



Health Information System Strengthening: Standards and Best Practices for Data Sources

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ABBREVIATIONS

ART	antiretroviral therapy
CAPI	computer-assisted personal interviewing
CHW	community health worker
COA	chart of accounts
CRVS	civil registration vital statistics
CSPPro	Census and Survey Processing System
DHS	Demographic and Health Survey
DRG	diagnosis-related group
EBS	event-based surveillance
EML	essential medicine list
EWAR	early warning and response
FMIS	financial management information system
GRL	Global Reference List
HAPT	Health Accounts Production Tool
HFA	health facility assessment
HIS	health information system
HMN	Health Metrics Network
HRIS	human resources information system
HWR	health workforce registry
IBS	indicator-based surveillance
ICD	International Classification of Diseases
ICHA	International Classification for Health Accounts
ICHI	International Classification for Health Interventions
IDSR	integrated disease surveillance and response
IFRS	international financial reporting standards
IHR	International Health Regulations
iHRIS	Open Source Human Resources Information Solutions
IIVRS	International Institute for Vital Registration and Statistics
ILO	International Labour Organization
ISCO	International Standard Classification of Occupations
ISHMT	International Shortlist for Hospital Morbidity Tabulation
JSI	John Snow, Inc.
LMIC	low- and middle-income countries
LMIS	logistics management information system

MDG	Millennium Development Goal
MFL	master facility list
MICS	Multiple Indicator Cluster Survey
MOH	Ministry of Health
MSH	Management Sciences for Health
NHWA	national health workforce account
NORAD	Norwegian Agency for Development Cooperation
NSO	national statistics office
OECD	Organisation for Economic Co-operation and Development
OPCS	Office of Population Censuses and Surveys
OpenHIE	Open Health Information Exchange
PAPI	paper-and-pencil interviewing
PSU	primary sample units
RHIS	routine health information system
SARA	Service Availability and Readiness Assessment
SAVVY	Sample Vital Registration with Verbal Autopsy
SDG	Sustainable Development Goal
SHA	System of Health Accounts
SML	Startup Mortality List
SNA	System of National Accounts
SPA	Service Provision Assessment
TB	tuberculosis
UHC	universal health coverage
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNC	University of North Carolina
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WFS	World Fertility Survey
WHA	World Health Assembly
WHO	World Health Organization
WHO-FIC	World Health Organization Family of International Health Classifications

INTRODUCTION

The purpose of this guide is to help health authorities and health information officers align health information system (HIS) data sources with standards and best practices. This alignment will maximize the likelihood that information on health conditions, services, and resources are recorded in a consistent way and ensure that reliable data produce comparable statistics at all levels of the health system.

Technical standards for health-related data provide common nomenclatures (common terminologies and definitions) and taxonomies (classifications and coding mechanisms) for deriving comparable health indicators. Standards are typically global because they are developed and maintained through an extended process of expert input and consultations with specialists from around the world. International organizations such as the World Health Organization (WHO) and other agencies of the United Nations (UN), because of their constituent member states, are well-positioned to coordinate the development of standards and achieve wide technical and political consensus on those standards.

National standards are important especially for types of data for which global standards do not exist. The same principles apply to national and international standards; both should facilitate the generation of data that record all possible conditions, resources, or activity (exhaustive) and ensure that each condition, resource, or activity can be classified according to a unique definition (mutually exclusive), in a format that can be analyzed statistically. Data that are aligned with standards that incorporate these principles will help ensure reliable comparisons of indicators across geographical areas and subpopulations, and over time, for any unit of analysis.

Best practices reflect successful approaches taken to implement standards or to provide needed guidance if standards are not available. They often address areas of HIS modernization, such as evolving technological solutions, and are developed by groups with expertise in a particular niche (Heywood & Boone, 2015; Ministry of Medical Services and Ministry of Public Health and Sanitation, n.d.). Academic institutions, expert communities, and nongovernmental organizations frequently have the flexibility and specialized professionals to explore a range of solutions and promote best practices. The DHIS 2 community, for example—supported by the University of Oslo, the Norwegian Agency for Development Cooperation (NORAD), the Research Council of Norway, the United States President's Emergency Plan for AIDS Relief (PEPFAR), and the Global Fund to Fight AIDS, Tuberculosis and Malaria—provides examples of best practices in using a web-based open-source software to compile and manage routine health data (DHIS 2, n.d.).

Although standards and best practices are continuously evolving, countries' ongoing efforts to align data sources will increase the HIS efficiency to monitor population health status and health service delivery, identify health inequalities, and allocate health finances to achieve universal health care. Aligning data sources will also improve the quality of national-level indicators used for benchmarking a country relative to others and facilitate participation in global development goals. Perhaps most importantly, HIS stakeholders will have increased confidence in the statistics that the system generates—especially, in terms of the statistics' relevance (meeting the needs of users), reliability (consistency in their capacity to measure), and validity (proximity to the true value of what the statistics aim to measure).

This guide is primarily directed to national health authorities and health information officers in ministries of health. It may also be informative for a wider range of technical and policy-oriented professionals. Each HIS data source module covers an HIS data source, summarizes best practices and standards for data from that source, and offers additional references to tools and resources. The twelve modules, along with a brief explanation of each source, follow:

Module 1: Individual Records. These are a source of patient level data on diagnoses and service interventions.

Module 2: Health Infrastructure Information System. These are a source of health facility data on infrastructure and services.

Module 3: Human Resources for Health Information System. These are a source of health personnel data and the types of health occupations.

Module 4: Logistics Management Information System. These are a source of data on the availability and cost of essential medicines and health commodities.

Module 5: Financial Management Information System. These are a source of financial data on budget estimates and revenues and expenditures.

Module 6: Health Facility Assessments. These are a source of data on the readiness of facilities to provide services.

Module 7: Population Censuses. These are a source of data for estimates of the population exposed to risk or service coverage.

Module 8: Population-Based Surveys. These are a source of health and socioeconomic data at the household and individual level.

Module 9: Civil Registration and Vital Statistics System. These are a source of birth, death, stillbirth, and cause of death data.

Module 10: Public Health Surveillance System. These are a source of data on reportable diseases conditions and threats to public health.

Module 11: Collective Intervention Records. These are a source of data on services that target the general population.

Module 12: Health Accounts. These are a source of expenditure data by financer, provider, and type of healthcare consumed.

Data Sources

The reference guide builds on the Health Metrics Network (HMN) Framework (WHO & Health Metrics Network [HMN], 2008) and the Health Information System Strengthening Model (MEASURE Evaluation, 2016). In particular, it delves into the data source component that is common to both of these conceptual models. Within that component it identifies 12 main data sources that generate the data needed to compute a range of health indicators. Table 1 groups these data sources as facility-based, institution-based, and other, and summarizes each according to the type of data generated, the primary unit of analysis, possible disaggregation, and related standards.

Table 1. Twelve main data sources and summary information for each

Data source			Type of data generated	Unit of analysis	Disaggregation	Standards
Institution-based data sources	1.	Individual records	<ul style="list-style-type: none"> Morbidity and health conditions Service interventions 	Patient or client	Sociodemographic characteristics	ICD-10, GBD, ICPC-2, ICHI, ISHMT
	2.	Health infrastructure information system	<ul style="list-style-type: none"> Infrastructure and amenities Types of services Equipment 	Facility	Geography, type of facility, type of management, other	MFL
	3.	Human resources information system	<ul style="list-style-type: none"> Health occupations 	Health worker	Sociodemographic characteristics	ISCO-08, HWR
	4.	Logistics management information system	<ul style="list-style-type: none"> Essential medicines and commodities 	Medicine or commodity	Geography, type of facility	NEML, ATC
	5.	Financial management information system	<ul style="list-style-type: none"> Budget estimates Revenue and expenditures 	Budget item	(National level)	Not applicable
	6.	Health facility assessments	<ul style="list-style-type: none"> Health resource inventories 	Facility	Geography, type of facility	SPA, SARA
Population-based data sources	7.	Population census	<ul style="list-style-type: none"> Population estimates and projections 	Person	Sociodemographic characteristics	United Nations Statistics Division Principles and Recommendations for a Population and Housing Census
	8.	Population-based surveys	<ul style="list-style-type: none"> Risk factors Knowledge, attitudes, and practices Coverage of services 	Person or household	Sociodemographic characteristics, socioeconomic stratifiers	DHS, MICS, SILC, HIS
	9.	Civil registration vital statistics system	<ul style="list-style-type: none"> Births Deaths Stillbirths Causes of death 	Person	Sociodemographic characteristics	United Nations Statistics Division Principles and Recommendations for a Vital Statistics System ICD-10
Other, mixed data sources	10.	Public health surveillance system	<ul style="list-style-type: none"> Reportable conditions Potential public health threats 	Disease or event	Geography, other	IHR
	11.	Collective intervention records	<ul style="list-style-type: none"> Community (not clinical) interventions 	Community	Geography, other	ICHA-HC6
	12.	Health accounts	<ul style="list-style-type: none"> Health financers Health providers Healthcare services or resources consumed 	Health expenditure	(National level)	SHA ICHA

Key:

ICD-10 - International Classification of Diseases, Tenth Revision

GBD - Global Burden of Disease (classification of morbidity & mortality groups)

ICPC-2 - International Classification for Primary Care, 2nd Revision

ISHMT - International Shortlist for Hospital Morbidity Tabulation (classification of morbidity & mortality groups)

ICHA-HC6 - Classification of Health Care Functions, Preventive Care

MFL - Master Facility List (minimal data elements in signature and service domains)

ISCO-08 - International Standard Classification of Occupations, 2008 revision

HWR - Health Workforce Registry (minimal data elements)

NEML - National Essential Medicines List

ATC - Anatomical Therapeutic Classification

SPA - Service Provision Assessment (tools and methodology)

SARA - Service Availability and Readiness Assessment (tools and methodology)

SILC - Statistics on Income and Living Conditions (tools and methodology)

HIS - Health Interview Survey (tools and methodology)

DHS & MICS - Demographic and Health Survey, Multiple Indicator Cluster Survey (tools and methodology)

IRH - International Health Regulations

SHA ICHA - System of Health Accounts, International Classification for Health Accounts

Institution-Based Data Sources

Institution-based data sources comprise routine, administrative data sources as well as cross-sectional data that are collected through periodic health facility assessments (Table 1). The common characteristic that groups these data sources together as “institution-based” is that the primary data describe an activity, situation, or resource associated with a given health institution.

The routine, administrative data sources include individual records and health resource information systems to monitor infrastructure, health workforce, commodities, and finances. These data sources are part of the routine health information system (RHIS). In an RHIS, health facilities record continuous primary data, many of which are later compiled, verified, and transmitted to regional and national levels, often in aggregate format (Lippeveld, et al., 2000).

Population-Based Data Sources

Population-based data sources are population censuses, civil registration vital statistics (CRVS) systems, and population surveys (Table 1). The CRVS system records routine, administrative data on a continuous basis, and census and survey data collections are undertaken periodically. The common characteristic among these data sources is that their data are representative of the general population. If data quality is good, then reliable inferences can be made to the general population in subnational areas, or to subpopulations such as sex and age groups or other sociodemographic groups. These data sources are typically managed outside the health sector, although they provide important health and demographic data for the HIS.

Other, Mixed Data Sources

This is a catch-all category for data sources that are not—or not entirely—institution-based or population-based. The public health surveillance system is rooted largely in the RHIS (institution-based data source), but it also relies on ad hoc reports from sources outside the health sector to identify and respond to public health emergencies. The health accounts data source collects data from financial sources, primarily at the central level, but it also relies on survey data for household consumption information. Collective intervention records are derived from health promotion activities initiated within or outside of the health sector.

Core Health Indicators

Countries define their own sets of core health indicators that provide information about the performance of the health system. These indicators are typically monitored in the context of a national health strategy document and other plans and policies that define the country’s vision, priorities, and courses of action (WHO, 2016).

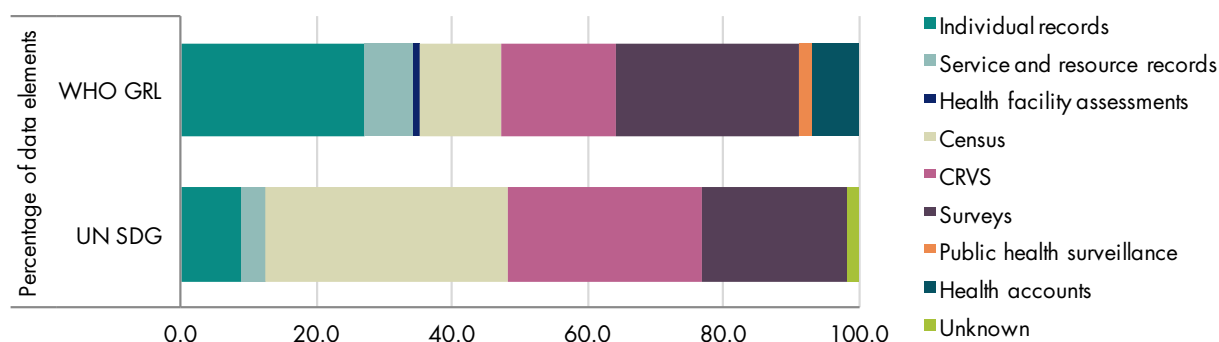
Although health system priorities and the burden of disease vary across countries, the types of information needed to monitor them is similar. Therefore, national sets of core health indicators include common indicator domains and even some common indicators. For example, in countries with a high burden of HIV, tuberculosis, and malaria, the international community has developed disease-specific indicator sets (WHO, 2015; United Nations Office for Project Services, 2015; Joint United Nations Programme on HIV/AIDS (UNAIDS), 2008; President’s Malaria Initiative, 2009; WHO, 2013). Under the auspices of the UN, countries have defined a set of health-related indicators in the context of the Sustainable Development Goals (SDGs) to monitor public health priorities globally (UN, 2016). WHO has published a model set of 100 core indicators to monitor health system performance (WHO, 2015).

Whatever the composition of the core indicator set, data from multiple data sources will be required to compute them. It is useful to map the indicator data elements to each of the data sources needed to generate them. This mapping exercise will reveal the relative demand across the HIS data sources. It is also useful to map each of the core health indicators to an indicator domain in order to evaluate the balance of indicators that the country has selected.

Data source demand. Core health indicators provide insights into the demand on each data source to generate data. As an illustration of how countries may evaluate demand, we mapped the WHO Global Reference List (GRL) of 100 Core Health Indicators (WHO, 2015) and health-related indicators from the SDGs, to the 12 main data sources.

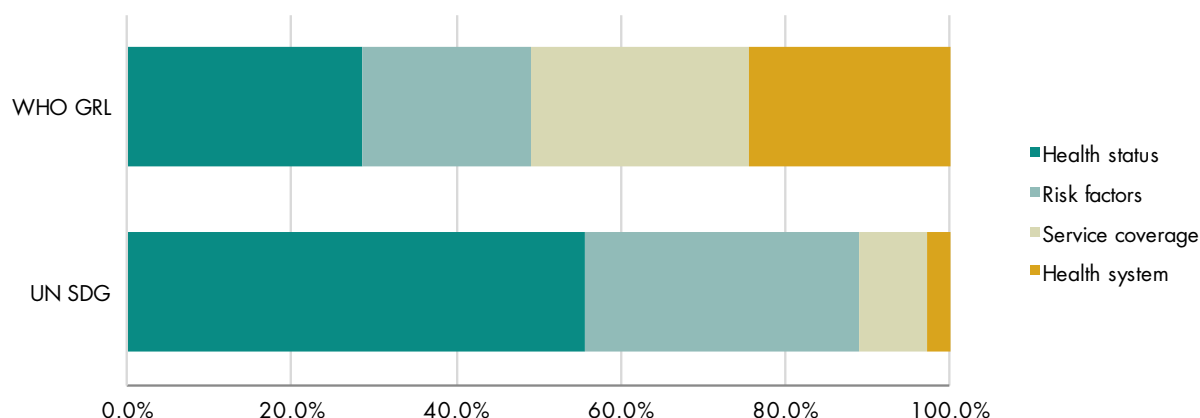
Figure 1 shows the percentage of data elements, among all data elements for these indicators, expected from each data source. Results reveal that about half of the WHO GRL indicators are derived from data from individual records and surveys, and about a third are derived from CRVS and censuses. SDG indicators are derived mainly from CRVS, censuses, and surveys. Note that for both indicator sets, the share of data from censuses tends to correspond to the share of data from CRVS. This is because the CRVS provides numerator information for causes of death and the census provides denominator information on exposure, and together they provide an indicator of prevalence.

Figure 1. Indicator demand on HIS data sources, percentage of data coming from each data source, by indicator set



Balance of indicators. Countries can ascertain the balance of their core indicators by grouping them in different domains.¹ To determine the balance of the WHO GRL and SDG indicators we used the four WHO indicator domains—health status, risk factors, service coverage, and health system (WHO, 2015).² Figure 2 shows the percentage of indicators in each of the domains. The WHO GRL indicators comprise a fairly balanced mix from each category of the health system (21 to 28 indicators in each domain); the SDG indicators are focused on two categories: population health status and risk factors. These results are not surprising, because the WHO GRL indicators are used to monitor performance of national health systems and the SDG indicators are used to assess global health status.

Figure 2. Indicator balance, percentage of indicators in four indicator domains, by indicator set



¹ The HMN Framework's three dimensions—determinants of health, health status, and the health system (WHO & HMN, 2008); WHO's six health system functions—health service delivery including quality of services, health financing, essential medicines, health workforce, health information, and health governance (WHO, 2010); WHO/International Health Partnerships and Related Initiatives (IHP+) four measurement domains—inputs and processes, outputs, outcomes, and impact (WHO & IHP+, 2011).

² Health status: mortality, fertility, and morbidity

Risk factors: nutrition, infections, environmental risk factors, and noncommunicable diseases,

Service coverage: reproductive, maternal, newborn, child, and adolescent care; HIV; HIV/TB; malaria; neglected tropical diseases; screening and preventive care; and mental health

Health systems: quality and safety of care, access, health workforce, health information, health financing, and health security.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 1:

Individual Records



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Morbidity Diagnoses and Health Interventions

Description

Individual records contain sociodemographic and medically relevant information on healthcare clients. Clinicians use the information in records to manage patients' care and coordinate integrated services. Hospital administrators use summary indicators to monitor patient safety and quality of care. Policymakers track the incidence and prevalence of health conditions, and quantity of service consumption, to efficiently finance the health system.

The format of health records varies widely between countries and even between health facilities within a country. In general, service providers in many countries use paper-based records in the form of patient charts or registries, and many are also transitioning to electronic records. Electronic patient records have numerous advantages for accurately recording, efficiently storing and retrieving, and transferring information between healthcare providers.¹

As electronic records evolve, there must be a joint effort between IT, clinicians, and coders so that information in patient health records and disease registries is transformed into useful data. The electronic environment should allow for clinicians to document patient diagnoses as accurately as possible, and coders to transform the diagnoses into unique codes. This synergy is only possible if all parties are working according to standards that provide terminology and definitions, a set of rules and instructions for their use, and common classification and coding mechanisms. These conditions alone allow for patient diagnoses and clinical procedures to be transcribed into a statistically analyzable format.

This module introduces standard classifications for generating comparable data on morbidity diagnoses and healthcare interventions. It focuses on information in individual records managed by hospitals or ambulatory providers, in the form of patient records or registries.

Types of Indicators

Morbidity diagnoses. The diagnosis or condition used for morbidity tabulation is the main one, defined as “the condition, diagnosed at the end of the episode of healthcare, primarily responsible for the patient’s need for treatment or investigation” (WHO, 2011).

Table 2 shows selected patient morbidity indicators derived from individual records. Maternal, newborn, and communicable diseases are the leading causes of disease burden in many low-income countries, so these countries place an emphasis on monitoring prevalence and incidence indicators related to these mainly infectious conditions (World Health Organization [WHO], 2008).

Many countries also monitor, or are starting to monitor, chronic conditions as indicators of the quality of healthcare (Department of Health and Human Services, 2001; Organisation for Economic Co-operation and Development [OECD], 2015; WHO, 2016d). For example, monitoring the rates of asthma, diabetes, chronic obstructive pulmonary disease, and congestive heart failure cases admitted to the hospital, by the type of patient,² is an indicator of the efficiency of the health system because it measures hospital admissions that might be avoidable if adequate primary care interventions were available. These conditions are referred to as avoidable hospital admissions.

³ The OpenMRS, for example, is a free and open-source medical record system that can be adapted to customize patient records. It is used in countries worldwide and has an active community of experts that support its adaptation and implementation (OpenMRS, n.d.).

⁴ There are three types of patients: (1) inpatients admitted to the hospital and discharged alive, (2) outpatients accessing ambulatory care, and (3) day cases receiving the range of hospital services, without spending the night.

Table 2. Morbidity indicators derived from individual records

Global Reference List of Health Indicators [*]	Sustainable Development Goal Indicators [†]	OECD Health Care Quality Indicators [∞]
New cases of vaccine-preventable diseases	Number of new HIV infections per 1,000 (Indicator 3.3.1)	Avoidable hospital admissions (asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes)
New cases of International Health Regulations notifiable diseases and other notifiable diseases	Number of new and relapsed TB cases per 1,000 (Indicator 3.3.2)	Surgical complications (following hip or knee surgery, abdominal surgery, or foreign body left in during procedure)
HIV incidence rate	Malaria cases per 1,000 (Indicator 3.3.3)	Mental health disorders (suicide, schizophrenia, bipolar disorder)
HIV prevalence rate	Hepatitis B incidence (per 100,000) (Indicator 3.3.4)	Survival rates for cervical cancer, breast cancer, colorectal cancer
Hepatitis B surface antigen prevalence	Prevalence of neglected tropical diseases (per 100,000) (Indicator 3.3.5)	Obstetric trauma
Sexually transmitted infection incidence rate		
Tuberculosis (TB) incidence rate		
TB notification rate		
TB prevalence rate		
Malaria parasite prevalence among children ages 6–59 months		
Malaria incidence rate		
Cancer incidence, by type of cancer		

^{*} WHO, 2015

[†] United Nations, 2016

[∞] OECD, 2015

Health interventions. A health intervention is an action performed for, with, or on behalf of a person or population whose purpose is to assess, improve, maintain, promote, or modify health, functioning, or health conditions (International Classification of Health Interventions [ICHI] Alpha, 2016).

Table 3 shows selected health intervention indicators derived from individual records. As with morbidity indicators, low-income countries place an emphasis on monitoring the coverage of health interventions for people with infectious diseases including HIV, tuberculosis, malaria, and selected tropical diseases (WHO, 2015).

Many countries also monitor some or all of the 30 common hospital interventions defined by the Hospital Data Project (OECD/Eurostat/WHO-Europe, 2013).³ Although international comparisons of these interventions are complicated by the use of different classification systems across countries,⁴ countries with a national intervention classification can make valid subnational comparisons with their local codes (Hospital Data Project, 2003).

⁵ These interventions include, among others, cataract surgery, tonsillectomy, Caesarean section, coronary angioplasty, coronary bypass, appendectomy, hysterectomy, kidney transplant, and knee and hip replacement.

⁶ An international procedure list is not yet available, and several countries have adopted the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) developed by the United States. Other countries use a variety of national procedure coding classifications and map their local codes to the ICD-9-CM sentinel list (comprising 18 codes). The ICD-9-CM was the U.S.-developed standardized list of codes for diagnoses and procedures. In 2015, the United States transitioned to a new classification based on an International Classification of Diseases, Tenth Revision (ICD-10) adaptation (ICD-10-CM) for diagnoses and ICD-10 Procedure Coding System (ICD-10-PCS) for procedural codes.

Table 3. Health intervention indicators derived from individual records

Global Reference List of Health Indicators [*]	Sustainable Development Goal Health Intervention-Related Targets [†]	OECD Health Care Quality Indicators [∞]
	Treatment for mental health and well-being (Target 3.4)	Medical technology (magnetic resonance imaging exams, computed tomography exams)
Prevention of mother-to-child transmission	Universal access to sexual and reproductive healthcare services (Target 3.7)	Coronary procedures
HIV care coverage	Access to quality essential healthcare services (Target 3.8)	Hip and knee replacements
Antiretroviral therapy (ART) coverage	Tobacco control (Target 3.a)	Caesarean sections
HIV viral load suppression	Ending malnutrition (Target 2.2)	Ambulatory surgery (cataracts, tonsillectomy)
Tuberculosis preventive therapy for HIV-positive people newly enrolled in HIV care		
HIV test results for registered new and relapse TB patients		
HIV-positive new and relapse TB patients on ART during TB treatment		
Treatment of confirmed malaria cases		
Coverage of preventive chemotherapy for selected neglected tropical diseases		
Coverage of services for severe mental health disorders		
Immunization coverage rate by vaccine for each vaccine in the national schedule		
Percentage of people living with HIV who have been diagnosed		
Intermittent preventive therapy for malaria during pregnancy		

^{*} WHO, 2015 add indicators from WHS

[†] United Nations, 2016

[∞] OECD, 2015

Standards

Standards are designed to provide comparable data not just on priority diseases and services, but also evidence of emerging conditions and the use of new technologies. As populations move through an epidemiological transition—shifting from mainly maternal, newborn, and communicable diseases to chronic conditions—decision makers need data on the breadth of conditions and treatments being sought. The WHO developed the Family of International Health Classifications for this purpose.

The WHO Family of International Health Classifications (WHO-FIC) facilitates the coding of primary data in individual records to enable a comprehensive and comparable analysis of morbidity diagnoses and health service delivery. It does so by developing and maintaining three standard classifications that take into account the range of possible health conditions, health interventions, and areas of bodily functioning and disability.

Two of these classifications, the International Classification of Diseases (ICD) and the ICHI, are most relevant to monitoring health system performance and population health status.⁵

WHO-FIC reference classifications

As the coordinating authority on international health work, the WHO establishes international reference classifications on health that are endorsed by member states. The WHO-FIC coordinates three main health-related classifications (WHO, 2016a):

- International Classification of Diseases (adopted by the World Health Assembly in 1967)
- International Classification of Functioning, Disability and Health (adopted by the World Health Assembly in 2001)
- International Classification of Health Interventions (adopted as a WHO project in 2012)

Standards for Morbidity Diagnoses

The ICD is the global standard for mortality and morbidity. It provides an international classification and corresponding coding system for all possible diagnoses. International Classification of Diseases, Tenth Revision (ICD-10) is the current version that has been in effect since 1990.⁶ The ICD-10 conditions are grouped in a way that is conducive to monitoring epidemiology trends in the population. To initiate coding using ICD, the clinician records an accurate medical diagnosis of the patient's conditions. Then, a records clerk or other designated person systematically codes the information according to the ICD list of morbidity conditions.

Healthcare clients may present multiple health problems. The condition used for morbidity tabulation is the *main* condition (WHO, 2011). If there is more than one such condition, then the one considered responsible for the greatest use of resources should be selected. If no diagnosis was made, then the main symptom, abnormal finding, or problem should be selected as the main condition.

⁵ The other classification, International Classification of Functioning, Disability, and Health (ICF), was endorsed by the WHO member states in 2001. This classification is used in clinical settings to assess the functioning and disability of an individual on a small scale, and the process of implementing it in national legislation and health and social reporting systems is being piloted in rehabilitation, home care, and disability evaluation activities in several countries.

⁶ ICD-11 will be adopted by the World Health Assembly in 2018, but countries should proceed with implementing ICD-10 because it will likely take many years for the first countries to implement ICD-11.

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ICD-10 Tabulation Lists for Morbidity

ICD-10 has approximately 70,000 diagnosis codes. In an effort to simplify tabulations and comparisons of diagnostic groups, the ICD-10 Volume 1 provides a special tabulation list for morbidity diagnoses that consists of a greatly reduced set of 298 principal diagnosis groups defined by their ICD-10 codes (WHO, 2016b). If this number of diagnoses is still too large for a country's needs or capacity, then the International Shortlist for Hospital Morbidity Tabulation (ISHMT), which is a shorter list consisting of 130 diagnostic groups defined by ICD-10 codes, may be most appropriate. The International Shortlist for Hospital Morbidity Tabulation was adopted by the OECD, Eurostat, the Nordic Medico-Statistical Committee, and the WHO in 2005 (WHO, 2016c).

ICD-10 Adaptations for Morbidity

The WHO has approved several official ICD adaptations that permit more detailed classifications of cancers, external causes of death, primary care, and mental and behavioral disorders (WHO, 2016a). These adapted classifications, which provide more detail than the corresponding ICD chapters,⁸ are useful for maintaining specific disease registries. Disease registries contain detailed data on individuals with specific diagnoses and are useful in tracking patients' clinical care and outcomes. They are often established for research purposes and may not be maintained on a national level.

Standards for Health Interventions

Data on patient services provide powerful indicators of the efficiency of the healthcare system when used in association with data on diagnoses. The services recorded in the patient record or disease registry constitute the primary data that can be classified as unique and quantifiable interventions reflecting the quantity and type of healthcare consumed.

No such international classification exists yet, though the WHO has been working toward a classification of interventions and procedures since the 1970s. In 1978, the WHO produced the first International Classification of Procedures in Medicine to be used for trials. Additional international work to adapt and expand the classification was postponed, beginning in 1989, during two decades of rapid new developments in procedures. In 2012, the WHO approved the ICHI Development Project. The ICHI can be adopted by countries that do not have national intervention classification, or it can be used to map local classifications to a common intervention classification.

⁷ ICD-11 will be adopted by the World Health Assembly in 2018, but countries should proceed with implementing ICD-10 because it will likely take many years for the first countries to implement ICD-11.

⁸ ICD-10 has 21 chapters. Chapter 2 corresponds to neoplasms (cancers), Chapter 5 corresponds to mental, behavioral and neurodevelopmental disorders, and Chapters 21 and 22 correspond to external causes of morbidity and mortality.

International Classification of Health Interventions

The WHO ICHI Development Project leads the development of one of the three classifications in the WHO-FIC. The ICHI takes into account all types of health services, including acute, primary care, rehabilitation, assistance with functioning, prevention, public health, and ancillary services by all types of providers. The only area not included is traditional medicine interventions. The ICHI is designed so that additional country adaptation is not necessary, but adding more detail is possible.

The ICHI is available as an Alpha (2016) application and is expected to be adopted by the World Health Assembly WHA in 2019. Countries are encouraged to install the ICHI Alpha application on computers, especially in hospital settings, and to assess its usability through the current procedures for recording interventions.

In countries where the full classification of health interventions is not feasible, health authorities may choose to monitor selected indicators of interventions that are meaningful in the national context. A meaningful indicator for all countries, for example, is caesarean section, because very high or very low proportions of these deliveries are associated with increased maternal mortality, maternal and infant morbidity, and complications for subsequent deliveries.

Diagnosis and Procedural Classifications

Several countries with a more evolved HIS have developed country-specific modifications of the ICD-10 that includes both diagnostic and clinical procedure codes (Table 4). The WHO, which owns the ICD copyright, limits the modifications it approves, in order to prevent changes in the meaning of the categories and thereby retain a level of comparison between groups of conditions. The motivation for a country to develop its own ICD modification is to combine diagnostic information with information on health interventions—a casemix system—as the basis for a nationally tailored reimbursement system. The U.S. ICD-9-CM classification was adopted and adapted by several European countries for coding diagnoses and/or procedures: Belgium, Ireland, Italy, Netherlands, Portugal, and Spain (Hospital Data Project, 2003).

Table 4. Examples of national ICD-10 modifications

Country	Diagnoses	Procedures
Australia	ICD-10-AM	Australian Classification of Health Interventions
Canada	ICD-10-CA	Canadian Classification of Health Interventions
France	Not available	Classification Commune des Actes Médicaux
Germany	German version	Not available
Nordic countries	Nordic version	The Nordic Medico-Statistical Committee: Classification of Surgical Procedures
United Kingdom	Not available	Office of Population Censuses and Surveys (OPCS) Classification of Interventions and Procedures (OPCS-4)
United States	ICD-10-CM (previously ICD-9-CM, Volumes 1 and 2)	ICD-10-PCS (previously ICD-9-CM, Vol 3)
WHO-FIC Reference Classification	ICD	Classification of Procedures in Medicine) (never updated) ICHI forecasted to have WHA approval in 2019 (developed from the Australian Classification of Health Interventions)

These diagnostic and procedural classifications allow for a second grouping of a patients' conditions and the health services delivered to the patient, which is the basis for grouping patient episodes into a clinically relevant, resource-homogenous, casemix reimbursement system, such as the diagnosis-related group. The ICHI provides the basis for countries to develop a clinical classification for their own casemix requirements, rather than starting from scratch or having to adapt another country's system.

Best Practices

- Facilities maintain individual patient records that include the patient's main diagnosis and the primary intervention received.
- A transition to electronic medical records and disease registries is underway or planned to facilitate recording and coding of the main diagnosis and primary medical health intervention for all healthcare clients.
- The main diagnosis of each hospital patient (inpatients and admitted day patients) is tabulated according to the ICD-10 special tabulation list for morbidity or the ISHMT or can be mapped to those tabulations.
- The primary medical procedure recorded on each individual record can be uniquely classified according to a national classification of intervention procedures.
- The country has in place or is exploring possibilities for developing a casemix system based on a patient's main condition and the primary intervention received.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 2:

Health Infrastructure Information System



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Health Facilities' Infrastructure and Services

Description

The facility register, or master facility list (MFL), is a complete, up-to-date list of health facilities that uniquely identifies each facility so that all stakeholders operate and make decisions based on the same information. When the MFL is programmed into the routine health information system, it facilitates complete and timely reporting from all facilities that are required to submit data. In cases of reporting gaps or delays, it permits the health information officer to easily identify which facilities have failed to report. Without an MFL, or with a poorly maintained MFL, there is almost certainly the risk of generating health resource indicators that are biased because of incomplete data.

The Ministry of Health is typically the owner and steward of the MFL. A fully functional MFL contains validated, up-to-date information on every facility and is easily available to users in a format that they can manipulate to meet their needs. The MFL database contains a minimal set of data elements that identifies each facility uniquely (signature domain) and may include basic information on service capacity, fixed assets, and amenities (service domain) (WHO, 2013).

Data from an MFL can be used to reveal inequalities in the types of health services available to the population. The data also provide insights into the density of services, which are relevant for informing decisions on allocation of capital health investments. Depending on other data elements programmed in the MFL, it can provide information on various amenities such as the number of hospital beds or an inventory of basic equipment. The inclusion of Global Positioning System coordinates for each facility permits service availability mapping as well as linking with other data sets for more meaningful analyses.

Another important function of the MFL is to facilitate linkages between routine health information system data sources (U.S. Agency for International Development [USAID], 2017). For example, linking the MFL to the logistical management information system helps healthcare suppliers efficiently manage stocks of drugs and commodities; linking it to the human resources for health information system helps the health and education sectors plan for the number and distribution of medical professionals; and linking it to facility data on patient diagnoses permits the correlation of resource consumption with major health conditions. Finally, the MFL provides the list from which to draw a representative sample of facilities for a health facility assessment or census.

To ensure the effective use of the MFL by a variety of stakeholders, and for various purposes, it must be easily accessible to a variety of users and in a readily usable format. A hardcopy or PDF, for example, is not an ideal format for users who need to query or manipulate information in the MFL. The information contained in the MFL must also be updated on a predictable basis and include each newly designated facility and flag or exclude each facility that closes or becomes obsolete. Each update should be clearly dated.

Types of Indicators

Basic signature domain and selected service domain data elements in the MFL are sufficient to compute indicators related to the type of health facility and the availability of health services to the population (density per capita). The Ministry of Health (MOH) may also decide to maintain additional information in the MFL, such as data related to physical infrastructure, amenities, and equipment. As shown in Table 5, WHO and USAID have defined several global indicators related to health access (WHO, 2015a; WHO, 2015b; USAID & WHO, 2012).

Table 5. Health service availability indicators

Global reference list of core health indicators*	Service readiness indicators†
Total number of health facilities per 10,000 population	Number and density per 10,000 population of hospitals, health facilities, and pharmacies, by type of management
Percentage of population living within 5 km of a health facility	Number and density per 10,000 population of hospital beds, by function of healthcare (e.g., curative, psychiatric, long-term, and maternity)
Hospital bed density (per 10,000 population)	Percentage of facilities with basic amenities (e.g., electricity, improved water source, adequate sanitation, communication equipment, Internet, or emergency transportation)
Density of computed tomography units per million population, radiotherapy units per million population, and mammography units per million women ages 50–69 years	

* WHO, 2015a; WHO, 2015b

† USAID & WHO, 2012

Alternative Data Sources

Health facility assessments can provide periodic information on health service availability, including the indicators listed in Table 2. They can also provide more detailed information on health service readiness (USAID & WHO, 2012). Health facility assessments are discussed further in Module 6: Health Facility Assessments.

Standards

The United States Agency for International Development and WHO have published guidelines and a resource package to help countries establish an MFL (USAID, 2017; WHO, 2013). These guidelines outline how to develop the ideal institutional arrangements; which standard data elements to include in the signature domain and the service domain; how to populate and update the MFL; and how to manage, maintain, and disseminate the MFL.

Kenya, Nigeria, and Zambia, among other countries, have developed an MFL, and documentation about the development process is published online (Republic of Kenya Ministry of Health, 2016; Makinde, et al., 2014; Republic of Zambia Ministry of Health, 2013).

Best Practices

- Elements of effective **MFL governance** are established that include appropriate leadership, stakeholder engagement, a favorable policy environment, and institutionalization to ensure sustainability.
- The MFL is a **comprehensive list** of facilities and contains a **unique identifier** for each one.
- For each facility, the **minimal data set of elements** include information on the location, facility type, ownership, and functional status.
- Procedures are in place for regularly **updating the MFL**, including updating information on data elements and updating the list to include new facilities and omit old ones.
- The MFL is made **accessible to users** in a user-friendly format, across Ministry of Health units, ministries, institutions, and partners, with different levels of access defined according to the user context.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 3:

Human Resources for Health Information System



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Health Occupations and Distribution of Workforce

Description

A health workforce must be adequate in numbers, skills, and distribution to deliver high-quality healthcare to a population. For this reason, the health workforce is identified as one of the six health system building blocks (WHO, 2010a). A human resources information system (HRIS) provides data to track the status of the workforce in terms of the number, occupation, and geographical distribution of health workers.

The international community recognizes the global shortages of health personnel and that low- and middle-income countries have difficulties retaining health workers in the face of better employment conditions in high-income countries. The World Health Assembly adopted the WHO Global Code of Practice on the International Recruitment of Health Personnel in 2010, and many WHO member states are committed to implementing it (WHO, 2010b). The Code encourages member states to establish or strengthen routine HRIS, including information on health personnel migration.

In 2016, the WHO Secretariat presented the Global Strategy on Human Resources for Health: Workforce 2030 to the World Health Assembly for deliberation by member states (WHO, 2016). This strategy calls for the adoption of a national health workforce account (NHWA) and lays out ten modules and their corresponding indicators to guide efforts in standardizing the collection and processing of health workforce data.

Many ministries of health and other organizations, such as professional councils and educational bodies, already maintain an HRIS to record the status of health workers and graduates (WHO, World Bank, & USAID, 2009). A well-functioning HRIS constitutes a registry of health workers that tracks the “lifespan” of health professionals from the time they are licensed and employed until they leave the health workforce (Fort, Pacue-Margolis, Ng, Kauffman, & IntraHealth International, 2015). An electronic HRIS, such as the Human Resource Information Solutions (iHRIS) application, provides an efficient way to manage information on the workforce (iHRIS, n.d.).¹¹ Standardized health workforce data should ultimately be compiled from the HRIS maintained by various organizations into a common health workforce registry from which core indicators can be directly calculated at national and subnational levels.

Types of Indicators

Basic information from a well-functioning HRIS is sufficient to compute the recommended health workforce indicators that should be regularly tracked at the national level. Table 6 shows core indicators for monitoring the health workforce.

Table 6. Health workforce indicators

Global reference list of core health indicators*	Sustainable development goal target and indicator†
Number of health workers per 10,000 population—by physicians, nursing and midwifery personnel, dentistry personnel, pharmaceutical personnel, and psychiatrists	Substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in least-developed countries and small island developing states (Target 3.c)
Distribution of health workers—by occupation/specialization, region, place of work, country of origin, age, and sex	Health worker density and distribution (Indicator 3.c.1)
Annual number of graduates of health professions educational institutions per 100,000 population—by level and field of education	
Optional indicator: Rate of retention of health service providers at primary healthcare facilities in the past 12 months	
Optional indicator: Proportion of nationally trained health workers (e.g., with distribution of foreign-trained workers by country of origin)	
Ratio of entries into the health workforce to exits from the health workforce—by way of retirement, migration, or death	

* WHO, World Bank & USAID, 2009; WHO, 2010a; WHO, 2015a; WHO, 2015b

† United Nations Economic and Social Council, 2016

Countries can evaluate the functioning of their HRIS using the Human Resources for Health) Action Framework. The United State Agency for International Development and WHO supported the Global Health Workforce Alliance in developing this framework to better describe and measure dimensions of human resources for health, including leadership and the enabling environment (Fort, et al., 2015).

Alternative Data Sources

Censuses and labor force or health facility surveys can provide periodic snapshots of the health workforce, including some of the indicators listed in Table 6. Censuses are discussed further in Module 7: Population Censuses, and surveys are discussed further in Module 8: Population-Based Surveys.

Standards

Three main standard methodologies ensure the consistency and comparability of health workforce data.

1. Classification of national occupations to International Standard Classifications of Occupations-08 (ISCO-08)

The International Labour Organization (ILO) maintains standard workforce terminology and classification, which are provided in the ISCO (International Labour Organization, 2008). To ensure that national health workforce data are comparable over time, and across national and subnational areas, countries may classify their health occupations according to the ISCO-08. To simplify the mapping of national health occupations to the ISCO classification, WHO has prepared a map of approximately 40 health occupations using five major groupings: health professionals, health associate professionals, personal care workers in health services, health management and support personnel, and health service providers not elsewhere classified (WHO, n.d.). Each major occupation group is associated with an ISCO code. A database of the active health workforce that adheres to standard occupation groups will also facilitate reporting on international indicators (Settle, Lwetabe, Puckett, & Leitner, 2014).

2. Health workforce registry

As stated earlier, countries are likely to maintain multiple sources of health worker data. To compute health worker indicators, they need to compile the data from various sources into a single, national health workforce registry (HWR) (WHO, 2015c). The Open Health Information Exchange (OpenHIE) provides an electronic solution to develop and maintain an HWR and to easily compile standard information into a common database (OpenHIE, 2014). This electronic solution, the OpenHIE Health Worker Registry, complies with the WHO Minimum Data Set for HWRs as well as Integrating the Health Enterprise, Fast Healthcare Interoperability Resources, and other data exchange standards (OpenHIE, n.d.; WHO, 2015c; Integrating the Health Enterprise, n.d.; Fast Healthcare Interoperability Resources, n.d.). The box above presents the minimal set of data elements that ensure comparable data across HRIS.

Data elements in the minimal data set for a health workforce registry

1. Identification number
2. Full name
3. Birth history
4. Citizenship, country of residence, and language
5. Address
6. Contact information
7. Education, professional license, and certification
8. Employment status
9. Employment address
10. Data submission institution

Source: WHO, 2015c, p. 9

3. Other data related to the health workforce

Other health workforce data are being standardized in the scope of the NHWA, led by WHO in partnership with the OECD, the World Bank, USAID, ILO, and the United Nations Education, Cultural and Scientific Organization, among others (WHO, 2016). The NHWA is inspired by the WHO-OECD-Eurostat System of Health Accounts (OECD, Eurostat, & WHO, 2011) and builds on existing standards and tools, including the WHO Minimum Data Set (WHO, 2015), the WHO Handbook for Monitoring and Evaluation of Human Resources for Health (WHO, World Bank, & USAID, 2009), and the OECD/Eurostat/WHO-Europe Joint Questionnaire (OECD, Eurostat, & WHO, 2017). Standardization underway includes:

- Defining the scope of work relative to qualifications, experience, and education
- Defining current activity (practicing, professionally active, and licensed to practice)
- Conversion of head counts to full-time equivalents

Best Practices

- A sufficiently broad **human resources for health stakeholder group** is established and includes key collaborators who have the authority to manage and establish national systems and standards.
- An **HRIS** is in place to track the numbers, skills, and distribution of health workers.
- Health worker occupations are standardized in the country and mapped to **standard ISCO-08 codes**, facilitating comparisons and aggregation of data across organizations and across countries.
- An updated HWR is aligned with the WHO **minimum data set for health workers**.
- For an electronic iHRIS, the **data elements are standardized**, allowing them to easily be compiled in a common HRIS.
- **Data producers** generate core national and international health workforce indicators at least annually, at national and subnational levels.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 4:

Logistics Management Information System



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Essential Medicines and Health Commodities

Description

The logistics management information system (LMIS) collects and provides data on healthcare commodities that are routinely supplied to health facilities (Routine Health Information Network, n.d.). The primary purpose of the LMIS is to manage the logistics of ensuring a smooth supply chain and that the data it generates are also relevant for monitoring key indicators of health system performance, namely essential medicines.

Essential medicines, including vaccines and contraceptives, are those identified as meeting the priority healthcare needs of the population. They should be available in the healthcare system at all times, in adequate amounts, in the appropriate dosage forms, with assured quality, and at a price that individuals can afford (WHO, 2016). Access to essential medicines, measured by their availability and affordability, is one of the health system building blocks (WHO, 2010). However, data to monitor indicators related to essential medicines are poor in most low- and lower-middle-income countries (WHO, 2015b). In the absence of routine data, many countries have conducted surveys to measure prices and availability of essential medicines using samples of health facilities (WHO & Health Action International, 2008).

To improve routine measurement of medicine availability and affordability, an electronic LMIS, such as OpenLMIS or Logistimo, can be programmed to provide timely data on both stocks and prices of medicines in medicine outlets, including pharmacies and health facilities (OpenLMIS, n.d.; Logistimo, n.d.). In addition to providing complete and timely data on essential medicines, an electronic LMIS can interoperate with a patient management system, such as DHIS 2, to effectively link the availability of and demand for medicines with health service delivery (Village Reach, 2017; John Snow, Inc., 2017).

Affordability is another dimension of access to essential medicines (Niens, et al., 2012; Cameron, et al., 2011). In 2001, WHO member states endorsed a resolution to develop a standardized methodology for measuring medicine prices, which is a crucial component of affordability (WHO, 2001). Although there is not yet an agreed-on methodology for measuring prices, an electronic LMIS can provide routine information on the range of prices and median prices for medicines by recording financial data on the distributed cost and treatment price for each medicine. This fundamental evidence can help define regulations and policies to ensure affordable medicines and promote equity in pricing.

Types of Indicators

To monitor access to essential medicines, countries select tracer medicines from the national and global essential medicine list (EML), including brand-name and generic products for each medicine (WHO, 2015c). Health information officers measure availability of these medicines through indicators of stocks on hand, stockouts, and other indicators (USAID, 2008). They measure affordability through median unit prices and consumer price ratios.

Consumer price ratios are calculated as the median local unit price divided by the Management Sciences for Health (MSH) international reference price. MSH has published the International Drug Price Indicator Guide with WHO since 2000 and updates it annually (Management Sciences for Health International [MSH], 2015). The international reference prices represent median prices of selected medicines offered to developing and middle-income countries by different suppliers. These ratios show the price of local medicine relative to the international reference price and are considered good comparative information on prices.

Table 7 shows several indicators for monitoring the availability and affordability of selected medicines.

Table 7. Essential medicine availability and affordability indicators

Global reference list of core health indicators*	Sustainable development goal targets and indicators†
Percentage of health facilities with essential medicines and life-saving commodities	Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries. Provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the Trade-Related Aspects of Intellectual Property Rights Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the agreement regarding flexibilities to protect public health, and, provide access to medicines for all (Target 3.b) Proportion of the population with access to affordable medicines and vaccines on a sustainable basis (Indicator 3.b.1)
Stockout rate (e.g., median availability of 14 essential medicines in public and private health facilities and 20 medicines of national importance) ¹²	Achieve universal health coverage, including financial risk protection; access to high-quality, essential healthcare services; and access to safe, effective, high-quality, and affordable essential medicines and vaccines for all (Target 3.8) Coverage of tracer interventions (e.g., child full immunization, ART, tuberculosis treatment, hypertension treatment, skilled attendant at birth) (Indicator 3.8.1)

Global reference list of core health indicators*	Sustainable development goal targets and indicators†
Median availability of selected generic medicines (%)	
Median consumer price ratios of selected generic medicines	

* WHO, 2015a, p. 112; WHO, 2010, pp. 63–64; WHO, 2015b, p. 115

† United Nations, 2016

Alternative Data Sources

Until a country has a national LMIS that routinely collects data on medicine stocks and prices from all public and private facilities that dispense medicines, it must rely on surveys to derive that information. The WHO and Health Action International Project on Medicine Prices and Availability have developed a standard survey methodology to measure price components of 50 essential medicines in public, private, and other sectors. The survey has been conducted in more than 50 countries, and the internationally comparable results are publicly available (WHO & Health Action International, 2008).

Standards

1. The national list of essential medicines, or in its absence, the WHO global list, serves as the basis for monitoring availability and affordability. Since 1997, the WHO has produced a global EML, with updates about every two years. The most current EML is the WHO Model List of April 2015, which includes 340 medicines that treat priority conditions, including malaria, HIV/AIDS, tuberculosis, reproductive health, and chronic diseases such as cancer and diabetes (WHO, 2015c).
2. The U.S. Agency for International Development funded a series of technical guides and tools aimed at developing essential health commodity supply chains. Project publications address strengthening logistics management information systems, streamlining distribution systems, identifying financial resources for procurement and supply chain operation, and enhancing forecasting and procurement planning (USAID, 2008; USAID, 2009; USAID, 2011). USAID also funded A Guide to Improving Drug Management in Decentralized Health Systems: The Monitoring-Training-Planning Guide for Program Implementation (Nelson & Adams, 2000).

⁹ The 14 global essential medicines are from the 2010 global core list of medicines. This list should be checked for updates, and countries should select tracer medicines that are most relevant to their needs (MEASURE Evaluation, n.d.).

Best Practices

- A **national EML** is adapted to national needs and formally adopted as part of the national medicine policy; both are updated every five years.
- The logistics management unit has a **strategic plan** that covers the next one to three years.
- The national logistics management unit maintains an LMIS with data on essential medicines, including routine information on **stock status and medicine prices**.
- **All medicine outlets**, including health facilities and pharmacies, are required to report in the LMIS.
- LMIS data are used regularly to derive indicators of **availability and affordability of selected essential medicines**.
- LMIS data are **periodically reconciled** against physical inventories and validated using a standard survey methodology, such as WHO and Health Action International's health facility assessment.
- Logistics **data are linked** to health service delivery data to match demand for essential medicines with availability.
- A **logistics system assessment** is conducted regularly using a tool such as USAID's Logistics System Assessment Tool, and results are used to update the program of work and for strategic planning exercises.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 5:

Financial Management Information System



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Health Revenues and Expenditures

Description

A financial management information system (FMIS) enables governments to formulate budgets and monitor revenues and expenditures by sector (Dener & Young Min, 2013). In the health sector, it routinely provides health authorities with information on financial transactions that help manage efficiency in health service delivery (WHO & Health Metrics Network, 2008). A fully functioning FMIS is inextricably linked to countries' success in achieving the Sustainable Development Goal of universal health coverage (UHC) by 2030: coverage of quality health services and financial protection for all (United Nations [UN] Economic and Social Council, 2016; WHO & World Bank, 2015).

Many developing and transitional countries are putting in place an integrated FMIS so their governments can strengthen financial controls and raise levels of financial governance, transparency, and accountability (USAID, 2008). An integrated FMIS computerizes budgets and standardizes accounting operations so that central governments and different public sectors, including the ministry of health, can contribute to and access financial information using a common platform. Starting with allocations of budget funds, the sectors post financial transactions using the appropriate, tailored account in the standard chart of accounts to the general ledger.

The general ledger is the source for deriving financial indicators and reports. A more complex FMIS may address additional functions such as debt, resource management, human resources, payroll, and auditing processes across central government, and it may include local government and other public sector and quasi-governmental agencies (USAID, 2008).

The World Bank, International Monetary Fund, and USAID have supported many low- and middle-income countries (LMICs) in the development of an integrated FMIS, usually under the Ministry of Finance (USAID, 2008; Diamond & Khemani, 2005; Dener & Young Min, 2013). Establishing an integrated FMIS is a long-term and costly process and few are sustained—not because of a lack of technological solutions, but rather because of factors related to adequate leadership, coordination, and long-term commitment to sustain the system (USAID, 2008).

At a minimum, to inform management decisions in the health sector, the FMIS should produce reports that include the following:

- Income or revenue data with costs allocated by cost centers (such as products or outputs, service units, and sets of services)
- Comparison of expenditures by budget line items (e.g., salaries, materials, health resources) with budgets (MEASURE Evaluation, n.d.)

Universal Health Coverage and Health Financing Reforms

Universal healthcare is organized around providing all members of society a basic package of promotive, preventive, curative, rehabilitative, and palliative services, while ensuring that the use of these services does not result in financial hardship (WHO, 2017). UN member states have agreed to work toward UHC by 2030.

The FMIS should be designed to accommodate health financing reforms that are linked to the UHC goal. The WHO has issued recommendations and resolutions on UHC that urge countries to avoid significant direct payments at the point of service delivery and to develop health financing systems that pool prepaid financial contributions and equitably distribute them across the population (WHO, 2010a; World Health Assembly, 2005; World Health Assembly, 2011).¹⁰ The UN General Assembly further encourages countries to track the flow of health expenditures through the application of standard accounting frameworks in a move toward providing universal coverage (UN General Assembly, 2012).¹¹ Such reforms should minimize out-of-pocket expenditures that risk preventing groups of people from receiving needed services or putting them in financial hardship (Mathauer & Carrin, 2010).

¹⁰ World Health Assembly resolution 58.33 in 2005, World Health Assembly resolution 64.9 in 2011

¹¹ UN General Assembly resolution 67/81 in 2012

Health financing mechanisms maintain three core functions: (1) raise healthcare revenues, (2) pool healthcare resources, and (3) purchase healthcare. Countries raise revenues from a variety of sources, including general tax revenues, social health insurance, private health insurance, community-based health insurance, out-of-pocket spending, and external aid (World Bank, 2011). Countries also pool prepaid financial resources, such as taxes, insurance contributions, and external funds, in various ways to spread risk across the population.

For the third core function—purchasing healthcare—governments and ministries of health make choices that are likely to involve one or more of four main payment mechanisms to providers (Table 8).

Table 8. Provider payment mechanisms

Mechanism	Description	Payment unit
Global or line-item budgets	Prospective, fixed payments based on historical patterns and number and type of employees	All services combined, to all patients or consumers, for a defined period
Capitation	Retrospective payments adjusted for location and patients' income levels	All services combined, per "average" patient or consumer, over time
Case reimbursement	Retrospective or prospective payments based on predefined diagnostic-related groups	Per patient or consumer, per admission
Fee-for-service	Retrospective payment for each health service provided	Each health service or resource consumed

Source: Adapted from Waters & Hussey, 2004, pp. 3–4

Regardless of the mix of mechanisms that countries use to pay for healthcare, purchasers require information from providers to accurately predict expected costs by cost centers and service units. In LMICs, the principal constraint on estimating costs is that adequate data are not available on administrative inputs, types and volume of services, and patient conditions (Ferranti, 1985). Limited by information gaps, LMICs commonly use line-item and global budgets to reimburse hospitals and district health offices (Waters & Hussey, 2004). This payment system is the simplest for governments to administer because payments are based on historical levels of financing rather than on costs related to specific healthcare consumption.

For LMICs to move to more efficient reimbursement systems, such as capitation or case reimbursement, they need to implement standard coding and classifications and address problems related to data availability and information technology (Mathauer & Wittenbecher, 2013). Resolving these challenges will help purchasers to set fair prices for reimbursing providers for health services (Waters & Hussey, 2004).

The healthcare purchaser can take two main approaches for establishing prices. One is a top-down approach in which total expenditures are disaggregated by patient visits or patient hospital days per cost center (e.g., inpatient wards, outpatient services, laboratory services, ancillary services). The other approach is a bottom-up approach in which utilization costs of each intervention, commodity, or administrative input consumed by the patient are aggregated. Either approach requires allocating costs to cost centers in the FMIS.

A bottom-up approach using patient-level data could be used to establish the average cost of a casemix group. Thereafter, a top-down approach could be used to prospectively or retrospectively reimburse providers according to a casemix system, such as through diagnostic-related groups. Each casemix group includes activities that cut across the organizational structure of a healthcare provider, such as those related to patient evaluation, admission, and treatment; the preparation, use, and maintenance of medical equipment and facilities; medical procedures and supplies; and hospitalization. Several LMICs have developed simple casemix payment systems for different procedures that could be expanded into diagnostic-related group-based payment systems (Waters & Hussey, 2004; Mathauer & Wittenbecher, 2013).

Types of Indicators

The FMIS provides public financing information needed to derive several of the internationally agreed-on health expenditure indicators defined in the internationally recognized framework, the System of Health Accounts (SHA) (OECD, Eurostat, & WHO, 2011) (Table 9). Some countries prefer to produce these indicators directly from the System of National Accounts (SNA), but they are not strictly comparable with the SHA indicators, owing to differences in the scope of healthcare goods and services included, the transactions selected, and estimation methods used (WHO, 2010b; OECD, Eurostat, & WHO, 2011; European Commission, International Monetary Fund, OECD, UN, & World Bank, 2008). Detailed descriptions of most of the SHA indicators can be found in the WHO *Indicator Code Book National Health Accounts* (WHO, 2015).

Table 9. Internationally agreed-on health expenditure indicators using FMIS data

WHO indicators*
Total health spending per capita
Total health spending as a percentage of gross domestic product
General government health spending as a percentage of total government spending
General government health spending as a percentage of gross domestic product
External resources for health as a percentage of total expenditure on health
Per capita government expenditure on health
Social security expenditure on health as a percentage of general government expenditure on health

* WHO, 2015; WHO, 2014; WHO 2010a; WHO 2010b

Alternative Data Sources

Other sources of data can be found in Health Accounts and SNA results and ad hoc studies in government health financing.

Standards

It is difficult to identify standards for FMIS because each system evolves in different ways, over long periods of time. This section describes several standards we have identified that are relevant for countries developing an FMIS with a health account.

Accounting Standards

Chart of Accounts (COA)—The COA is the foundation for any accounting system, including the FMIS. It is a list of all accounts tracked by the system, including the health account. Each account in the chart is assigned a unique identifier, or an account number, involving a series of information tags that denote certain things about the data being entered into the system. For example, these tags may denote the cost center, the department or unit responsible for the transaction, the program or purpose for which the transaction is being made, or the nature of the transaction. The account number attaches to the data and serves accounting, management, and all other reporting purposes. It also forms part of the data validation process, providing information on details such as whether a vendor exists, whether there is an authorized budget, and whether funds have been committed. Without an appropriately designed COA, created with consensus of key stakeholders, information cannot be stored or accessed properly (USAID, 2008).

International Financial Reporting Standards (IFRS). IFRS is the global standard accounting framework. It replaced the International Accounting Standards in 2001. Most countries around the world require domestic public companies to use IFRS, and they are also recommended for implementing an integrated FMIS (International Financial Reporting Standards [IFRS] Foundation, 2017; USAID, 2008).

Open Data Standards

A common data structure facilitates information sharing, further use of data, and comparability over time. The FMIS should follow the principle of open data standards, which include the following:

- Public finance information covers all public-sector revenues, expenditures, assets, and liabilities.
- Budget data include primarily general government revenues and expenditures.
- FMIS platforms are subject to regular information technology audits to ensure the reliability and integrity of systems, the security of operations, and the effectiveness of information technology governance and oversight functions.
- Open data are accessible to the public (online) in editable (machine-readable) and reusable format, without any restriction (free and legally open) (Dener & Young Min, 2013).

System of Health Accounts

The SHA draws on FMIS public expenditure data to produce information on three dimensions of healthcare: functions of care, providers of services, and sources of funding (OECD, Eurostat, & WHO, 2011). Countries that are not using the SHA methodology can use the SNA framework or another national health account framework to produce health financing indicators (European Commission, International Monetary Fund, OECD, UN, & World Bank, 2008). Health expenditures accounted for in the SNA framework can be mapped to SHA to obtain comparable levels and structures of healthcare spending.

Best Practices

Drawing from observations from a World Bank study, as well as other resources, the following best practices are identified for developing an FMIS (Dener & Young Min, 2013):

- The FMIS complies with **open data standards** and publishes timely and regular reports on budget implementation.
- Responsible staff are trained in **accounting principles and reporting requirements**, which are clearly stated in a reference document.
- **Expenditures are tracked** by budget line items and are recorded as they occur.
- **Expenditures are also linked** to defined cost centers and units of service.
- Financial reports regularly compare **actual expenditures to the budget**.
- Financial reports are consistently used for **management decisions**, including allocation of resources.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 6:

Health Facility Assessments



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Health Resources Inventories

Description

A health facility assessment (HFA) provides periodic information on the status of service delivery across a country's network of health facilities. The information collected reflects both inputs made to the health system—in terms of infrastructure, personnel, medicines, and equipment—and outputs of the health system to the population in terms of availability of different types of services and quality of services provided (MEASURE Evaluation & USAID, 2008).

Although much of the information collected through service-related inventories can be collected efficiently through a well-functioning RHIS, the advantages of collecting information through an HFA are to (1) enhance the scope of information on health system inputs and outputs (beyond data that are routinely collected), (2) periodically validate comparable data in the RHIS, and (3) provide subjective information on staff and patient satisfaction and on patient consultation processes.

HFA data are collected through a facility census or survey in which trained enumerators visit facilities and conduct activities, including various inventories, interviews with staff and patients, and observation of service delivery. Table 10 summarizes the difference between a health facility survey (enumeration of a sample of facilities) and health facility census (enumeration of all facilities).

Table 10. Summary of differences between health facility census and health facility survey

	Description	Strengths	Limitations
Health facility census	Periodic census of all public and private healthcare facilities within a country.	Provides information useful to planners at all levels, such as basic characteristics (ownership, facility type, coordinates), availability and functionality of basic infrastructure, staffing, service provision, and general status	Time consuming and can be costly; Requires a complete and updated master facility list to identify all healthcare facilities; Access to all facilities may be problematic.
Health facility survey	Periodic survey of a representative sample of public and private healthcare facilities within a country	May collect more detailed information than a facility census, including verification of service statistics, assessment of quality of care from staff and patient interviews, and observations on service provision	Time consuming and costly; Information likely to be representative only at the national level. Requires a complete and updated master facility list for the sampling frame. Access to selected facilities may be problematic.

Source: Adapted from the World Health Organization (WHO) (2008, p. 6)

Types of Indicators

Indicators derived from HFAs measure aspects of the health system, including the following:

- Health service infrastructure, amenities, and equipment
- Availability of health workers, standard precautions, and essential medicines
- Availability of and readiness to deliver various types of health services and diagnostic capacity
- Satisfaction of clients and service providers with the service delivery environment
- Accuracy with which service inputs and outputs are being recorded and reported (RHIS data quality)

Alternative Data Sources

Health resource inventories can be programmed through the RHIS for routine collection or through the separate data subsystem, which includes the human resources information system, the logistical management information system, and the MFL. Special surveys of patients and providers can be conducted to assess satisfaction with services, and data quality can be assessed through record reviews and supervisory visits.

Standards

Facility Census

A facility census is designed to enumerate all public and private facilities in the country. Inventory data from the facility census should correspond with each facility listed in the MFL, so it provides reliable measures of health service availability, as well as baseline information, with which future progress can be compared. The WHO recommends updating the facility census database every five years using the updated MFL as a reference list. In the interim, more in-depth surveys can also be conducted.

The WHO Service Availability and Readiness Assessment (SARA) methodology and instruments are designed to collect basic data on service availability and readiness (WHO, 2015a; WHO, 2015b). A facility census conducted with SARA instruments measures the availability and readiness of specific service areas, including family planning, neonatal and child health, HIV and prevention of mother-to-child transmission, tuberculosis and malaria, basic and comprehensive emergency obstetric care, and noncommunicable diseases. In practice, however, a full SARA census is not often conducted because it is time consuming and costly.

SARA instruments also collect data on health workforce staff, adherence to standard precautions, and the availability of essential medicines and basic supplies and equipment. Key tracer indicators from each of these domains indicate basic elements of service quality and are used to compute composite indicators developed by WHO and USAID for service readiness (WHO, 2015a).

Facility Survey

A facility survey is conducted on a nationally representative sample of facilities using the MFL as a facility sampling frame. The Service Provision Assessment (SPA) is a comprehensive facility survey methodology designed to collect basic data on service availability and readiness as well as a wider range of quality measures (Demographic and Health Surveys [DHS] Program, n.d.a).

The SPA contains several questionnaire instruments. The inventory questionnaire is harmonized with WHO and USAID service readiness indicators (USAID & WHO, 2012). Other SPA instruments include (1) the SPA

observation questionnaire to determine the extent to which patient consultations follow generally accepted standards of care for antenatal care, integrated management of child illnesses, and family planning; (2) the SPA exit interview questionnaire to provide information on the client's perception of the service delivery environment; and (3) the SPA health provider questionnaire to measure professional qualifications of staff and attitudes about the work environment.

Model SARA and SPA country reports can be found on the WHO Health Statistics and Information website (WHO, 2016) and the USAID-funded DHS Program website (DHS Program, n.d.b).

Best Practices

- **Maintain an MFL** with unique identifiers and basic service provision information for each public and private facility, including hospitals, health centers, laboratories, and pharmacies. The updated MFL serves as the reference list for a facility census and serves as a facility sampling frame for a facility survey.
- **Conduct a facility assessment every five years** using standard SARA or SPA instruments to validate or augment information captured through the RHIS.
- **Conduct an in-depth facility survey periodically** using SPA instruments to collect a wider range of quality measures for health services.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 7:

Population Censuses



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Population Exposed to Health Risks and Interventions

Description

A population census, often combined with a housing census, is usually conducted by the national statistics office every 10 years. It consists of an individual enumeration of the entire population, with the objective of providing an accurate count of the population at a fixed point in time. It is the most logistically complicated and expensive data collection operation that a country can undertake (UN, 2014a). Several countries in Europe conduct an “administrative census,” in which they obtain a count of the population from a complete population registry instead of, or sometimes in addition to, a traditional enumeration (Valente, 2010).

The results from the enumeration constitute a base population, comprising counts of persons for each precisely delineated administrative unit, or enumeration area, without omissions or overlaps of land or population. The base population usually refers to the “usual resident population count” that includes all usual residents at the time of the enumeration, as well as their age, sex, occupation, and basic living standards. The list of enumeration areas, with their corresponding population count, serves as the baseline for intercensal estimates and projections and also a sampling frame for selecting survey samples.

The UN recommends that a population census include 31 core topics, and the two topics of greatest interest for computing health indicators are “demographic and social characteristics” and “fertility and mortality” (UN, 2014a).

Population Estimates and Projections

Intercensal estimates are annual estimates of the mean population by age and sex for the years between censuses. They provide important denominator information to calculate time series for many health-related and other indicators. Demographers calculate intercensal estimates using a standard demographic method called the cohort component method. This method takes into account natural population change and net migration. The cohort component method starts with the base population and every year thereafter takes the resident population at mid-year of the previous year and advances the population by one year of age. That is, births during the year prior to July 1 are added to the population, deaths during the same period are removed, and the number of net migrants is accounted for.

The intercensal estimates from the cohort component method are only as accurate as the base population count and the input information on births, deaths, and migrants. Direct demographic estimates require information on the number of births and deaths by age and sex from the CRVS system after any adjustments for under coverage have been made. These numbers are supplemented by the number of net migrants, which, at the subnational level, is often the most important and most difficult population component to measure (Jarabi, n.d.). If the numbers of demographic events are not readily available, indirect techniques can be used to estimate fertility, mortality, and migration inputs.

Population projections are similar to intercensal estimates but are used to inform future planning and resource allocation and for target setting. They are also calculated using the cohort component method, but, unlike estimates, projections are calculated using assumptions about future trends of fertility, mortality, and migration rather than the actual levels.

A number of valuable resources are available to analyze and use census data. MEASURE Evaluation’s online course, Cohort Component Population Projection Method, presents a straightforward approach to this method, requiring minimal demographic information (MEASURE Evaluation, n.d.). The International Union for the Scientific Study of Population provides Internet-based tools with step-by-step instructions for a variety of demographic estimation techniques, all downloadable from its website (International Union on the Scientific

Study of Population, 2013). The International Programs Center of the U.S. Census Bureau provides a suite of pre-programmed Microsoft Excel sheets for basic demographic analysis of census data, including data on age structure, mortality, fertility, migration, geographic distribution of the population, urbanization, and population projections (U.S. Census Bureau, 2013a; U.S. Census Bureau, 2013b). In addition, a number of older resources from the United Nations are still relevant, especially for guidance on indirect computations of demographic indicators from census data (UN, 1955, pp. 184–199; UN, 1983; UN, 2004).

Small Area Population Estimates

For official purposes, population-based health statistics should be produced for national and subnational administrative divisions as long as population estimates can provide accurate denominator data to calculate them. However, national statistics offices usually do not provide official estimates and projections for areas below the national or provincial level because precise data on births, deaths, and migration are not usually available for small administrative areas (Rayer, 2015).¹² In addition, health catchment areas are often different from official administrative boundaries, so it may be meaningful for the health sector to produce indicators for planning and operational purposes using local estimates of the catchment population. Both official statistics and operational statistics are valid to serve their respective purposes.

Types of Indicators

The most basic indicators derived from a census are the counts, in absolute numbers, of usual residents. Decision makers need this information for planning future service delivery and resource allocation, especially because aging populations are causing priorities to shift in the health system.

In addition to population counts, census data are a fundamental source of health information in two ways. First, they provide denominator data for a number of indicators presented in other HIS data source modules. Second, the intercensal estimates are used to calculate key fertility and mortality indicators. For example, indicators related to the basic tabulations from core census topics are as follows:

- Total population by age, sex, locality, and other background characteristics
- Median age of population
- Crude birth rate
- Total fertility rate (children ever born)
- Sex ratio at birth
- Crude death rate
- Childhood mortality
- Age- and sex-specific death rates
- Life expectancy at any age

Alternative Data Sources

Population-based surveys can provide periodic indicators on mortality and fertility.

¹² See Swanson (2008) for information on regression-based techniques that can be used to estimate small area populations, such as the Ratio-Correlation Method.

Standards

Data collection and processing. The UN Statistics Division developed and maintains a compendium of standards on conducting a census (UN, 2014a). It includes recommendations for planning and operationalizing the population and household enumerations, and it presents important concepts and definitions that should be applied consistently in a country's integrated program for data collection and analysis. It also provides a detailed set of tabulations that maximize information collected on core census topics.

Data confidentiality. Although the census enumeration is mandated by a national law and obliges every resident to respond, Principle 6 of the UN Fundamental Principles of Official Statistics resolves that personal data collected are to be kept strictly confidential and used for statistical purposes only (UN, 2014b).

Age standardization. Fertility, mortality, and other health-related indicators require age-specific population estimates in their denominators. However, because population age structures differ across areas and change over time, they need to be normalized to reliably monitor progress or compare levels nationally or internationally. Indicators can be made directly comparable by applying standard population weights using a standard (or reference) population. Any standard population can be used, such as the international WHO standard population (Ahmad, et al., 2001) or other regional reference population. Naing (2000) provides useful instructions on how and why to apply age-standardization methods.

Best Practices

- Census legislation has provisions for ensuring **data security and confidentiality**, in accordance with the UN Fundamental Principles of Official Statistics.
- The census is designed using UN-recommended **population census topics** and the published results include UN-recommended **tabulations**.
- Updated **population estimates and projections** are calculated at a minimum for the national level and the first official subdivision level. Health information officers make estimates available to health managers at every level.
- Indicator metadata for mortality and fertility indicators stipulate the **use of official population estimates** in the denominators.
- **Social and demographic indicators from the census are compared** to comparable measures from household surveys to help ascertain data quality of both sources.
- **Numbers of births and deaths are compared** to comparable numbers from the CRVS system, at the national and subnational levels, to help determine completeness of the CRVS.
- To control for different population age structures, **a standardized population is applied** when comparing fertility, mortality, or other health indicators over time, or when comparing levels across subnational areas or internationally.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 8:

Population- Based Surveys



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Risk Factors, Service Coverage, and Knowledge, Attitude, and Practices

Description

National population surveys produce nationally representative and internationally comparable estimates of demographic, health, and social indicators. The data collection methodology consists of trained enumerators administering interviews using standardized questionnaire instruments to eligible individuals selected in a scientifically designed sample. Interviewers may record responses using paper-and-pencil interviewing (PAPI) or capture them electronically through computer-assisted personal interviewing (CAPI).

Measures derived from these survey data consist of point estimates for indicators expressed as rates, ratios, and probabilities. Each survey estimate has defined confidence bounds that represent the known margin of uncertainty and should be considered when interpreting the significance of key indicators.¹³ Confidence bounds take into account sampling error, which is a statistical error associated with any probabilistic sample. Non-sampling errors, on the other hand, are a result of human errors committed while conducting the survey, such as failure to elicit or record correct responses, or mistakes in data entry. The latter type of error cannot be reliably quantified, and great care should be taken to minimize errors through conscientious design, training, and implementation.

Survey Implementers

The national statistics office (NSO) is usually the agency responsible for conducting a national survey, because it is most likely to have the logistical capacity needed for large-scale data collection operations, including sampling expertise, access to the sample frame, and experience with data entry and database management. The NSO also usually has a roster of available short-term agents to employ for enumeration and data entry. Finally, because the NSO is the producer of official statistics, the results automatically comprise part of the evidence base owned by the government. This is in contrast to an outside entity, independent of the government, whose results may not be readily accepted.

However, the NSO does not have the specialized knowledge of specific areas of health to develop the questionnaire content. Therefore, it is important that specialists from the Ministry of Health and other sectors are involved in the early design stages and in the analysis and interpretation phases.

Advantages

- **Internationally comparable time-series information.** Survey data can provide health, nutrition, and demographic information on populations, even when national administrative structures are weak, for example, in the absence of a functioning routine health information system or civil registration and vital statistics system.
- **Health inequalities.** Survey data can provide indicators disaggregated by background characteristics that reveal inequalities between geographic areas, socioeconomic groups, and other subpopulations.
- **Determinants of health.** Survey data can link respondents' characteristics to their health outcomes, offering the potential to estimate independent effects of various determinants on health, ill-health, and mortality outcomes.
- **Unique source of population-based information.** Surveys are the most appropriate, if not the only, data source for monitoring health trends in the population, including nonmedical determinants of health, such as exposure to chronic disease risk factors, knowledge about disease transmission and treatment, self-reported health and prevalence of symptoms, and coverage of services.

¹³ Smaller-scale surveys are sometimes conducted using simpler sampling approaches, such as the lot quality assurance sampling approach. Although this is a cost-effective way to establish whether a certain indicator falls above or below a preestablished level, it is not designed to measure trends over time, because population parameters cannot be calculated with statistical precision.

- **Validation of independent data collection mechanisms.** Survey data can produce fertility and mortality measures independent of those generated by the routine vital statistics system. They can therefore validate the completeness of other national data collection systems by comparing levels of comparable measures.

Disadvantages

Measures generated from national household surveys cannot replace reliable administrative systems for routine data collection for the following reasons:

- **Only a periodic data source.** Surveys provide data usually only about once every five years. The ideal timing of the implementation of a survey may be compromised by weather factors affecting field conditions, availability of financial and human resources, or an election period.
- **Labor and cost intensive.** Surveys are an expensive and labor-intensive operation, and they often rely on external assistance at various phases of implementation, notably for sample and questionnaire design, data processing, and analysis of final data.
- **Imprecision caused by sampling error.** Even the best-designed and best-resourced surveys are subject to sampling error, with imprecision increasing at smaller subnational levels.

Types of Indicators

Survey data are a unique source of nationally representative information about the population's social and behavioral determinants, health knowledge and healthcare-seeking behavior, and coverage of health services. Core indicator categories include the following:

- Household characteristics, including water and sanitation
- Household members' characteristics, including education level
- Fertility, fertility preferences, and proximate determinants of fertility
- Contraceptive method knowledge and use
- Early childhood mortality
- Maternal and child health and nutrition
- Early childhood development and child disability
- Child protection
- Malaria and HIV/AIDS

Survey modules can also derive information related to domestic violence, health expenditures, maternal mortality, noncommunicable disease risk factors, disabilities, and newborn care.

National household surveys are also a vehicle to collect biomarkers of nutritional status and prevalence of conditions such as anemia, HIV, malaria parasites, and other conditions (MEASURE Evaluation, 2000).

Alternative Data Sources

The civil registration and vital statistics system should be the primary source of data for the fertility and mortality indicators; the census provides household and household member characteristics every 10 years.

Standards

National household surveys have their roots largely in the World Fertility Survey (WFS) program, established by the International Statistical Institute in 1973 with funding from USAID and the United Nations Population Fund to complete 42 surveys (Grebenik, 1981). In 1984, the WFS evolved into the USAID-funded DHS Program, which has supported more than 300 surveys conducted in about 90 countries (DHS, n.d.). The DHS Program updates the methodology and instruments continuously according to developments in national and international priorities, new technologies, and ways to obtain the most efficient, high-quality results. Since the mid-1990s, the United Nations Children's Fund (UNICEF) Multiple Indicator Cluster Survey (MICS) is another large-scale household survey program that has supported about 300 surveys conducted in more than 100 countries, focusing on the situation of women and children (United Nations Children's Fund [UNICEF], 2014). The DHS and MICS methodologies and the indicators that are common to both surveys are largely harmonized. In the 2000s, other large-scale surveys using similar methodologies have been the WHO World Health Survey, implemented in 70 countries between 2002 and 2004 (WHO, 2017a); the WHO STEPwise approach to noncommunicable disease risk factor surveillance survey for monitoring noncommunicable disease risk factors, implemented in 102 countries since 2004 (WHO, 2017b); and Eurostat's European Health Interview Survey that member states of the European Union conduct regularly (Eurostat, 2015).¹⁴

These large-scale surveys apply standard approaches in each phase of survey implementation to obtain reliable data, described as follows:

Sample design. A probability sample of households provides valid data, and a two-stage cluster procedure is a typical, cost-efficient approach. In the first stage, primary sample units (PSUs) are selected from an official sampling frame, commonly a census frame, containing a complete and up-to-date list of enumeration areas for the entire target population. Primary sample units are selected randomly using a probability proportional to size method. For each selected PSU, a household listing field operation should be conducted before the survey to update the dwellings and households within the boundaries. In the second stage, a predetermined number of households—usually 20–30—is selected systematically (with a random start) from the final lists of households in each PSU, or cluster (ICF International, 2012; UNICEF, n.d.a).

The sample design provides for sample weights, which are inflation factors that permit the results to be extrapolated to the target population. Sample weights also include a design weight that corrects for nonresponse to reduce response bias. Sample weights are calculated separately for household and individual records.

Questionnaire design. The major survey programs such as the ones mentioned above have largely harmonized questionnaire instruments, including the wording of questions, composition of question sets, and questionnaire modules. The International Household Survey Network developed and maintains a question bank to disseminate standard questions and questionnaire modules (International Household Survey Network, n.d.). Indicator definitions and computations are also increasingly aligned among the various survey programs. The standard instruments, usually consisting of a household questionnaire and individual questionnaires, are available online and can be adapted for use in each country (for example, ICF International, n.d.; UNICEF, n.d.b; WHO, n.d.; Eurostat, 2010).

Data processing and analysis. Principles of data processing that are currently widely applied are deeply rooted in WFS, DHS, and MICS practices. These major survey programs, as well as censuses and many other surveys, use the Census and Survey Processing System (CSPro) software to process survey data, including data entry, automated consistency checks, editing and imputation, tabulation, and computing sample errors. CSPro has evolved with survey and census data collection and is designed to handle a multitude of complex applications with hierarchical data entry. CSPro applications for processing PAPI or CAPI data are available to download for free from the U.S. Census Bureau International Programs website (United States Census Bureau, 2017).

¹⁴ EHIS wave 1 was implemented in 17 countries between 2006 and 2009. Wave 2 is under way in 2014. Retrieved from http://ec.europa.eu/eurostat/statistics-explained/index.php/European_health_interview_survey_-_methodology

PAPI data entry should be verified by two different data clerks who enter data independently from all questionnaire instruments (double data entry). The results of both entries are then compared, and any discrepancies are manually resolved.

Final datasets should be recoded into standard recode files for dissemination to outside users. Standard recode files started with the WFS and have been continued by the DHS in order to facilitate cross-country comparisons (ICF, 2013). For example, recode data have allowed multiple DHS datasets to be analyzed efficiently using common variable names, definitions, and comparable response categories.

Standard routines for editing incomplete and inconsistent data, including flagging imputations where necessary, are documented by DHS (Croft, n.d.). Standard calculations of national and global indicators are also published by DHS (Rutstein & Rojas, 2006; Rutstein & Johnson, 2004).

Best Practices

- A **probabilistic sample** is designed based on an updated sampling frame, with a sample size large enough to ensure adequate precision of key indicators for defined populations.
- Questionnaire instruments are designed based on **standard question sets** to ensure that indicators can be properly computed and are comparable across other data sets.
- In order for field staff to adequately assimilate information, to carry out field practices effectively and design questionnaire instruments correctly (for example, skip patterns and translations), they must receive adequate trainings: include a thorough **pretest training** for senior survey staff and then a **main training** for all field staff.
- As part of data quality assurance during data collection, regular **field check tables** are produced for central office staff to monitor progress and minimize non-sampling errors.
- Software used for **processing survey data** handles complex applications (such as skip patterns), hierarchical files (for example, linking individuals to households), and PAPI or CAPI routines, and it includes automatic consistency checks.
- Final survey data sets disseminate clean and consistent data in **standard recode files**, with any imputed data clearly flagged and described in accompanying documentation.
- **Sample weights** take into account nonresponse rates and are applied separately to household and individual records.
- For users to properly interpret survey results and microdata, **survey metadata** are available that describe the design, implementation, data processing, and analysis.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 9:



Civil Registration and Vital Statistics System

9A: Registration of Events



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Births, Deaths, and Causes of Death

Description

The civil registration and vital statistics system has two functions, one legal and the other statistical. Two or more national agencies share the responsibility for these functions. To carry out the legal function, the civil registration system operates under a national civil registration authority. The civil registration system is the continuous, permanent, compulsory, and universal recording of vital events pertaining to the population, as provided through decree or regulation, in accordance with the legal requirements of a country (UN, 2014a). The civil registrar records and archives minimally recommended information surrounding individual vital events: births, deaths, causes of death, marriages, and divorces (UN, 2014a). The registrar can then issue a legal certificate to an individual to use for legal, administrative, and other purposes.

The second function of the CRVS system is to compile and process vital statistics, namely from records archived in the civil register. In a well-functioning civil registration system, these records constitute the timeliest and most accurate source of vital statistics in a country. The civil registration authority can process these data or coordinate with another agency, such as the ministry of health, national statistics office (NSO), or a national registration agency to process the data.

Most countries have a legal framework in place for a national civil registration system. In most low- and middle-income countries, however, the coverage of birth and death registration remains under 50 percent, and vital statistics are not routinely tabulated (United Nations Statistical Division, 2017). Regardless of registration coverage levels, modernizing a CRVS system to facilitate regular processing of vital statistics has great value for countries (UN, 2014a; Inter-American Development Bank & United Nations Children's Fund, 2015; Africa Programme for Accelerated Improvement of Civil Registration and Vital Statistics, n.d.). The timely production and dissemination of standard tabulations of vital statistics can call attention to the need for strengthening this data source and improve the capacity to use and interpret the data.

National governments in most regions of the world have renewed commitments to strengthen CRVS systems.¹⁵ Since 2014, about 20 regional and international partners have come together as members of the Global Civil Registration and Vital Statistics Group to coordinate global activities to support countries in their commitments (UN, 2014b).

Registration Coverage

To mark progress toward higher birth and death registration coverage and to mobilize the resources needed to achieve higher coverage, the international community has agreed to work toward the goal, “Universal civil registration of births, deaths, and other vital events, including reporting cause of death, and access to legal proof of registration for all individuals by 2030” (WHO, 2014. Table 11 shows the targets that relate to that goal.

¹⁵ Examples of commitments to strengthen CRVS systems include the following: the United Nations Economic and Social Commission for Asia and the Pacific “Make Every Life Count” Global Summit on Civil Registration and Vital Statistics (Thailand, 2014); the United Nations Economic Commission for Africa first, second, and third Conferences of African Ministers Responsible for Civil Registration (Ethiopia, 2010; South Africa, 2012; Cote d'Ivoire, 2015); the WHO Regional Office for the Eastern Mediterranean Regional Strategy for the Improvement of Civil Registration and Vital Statistics Systems 2014–2019; and the Pan American Health Organization Regional Plan of Action for Strengthening Vital and Health Statistics.

Table 11. Targets for the global CRVS scaling up plan

Targets	2020	2025	2030
Births in given year are registered	80%	90%	100%
Children whose births are registered have been issued certificates	70%	85%	90%
Deaths in given year reported, registered, and certified with key characteristics	60%	70%	80%
Maternal and newborn deaths reported, registered, and investigated	80%	90%	100%
Deaths in children under 5 reported, disaggregated by age and sex	60%	70%	80%
Cause of deaths in hospitals reliably determined and officially certified	80%	90%	100%
Countries have community assessments of probable cause of death determined by verbal autopsies using international standards	50%	65%	80%

Source: World Bank & WHO (2014)

In addition, in 2016, UN member states defined SDG Target 16.9 (on providing legal identification to individuals) and Target 17.19 (on building statistical capacity) that include measures of birth and death registration coverage by 2030 (UN Economic and Social Council, 2016).

To reach these targets in their own context, some countries require substantial infrastructure investments to expand civil registration services. Other countries that have sufficient civil registration service points and few remote populations, may be able to increase coverage quickly by strengthening oversight and accountability of local service centers.

For countries that currently have low registration coverage, a number of techniques can be used to estimate completeness of coverage (UN, 2014a). A simple approach is to assess the total number of births or deaths registered within a defined period and area as a percentage of the expected number of events (WHO, 2010b; WHO, 2013a). For comparisons of coverage over time using this approach, it is important that the expected numbers of events, which constitute the denominator, are used consistently from the same source, because expected numbers vary between sources. Ideally, the expected numbers used should be official numbers produced by the NSO. Otherwise, expected numbers from an international source, such as the UN Population Division or the U.S. Census Bureau International Data Base, can be used (UN Population Division, 2015; U.S. Census Bureau, 2015). One disadvantage of using an international source is that the numbers represent only the expected number at the national level, and the NSO may produce the numbers at the subnational level, allowing insight into patterns of inequalities in registration coverage.

For countries in which registration coverage is approaching completeness, a more precise method is needed, namely a direct method to match records from an independent source to the civil registration records. These methods are presented in UN documents (UN, 2014a) as well as in older, but still relevant, sources, such as those produced by the International Institute for Vital Registration and Statistics (IIVRS) (1990).

Causes of Death

Complete and comparable information on causes of death is an important part of a fully functioning CRVS system. Guidance on these data is addressed in a separate CRVS section following this one: Civil Registration and Vital Statistics System: Causes of Death.

Sustainable Development Goals related to registration coverage

SDG 16, Indicator 16.9.1: Proportion of children under 5 years of age whose births have been registered with a civil authority, by age

SDG 17, Indicator 17.19.2: Proportion of countries that have achieved 100 percent birth registration and 80 percent death registration

Types of Indicators

Civil Registration and Vital Statistics data are used to derive a range of fertility and mortality rates and ratios. If birth and death registration coverage is largely complete, then direct approaches to deriving this information can be used. These indicators can be produced at subnational levels, to the extent that intercensal estimates exist for denominators. Useful guidance on the required data and computation of vital registration rates and ratios is presented in the *Handbook of Vital Statistics Methods* (UN, 1955) and the *Handbook on the Collection of Fertility and Mortality Data* (UN, 2004).

Because birth and death registration coverage in many countries is still incomplete, a demographer, statistician, or someone with specialized training should routinely evaluate the CRVS data and apply conventional techniques to adjust or correct the data before deriving fertility and mortality measures. These are referred to as indirect techniques of estimation. Two authoritative sources on these techniques are the Manual X Indirect Techniques for Demographic Estimation (UN, 1983) and the International Union for the Scientific Study of Population tools for demographic estimation (International Union for the Scientific Study of Population, 2011).

Fertility and mortality indicators derived from CRVS data include the following:

- Crude birth rate
- Age-specific fertility rate
- Total fertility rate
- Birth rates by birth order
- Birth ratios by specific characteristics (e.g., sex, duration of marriage, and parity)
- Crude death rate
- All-cause age- and sex-specific death rates
- Early childhood death rates and ratios, including neonatal, postnatal, infant, and under-five child mortality
- Fetal and perinatal death rates and ratios (e.g., by sociodemographic characteristics of the mother)
- Death ratios by specific characteristics (e.g., sex, cause of death, and occupation)
- Cause-specific mortality rates resulting from infectious diseases, noncommunicable diseases, and accidents and injuries

A well-functioning CRVS system is also an important source for efficiently monitoring about a dozen global development indicators defined in the 2015–2030 SDGs (Table 12). Several of the SDG indicators correspond with former Millennium Development Goal (MDG) indicators, whose measurement period has been extended. Several of the indicators, denoted in Table 12 by an asterisk, require data on cause of death.

Table 12. Global development indicators, MDG and SDG, derived from the CRVS system

MDG†	SDG‡	Indicator
Target 5.A, Indicator 1	Target 3.1, Indicator 1	Maternal mortality ratio
Target 5.A, Indicator 2	Target 3.1, Indicator 2	Proportion of births attended by skilled health personnel
Target 4.A, Indicator 1	Target 3.2, Indicator 1	Under-five mortality rate
Target 4.A, Indicator 2	N/A	Infant mortality rate
N/A	Target 3.2, Indicator 2	Neonatal mortality rate
N/A	Target 3.4, Indicator 1	Mortality of cardiovascular disease, cancer, diabetes, or chronic respiratory disease*
N/A	Target 3.4, Indicator 2	Suicide mortality rate*
Target 6.C, Indicator 6	N/A	Incidence and death rates associated with malaria*
Target 6.C, Indicator 9	N/A	Incidence, prevalence, and death rates associated with tuberculosis*
N/A	Target 3.6, Indicator 1	Death rate caused by road traffic fatal injuries*
Target 5.B, Indicator 4	Target 3.7, Indicator 2	Adolescent birth rate (ages 10–14 years; ages 15–19 years) per 1,000 women in that age group
N/A	Target 3.9, Indicator 1	Mortality rate attributed to household and ambient air pollution*
N/A	Target 3.9, Indicator 2	Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene (exposure to unsafe water, sanitation, and hygiene services)
N/A	Target 3.9, Indicator 3	Mortality rate attributed to unintentional poisoning*
N/A	Target 16.1, Indicator 1	Number of victims of intentional homicide per 100,000 population, by age and sex*
N/A	Target 16.9, Indicator 1	Proportion of children under five years of age whose births have been registered with civil authority, by age
N/A	Target 17.19, Indicator 2	Proportion of countries that have achieved 100 percent of birth registration and 80 percent of death registration

† Extracted from the official list of MDG indicators. Retrieved from <http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Indicators/OfficialList.htm>

‡ Extracted from the *Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators* (UN Economic and Social Council, 2016)

* Cause of death indicator

N/A=not applicable

Alternative Data Sources

Until existing CRVS systems are sufficiently strengthened, population-based surveys and censuses can provide periodic indicators of fertility and mortality, although these sources produce less timely and less precise information. For example, vital statistics from surveys lack precision, especially at subnational levels, because of statistical uncertainty inherent in sample estimates; vital statistics from population censuses lack timeliness because they are generated only once every 10 years; and vital statistics from a routine health information system provide valuable operational data for the health sector, but they are incomplete at the population level because they include events in health facilities but not necessarily those occurring in the community.

Standards

- **Standards for national CRVS systems.** Since 1953, the UN Statistical Division has compiled and maintained the fundamental standards for generating accurate, reliable, and regular vital statistics from national civil registration systems. In 2014, the UN Statistical Commission adopted the third revision of the Principles and Recommendations for a Vital Statistics System (first revision in 1973, second revision in 2001) (UN, 2014a). The five UN handbooks on CRVS published with the second revision remain highly relevant in their respective areas (UN, 1998a–1998e).
- **CRVS assessment tools.** WHO and the University of Queensland have produced two assessment tools to guide the country in a standards-based review of the CRVS system (WHO, 2010a; WHO, 2010b). The first tool is a rapid assessment consisting of 25 questions addressing 11 areas of the system. Assuming that the key informants are readily available to contribute, the rapid assessment can be conducted in a few hours using an automated spreadsheet for immediate results. The second tool is a detailed tool to review and strengthen the CRVS system, including guidance for a comprehensive review (building on the rapid assessment) and the development of a road map for strengthening weak areas.
- **CRVS training.** The U.S. Centers for Disease Control and Prevention (CDC) provides a CRVS training course for public health professionals. The training materials consist of an instructor guide, participant notes, 10 chapters on selected CRVS topics with PowerPoint slide sets, optional exercises and assignments, and technical appendices. At least 10 training days are necessary to cover the material. All materials are available free of charge and can be downloaded from the CDC website (CDC, 2015a).
 - Many countries will also benefit from rediscovering a series of 72 technical papers on the CDC website, published from 1979 to 1998 by the IIVRS. These papers offer an historical perspective on vital statistics systems in various countries and whose improvement methods are still relevant to current efforts (CDC, 2015b).
- **Sample Vital Registration with Verbal Autopsy (SAVVY).** For countries whose civil registration system does not provide complete coverage of birth and death registration and cause of death information, a probabilistic sample of areas in which all events are properly recorded and registered has the potential to provide representative fertility and mortality indicators (President's Emergency Plan for AIDS Relief, U.S. Agency for International Development, MEASURE Evaluation, & U.S. Census Bureau, n.d.)

Best Practices

- Establish an **interagency CRVS group** with representation from national stakeholders and development partners to plan and conduct a standards-based assessment of the CRVS system and, based on the results, develop a detailed workplan to strengthen the system.
- Estimate the **completeness of coverage** of registered births and deaths at least annually, at the national and subnational levels, to inform the interpretation and reliability of CRVS data for decision making.
- **Align official registration forms** with the UN minimal-recommended data elements.
- Undertake steps to obtain cause of death data as part of a long-term plan toward implementing **International Classification of Diseases, Tenth Revision, death certification and coding**. Interim measures to fill the gap in cause of death information may be establishing a SAVVY or implementing the WHO Simplified Mortality List (see the CRVS System: Causes of Death section).
- Disseminate annual vital statistics according to **standard tabulations** recommended by the UN Statistics Division. These may be in the form of a **national vital statistics report** or another dissemination medium. Note that even if the national CRVS system lacks full registration coverage, or does not collect all required

data items for the recommended tabulations, it is nevertheless important to produce the tables to the extent possible and document where the information falls short in quality or completeness.

- Ensure that designated national authorities comply with **international reporting** practices by (1) submitting official vital statistics data to the UN Statistics Division for publication in the annual Demographic Yearbook and the biannual Population and Vital Statistics Report (United Nations Statistics Division, n.d.a; United Nations Statistics Division, n.d.b) and (2) submitting annual cause of death data to WHO to be publicly disseminated through the WHO Mortality Database (WHO, n.d.).

Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 9:

Civil Registration and Vital Statistics System

9B: Certification of Cause of Death



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Causes of Death from Communicable Diseases, Chronic Conditions, and Fatal Injuries

Description

Vital statistics derived from civil registration constitute the only nationally representative source of information on mortality by cause of death, provided that civil registration services are universal, continuous, and permanent (UN, 2014b). The description, standards, and best practices for cause of death data in the civil registration and vital statistics CRVS system are addressed in this section because a different national agency, namely the MOH, manages the collection of these data. The MOH authorizes medical personnel to certify and record causes of death and sets procedures for data coding, transmission, and archiving.

After compiling the cause of death data, the MOH coordinates with the appropriate national agency, usually the civil registration authority or the national statistical office, to link individuals' cause of death data to the legal death registration record. A successful linking of information from the legal record in the civil registration system to the cause of death certificate in the MOH will allow the CRVS data source to provide the complete, minimally recommended data elements needed to compute cause of death indicators (UN, 2014b).

Types of Indicators

- CRVS cause of death data can be used to derive cause-specific mortality rates resulting from infectious diseases, noncommunicable diseases, and accidents and injuries, including several Sustainable Development Goal indicators (see, Module 9a: Civil Registration and Vital Statistics System – Registration of Events, Table 12).

Alternative Data Sources

In the absence of physician-certified deaths in a CRVS system or sample registration system, a country can obtain probable cause of death information from verbal autopsies. In the CRVS database, these or other cause of death data should be clearly distinguished from physician-certified cause of death data because the methods are not strictly comparable.

Standards

1. **Cause of death certification and coding.** The international standard rules and instructions for classifying and coding deaths are defined in the WHO *International Statistical Classification of Diseases and Related Health Problems (ICD)* (WHO, 2010a). The current version is the tenth revision (ICD-10). The next revision, ICD-11, will be released in 2018.

“In compiling and publishing mortality and morbidity statistics, WHO member countries agree to comply as far as possible with recommendations made by the World Health

International Classification of Diseases

Since 1948, the WHO ICD is the single internationally endorsed standard for generating comparable statistics pertaining to morbidity and cause of death trends. It provides evidence for monitoring and evaluation, epidemiological research, and provider reimbursements and resource allocation. ICD is used by more than 115 countries for diagnosing and coding causes of death.

ICD-10 consists of three volumes: Volume 1 is a tabular list of the classification of diseases in three- and four-character levels; Volume 2 is an instruction manual and guidance on using ICD; and Volume 3 is an alphabetical index to diseases and nature of injury.

Assembly as to classification, coding procedure, age-grouping, territorial areas to be identified, and other relevant definitions and standards.” (WHO, 1967)

2. **International medical certificate of death form.** This form ensures the proper recording of the immediate, antecedent, and underlying causes of death (Figure 3). The form may be translated, but the standard format and wording must stay intact. It is typically embedded in the official death notification form where other facts surrounding the death are recorded. This form provides information for identifying the underlying cause of death, which should be linked to the official registration record in the CRVS database.

Figure 3. International form of medical certificate of death

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH	
Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*
due to (or as a consequence of)
Antecedent causes Morbidity conditions, if any, giving rise to the above cause, stating the underlying condition last
(b)
due to (or as a consequence of)
(c)
due to (or as a consequence of)
(d)
<hr/>	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it
.....
<i>*This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.</i>	

Source: WHO ICD-10 Volume 2, Section 4.1.3 (WHO, 2010a)

3. **ICD-10 training.** WHO provides an interactive self-learning tool structured to provide a full ICD-10 training or training on specific modules (WHO, 2010b). It can be used for self-learning, in a classroom setting, or on the web, allowing for interaction with specialists. The tool also has translation capabilities. It can be used online or downloaded and installed on a computer. The basic training on ICD-10 coding is about two hours, the training on completing the medical certificate of death is less than an hour, and the full training is about 40 hours. A brief overview of ICD-10 can be obtained through reviewing the chapter summaries (about five hours).

In addition, since 2010, the WHO Family of International Classifications Network Education & Implementation Committee, the international body responsible for ensuring standardized coding of mortality and morbidity data in WHO member states, develops ICD implementation, curriculum, training, and certification materials. The Centers for Disease Control and Prevention National Center for Health Statistics publishes these documents on its website (Centers for Disease Control and Prevention National Center for Health Statistics & Education & Implementation Committee, 2016).

4. **ICD-10 automated software.** This software provides for automated coding of causes of death and selecting the underlying cause of death. It is developed and maintained by the Iris Institute, an international cooperation between six countries (Germany, France, Hungary, Italy, Sweden, and the United States). The software can be downloaded for free from the German Institute of Medical Documentation and Information website (German Institute of Medical Documentation and Information, 2016).
5. **Verbal autopsy.** For countries that do not have the capacity for full ICD-10 implementation verbal autopsy tools, WHO and the Institute for Health Metrics and Evaluation have developed standard questionnaire instruments and analysis applications (WHO, 2017; Institute for Health Metrics and Evaluation, n.d.). These verbal autopsy instruments are suitable for routine use in capturing information on the circumstances surrounding deaths for all age groups, including on circumstances related to maternal and perinatal deaths and deaths caused by injuries. The WHO recommends that results recorded in the verbal autopsy instruments are reviewed independently by two or more physicians. If the probable cause of death is the same for both, then this is the final cause recorded; if the cause of death is different from the two physicians, then a third physician will decide on the final cause to record. Publicly available software that automates cause of death diagnoses also exists, such as open-source tariff method, InterVA-4, and others, but although these methods have shown some success in replicating cause-specific mortality fractions in the population, they have replicated physician-assigned cause of death at the individual level only about half the time (Desai, et al., 2014).
6. **Simple mortality list.** WHO has developed a Startup Mortality List (SML) (ICD-10-SML) of 115 categories of causes based on the full ICD-10 general mortality list. Countries that do not have the resources to code causes with ICD 3- or 4-digits can start with the SML as a first step toward standardized reporting of causes of death. An electronic module (DHIS 2) has been developed to collect and tabulate information on deaths (WHO, 2014a). This is especially relevant for hospital deaths.

Iris software for automating cause of death information

The Iris software is based on the international death certificate form. There are two ways that Iris software can be used. First, in the “code entry” mode, an officer enters information about a death, including each of the physician-certified diagnoses and the corresponding ICD-10 code. Iris will then automatically apply the ICD-10 rules to the sequence of coded causes and use an algorithm to select the underlying cause.

Second, in the “text entry” mode, an officer (or physician) enters the cause of death diagnoses in free text, and a country-specific dictionary of medical terms will automatically translate the diagnosis into an ICD-10 code. IRIS has an English dictionary of medical terms, and dictionaries with terms in other languages are being developed. After the dictionary is enhanced with local terms, text entry becomes the most efficient mode to produce consistent data.

Most countries in Europe have used Iris for several years. Australia implemented it fully in 2013, and the United States is transitioning from the Mortality Medical Data System to Iris. Iris software presents an excellent opportunity for any country planning to use an automated system.

Verbal autopsies

What are they? In low- and middle-income countries, deaths in the community are least likely to be certified by a physician and registered in the civil registration system. To address this discrepancy, WHO and other partners have developed standard verbal autopsy instruments. Verbal autopsy is a method that helps determine probable causes of death at the population level, where there is generally no medical certification.

How to administer them? To obtain nationally representative results on causes of death, the verbal autopsy instrument can be employed as part of a Sample Vital Registration with Verbal Autopsy or included as a module in a larger population-based survey. To administer the verbal autopsy, interviewers are trained to conduct an interview with a household member and record information on signs and symptoms of a recently deceased person. The probable cause of death can be either derived manually by physicians reviewing the questionnaires and assigning a cause or derived automatically from a computer algorithm.

Caveats—Probable causes of death provided by verbal autopsies can fill a gap in mortality data, but this should be regarded as a temporary measure. Although the probable cause of death from the verbal autopsy is attributed an ICD-10 code, the causes of death are not physician certified per the required medical certificate of death form and according to ICD rules and instructions. Therefore, although studies suggest that verbal autopsy can provide cause of death information that at the population level is similar to physician-certified deaths in high-quality hospitals, the data from the two sources are not strictly comparable and should be distinguishable at the time of analysis. (Note that the WHO Mortality Data Base contains only physician-certified deaths.)

Most low- and middle-income countries only generate ICD-10 physician-certified cause of death information for deaths that occur in some hospitals (WHO, n.d.). Some steps toward obtaining more complete and reliable mortality data in the long-term are as follows:

- Establish a permanent **ICD-10 reference body** to oversee ICD-10 implementation and quality assurance.
- Update and institutionalize the **International Medical Certificate of Death** form, in paper or electronic format. Train physicians on how to properly complete the form following the WHO guidelines on sequencing of events leading to death. The WHO quick reference guide provides instructions for properly completing the international medical certificate of death form. It gives step-by-step instructions to certifiers on how to correctly complete the form, and indicates frequently used ill-defined causes of death that certifiers should avoid. The form can be easily translated, printed on two pages, and folded into a small booklet for easy dissemination (see Standard #2).
- Develop and roll out **physician training**, refresher courses, and continued professional development on ICD-10 certification. Institute ICD-10 training in medical school curriculums (see Standard #3).
- Train and engage a small number of **dedicated ICD-10 coders** who are not practicing physicians, who all receive the same training, and who code deaths daily or at least on a regular basis. This will help ensure consistent coding practices between individual coders that will minimize bias and provide experience with a sufficient number of deaths so that skills are continuously exercised and sharpened (see Standard #3).
- Because all hospitals have physicians on staff and the completion of a death certificate is a routine aspect of medical care, ICD-10 certification and coding should be implemented for all **deaths in hospitals**, with the expectation of rolling out the procedures for deaths in the community. For countries that intend to apply ICD-10 to deaths in hospitals but do not yet have the capacity to code those deaths in standard format of

ICD-10 3 or 4 characters, WHO developed the ICD-10 SML (see Standard #6) that can be used as a first step toward standardized reporting of causes of death.

- The underlying cause of death is considered to be the most informative data element related to cause of death from a public health point of view, and thus is used for tabulation and comparisons. It is “the disease or injury that initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence that produced the injury” (WHO, 2010a, Section 4.1.2). To **properly select the underlying cause of death**, coders are taught to apply the ICD rules and instructions to the sequence of causes. Automated software developed by the Iris Institute is available to facilitate coding of multiple causes of death and selection of the correct underlying cause (see Standards #3 and #4).
- WHO has produced two useful tools for **processing ICD-10 codes**. First, the Microsoft Access-based CoDEdit tool improves data quality by checking the validity of each ICD-10 death record and flagging records in which a correction needs to be made (WHO, 2014b). Second, the Microsoft Excel-based ANACoD application performs a comprehensive analysis of ICD-10 data on mortality levels and causes of death (WHO, 2013b; AbouZahr, et al., 2010).
- For communities where deaths are not certified by a physician, cause of death information may be captured through a standard **verbal autopsy instrument**, in which the probable cause of death may be assigned either through review by trained physicians or using computer algorithms (see Standard #5).

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 10:

Public Health Surveillance System



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Reportable Diseases and Conditions and Public Health Threats

Description

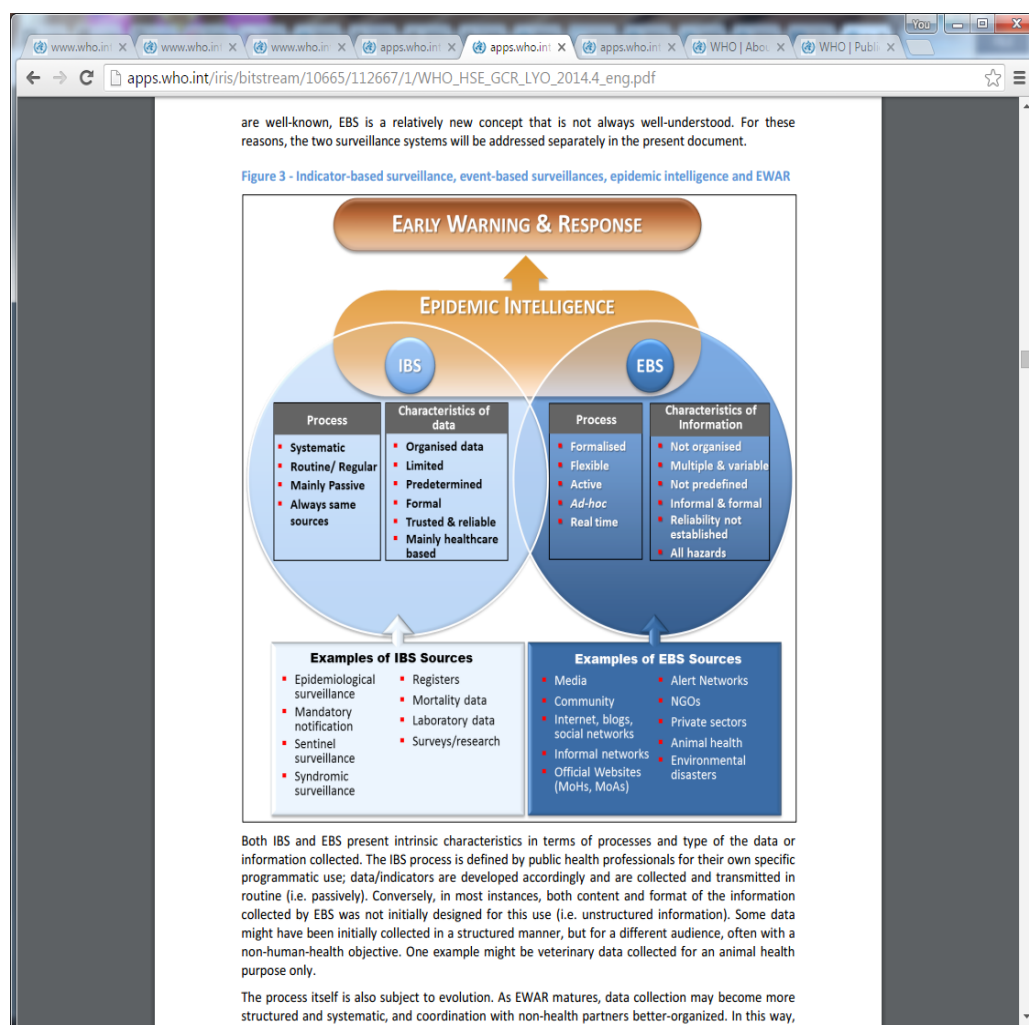
A public health surveillance system is an essential public health function defined by ongoing systematic collection, compilation, analysis, and dissemination of data on reportable diseases and other events that present a potential threat to public health security (Thacker & Berkelman, 1988). The system is designed to monitor routine and ad hoc data within and outside the health system and to use them to assess risks to public health. If predefined risk thresholds are surpassed, the system triggers rapid response activities. The response activities, including coordinating investigative and control measures, are carried out by officers in the Ministry of Health and by other emergency response teams, depending on the origin of the threat. This module focuses on surveillance activities rather than response mechanisms because they are the data source for monitoring public health threats.

A national surveillance system consists of two main components: indicator-based surveillance (IBS) and event-based surveillance (EBS) (WHO, 2008, 2014; European Centre for Disease Prevention and Control, n.d.). Indicator-based surveillance represents the classic functioning of a surveillance system designed to monitor the frequency, origin, and distribution of reportable national and international diseases. It is passive surveillance in the sense that cases are reported through the routine health information system from disease surveillance sites, laboratories, central medical stores, and other routine reporting channels. The data are typically structured according to case definitions, and they enter the health system through a patient encounter at an outpatient consultation or inpatient admission, or a patient encounter with a health worker in the community. One of the shortcomings of passive surveillance is that reportable cases remain unidentified if symptomatic persons, for whatever reason, are not captured through a routine reporting system.

The EBS component is designed to recognize events and emerging public health threats that may not otherwise enter the surveillance system (WHO, 2014). This mechanism complements IBS by actively scanning the Internet, media, and sources of big data, and by making ad hoc contact with health providers and others in the community (such as at schools, workplaces, border control) to detect potential risks. EBS does not necessarily adhere to case definitions, and unstructured data must be analyzed to determine the presence of a public health risk. An example of EBS is monitoring the patterns of flu and dengue data that are collected by Google Internet search engines (Google, 2015).

Together, the IBS and EBS surveillance components constitute “all hazards” surveillance and require an early warning and response (EWAR) mechanism (Figure 4).

Figure 4. Indicator-based surveillance and event-based surveillance



Source: WHO (2014, p. 13, Figure 3)

In summary, the core activities of a surveillance system are as follows (WHO, 2001, 2006a):

- Prioritization of diseases and events in the surveillance system
- Detection of reportable diseases according to a case definition
- Assessment of other potential public health threats
- Registration of standardized cases
- Confirmation of cases (clinical or laboratory confirmation)
- Notification and reporting of confirmed, probable, or suspect cases¹⁶
- Analysis and interpretation (updating information and visualization products, including maps, to assess trends, patterns, and risks)
- Triggering of response and control measures (epidemic preparedness and outbreak investigation)
- Provision of information, education, and communication
- Provision of feedback to data providers

¹⁶ Notification is the formalized mandatory communication process through which reportable diseases or events are communicated in national or international surveillance systems (WHO, 2014).

Types of Indicators

The EBS system works with unstructured, ad hoc data and therefore is not associated with pre-defined indicators. The IBS system, however, generates indicators that correspond to each notifiable (reportable) disease or condition. Because each condition is recorded in a standard format, the following types of indicators are derived from individual or aggregated reported cases:

- The number of cases according to each case definition (disease-specific or syndromic)
- Survival status of cases (clinical diagnosis of morbidity or mortality)
- Laboratory diagnoses
- Classification of cases (suspected, probable, or confirmed)

Surveillance officers should monitor the number of cases for each disease or event frequently and produce a sufficiently detailed epidemiological description to track its origin and distribution. Indicators should be broken down by selected individual characteristics (such as sex and age), geographical location, and time period. These dimensions, referred to as “person, place, and time,” are necessary to identify subpopulations and areas that are prone to outbreaks so they can be targeted for intensified preventive measures, such as information, education, and communication; immunization; vector control; and sanitation efforts (Centers for Disease Control and Prevention [CDC], 2012).

Alternative Data Sources

None

Standards

The WHO publishes international health regulations to help control the international spread of disease. The World Health Assembly adopted the first International Health Regulations (IHR) in 1969. In subsequent decades, increases in global travel and trade have resulted in increased risks of disease spreading across borders, and the IHR were substantially revised in 2005 (WHO, 2005). In addition to defining a limited list of predefined, notifiable diseases, the new IHR introduces a decision instrument for countries to use to determine whether an event constitutes a public health emergency and must be reported to WHO (WHO, 2005). These emergencies can be any unexplained illness or condition, regardless of origin or source, which could present significant harm to humans. The IHR also require countries to develop and maintain core capacities for surveillance, throughout the country and at points of entry, to prevent and respond to acute public health risks (WHO, 2010; 2013).

International Notifications

The national IHR focal point notifies the WHO contact point of the first new or suspected case within 24 hours and all cases thereafter that meet any of the following criteria (WHO, 2005):

- Four diseases *must be* reported to WHO: smallpox, poliomyelitis, human influenza caused by a new subtype, and severe acute respiratory syndrome.
- Other diseases with high epidemic potential (cholera, pneumonic plague, yellow fever, and viral hemorrhagic fever) *may be required* to be reported to WHO if they are considered an international public health concern according to the IHR decision instrument.
- According to the IHR decision instrument, these diseases and events should also be reported: “Any (other)

event or disease of potential international public health concern, regardless of the origin (e.g., biological, radiological, nuclear, chemical, contaminated food or natural disasters), including those of unknown causes or sources (WHO, 2005).”

Regional and National Notifications

The Centers for Disease Control and Prevention and the WHO Regional Office for Africa developed technical guidelines for integrated disease surveillance and response (IDSR) in the African region to streamline surveillance activities and standardize the flow of information among and within the levels of the health system. Integrated disease surveillance and response is a strategy to strengthen surveillance, laboratory, and response capacities at each level in the health system, in line with IHR (WHO & CDC, 2010). The IDSR technical guidelines provide a wealth of guidance, including a list of priority diseases in the region; standard case definitions for each disease; model forms for reporting; and recommendations for and examples of analyzing reported and confirmed cases by person, place, and time.

National public health policy should establish a country-specific list of notifiable diseases and conditions. The list should be reviewed about once every five years to determine whether changes are needed, such as (1) discontinuing surveillance for low-ranking diseases or events; (2) revising the surveillance and response procedures at each level of the health system for notifiable diseases or events; or (3) incorporating new, high-priority diseases and health threats. Surveillance activity would typically focus on a list of approximately 20 diseases, although each country determines the number, given its prevailing risks and resources. WHO provides guidance on undertaking this type of regular prioritization exercise (WHO, 2006b).

Countries should also comply with IHR 2005 if they implementing the EWAR mechanism. The WHO interim document on implementing EWAR, with a focus on EBS, is an excellent reference (WHO, 2014).

Best Practices

- Conduct an evaluation using the **Joint External Evaluation Tool** (WHO 2016) to assess country capacity to prevent, detect, and rapidly respond to public health threats.
- Formulate and implement a public health surveillance **monitoring and evaluation strategy** and set of procedures.
- Ensure that every reportable disease has an explicit **case definition** that describes the condition, the laboratory criteria, and the case classification.
- Employ **standard reporting forms** for each reportable condition, including international standard reporting forms where they are available.
- Take advantage of **affordable technologies** to streamline the surveillance system.
- Obtain **complete and accurate reports** of all reportable diseases and events from all public and private health facilities required to notify cases.
- Periodically review the **official list of priority surveillance diseases** and events about once every five years and revise as necessary.
- In collaboration with WHO, the Ministry of Health, and stakeholders, carry out a **five-year external assessment** of the implementation of the surveillance and response strengthening efforts, as well as the multi-disease approach. Undertake **annual internal reviews**.
- Apply the **IHR decision instrument** to determine whether a public health event constitutes a public health emergency and requires notification to WHO through the IHR focal point and WHO contact person (WHO, 2005).

- In the WHO African Region, use **IDSR** as a vehicle for IHR implementation, including integrating **standard case definitions, reporting instruments, and other regional strategies** as applicable.
- Have procedures and tools in place to monitor and assess early threats detected through **event-based surveillance**.
- Empower **local leaders** to support surveillance activities, particularly to detect reportable cases and work with public health authorities to alert potential threats in their communities.
- Monitor surveillance data continuously and assess them for outbreaks and public health risks, with particular attention to person, place, and time, which **trigger responses to targeted subpopulations** most in need of interventions.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 11:

Collective Intervention Records



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Community-Level Interventions and Interventions Targeted at the Health System

Description

Healthcare interventions generally entail a mix of personalized services and goods that an individual consumes when coming into contact with the health system. These interventions require an individual's action to acquire the good or service from a provider, and they can be recorded in an individual record (see, Module 1: Individual Records) (Rychetnik, et al., 2002; McLeroy, et al., 2003). Collective services, on the other hand, target the general population or the entire health system rather than individual users.

Collective interventions include diverse services at the community-level whose common purpose is to improve or maintain overall health and safety of everyone in the target population simultaneously (OECD, Eurostat, & WHO, 2011; Institute of Medicine, 2002; McLeroy, et al., 2003; ICHI Alpha, 2016). Community-level services promote or protect health, or prevent ill health, in communities or populations. They comprise programs, for example, that promote healthy living conditions, halt the onset of disease, diminish the number of cases, and/or lessen the severity of disease (OECD, Eurostat, & WHO, 2011). Collective services also include interventions on the governance and administration of the whole healthcare system with the aim to improve its effectiveness, efficiency and equity for the benefit of all users (OECD, Eurostat, & WHO, 2011). These health system interventions relate to policy formulation, standards setting, information systems strengthening, monitoring and evaluation, and financial management.

Community-level interventions are carried out by a wide variety of public and private actors in the health sector as well as in other sectors. In the health sector, it is common in low- and middle-income countries to train community health workers to carry out a range of activities to facilitate healthcare, conduct education and advocacy campaigns, and collect data (WHO, 2007).¹⁷ Establishing a community health worker (CHW) program, including the recruiting, training, and deploying of CHWs in communities, is in itself a community-level health intervention that governments might wish to track. In addition, CHWs carry out individual-level interventions on behalf of the health facility, such as notifying vital events in the community, visiting patients in their home to supervise various treatment regimes, and referring patients to the appropriate care provider. These individual-level interventions carried out by the CHW contribute to other data sources, including individual records and civil registration and vital statistics system (see, Module 1: Individual Records and Modules 9a and 9b: Civil Registration and Vital Statistics System).

Objectively defined data on collective interventions are rarely readily available, yet the information is important for two main reasons. One, the expenditures linked to these interventions are necessary for producing health accounts. Second, for research, the information provides potentially significant explanatory power when evaluating factors influencing health outcomes. The lack of data in this domain can be explained in part by: (1) the definition of community is ambiguous as a unit of analysis; (2) community-level indicators are associated with outputs from a project, program, or public health initiative, and, therefore, information is scattered in various mid-term or end-term reports produced by the project; and (3) community-level indicators lack definition that make them SMART.¹⁸

¹⁷ Mobile phones are an increasingly used for recording health interventions that take place in the community, outside of a health facility. This is called mobile health, or mHealth, and it refers to the use of mobile communication devices in health promotion, including both community-based and individual-level initiatives in the community (WHO, 2011). However, although the interventions take place in the community, such as the ones carried out by CHWs, they are likely to be individual-level interventions rather than collective interventions.

¹⁸ SMART = specific, measurable, attainable, relevant, time bound

Evaluating Community Interventions

Collective interventions are implemented at community level, and the community is the level of analysis. Indicators of collective interventions can provide important inputs into evaluation studies to ascertain the impact of projects and initiatives on population health outcomes. Below are examples of their use:

- A community-level information campaign on the benefits of needle exchange implemented in Community A is associated with a significantly higher rate of needle exchange among most at-risk populations compared to Community B, where there was not an information campaign.
- The deployment of a larger number of CHWs per capita in Community A is associated with significantly higher birth registration coverage rates in compared to Community B.
- The implementation of a substance abuse program in Community A has a significant effect on reducing the number of single vehicle nighttime crashes (Community Toolbox, 2016).

Although community-level interventions are often used as simple, categorical variables, as in the examples above, they can be used as group-level inputs in more sophisticated analyses, for example, in a multi-level analysis, to determine their effect on health outcomes (Diez-Roux, 2000).

Types of Indicators

Indicators of collective interventions can be expressed as the number of targeted communities in which specified public health interventions are implemented in a certain reference period. The following are examples of community-level services:

- Assessment and purification of source water
- Modification of public entrances for accessibility
- Preparation for disasters
- Anti-smoking campaigns
- Promotion of healthy transportation behavior, e.g. wearing a helmet
- School lunch programs
- Public health surveillance and screenings
- Fortification of food products
- Community mosquito control
- Media or advocacy campaigns on healthy lifestyles
- Immunization program operations

Community-level services can target most-at-risk populations and reach out to vulnerable groups of people. For example, for persons at risk of AIDS or living with AIDS, providers can launch specially designed educational campaigns to reduce barriers for voluntary testing and treatment, implement needle exchange programs, and install syringe drop boxes in public places.

Public health intervention indicators do not feature among internationally agreed-on indicators, but they do appear as part of the inventory of healthcare evidence in some countries. The Saskatchewan Population Health and Evaluation Research Unit, for example, has presented a range of community health indicators as well as a conceptual framework for their evaluation (Jeffery, et al., 2006).

Alternative Data Sources

The primary data sources and their format will vary widely, depending on the community-level indicator and the sector that records the indicator.

Standards

Two standards exist for classifying collective interventions. The International Classification for Health Accounts (ICHA), used in standard health accounts, classifies collective interventions under program code HC.6, Preventive & public health services and HC.7, Governance, and health system and financing administration (OECD, Eurostat, & WHO, 2011).

HC.6 program codes distinguish collective interventions to benefit a population, prior to individual diagnoses being made, from individual curative and rehabilitative interventions. These include:

- HC.6.1 Information, education and counselling programs
- HC.6.2 Immunization programs
- HC.6.3 Early disease detection programs
- HC.6.4 Healthy condition monitoring programs
- HC.6.5 Epidemiological surveillance and risk and disease control programs
- HC.6.6 Preparing for disaster and emergency response programs

HC.7 program codes define collective services that focus on the health system, aimed to benefit users of the health system, versus direct care services.

- HC.7.1 Governance and health system administration
- HC.7.2 Administration of health financing

In addition to the ICHA classification, the ICHI is a statistical classification used for health interventions, including public health interventions at the population level (ICHI Alpha, 2016). Although still in alpha version, ICHI has the potential to produce comparable data on collective public health interventions across countries.

International Classification of Health Interventions classifies collective interventions around three axes: target, action, and means. A few examples are the following:

- The ICHI code for “Media campaign about immunizations” is VAF PM QA, indicating health-related behavior, immunization (target), education (action), and media campaign (means).
- The ICHI code for “Education about alcohol use by providing instruction materials” is VAA PM QC, indicating health-related behavior (target), education (action), and instructional materials (means).
- The ICHI code for “Capacity building interventions targeting drug use” is VAC VA ZZ, indicating illicit drug use (target), capacity building (action), and intervention using other method, without approach, or not otherwise specified (means).

Best Practices

- The health information unit **maintains a repository** of collective public health interventions and classifies these by the type of activity, implementation date, target communities or at-risk populations, and responsible party.
- The health information unit **reports on community-level interventions** regularly to raise awareness and elicit demand for and use of these data, and to make them available for further analysis of their effectiveness and cost-efficiency on health outcomes.

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Health Information System Strengthening: Standards and Best Practices for Data Sources

MODULE 12:

Health Accounts



This module is one of 12 HIS data source modules in *Health Information System Strengthening: Standards and Best Practices for Data Sources*. The full series of modules (available at <https://www.measureevaluation.org/resources/publications/tr-17-225>) is intended to provide health authorities and other health information stakeholders with a reference guide that, along with other sources, can help align the HIS data sources with international standards and best practices.

Type of Data Generated: Healthcare Spending by Financing Source, Provider, and Healthcare Consumption

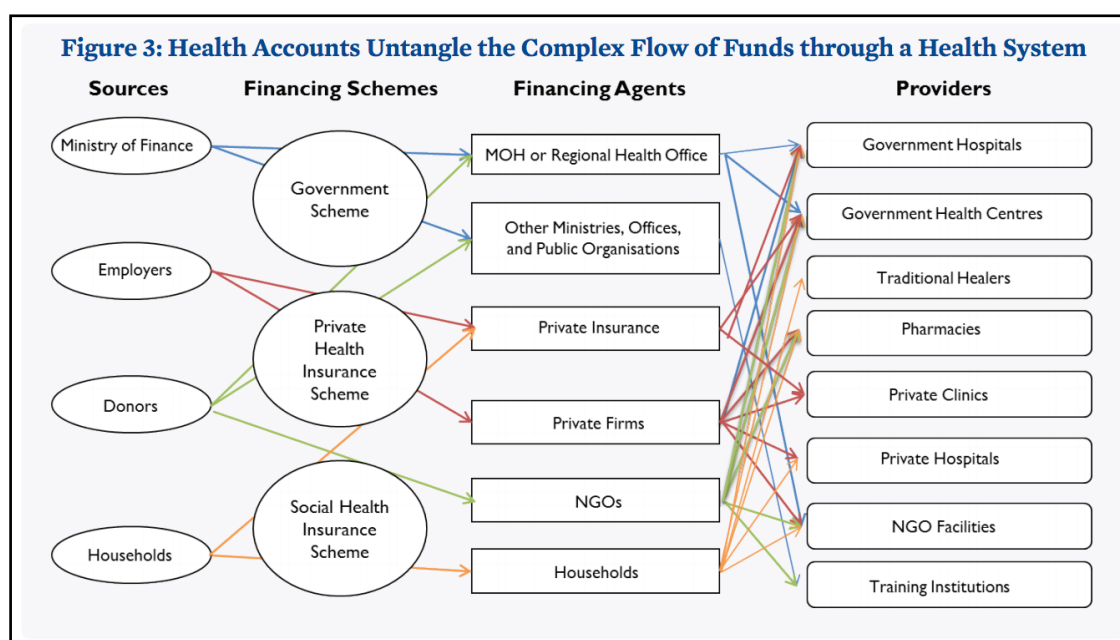
Description

Health accounts measure healthcare spending and track funds that flow through the health system, from their origin, to agencies that pool and distribute the money, to providers who engage in healthcare activities, and finally to beneficiaries of the activities. The System of Health Accounts (SHA) is an international framework that improves accountability and governance of health resources by defining standard criteria for classifying expenditures and answering policy-related questions about how resources are mobilized and managed (Cogswell & Dereje, 2015).

Health accounts' health expenditures encompass all activities whose primary purpose is to restore, improve, and maintain health for the nation and for individuals during a defined period of time (WHO, 2000). Records of expenditures for these activities, or a basis for estimating them, are required regardless of the type of institution or financing entity, which includes traditional, complementary, and alternative medicine. It also includes preventive and long-term care.

Health accounts also track the flow of health resources by using financial data compiled from various entities in the health system. These funding sources include the government, development partners, employers, and households; insurers and other pooling mechanisms; financial agents paying for healthcare activities; and healthcare providers (Figure 5).

Figure 5. Flow of health resources in the health system



Source: Cogswell & Dereje (2015)

Evolution of the Health Accounts Framework

The Organisation for Economic Co-operation and Development developed a standardized methodology for health accounts based on the underlying principle of health consumption: “what is consumed (expended) has been provided and financed.” The principle was developed into the ICHA and published in *A System of Health Accounts, Version 1.0* (OECD, 2000). This triaxial classification system enabled OECD member countries to produce comparable results on healthcare consumption, healthcare provision, and healthcare functions.

Several countries outside of the OECD also adopted the SHA v1 as a means to compare the level and structure of their healthcare spending with those of other countries. However, given that the original framework did not include a way to capture the multitude of financiers of the health sector in developing countries separately, the World Bank, the WHO, and the U.S. Agency for International Development (USAID) added a source of funding classification. In 2003, they published the *Guide to Producing National Health Accounts, with Special Applications for Low-Income and Middle-Income Countries*, referred to as the national health account Producer’s Guide (World Bank, WHO, & the United States Agency for International Development, 2003).

Since 2007, OECD, Eurostat, and WHO, along with other development partners, updated the SHA v1, and incorporated the financing sources from the Producer’s Guide, to produce a single global health accounting standard. *A System of Health Accounts*, published in 2011, is currently the international standard for comparing national spending levels and structures (OECD, Eurostat, & WHO, 2011). Although there are a few key differences between SHA v1 and SHA 2011, the triaxial approach remains the fundamental classification scheme for expenditures (Cogswell, et al., 2013).

There are several advantages to SHA 2011, which include the following:

- The classification system can be used in countries regardless of their health system structure and income level.
- The system is compatible with other national classification systems so that countries can produce results using the national system and/or map expenditures to the international standard.
- The system is compatible with other standard classifications, including the International Classification of Diseases-10 to code diagnoses, the International Standard Industrial Classification to code economic activities, and the System of National Accounts, which is the standard structure for broader economic accounting (e.g., gross domestic product and other macroeconomic measures).

Institutionalizing Health Accounts

In order to maximize the potential of health accounts to track financial flows, monitor health system performance, and benchmark healthcare spending with other countries, they should be produced on a regular basis, ideally annually (Cogswell & Dereje, 2015). Health accounts that rely heavily on survey estimates for out-of-pocket expenditures, for example, will be conducted less regularly because of the time it takes to conduct the surveys and obtain the results (WHO, 2010). To ensure regular production of the health accounts, the central government, such as the ministry of health or central statistics office, should establish a health accounts team that ensures sufficient human capacity, the necessary hardware and software, and access to data. The cost of sustaining regular production depends on the availability of data from the financial information system and other sources, and the extent of external expertise needed to process the data. Implementing a health account for the first time is the costliest step, but over time, as financial information systems are improved and analytical capacity is strengthened, both the quality and efficiency of health accounts will improve.

Alternative Data Sources

None.

Types of Indicators

The data that are compiled and processed from the SHA 2011 are reported in a systematic way in a series of standard tabulations (OECD, Eurostat, & WHO, 2011, pp. 353–369). The basic set of tables includes cross-classifications of the main ICHA classifications (HCxHF, HCxHP, and HPxHF), and more detailed tables can be produced according to the country's needs. The data in these tables are used to present and compute health expenditure indicators.

Some key indicators are computed directly from data in the tables (e.g., expenditure levels, percentage share to total, ratios of one health accounts component to another), and others are computed in combination with additional financial data (e.g., share of gross domestic product, per capita values, values converted to purchasing power parity).

The WHO Global Health Expenditure database defines 20 global health expenditure indicators, all generated in accordance with the SHA 2011 methodology (WHO, 2014).

Examples of key indicators from the basic SHA 2011 tables include the following:

- Share of prevention in hospital services
- Ratio of inpatient and outpatient spending financed by government
- Level of capital spending in publicly owned hospitals
- Total amount of out-of-pocket health expenditures
- Total amount paid to hospitals
- Total amount spent for prevention
- Total amount spent on pharmaceuticals (adding inpatient use of pharmaceuticals to outpatient use)
- Total amount spent on long-term care (adding the healthcare and the social parts)

Table 14 presents selected indicators produced from the SHA 2011 tables.

Table 13. Selected examples of indicators used in healthcare analysis

Axis	Indicator	Min NCU	USD or EUR	PPP	% GDP	Per capita NCU	Per capita USD or EUR	Per capita PPP	Percentage of CHE
General	Total current health expenditure	X	X	X	X	X	X	X	
	Total current health expenditure plus capital spending ⁵	X	X	X	X	X	X	X	
Health functions	Preventive spending								X
	Curative spending								X
	Inpatient spending								X
	Outpatient spending								X
	Health expenditure on long-term care	X	X	X					X
	Total LTC spending	X	X	X	X	X	X	X	
	Total pharmaceutical spending	X	X	X	X	X	X	X	X
Financing schemes	Government health schemes								X
	Compulsory contributory health insurance schemes								X
	Voluntary health insurance schemes								X
	Out-of-pocket expenditure on health								X
Providers	Hospital health spending								X
	Ambulatory health spending								X
Revenue of schemes	Externally funded expenditure on health								X
	Publicly funded expenditure on health								X
	Privately funded expenditure on health								X
Factors	Expenditure on human resources								X
	Expenditure on health on non-communicable diseases	X	X	X	X	X	X	X	X
Beneficiaries	Expenditure on health on injuries	X	X	X	X	X	X	X	X
	Expenditure on health age 65 and over	X	X			X	X		X
	Total public spending on capital formation	X	X						X
Capital formation	Total private spending on capital formation	X							X
	Spending on capital formation by hospitals	X							X

LTC = long-term care

CHE = current health expenditure

Source: SHA, 2011, p. 347

From the most recent information available on the WHO Global Health Expenditure Database website (see “Document Center”), 53 countries have completed the collection and classification of health expenditure data for at least one year, using the SHA 2011 system. Another 34 countries are undertaking the production of SHA 2011 data for the first time (WHO, 2014).

Standards

The SHA 2011 is the internationally recognized framework on which health accounts can be developed, or mapped, for national use and international comparisons (OECD, Eurostat, & WHO, 2011).

SHA 2011 is organized around three axes defined by the ICHA: healthcare functions, healthcare provision, and healthcare financing. The results inform the country on the kinds of healthcare consumed, the providers that deliver the healthcare, and the financing source that pays for the healthcare (Cogswell, et al., 2013; Cogswell & Dereje, 2015).

Tools

The Health Accounts Production Tool (HAPT) is a software application developed by USAID and WHO that supports countries undertaking a health accounts exercise. The HAPT facilitates the production of health accounts by mapping national health expenditures by the SHA 2011 core and any defined country-specific classifications (Health Finance and Governance Project, 2014). The Health Account Analysis Tool complements the HAPT by automatically producing graphs and charts for informing the policy process. Both tools are available for download from the WHO website (WHO, 2016).

Best Practices

Best practices are adapted from the Health Finance and Governance Project (Cogswell, et al, 2013; Cogswell & Dereje 2015):

- The government mandates that health accounts are **institutionalized** in a central government agency or a local university.
- The regular production of health accounts is an **item in the government's budget**.
- A health accounts **technical team is established** to plan, manage, and monitor the estimation process, including mapping expenditures to the SHA 2011.
- The country's **key health expenditure indicators** are produced from standard health accounts tables.
- Health accounts are packaged in a **format that informs policy** and planning.
- A health accounts steering committee and other stakeholders promote the **dissemination and use** of results.

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