leadership, subnational expertise to ensure observation of data-quality standards and data use.

*Communications infrastructure.* Infrastructure and policies for the transfer of information between producers and users within and outside the health system.

*Coordination and leadership.* Well-established mechanisms to lead health information systems effectively and efficiently.

### 2.1.1 Information policies

The legal and regulatory context within which health information is generated and used is an important element, since it enables the establishment of mechanisms to ensure data availability, exchange, quality and sharing. Legislation and regulation are of particular significance in relation to the ability of the health information system to draw upon information from both the private and public health services, and from non-health sectors. Furthermore, the existence of a legal and policy framework consistent with international standards such as the *Fundamental principles of official statistics*<sup>1</sup> enhances confidence in the integrity of the results. The legal framework also defines the ethical parameters for data collection, information dissemination and use. The policy framework for health information should identify main actors and coordinating mechanisms, ensure links to programme monitoring, and identify accountability mechanisms. An institutional policy, which defines the respective roles of the health and statistics institutions, should be in place. It should ensure the independence of health data from external influences and facilitate accountability for health statistics.

### 2.1.2 Financial resources

Little research has been carried out on the level of investment needed to ensure a sound health information system, and this can be expected to vary according to the overall level of development of a country. The annual costs of a comprehensive health information system have been estimated to range from US\$0.53 to US\$2.99 per capita.<sup>2</sup>

### 2.1.3 Human resources

Improvements in the health information system cannot be achieved unless attention is paid to the training, deployment, remuneration and career development of human resources at all levels. At the national level, skilled epidemiologists, statisticians and demographers are needed to oversee data quality and ensure appropriate analysis. At peripheral levels, health information staff should be accountable for data collection, reporting and analysis. Too often, such tasks are handed over to overburdened care providers who see this as an unwelcome additional burden that detracts from their primary role. Deploying health information officers within large facilities and districts (as well as at higher levels of the health-care system) results in significant improvements in the quality of data reported and in the understanding of its importance by health-care workers.

Appropriate remuneration is essential to ensure the availability of high-quality

<sup>1</sup> United Nations. *Fundamental principles of official statistics*. New York, UN Statistics Division, 1994. These principles include impartiality, scientific soundness, professional ethics, transparency, consistency and efficiency, coordination and collaboration.

<sup>2</sup> Stansfield SK et al. *Information to improve decision-making for health*. Chapter 54 in: Jameson et al. (eds) *Disease control priorities for the developing world* (in press).

staff and limit attrition. This implies, for example, that health information positions within the ministry of health should be graded at a level equivalent to those of major disease programmes. Within statistics offices, measures should be taken to retain well-trained staff to the extent possible. The establishment of an independent or semi-independent statistics office should allow for better remuneration and subsequent retention of high-level staff.

Targeted capacity development is needed, and training and educational schemes should address human resource development in the areas of health information management and use, design and application, and epidemiology. Such training should be for all levels of competency: from preservice training of health staff to continuous education, as well as public health graduate education at the Master and PhD levels.

Development of the health information system also depends on the functioning of key units and institutions such as the central HIS unit of the ministry of health and the central statistics office, which have responsibility for designing, strengthening or supporting data collection, transmission, analysis, reporting and other dissemination. It may be useful to undertake some form of institutional analysis in order to identify constraints (for example, those related to reporting hierarchies or relationships between different units with responsibility for monitoring and evaluation) that undermine policy and the implementation of monitoring and evaluation programmes. A World Bank web site notes that “Institutional analysis evaluates formal institutions, such as rules, resource allocation and authorization procedures. It also evaluates ‘soft’ institutions, such as informal rules of the game, power relations and incentive structures, which underlie practices”.<sup>1</sup>

#### 2.1.4 Information and communications technology

Information and communications technology has the potential to radically improve the availability, dissemination and use of health-related data. However the implementation of the technology requires careful planning and training. In order to fully realize the benefits of information technology, a communications infrastructure should be established. Internet communication is essential although basic telephone (land line or mobile) can be useful. Information technology can improve the quality of the data collected, and communications technology can improve the timeliness, analysis and use of information. Unfortunately in many settings, computers are used as part of separate vertical health information programmes which results in a vast number of non-compatible systems in countries. This often aggravates rather than alleviates duplication and overlap. Coherent capacity building of human resources across all levels of the system is both more effective and more cost-efficient. This needs to be supported by a clear data-management policy, which also addresses issues of privacy and confidentiality. The issue of data management is addressed in section 2.4.

Ideally, at national and subnational levels, health managers should have access to an information infrastructure that includes computers, e-mail and Internet access. All facilities should have such connectivity, but this is a long-term objective in most developing countries. Similarly, national and regional statistics offices should be equipped with transport and communications equipment to enable the timely collection and compilation of data at the subnational level.

<sup>1</sup> <http://lnweb18.worldbank.org/ESSD/sdvext.nsf/81ByDocName/ToolsandMethodsInstitutionalanalysis>.

## 2.1.5 Coordination and leadership

A representative national committee consisting of key stakeholders from health and statistics constituencies in the country is needed to guide the development and maintenance of a health information system, and to ensure that information is shared across programmes and institutions. It should include high-level representatives of key programmes within the ministry of health, the statistics office, academia, NGOs, and international multi- and bilateral agencies in the country. The chairmanship may alternate between health and statistics. It may also be undertaken by the office of the (vice) president if relevant.

Such a committee should to the greatest possible extent build upon existing coordinating mechanisms, and also fit into broader statistics strategies. It should be associated with the development of the national strategic plan for statistics, of which the health sector is an important area. In countries with poverty-reduction strategies, building upon the structures set up as part of a national poverty-monitoring masterplan is essential.

National and international demands and requirements for reporting of data from health programmes, donors and other national stakeholders should be agreed upon and sanctioned by this committee. It is also crucial that the country health information system environment encourages local innovation and entrepreneurship among stakeholders, i.e. that the overall system and, as far as possible, each subsystem are able to accommodate extensions to the various data sets and systems.

A national HIS strategic plan is also essential for coordination. This is a roadmap to guide HIS investments, with indications of the timeline and anticipated budget of activities to be completed in the short (1–2 years), intermediate (3–5 years) and long term (10 years and beyond). The document should provide for maintenance/strengthening and coordination of each of the key components of the HIS: vital statistics, household surveys/census, disease surveillance, routine service statistics and national health accounts. The strategic plan should emphasize the integration of data sources at the national and subnational levels.

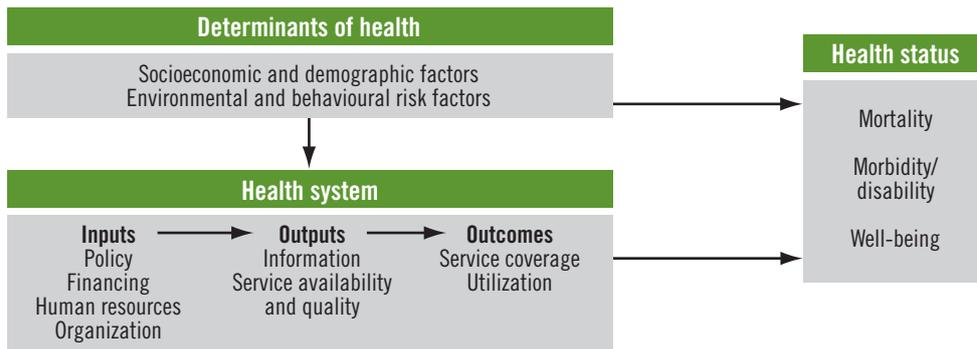
## 2.2 Indicators

### 2.2.1 Domains of health information

The boundaries of the health information system are not confined to the health sector. There is also a strong interdependence of health information systems with information systems in other sectors. Health information systems should provide information to meet a range of needs, from data for the provision of services to individual clients, to statistics for the planning and management of health services, to measurements for the formulation and assessment of health policy. Core health indicators are needed to assess change in three major domains (*Fig. 3*):

1. *Determinants of health.* These include socioeconomic, environmental, behavioural and genetic determinants or risk factors. Such indicators also characterize the contextual environments within which the health system operates.
2. *Health system.* These include: inputs to the health system and related processes such as policy, organization, human resources, financial resources, health infrastructure, equipment and supplies; outputs (e.g. health service availability and quality, information availability and quality); and immediate health system outcomes (e.g. coverage of the population with key health services).

**Fig. 3 Domains of measurement for health information systems**



3. *Health status*. These include mortality, morbidity, disability and well-being. Health status variables depend on the coverage and efficacy of the interventions and the determinants of health which may have an influence on health outcomes, independent of health service coverage.

The stratification or disaggregation of health system and health status indicators by other variables such as sex, socioeconomic status, ethnic group and geographical location capture the distribution of health and health services in the population.

### 2.2.2 Defining core indicators

Core indicators of the health system should reflect changes over time in the three health information domains. A vast number of indicators have appeared in recent years. Every programme area has defined a “minimal” list of indicators, often at the instigation of external partners and donors. When added together, they create a huge burden of data collection, analysis and interpretation. A rational selection of a minimum set of core health indicators is essential. A compendium of standard definitions and measurement issues related to 40 core indicators can be found in a recent WHO publication.<sup>1</sup>

A national set of core indicators is not necessarily the same as a subnational set, but for some indicators the subnational data collection, e.g. through health service provision records, is the basis of the national statistic. For other indicators, a national household survey may form the basis when subnational data collection is not feasible, e.g. child mortality rates.

Health indicators should be established to monitor local and national priorities. However, indicator definitions must meet international technical standards. Moreover, there should be a consistent link and harmonization of national indicators with key indicators used in major international and global initiatives such as the MDGs, Global Fund and GAVI.

The choice of the indicator and its attributes, such as frequency of measurement and level of disaggregation, should also take into account national and subnational measurement capacities. An indicator for which no statistic can be generated is not very useful.

As with any indicators, health indicators should be valid, reliable, specific, sensitive and feasible/affordable to measure. They must also be relevant – useful for decision-making at the level of data collection, or where there is a clear need for the data at higher levels.

<sup>1</sup> World Health Statistics 2005. Geneva, World Health Organization, 2005.

Careful selection and regular review of core indicators are key steps in efforts to strengthen a health information system. Such indicators can be viewed as the backbone of the health information system, the minimum information package needed to support macro- and micro-health-system functions. To ensure that they enable the comprehensive monitoring and evaluation of health and the health system, it is helpful when selecting indicators to develop a monitoring and evaluation framework that identifies key management functions and strategic decisions, and classifies these decisions according to whether they involve inputs/resources, processes, outputs and results.

All countries should have a nationally-defined minimum set of health-related indicators that is regularly used in national programme planning, monitoring and evaluation. The reporting frequency may vary depending on the type of indicators and the likelihood of change. Core indicators may include, but would not be limited to, those included in the MDGs.<sup>1</sup> More detailed information is needed for the management of specific programmes and services. The precise list of indicators will vary according to the epidemiological profile and development needs of each country.

The process of defining the core set of indicators should involve key national and international stakeholders in the country. The main challenge is to identify a small set of indicators, as programmes tend to have very diverse and detailed needs which may lead to a long list of indicators. For many core indicators, it is appropriate to set targets, either in line with international goals such as the MDGs or in line with national plans. Long-term targets and intermediate benchmarking are useful, but should be guided by existing data and well-established baseline statistics.

It is essential to link core health indicators and related data-collection strategies to a broader national statistics strategy, and notably a poverty-monitoring masterplan in countries with poverty-reduction strategy papers (PRSP).

### 2.2.3 Linking indicators with data-collection strategies

Suitable data sources should be identified for each selected indicator. For some desirable indicators, there may be no suitable data source, in which case a proxy indicator may be required (for example, routine statistics on DPT3 administration are used as a proxy to assess full immunization coverage when the latter cannot be currently measured using a household survey). For other indicators, there may be only a single practical method of measurement. In some cases, multiple data sources may be available (as an example, maternal mortality may be measured through vital statistics or through a household survey). In such cases, one method of data collection may simply be superior to or more cost-effective than the alternative method. Or each alternative measurement strategy may have its relative advantages and disadvantages. When there is no single best source of data, it is advisable to use triangulation, a method that combines data from different sources. A good example is the measurement of HIV prevalence among adults in countries with generalized epidemics. Antenatal clinic-based surveillance systems provide annual data on the trend in HIV prevalence among pregnant women, but this is a biased population sample. Through nationally-representative household surveys that include HIV testing, it is possible to generate unbiased estimates that cover all regions in the country and include non-pregnant women as well as men. However, cost considerations preclude conducting annual population-based surveys of HIV prevalence. For monitoring

<sup>1</sup> [http://www.who.int/mdg/publications/mdg\\_report/en/index.html](http://www.who.int/mdg/publications/mdg_report/en/index.html).

progress, antenatal surveillance results are used and occasional household-survey results provide information to calibrate and adjust the surveillance results. The precise combination of different data sources will depend on the indicator in question and the methodologies available to generate the data.

These considerations form the basis for a data-collection plan for the coming decade, which should clearly specify for each core health indicator the method and frequency of data collection. A budget should be developed for this 10-year period, and the plan should indicate likely sources and levels of financing.

## 2.3 Data sources

Given the broad range of data requirements, no single method of data collection can meet all needs. The most appropriate data source depends on the information required, cost-effectiveness and feasibility of the method, human and technical capacity to collect, manage and disseminate the data, and financial and time constraints.

All country health information systems should draw on a set of core data sources. The role and contribution of each source to the health information system will vary, as there is overlap between the kinds of information each source is best able to collect. In many cases, a combination of sources can contribute to better-quality information while maintaining efficiency. In other cases, it will be more efficient to avoid duplication. The optimal choice will depend on a range of factors, including epidemiology, specific characteristics of the measurement instrument, cost and capacity considerations, and programme needs.

The following sections describe the key features and desirable standards for the leading data sources. A set of common principles applies to all data sources. Core procedures to ensure data quality should be implemented. There should be standard definitions for indicators, appropriate data collection methods, metadata and a data audit trail, use of routine procedures to correct bias and confounding, and ready access to primary data.

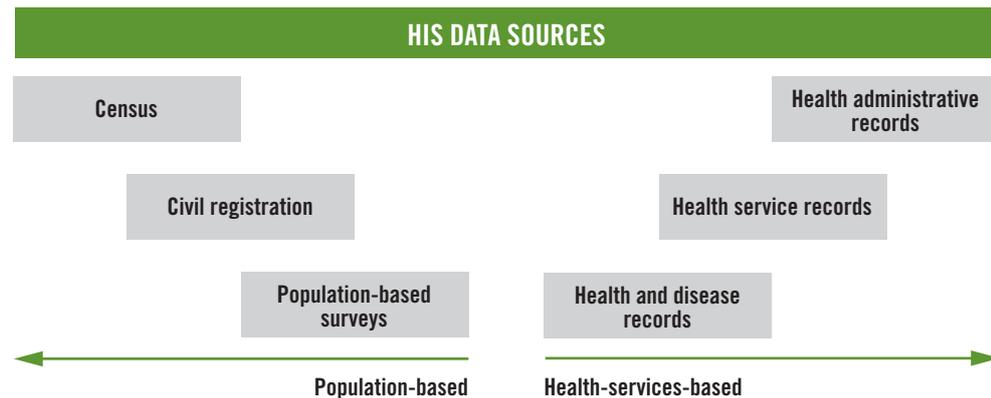
Sources of health data can be divided into two broad groups: those that generate data relative to populations as a whole, and those that generate data about the operations of the health services (*Fig. 4*).<sup>1</sup> Population-based health information sources include the census, vital events monitoring (civil registration, as well as sample or sentinel surveillance of births, deaths and causes of death), and population-based (usually household) surveys and surveillance. Also included here are vector and environmental quality surveys.

Health service-based sources generate data as an outcome of health-related administrative and operational activities. There are a wide variety of health service-based data: facility-based data on morbidity and mortality among those using services; types of services delivered, drugs and commodities provided; information on the availability and quality of services; financial and management (e.g. human resource, logistics) information. The HMN Framework classifies these data as: (a) health and disease records; (b) health-service records; and (c) administrative

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<sup>1</sup> Health service-based data sources have often been labelled using a variety of terminologies such as health management information system (HMIS), routine health information systems (RHIS), management information systems (MIS) or sometimes health information systems (HIS). In the HMN Framework, in order to avoid terminological confusion, these are referred to as “health service-based data sources”, while the term HIS is used exclusively to describe the total information system, including both population-based and service-based sources.

**Fig. 4 Data sources in a comprehensive health information system**



records. Health and disease records include those for notification of cases of disease as part of surveillance systems (acute and chronic), individual patient records, and cancer registries. Health-service records report on services provided at health facilities as well as during outreach and at community level. Administrative records generate data on the overall functioning of the health system, such as the availability of human resources, infrastructure and commodities, as well as financial flows. Whereas these three data sources can be recognized as distinct once the data have been aggregated and compiled at national level, there is an overlap between them at district, facility and community levels.

Most health service-based data are generated “routinely” in the course of recording and reporting on services delivered. Surveys of a sample of facilities and censuses of all facilities provide special methodologies for collecting health service-based data and validating routine data through observations of service delivery, inspection of facilities, interviews with health staff and clients and review of archived records.

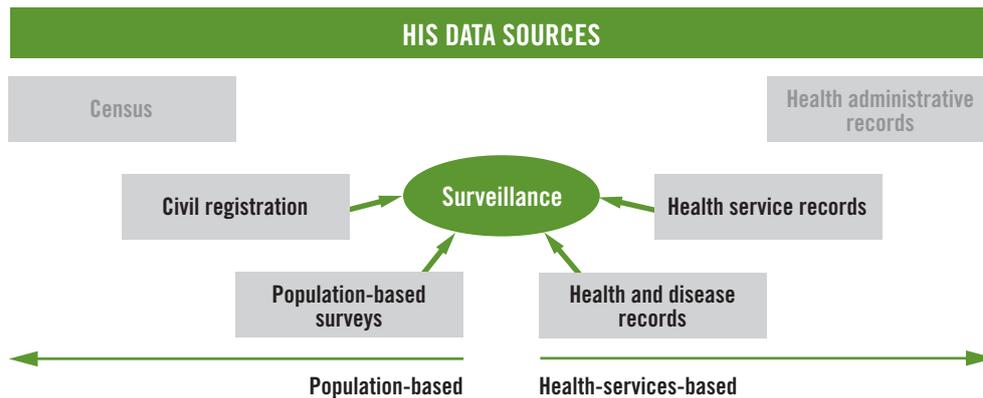
When the geocoordinates of service delivery sites have been determined, health service-based data (whether from routine collection or from facility surveys/censuses) may be presented as maps displaying the geographical distribution of facility-based health events (cases of disease presenting), inputs (facilities, human resources), outputs (services) and outcomes (deaths). Service availability mapping (SAM)<sup>1</sup> is a special approach based upon periodic (e.g. biannual) district-managed censuses of facility inputs, processes and outputs.

In the HMN Framework, “surveillance” in its broader sense is viewed as a function rather than as a data source. This is shown in *Fig. 5*. The origin of public health surveillance was in the system of notifiable conditions – diseases or health events of such priority and public health significance that they required enhanced notification and an immediate public health response. The classic notifiable conditions included smallpox, cholera, yellow fever and plague, diseases whose appearance threatened to precipitate or herald a community outbreak. In this sense of the term “surveillance”, surveillance in fact represents a type of data source. In the HMN classification of data sources, notifiable conditions reports are classified within Disease and health records.

However, over the past decades, surveillance has increasingly widened its scope from its base in notifiable conditions to draw upon an ever-broadening set of data sources and to use a more extensive set of methods, for the purpose of ongoing

<sup>1</sup> <http://www.who.int/healthinfo/systems/serviceavailabilitymapping/en/>.

**Fig. 5 Use of multiple data sources for surveillance**



monitoring of health status and sustained vigilance for conditions that should trigger an urgent public health response. Thus, rather than being linked to one data source, the surveillance function now regularly includes specialized approaches to monitoring of vital events, frequent and increasing use of survey methods (such as the core element of HIV surveillance through surveys in antenatal care settings), and analysis of health service records systems. Surveillance has even come to include monitoring of administrative systems, such as surges in the purchase of particular pharmaceuticals, or monitoring of rumours or lay reports of unusual patterns of illness in electronic media. From the perspective of this functional concept of surveillance, a particular interest of HMN is the prospect of promoting common data and information standards not only *within* each of the data sources that are applicable to modern public health surveillance, but also *across* each of those data sources. This will help to promote the analysis and interpretation of summary information that is increasingly being assimilated from multiple data sources, with the goal of achieving a clearer, composite perspective that contributes to public health knowledge, evidence and action.

Other sources of information such as health research, clinical trials and longitudinal community studies may also feed into the health information system.

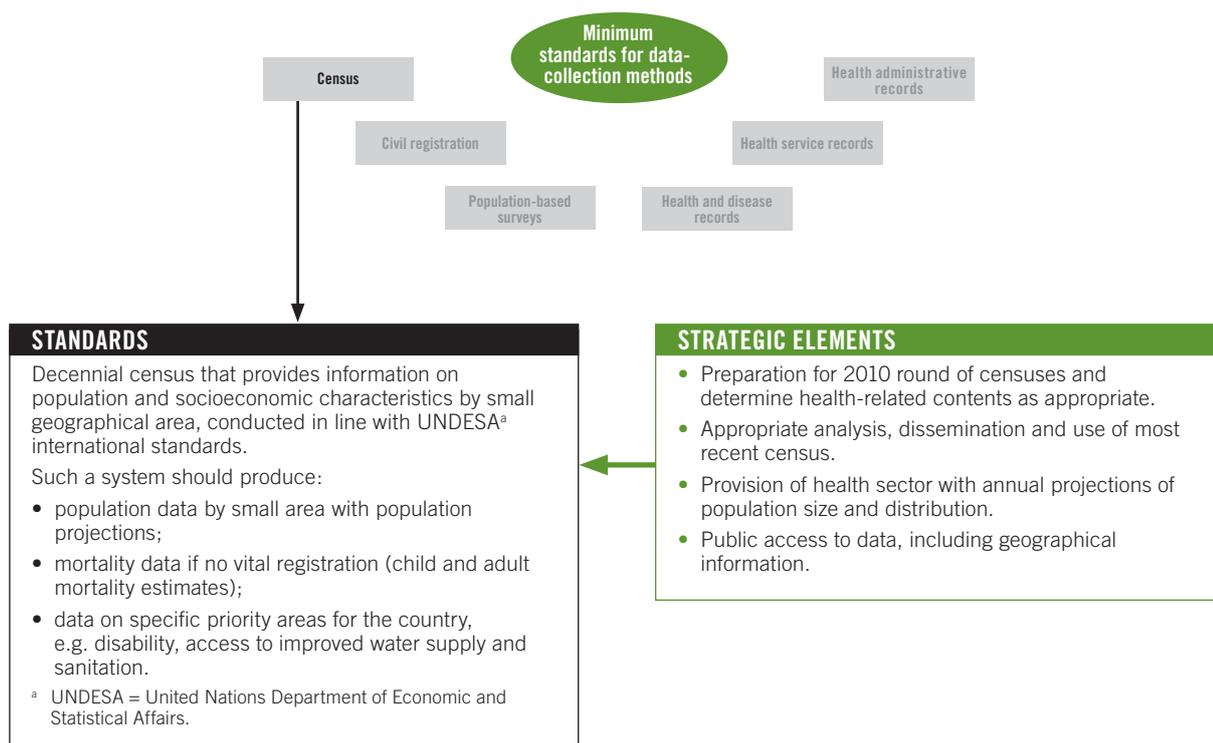
### 2.3.1 Census

The population and housing census is the primary source of information concerning the size of a population, its geographical distribution and the social, demographic and economic characteristics of its peoples. Consequently, population and housing censuses have been carried out in almost every country of the world during the past few decades, and some countries have been conducting censuses for more than a century. These censuses provide critical statistical information on the population and housing situation at even the smallest administrative levels (Fig. 6).<sup>1</sup>

A census should be held on a decennial basis. From the health perspective, information on the population numbers and distribution by age and sex and other characteristics is essential for local area planning, estimation of target population size and evaluation of service-coverage rates. Information on major determinants and risk factors such as poverty, housing conditions, water supply and sanitary facilities,

<sup>1</sup> The Statistics Division of the United Nations Department of Economic and Statistical Affairs (UNDESA) has developed principles, recommendations and manuals for population and housing censuses, available from their web site (<http://unstats.un.org/unsd/demographic/sources/cwp2010/docs.htm>).

**Fig. 6 Census – Standards and strategic elements**



may also be included. The nature of the census allows for small-area estimation and for disaggregations by key stratifiers such as socioeconomic status.

The census can also be used to provide additional information on health and mortality. The disadvantage is the small number of health questions that can be included. Questions to women of reproductive age on children ever born and children still alive have been used extensively, using indirect methods, to estimate child mortality. Censuses could include questions on recent deaths in the household, providing information on age and sex patterns of mortality at national and sub-national levels. A major issue is to accurately estimate and correct for the level of underreporting of recent deaths, which generally occurs on a fairly large scale. Some censuses have included information on causes of death, particularly those that can be defined clearly, such as pregnancy-related death or deaths due to injuries.<sup>1</sup> However, accurate cause-of-death reporting (such as AIDS-specific mortality) using this method is less likely to be successful, mainly because of reporting biases and the difficulties in identifying such deaths correctly.

The usefulness of including mortality questions in the census depends on the availability of data from other sources. For instance, if mortality data are available from vital statistics systems with high levels of coverage (over 90% of deaths), no mortality questions should be added. If data on mortality levels and trends are limited, censuses should include mortality questions.

Countries will need to plan the timing and contents of the 2010 round of censuses well in advance. Analysis of the most recent census is still ongoing in many

<sup>1</sup> Stanton C et al. Every death counts: measurement of maternal mortality via a census. *Bulletin of the World Health Organization*, 2001, 79:657–664; and *Measuring maternal mortality from a census: guidelines for potential users*. MEASURE Evaluation. Chapel Hill, University of North Carolina, 2001.

countries and should include detailed projections of the age and sex of the population for small geographical areas for use by the health sector. Furthermore, it is important that census microdata become easily accessible for analyses, such as determining the population with access to health services or the distribution of health workers.

### 2.3.2 Civil registration

Civil registration is the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital events, pertaining to the population, as provided by decree or regulation, in accordance with the legal requirements of a country. The vital events of interest include births, deaths and changes in marital status. Civil registration therefore provides the ideal source of vital statistics on a regular basis.<sup>1</sup>

Civil registration has a dual purpose, administrative and legal on the one hand, and statistical, demographic and epidemiological on the other. For the individual, the civil statistics records of birth or death provide essential legal documentation for a wide range of purposes. From a population in general, birth and death records can provide important public health information.

A vital statistics system is defined as the total process of collecting information by civil registration or enumeration on the frequency of occurrence of specified and defined vital events, as well as relevant characteristics of the events themselves and of the person or persons concerned, and compiling, processing, analysing, evaluating, presenting and disseminating these data in statistical form.

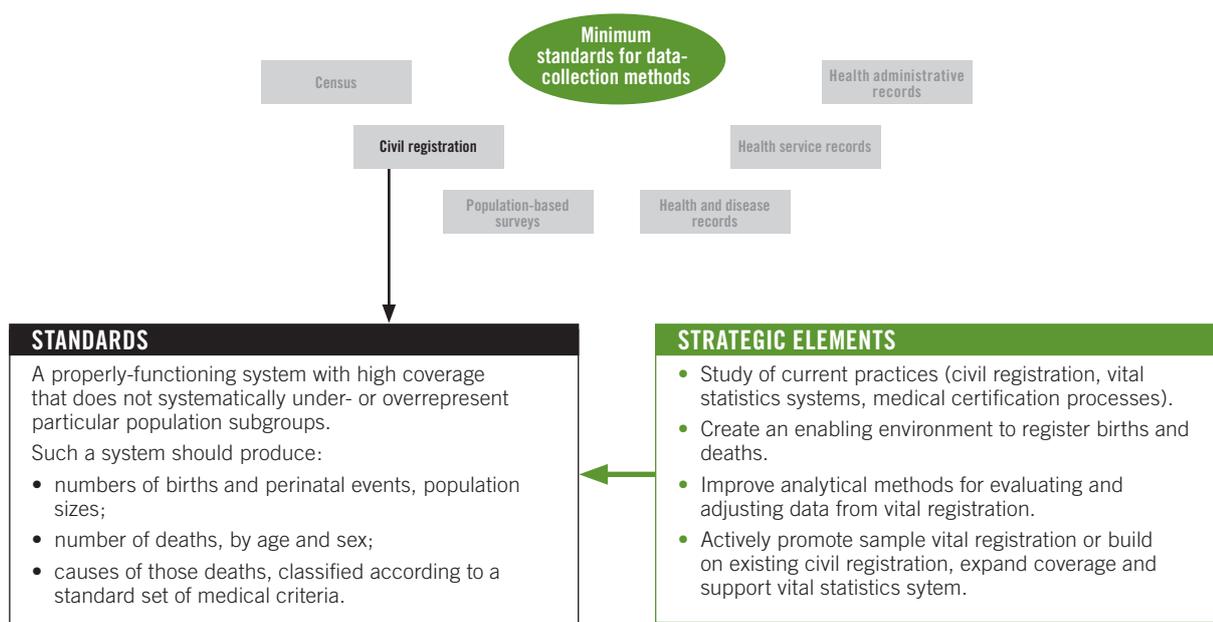
The main source of vital statistics is a civil registration system. For the calculation of vital rates, civil registration data are usually complemented by census information, which also has national coverage. When civil registration data either do not exist or are extremely deficient, countries should use other censuses and sample surveys to estimate the necessary vital statistics. However, even when data on a particular topic are less than adequate, the regularity of demographic processes, coupled with the availability of other sources of information, often provide a good basis for adjusting or correcting deficiencies of data derived from civil registration. Complementary data sources, such as censuses and sample surveys, are also used to enrich and evaluate civil registration data.

Vital statistics are an essential input for policy-making and planning in human development. Knowledge of the size and characteristics of a country's population on a timely basis is a prerequisite to socioeconomic planning. Information on the number of live births occurring over a time period, classified by various characteristics of the women giving birth, constitutes the basis for analysis of the dynamics of reproduction. Information on deaths, classified by various characteristics of the deceased, especially age and sex, is necessary for calculating life-tables and estimating the probability of dying at various ages.

Vital statistics derived from civil registration are the only nationally representative source of information on mortality by cause of death. Deaths are coded using the most recent International Classification of Diseases and Injuries (ICD), currently ICD-10. Such information is invaluable for the assessment and monitoring of the health status of a population and for the planning of health interventions.

<sup>1</sup> For more details, please refer to the *Principles and recommendations for a vital statistics system*. Revision 2. New York, United Nations, 2001. (Sales No. 01.XVI.10; [http://unstats.un.org/unsd/publication/SeriesM/SeriesM\\_19rev2E.pdf](http://unstats.un.org/unsd/publication/SeriesM/SeriesM_19rev2E.pdf)).

**Fig. 7 Vital registration – Standards and strategic elements**



The gold standard is a vital statistics system that provides a complete record of all births and deaths (100% coverage) and that includes medically-certified causes of death (Fig. 7). Achieving the gold standard may not be attainable in most developing countries for the foreseeable future. However, there are possibilities for improvement in the short term. For example, countries such as China and India have introduced sample vital statistics systems that have been shown to work fairly effectively. In the near future, packages such as Sample Vital Statistics with Verbal Autopsy (SAVVY) could considerably improve knowledge about basic health statistics in a population. Demographic Surveillance Systems (DSS) focus on specific local populations for a prolonged period of time and may offer another valuable data source, but are not part of a national sample. Notably in countries with low levels of medical certification of the cause of death, verbal autopsy can be used to ascertain the probable cause of death by standardized interviews with the relatives of the deceased. The accuracy of the diagnosis of the cause of death tends to vary by cause and so does the ability to detect cause-specific mortality trends by verbal autopsy.

In countries with very low coverage of civil registration and poor-quality cause-of-death data, it is crucial to establish at least one urban and one rural sentinel demographic surveillance system in order to get an overview of the causes of death at population level and to build capacity in cause-of-death coding. Later, as capacity is extended, such countries might consider improving the representativeness of the system by adding a broader sample registration system such as SAVVY, as used in China or India. All through this period, coverage of the routine civil registration should be steadily improved using the sentinel or sample systems to validate or calibrate the routine system. Once coverage of the routine system exceeds 80%, the sentinel/sample systems may be phased out.

The operation and maintenance of a civil registration system requires the accurate and continuous registration of records of vital events pertaining to the population from birth to death, recorded at the time they occur on a continuous basis and

under strict national standards. Details on the strategic objectives can be found in the UN *Principles and recommendations for a vital statistics system*.<sup>1</sup>

An approach to improve civil registration and vital statistics systems may begin with a systematic examination of the internal activities of the civil registration and vital statistics processes, as well as the external relationship with other systems.

The legal mandate and financial limitations determine the structure of the organization and should be examined. The day-to-day operations of the system, including the registration and statistical reporting functions, the network of registration offices, personnel issues, physical equipment and supplies and other facilities, should be continuously monitored. Cooperation and coordination with other government agencies and the general public in order to facilitate the functioning of civil registration and vital statistics systems should be developed, strengthened and enlarged.

As a starting point to improve the situation, the different components of civil registration and vital statistics systems should be examined including legal provisions, organizational structure (civil registration), administrative structure (vital statistics, aiming to analyse the civil registration data), mechanisms of coordination, and the presence of evaluation. The UN manual<sup>1</sup> provides specific suggestions for early-stage, intermediate-term and long-term activities.

### 2.3.3 Population-based surveys

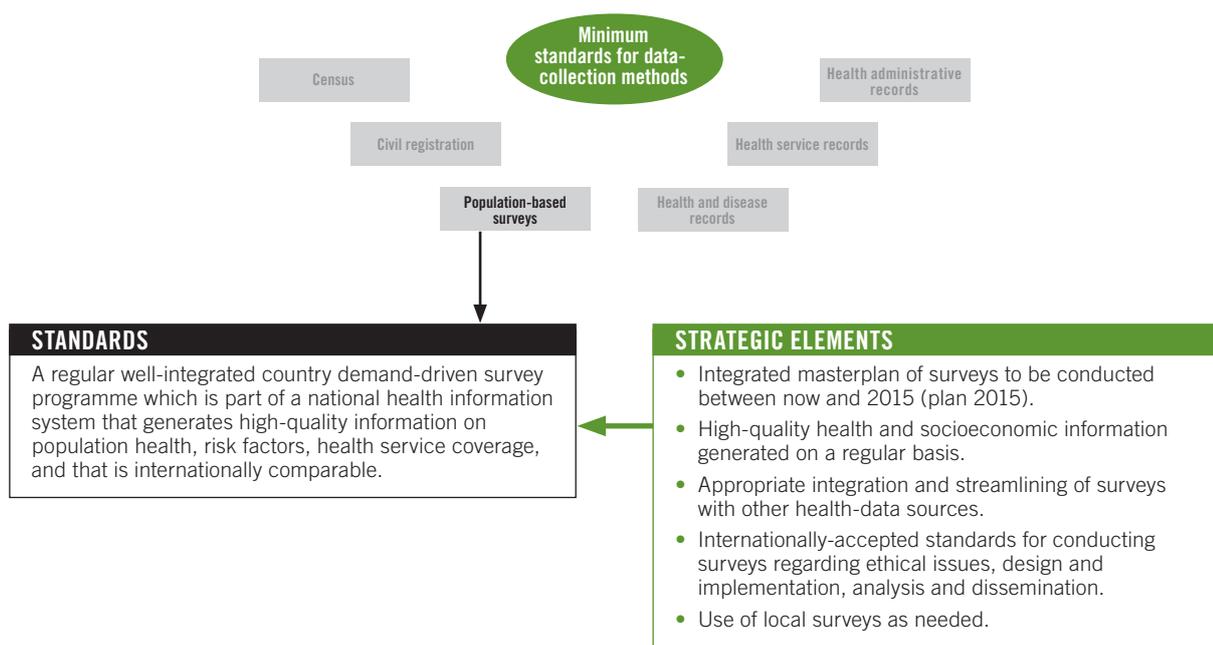
In many developing countries, population-based surveys are the single most important source of population health information. Of the 23 health-related Millennium Development Goal indicators, 17 are generated through household surveys, such as the USAID-supported Demographic and Health Surveys and the UNICEF-supported Multiple Indicator Cluster Surveys. Household surveys are used to generate: data on child and maternal health, nutrition, use of services, knowledge and practices related to health care; health-status evaluations and descriptions, determinants of health; knowledge, beliefs and practices related to disease prevention and transmission (especially in HIV); and household expenditure on health. Moreover, surveys are the prime source of information on risk factors such as unsafe sex, smoking, substance abuse and poor nutritional status. While some of these data can be derived from service-based sources, population-based sources are less subject to bias and more representative of the population as a whole compared with service-based data which concern users of services only. Many of these indicators are also tracked through sample and sentinel surveillance systems mentioned under *Vital statistics*.

More recently, household surveys have also been the vehicle for biological and clinical data collection (health examination surveys), providing much more accurate and reliable data on health outcomes than self-reports. A substantial number of countries, especially in Asia and Latin America, conduct national household surveys on health or include health questions in economic and demographic surveys. By linking surveys focused on health with those directed to other issues such as living standards, education or employment, it is possible to generate important information on the links between health and socioeconomic determinants.

The gold standard is a well-integrated demand-driven household survey programme that is part of national health information and statistical systems and generates essential high-quality information on population, health and socioeconomic

<sup>1</sup> For more details, please refer to the *Principles and recommendations for a vital statistics system*. Revision 2. New York, United Nations, 2001. (Sales No. 01.XVI.10; [http://unstats.un.org/unsd/publication/SeriesM/SeriesM\\_19rev2E.pdf](http://unstats.un.org/unsd/publication/SeriesM/SeriesM_19rev2E.pdf)).

**Fig. 8 Surveys – Standards and strategic elements**



status on a regular basis (Fig. 8). As such, national surveys become major national planning and evaluation instruments. Whether the surveys are part of international survey programmes or are national surveys, it is important that international standards and norms are adhered to.

To obtain a well-functioning and integrated survey system as part of the health information system, a number of steps should be taken. A detailed assessment of what the data needs are (core indicators) for the next decade on health (and other areas such as poverty) should be followed by an analysis of which data sources are the best and most feasible to meet the demand. Mapping of all population-based surveys is essential, both past and planned for the next decade. This should lead to a 10-year country plan in which all major national population-based surveys are mapped, and the role of national and international stakeholders and partners is indicated.

The integration of population-based surveys into the overall information system has several dimensions. Firstly, careful consideration should be given to which health data can be collected as part of non-health surveys, such as economic surveys, which tend to be more frequent and larger in sample size. Secondly, surveys are an essential source of validation and calibration of more regular data sources on e.g. immunization or HIV prevalence. Thirdly, data collection on certain topics such as mortality and causes of death should be carefully weighed against other options such as vital statistics systems. The latter may not have immediate results, but in the long term they are likely to generate more frequent and more complete data. On the other hand, large-scale national household surveys are costly and complex undertakings that are rarely feasible or cost-effective to conduct more than once every 3–5 years. Moreover, data from household surveys are inevitably subject to margins of uncertainty owing to sampling and other errors. This illustrates the importance of triangulation of data sources (i.e. taking several data points and comparing them), using household surveys to calibrate data from service-based sources for example, while using the latter as indicative of short-term trends.

Population-based surveys should be conducted following internationally-agreed

standards with regard to sampling, questionnaire design, field supervision, consent and confidentiality, data processing, body-fluid collection and analysis, and reporting. Also the data should be made available in the public domain within a reasonable time frame. In order to deliver these standards, a country should have adequate capacity, both in terms of human resources (design, sampling, data collection, data processing, analysis and report-writing, dissemination) and infrastructure (vehicles, computers, communications technology). In most countries, national statistics offices are the prime survey organization in the country. However as biomarkers and health examination surveys are increasingly integrated into large population-based surveys, close collaboration is essential between ministries of health and national statistics offices.

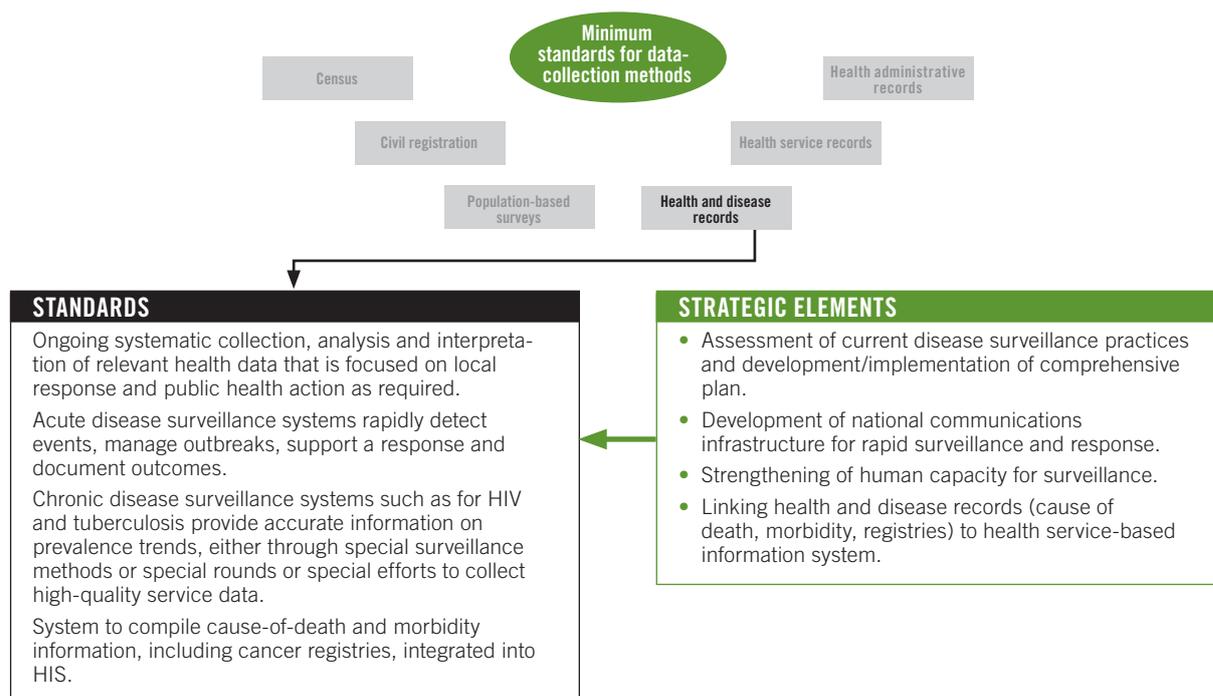
The demand for subnational information on population health indicators should also be taken into account. Large surveys may provide reliable subnational estimates for some health indicators, but this is often not possible down to the district level, where budget allocations are made. Further work is needed to find out whether simple local surveys can provide accurate data at that level.

### 2.3.4 Health and disease records

These include individual health records (e.g. growth monitoring, antenatal, delivery outcome) and disease records (consultation, discharge) routinely produced by health workers as well as by special disease registries (e.g. for cancer). These also include notification and documentation of diseases and other health events captured by surveillance systems and vertical disease programmes.

Disease surveillance and response is the ongoing systematic collection, analysis and interpretation of data on disease incidence, closely integrated with the timely dissemination of these data to those responsible for taking public health action to prevent and control disease or injury (Fig. 9). Disease surveillance is an essential

**Fig. 9 Health and disease records – Standards and strategic elements**



component of the health information system with objectives and methods that inform action for public health. Different types of information are generated, depending on the system's objectives. For example, surveillance systems focused on epidemiological intelligence lead to the development of early warning systems that produce information relevant and effective for a quick response.

A sound surveillance system for acute communicable diseases is able to detect events rapidly, manage outbreaks, support response and document outcomes in an integrated manner.<sup>1</sup> It requires a well-designed and -supported detection and reporting system, backed up by quality laboratory services. While the emphasis is on the formal reporting structure, it should also be possible to include unstructured information. Different kinds of diseases are included and each may require a different intensity of reporting and response. These include epidemic-prone diseases (e.g. cholera, haemorrhagic fevers, bacillary dysentery, plague, measles, yellow fever, meningitis, rabies/animal bite), diseases targeted for elimination or eradication (e.g. poliomyelitis, neonatal tetanus), and diseases of public health importance (e.g. diarrhoea and pneumonia in children, malaria, typhoid).

Another type of disease surveillance focuses on chronic diseases including HIV/AIDS and tuberculosis. The type of HIV-surveillance system depends on the type of the epidemic. In generalized epidemics, antenatal clinic-based surveillance, complemented by population-based surveys, is the primary source of information on the prevalence of HIV infection. In concentrated or low-level epidemics, the focus should primarily be on higher-risk populations, such as sex workers, injecting drug users, or men who have sex with men. The systems should also include behavioural monitoring, and in most countries annual surveillance rounds are recommended.

The tuberculosis surveillance system is based on case notification at facility level and quarterly summary reporting of facilities to the district level. At the national level, annual reports are prepared and case-notification trends are a major source of the estimation of national incidence trends.

Sentinel systems use selected health facilities to monitor trends in disease over time. Sentinel sites allow the provision of more intensive support to data collection. For some diseases, a special effort to collect additional data over a specified period of time (e.g. HIV testing on residuals of blood samples collected for syphilis testing among pregnant women attending antenatal clinics) is conducted in sentinel clinics.

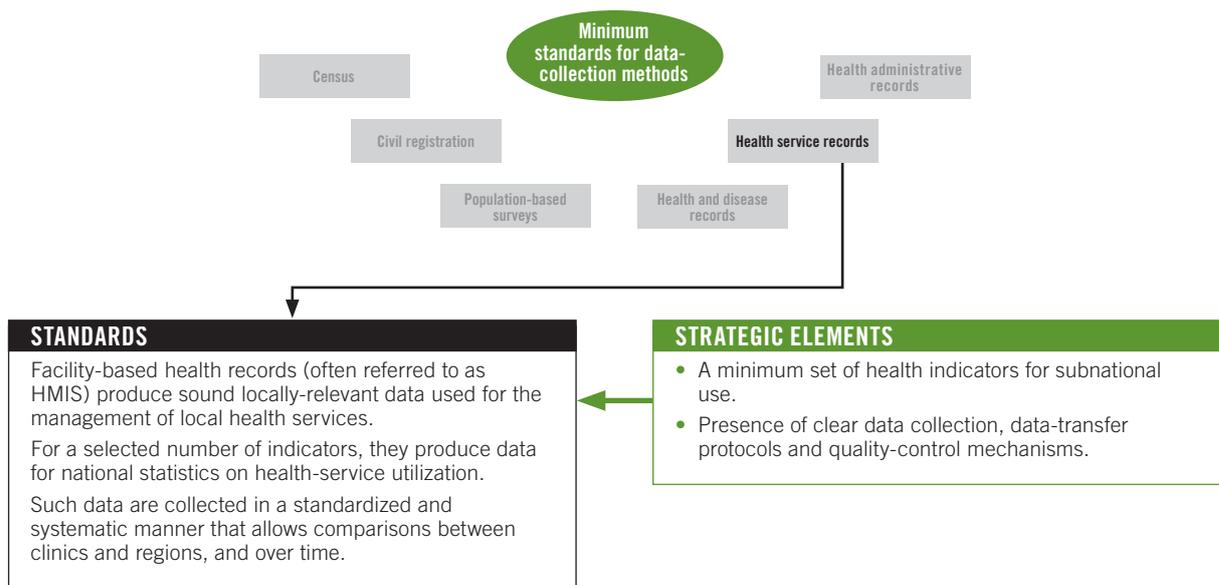
Health service-based data on mortality or morbidity are rarely sufficient to make estimates of population prevalence or incidence of disease or causes of death (e.g. maternal mortality), unless service coverage is close to 100%. They may however provide useful information on trends over time and in space, and on the relative importance of diseases and causes of death. Top-10 rankings of the causes of death in hospitals or cancer registries are an example of such information. Taking into account some of the biases of such data may further enhance its utility.

### 2.3.5 Health service records

Service records capture information on the numbers of clients provided with various services and the drugs and commodities consumed. To the extent possible, the health information system should capture service statistics from the private sector as well as from communities and civil society organizations (*Fig. 10*).

<sup>1</sup> For further information, please refer to <http://www.who.int/csr/labepidemiology/projects/surveillance/en/index.html> and [http://www.cdc.gov/epo/dih/Eng\\_IDSR\\_Manual\\_01.pdf](http://www.cdc.gov/epo/dih/Eng_IDSR_Manual_01.pdf).

**Fig. 10 Service records – Standards and strategic elements**



The focus is on subnational information that is used for the management of health services. Service records are based on service-generated data derived from facilities and patient-provider interactions covering care offered, quality of care, treatments administered, etc. A major characteristic and strength of service statistics is their local use for facility- and patient-management. Where appropriate, such service statistics may be used to develop population-based estimates of coverage of immunization, maternity care, etc. Although such estimates may be imprecise owing to the need to estimate denominators and possible under- or double-counting, they provide a regular source of information that can be validated periodically with statistics from occasional household surveys. Only limited data should be collected with the primary aim of national summaries. The summary of district information can however provide information that is useful for national-level planning, monitoring and evaluation.

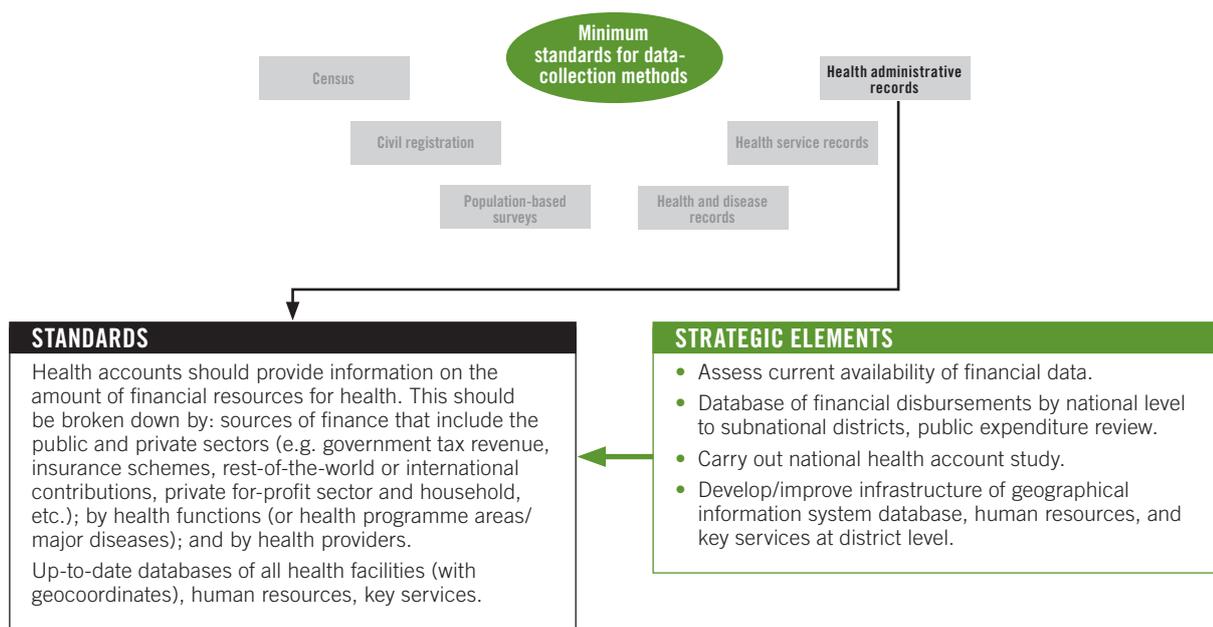
### 2.3.6 Health administrative records

A related component of health service information concerns the quality, availability and logistics of health service inputs and key health services (*Fig. 11*). This includes information on the density and distribution of health facilities, human resources for health,<sup>1</sup> drugs and other core commodities<sup>2</sup> and key services. The minimum requirement is a database of health facilities and the key services they are providing. The next level of development of this aspect of the health information system involves the mapping of facilities, human resources, core commodities and key services at national and district levels. Mapping the availability of specific interventions can provide important information from an equity perspective, and can help promote efforts to ensure that needed interventions reach peripheral areas and do not remain concentrated in urban centres.

<sup>1</sup> The information subsystem used routinely to manage the health workforce at various levels is sometimes referred to as the human resources management information system.

<sup>2</sup> The information subsystem used routinely to manage supply logistics is sometimes referred to as the logistics management information system.

**Fig. 11 Health administrative records – Standards and strategic elements**



The quality of services should be assessed regularly as part of the health information system. This can be done as part of regular supervision systems, as long as the information is collected in a standardized and systematic manner that allows comparison between clinics and regions, and over time. Additional information may be collected through a health-facility survey. Such a survey, which is usually based on a sample of clinics, may consider different aspects of quality, such as availability of drugs, commodities and trained staff. Special techniques such as record review, observation of client-provider interaction and use of mystery clients, add considerable value to the assessment but also add to the costs and complexity. Data collected from record reviews and staffing inventories can be used to validate routine administrative statistics on the volume of services delivered and the availability and geographical distribution of human resources.

Information on the level and distribution of human resources for key staff such as doctors, paraprofessional clinicians,<sup>1</sup> midwives, nurses, nurse auxiliaries, laboratory technicians, etc. is essential and should be monitored centrally as well as at the district and facility levels. Such data should be complemented by data on the attrition of health workers through mortality, resignation and possibly migration, and by data on the output of health training institutions.

The availability of information on core commodities and drugs can be assessed through facility reports or through administrative records provided by the medical stores at different levels of the health system. This may include essential medicines, condoms, emergency obstetric care kits, etc.

Another component of health service information concerns financing. For the purposes of managing the health services, data on financing are routinely provided by the financial management information system. For the purposes of policy development and strategic planning, financial information is compiled using the national health accounts methodology. National health accounts provide information on the

<sup>1</sup> Referred to variously as medical assistants, clinical officers, physician assistants and nurse practitioners.

amount of financial resources for health, and the flow of these resources across the health system. Breakdown by private vs. public sector is important. Disaggregation by major disease or health programme area is desirable, but may not be possible. At the subnational levels, budget information is needed as a minimum; information on actual expenditure is the next step.

### 2.3.7 Linking indicators and data sources

Each essential indicator should be linked with one or more suitable data sources. As has already been noted, sometimes there is only one gold-standard data-collection method for a given indicator. More often, however, different sources can be used to generate similar indicators, and decisions should be made about the most suitable data source given the circumstances (*Table 1*).

**Table 1 Sources of data for indicators by area**

	Health status	Health system		Determinants
		Inputs and outputs	Outcomes (use)	
Census				●
Vital statistics	●			●
Surveys	●	●	●	●
Health status records	●		●	●
Service records	●		●	
Administrative records		●		

The best data source for mortality is vital statistics of deaths with medically-certified cause of death. Verbal autopsy can be used as an alternative method to collect cause-of-death information if no medically-certified records are available. When there are no vital statistics, household surveys and censuses can provide information on levels and trends of mortality. This has been more successful for child than for adult mortality. If the vital statistics system does not have full coverage, or completeness of reporting is suboptimal, household surveys may provide important supplementary information to adjust mortality levels and trends.

Morbidity information is difficult to obtain for the general population unless objective measurement instruments are available. Surveys with biological data collection provide the most objective information on health and disease. A good example is the inclusion of HIV, blood pressure, anthropometry and anaemia-testing in population-based surveys. Population-based health interview surveys are also a source of information on estimates of episodes of common illnesses such as diarrhoea, but there are concerns about the reliability of such data and they are rarely used in national statistics. Self-reported measures of health are also subject to considerable bias, and recent efforts to control for such biases are being evaluated.

In addition, disease incidence or prevalence is estimated from health service information. This is either done through sentinel sites, such as antenatal clinic-based HIV surveillance, or service reports, as is done for tuberculosis and malaria. When clinic-based data are used, they are often combined with population-based surveys to obtain an estimate of disease prevalence or incidence through modelling. In addition, the population incidence of specific acute infectious diseases that are notifiable such as haemorrhagic fevers, severe acute respiratory syndrome (SARS), poliomyelitis and dysentery can be estimated from health service reports.

Information for disability indicators may use the same data-collection methods as morbidity, however household surveys are the best method, especially if biological or clinical data collection are included.

The coverage or use of health service provision is generally measured in one of two ways. The first is based on numbers of events such as vaccinations given or births attended, reported by the health facilities to the district and national levels of the health information system. The denominator – the number of persons in need – is generally estimated from administrative records, including projections of the census population. The main advantages of this approach are the ability to disaggregate to small geographical units and the frequency (annual or even quarterly) with which coverage can be measured. Disadvantages include inaccurate denominators and variable quality of reporting on the numerator.

The second way of estimating coverage of health service provision is through representative surveys of households. The advantages are the greater validity and consistency of the estimate and the ability to disaggregate by client characteristics such as socioeconomic status, which are not typically captured in routine administrative statistics. The main disadvantages include the low frequency of the estimates (often at 3–5 year intervals) and a limited ability to disaggregate below the first administrative level (i.e. province, region or state).

Reconciliation of the two sources of information will usually lead to adjustment of estimates based upon routine health-facility reports. This is the approach used in immunization-coverage estimation, but it can also be used for antenatal clinic-based HIV surveillance, when compared with population-based surveys that include HIV testing. The principle is to use less frequent high-quality population-based data to calibrate the information obtained from clinics, and thus improve population estimates of coverage and prevalence.

The availability of information on health system structure and functioning is an essential element of the health information system. Most information is derived from administrative records. This includes statistics on the level and geographical distribution of health service provision, key services (public health mapping), human resources, finances (expenditures, budgets, national health accounts), and other key inputs (drugs, equipment and supplies).

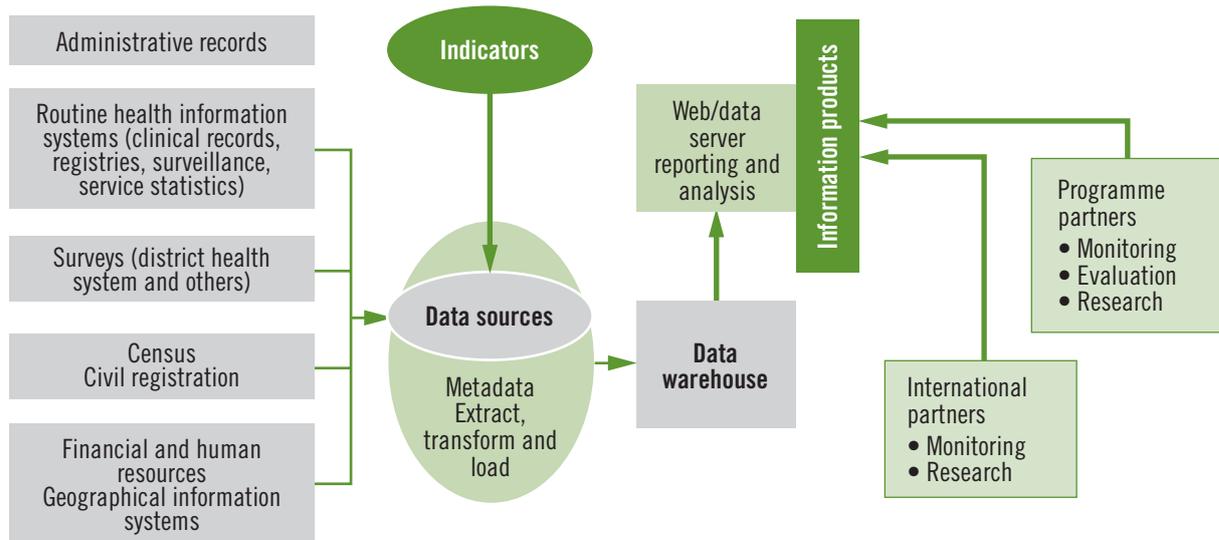
Population-based sample surveys are the major source of data on health determinants and risk factors. Examples of information collected are socioeconomic characteristics (wealth, education), demographic variables (age, sex, birth intervals), environmental conditions (indoor house pollution, water supply and sanitary facilities, geographical area), and risk behaviours (smoking, alcohol use, hypertension, unsafe sexual practices), mostly collected through large- or small-scale population-based surveys.

Risk-factor surveillance for noncommunicable diseases is an example of a system that includes population-based surveys complemented by clinical information. Such a system includes regular monitoring of a limited number of risk factors, with special attention to behaviours that have been shown to have a strong association with health outcomes, such as smoking, elevated systolic blood pressure and dietary habits.

## 2.4 Data management

Data management is a set of procedures for the collection, storage, analysis and distribution of data (*Fig 12*). Accurate and complete data are a fundamental prerequisite. Once data are collected, a sound management approach is essential.

**Fig. 12 Data management**



Firstly, a metadata dictionary (see below) should be developed. Next, sound data storage procedures require a well-designed logical structure which permits data retrieval and analysis. Data analysis and presentation include calculating indicators and the preparation of tables and graphs. Finally, the data should be made available to all who can use them and act on them. *Box 1* provides the definitions of some key data-management terminology.

### 2.4.1 Data collection

Accurate and complete data collection is the foundation of the data management plan. All other efforts are futile if the data are not of good quality. Incomplete and inaccurate data are confusing for all concerned. Therefore procedures for ensuring data quality should be established. The first of these is to reduce the amount of data to the minimum necessary. This “minimum data set” will reduce the burden of data collection. This procedure alone should already improve data quality. Other management actions which can improve data quality are regular local quality control and use of data, clear definitions of data elements, up-to-date training, and frequent feedback to those collecting and using data. When electronic communications facilities are available, data can be entered into a data warehouse (see below) at decentralized locations and thus provide immediate reporting to all levels.

#### BOX 1

##### Key data-management terminology

As the terminology of data management can be confusing, some short definitions are proposed for orientation:

- A database is a collection of tables.
- Each table may be considered to be similar to a spreadsheet with columns (data elements or fields) and rows (records) of data.
- A “relational structure” can be established among tables by using columns that have the same definition.

This relational structure can be used to combine data from different sources. For instance, a database may contain separate tables with immunization, health services, family planning, financial, human resource and geographical information. If each of these tables contains a column with a code for the facility, all these tables can be related to each other and information from each of them can be extracted to assemble a complete picture that includes multiple aspects of each facility. The metadata dictionary is essential to understanding the data and ensuring that consistent definitions are followed so that the relational structure is valid.

### 2.4.2 The metadata dictionary

In order to relate data from multiple sources, it is essential to develop common definitions and to understand the characteristics of each data element. The tool to do this is the metadata dictionary. The metadata dictionary strictly defines data elements and their use in indicators, including numerators and denominators, It also specifies the data-collection method, periodicity, analysis techniques used, estimation methods and possible biases of the data. This is a critical element to ensure quality and data transparency.

### 2.4.3 Data storage

Integrated data storage offers many important benefits. Integrating data from multiple sources can make the best use of data complementarity and synergies. The integrated central storage area is known as a data warehouse. By developing a data warehouse and a metadata dictionary, it is possible to create an integrated health information system.

The data warehouse integrates data from a wide range of sources including routine service statistics, surveys, surveillance, vital registration, census, financial, human resource and geographical information. It can be difficult to relate data from this wide variety of sources and this task is complicated by the fact that data are collected at different times and may have different field definitions. The competing demands of donors, vertical programmes and regions serve to complicate data rationalization. As noted above, it is essential to establish a metadata dictionary that will help provide common data-element definitions and ensure that other vital information, such as data time periods and geographical designations and other dimensions, are understood.

The process of defining metadata and entering data into the data warehouse through the “extract, transform and load” procedure can bring order to data chaos. The result is a rigorous relational data structure that can be used for monitoring, evaluation, management and research.

Extraction is the process of selecting data elements from the raw data that are available. The extraction process takes the data of interest from the source data tables. Not all data from the source tables are taken into the data warehouse, only data that are selected to fit into the information structure. Transformation of the data may include aggregation, calculation, cleaning, normalizing or merging tables, translating code values, or transposing values. The transformation process ensures the quality of the data and puts them into the proper relational structure as defined by the data warehouse. This relational structure ensures that the data can be used with similar data from other sources. The final step is to load the data into the data warehouse.

### 2.4.4 Data analysis and presentation

It is vital to improve the use of data at the local and district levels where it can have the most immediate impact on service delivery. The move to health system decentralization and reform reinforces the need for local availability of data. The data warehouse provides an ideal tool for the immediate feedback of information to the facility and district levels. It improves data access and use at the local level by providing immediate access to high-level data-analysis tools.

Facilities, districts and programmes can view their own data and also compare them to data from other sources at the same level. Districts can compare facilities in

their area as well as compare them to facilities in other districts. Similarly, information can be aggregated at the national level to give an overall picture or to compare regions. Since the data warehouse contains all the information from all levels, it is possible to aggregate it, to examine more detailed information at a local level, and also to compare areas.

The data warehouse is an ideal solution to the problem of providing information to local levels as well as to higher levels. Data have value at the source (facility level) and also as they move to the district and national levels. At the national level, the data warehouse provides a convenient central location where all data are available for analysis, evaluation and research, so as to influence policy, planning and management decisions.

### 2.4.5 Data distribution

The data warehouse facilitates the distribution of data to all levels of the country, and to the government as well as to international partners. The data warehouse should be designed with a web interface and connected to the Internet with appropriate access control. Where Internet access is available, the data warehouse can be accessed directly. Reports can be printed closest to the area of use. These reports have the advantage of sophisticated data analysis and presentation tools that are developed centrally, and they also benefit from the data-management quality procedures. The reports may contain comparative information from other areas or programmes to improve the understanding of the data and promote their use.

An electronic documentation centre where all relevant outputs of the country are stored (e.g. in PDF format) and made accessible through the web or otherwise is also an important information management tool.

### 2.4.6 Data warehouse implementation

To implement and manage a data warehouse, a sustained and coordinated effort is required. It is advised to respect the following sequence of procedures carefully. Expert technical assistance is highly recommended.

#### A. Data warehouse design

- Assemble a stakeholder group representing sources of data and users of data. This group should provide initial design guidance and ongoing oversight of the operation of the data warehouse.
- Determine the fundamental analytical dimensions that the system will support, so that resulting information can support action. Suggested data categories (see *Fig. 3*) of the data warehouse include:
  - determinants of health: socioeconomic and demographic indicators; environmental and behavioural risk factors;
  - health system inputs: policy, financing, human resources and organization;
  - health system outputs: service availability and quality;
  - health system outcomes: service coverage and utilization;
  - health status: mortality, morbidity/disability, reproductive health outcomes;
  - disease-burden calculation as an input to resource allocation decisions (by aligning disease burden, cost-to-treat, and cost-to-prevent information with resource allocation).

- Develop a metadata dictionary of all potential data sources:
  - health service records
  - registries
  - surveys (antenal care, demographic and health surveys, prevention of mother-to-child transmission, etc.)
  - financial
  - census
  - human resources
  - geographical information systems (GIS)
  - vital statistics.
- Design the data warehouse database tables and relationships.
- Design queries and reports.

### B. Data warehouse operation

As new data are collected and reported they should be extracted, transformed and loaded into the data warehouse. This may occur daily, weekly, monthly or less often depending on the data-collection schedule. It is best to set this up as an automated process to the greatest possible extent. The process of extracting, transforming and loading can be complex owing to variations in source-data quality, update cycles, and the transformation process itself. It is best to design this process carefully. Software tools are available to facilitate the process.

Data warehouse operation is not solely a technical undertaking. Sociopolitical factors influence and constrain the process. Operational questions to be considered are:

- Who should manage the warehouse?
- How should it be managed?
- How is it secured?
- Who has access to the data?

Resources are required to set up and maintain a data warehouse:

- a professional designer with database experience;
- a database administrator;
- a query and report designer;
- a managing board with representatives from data-source organizations;
- a stakeholder group.

The data warehouse is an ongoing project that will evolve as data become available and as needs evolve. It will require continuous maintenance not only to load updated data but also to add new types of data, queries and reports. The stakeholder group should hold regular meetings to keep information sources up to date and to communicate their information needs.

### 2.4.7 Integrating vertical systems

Vertical data-collection systems have frequently caused problems for the collection of health information. Many vertical programmes such as those dealing with malaria or tuberculosis have developed their own data-collection systems. This is partly in reaction to the failure of existing information systems to provide good

information, but it is also intended to meet the perceived unique information needs of these programmes. Often the vertical programmes have developed extensive data-collection instruments that impose a significant burden on facility staff. The data warehouse provides a mechanism for integrating data from vertical systems into health decision-making.

The process of developing a data warehouse can also be an opportunity to examine the information systems of these vertical programmes and to rationalize their data collection. However, many vertical programmes have a strong mandate and rigid data procedures, and they may be difficult to change. In this case, an effort should be made to include appropriate selected indicators from the vertical programme in the national data warehouse. Over time, vertical programmes may come to rely on these national core indicators and may realize that they do not need a complete data set to be collected separately. Often, a core indicator set in combination with the episodic surveys of vertical programmes provide better-quality and more complete information.

#### 2.4.8 Standards of data quality

The health information system should ensure that the data meet standards of reliability, transparency and completeness. It is important to assess the strength of the source data and the statistical techniques and estimation methods used to generate indicators. Building upon the Data Quality Assessment Framework (DQAF) of the IMF, the following criteria are used to assess the quality of health-related data and indicators:

*Timeliness.* The gap between when data are collected and when they become available to a higher level or are published.

*Periodicity.* The frequency with which an indicator is measured.

*Consistency and transparency of revisions.* Internal consistency of data within a dataset as well as consistency between datasets and over time; extent to which revisions follow a regular, well-established and transparent schedule and process.

*Representativeness.* The extent to which data adequately represent the population and relevant subpopulations.

*Disaggregation.* The availability of statistics stratified by sex, age, socioeconomic status, major geographical or administrative region and ethnicity, as appropriate.

*Confidentiality, data security and data access.* The extent to which practices are in accordance with, for example, OECD *Guidelines for data protection*<sup>1</sup> and other established standards for storage, backup, transport of information (especially over the Internet) and retrieval.

Finally, there are standards for the technical soundness and transparency of data, the estimates derived from them and the methods (adjustments, data transformation and analytical methods) used to make those estimates. These are discussed below.

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<sup>1</sup> [http://www.oecd.org/document/18/0,2340,en\\_2649\\_34255\\_1815186\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/18/0,2340,en_2649_34255_1815186_1_1_1_1,00.html).

## 2.5 Information products

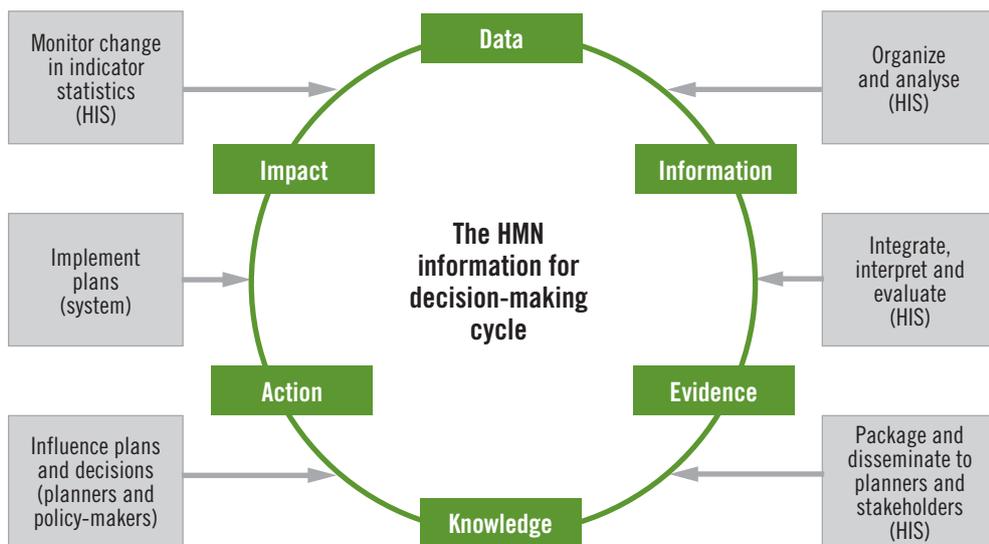
Sections 2.1–2.4 have dealt with the inputs to a comprehensive health information system in the form of resources, indicators, data sources, data management and data quality. Sections 2.5 and 2.6 deal with the information produced by the health information system and its dissemination and use.

The Framework has so far addressed the products of the health information system in the form of data. However, data are only the raw products. Data themselves have little value until cleaned, controlled, organized and analysed. At this stage the *data* become *information*. Yet information is of limited value until it is integrated with other information and evaluated in terms of issues confronting the health system. At this stage the information becomes *evidence* of use to decision-makers. The synthesis of evidence is still insufficient however until packaged, communicated and disseminated to decision-makers in a form that changes their understanding of the issues and needs. At this stage, the evidence becomes *knowledge*. Once knowledge is applied through the planning process to result in *action* and change, an *impact* on the indicators can be expected. And such impact should be measurable through change in the source data for the indicators. This is how the Health Metrics Network visualizes a continuous cycle of data to obtain the greatest possible impact thanks to a comprehensive health information system (Fig. 13)

### 2.5.1 Converting data to information

Health information systems in low- and middle-income countries tend to be data-rich, but information-poor. This is a consequence of the belief that data can be used directly for decision-making, without the value-added approach outlined in Fig. 13. Raw data alone are rarely useful. The point of the system is not just to generate data and hope that it will be used. Raw data must be cleaned, validated, organized and entered into a first-level data repository or warehouse (see above). At the same time,

**Fig. 13** Relation of data and health system impact in the HMN Framework



Based on: De Savigny D, Binka F. Monitoring future impact on malaria burden in subSaharan Africa. *American journal of tropical medicine and hygiene*, 2004, 71:224–231.

a preliminary analysis of data converts them to initial information at the primary level that is already useful for front-line programme management, monitoring and measurement of progress on local targets. Such a preliminary analysis of data should be done as close to the level of data collection as possible. In this process, raw data are converted into immediate information and evidence for local decision-making within the system.

Once the health information system has started to convert data into information, the information should be used on a regular basis at meetings, and displayed where it can be seen by staff and the public. By being used, the information system, and the quality of its information, is gradually improved through a cyclic learning process. By learning through hands-on experience, problems are identified, new needs defined, and new features added that will be refined and improved upon in the next cycle. This low-level analysis of primary data requires an appropriate and simple tool-kit of targeted methods aimed at providing relevant feedback to the front lines.

### 2.5.2 Converting information to knowledge

As data and information move up the line to higher levels of the health system via the data repositories at these levels, they can be synthesized and triangulated (compared) with other sources and compiled into usable statistics for deeper analysis and comparison across the health system. A critical aspect is that of analysis, i.e. identifying results from the synthesis of data from multiple sources, examining inconsistencies and contradictions, identifying and accounting for biases, and summarizing into a consistent assessment of the health situation and trends. Such higher-level analysis provides estimates, i.e. knowledge on the burden of disease, patterns of risk behaviour, health service coverage, trends in indicators, and health system performance. The current fragmentation of data sources and subcomponents of the health information system represents a serious obstacle in this regard.

Establishing a data and information repository as a shared resource at national, subnational and district levels is therefore an important step in improving information practices and enabling the necessary high-quality data analyses. It is from this level of analysis that results are used for policy development and strategic planning. Such analysis, interpretation and advocacy do not take place spontaneously, and need to be driven. They require the packaging, communication and dissemination of evidence in a format and language accessible to the higher-level policy- and decision-makers. This is a generally neglected aspect of most health information systems that tend to short-circuit the cycle illustrated in *Fig. 13* by providing data direct to decision-makers without appreciating the need for intermediate steps (see section 2.6). The Health Metrics Network is identifying and developing tools and best practices for each step in this cycle.

## 2.6 Dissemination and use

Information is used at various levels of the health system for health service management, health system management, planning, advocacy and policy development. A broad range of users are involved in these various uses, each from different technical disciplines and vocations with associated vocabularies and methods of communication. Dissemination should be planned for the unique characteristics of each, and the most effective packaging and channels of communication for carrying “the story” should be chosen. The timing of information dissemination should be planned care-

fully to fit in with the planning cycles and needs of users. Communications experts can assist with the packaging of information for different audiences.

The dynamic links between demand, supply and quality of information should be addressed by encouraging an information culture where information is demanded and the use of information promoted. In practical terms, this depends on the establishment of institutional mechanisms and incentives for information use. Experience shows that the most effective mechanisms involve linking data/information to actual resource allocation (budgets) and developing indicator-driven planning.

### 2.6.1 Institutionalizing information use and demand

Even if high-quality data are produced, this does not necessarily result in their effective use in decision-making. Other factors (including individual behavioural, organizational and environmental factors) all influence the extent to which information is used. Countries should establish institutional mechanisms for the use of information for decision-making and planning. Entry points for improving the use of information include the presence of:

- mechanisms linking data/information to actual resource allocation (budgets and expenditure);
- indicator-driven, short- (1 year) and medium-term (3–5 years) planning;
- organizational routines where managers are held accountable for performance through the use of results-based indicators at all levels of the health system;
- a programme addressing behavioural constraints to data use, for example through the use of incentives for data use, such as awards for the best service-delivery performance, for the best/most improved district, or for the best HIS products/utilization; and
- a supportive organizational environment that puts a premium on the availability and use of well-packaged and -communicated information and evidence for decision-making.

### 2.6.2 Packaging and communicating information for decision-making

There have been many recent innovations and positive experiences in packaging complex information and evidence in simple and attractive formats that catch the attention of decision-makers and communicate effectively the message embodied in the information. Some formats take advantage of web- or computer-based access to repository or observatory data served in an interactive format. Some new computerized analysis tools generate standardized reports rich in graphical and even cartographical (geographically mapped) representation of information. Standardized reporting formats, profiles and briefs are also highly effective. Such formats should guide decision-makers and policy-makers by providing interpretations based on the potential consequences (what-if) of alternative decisions and scenarios.

### 2.6.3 Use of information for decision-making

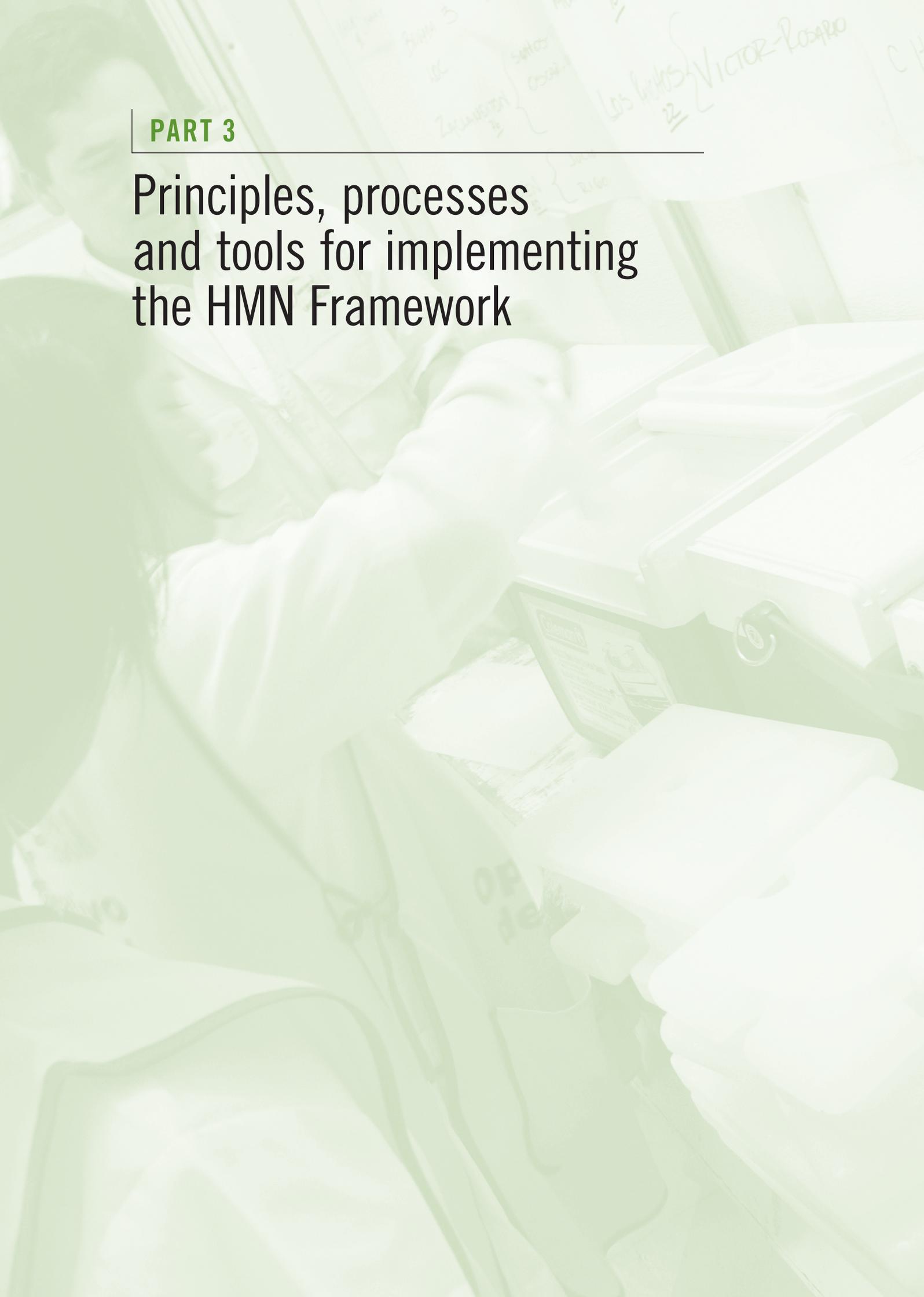
Following the packaging and communications stage, data should be used for decision-making. Capacity for data analysis is often lacking at peripheral levels where the data are generated and the results should be used for planning and

management. Bringing together a comprehensive analysis of the health situation and trends with data on health inputs, such as health expenditure and health system characteristics, is particularly important. The development of such analytic capacity requires planning, investment and tools.

An important function of the health information system is to connect data production with data use. Users comprise those delivering care as well as those responsible for the management and planning of health programmes. More broadly, users include those financing health care programmes, both within the country (health and finance ministries) and outside (donors, development banks and technical support agencies). Users of health-related data are not confined to health-care professionals, managers or statisticians. Indeed, decision-making around country health priorities necessarily involves the wider community, including civil society as well as policy-makers at the senior levels of government.

These different users of data have varying needs in terms of the level of detail and technical specificity required. Health-care planners and managers responsible for tracking epidemiological trends and responses of the health-care system generally require more detailed data than policy-makers who need data for broader strategic decision-making and investments (see *Fig. 2*).





**PART 3**

# Principles, processes and tools for implementing the HMN Framework



## 3.1 Guiding principles for HIS development

Implementation of the HMN Framework at country level should be underpinned by a set of commonly-accepted principles: country leadership and ownership, a focus on the needs of individual countries, building on what already exists, broad-based consensus-building, and HIS development as an incremental process (*Box 2*).

### 3.1.1 Country leadership and ownership

Country leadership and ownership are critical to the success of HIS strengthening, and to its long-term sustainability. The role of partners is to offer flexible support, information and guidance as needed.

A senior widely-respected decision-maker should be identified to provide overall leadership and direction during the process. Such “country champions” are often essential to the success of strengthening efforts.

### 3.1.2 Responding to country needs and demands

Strengthening of country health information systems should always start from a felt need in the country itself. As a matter of principle, it should seek to respond to the needs of users of health information, but be realistic about what can be achieved within available resources and capacities.

A key product is a comprehensive vision of health information that: addresses institutional and organizational constraints, including human and financial resources; serves as a coherent framework for international support to improved health information; and is flexible enough to change in response to changing needs.

### 3.1.3 Building on existing initiatives and systems

The process should build upon existing initiatives, systems and knowledge whenever possible.

For example, strengthening of country health information systems should not take place in a vacuum but be linked to and build upon other similar initiatives, especially national strategies for the development of statistics.<sup>1</sup> Examples of current efforts include the work of the UN Statistics Division to support census and vital statistics; promotion of statistical capacity-building by the World Bank and the Organisation for Economic Co-operation and Development (OECD) through the

#### BOX 2

##### Implementing the HMN Framework in countries

The process of strengthening a country health information system through implementing the HMN Framework should:

- be nationally led and owned, with high-level political support and champions;
- respond to the needs of health information users, but be realistic about resources and capacities;
- build upon what exists, including any broader efforts to improve the production and use of information;
- be developed in an inclusive and consultative way;
- be tackled as a gradual, incremental process requiring long-term investment;
- describe a comprehensive vision of health information that is flexible enough to change in response to changing needs;
- draw on the best international standards, and be guided by the *Fundamental principles of official statistics*;
- address institutional and organizational constraints, including human and financial resources;
- serve as a coherent framework for international support to improve health information.

<sup>1</sup> *A guide to designing a national strategy for the development of statistics*. Paris, PARIS21 Secretariat, 2004.

<sup>2</sup> <http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/> and <http://www.paris21.org/pages/advocacy/why-statistics/index.asp#credits>.

<sup>3</sup> <http://unstats.un.org/unsd/statcom/doc04/data-quality.pdf>.

Partnership in statistics for development in the 21st century (PARIS21),<sup>2</sup> and IMF work on data-quality improvement.<sup>3</sup>

Coordination mechanisms for the strengthening process should make use of any appropriate existing structures, and the initial assessment of the health information system should draw on all available information.

### 3.1.4 Building a broad-based consensus

Broad-based consensus-building is a critical first step, as much of the data needed by the health sector is generated by other sectors, and the resources required for strengthening health information systems generally come from constrained national budgets. Although the inputs of external partners and donors are initially important to catalyse action, countries themselves will need to sustain the necessary investments in the longer term.

To ensure long-term consistent financial and political support, national statistics offices, those seeking to improve monitoring and evaluation within the ministry of health and their allies must “make the case” and convince decision-makers of the need to invest in good statistics.

The PARIS21 consortium has focused on advocacy for statistics and evidence-based policy-making. Their web site<sup>1</sup> provides advocacy materials such as presentations concerning the importance of using statistical information in the policy-making process. The advocacy guide published by PARIS21, *Why statistics*, notes that in order to use advocacy materials effectively, “...it will be important to analyse the targets to be reached”. The following points are made:

- An advocacy campaign targeted at government, parliament or senior civil servants will probably be most effective using speeches, reports or material produced for specific occasions (for example, a parliamentary hearing of the chief statistician). This can make use of information and examples from other countries and their official statisticians.
- Leaders of public opinion, regional organizations, pressure groups, academia and the research community can be targeted via publications that periodically give a summary of the work of the statistics office. With the spread of the Internet, online dissemination will become more and more important.
- The national business community is particularly aware of the importance of statistics and of their timeliness and sectoral and local disaggregations, and should be reassured about such things as the burden imposed by the provision of statistics and privacy issues.
- The materials can also be useful in training staff, to provide them with effective arguments to explain the nature of a good statistical system and why it is necessary.

### 3.1.5 A gradual and incremental process with a long-term vision

The strengthening of country health information systems is best approached as a gradual incremental process. It need not entail an immediate and total overhaul of the whole health information system (although this may be necessary in countries where the system is completely dysfunctional) or major structural change. It is gen-

<sup>3</sup> <http://unstats.un.org/unsd/statcom/doc04/data-quality.pdf>.

erally more effective to deal with one aspect of the system at a time, such as one of the subsystems (disease surveillance or household surveys), or to address a specific need, such as the introduction of indicators related to a new health intervention, e.g. the treatment of HIV/AIDS. When improvements have been secured, the strengthening process can identify a further set of priorities for action.

Whether the scope is narrow or broad however, over the long term (i.e. by 2015) the goal should be a balanced coherent comprehensively-developed health information system. This requires consistent long-term investment.

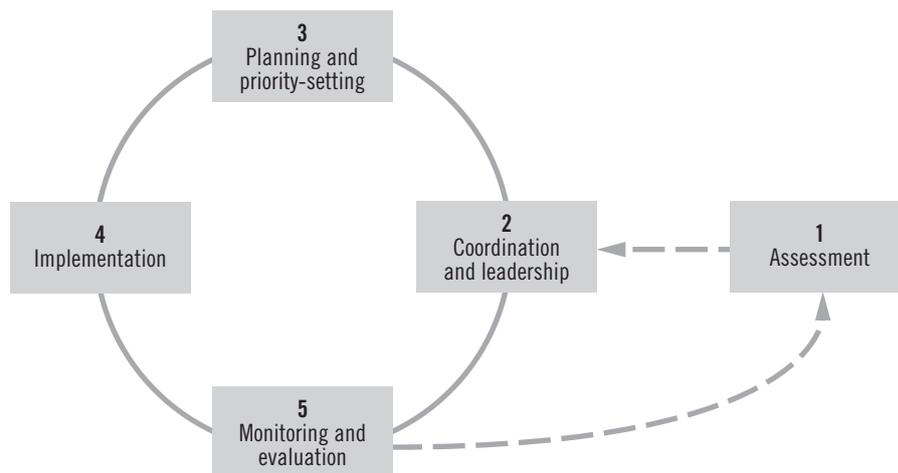
### 3.2 Implementation process for HIS strengthening

The scope, form and content of this process depend on locally-specific factors such as the structure of government, the level of development, institutional capacities and affordability. Whatever the circumstances, the process of implementing the HMN Framework should include the following elements:

- The establishment of consultation and coordination mechanisms that bring together all key stakeholders, including those working in health and statistics, and all producers and users of health data.
- The establishment of a steering committee to provide ongoing oversight and coordination of HIS-strengthening activities.
- Depending on the circumstances, the creation of country action teams and the identification of country “champions” (see above).
- An assessment of the current situation, including any current work to improve health statistics. The assessment template should also provide the basis for monitoring improvements.
- Agreement on a shared vision and goals for the future of the health information system.
- The definition of minimum standards for data availability, timeliness and quality.
- The identification of strategic actions needed to achieve the vision, including prioritization of tasks.
- A detailed costed action plan, with a timetable and allocation of responsibilities in order to achieve the desired outcomes.
- The synthesis, analysis and use of country evidence to inform planning, resource allocation and evaluation.
- The development and use of implementation monitoring-and-evaluation mechanisms, leading to reprogramming.
- A dissemination and communications plan to keep stakeholders (producers, users, civil society) involved throughout the strengthening processes and to report back on results obtained, especially at the evaluation and reprogramming stages.

The process is a virtuous cycle in which implementation is followed by evaluation and reprogramming (see *Fig. 14*). The key phases are: coordination and leadership; assessment; prioritization and planning; implementation; monitoring and evaluation; and back to planning. The results of the strengthening process are improved availability and use of quality health information.

**Fig. 14 The cycle of HIS strengthening**



### 3.2.1 Phase 1 – Assessment

The assessment phase identifies the strengths and weaknesses of the health information system, gaps and opportunities, resources, barriers to health information generation and use, and key actors to be involved.

#### Assessment

One of the first tasks of the steering committee is to arrange for an assessment of the current status of the country health information system. HMN recommends using the HMN Framework as a guide and the HMN *Health information system situation assessment tool*<sup>1</sup> for this first baseline assessment and for subsequent monitoring. The committee should draw up the terms of reference for the baseline assessment, identify the composition of the assessment team, and mobilize human and financial resources for the assessment. The purpose is to assess the extent to which the health information system and its various subsystems are currently meeting the needs of users, i.e. its capacity to provide the sound and timely data needed for public health action, including priority indicators of national and global health interest.

Such an assessment is a complex undertaking. It should be comprehensive in nature and cover the many subsystems of the health information system, including both public and private sources of health-related data. The assessment should address the resources available to the health information system (inputs), its methods of work and products (processes and outputs) and its results in terms of data availability, quality and use (outcomes). In addition to examining the data generation processes (technical determinants), it should also consider the behavioural, environmental and organizational determinants that influence the performance of health information systems. Its methodology should include both quantitative and qualitative approaches, including document review and interviews with in-country stakeholders at central and peripheral levels, and external actors in health-related information.

In many settings, assessments of the health information system, or individual components of it, are likely to have been carried out in the past and should be built upon, not duplicated. The findings should provide the foundation for an analyti-

<sup>1</sup> This and other tools may be downloaded from <http://www.who.int/healthmetrics/tools/en/>.

cal and strategic assessment of the strengths and weaknesses of the current health information system. Once endorsed, it provides the baseline against which future progress in HIS strengthening should be evaluated. The assessment report, providing recommendations for action, should be made accessible to the various stakeholders, including health professionals and civil society.

The dotted lines in *Fig. 14* indicate that after initial assessments, the improvement cycle will continue through successive iterations, but it will be necessary periodically to move out of the cycle into the more extensive assessment step to progress, and then move back into the cycle.

### 3.2.2 Phase 2 – Coordination and leadership

The coordination and leadership phase is essential for the success of the process, as many diverse actors have key roles to play and consensus is needed concerning the determination of priorities and the methods for addressing them.

#### Policy commitment

The first step in HIS strengthening is to obtain policy commitment, i.e. the decision that action is needed. High-level political commitment is an essential part of this phase, and it should be maintained throughout the process.

#### Leadership

Practical success in HIS strengthening depends to a large extent on the personal commitment and dedication of those involved, in particular senior decision-makers and managers. An important step is the identification of a senior country “champion” with decision-making powers to lead the process, able and willing to put time and effort into convening stakeholders, involving different partners (internal and external) and moving the process forward.

#### Consensus building

Although the initial impetus for HIS strengthening may come from any one of a variety of partners (including non-health partners such as statistics offices), the chances of success will be greatly enhanced by high-level commitment involving both health and other sectors, notably statistics, local government (especially in the context of health-sector strengthening), finance, planning, education, labour, food and environment. Ensuring linkages between ministries of health and national statistics offices is particularly important.

Consensus-building for HIS strengthening should also involve donors and development partners such as multilateral and bilateral agencies. Other users and stakeholders may include NGOs, academic institutions, professional associations (medical, statistical), and users of health-related information such as parliamentarians, civil society (health-related advocacy groups) and the media. In countries with decentralized systems, the process should be clearly articulated and involve managers and representatives of care providers at peripheral levels (e.g. districts) as well as stakeholders at the central level.

#### Coordination

A coordinating mechanism with links to relevant line ministries, research institutions, NGOs, technical support agencies and donors is crucial. If a suitable body

does not already exist, a steering committee under high-level leadership should be constituted to ensure coordination and to provide strategic guidance and oversight. It should convene regular meetings, mobilize technical advice, provide guidance and oversight, and disseminate reports of progress to all stakeholders. The precise nature of the operational arrangements to take action will vary depending on the individual country context.

### 3.2.3 Phase 3 – Planning and priority-setting

Defining the scope of HIS strengthening and planning its implementation is a key step in the overall process.

#### Prioritization

The assessment report provides the basis for strategic decision-making and framing a comprehensive vision of HIS in the future. However, it is also likely to contain a long list of issues to be resolved. An important next step therefore is prioritization and the identification of actions to be undertaken in the short, medium and longer terms. The underlying philosophy for priority-setting should be that strengthening will be incremental, with a step-by-step implementation of key actions and a gradual scaling up as resources and capacities permit.

The process of priority-setting should be inclusive and transparent. A national stakeholder workshop should be convened to permit open discussion of the assessment report and broad-based involvement in setting aims, objectives and priorities. Determining priorities involves first describing options for addressing the issues raised in the assessment phase and then determining, through a process of discussion and consensus, what is feasible given current capacities and opportunities for resource mobilization, and the sequence in which issues should be addressed.

#### Identifying key indicators and data-collection methods

An integral element of the prioritization process should include the identification of a number of key indicators and agreement on data-collection methods. The precise list of indicators will vary according to the epidemiological profile and development needs of each country (see also sections 2.2.2 and 2.2.3 for a detailed discussion of key indicators and data collection).

#### Planning

Once broad agreement has been reached on a limited set of priorities for the initial period of strengthening, a national plan – preferably with a long-term perspective, typically 10 years – should be prepared under the overall guidance and leadership of the steering committee. Each group identified as having specific responsibilities in delivering the outputs defined in the plan should develop a detailed activity-specific workplan. A further national workshop should be convened to finalize the plan of action and allocate roles and responsibilities. The strengthening plan should be endorsed at the highest level.

#### Costing and resource mobilization

The HIS strengthening plan should be costed, and plans for financing and strategies for resource mobilization discussed. Costing should cover both capital and recurrent costs, including training of existing and new human resources. The costs of

external technical assistance should also be included. Where possible, the choice of alternative data collection methods (e.g. special surveys vs. ongoing vital statistics for measurement of mortality rates) should be based upon cost-effectiveness estimates.

### 3.2.4 Phase 4 – Implementation of HIS strengthening activities Implementation

Overall guidance on the implementation of the plan should be provided through the steering committee, where the continuing participation of high-level leadership and involvement of stakeholders will help maintain momentum and commitment. HIS strengthening is likely to require additional efforts by the many actors involved beyond their normal responsibilities. Any resulting stresses should be recognized and acknowledged. The action plan may consider identifying rewards for improved data collection, presentation and use of information.

#### Data collection

Country plans should involve the identification of areas urgently requiring strengthened data collection, for example the introduction of sample vital statistics, enhanced cause-of-death reporting, a coordinated household-survey plan, or improved routine data collection linked to geographical information systems.

### 3.2.5 Phase 5 – Monitoring, evaluation and reprogramming

The monitoring and evaluation phase should feed a renewed cycle of assessment, planning and implementation in order to build incrementally towards the agreed vision.

#### Monitoring

The strengthening plan should include a monitoring and evaluation framework with specific indicators for tracking progress. Indicators should cover the spectrum of inputs, processes, outputs, outcomes and the ultimate impact in terms of the availability and use of sound health information.

Six-monthly reports on progress of activities and disbursement of funds should be provided to the steering committee to enable corrective action and modifications to the plan, if necessary. The achievement of milestones, and the difficulties encountered and addressed, should be reviewed and discussed annually by stakeholders.

#### Evaluation and reprogramming

A full evaluation of the implementation of the strengthening plan should be undertaken at intervals appropriate to the timescale of the plan. It may be helpful to undertake a first evaluation within three years of the start of implementation.

The evaluation should include a reassessment of the health information system, using the same HMN *Health information system situation assessment tool* to allow a comparison of improvements against the baseline. The evaluation should consider specifically the availability, quality and use of important health information, and the extent to which there is an improved ability to measure and monitor inequities in health and to take action based on these measurements. It should also permit an assessment of the degree to which there is improved coordination between country

and external partners and greater coherence in the overall demands for information. The evaluation should lead into a renewed cycle of prioritization, planning and implementation. A national workshop should be convened to finalize and endorse the reprogrammed plan of action.

### Implementation research

The strengthening process may involve elements of research and development when major gaps have been identified that currently available methods are unable to address. Operations research and the introduction of new approaches should be seen as an integral element of strengthening that can be facilitated through discussions with partners such as the Health Metrics Network. Examples of topics for a research agenda might include:

- costing of HIS strengthening;
- assessing the effectiveness of various targeted interventions (training, supervision, feedback, incentive schemes) for improving the quality of data;
- assessing the effectiveness of different information-dissemination methods to enhance the use of information;
- characterizing sociocultural constraints and factors enabling the use of information;
- field-testing and validation of sentinel methods of vital-events monitoring and cause-of-death attribution;
- validation of verbal-autopsy tools for use in diverse settings;
- development of methodologies to merge data from multiple household surveys;
- development of simple methods for evaluating the completeness of reporting systems.

A summary of key activities is provided in *Table 2*.

### 3.3 Key HMN tools

Efforts to strengthen HIS will benefit from a range of tools and methods for use at country and global levels. Some of these tools are already available. Others are to be developed by HMN through an interactive process involving country and global partners.

*Fig. 15* illustrates the relationship between steps in the process of producing quality data and the proposed HMN tools leading to desired outputs. These core HMN tools are discussed in detail in on the HMN web site.<sup>1</sup>

### 3.4 Evolution of the HMN Framework

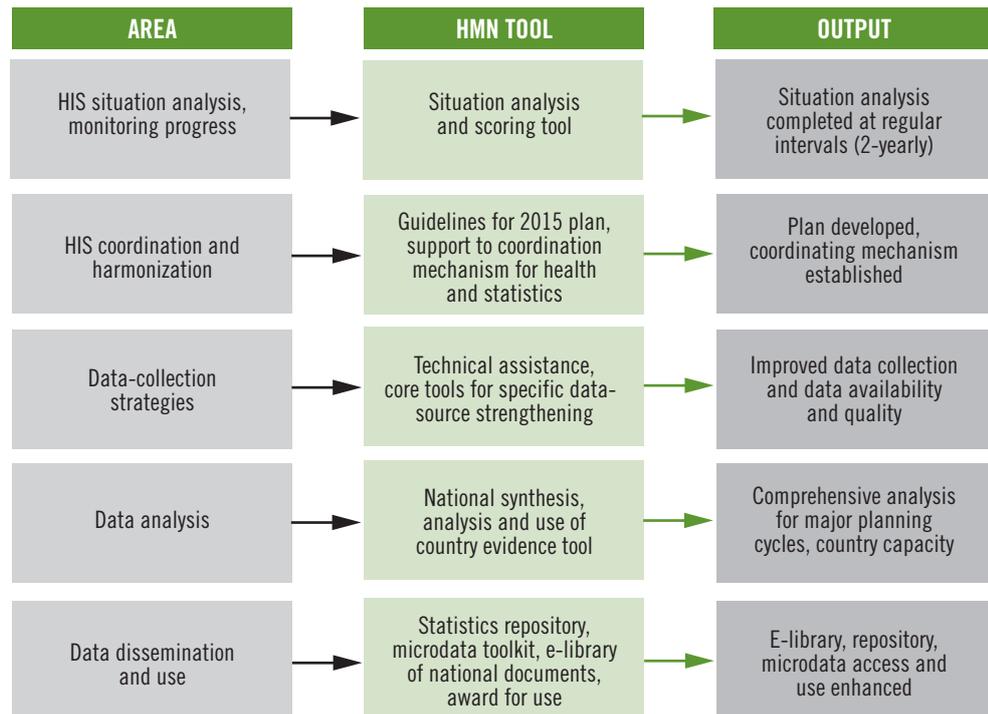
The standards and guidelines described in this document are based upon existing accepted standards and the opinions of experts obtained by the Health Metrics Network. The next steps are to build consensus around and to support the implementation of these standards and norms for the collection, management, synthesis, analysis and use of health information. These are the objectives behind the development and use of the HMN Framework.

<sup>1</sup> This and other tools may be downloaded from <http://www.who.int/healthmetrics/tools/en/>.

**Table 2 Process for HIS strengthening**

STAGE	ACTION	KEY OUTPUTS
<b>Coordination and leadership</b>	<ul style="list-style-type: none"> <li>• Stimulate initial interest in HIS strengthening (ideally request from the ministry of health)</li> <li>• Identify and mobilize key partners</li> <li>• Conduct stakeholder analysis (national and subnational)</li> <li>• Identify country champion</li> <li>• Establish country steering committee</li> <li>• Identify immediate key milestones</li> <li>• Commission assessment</li> </ul>	Policy framework for HIS strengthening Country steering committee Key milestones Terms of reference for baseline assessment
<b>Assessment</b>	<ul style="list-style-type: none"> <li>• Undertake baseline assessment of HIS, including mapping existing assessments and ongoing HIS development work, using HMN Framework and situation assessment tool</li> <li>• Identify strengths and weaknesses of current HIS, including subsystems</li> <li>• Describe information needs for different indicators</li> <li>• Analyse results, prepare and disseminate report</li> </ul>	Baseline assessment of health information system Report disseminated
<b>Prioritization and planning</b>	<ul style="list-style-type: none"> <li>• Convene national workshop to share results, agree on vision of health information, and identify priorities for action</li> <li>• Identify core indicators for the national health information system, including metadata, storage, dissemination practices</li> <li>• Draw up strategy and action plan, including generation of consensus indicators</li> <li>• Identify data-collection methods for core indicators</li> <li>• Convene national workshop to finalize and endorse plan of action and allocate roles and responsibilities</li> </ul>	Comprehensive vision of health information Prioritized and costed strategy and action plan Roles and responsibilities allocated
<b>Implementation</b>	<ul style="list-style-type: none"> <li>• Identify, design or modify data-collection tools, data-processing and decision-support tools; train data collectors and users at all levels</li> <li>• Produce regular reports on core indicators; develop and apply data-quality monitoring tools; disseminate reports to all stakeholders</li> <li>• Carry out comprehensive analysis to inform planning cycles</li> <li>• Develop national capacity</li> </ul>	Reports on core indicators
<b>Monitoring and evaluation</b>	<ul style="list-style-type: none"> <li>• Ensure regular monitoring of performance against agreed milestones</li> <li>• Evaluate progress against plan at regular intervals (e.g. within the first 3 years)</li> <li>• Workshop on evaluation report to modify plan in light of evaluation</li> </ul>	6-monthly progress reports Evaluation report Reprogrammed plan

**Fig. 15 HMN tools**



Best practice is still being defined through implementation research and the careful assessment of efforts to strengthen health information systems. In important respects, the HMN Framework is a work in progress to be informed by findings over the next decade from the implementation of various interventions to strengthen national health information systems. Hence it is up to users of the Framework, members of the Health Metrics Network at both country and global levels, to develop it further.