

health facility & community data



toolkit

World Health Organization
In collaboration with
US Agency for International Development (USAID)
and University of Oslo



WHO Library Cataloguing-in-Publication Data

Health facility information systems resource kit. Product of a Technical Consultation
on Monitoring Results with Health Facility Information Systems

I. World Health Organization.

ISBN 978 92 4 154886 1

Subject headings are available from WHO institutional repository

© World Health Organization 2014

All rights reserved. Publications of the World Health Organization are available on [the WHO web site \(www.who.int\)](http://www.who.int) or can be purchased from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: bookorders@who.int).

Requests for permission to reproduce or translate WHO publications –whether for sale or for non-commercial distribution– should be [addressed to WHO Press through the WHO website \(www.who.int/about/licensing/copyright_form/en/index.html\)](http://www.who.int/about/licensing/copyright_form/en/index.html).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use.

Contents

Acknowledgements	2
Aim and structure of this toolkit	2
Introduction	3
Main sources of data from health facilities	8
Attributes of a well-functioning facility-based information system	10
Improving facility-based information systems: an action agenda for countries	11
<u>Governance</u>	
Institutional and policy framework	11
Data standards	13
Data architecture framework.....	14
Human resources and capacities.....	16
<u>Data collection and management</u>	
Patient-level monitoring with unique identifiers	18
Web-based facility reporting.....	20
Community-based service data.....	21
Facility-based data on mortality and causes of death	23
Monitoring quality of care with facility data.....	25
<u>Data quality and analysis</u>	
Health facility assessments (HFAs)	27
Data quality assessment and verification.....	29
Synthesis of data in analytical reports of progress and performance	31
<u>Data dissemination and use</u>	
Data sharing and transparency	33
Data interpretation, visualization and dissemination	34
Annex: Checklist of key items	39

Acknowledgements

This document was developed in the context of a Technical Consultation on Monitoring Results with Health Facility Information Systems, which took place in Glion-sur-Montreux, Switzerland from 11-12 June 2014.

Aim and structure of this toolkit

The aim of this toolkit is to provide an overview of best practices, innovations, tools and methods that are available to countries in support of strengthening the components of a health facility information system.

The materials are presented according to an organizing framework for the key components of a country health facility information system, namely: governance (an overarching component); data collection and management; data quality and analysis; and data dissemination and use. Within each section, key action steps are identified for countries and examples of available tools and resources to support country action are provided.

A checklist of key items and attributes is also provided designed to facilitate monitoring of progress towards defined standards (also available as a separate spread sheet). The checklist can be used to monitor progress and should be completed in a collaborative process by all stakeholders, including data producers and data users.

Introduction

Recent substantial increases in international funding for health have been accompanied by greater demands for statistics that accurately track real-time progress and performance in health, and ensure accountability at country and global levels. As countries continue to scale up efforts towards achieving the health MDGs, improve service delivery, and set Sustainable Development Goals (SDGs) and targets for Universal Health Coverage (UHC), reliable, regular and timely data are needed to monitor country progress. There is increasing demand for timely sub-national data on service access, coverage, and quality for annual health sector reviews and associated operational planning processes, as well as for performance-based financing mechanisms by major global donors.

This toolkit describes core elements and attributes of a well-functioning health facility information system and presents tools and resources to support countries in strengthening their systems. Application of such approaches will help overcome current weaknesses and align and maximise the benefits of investments in country information systems. This is an opportune moment for such an undertaking given the potential to enhance facility-based information systems using common standards and innovative technologies that enable “real-time” data collection, rapid analysis, synthesis and summary of results, and dissemination to decision makers in simple, easily understood ways.

FACILITY-BASED DATA WITHIN HEALTH INFORMATION SYSTEMS

The facility-based information system is an integral component of the broader health information system (HIS) that brings together data from multiple sources, including from health facilities, household surveys, censuses, civil registration systems, surveillance systems, and other administrative data sources.¹ The effective functioning of the HIS requires the application of standards across the chain of data collection, compilation, quality assurance, analysis, dissemination, sharing and use. This is of particular importance for facility-based information systems, as shown by a recent study on data quality and use in 23 countries.²

A facility-based information system comprises data derived on a routine basis from health services in both the public and private sectors (non-profit, for profit, NGOs, faith-based facilities). It includes data collected within health facilities, for example from service delivery records and patient–provider interactions, as well as from the activities of the health system at community level, for example by community health workers and health visitors. It also includes data collection from health-related service delivery sites beyond health facilities, such as prisons, schools, workplaces and communities. In addition to routine data collection, information is collected through occasional facility assessments and surveys that provide objective, independent information on health service distribution, capacities, and quality of care. Such facility assessments provide a complementary source of data to routine facility reporting.

Facility-based information systems generate information on a range of interventions offered such as treatments administered and treatment outcomes. These data can be used for a wide range of purposes, including managing patient care, epidemiological surveillance, monitoring of intervention-specific programmes and quality assessments. In addition, these data are sometimes used to complement other sources for detecting and reporting epidemic outbreaks.

The important contribution of facility assessments and routine facility-based reporting is highlighted in the guidance for strengthening country monitoring and evaluation platforms developed by the International Health Partnership (IHP+).³ This framework has been endorsed by multiple agencies, development partners, funds and foundations and is an important tool for improving alignment of partner investments and support to facility information systems, through the application of harmonized approaches and tools and joint investments. The IHP+ M&E framework (Figure 1) not only facilitates the identification of core indicators along each element in the results chain, but also links indicators to underlying country data systems and data collection methods. The

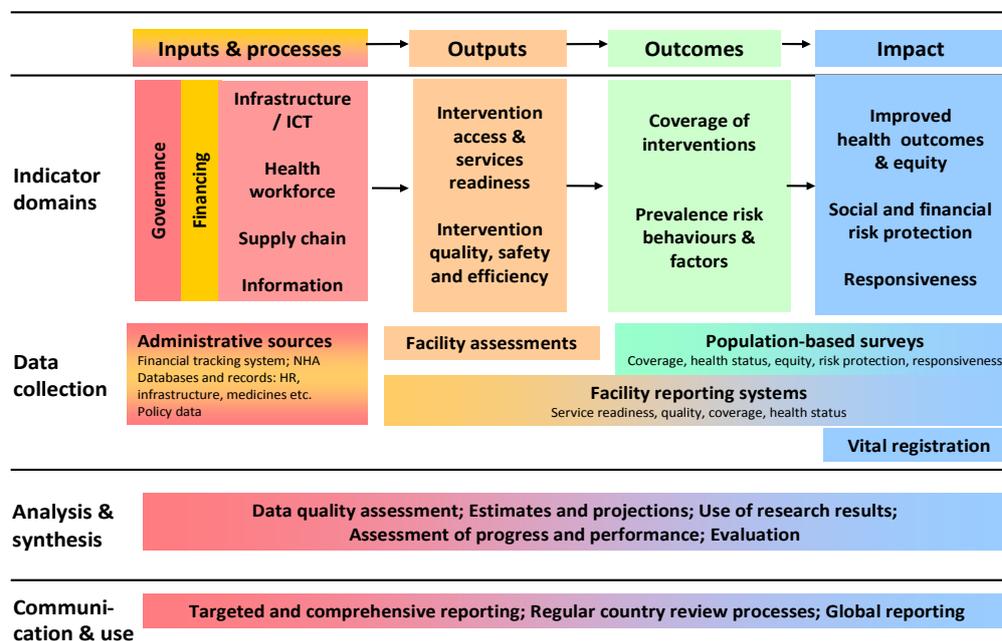
¹ HMN Framework (http://www.who.int/healthmetrics/documents/hmn_framework200803.pdf)

² Inventory of PRISM Framework and Tools: Application of PRISM Tools and Interventions for Strengthening RHIS Performance. Working Paper Series. MEASURE Evaluation. June 2013

³ Monitoring, Evaluation and Review of National Health Plans; A country led platform for information and accountability. IHP+ and WHO, 2011.

framework highlights the need for analysis and synthesis of data from multiple sources and regular data quality assessment, and demonstrates how the data need to be communicated and used for both country and global reporting purposes.

Figure 1 – The IHP+ common monitoring and evaluation framework⁴



USES OF FACILITY-BASED DATA

As part of their routine activities, health facilities generate data on service delivery, health interventions coverage and disease patterns. Unlike household surveys, facilities produce data on a continuous basis and can report annually or more frequently if required. They are the main source of sub-national data – by province/region or district – that link directly to managerial decisions. For several indicators, such as tuberculosis treatment outcomes, coverage of interventions for prevention of mother-to-child transmission (PMTCT) of human immunodeficiency virus (HIV), and uptake and continuity of antiretroviral treatments (ARVs), facilities are the sole source of data. Facilities generate data on programme inputs that are action oriented and include geographic (district) equity dimensions. Because facility data are available on a continuing basis and for the lowest service delivery levels, they are used in annual health sector reviews, health statistics reports and analyses of health system performance. They guide operational planning of the health system and enable tracking of progress and performance over time

Facility-based data also contribute to country level monitoring and evaluation (M&E) and enable to calculation of performance indicators at the levels of outputs, outcomes and impact, as shown in Figure 1. Facility assessments play a key role in generating information on outputs (such as availability of services and interventions). Routine facility data produce information on outcomes (such as intervention coverage) and impact (including health outcomes and equity).

Facility-based data can be used to demonstrate performance of both disease-specific and health systems interventions. However, because facility-based data are, by definition, limited to those who attend health facilities or use related community-based services, they are not necessarily representative of the whole population in any given catchment area. They should, therefore, be compared with data from other sources, notably household surveys. The synthesis and analysis of data from multiple sources and reconciliation of indicator values is essential in order to maximize the value of all sources of data.

⁴ World Health Organization (2011) Monitoring, evaluation and review of national health strategies: a country-led platform for information and accountability. World Health Organization. II. International Health Partnership. ISBN 978 92 4 150227 6 (NLM classification: WA 540)

CHALLENGES AND OPPORTUNITIES FOR FACILITY-BASED DATA

Despite significant investments in facility-based information systems, in many settings there are major obstacles that impede the quality and effective use of facility-based data. A common feature across countries is that routine reports from health facilities and districts are often late, incomplete and inaccurate. Such data quality issues undermine credibility and hamper the use of routine facility-based indicators. As a result, development partners and donors have tended to invest in parallel, disease focused information systems, neglected the routine health management information systems. This fragmented approach has resulted in a large number of indicators and reporting forms at the health facility level and created a heavy reporting burden for overstretched facility health personnel.⁵ Moreover, analysis and communication of facility statistics, particularly within the context of health sector reviews to shape decision making, are largely inadequate in most countries.

Despite these challenges, there is room for optimism. New standards and innovative approaches, often using IT, are leading to substantial improvements in the availability and quality of facility data for health decision-making. Significant advances have been made in the development of tools and standards, including standardization of point-of-service data collection in order to enhance comparability across facilities, districts and over time. Examples include data collected on immunization, directly observed treatment short course (DOTS) and antiretroviral drugs for HIV infection.

Innovations in information and communication technologies (ICT) hold great promise in improving the entire health information cycle from data collection, transfer, compilation and sharing, to analysis and synthesis, communication, and dissemination and use of data. Examples include electronic data reporting systems combined with internal quality controls and system revision (e.g. DHIS 2.0), rapid tools to regularly assess service delivery and data quality such as Service Availability and Readiness Assessment (SARA), innovations to manage stock-outs of medicines and commodities (e.g. Rapid SMS), application of universal standards for cause of death reporting (e.g. ICD and automated coding), electronic health records for reporting systems (e.g. ART, TB monitoring), mobile computing devices and communication technologies in emergency response and field outbreak investigations, state-of-the-art visualization and analytical tools, etc. These tools and approaches are described more fully later in this document.

PRINCIPLES FOR FACILITY-BASED DATA IMPROVEMENT EFFORTS

In order to maximise the potential of new methodologies and technologies for improving health facility information systems and avoid the fragmented and inconsistent strategies that have characterised development partner support in the past, it is essential to pursue a coordinated approach that adheres to a number of best practices and principles:

- **National governance and oversight mechanism:** Countries should include facility-based information systems within an overall governance framework for health information systems that brings together stakeholders across programmes, projects and sectors, including academia, to coordinate and monitor strategies for improving facility-based data. Governance structures should ensure overall coordination, data quality assurance and technical oversight and should support capacity development and the identification of funds and resources.
- **Harmonized country-led plan:** There should be a country-led plan for health facility data that defines the information items to be collected, periodicity, timing, contents and sources. The plan should specify the timing of regular health facility assessments and include details on their contents, funding and execution, thus reducing duplication and inefficiencies. Ideally health facility assessments are timed in accordance with the national health planning cycles so that results feed into programme specific or health sector analytical reviews.
- **Standardized methods and indicators:** Health facility data collection and compilation should be conducted according to standardized procedures and application of definitions based on international

⁵ A rapid assessment of the burden of indicators and reporting requirements for health monitoring. Prepared for the multi-agency working group on Indicators and Reporting Requirements by the Department of Health Statistics and Information Systems, World Health Organization, February 2014

recommendations. The information to be collected should be most relevant to country priorities and feasible within attainable resources, bearing in mind the multiple uses and users of facility-based data.

- **Adherence to quality standards for data collection and management:** Quality standards should be enforced for data collection and management at all levels, from patient records, to facilities, district and national levels. Data quality assurance processes should cover training and supervision, processing, feedback, analysis and dissemination of data reports.
- **Institutional capacity:** Responsibility for facility-based data should lie primarily with the Ministry of Health, working in collaboration with the private health sector and the national statistics office. The support of national academic bodies and public health institutes is important, given their expertise and capacity to provide objective assessment of data quality. If national level capacity is insufficient, regional or international organizations should be used to provide capacity building and to oversee technical quality of the data.
- **Results, analyses and reports:** Health facility statistical reports should be prepared annually and should include not only descriptive tabulations of the data but also analytical summaries and interpretation of key findings and trends presented in a user-friendly manner and targeting non-technical audiences, including policymakers. The results, recommendations and reports should feed into the decision-making process and resources allocation by programme management.
- **Open data access:** Data and reports should be made publically available through a central data repository and national website.

CORE DATA ELEMENTS GENERATED FROM HEALTH FACILITIES

Many indicators and indicator definitions have been developed by disease-focused programmes and projects, international organizations, technical reference and interagency groups, country planners and managers, academics, advocacy groups, and programmes. The indicators are used for different purposes including programme management, allocation of resources, monitoring progress in country, performance-based disbursement, global reporting etc.

Indicators can be classified along multiple dimensions. One dimension relates to intervention programme area, for example infectious diseases (HIV/acquired immune deficiency syndrome (AIDS), sexually-transmitted infections (STIs), tuberculosis (TB), malaria, neglected tropical diseases, outbreak/epidemic diseases); immunization; nutrition; essential medicines; perinatal, newborn, child, and adolescent health; maternal and reproductive health (including sexual health and reproductive rights); noncommunicable diseases (including chronic diseases and mental health); injuries, violence, abuse and accidents; health promotion and protection; health determinants and risks (behavioural, social and environmental).

A second dimension relates to broad health domains, such as health status (mortality, morbidity, disability, wellbeing); service access and coverage; risk factors and determinants; and health systems (infrastructure, workforce, financing, essential medicines, commodities and supplies; quality of care. A cross-cutting component is equity, in terms of determinants, service access and use, and health status.

A third dimension classifies indicators by a results chain framework (input, output, outcome and impact). This results chain can be mapped to the health domains and above as shown in Figure 1. The various programme areas include indicators across all elements of the results chain and health domains.

A separate category of indicators relates to specific project management and/or donor reporting. These indicators are used by projects and donors for programme management and accountability. Grant and project monitoring indicators differ in multiple ways: they are more often input or output indicators and tend to be based on crude data (counting events). The scope is often subnational, limited to a certain population, area or set of clinics engaged in the project. The indicators tend to be computed against a grant or project target rather than population as a whole. The data collection investments are local and related to the project and generally not aiming to strengthen the country system. Sometimes national monitoring systems are weakened because of critical staff moving to grant and project monitoring and, if there are multiple projects in parallel, because it becomes more difficult to obtain a national picture from disparate projects.

In order bring greater coherence into the every growing demands for data and indicator reporting, WHO has worked with multiple partners to develop a core reference list of global core indicators.⁶ The core list is designed both to enhance alignment and improve efficiency in the demand for data on the part of global partners and to harmonize indicator definitions, reporting periodicities, data collection, and capacity development, thus reducing the reporting burden to countries and enhancing the effectiveness and efficiency of country and donor investments in health information systems. The reference list not only identifies and standardizes core indicators, it also describes data sources.

⁶ World Health Organization (2015) Global Reference List of Core Health Indicators

Main sources of data from health facilities

Sources of facility data include individual patient records, family record card, admissions and discharge registers, ward registers and tally sheets, community level records, and records of health interventions delivered in non-health settings. For the sake of simplicity, these are divided into three groups, namely, individual record systems including electronic medical records (EMRs), facility records, and community-based records.⁷

INDIVIDUAL RECORD SYSTEMS

This is the majority of the data collected at the health facility and needs to be kept to a minimum to reduce the burden of data management on health workers. All individuals need a card or file in which to record the details of their interactions with the health service provider. This important document contains key patient identification details as well as diagnosis and treatment of all visits. While some health authorities provide such a record for each patient, others use a simple school “copy book” in which to record their information, and others enter data into an electronic database. Individual patient management data is potentially massive and requires careful design of data collection tools and reporting of only a minimum of data to the next level of the health system. Data collection includes:

- Name, address and other identifying characteristics;
- Clinical diagnosis, results of laboratory and diagnostic tests;
- Drugs prescribed;
- Money paid;
- Health education and other information given to the patient on potential risks and plans for future care;
- Preventive activities undertaken (e.g. Expanded Programme on Immunization (EPI), antenatal care (ANC), postnatal care (PNC), etc.);
- Promotive activities (e.g. behaviour change communication, healthy lifestyle, nutrition education, etc.);
- Rehabilitation (e.g. prostheses, nutrition rehabilitation, physiotherapy etc.).

ELECTRONIC HEALTH RECORDS (EHR)

In most low- and middle-income countries, paper-based systems are currently used for individual records. The use of Electronic Health Records (EHRs) will become increasingly common in the next few years as technology improves and computers become increasingly available. Clinical care providers will increasingly collect beneficiary data using computers, mobile phones and tablets to record data electronically. There are many potential advantages, provided the necessary resources and skills are available, for example:

- Data are entered only once, saving staff much time and trouble;
- Ensure continuity of care, and remind clients and service providers of follow-up;
- Improve quality of care with diagnostic algorithms and service provider support;
- Enable communication between different medical and administrative units;
- Facilitate coordination between clinical provider, pharmacies and laboratory so that requests from clinicians are quickly acted upon and results are immediately fed back;
- Provide health education to clients;
- Provide immediate computer entry of diagnoses by clinical care workers, particularly for inpatient and hospital diagnoses;
- Reduce the burden to health workers of completing data collection forms;
- Facilitate and speed up reporting processes for facility and system management;
- Directly link administrative functions such as billing and stock control to client care.

⁷ USAID, MEASURE Evaluation. Draft Guidelines for Data Management Standards in Routine Health Information Systems. MEASURE Evaluation. September 23, 2013 Version

However EHR implementation requires advanced technology and networking skills, sophisticated management processes, and maintenance that are often not available at remote facilities in developing countries. There is also the challenge of understanding and using the data collected, often made worse by the temptation to increase the volume and complexity of electronic data collected. Emphasis should be placed on the need for skilled staff to use these tools, and resources for their training.

FACILITY-BASED REGISTRY SYSTEMS

Facility-based registers include admission and discharge registers, ward registers and registers for conditions that need follow-up over long periods, such as antenatal care, immunization, family planning (FP), TB or chronic illnesses. The details kept in the registers are the minimum required to provide a summary of care of the patient and ensure follow-up, such as immunizations given, method of FP administered, or TB or HIV treatment. The register also facilitates the compilation of indicators for periodic reporting since data managers need only flip through the register to aggregate services provided to clients, rather than accessing all the individual patient records.

Quality of care is vitally involved with continuity – far more than just the number of services provided. Most priority programme areas require continuity and should have registers that enable a nurse to see at a glance which patients have attended clinics as expected and which need follow-up or tracing in the community. Regular review of registers enables the identification of patients who must be actively pursued to assure completion of immunization, timely continuation of contraception, full treatment of TB, or regular monitoring and control of blood pressure. Though paper registers are very helpful in ensuring continuity of care and facilitating reporting, they are costly to produce and require effort to maintain effectively.

Hospital discharge data are a specific type of routine health service registry data. They are widely available and very useful for monitoring the quality of health services and for capturing treatment interventions. This source almost always includes individual records capturing different dimensions of the interactions between the health service and the individual. The data generally include attributes of the individuals (e.g. age and sex), treatment and interventions (often using International Classification for Disease (ICD), and cause of admission and cause of discharge (also often using ICD-CM). When a particular patient dies in hospital and is assigned an ICD-based cause of death, this information is reasonably comparable, though obviously dependent upon quality.

COMMUNITY RECORDING SYSTEMS

The Primary Health Care strategy adopted by most governments in the world calls for a reorganization of the traditional health services system, adapting health care delivery to the needs and limitations at the community level, and involving and empowering the community in the planning and management of local health services. This includes restructuring of health information systems to give health care managers and providers a better understanding of community needs and to increase community involvement in the generation and use of information. Ministries of Health and non-government organizations have expanded the classic health unit data collection methods to include community data collection for a number of purposes, namely to:

- Monitor health activities performed in the community;
- Generate representative data on the health status and living environment of the communities served,^{8,9} including data on births and deaths in the community;
- Underpin planning for health services that are more accessible to the community.

⁸ Prospective Community Studies in Developing Countries, Garenne & Cantrelle, 1989

⁹ An Introduction to Health Planning for Developing Health Systems, Amonoo-Larston et al., 1994

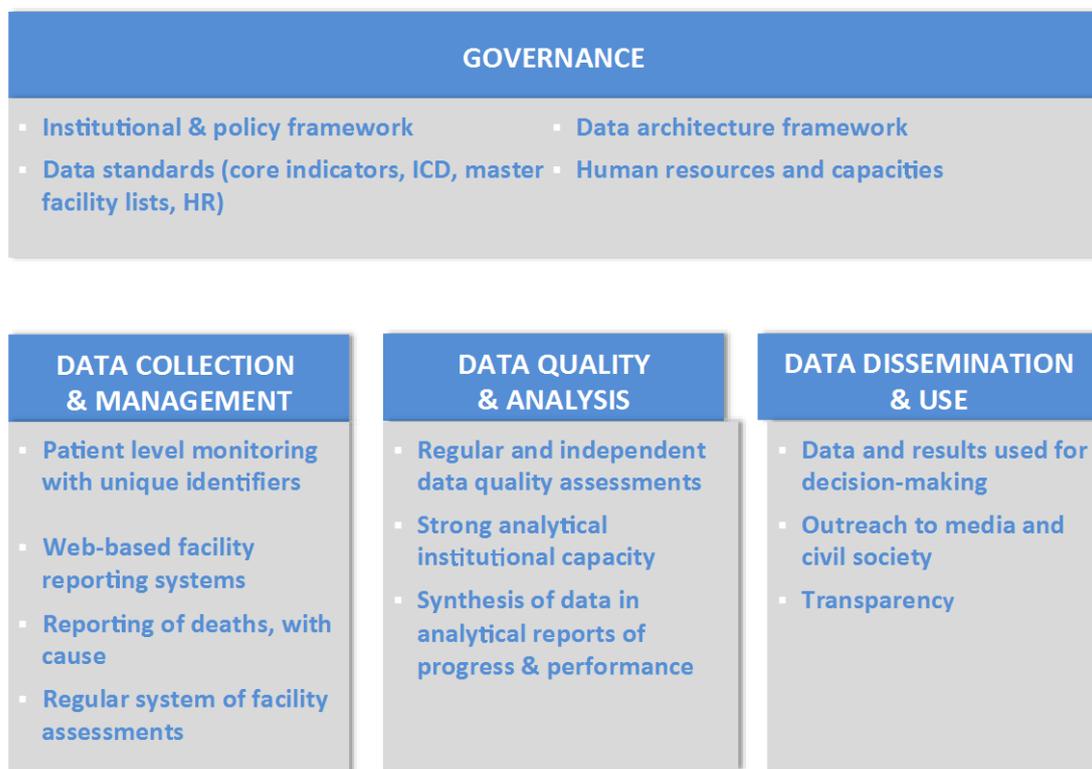
Attributes of a well-functioning facility-based information system

The main components of a well-functioning health facility information system comprises an overarching system of governance, that supports the effective functioning of three subcomponents, namely data collection and management, data quality and analysis, and data dissemination and use (Figure 2).

- **Governance:** A basic prerequisite for a well-functioning health facility information system is the existence of a supportive institutional and policy framework including plans, standards, institutional capacity and accountability and coordination among stakeholders. The governance framework enables the good functioning of the facility-based information system in terms of the three core action areas, namely:
- **Data collection and management:** This requires mechanisms and processes for the identification of core metrics and indicators; the application of standard definitions, metadata and data collection approaches; efficient and timely data compilation, management and transfer;
- **Data quality and analysis:** This implies that a systematic and regular system of data quality assessment, including an independent data verification mechanism is specified and routinely conducted. After data review and any necessary adjustment, facility data are integrated with data from other data sources and appropriate techniques to analyse and interpret the aggregated data are used;
- **Data dissemination and use for policy and programming:** This involves targeted dissemination and communication strategies to facilitate data use for policy and programming. Results are incorporated into decision-making processes, including operational planning and resource allocation.

Figure 2: Key components to enhance the quality and use of facility-based information systems

HEALTH FACILITY INFORMATION SYSTEMS COMPONENTS & KEY ATTRIBUTES



Improving facility-based information systems: an action agenda for countries

Governance

Country health information systems (HIS) are rapidly evolving, in line with advances in health care delivery systems and increased complexity in how health system and health programmes are managed. Technological innovations are opening up new opportunities for improving the availability of real-time data, managing huge databases and linking systems for sharing data. As the private sector provides an ever-growing proportion of health services, health data from private facilities needs to be mainstreamed into the national information system. As countries are striving for greater ownership of their health information systems, better coordination and collaboration among development partners is essential for maintaining efficiency and avoiding wasteful fragmentation and duplication of efforts. Good governance of the health information system in general and of its facility-based component in particular is increasingly important.

INSTITUTIONAL AND POLICY FRAMEWORK

A clear legal framework should underpin policy and planning for facility-based information systems. The legal framework and associated regulations should articulate the roles and responsibilities of producers and users of facility-based data. It should be integrated within the overall legal framework for health information and statistical systems and be aligned with the legal basis of the health system.

Policies for facility-based information should be based on the principles of accountability, transparency and participation of multiple stakeholders at different levels. Policies should make explicit provision to assure ethical use of data and protection of individual privacy and confidentiality. Policies should promote and protect independent and objective monitoring of facility information system performance, including data quality, fitness for purpose, and transparency.

Planning and management for facility-based information involves ensuring that institutions and processes are in place for maintaining the strategic direction of policy development and implementation. The facility-based information system should be responsive to the health systems' needs – including at community level. It should ensure regulation of various actors in both public and private sectors, foster cross-organizational and multi-partner collaboration, balance *ad hoc* or narrow information needs with broader institutional needs, maintain transparency and accountability in managing resources, and make the facility information system efficient and effective.

Accountability is an important aspect of governance and requires that health information system leaders assume responsibilities for the good performance of the facility-based information system. It comprises oversight and an obligation to report on progress and to be answerable for the results and outputs of the information system. Accountability implies continuous performance monitoring of facility-based information as well as formal assessment and system strengthening activities. In order to improve the performance of facility-based information systems, the current system should be assessed to gauge the current (or baseline) level of performance. Standardized tools are available for this purpose, though they employ different methods and have different foci.

Key actions for countries include:

1. Establish or update the **legal framework**, codified in a legal mandate, with clearly articulated roles and responsibilities at all levels, identification of decision-making authorities, and mechanisms for accountability to both data users and data producers.
2. Develop and implement a **strategic plan** for facility-based information, in a participatory process that involves the public and private sectors, researchers, academia, civil society and development partners as appropriate.
3. Clearly define facility-based **management structures**, including:

- Reporting requirements and responsibilities;
 - Standard operating procedures;
 - Appropriate, updated, and well maintained ICT infrastructure;
 - Strategic and financial planning mechanisms;
 - Targets, annual plans, internal and external reviews and planning structures;
 - Regulatory body to oversee the facility-based information system;
 - Appropriate planning for upkeep and improvement of RHIS, including financial, equipment, personnel, training and capacity building, audits, etc.
4. Establish and maintain **data collection and management policies and procedures**, including:
- Sufficient regulatory authority;
 - Written governance plans;
 - Data standardization policies, framework and procedures;
 - Adequate management of meta-data;
 - Policies to ensure contributions to the facility-based data from the private sector.
5. Establish adequate **staffing and workforce development** mechanisms, including:
- Training Infrastructure, including planning, standardized curricula, and data on training;
 - Supervision and mentoring, with standard procedures, checklists and reports, data quality checks, and feedback.
6. Assure **monitoring, evaluation and accountability**, including:
- Carrying out baseline and monitoring assessments using standardised tools (e.g. PRISM assessment which measures data quality, data use and management practices);
 - Establishing governance councils or oversight committees to provide independent, objective assessment of data availability and quality;
 - Ensuring that action planning is conducted following assessments to guide system-strengthening activities;
 - Develop strategies for data dissemination, including national health statistical reports and ensuring open and timely access to the data generated by the facility information system through a national data repository;
 - Provide regular feedback to data providers.
7. Encourage **harmonization and alignment** of donors and development partners around country strategies and action plans for facility-based information systems.

Available tools and resources include:

- USAID, MEASURE Evaluation. **Draft Guidelines for Data Management Standards in Routine Health Information Systems**. MEASURE Evaluation. September 23, 2013 Version - This document was developed based on the results of an expert workshop, held in Johannesburg, South Africa in May, 2012 and was later validated in Nigeria and Bangladesh. It primarily focuses on routine health information system (RHIS) standards. Chapter 4 of this document elaborates on the standards for the governance of RHIS data management. http://pdf.usaid.gov/pdf_docs/PA00KB8N.pdf
- **HMN Framework and Assessment Tool for Country Health Information Systems** – The HMN Framework and associated Assessment Tool lay out the core elements of a country health information system. However, the tools do not formally assess the performance of health facilities data reporting (facilities and reported data are not formally assessed). Another tool that focuses more acutely on the HMIS and its performance is the Performance of Routine Information System Management (PRISM) tool. https://www.dropbox.com/s/38afzlufrv488lu/1_HMN_Assessment_Tool_Version_4_0_Eng_With_Switchboard.xls?dl=0
- **The PRISM tool** measures performance of HMIS (in terms of the data quality, use of data for decision making, and management capacity) on a sample of health facilities and the subnational units through which they report. The output of PRISM permits the identification of gaps in capacity and points the way toward system strengthening activities. When implemented systematically and routinely the PRISM tools permit the continuous assessment and improvement of the HMIS. <http://www.cpc.unc.edu/measure/resources/webinars/publications/ms-11-46-d>

DATA STANDARDS

With the increasing emphasis on monitoring and evaluation (M&E) there is a proliferation of indicators, which often lack harmonization and increase workload without improving management. To reduce the burden of data management to health system staff the number of indicators should be kept to a minimum based on the actual decisions that are routinely made at a particular level. Each country should reach consensus around a core indicator set for national planning, monitoring and evaluation of priority programmes, as well as for lower-level management of clients, facilities and systems. The core indicator set should be developed through a consensus-building process involving relevant stakeholders among priority programmes at national and subnational levels.

At the facility level, indicators should be selected to monitor efforts to improve health system performance. The data for the core facility-based indicator set should be based on the national essential health service package and defined by the decisions that managers are able to make at their particular level.

The use of international standards and classification for the aggregation and reporting of indicators facilitates storage, retrieval, analysis, and interpretation and permits comparisons within populations over time and between populations at the same point in time as well as the compilation of nationally consistent data. A master facilities list should be produced in order to improve reporting efficiency and transparency, and promote better analysis and synthesis of data to improve decision-making and the functioning of the health system.

Key actions for countries include:

Core indicators

1. Establish an inclusive process involving major stakeholders to reach agreement on a balanced and parsimonious set of facility-based indicators for facility, district and national levels. Ensure that core standardized indicators are appropriate for each level of reporting regarding their management and programmatic decisions.
2. Determine appropriate frequencies for indicator reporting and ensure that they are clear to all personnel at all levels of the reporting system;
3. Ensure that indicators for disease- and programme-specific M&E are aligned with the core indicator set.
4. Determine baselines and establish agreed targets for key indicators at national and subnational levels. Indicator targets should be ambitious yet feasible, with clearly articulated goals that are based on health system improvement.
5. Define relevant stratifiers (age, sex, urban/rural, district, subnational administrative areas) for facility-based indicators and establish procedures for retaining this information during transmission to higher levels of the system.
6. Produce a national data and metadata dictionary that is aligned with global standards and includes indicator definitions, data sources, and data collection methods, reporting frequency, dissemination methods and use.

Master facility list

7. Establish and maintain a master list of health facilities that includes both the signature domain (unique identifier for each health facility) and the service domain (available services and capacity for each health facility).
8. Develop a shared integrated data repository that stores and maintains all facility data and that facilitates access to the aggregated data by interested users and analysts.

Classifications

9. Adopt international or national classifications for categorizing aggregated data in order to facilitate the storage, retrieval, analysis, and interpretation of indicators and permit temporal, intra-country and inter-country comparisons. Major classification systems include: the ICD for classification of mortality and morbidity data; WHO and International Labour Organization (ILO) classification of occupations for categories of health care workers; WHO list of essential medicines.

Available tools and resources include:

- **WHO Consolidated Indicator Reference List** – Extraction of reference indicators derived from health facility records (Draft 1 April 2014). https://www.dropbox.com/s/ku1jcbo437j1w2i/1-Draft_HMIScoreindicatorslist_2016-04-29.xlsx?dl=0
- **A rapid assessment of the burden of indicators and reporting requirements for health monitoring.** Prepared for the multi-agency working group on Indicators and Reporting Requirements by the Department of Health Statistics and Information Systems, World Health Organization, September 2014. http://www.internationalhealthpartnership.net/fileadmin/uploads/ihp/Documents/Key_Issues/One_M_E_P_latform/Outcome_statement_Indicators_and_Reporting.pdf.
- **WHO Indicator and Measurement Registry (IMR).** The IMR is a central source of indicator and measurement definitions (text and computer-readable), metadata, and translations. It supports global indicator definitions and codelists and includes complete and well-structured metadata. http://apps.who.int/gho/indicatorregistry/App_Main/browse_indicators.aspx
- WHO (2012). **Creating a Master Health Facility List**, Geneva, World Health Organization, March 2012. This document produced by WHO and USAID describes the steps necessary to create and maintain a Master Facility List, as well as the minimum set of indicators that should be included. The document is divided into three main sections: 1. Establish institutional arrangements, 2. Develop an implementation plan, and 3. Technical aspects of establishing a Master Facility List. http://www.who.int/healthinfo/systems/WHO_CreatingMFL_draft.pdf
- **The WHO template for classifying health workers** uses common definitions and classifications in order to enhance comparability and generalizability of data on the health workforce at the national, regional and international level http://www.who.int/hrh/statistics/Health_workers_classification.pdf?ua=1
- **The International Standard Classification of Occupations (ISCO)** is maintained by the ILO and is a tool for organizing jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job. Its main aims are to provide: a basis for the international reporting, comparison and exchange of statistical and administrative data about occupations; a model for the development of national and regional classifications of occupations; and a system that can be used directly in countries that have not developed their own national classifications. <http://www.ilo.org/public/english/bureau/stat/isco/index.htm>
- **The WHO Model List of Essential Medicines** is a guide for the development of national and institutional essential medicine lists. Although not designed as a global standard, the Model List has led to a global acceptance of the concept of essential medicines as a powerful means to promote health equity. Most countries have national lists and some have provincial or state lists as well. National lists of essential medicines usually relate closely to national guidelines for clinical health care practice, which are used for the training and supervision of health workers. http://www.who.int/medicines/services/essmedicines_def/en/
- WHO. **Monitoring the Building Blocks of Health Systems: A handbook of indicators and their measurement strategies.** Geneva: World Health Organization, 2011. http://www.who.int/healthinfo/systems/WHO_MBHSS_2010_full_web.pdf?ua=1

DATA ARCHITECTURE FRAMEWORK

The information system “architecture” is a designed approach to make different systems work together, ‘interoperate’ and appear as a ‘whole’, or as a system of systems. The architecture toolbox consists of various semantic standards, which are needed for systems to work together. The most important standards needed for facility-based architecture are a master facility list and a data and indicator dictionary.

A key feature in the facility-based health information system and architecture is a central data warehouse, or data repository, for aggregated data. This makes it practically feasible to bring together data across health facilities at different levels, electronic patient records, and human resource management systems. In advanced data warehouse systems it is possible to integrate data from other sources such as community information, household surveys or the census.

In addition to these two types of ‘semantic’ standards, there are also technical (or syntactic) interoperability standards such as SDMX-HD, which are needed for the exchange of data to happen. The development of the

SDMX-HD has turned out to be problematic and the standard has been complicated to implement. A new initiative under HELINA and OpenHIE is trying to address this.

The design of the central data repository should take into account the fact that facility-based data collection and transfer in many countries are predominantly paper-based. The gradual introduction of electronic medical records will help change this but is far from complete in all countries. Therefore, the architecture approach needs to be flexible and workable under many different configurations and assume that infrastructure, skills, and uptake will be uneven within and between countries. The architecture approach should build on a maturity model implying that solutions need to be able to grow with time; from one to more places, from one level of the health system to the level below (from district to facility), and to gradually become more granular and comprehensive. The national data repository represents an integrated framework within which, for example, medical record systems can scale, as they are “plugged in” (transferring aggregated data) at the pace they are being implemented.

Key actions for countries include:

1. Establish an overall architecture and plan for ICT, including equipment and training in use of ICT for the health information system. The architecture should ensure that indicators, data collection, and reporting systems are standardized across all HIS data sources and harmonized across all programs areas and implementing partners. Ensure that the design of the system (architecture) facilitates adequate quality and coverage to generate trust in the data.
2. Establish an integrated common data repository for all facility-based data for the whole country. Build a flexible architecture that can grow and adapt to changes and new requirements over time. Ensure that the facility-based information system is interoperable with other systems at all levels (i.e. data can be shared between systems) and that there is adequate facility-based meta-data available to permit interoperability (e.g. data dictionaries). Make use of common global standards for data exchange where feasible, that will allow faster growth of the integrated architecture.
3. Ensure that managers of facility-based reporting at all levels have sufficient autonomy (i.e. are able to define their own data needs and can use the data locally for system strengthening). Encourage facility-based information staff to be flexible to changes in the system (i.e. open to re-design of work flow and processes as the system evolves).

Available tools and resources include:

- **SDMX –HD.** The SDMX-HD is a Statistical Data and Metadata Exchange (SDMX)-based data exchange format intended to serve the needs of the Monitoring and Evaluation community. It has been developed by WHO and partners to facilitate exchange of indicator definitions and data in aggregate data systems.
- **OpenHIE:** Community architecture with a focus on transaction-based architectures (patient records) but also HMIS and routine facility-based reporting systems. Sub groups are focusing on facility registers (operationalized MFL), provider registers, patient registers. <http://ohie.org/>
- Braa, Jørn and Sahay, Sundeep (2012). **Integrated health information architecture: power for the users: design development and use.** New Dehli : Matrix Publishing. ISBN: 978-93-81320-06-8. <https://www.mn.uio.no/ifi/english/research/networks/hisp/integrated-health-information-architecture/prelims.pdf>
- **RHINO Online Forum on integration of health information systems.** <http://rhinonet.org/>.

HUMAN RESOURCES AND CAPACITIES

Improvements to health facility information systems require attention to the training, deployment, remuneration, and career development of the health facility information system workforce. Training is critical to provide the core competencies required to complete the tasks necessary to achieve the goals and objectives of the information system. All countries should have a human resources development infrastructure to ensure that training is comprehensive and high quality. Supervision is critical for cementing gains made during training. Following up after training ensures that health workers can implement the skills they have learned during the training. Supervision should be focused on the conditions required for proper functioning of the system, i.e. standard practices. Effective supervision should include joint observation of the tasks performed, followed by discussion of strengths and weaknesses, and direct problem solving.

Key actions for countries include:

Planning, management and training

1. **Identify/define the required positions/cadres (and respective knowledge, skills, and competencies of each) disaggregated by level (community, facility, district, etc.).**
2. **Produce a workforce development plan** that includes national standards (and standardized job descriptions) for the required positions and functions; establishes career paths for information system positions; and identifies professional development opportunities for each position/cadre.
3. **Implement a workforce assessment** to map existing cadres to the required job positions and to identify gaps in positions and capacity within the workforce. This includes numbers of staff and types of knowledge, skills, and capacity needed.
4. **Develop a costed workforce training plan** to map out which positions/cadres should to be trained for what, when, and how often. The plan should be updated periodically and should cover both pre-service and in-service training, and be specific for each level of the health system.
5. **Implement standardized training curriculum/materials mapped to the required positions/cadres.** A standardized curriculum ensures that all required competencies are part of each relevant training programme and that competencies learned in one institution or part of the country are the same as those learned everywhere else. The curriculum should be pilot tested to gauge its effectiveness at building competence, and for trainee perception of its acceptability and usability. The curriculum should be easily updated and available from a central repository (e.g. on the internet).
6. **Coordinate with training institutions** to ensure that they include health facility information system modules in their programmes and are supported to implement the standardized training curricula. They also should collaborate with capacity building partners to participate actively in and to form a health facility information system capacity development network.
7. **Maintain a training database** with information on training (such as who was trained in what domain/skill set, where, and when) to help identify the training needs of institutions and individuals by geographical sub-unit within the country. The database will also permit monitoring of the effectiveness of the training plan (#2 above) by facilitating the analysis of training data. The training database should be available to stakeholders when needed (e.g. integrated into the larger electronic health information system) so that training needs are considered when conducting overall strategic planning and budgeting for the HIS.

Supportive supervision and mentoring

8. **Develop guidelines for standardized, effective supervision.** Supervision should be standardized across the programme so that health facility information system workers receive the same support regardless of geographic location. Guidelines on effective supervision techniques should be prepared and distributed with training to staff conducting supervisory visits.
9. **Develop standardized supervisory checklists.** The most important tasks (e.g. indicator compilation) should be reviewed with information system staff and their performance assessed. A checklist will help ensure that the most important elements are reviewed while reducing the burden on supervisors and those being supervised and permit comparison of performance across facilities and districts.

10. **Provide feedback and mentoring** to the staff being supervised so they are aware of their own performance and areas of strength and weakness. Individual counselling should be conducted during the supervisory visit (mentoring) while a compiled report should be shared with the unit shortly thereafter.
11. **Complete standardized supervision reports** to track results and monitor trends. A standard report of the results of supervision should be prepared and submitted to the information system management at higher levels so this information can inform the planning process.
12. **Develop and implement a schedule of regular supervisory visits.** Supervision should be conducted regularly, on a set schedule, depending on available resources.
13. **Integrate data quality checks.** Data accuracy should be assessed for one or two priority indicators when performing supervisory visits to health facilities.

Available tools and resources include:

- **Performance Improvement Toolkit** - Performance Improvement (PI) is a method for analysing performance problems and setting up systems to ensure good performance. PI is applied most effectively to groups of workers within the same organization or performing similar jobs. <http://www.intrahealth.org/sst/intro.html>
- **Selected Health Workforce Tools from CapacityPlus** - Compiles selected tools and resources for the global health workforce from CapacityPlus, and includes brief descriptions and links to online versions. <http://www.capacityplus.org/files/resources/selected-health-workforce-tools-from-capacityplus.pdf>
- **The WHO template for classifying health workers** uses common definitions and classifications in order to enhance comparability and generalizability of data on the health workforce at the national, regional and international level. http://www.who.int/hrh/statistics/Health_workers_classification.pdf
- **Guidance on Capacity Building for HIV Monitoring and Evaluation** - Provides an overview of what can be done at the system and organizational levels to ensure an adequate number of skilled individuals are available at all levels in order to complete all tasks defined in the annual, costed, national HIV M&E work plan. http://www.unaids.org/en/media/unaids/contentassets/documents/document/2010/5_4_MERG_Guidance_HIV_ME_Capacity_Building.pdf
- **Supportive Supervision in Monitoring and Evaluation with Community-based Health Staff in HIV Programs: A Case Study from Haiti** - Provides a case study on how supportive supervision has been applied to M&E at the community level. Demonstrates that it can increase staff capacity to collect, manage, and use data, and improve leadership capacity to make decisions based on collected data. <http://www.cpc.unc.edu/measure/publications/sr-13-83>
- **HRH Global Resource Center** - Global library of human resources for health (HRH) resources focused on developing countries. <http://www.hrhresourcecenter.org/>
- **iHRIS:** Open source health workforce information solutions. iHRIS is a package of software built on a flexible framework that can be adapted to meet a wide variety of needs for managing health workforce information. <http://www.ihris.org/>

Data collection and management

The rapid expansion of information and communication technologies has opened up new possibilities for data collection and transmission, and for the creation of online data repositories, thereby drastically simplifying data compilation processes and facilitating access to data. Internet connectivity through the use of mobile USB modems connected to a laptop or directly using a mobile phone, allows health workers at lower level administrative offices and health facilities to directly interact with an online system for data collection, validation and analysis. At the same time, the expansion of systems of unique individual identifiers, both within the health sector and more broadly in population registers, facilitates data collection across multiple facilities and levels and the sharing of data across databases. While this greatly enhances the analytical power of data, it also implies the needs to protect individual privacy and ensure the confidentiality of personal data.

PATIENT-LEVEL MONITORING WITH UNIQUE IDENTIFIERS

Good quality clinical care involves collecting and interpreting patient data – diagnoses, treatments, and outcomes. Facility-based individual-level data includes data routinely collected in a range of circumstances and places:

- Individual patient records (held by patients or by the health system) that are events-based and may cover specific types of care (such as maternity care, immunization, child health care etc.);
- Individual patient records for conditions requiring long-term care and multiple visits e.g. HIV, diabetes etc.;
- Records of results of clinical and laboratory tests and analyses;
- Outpatient, admissions and discharge registries;
- Individual records from facility registers e.g. maternity/delivery registers, antenatal care registers etc.;
- Individual records aggregated at district level (for example, from TB registers);
- Birth records that may be used for notification of births to civil registration authorities;
- Death records and medical certificates of causes of death that may be used for death notification to the civil registration authorities.

Individual level data are used first and foremost for ensuring quality care to individual patient. These data can also permit the evaluation of long-term outcomes such as referrals, compliance, treatment failure etc. Although individual-level data are generally not representative of the whole population, when compiled they can be used to evaluate the impact of services, assess quality of care, and monitor programmes, disease progression and health outcomes although this is challenging in settings where paper-based systems are the norm. The collection and aggregation of individual data using electronic medical records and interoperable databases facilitates their use for epidemiological analysis, and routine monitoring and evaluation at local or national level. For this to be possible, there needs to be coordination between different providers/agencies in order to ensure the same clinical data are collected from all patients, along with standardized definitions for eligibility, and for outcomes. It is also important to invest in data collection systems, and databases for storage and processing of clinical data. Skilled health information personnel are required for data collection, management, analysis and interpretation.

When a system of unique individual identifiers is in place, records can be matched across health facilities and disease conditions in order to conduct detailed analyses of health problems, long-term care and eventual outcomes. For example, the ability to track patients across different facilities enables assessment of treatment compliance and outcomes. Linking birth and death records may permit more complete evaluation of numbers of maternal and neonatal deaths. It may also be possible to link facility-based data to data at community level in order to track longer-term, population-based outcomes.

Ethical issues are a big concern when patient identifiers will be collected. These may be necessary in the health facility for good management of the patient, but should never be made available outside of the clinical setting (in routine reports, or data for analysis).

Quality of the data is another challenge as clinicians and clinical staff facing many challenges in the recording of patient level information. Assessment of the quality of medical records is necessary to ensure the information they contain is sufficiently reliable for the intended use. Proactive checks on the data are needed at the time of entry, as well as checks on the quality of data when compiling or merging datasets.

Key actions for countries include:

1. Identify the individual-level data to be collected and why, bearing in mind that:
 - The need for the data should be defined by the Ministry of Health (MoH) policy makers,
 - Ethical considerations should be explored by national and international independent review boards or ethical review committees;
 - Feasibility should be studied by IT and database experts;
 - Long-term sustainability of funding for data collection should be assured as there needs to be a continuous data stream (which is unlikely from soft-funded research studies).
2. Develop a recording form for the clinical episodes (including electronic medical records). It is necessary for the individual level data to be standardized across the clinical condition or location. Agreement from all stakeholders and clinics is required.
3. Develop standard operating procedures and eligibility for use of the recording form.
4. Develop the data systems for the electronic data on individuals.
5. Train personnel in the collection of the data (mainly clinicians, but also other clinical staff), and for the input of the data into the computer database.
6. Develop guidance on processes for use and analysis of the data. Most individual-level data can be used in the health facility where it was collected. Further use of consolidated data across different health facilities will require transfer of data to regional and national agencies.
7. Develop capacities in the technical aspects of data transfer.
8. Agree on data use policies. Many analyses should be done at national level within MoH, as these will be needed in routine reports, and for specific policy and implementation. These analyses will require skilled analysts in MoH. However, it would be beneficial to allow access to the data – under approved procedures – to academic and commercial organizations, which can conduct in-depth analysis of specific questions. How this should be facilitated needs careful and open discussion.
9. Develop guidelines/protocols to ensure client confidentiality (e.g. data are kept securely, health workers have signed confidentiality agreements, and client-level data is not transmitted electronically) according to national policies.

All of these processes, actions and decisions need to be reviewed regularly as new technologies are developed that make it easier to collect individual level data, but also make existing systems vulnerable to unauthorised use and abuse.

Available tools and resources include:

- **OpenMRS:** Collaborative open source project to develop software to support the delivery of health care in developing countries. <http://openmrs.org/>
- **OpenClinic:** OpenClinic GA is an open source integrated hospital information management system covering management of administrative, financial, clinical, lab, x-ray, pharmacy, meals distribution and other data. Extensive statistical and reporting capabilities. <http://sourceforge.net/projects/open-clinic/>
- **CTC in Tanzania:** The Tanzanian Care and Treatment database is focused on the provision of services to HIV infected people within Tanzania. All clinics collect individual level data on paper, and some also input the data into CTC 2 database. Data are transferred to a national database, at regular intervals. <http://opendata.go.tz/dataset/list-of-hiv-care-and-treatment-centre-ctc-by-district>
- **Paediatric hospital admissions in Kenya:** In 2010 a neonatal and infant admissions form was introduced to ensure that all paediatric hospital admissions had a proper investigation and the data were recorded for clinical management. This has been used by researchers to investigate interventions to improve the quality of care. <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1001238>

WEB-BASED FACILITY REPORTING

The amount of data collected at the health facility needs to be kept to a minimum to reduce the burden of data management on health workers. This requires careful design of data collection tools and aggregation and reporting of only a minimum of aggregated data and indicators to the next level of the health system

In order to permit integrated analysis of aggregated health facility data a standards-based approach to data collection is required across the country. The use of standard medical records systems (eventually extending to electronic medical records) is essential to permit appropriate data aggregation. A central electronic management system for storing, maintaining, and processing the data is needed to maximise the accessibility and utility of the data for decision-makers at all levels.

The rapid expansion of mobile Internet has opened up new possibilities for data collection and transmission, and for the creation of online data repositories, thereby drastically simplifying data compilation process and facilitating access to data. Internet connectivity through the use of mobile USB modems connected to a laptop or directly using a mobile phone, allows health workers at lower level administrative offices and health facilities to directly interact with an online system for data collection, validation and analysis. Such an approach largely reduces the need for local-level maintenance of computer systems as the local installations are reduced from advanced database systems to standard web-browsers. This also creates a dynamic at the local levels where online access to data analysis tools allow for use of data as opposed to purely reporting data upwards, and thereby also provides incentives to collect good quality data on time.

However, the achievement of connectivity for all health facilities and national coverage will require a stepwise process, with the coexistence of paper-based and electronic data collection and transmission systems for some time to come. The introduction of e-health or m-health solutions will depend on the available infrastructure (electricity, computers, mobile devices, internet access), the capacity to use and maintain technology, the amount of data collected, and the urgency of the need to use data.

Whatever medium is used to collect and transmit the data from the health facility – paper, an SMS from a low-end phone, a tablet application, or an online laptop – the key principle must be to follow the defined standards from the national data dictionary, the facility registry and the interoperability procedures to reach the goal of one common integrated data repository.

Key actions for countries include:

1. Establish standards for data collection and aggregation across all health facilities and districts, including standards from the data dictionary and the master facility list. Ensure that the standards are well understood by health care workers at all levels.
2. Introduce data collection tools designed using a participatory process, with stakeholder involvement, including donors, NGOs and the private sector.
3. Introduce electronic medical records in a phased manner in line with country capacities and availability of necessary infrastructure.
4. Use m-health and e-health strategies for data collection especially for remote and isolated areas.
5. Set up a national online integrated data repository to store and maintain all aggregated facility data and to enable on line data entry, effective data analysis and use.
6. Ensure that aggregated data are assessed for accuracy and completeness prior to transfer and timely transmission.
7. Ensure that data disaggregated by key stratifiers (age, sex, geography) are maintained during compilation and transfer in order to permit equity analysis.
8. Ensure that data transfer to the next level occurs in a timely way, making use of innovation and IT.
9. Provide feedback systematically to all reporting units on the quality of their reporting (i.e., accuracy, completeness and timeliness) and use of data for decision-making based on their submitted reports.
10. Establish policies and guidelines for adequate storage and archiving of health data (paper or electronic).
11. Provide training for staff at facility and district levels in data collection and use, and offer guidance and supportive supervision to ensure the implementation of national guidelines.

Available tools and resources include:

- **DHIS 2:** Free and open-source software-based highly configurable data collection, aggregation, management and analysis tool that uses a data source hierarchy to capture and report on health data from its source, up to and including well-structured, decision-supporting information. It is currently used in more than 30 countries around the world as a routine health management information system and data warehouse. The recently updated DHIS-2 features a dashboard module. DHIS 2 provides for the development of web-based pivot tables, different chart types and thematic maps that can be easily dragged into the DHIS 2 dashboard interface. <http://dhis2.org>
- **Rapid SMS:** free and open source framework for rapidly building SMS (text message) services for data collection using basic mobile phones, which can present information on the internet as soon as it is received. <https://www.rapidsms.org/>

COMMUNITY-BASED SERVICE DATA

As provision of health services continue to expand to community level, it is important to track this information at the point of service for programme management and decision-making on budget, policies and human resources. Such data also enable community health workers (CHWs) to follow their clients effectively and manage their care. HIV, TB and other programmes require longitudinal follow-up and necessitate community-facility linkages through work done around community engagement, defaulter tracking etc. Currently, although there are no agreed upon tools or standards specifically for community-based information systems, many of the core components of a facility-based information system apply equally to the community-based system. There need to be standard operating procedures, defined capacity building approaches and ongoing supervision, reporting structures, defined data elements, standardized data collection tools, secure data storage, data quality checks and a data use and dissemination plan. However, there are many aspects of community-level data collection that are unique and need to be specifically addressed. These include:

- Community-based services are a mix of preventative services and messages, health service delivery and social services, which often involve coordination and efficient reporting channels across multiple ministries at the national level.
- Community-based data collection needs to have a formal process of linking to facility or district level information systems to avoid double counting and to reflect the increasing contribution of CHWs to health.
- The data collection tools need to capture both the data elements useful for the community-health workers and those needed by the MoH for reporting, without getting too burdensome.
 - One strategy is to develop one integrated data collection tool for all disease areas since service delivery at the community level is more likely to be integrated.
 - Special tools and approaches may be needed for data aggregation.
 - Data capture tools need to be accessible and understood by low literacy community health workers.
 - CHWs are usually a mobile work force, so data recording tools need to be in a small format that can easily be carried from house to house.
- Community-based programmes need to have the types of personnel that are needed to handle M&E and data management tasks.
- Because there are so many CHWs, with minimal training systematic data quality audit is difficult. A different approach is needed to address common data quality problems, such as lack of or under reporting, double counting of individuals who receive multiple services, etc.
- Staff from health facilities need to be engaged in using the community health information system to monitor data from the CHWs in their catchment areas to better target their supervisory activities, to properly delegate clinical services (e.g. community DOTS) and to help find clients/patients who are lost to follow-up.

Key actions for countries include:

1. Establish a community-based service delivery strategy or programme at the national or sub-national level.
2. Conduct a Rapid Assessment to help map the organizations working at community-level to assess monitoring and evaluation systems/capacity in place, and if and how these programmes relate to a national M&E framework.
3. Undertake an indicator harmonization process to help streamline the collection, reporting, and use of community-level information. The key output would be an agreed upon minimum set of indicators as well as the data collection tools.
4. Define a process to routinely link to the facility, district or national-level health information system (both technologically and through formalized collaborative meetings).
5. Develop an organizational structure for the human resources aspect, including a formal M&E officer, supportive supervision and manageable catchment areas at all levels.
6. Define an initial training and continuous capacity building plan, specifically designed considering low literacy if applicable.
7. Establish a regular plan to use and disseminate the data appropriate for a community-based setting and a formal feedback loop to the health care workers collecting the data and the community itself.
8. Provide data in a format that is easy to access, interpret and use at different levels of the health system and at the community level.
9. Develop a regular process to assess and address data quality issues.
10. Build in an annual assessment of the overall system.

Available tools and resources include:

- **Community Level Program Information Reporting for HIV/AIDS Programs (CLPIR), MEASURE Evaluation:** The objective is to support harmonized monitoring and reporting systems that capture indicator data from programmes. CLPIR contains both tools and process guidelines. CLPIR focuses on the following HIV/AIDS programme areas: 1) HIV Prevention; home-based care (HBC); and orphans and vulnerable children (OVC). <http://www.cpc.unc.edu/measure/tools/hiv-aids/clpir/clpir.html>
- **Child Well-being Tools, MEASURE Evaluation:** This webpage contains a variety of M&E tools specific to child health and well-being, including OVC and child survival programs. Many of these tools may be adapted for other (non-OVC) use. For example, the Community Trace and Verify tool for example is intended to verify whether clients actually received care (when they are reported as having done so). <http://www.cpc.unc.edu/measure/tools/child-health>
- **Community Tool for Immunization for Self Monitoring, BASICS:** <http://www.comunit.com/clickthru/e0078e2d60a73c97e310cbbb2c04c4f3?node=299847>
- **Referral System Assessment and Monitoring Toolkit:** This toolkit was piloted in Thailand and Kenya and is being used guidance for strengthening the referral system in Kenya. <http://www.cpc.unc.edu/measure/publications/ms-13-60>.
- **The mHealth Compendium, MSH & USAID** contains case studies that document a range of mHealth applications being implemented throughout Africa and, in some cases, in other regions. <http://www.msh.org/sites/msh.org/files/2012-usaid-mhealth-compendium-web.pdf>

FACILITY-BASED DATA ON MORTALITY AND CAUSES OF DEATH

Information on causes of death is indicative of the overall health status or quality of life of a population. Countries should have the capacity to report leading causes of death that account for large numbers of deaths within a specified population group and time period. Hospitals are important sources of mortality data because they are generally the only source of medically certified deaths. Common statistics derived from such aggregate hospital records include total institutional deaths by sex and age group and by major causes. Important facility-based indicators that can be derived from such data include:

- All cause hospital mortality rates by age group and sex per 1,000 admissions;
- Distribution of causes of death by sex and age group;
- Cause-specific case fatality rates per 1,000 admissions for major causes by sex and age group;
- Institutional maternal mortality ratio (facility maternal deaths per 100,000 facility deliveries).

In settings where most deaths occur in the health sector and where population denominators are known or can be estimated, hospital-based reporting can be used to generate population-based mortality rates by age, sex and cause. However, even where most deaths in a country occur outside of hospital facilities, routine hospital data is still an important source of mortality data. The ICD is available to assist with coding medically certified deaths in hospital settings. Recent innovations, particularly in health information technology, mean that routine collection of cause of death data is even more possible.

Key actions for countries include:

Improve the availability and quality of facility-based mortality and cause of death statistics by ensuring that all hospitals record deaths by sex and age; all hospital deaths are certified by physician using the international form of the Medical Certificate of cause of Death; and causes of death are coded according to ICD standards, which can be greatly facilitated by the use of available automation tools.

1. **Establish a national committee with the mandate of improving hospital mortality data.** The national committee should involve multiple stakeholders from the health sector, medical training establishments, academia, researchers, and user groups and should develop a national strategic plan for improving hospital mortality data. As part of this, key actions include:
 - The definition of a national minimal set of mortality data to be collected by all hospitals and health facilities;
 - The implementation of global standards and definitions of deaths and causes of death in accordance with ICD);
 - Carrying out regular reviews of the policies and procedures for collecting and consolidating cause of death data from hospitals and other health care facilities.
 - Formulation of clear reporting structures for the effective provision of mortality data from hospital and other health facilities;
 - Identification of responsibilities for the analysis and dissemination of mortality data and feedback on levels, patterns and trends in mortality and causes of death to data providers;
 - Conduct of regular reviews of the quality of medical records, and of forms used from admission to discharge and introduction of improvement strategies where needed.
 - There are sufficient numbers of trained staff to meet the needs of the medical records department
 - Carrying out or commissioning mortality data quality reviews of accuracy, validity, reliability, legibility, and completeness of medical records.

2. **Introduce the International Form of the Medical Certificate of Cause of Death (IMCCD).** The quality of medical records should be sufficient that the routine system can collect:
 - **Individual patient data:** including sex, age, date of admission, date of discharge, death, pregnancy, accident, treatment, and diagnosis (including reason for admission + comorbid conditions);
 - **Individual cause(s) of death** collected on the International Form of the Medical Certificate of Cause of Death (IMCCD), the standard data collection form for cause of death in routine health facility settings.
3. **Implement or Improve Medical Certification.** Key steps to medically certify a death using the IMCCD and according to the ICD involve:
 - **Document processes** for medical certification;
 - **Training:** Ensure that certifying physicians have the knowledge and skills needed and that they are aware of the importance of correct cause-of-death certification. This involves both pre-service and in-service training for physicians in medical certification of death and in the business process for data collection. In addition, administration, doctors and nursing staff should be trained in legal regulation, data flows and responsibilities;
 - **Quality assurance** processes should be established for quality assurance of certification– for example, certification completeness and cause of death sequence. Feedback should be provided to physician certifiers as an incentive for good quality certification.
4. **Implement Standard ICD Coding.** This step does not necessarily have to happen in hospitals – it can be applied centrally in a health department, or even through a national statistics office. Key steps to develop or improve a process to code medically certified deaths using the ICD:
 - **Document processes:** Document business processes for centralized and/or decentralized coding of the IMCCD. Possibilities for a well-functioning system using standard ICD coding are contained in Box 1;
 - **Automation of ICD Coding:** There are (free) available automated coding tools to help ensure standardization of coding and deal with greater volumes of coding. A well-functioning automated system can automate coding for the majority of records but manual coding will still be needed in some cases;
 - **Training:** Ensure that coding staffs are trained in the requirements for coding using the ICD using the automated system and residual handling;
 - **Quality assurance:** Establish quality assurance process for electronic or manual coding, for example, including congruency between age-disease, unexpected leading cause, ill-defined diagnoses, missing diagnoses, non-lethal conditions, longitudinal disruption, causes in ‘wrong’ departments.
5. **Compile and improve Cause of Death Statistics.** This step does not necessarily have to happen in hospitals – it can be applied centrally in a health department, or even through a national statistics office – and involves:
 - **Establishing a routine compilation process:** including data sharing between facilities/agencies where required;
 - **Developing the analytical framework:** including national reporting and table requirements and timelines;
 - **Establishing quality assessment process:** quality checking for coded data, including use of automated quality checking tools.
6. **Use hospital data on levels and causes of mortality to improve policies and practices:** Facility-based information on mortality and causes of death should be used to improve the quality of care within facilities and beyond. This involves;
 - Producing and disseminating an annual/biennial report on hospital mortality, with tables and charts on key indicators including distribution of causes of death by sex and age and cause fatality rates for major causes of death;
 - Using facility mortality data to identify avoidable deaths and deficiencies in quality of care;
 - Using data on mortality and causes of death to trigger facility audits of adverse events (such as maternal and perinatal mortality) in order to identify avoidable factors within the facility and at community level;
 - Compiling mortality statistics from all hospitals to build up an overall picture of facility mortality and develop system-wide responses to reduce preventable mortality.

Available tools and resources include:

- **The International Statistical Classification of Diseases and Related Health Problems (ICD)** – The purpose of the ICD is to allow the systematic recording, analysis, interpretation and comparison of mortality and morbidity data. The ICD is used to translate written diagnoses of diseases and other health problems into alphanumeric codes in a process known as clinical coding. Once coded, causes of death can be compiled and statistics produced for storage, retrieval and analysis.
<http://www.who.int/classifications/icd/icdonlineversions/en/index.html>
- **WHO ICD online training tool** – This interactive and self-training online tool is designed to improve understanding and enhance the use of the ICD-10. Specific paths for different users include an introduction to cause of death certification for physicians, a fast track for people such as managers, and an in-depth training path for coders. A two-page quick-reference guide/flyer on cause-of-death certification is also part of the online training tool. <http://apps.who.int/classifications/apps/icd/icd10training/>
- **Handbook for doctors on cause-of-death certification** – This handbook is written for doctors and medical students in developing countries and can be used as the basis for training in interactive workshops.
<http://getinthepicture.org/resource/handbook-doctors-cause-death-certification>
- **Physicians' Handbook on Medical Certification of Death** – This handbook provides guidance for physicians and medical students in the United States on how to complete death certificates.
http://www.cdc.gov/nchs/data/misc/hb_cod.pdf
- **ICD Core Curriculum** – Developed through a collaborative effort involving the WHO-FIC Network and IFHIMA, this international core curriculum describes the minimum content requirements for training courses in certifying underlying causes of death. Its purpose is to provide a basis for such training in all countries.
<http://www.ifhima.org/whofic.aspx>
- **IRIS – Automated coding system for causes of death** – IRIS is an interactive computer-based system for coding multiple causes of death, and for selecting the underlying cause of death. IRIS is a language-independent software system based on the use of national dictionaries, and can be operated from a laptop. The main objective of IRIS is to increase the quality and comparability of mortality data at the international level. <http://www.cepidc.inserm.fr/site4/index2.php>
- **Mortality statistics: a tool to enhance understanding and improve quality and Analysing Mortality Levels and Causes-of-Death (ANACoD)** – These tools have been developed to facilitate checking the quality of mortality data, including cause-of-death data, from complete civil registration systems. However, they can be used to identify possible problems with hospital-based mortality data.
<http://www.who.int/healthinfo/anacod/en/>

MONITORING QUALITY OF CARE WITH FACILITY DATA

Quality of care is a fundamental aspect of the health system and an essential component of monitoring of health services. Quality of care should be explicitly institutionalized in the national health sector strategy and embedded in health facility management. Routine facility data collection on quality of care is central to supervision, performance management and accountability. Information on quality of care should be derived both directly from facilities and also through links with communities.

The Institute of Medicine (IOM) defines quality of care as the “degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.” IOM articulates six elements of quality: 1. Patient safety; 2. Effectiveness; 3. Patient-centeredness; 4. Timeliness; 5. Efficiency; 6. Equity. These multiple dimensions of quality present a complex challenge to those tasked with monitoring health services and moving towards integrated high quality care.

Efforts at measuring quality have often focused on measures of structure given the relative ease with which this can be measured. Process measures, by contrast, have proven difficult to implement widely. Certain national systems have moved to outcome measures of quality that should result from quality health care. Finally a minority of systems have experimented with measuring events that should not happen, i.e. never events, within systems of financing reform. Multiple mechanisms have been used including chart abstraction, direct observation, standardized patients, clinical vignettes as well as focused efforts at improving the quality of care related to specific technical subject areas. Patient safety improvement efforts have been particularly active. Yet

the potential for routine administrative data to provide insights into quality have been largely untapped. With the growing importance of the principle of UHC, the need to be to monitor both the utilization of services and the quality of care provided, there is an urgent need to develop clear thinking, systems and tools to monitor quality of care services with facility data.

Key actions for countries include:

Key actions needed to improve the measurement and monitoring of quality of care using facility-based data include the following:

1. Generate **enhanced understanding** of the need to embed quality of care monitoring within health system management, supervisory functions and information systems through sensitization and training efforts at all levels of the health system.
2. Develop a **framework** for monitoring quality of care and an **agreed list of indicators** for monitoring quality of care that can be collected from facility-based sources and related community sources.
3. Conduct **national level planning** on harmonization of quality monitoring efforts, informed by facility level experience and gap analysis and agreement on “basket” of potential quality monitoring mechanisms.
4. Develop **national level quality of care dashboard** in order to ensure close linkage between quality monitoring mechanisms and UHC systems.
5. Provide **technical capacity building** in monitoring quality of care services e.g. institutional health partnerships.
6. Ensure that **facility assessments** include periodic evaluation of patient satisfaction and quality of services received. Such evaluations can use client exit interviews, direct observation of client-provider interactions, and other methods as appropriate.

Available tools and resources include:

- **OECD Health Care Quality Indicators (OECD HCQI)** enables measurement and comparison of quality of care in each of the 34 OECD countries. An Expert Group has developed a set of quality indicators at the health systems level, which allows assessing the impact of particular factors on the quality of health services. This resource can be adapted for use in wider settings. <http://www.oecd.org/els/health-systems/health-care-quality-indicators.htm>
- **Agency for Healthcare Research and Quality (AHRQ)** has developed Quality Indicators (QIs) under the umbrella of the United States Department of Health and Human Services. These are designed for routine collection at a facility level from readily available hospital data. Four aspects of care are included in the current modules: 1. Prevention Quality Indicators (PQIs); 2. Inpatient Quality Indicators (IQIs); 3. Patient Safety Indicators (PSIs); 4. Paediatric Quality Indicators (PDIs). <http://www.qualityindicators.ahrq.gov/>
- **WHO Assessing and tackling patient harm: A methodological guide for data-poor hospitals.** Produced to help health practitioners & patient safety researchers in developing and transitional countries measure and tackle patient harm at the health-care facility level. The five methods described have been piloted in four developing countries from four world regions. http://www.who.int/patientsafety/research/methodological_guide/en/
- Global Initiative for Emergency & Essential Surgical Care <http://www.who.int/surgery/globalinitiative/en/>
- African Partnerships for Patient Safety – Assessment Tools and Resources <http://www.who.int/patientsafety/implementation/apps/resources/en/>
- WHO Hand Hygiene Self-Assessment Framework http://www.who.int/gpsc/5may/hhsa_framework/en/
- FRAME Tool (Framework for Assessing, Monitoring and Evaluation) for Blood Transfusion Services. http://www.who.int/bloodsafety/transfusion_services/joint_project/en/
- EMRO Patient Safety Friendly Hospital – Assessment Manual. http://applications.emro.who.int/dsaf/emropub_2011_1243.pdf

Data quality and analysis

Assuring data quality is an essential component of strengthening facility-based information systems. When they are of good quality, health facility data are important inputs to annual health sector reviews and assessments of national progress and performance. They also provide the basis for subnational/district performance assessment. However, health facility data are often beset with data quality issues. When data are perceived to be inaccurate and unreliable, they will not be trusted and will, therefore, not be used.

HEALTH FACILITY ASSESSMENTS (HFAs)

Routine facility reporting systems provide key information for monitoring and evaluation of service utilization and resource availability. HFAs periodically collect information from health facilities that are not included in routine reports and can provide a holistic picture of how inputs, processes and systems come together at a service site to influence outputs and outcomes. They provide external validation to self-reports and are an efficient way to collect information complementary to routine reporting that is needed for monitoring service quality and identifying where change is needed to strengthen the health system. The scope of health facility assessments will vary depending on available skills and resources. For health information systems that are primarily paper-based, the health facility survey will be of broad scope including service availability. With more robust electronic system the health facility assessments should focus more on other components, in particular service readiness, service quality and data validation. Information commonly collected through HFAs includes:

- **Availability** of basic infrastructure, resources, and services (e.g., building and utilities infrastructure, staff, beds, and services, drugs, supplies, and diagnostics, budget, and linkages with the community and with other facilities);
- **Readiness** to provide specific services to a defined minimum standard (e.g., trained staff, guidelines, drugs, supplies, diagnostics, equipment, appropriate service site);
- **Management** practices to support continuous service availability and quality (e.g., supervision, financial and staff management practices, quality assurance, maintenance);
- **Service quality** (e.g., adherence to standards in practice, provider knowledge, client knowledge and opinion);
- **Community linkages:** (e.g. workers, services, input into facility management, support to facility);
- **Data verification:** Validating routine service statistics and self-reports on facility infrastructure, resources, and service provision status collected from patient encounters.

HFAs should be embedded into supervision system and implemented on a regular basis, with periodic external validation at national level every 2-3 years. This can be based on a sample basis. The better the HMIS data quality is, the smaller and the less frequent the verification can be. The sustainability of using HFAs needs to be taken into consideration and continuity ensured with regard to staff training and capacity development.

It is important to link health facility data sets and routine HMIS. For this, it is essential to have a regularly updated Master Facility List and to address issues such as staff qualifications and skills, costs and time to enable interoperability of data sets.

Key actions for countries include:

1. **Harmonized Plan:** Develop a country-led harmonized plan for HFAs that reduces duplications and includes specific details on contents, funding and execution. The plan should address financial issues, coordination between national institutions and with partners. The plan should ensure that HFA is institutionalized as part of the national M&E plan, and that country ownership and leadership are assured.
2. **Modular approach:** Conduct HFA using modules based on international expertise and harmonization. Select modules to be implemented based on country need and the expectation of change within a time period.
3. **Timing:** Based on expectation of change and planning/implementation needs, ensure information available in advance of national health planning cycles so that results feed into analytical reviews of health sector performance.

4. **Capacity:** Identify national institutes with relevant experience for capacity building in order to ensure survey technical quality and for survey implementation.
5. **Contents:** Reach consensus among programmes and partners around the content of the HFA, which should include:
 - A census of all facilities every 5-7 years in order to update the master facility list of public and private facilities;
 - Infrastructure availability, location and distribution (facilities, beds, equipment etc.);
 - Readiness to provide services and availability of systems and resources to support quality service provision;
 - Staff qualifications, training, operating hours and supervision;
 - Periodic evaluation of quality of care and patient satisfaction;
 - Adherence to standards of practice and infection control;
 - Validation of routine service statistics and self reports on facility infrastructure, staffing and resources.
6. **Dissemination:** Facility assessment results are disseminated through meetings with key stakeholders and the implications of the findings for programme management and resource allocation are highlighted.
7. **Results and analyses:** Implications of results and recommendations for programme management and resource allocation are developed with stakeholders and fed into the analytical review process.
8. **Public availability of data and reports:** Findings of HFAs are made publicly available through the MoH website, or central data repository/national observatory.

Available tools and resources include:

- World Health Organization (2014) Towards a harmonized approach for Health Facility Assessments: Vision, Guiding Principles and Roadmap. Outcome of a Technical Consultation. Geneva, 12-13 November 2014. http://www.who.int/healthinfo/facility_information_systems/hfa_meeting_november2014_report.pdf
- USAID. **Demographic Health surveys Program. Service Provision Assessment (SPA).** SPA Questionnaires. <http://dhsprogram.com/publications/publication-search.cfm?type=37>
- WHO (with USAID). **Service Availability Readiness Assessment (SARA)- An annual monitoring system for service delivery –Reference Manual & Implementation Guide.** Version 2.1, September, 2013 Geneva: World Health Organization, 2013. http://www.who.int/healthinfo/systems/sara_introduction/en/
- WHO. **Inpatient service and management assessment (SARA-H) (in process of pretesting).** Geneva: World Health Organization, 2014.
- World Bank. **Service Delivery Indicators (SDI). Survey Instruments.** <http://www.sdindicators.org/survey-instruments/>
- UNICEF, WHO, UNFPA, AMDD. **Emergency Obstetric and Neonatal Care (EmONC) Indicators/measurement – Technical resources.** Averting Maternal Death and Disability, Columbia Mailman School of Public Health. Focus: all aspects of EmONC services. Sometimes incorporated into above surveys <http://www.amddprogram.org/content/emergency-obstetric-and-newborn-care>
- Edward A, Matsybiyashi T, Fapohunda B, Becker S. **A comparative analysis of select health facility survey methods applied in low and middle income countries** (working paper WP-09-11). Chapel Hill, NC: MEASURE Evaluation, 2009. Focus: Readiness to provide MCH PHC services, public accountability in financing and staff, quality of care using provider responses to vignettes. <http://www.cpc.unc.edu/measure/resources/publications/wp-09-111>
- Fapohunda B. **Using Health Facility Assessment Data to Address Programmatic Questions- Illustrative Examples for program managers.** Chapel Hill, NC: MEASURE Evaluation, 2012. <http://www.cpc.unc.edu/measure/publications/sr-12-72>
- O’Neill K, Takane M, Sheffel A, Abou-Zahr C, Boerma T. **Monitoring service delivery for universal health coverage: the Service Availability and Readiness Assessment** (Bulletin of the World Health Organization). September, 2013 Geneva: World Health Organization, 2013. <http://www.who.int/bulletin/volumes/91/12/12-116798/en/>

DATA QUALITY ASSESSMENT AND VERIFICATION

Data are considered to be of good quality if they are accurate, complete, timely, and consistent. These elements of facility data quality can be assessed by an examination of the following components:

- Completeness and timeliness of reporting from facilities to districts and from districts to higher administrative levels;
- Accuracy, integrity and internal consistency of reported data;
- Quality of population data used in the calculation of performance indicators (i.e. denominators), and
- Comparisons of indicator values derived from routinely reported data to the same indicators measured by period population-based surveys.

Assuring good data quality begins during data-collection and continues at the phase of data compilation, transfer and aggregation into summary indicators. At the data collection stage the focus of data quality assurance is on microdata – that is, the accuracy and completeness of the information contained in each individual record or register. During the later stages of data compilation and transfer, the focus is on the accuracy, consistency and plausibility of the aggregated (macro) data. This distinction is important since different data-quality assessment techniques will be needed in each case.

The application of standard tools to evaluate data quality enables the understanding of the adequacy of routine data used for health sector planning, monitoring and evaluation and permits stakeholders to know that the routine data have undergone a known minimum level of scrutiny which lends credibility and confidence in the data.

Some programmes and agencies have developed disease-specific DQA tools and approaches designed to ascertain the extent to which routinely collected data are of good quality and to identify areas of weakness. Perhaps the most widely used DQA tools are those developed by GAVI and the Global Fund (see tools section). Other tools have taken a more cross-cutting approach and focused on the ability of the overall routine health information system to deliver high quality data (see, for example, the USAID-JSI PRISM tool). The uncoordinated and ad hoc application of these tools within countries, by health programmes and/or for donor-funded projects, has led to overlap and inefficiency.

In response, WHO working in collaboration with The Global Fund and GAVI has proposed a unified approach to data quality assessment that integrates existing tools and methods into a holistic harmonized toolkit, “*The DQR framework and toolkit*”, that builds on previous and current approaches designed to assess data quality and takes into account best practices and lessons learned from the many countries. It includes cross cutting and programme specific indicators and metrics and incorporates health facility level data verification and a qualitative system assessment to evaluate whether or not the elements essential for quality data are present.

The vision is that there should be an integrated approach to facility data quality assessment at country level, including:

- Systematic annual assessments of facility-based data quality;
- Existence of a coordinating authority for data quality;
- The application of independent data quality verification on sample of facilities using the Service Availability and Readiness tool;
- Independent assessments of programme-specific data from health facilities in order to develop data quality improvement plans and evaluate progress.

DQA should be conducted regularly and linked to the annual health sector review and the quinquennial health sector planning cycle. In order to build technical capacities for DQA, links should be forged with national statistics agencies, academic institutions, and technical/development partners. DQA should be conducted in a spirit of openness and transparency and should include regular feedback to data producers at the health facility and district levels. Development and technical partners can greatly contribute to the success of data quality improvement effort and should align around on a standardized set of data quality indicators.

However, conducting a detailed DQA is not a trivial matter: its scope and depth should be determined by the level of maturity of the health information system. A first step is to focus on improving accuracy, completeness and timeliness of reporting. At a later stage, more detailed data quality assessment can be phased in with the longer term aim of conducting detailed analysis of data plausibility and applying imputation and adjustment to deal with missing values and bias.

Key actions for countries include:

1. Develop a national DQA strategy and plan that:
 - Institutionalizes the evaluation of facility-based data using standard tools and methods;
 - Addresses services beyond the facility (e.g. community based activities);
 - Includes a system assessment or qualitative review of essential elements for quality reporting in order to determine the extent to which the system has the capacity to produce good data;
 - Assigns roles and responsibilities for data quality at each level and formulate a clear timetable for facility and district reporting and ensure that all data producers are aware of it and that late reporting is investigated;
 - Provides training and capacity development in the application of DQA tools at facility, district and national levels and supportive supervision to enable the identification of data collection and reporting gaps and their rectification;
 - Introduces IT to identify outliers and missing values in facility and district level reporting on key indicators.
2. Conduct systematic and comprehensive assessments of data quality based on a standard set of data quality metrics and report the findings regularly (annually), including analysis of completeness, timeliness, accuracy, integrity and consistency over time.
3. Carry out independent verification of the quality of data regularly (annually) on a sample of facilities that includes reviews of service and patient records.
4. Conduct periodic in-depth independent assessments of specific programme data reporting system (e.g. Immunization) at least once every three years to inform the development of data quality improvement plans, monitor progress in data quality over time, and evaluate the impact of data quality improvement plans.
5. Link the DQA system to the annual health sector planning cycle in the country so that information on data quality is available prior to the use of these data for planning. Planning needs to begin 6 months ahead of time with dedicated resources.
6. Conduct DQA in collaboration with the MoH and national statistics office and with country institutions such as public health institutes and universities.
7. Issue periodic reports of health facility data quality that include analysis of gaps and limitations in data quality and remedial actions. Ensure transparency and feedback of the DQA findings to data producers, users and relevant stakeholders.
8. Develop, implement and monitor data quality improvement plans in order to address quality problems identified in the assessments.

Available tools and resources include:

- **WHO/Global Fund/GAVI: Data Quality Review (DQR) for Health Sector Planning – An annual system of monitoring health facility data quality-Implementation Guidelines, Working document.** Geneva, World Health Organization, May 2014. The framework and toolkit combines the following tools:
 - WHO immunization data quality audit (DQA) tool (http://www.who.int/entity/immunization/documents/WHO_VB_03.19/en/index.html)
 - WHO Immunization data quality assessment (DQS) tool (http://apps.who.int/immunization_monitoring/routine/DQS_tool.pdf)
 - WHO data quality report card methodology, including facility assessment of data verification (http://www.who.int/healthinfo/tools_data_analysis/en/)
 - The Global Fund. Data Quality Tools and Mechanisms. Geneva: The Global Fund to fight HIV/AIDS, Tuberculosis and Malaria. <http://www.theglobalfund.org/en/me/documents/dataquality/>
 - Global Fund/MEASURE Evaluation DQA/RDQA (<http://www.cpc.unc.edu/measure/tools/monitoring-evaluation-systems/data-quality-assurance-tools>)

- **The PRISM framework** was developed through the USAID-supported MEASURE Evaluation RHINO initiative. The PRISM framework assumes that RHIS performance is affected by RHIS processes, which in turn are affected by technical, behavioural and organizational determinants; it outlines the direct and indirect impacts of these determinants on RHIS processes and performance. The tool offers a qualitative assessment of performance rather than quantitative.
<http://www.cpc.unc.edu/measure/resources/webinars/publications/ms-11-46-d>

SYNTHESIS OF DATA IN ANALYTICAL REPORTS OF PROGRESS AND PERFORMANCE

Countries are often faced with discrepant values of indicators derived from facility sources compared with from household surveys. This arises when facility-based data are incomplete or inaccurate and also reflects the fact that facility-based data are not generally representative of the population as a whole unless facility utilization rates are in excess of 95%, which is rarely the case. Nonetheless, facility-based statistics have several advantages over other methods of data collection, such as household surveys and censuses; facility-based data collection is continuous, applies across the whole country, and covers a wide range of health service provision and outcomes. The solution is, therefore, to maximize the utility of facility-based data by using analytical techniques to render the information more representative of the population in general. This enables facility-based data to be used in the reporting of levels, trends and differentials for key indicators.

For this to happen, it is necessary to conduct an analysis of health facility data and address data challenges that are inevitable in all data sets, such as missing values and bias. The analysis should address these challenges in a transparent and consistent manner, in order to present the most reliable information to data users. The analysis builds upon the data quality review that has produced a 'clean' data set in which basic errors and omissions have been addressed. The analysis involves data imputation and adjustment in order to correct for missing values and biases and generate improved population-based estimates for key indicators. A feature of the analysis is the comparison of health facility data with other sources of information, especially household surveys.

The complexity of the analysis stage varies according to the level at which the data are to be used. At the national level, the focus is on the data produced by subnational administrative levels such as provinces, districts and health facilities. At the subnational level, the focus of the analysis is on the health facilities. At the facility level, the focus is on the microdata derived from patient/client interactions. At facility level level the extent of analysis is minimal, focusing largely on the raw numbers and the need to link the data to action at local level. At the district level, the analysis has to address problems of random fluctuations, small numbers of events (especially for rare events such as maternal deaths), and how to estimate denominators in order calculate rates and ratios. At the national level, the analytical challenge is how to make sense of data derived from different sources, notably from facility-based data collection and household surveys. At this level, it is essential to involve not only the health facilities and district level administration, but also national institutions such as researchers and academics.

The type of analytical approach also depends on the nature of the health indicator. Different analytical issues arise for indicators related to mortality and morbidity, compared with indicators on intervention coverage or health system resources (governance, finances, human resources, essential medicines and supplies etc.). The kinds of analytic approaches used include:

- Reconciliation of data from different sources;
- Trend analysis;
- Summary measures of coverage, health system strength;
- Equity analysis;
- Efficiency and performance assessment;
- Uncertainty ranges.

The analyses described in this module are complex and demanding and would not be undertaken routinely. Rather, the aim is to conduct such analyses periodically in order to come up with an assessment of the degree to which facility-based data are representative of the population and can be used as part of overall programme and health sector performance assessment. These analyses should be conducted in collaboration with local academic institutions and researchers.

Key actions for countries include:

1. Establish collaborative arrangements with local institutions and experts (academia, researchers, technical partners) to support periodic analytical reviews of facility data. The analyses should focus on key indicators derived from health facility data, namely:
 - Health system indicators;
 - Intervention coverage indicators;
 - Health status indicators (mortality, morbidity).
2. Define general principles for analysis of health facility data in order to address key challenges, including:
 - Incompleteness: dealing with underreporting, late reporting, missing values;
 - Inconsistency: correcting for outliers and implausible reporting;
 - Denominators: estimating denominators for the calculation of indicators: correcting population projections and catchment populations;
 - Reconciliation: comparing facility-based indicators with survey data and other sources.
3. Work with technical experts, development partners and communicators to describe and interpret the result of data analyses in order to increase their use for policy and programming.

Available tools and resources include:

- **WHO and USAID Analysis of health facility data:** Guidance for managers and analysts (in process). Guidelines for managers and analysts to review, analyze and present the findings from data that are routinely reported by health facilities.
- **Health sector performance assessments: Midterm analytical review of performance of the health sector strategic plan III, 2009-2014, September 2013.** Ministry of Health and Social Welfare, United Republic of Tanzania in collaboration with Ifakara Health Institute National Institute for Medical Research and World Health Organization, September 2013.
http://www.who.int/entity/healthinfo/country_monitoring_evaluation/TZ_AnalyticalReport_2013.pdf.
- **Reporting of health statistics from service data: country best practices.** Report, International workshop, Bangkok, 10-11 October 2007. World Health Organization, Health Metrics Network, Ministry of Public Health Thailand, 2007.
http://www.who.int/healthinfo/country_monitoring_evaluation/report_workshop_annual_health_statistics_reporting.pdf
- **Reporting of statistics from health facilities:** guidance on countries' annual health statistics reporting. January 2008.

Data dissemination and use

Facility-based data collection is not an end in itself but is done in order to meet the needs of a wide range of users including to improve patient care, ameliorate the way health services function, and enhance people's health and wellbeing. An important step to facilitate the use of facility-based data is to ensure that the data collected are disseminated and shared with a range of stakeholders, including those who would use the information to strengthen the health system as well as with users of the system who have a right to know how well it is functioning. Facility-based information should also be shared with the data producers at lower levels (feedback). The development of information products and the ways in which these are disseminated should be standardized and routine. This implies clear procedures and practices, such as automated feedback reports, the use of presentation tools and visual aids, such as charts and maps, and mechanisms for data sharing and dissemination, such as a web portal.

DATA SHARING AND TRANSPARENCY

Once data have been collected and analysed according to the highest standards, they should be made available to and shared with potential users. This encourages transparency, which is an essential element of accountability. The most commonly shared data are aggregated data. However, there is also value in sharing individual record data (microdata) with *bona fide* users such as researchers, as long as there are solid mechanisms to ensure data privacy, confidentiality and security. Data sharing has numerous advantages. It permits analysts and researchers to conduct in-depth analyses, study historical trends, draw out correlations and relationships, and enhance the policy value of the information collected. A supportive legal and administrative framework is essential to enable sharing and use of aggregated data, in accordance with agreed standards for confidentiality and data security. Sharing of individual record information with the health department is a core element of public health surveillance.¹⁰

A first step is to make data available through the issuance of an annual health facility statistics report that includes summary tables and charts of key facility indicators. The potential for data sharing is greatly enhanced by the establishment of a data warehouse, a central repository of data created by integrating data from one or more disparate sources. Data warehouses store current as well as historical data and are used for creating trend reports for senior management such as annual and quarterly comparisons. A data warehouse includes business intelligence tools that can provide users with dynamic multidimensional analytical capabilities (data triangulation) and is one of the main tools for data integration. It can extract, transform and load data and be used to manage the data dictionary and metadata. The data warehouse can be connected to a portal or web interface in order to facilitate the dissemination and use of the information (see below). A data warehouse has multiple advantages, including:

- Congregate data from multiple sources into a single database so a single query engine can be used to present data;
- Maintain data history, even if the source transaction systems do not;
- Integrate data from multiple source systems, enabling a central view across the system;
- Improve data quality, by providing consistent codes and descriptions, flagging or even fixing bad data;
- Present the organization's information consistently;
- Provide a single common data model for all data of interest regardless of the data's source;
- Restructure the data so that it makes sense to users;
- Restructure the data so that it delivers excellent query performance, even for complex analytic queries, without impacting the operational systems.

¹⁰ Centers for Disease Control and Prevention (2015) Standards to Facilitate Data Sharing and Use of Surveillance Data [http://www.cdc.gov/nchhstp/programintegration/SC-Standards.htm#DATA-SHARINGfor Public Health Action](http://www.cdc.gov/nchhstp/programintegration/SC-Standards.htm#DATA-SHARINGfor%20Public%20Health%20Action). See also <http://www.cdc.gov/nchhstp/programintegration/Data-Security-FAQ.htm>

A data warehouse requires extensive planning and a highly developed IT infrastructure. It also requires significant expenditures in IT hardware, software and ongoing support. The advantages of data warehousing in terms of accessibility and quality of data are many, but given the significant investment and the IT sophistication required, it should not be undertaken without careful consideration of the IT readiness of the system, as well as the cost versus benefit.

Key actions for countries include:

1. Produce an annual health facility statistics report that includes summary tables and charts of key facility indicators. These should include trend and comparative analysis of facility (hospital) morbidity, mortality and cause of death data; intervention coverage and equity; health systems inputs and processes (including infrastructure availability, distribution and service readiness, and human resources availability, distribution and training); analyses of quality of care; analyses of data quality; and metadata descriptors to enable users to interpret the reported statistics.
2. Establish a data warehouse or repository to enable sharing of facility-based data across national, subnational and district levels to support data analysis and use. The data warehouse should link to a web portal (see below) and provide a dynamic user-friendly interface to enable visualizations of aggregate data based on user queries.
3. Offer bona fide researchers access to facility micro data for research and analysis (with appropriate safeguards for confidentiality).

Key tools and resources include:

- **The District Health Barometer (DHB)** is a flagship publication of South Africa's Health Systems Trust (HST) that is produced annually. It provides a summary of socioeconomic, health and health-related data for each district in South Africa. A publication that illustrates the important aspects of the Health system at district level through analysis of a carefully selected range of health indicators from which comparisons between and among districts (across provinces) can be made, thereby allowing for corrective measures that remove backlogs in service delivery. <http://www.hst.org.za/projects/district-health-barometer-dhb>
- **The District Health Information System (DHIS)** is The DHIS is a free and open-source software-based highly configurable data collection, aggregation, management and analysis tool that uses a data source hierarchy to capture and report on health data from its source, up to and including well-structured, decision-supporting information. It is currently used in more than 30 countries around the world as a routine health management information system and data warehouse. The recently updated DHIS-2 features a dashboard module. DHIS 2 provides for the development of web-based pivot tables, different chart types and thematic maps that can be easily dragged into the DHIS 2 dashboard interface. www.hisp.org and <http://www.dhis2.org> and <http://www.mn.uio.no/ifi/english/research/networks/hisp/>

DATA INTERPRETATION, VISUALIZATION AND DISEMINATION

Even when data have been gathered and summarised to high standards, further analysis of both what is reported and what is missing is usually needed before the information can be disseminated and communicated to non-technical audiences and used as the basis for policymaking. Data should be interpreted and presented in formats that emphasise relations to past trends, current policy, and fiscal considerations. Much reporting falls far short of this standard and many facility-based data reports are confined to raw data served in formats unpalatable or incomprehensible to policymakers.

Presentation of complex information in simple charts and maps is a well-tested route to enhancing use of data for decision-making. There is currently considerable innovation in the sophistication and utility of visualization techniques that can significantly assist data use. The challenge is to select the most appropriate type of presentation format to meet the information needs of different users

In some settings, a specific agency – for example, the national statistics office or a dedicated health NGO – is tasked with producing analytical summaries of important health topics such as inequities in health status or health care utilization.

Facility-based information should be disseminated to all stakeholders with those who would use it to advance the mission of the health system. It should also be shared with the data producers at lower levels (feedback). Information can be conveyed directly to users such as policymakers or indirectly through secondary audiences, including academics, researchers, health professionals, parliamentarians, or advocacy groups, who are in a position to influence policymakers. Communication channels include seminars, peer-reviewed journals, special events, national and international meetings, and policy briefs. The media can be helpful in translating health information into formats for policymakers and for civil society. Some countries have set standards and guidelines for information dissemination, including relations with the media.

A 'web portal' should function as a single point of access to information from the national data warehouse and other relevant sources. The role of the web portal is to make such data sources easily accessible in a structured and systematic way and is a potentially powerful tool for disseminating information and providing feedback to lower levels. Some important considerations for implementing a web portal for dissemination of RHIS data are the need to:

- Engage stakeholders, including data producers and data users, to define information needs and the format for data presentation;
- Develop content appropriate to the stakeholder group – i.e. the information and how it is presented should be customized to the user – that is simple and concise for politicians or the general public, but more detailed and technical for facility and district managers;
- Strengthen visualization and analysis aspects of the portal to encourage use, including:
 - GIS functionality to enable spatial analysis and mapping,
 - charts, graphs and dashboards.

Key actions for countries include:

1. Establish standard operating procedures (SOPs) to regulate reporting of data from lower to higher levels and the dissemination and feedback from higher to lower levels. The SOPs should describe and promote routine production and dissemination of regular reports, including:
 - Monthly, quarterly and annual reports;
 - Regular bulletins, disseminated at all levels, wherein data are analysed and indicators used to monitor performance against targets;
 - Feedback reports with analysed data and information on performance specific to the facility or district (e.g. results of supervision visits, data quality issues uncovered at higher levels, etc.);
 - Development of standard procedures and practices for dissemination and feedback (e.g. an automated report); and
 - Development of quality information products, including visual aids, such as charts and maps, and mechanisms for dissemination, such as a web portal.
2. Develop a comprehensive data dissemination strategy relevant to each level of the health system.
3. Issue periodic data summaries and bulletins describing key findings, interpreting levels, trends and disparities.
4. Produce policy briefs describing key findings identifying key actions needed to improve service availability, delivery and use.
5. Employ a variety of dissemination techniques, including dashboards and summary charts to convey information to diverse target audiences in ways that are meaningful to the media, general public and policy makers. Engage with the media and civil society to disseminate the findings from facility-based reporting.
6. Set up a Web Portal functioning as a single point of access to information from the national data warehouse and other relevant sources. The portal should develop content appropriate to different stakeholder groups and use innovation in visualization and analysis aspects including GIS functionality to enable spatial analysis and mapping, charts, graphs and dashboards.
7. Establish national and/or subnational observatories focusing on core cross-cutting themes of major policy relevance such as equity, using facility-based data to summarise key issues and provide analytical interpretation, for example, drawing comparisons over time, across subnational areas, and cross-country.

Key tools and resources include:

- **The WHO Global Health Observatory (GHO)** is a data repository containing an extensive list of indicators, which can be selected by theme or through a multi-dimension query functionality. It is the World Health Organization's main health statistics repository. The GHO includes health facility-based data as well as data from other sources. It uses a range of visualization techniques to facilitate the understanding of the data and permit comparisons across countries and over time. <http://www.who.int/gho/database/en/>
- **The Africa Health Observatory** is a statistical database maintained by the WHO Regional Office for Africa that contains regional, sub regional and country-level statistical tables and fact sheets detail health status and trends; health systems; programmes and services; key determinants of health; and progress on health-related MDGs. <http://www.aho.afro.who.int>
- **The Health Information and Intelligence Platform (HIIP)** is maintained by the WHO Regional Office for the Western Pacific and is designed to make health information accessible and user-friendly. Using HIIP, policymakers, researchers and the public can compare, visualize and manipulate country- and regional-level data. The focus of the platform is to support countries to enhance their own health information systems and improve nationally reported health statistics. The tools on the platform help countries to improve data quality, data analysis and utilization, and apply decision-making support. At the heart of HIIP is an integrated database of health-related indicators. The HIIP website is designed with users in mind, to enable easy charting, mapping and tabulation. HIIP encourages easy transfer of knowledge and promotes harmonization and standardization of health indicators used across the region. <http://hiip.wpro.who.int/portal/default.aspx>

DATA USE FOR DECISION-MAKING

The use of data to support decision-making is the most important element of the facility-based information system. There is no point in collecting quantities of data unless they are used to inform decisions at different levels of the health system. The most visible outcome of a successful information culture is that information is in demand, valued as an important resource, and used at all levels for improved service delivery to clients, strengthened facility management and management of systems at that level.

At the level of service delivery, clinical practitioners need clinical data on a daily basis during ward rounds and use local laboratory and other diagnostic data to monitor clinical improvement of patients. They particularly need data for follow-up of patient clients with significant episodes, such as pregnancies, children below five, chronic infectious and non-communicable diseases.

At the level of health facilities, managers need data on a regular basis to improve facility infrastructure, equipment and human resources. They need to know norms for infrastructure, basic service packages, staffing and equipment standards. They need to be able to calculate and interpret indicator values in order to determine gaps and resources needed for their service area.

At the system level, health planners and managers at district level up to national level, need data to monitor and plan for health service delivery. Statistics are required on health status, services provision and utilization, and on management of resources such as personnel, equipment, supplies, transport, drugs and vaccines, and finances.

The organization of the health system is intimately linked with information demand. The more decision making and funding are decentralized, the greater the likelihood that information will be demanded and used at lower levels to improve service delivery. Moreover, decentralized capacity and resources for decision making, combined with increased granularity of data and availability of user-friendly analysis and display tools, enhance the quality of decision making at all levels.

However, even when data are of high quality and disseminated to different users through a variety of media, this does not necessarily imply that they will be used. There is no simple linear relationship between data production, dissemination and use. It is important to recognise the political issues around data release and use and engage proactively with decision-makers to ensure that data and evidence are effectively used to guide policies and programmes. There are good country examples of the use of public meetings, engagement with citizens groups and with media to disseminate findings and ensure their use by decision makers.

Key actions for countries include:

1. Conduct a systematic assessment of data needs and users in order to build a facility-based health information system that is proactive, dynamic, and action-oriented. Specific steps include:
 - Undertaking a functional analysis of management functions and decision-making processes (i.e. business process analysis) of all the levels of the health system. The analysis should include individual client care and essential public health functions for institution and system management;
 - Identification of the relevant information needed to manage and monitor the functioning of the routine health information system;
 - Definition of standard operating procedures (SOPs) for the reporting of data from lower to higher levels and the dissemination and feedback from higher to lower levels.
2. Establish a forum bringing together data producers and users to examine ways of making facility data more relevant to policy makers and planners and to enhance understanding of statistical findings.
3. Foster a culture of information use, including by:
 - Incentivizing clinical practitioners to use clinical data on a daily basis to monitor patient care and outcomes and encouraging facility managers use data to improve infrastructure, equipment and human resources. This will also help create demand for sound data on the part of policy makers, planners and programme managers;
 - Ensuring that facility-based data are used in health sector reviews and that health development plans reference health facility data alongside other data sources;
 - Encouraging national authorities and development partners to use facility reports for monitoring and evaluating progress towards national and global health goals and targets. In support of this, ensure that facility-based data are of good quality and analysed alongside other sources of information on key indicators in regular data reconciliation exercises.

Annex:

Checklist of key items

Institutional and policy framework		
1	There is up-to-date legislation and detailed regulations for facility-based information aligned with the framework for health information, with clearly articulated roles and responsibilities at all levels, identification of decision-making authorities, and mechanisms for accountability to both data users and data producers.	
2	There is a comprehensive 5-year plan, costed, with clear roles and responsibilities, developed through a participatory process involving key actors from the public and private sectors, researchers, academia, civil society and development partners as appropriate.	
3	There are clearly defined management structures, including a regulatory authority, coordination body involving key stakeholders, ICT infrastructure and support, financial and human resources, and an oversight body.	
4	There are explicit data management procedures including, reporting requirements, standard operating procedures, written plans, data standardisation policies, metadata and inclusion of facility-based data from the private sector.	
5	There are adequate staffing and workforce development mechanisms in place to ensure technical competence and capacity development.	
6	There is on-going monitoring and evaluation, including performance assessments of the facility-based information system; independent, objective assessments by technical partners, and appropriate action planning is conducted following system assessments to guide system strengthening activities.	
7	Governance councils or oversight committees are established to provide independent, objective assessment of data availability and quality;	
8	There are regular assessments of the extent to which development partners and donors support harmonization and alignment around country facility-based information system strategies.	

Data standards		
Core indicators		
1	There is national and partner agreement on a balanced and parsimonious set of facility-based indicators for facility, district and national levels.	
2	The frequency of reporting for indicators is appropriate and clear to all personnel at all levels of the reporting system.	
3	Indicators for disease- and programme-specific M&E are aligned with core indicator set.	
4	Baselines for key indicators are defined at national and subnational levels and Indicator targets are clearly articulated and feasible based on health system capacities and improvement plans.	
5	Indicators are disaggregated by key stratifiers (age, sex, administrative area) as appropriate.	
6	The national data and metadata dictionary is aligned with global standards and includes definitions, data sources, data collection methods, reporting frequency, dissemination methods and use.	
Master facility list		
7	There is a comprehensive master list of health facilities, with unique facility identifier and service domain, that includes the private sector and special facilities (army etc.).	
8	There is a publicly accessible data repository that stores and maintains all facility data.	
Classifications		
9	International or national classifications are used for categorising aggregated data (ICD, facilities, human resources, essential drugs).	
Data architecture framework		
1	There is an overall framework and plan for ICT, including equipment and training in use of ICT for health information system.	
2	Indicators, data collection and reporting systems are standardized across all HIS data sources and harmonized across all programme areas and implementing partners.	
3	There is an integrated common data repository for all facility-based data for the whole country that is built upon a flexible architecture that can grow and adapt to changes and new requirements over time. Ensure that the facility-based information system is interoperable with other systems at all levels and there is adequate facility-based meta-data available to permit interoperability.	
4	The managers of facility-based reporting at all levels have sufficient autonomy (i.e. are able to define their own data needs and can use the data locally for system strengthening).	

Human resources and capacities		
Planning, management and training		
1	Staffing positions and respective knowledge, skills, and competencies have been identified, disaggregated by level (community, facility, district, etc.).	
2	There is a workforce development plan that includes national standards (and standardized job descriptions) for the required positions and functions; establishes career paths for information system positions; and identifies professional development opportunities.	
3	A workforce assessment has been carried out to map existing cadres to the required job positions and to identify gaps in positions and capacities.	
4	There is a costed workforce training plan that covers both pre-service and in-service training.	
5	A standardized training curriculum is being implemented.	
6	There is coordination of training institutions to ensure that they include health facility information system modules in their programmes and are supported to implement the standardized training curricula.	
7	A training database is maintained with information on training (such as who was trained in what domain/skill set, where, and when) to help identify the training needs of institutions and individuals by geographical sub-unit within the country.	
Supportive supervision and mentoring		
8	There are guidelines for standardized, effective supervision, including standardized supervisory checklists.	
9	Feedback and mentoring are provided to the staff being supervised so they are aware of their own performance and areas of strength and weakness.	
10	Standardized supervision reports are completed to track results and monitor trends.	
11	A schedule of regular supervisory visits is implemented.	
12	Data quality checks are conducted when performing supervisory visits to health facilities.	

Patient-level monitoring with unique identifiers		
1	The individual level data to be collected has been identified bearing in mind the needs of policy makers, ethical considerations, feasibility (in relation to IT) and long-term sustainability.	
2	Recording forms for clinical episodes and individual level data (including electronic medical records) are standardized across the clinical condition or location.	
3	Standard operating procedures and eligibility criteria for use of the recording form have been defined.	
4	The data systems for the electronic data collection on individuals have been developed.	
5	Personnel (clinicians and other staff) have been trained in the collection of the data (clinicians and other clinical staff), and for the input of the data into the computer database.	
6	Guidance is available on processes for use and analysis of the data in the health facility where it was collected as well as for the use of consolidated data across different health facilities and at different levels.	
7	There is capacity development for staff in the technical aspects of data transfer.	
8	There are agreed data use policies, both for data use within the MoH and for data analysis by researchers.	
9	There are guidelines/protocols to ensure client confidentiality (e.g. data are kept securely, health workers have signed confidentiality agreements, and client-level data is not transmitted electronically).	
10	The individual level data to be collected has been identified bearing in mind the needs of policy makers, ethical considerations, feasibility (in relation to IT) and long-term sustainability.	

Web-based facility reporting		
1	Standards for data collection, aggregation and reporting are clearly defined and understood by facility personnel.	
2	The data collection tools were designed using a participatory process, with stakeholder involvement, including donors, NGOs and the private sector.	
3	Electronic medical records are introduced progressively across all hospitals and health facilities.	
4	Data collection includes use of m-health and e-health especially for remote and isolated areas.	
5	There is an integrated, on-line national data repository to store and maintain the all aggregated facility data and to enable on line data entry, effective data analysis and use.	
6	Aggregated data are assessed for accuracy and completeness (using electronic methods where feasible) prior to transfer and timely transmission.	
7	Data disaggregations by key stratifiers (age, sex, geography) are maintained during compilation and transfer in order to permit equity analysis.	
8	Data transfer to the next level occurs in a timely way, making use of innovation and IT.	
9	Feedback is systematically provided to all sub-reporting units on the quality of their reporting (i.e., accuracy, completeness and timeliness) and use of data for decision-making based on their submitted reports.	
10	There are clear policies and guidelines for adequate storage of health data (paper or electronic) at different levels (national, subnational, district, facility).	
11	Training is provided for staff at facility and district levels in data collection and use with guidance and supportive supervision to ensure the implementation of national guidelines.	

Community-based service data		
1	A community-based service delivery strategy has been developed at the national or sub-national levels.	
2	A rapid assessment has been conducted to map the organizations working on community-level programmes and assess monitoring and evaluation systems and capacities.	
3	An indicator harmonization process has been undertaken to help streamline the collection, reporting, and use of community-level information and agreement on a minimum set of community indicators and data collection tools.	
4	There are electronic linkages to permit integration of facility-based and community-based data.	
5	There is an organizational structure for the human resources aspect of community level data, including a formal M&E officer, supportive supervision and manageable catchment areas at all levels.	
6	A training and capacity development plan is in place specifically designed to address needs of low literacy CHWs.	
7	There is a plan to use and disseminate the data appropriate for a community-based setting and a formal feedback loop to the health care workers collecting the data and the community itself.	
8	Data are made available in formats that are easy to access, interpret and use at different levels of the health system and at the community level.	
9	There is an established process to assess and address data quality issues.	
10	There are regular assessments of the performance of the overall system, including the extent to which data are accessible and used for policy and planning.	

Facility-based data on mortality and causes of death		
1	There is a national committee and strategic plan for improving hospital mortality data that includes an agreed national minimal set of mortality data to be collected by all hospitals and health facilities using global standards and definitions and describes reporting and feedback structures and dissemination mechanisms.	
2	There are regular reviews of the policies and procedures for collecting and consolidating cause of death data from hospitals and other health care facilities.	
3	Strategies are in place to improve medical records and other sources of information on deaths such as ward registries, hospital discharge registries.	
4	The international form of the death certificate is used in all facilities for the medical certification of death.	
5	Certifying physicians have the knowledge and skills needed to accurately complete the ICD international form of the death certificate and are aware of the importance of correct cause-of-death certification.	
6	The quality of hospital cause-of-death certification is regularly assessed using a medical records review. The findings are used to put in place corrective actions.	
7	The ICD most recent revision is used for coding causes of death.	
8	Statistical clerks and health information officers have the training and reference materials needed to code deaths and disabilities according to the ICD.	
9	Systems for the automated coding of causes of death are progressively used to the maximum extent possible.	
10	There are regular audits of coding as part of quality assurance procedures.	
11	There is an annual/biennial report on hospital mortality, with tables and charts on key indicators including distribution of causes of death by sex and age and case fatality rates for major causes of death.	
12	Hospital-based mortality statistics are used to identify avoidable deaths and deficiencies in the quality of care.	
13	Hospital mortality data are used to trigger audits and confidential enquiries of adverse outcomes, such as maternal and perinatal deaths.	

Monitoring quality of care services with facility data		
1	Sensitization and training is conducted to generate a broad understanding of linkage between quality of care and health management and information systems.	
2	There is an agreed list of indicators for monitoring quality of care that can be derived from facility-based information systems, including standards-based care, effective care, patient safety, timeliness, and patient satisfaction.	
3	National level planning on harmonization of quality monitoring efforts is informed by facility level experience and gap analysis and agreement on a “basket” of potential quality monitoring mechanisms.	
4	There are national level quality of care dashboards to ensure close linkage between quality monitoring mechanisms and UHC systems.	
5	Technical capacity building in monitoring quality of care services is offered, for example through institutional health partnerships.	
6	Facility assessments include periodic evaluation of patient satisfaction and quality of services received, collected through observation of client-provider interactions, and client exit interviews.	

Health Facility Assessments (HFAs)		
1	There is a country-led, harmonized plan for systematic and regular facility assessments based on country data needs and including scope, contents, periodicity, funding and execution.	
2	HFAs are conducted using a modular approach based on international expertise and harmonization.	
3	Facility assessments are conducted in advance of national health planning cycles so that results feed into analytical reviews of health sector performance.	
4	Countries work with national agencies (national statistical offices, public health schools), to support the planning, management of the assessments and to provide a quality assurance role.	
5	The content of the HFA is determined through stakeholder discussions and contents and covers the following broad areas:	
6	A census of all facilities is conducted every 5 – 7 years in order to update the master facility list of public and private facilities (including for profit, non-profit, and faith based organizations).	
7	Facility assessments generate data on service availability, location, and distribution as well as infrastructure (health care facilities, beds, basic medical equipment).	
8	Facility assessments generate statistics on readiness to provide services (and availability of systems and resources to support quality).	
9	Facility assessments identify administrative entities and quality control procedures.	
10	Facility assessments generate information on staff qualifications, training, operating hours, and supervision.	
11	Facility assessments include periodic evaluation of quality of care -patient satisfaction by type, number, quality of services received, collected through observation of client-provider interactions, and client interviews.	
12	Facility assessments include analysis of adherence to standards of practice and infection control, such as injection safety and medical waste management practices.	
13	Facility assessments are used to validate routine service statistics and self reports on facility infrastructure, resources, and service provision status collected from patient encounters.	
14	Facility assessment results are disseminated through meetings with key stakeholders and the implications of the findings for programme management and resource allocation are highlighted.	
15	The outputs of facility assessments are fed into the analytical review process, combined with data from the routine, administrative system and population surveys in order to provide a comprehensive analysis of health sector performance.	
16	Facility assessment reports and data are made publically available through for example the MoH website, or central data repository /national observatory.	

Data quality assessment and verification		
1	A data quality assessment and assurance plan has been developed and shared to guide stakeholders in improving the reported data quality. The plan covers the following components:	
2	Facility data quality assurance standards are defined and enforced, including completeness, timeliness, accuracy, integrity, and consistency over time.	
3	Roles and responsibilities for data quality are assigned at each level, including community-based data capture, and capacity to verify, validate, and summarize facility data quality issues and develop improvements strategies.	
4	Training and capacity development in the application of data quality assurance are provided at facility, district and national levels, using harmonized tools.	
5	Supportive supervision is offered to enable the identification and rectification of data gaps and deficiencies.	
6	There are mechanisms in place to identify outliers and missing values in facility and district reporting for key indicators.	
7	Systematic and comprehensive assessments of data quality from facility reporting are reported regularly (annually) in advance of health sector reviews, including analysis of completeness, timeliness, accuracy, integrity and consistency over time.	
8	Independent verification of the quality of data is conducted regularly on a sample of facilities that includes reviews of service and patient records as well as systems analysis.	
9	Periodic in-depth independent assessments of specific programme data reporting system (e.g. Immunization) at least once every three years.	
10	The DQA system is linked to the annual health sector planning cycle in the country so that information on data quality is available prior to the use of these data for planning.	
11	There is collaboration between the MoH and national statistics office and national stakeholders (such as public health institutes and universities) on data quality assurance.	
12	A report of health facility data quality is issued periodically to appropriate stakeholders and includes analysis of gaps and limitations in data quality and remedial actions.	
13	Agreed upon data quality metrics are collected routinely over time to show trends in data quality at the various levels.	
14	Data quality improvement plans are developed, implemented and monitored to address quality problems identified in the assessments.	

Synthesis of data in analytical reports of progress and performance

1	There are collaborative mechanisms established with local research and academic institutions to conduct analytical reviews of facility data on a periodic basis.	
2	General principles for analysis of facility data are defined, including how to deal with incompleteness, inconsistency, implausibility, estimation of denominators and data reconciliation across data sources, and imputation of missing values.	
3	Health planners and development partners use the results of the analysis of facility data to produce analytical reports of progress and performance for the health sector review.	

Data sharing and transparency

1	A report of health facility statistics is produced annually and includes: trend and comparative analysis of facility (hospital) morbidity, mortality and cause of death data; intervention coverage and equity; health systems inputs and processes (infrastructure availability and distribution; service readiness; human resources availability, distribution and training); analyses of quality of care; analyses of data quality; and metadata descriptors.	
2	A variety of dissemination techniques is used, including dashboards and summary charts to convey information to diverse target audiences in ways that are meaningful to the media, general public and policy makers.	
3	Bona fide researchers can access to facility micro data for research and analysis (with appropriate safeguards for confidentiality).	

Data interpretation, visualization and dissemination		
1	A culture of information use is promoted by policy leaders and decision-makers and reflected in the use of facility-based data in planning, monitoring and evaluation reports.	
2	Clinical practitioners use clinical data on a daily basis to monitor patient care and outcomes and facility managers use data to improve infrastructure, equipment and human resources.	
3	Facility-based data are used in health sector reviews and that health development plans reference health facility data alongside other data sources.	
4	National authorities and development partners use facility reports for monitoring and evaluating progress towards national and global health goals and targets.	
5	A systematic assessment of data needs and users has been carried out in order to build a facility-based health information system that is proactive, dynamic, and action-oriented. Key features include:	
6	A functional analysis of management functions and decision-making processes at all the levels of the health system.	
7	The identification of information needed to manage and monitor the functioning of the facility-based information system.	
8	Standard operating procedures (SOPs) for the reporting of data from lower to higher levels and the dissemination and feedback have been defined.	
9	A forum has been established bringing together data producers and users to examine ways of making facility data more relevant to policy makers and planners and to enhance understanding of statistical findings.	
10	There is a comprehensive data dissemination strategy relevant to each level of the health system, with key products defined.	
11	Periodic data summaries and bulletins are produced describing key findings, interpreting levels, trends and disparities.	
12	There is outreach to the media and civil society to disseminate the findings from facility-based reporting.	
13	There is a national data warehouse or repository to enable sharing of facility-based data across national, subnational and district levels to support data analysis and use.	
14	A Web Portal functions as a single point of access to information from the national data warehouse and other relevant sources. The portal contains content appropriate to different stakeholder groups and uses innovation in visualization and analysis.	
15	Policy briefs are issued describing key findings from facility-based information systems and identifying key actions needed to improve service availability, delivery and use.	
16	National and/or subnational observatories have been set up to focus on core cross-cutting themes of major policy relevance such as equity, using facility-based data to summarise key issues and provide analytical interpretation	

