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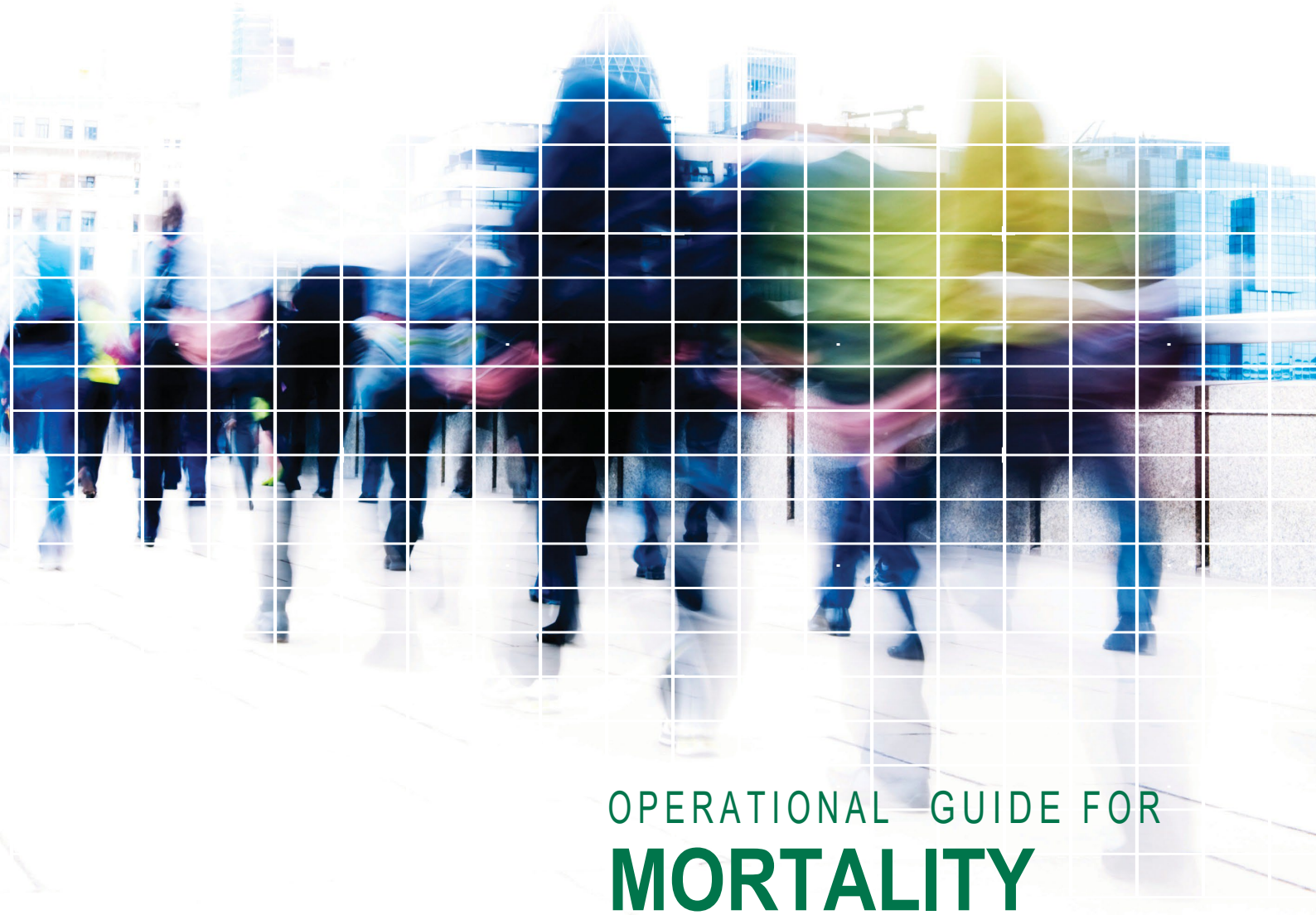

OPERATIONAL GUIDE FOR

MORTALITY SURVEILLANCE

A practical guide for establishing and implementing mortality surveillance in Africa

JUNE 2024

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Africa CDC is a continental autonomous health agency of the African Union established to support public health initiatives of Member States and strengthen the capacity of their public health institutions to detect, prevent, control and respond quickly and effectively to disease threats.

Safeguarding Africa's Health

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PREFACE

In response to the growing necessity for accurate and timely information regarding deaths categorized by age, sex, and cause of death, underscored by the profound impact of the COVID-19 pandemic, the Africa Centres for Disease Control and Prevention (Africa CDC) developed the Continental Framework designed to fortify mortality surveillance within the African Union Member States. This Operational Guide is a comprehensive companion, delineating specific activities harmonized with the framework.

This guide outlines fundamental steps and instructions for establishing an effective mortality surveillance system through its pages. Each chapter contributes to a cohesive and actionable guide from providing essential background insights to detailing a model structure for national programs, assessing existing mortality data systems, formulating optimal system designs based on assessments, developing national action plans and the critical facet of implementation monitoring and evaluation. This document highlights the importance of adapting to various country specific situations in order to maximise the effectiveness of current systems and resources, thereby preventing duplication and redundancy. The guide also furnishes templates for various stages, positioning both the Continental Framework and Operational Guide as indispensable tools for elevating mortality surveillance in Africa at national and regional levels.

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Africa CDC

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ACRONYMS AND ABBREVIATIONS

Africa CDC	Africa Centres for Disease Control and Prevention
AU	Africa Union
CHAMPS	Child Health and Mortality Prevention Surveillance
CoD	Cause of Death
COMSA	Countrywide Mortality Surveillance for Action
CR	Civil Registration
CRVS	Civil Registration and Vital Statistics
DHIS2	District Health Information System 2
DHS	Demographic Health Surveys
HDSS	Health and Demographic Surveillance System
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
ICD	International Classification of Diseases
IDSR	Integrated Disease Surveillance and Response
IT	Information Technology
M&E	Monitoring and Evaluation
MCCD	Medical Certification of Cause of Death
MICS	Multiple Indicator Cluster Surveys
MoH	Ministry of Health
MPDSR	Maternal and Perinatal Death Surveillance and Response
MS	Mortality Surveillance
NPHI	National Public Health Institute
NSO	National Statistics office
PHC	Primary Health Centre
RMS	Rapid Mortality Surveillance
SAVVY	Sample registration system methods with verbal autopsy
SME	Subject matter experts
SOP	Standard Operating Procedures
SRS	Sample Registration System
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TB	Tuberculosis
TWG	Technical Working Group
UNICEF	United Nations Children's Fund
VA	Verbal Autopsy
WHO	World Health Organization

GLOSSARY OF KEY TERMS AND CONCEPTS

1. Routine mortality surveillance (RMS):

RMS is the systematic and continuous collection, compilation, analysis and dissemination of the incidence and cause of death in a population, for evidence-based decision-making.

2. Planning and Coordination of mortality surveillance system:

Aims to establish a governance structure for the mortality surveillance system through strong commitment and leadership. This requires the establishment of a national steering committee and technical bodies such as technical working groups with clear roles and responsibilities.

3. Mortality data systems assessment:

This process evaluates and analyses mortality data systems, identifies performance problems and their causes, and leads to system redesign.

4. Design of mortality data systems:

Design of the best of mortality system by strengthening the most robust system between CRVS and HMIS in all aspects while the weaker system is strengthened in data linkage and sharing across the two systems.

5. Harmonized strategic plan of action

This process refers to the development of a five-years strategic plan and an action plan based on the results of the systems assessment and the establishment of the envisaged surveillance system.

6. A phased approach to implementing integrated mortality surveillance in the health sector:

This means progressive coverage of community, health centers/health facilities as the system expands, and the likely utility of surveillance data for each of the five phases.

- Phase 0: Compilation and analysis of existing mortality data from different sources.
- Phase 1: Not nationally represented mortality surveillance – Sentinel sites (healthcare facilities & communities in a specific geographic or administrative area). All death events occurring in health care facilities and communities are reported with or without their causes.
- Phase 2: Nationally representative Sentinel Sites for mortality surveillance (health care facilities & communities in a specific geographic or administrative area). All death events occurring in health care facilities and communities are reported together with their causes.
- Phase 3: All hospitals and a nationally representative sample of primary healthcare facilities and communities
- Phase 4: All hospitals and primary health care facilities and a nationally representative sample of communities
- Phase 5: All healthcare facilities and all communities covered

EXECUTIVE SUMMARY

Timely and reliable information on deaths by age, sex and cause of death is essential for population health assessment and evidence-based health policy. The COVID-19 pandemic highlighted the critical paucity in the availability of such data for many countries worldwide. Also, it underscored the need for such data on a 'near to real-time basis, to guide health system actions for pandemic control. The Africa Centres for Disease Control and Prevention (Africa CDC) has developed and adopted a Continental Framework for strengthening mortality surveillance in the African Union (AU) Member States in response to these twin challenges.

Mortality surveillance (MS) is defined as the continuous systematic collection, analysis and interpretation of data on all deaths in a defined population or region. It involves tracking incidence and trends in mortality rates, causes of death, and other related factors to monitor public health, identify emerging health threats, and inform policy and intervention strategies. It also emphasizes collation of data from all available sources and rapid dissemination of the resulting analytical outputs on a continuous basis over specified time periods.

To support countries in developing national programs aligned with the Continental Framework, Africa CDC has prepared this Operational Guide, which describes specific activities across various domains of design and implementation of mortality surveillance. From a broad perspective, the Guide provides basic steps and instructions for the functions described in Chapter 4 of the Continental Framework document titled 'Steps in establishing a mortality surveillance system' but also refers to relevant information from other chapters of the Framework.

Chapter 1 of the Guide provides background information on various definitions, purposes of the guide and specifies some of the intended users and uses of this document.

Chapter 2 describes a generic model of the structure and organization of national mortality surveillance programs, along with guidance on the roles and responsibilities of individual stakeholders within an overall scheme of governance. Instructions are also provided for constitution of the national Coordination Committee and various Technical Working Groups (TWGs) that would lead the design and implementation.

Chapter 3 includes specific details of tasks that need to be undertaken to assess the range of existing mortality data systems within countries and for analysis and documentation of assessment findings in standardized reports to inform the development of the mortality surveillance system. This includes detailed instructions for assessment of each existing system from both design and data quality perspectives and a framework for evaluating strengths, weaknesses, opportunities and threats, which will provide an empirical basis for surveillance development.

Chapter 4 guides national teams in utilizing the findings from the systems assessments to develop an optimal system design, including the institutional network, tools and operational procedures for death recording, data management, and analytical functions.

Chapter 5 provides information on development of a national plan of action with options for a phased approach to implementation, including potential use of national sample-based mortality surveillance. There is also guidance on evaluation of resource needs and costing, as well as on approaches to data digitization and prioritization of indicators for data dissemination.

Chapter 6 guides on the adoption of data standards. The Africa CDC Health Information Exchange (HIE) standards for mortality surveillance data can help member states in their data collection, storage, and sharing practices with the standardized formats, protocols, and interoperability.

Chapter 7 describes the actions to be taken to establish a sound program for monitoring and evaluation of the surveillance program.

Several aspects must be considered when national teams refer to this Operational Guide. Firstly, this document is not prescriptive; it only provides generic guidance which must be adapted to country situations and needs. Also, national MS design and development must be based on maximizing utility of existing systems and resources, to avoid duplication and redundancy, and this aspect must be carefully considered at the stages of systems assessment and system design. Further, it is likely that in several countries, a core staff team might be involved in most of the steps in MS program development, without establishing separate teams for various functions as mentioned in this guide.

Finally, several templates and tools have been provided here, along with references to generic instruments for systems assessment or data collection developed by international agencies and development partners. These can be adapted and modified as necessary for national implementation. The Africa CDC Continental Framework and this Operational Guide should be used together as useful resources for strengthening mortality surveillance at national and regional levels in Africa.

I. BACKGROUND

Routine mortality surveillance is critical for timely detection of health threats and providing essential insights to understand, respond to, and combat threats to public well-being. By monitoring deaths in a population, public health authorities can quickly identify unusual patterns or increases in mortality rates that may indicate the presence of a disease outbreak.

Africa Centres for Disease Control and Prevention (Africa CDC) has published the Continental Framework for Strengthening Mortality Surveillance Systems in Africa (the "Continental Framework"). The Continental Framework establishes the principles for design and implementation of mortality surveillance and aims to guide all African Union (AU) Member States on adopting a strategic approach to develop their national mortality surveillance programmes based on country contexts.

The Continental Framework lays out three principal objectives that national-level stakeholders implementing mortality surveillance should aim to achieve:

- Harmonize death recording and reporting procedures across the multiple and parallel death recording systems in various government sectors including health, civil registration, and others.
- Integrate mortality data from fragmented systems into a central repository while ensuring electronic data management programmes comply with international quality standards.
- Strengthen health system capacity for routine data collection, analysis, and dissemination to inform public health policies and interventions.

A five-year roadmap was developed to make the various components of the continental framework for mortality surveillance easy to operationalize (Annex 5 of the continental framework). The roadmap is needed to provide a strategic approach to strengthening or establishing mortality surveillance systems in the AU Member States. It aims to provide a shared strategic vision, considering that countries are at different stages regarding mortality surveillance.

The roadmap is structured into seven (7) thematic areas, each with its overall objective and a set of action items that are necessary for an effective mortality surveillance system. The thematic areas include Leadership and governance; Advocacy/awareness raising; Policy and legal framework; Technical implementation; Workforce and capacity strengthening; Sustainability/resource mobilization and Monitoring and Evaluation.

An action plan template, with the thematic areas, strategic objectives and action items from the roadmap, was developed to guide AU Member States in developing their national strategic action plans for mortality surveillance. The action plan template also includes slots for activities needed to accomplish each action item, responsible authority and timeline.

1.1 What is mortality surveillance?

Mortality surveillance is the ongoing systematic collection, compilation, analysis, and dissemination of the incidence and cause of deaths in a population to inform action. The concept of mortality surveillance emphasizes the importance of routine monitoring and analysis of fact and cause of death data and disseminating the resulting information to Ministries of Health (MoH) and other stakeholders to enable timely interventions to public health threats continuously. Information from mortality surveillance is used to set priorities, plan programmes, and take actions to promote and protect the public's health. Information about death events can also serve as an early warning alert of Public Health Emergency of Continental Security (PHECS) to trigger a timely response.

1.2 Purpose of mortality surveillance

Timely all-cause mortality data is a critical element of epidemic surveillance and response. Information on deaths by sex, age and cause of death is essential for population health assessment, policy and programme evaluation, and epidemiological research. Therefore, mortality surveillance systems should provide information for both routine programming and epidemic preparedness and response in emergency settings. On a routine basis, the system should enable timely:

1. Recording and reporting of deaths
2. Analysis of the following:
    a. Fact of death and cause of death data
    b. Temporal and spatial clusters of death
    c. Emerging trends and patterns of death of potential surveillance interest
    d. Measuring excess mortality (mainly in emergency settings)
3. Dissemination and use of findings

1.3 Current gaps and challenges

Poor or inconsistent mortality data recording across multiple data systems (or even the absence of mortality data recording) account for most of the challenges in establishing mortality surveillance in AU Member States. Other key challenges affecting availability of mortality data include:

- Leadership and governance issues such as lack of clarity on institutional roles and responsibilities, absence of strategic plans, policies and, legal frameworks and data architecture frameworks
- Fragmented and siloed processes for data generation, storage, transmission & analysis coupled with a lack of harmonized tools, standards and guidelines
- Technical capacity for cause of death data collection
- Limited communication and use of the resulting information

Successfully implementing or strengthening mortality surveillance depends on ensuring appropriate coordination, assessment, planning, resourcing and collaboration across the different stages.

1.4 Intended Users of the Operational Guide

This Operational Guide aims to provide an instructional manual with tools and resources needed by MoH, National Public Health Institutes (NPHIs), or similar institutions responsible for coordinating the planning and implementation of mortality surveillance. This operational guide also aims to support the development and implementation of systematic and mortality surveillance where data capture and analysis is integrated as a key public health activity, alongside other public health programmes, civil registration and vital statistics (CRVS).

The target audience for this guidance includes epidemiologists, information system managers, public health and primary healthcare workers, policymakers (which can consist of public health officials), healthcare workers, researchers, and implementing partners at national, sub-national, regional and district levels. The guidelines may be applicable in different settings such as hospitals, primary healthcare facilities and communities.

1.5 Structure of the Guidelines

This Operational Guide is structured in seven sections, including annex at the end of the sections and is aligned to the recommendations of the Continental Framework. Chapter 1 provides an introduction to mortality surveillance, current gaps and challenges in the operationalization of mortality surveillance, the development of the Continental Framework to guide African Union member countries in planning for the establishment of mortality surveillance (MS) in their countries, and the introduction of this Operational Guide as a complementary tool to assist countries in their MS assessment and solution planning activities.

Chapter 2 provides guidance to countries on planning and coordinating to strengthen mortality surveillance systems. This section includes a discussion on governance mechanisms for all aspects of MS, constitution and roles of the Technical Working Group (TWG) and its various sub-working group, and the roles of various stakeholder institutions.

Chapter 3 discusses key considerations necessary for conducting a detailed analysis of the design and operational characteristics of existing systems/ sub-systems for death recording, data compilation and dissemination. This section also provides instructions for identifying and documenting each mortality data system's key strengths and weaknesses.

Chapter 4 guides the utilisation of findings from the systems analysis (Chapter 3) to design an overall MS solution for the country, including recommendations for institutional structure and organization and digitisation, inter-sectoral collaboration, operational procedures, and data management. Chapter 5 should help countries develop harmonized national strategies and action plans for implementing the MS system design. This includes but is not limited to establishing a five-year mortality surveillance development strategy, steps to be followed for the Implementation Stage, methods and expected outcomes from assessing the resource needs, procedures for MS system digitisation implementation and plans for resource mobilization.

Chapter 6 is dedicated to the adoption of data standards. This chapter provides information to member states on the adoption of the African CDC Health Information Exchange (HIE) standards for mortality surveillance data, as a reference for data privacy and sharing protocol, as well as

for data backup and archiving. This section also provides information on data analysis and assessment of resource requirements.

Chapter 7 provides guidance on mortality surveillance system monitoring and evaluation (M&E). In this section, a focus is put on monitoring the mortality surveillance design and implementation, which is the best way to monitor and report on the timely and satisfactory completion of each activity in the overall system design and implementation plan. Instructions are provided for each M&E topics, such as data quality assurance, data quality assessment, control and improvement, and sample indicators. The section also guides country teams in developing plans for budget allocation for monitoring and evaluation will be discussed in-depth in this section.

1.6 Development Process

This Operational guideline was developed through a collaborative and iterative effort involving various stakeholders and partners. The development process commenced with an initial scoping phase where key actors, including country representatives, public health experts, regional and international organizations, identified the need for comprehensive guidelines to enhance implementation of the continental framework for mortality surveillance. A multi-stakeholder TWG was formed and comprised subject matter experts, policymakers, and technical specialists. This task force, led by the Africa CDC engaged in an inclusive consultative process, soliciting input and feedback from a wide array of stakeholders, including public health practitioners, researchers, and civil society organizations. The identified stakeholders validated the draft operational guidelines in a meeting organised by Africa CDC. Their valuable insights and international best practices were carefully reviewed and integrated into the guidelines. The result is a set of implementation guidelines that reflect a collective commitment to strengthening mortality surveillance in Africa, underpinned by a robust partnership that promotes inclusivity and excellence in public health practice.

1.7 Conclusion

Achieving the objectives of the continental framework including harmonising data collection processes, integrating data from multiple sources into a central repository, and strengthening country capacities for routine surveillance requires a complex set of inter related processes that must happen to ensure accuracy, and effectiveness in collecting and analysing mortality data across diverse contexts.

This operational guideline has been developed to provide the intended users with the necessary tools and resources for enhancing the implementation of the principles and recommendations laid out in the continental framework. Africa CDC urges all African countries, partners, and stakeholders to adopt these guidelines to actively enhance their mortality surveillance systems.

II. PLANNING AND COORDINATION

2.1 Overall mortality surveillance leadership

A high-level commitment and leadership is crucial to establishing a sustainable national mortality surveillance program. Another key principle to be followed is that the program should be built on existing systems through a process of assessment, integration, and strengthening activities to ensure data timeliness and accuracy.

The government should take a decision to identify/nominate a lead institution to host the mortality surveillance programme. The nominated institution must have the official mandate and capacity to lead the mortality surveillance programme. Such official mandates may be the legal framework for CRVS, the National Public Health Law, or similar legal provisions. In some instances, an existing entity/institution may already perform similar functions, which could then be nominated to lead the programme.

The government must communicate this decision to all relevant agencies and stakeholders with clear instructions on the lead institution's terms of reference and role. These terms of reference may include

1. Identifying key stakeholders who will constitute the coordination committee. At the preliminary stage, these could comprise the core agencies associated with mortality data collection, compilation and analysis mentioned below. The committee could later be augmented by including other key stakeholders identified through the stakeholder mapping and systems assessment exercises.
2. Communicating to key stakeholders to nominate representatives to join the coordination committee
3. Coordinating meetings in the development of a national strategy for the design and implementation of the mortality surveillance programme
4. Serving as the secretariat for all administrative activities for the coordination committee and all other technical working groups to be constituted
5. Coordinating the operations of the national mortality surveillance programme
6. Mobilizing resources for the function and execution of decisions of the coordination and technical working groups

2.2 Formation of the national coordination committee

Through the lead institution, the national government should establish a broad-based governance and coordination structure led by a national coordination committee at both strategic and implementation levels. For this purpose, similar structures, e.g., national CRVS/Health Information System (HIS) coordination committees, could be leveraged to avoid duplication of efforts and resources.

The national coordination committee should have membership from various national ministries responsible for CRVS (Home Affairs, Health, and Local Administration) and other departments involved in death recording and data, such as the police and National Statistics Office. This committee should have overall responsibility at the strategic level for designing, implementing

and maintaining the mortality surveillance system. The committee will also have coordination functions at the technical/implementation level as the program progresses over time, for which there may be a need for a separate technical/implementation coordination working group.

The lead institution should convene the initial meeting of all nominated stakeholders who will form the coordination committees for the first meeting

The terms of reference for the national coordination committee will be formulated at the strategic level and would include:

1. Convening of stakeholders
2. Promoting inter-ministerial/intersectoral collaborations,
3. Advocacy and support to technical recommendations from working groups,
4. Budgeting, resource mobilisation and allocation
5. Engagement with international agencies and development partners to align with international standards for mortality surveillance.

A key function of the national coordination committee/s would be to generate a common understanding of the role, functions and benefits of MS across all stakeholders, and develop consensus on a strategic approach to developing the national MS program. The committee(s) will work towards developing consensus and agreement among stakeholders regarding governance roles, leadership, and responsibilities for coordination and implementation.

2.3 Formation of the national technical working group

A national TWG should advise the national coordination committee with several sub-working groups overseeing various MS functions and processes. The Technical working group should be composed of technical experts from the stakeholder agencies to oversee the overall programme design and implementation and users of mortality data (such as research institutions, technical support agencies, donors and development partners). The lead institution, which may be the department within the Ministry of Health responsible for surveillance/health information or the National Public Health Institute, should coordinate the national technical working group. The TWG should regularly report to the national MS coordination committee and have a mandate from these committees to support mortality surveillance in the country.

This TWG should develop detailed terms of reference (TOR) along with a list of specific roles, responsibilities and activities. The TWG TORs should include formation of sub-working groups to cover the following functions:

- Providing technical advice
- Oversight of the baseline assessment of the existing systems and capacities
- Establishing a national mortality surveillance strategy with attention to data standardization and data quality assurance, along with goals, objectives, and expected outputs
- Estimating resource requirements and potential funding sources, and ensuring investments are aligned with the strategy
- Obtaining stakeholder consensus during programme planning and implementation
- Monitoring the implementation of the mortality surveillance strategy, as well as the performance of the MS program during implementation, and reporting the findings from monitoring for review and corrective action

- Convening regularly to deliberate on key issues including the interpretation of findings from monitoring as well as surveillance data reports, and review of recommendations from various sub working groups.

In the composition of the TWG, the coordination committee may use table 1 below as a guide in identifying relevant agencies and institutions and their functions. Additional columns could be created for each other agency with a role/mandate for mortality recording and reporting.

Table 1: Matrix of roles and mandates for agencies

Steps	Agencies				
Roles/Mandates	MOH	NPHI	NSO	CRVS	Others
Detection of Death: Community					
Detection of Death: Health Facilities					
Reporting to Civil Registry					
Ascertain Cause of Death: Medically Attended					
Ascertain Cause of Death: Not Medically Attended					
Provision Cause of Death Coding					
Report Cause of Death					
Compilation of Data Collected					
Quality Evaluation & Control					
Analysis of Surveillance Data					
Interpretation & Documentation (Reporting)					
Evidence Dissemination					
Other					

The main technical working group will also constitute sub-working groups to oversee four technical areas:

- System analysis
- System design
- MS Implementation stages
- M&E

The above four technical areas are aligned with the steps/functions in establishing mortality surveillance, as described in the subsequent chapters of this Guide. Country teams could modify the need and/or terminology for sub-working groups to support the functions of the TWG, according to local circumstances. This could include assigning such tasks to existing technical support structures at national/local levels for other programs such as CRVS/HIS. This will avoid duplication of resources and efforts.

The technical committee may co-opt other relevant institutions and persons with needed expertise to join in the formation of these sub-working groups. Each sub-working groups will also develop its TORs outlining its role and responsibilities, further engage stakeholders and SMEs, and oversee and monitor activities in the specific technical area with planned timeline.

Additionally, each sub- working groups will ensure streamlined communications and coordination with other sub- working groups, including reporting back to the main working group regularly.

Figure 1 below depicts the overall leadership and coordination structure.

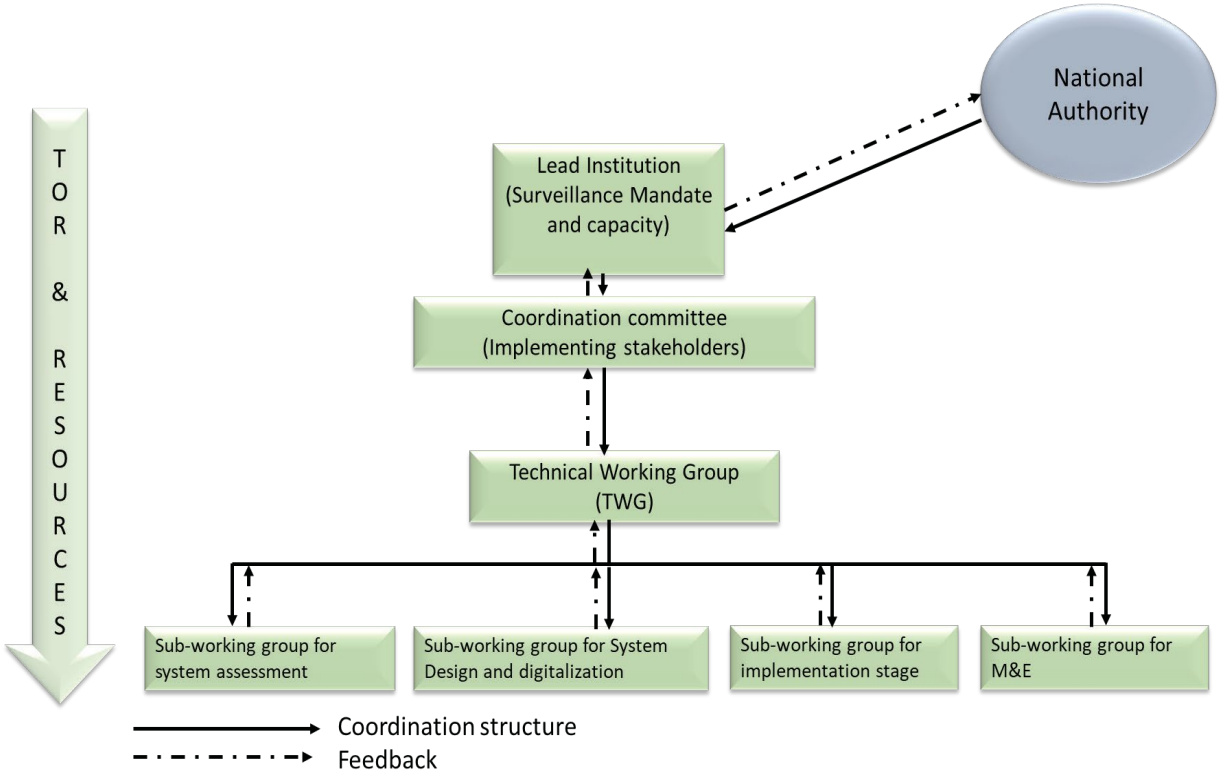

Figure 1: Overall leadership and coordination structure for mortality surveillance

III. MORTALITY DATA SYSTEMS ASSESSMENT

This section provides detailed guidance on assessing and analysing mortality data systems, identifying key performance issues and their associated root causes, and generating recommendations for redesigning the system to achieve improvements. The systems assessment will involve a series of activities, including data collection, compilation and analysis, which a designated core team of assessors will accomplish. This assessment team will be convened under the sub-working groups for mortality data systems assessment, which will include representatives from stakeholder institutions and supported by independent assessors.

The composition and tasks of this assessment team could be determined according to national context and availability of resources. This team will first review the mission, vision, core values, and strategic plans of the national and regional mortality data systems where these exist. The assessment team will then apply a standard framework to review the design parameters as well as a limited set of indicators to benchmark the current performance of each mortality data system. This will ensure that any redesign options are consistent with existing or intended national and regional strategies and priorities.

The assessment team will first undertake a document review and some key informant interviews where necessary to gather relevant information for each system. The review could also examine the availability and quality of mortality data from each source. Subsequently, a field visit may be conducted to validate and further elaborate on the performance issues and root causes identified. As the final step of this analysis stage, the assessors will identify and develop ideas to address the identified root causes of systemic issues that impact data availability. This will ensure that all systems are harmonized to support routine mortality surveillance functions and will meet the goals and objectives of the program.

More information on the (re)design process is provided in the next chapter. A report of the analysis will be compiled and presented to the TWG and the mortality surveillance Coordination Committee for review, comment, and endorsement.

3.1 Composition of assessment teams

The assessment team members should be drawn from various key stakeholder institutions within and outside government. These persons should have first-hand information about how their respective mortality data systems function in practice at the national, provincial, and local levels. All major stakeholder institutions should be invited to participate in the task teams. They may include:

- Relevant government agencies involved in the mortality data processes (CRVS, HIS, National Statistics Office (NSO), other relevant government institutions)
- Private sector institutions
- Non-governmental/civil society/other organizations working in this area
- Relevant international agencies and development partners
- Field implementing staff/stakeholders
- Academic institutions and researchers with recognized experience in relevant areas
- Civil society organizations (CSOs)

The task teams should be constituted according to approved communication protocols with national stakeholder institutions. In most countries, it will be necessary to contact the organizations and agencies involved in the systems that produce and use mortality data in the country and invite them to designate representatives with specific backgrounds and professional characteristics. The nominating institutions will be provided with a statement of the scope of work, terms of reference for participation in this assignment, and an anticipated time commitment duration.

The task teams should be organized into sub-groups with focussed tasks and attention pertaining to individual mortality data systems. Following the specific systems assessment, the team will reconvene to analyse the findings from the assessment and make recommendations for the proposed mortality surveillance program.

3.2 Documentation requirement for desk review

The assessment team should compile a set of documents pertaining to the design and operations of mortality recording and data systems within the country. These may include the following:

- Legal and policy framework documents, implementation rules and regulations, and any other part of the local legal framework that is directly or indirectly related to matters of mortality.
- Existing tools/forms used to record and report deaths in each system
- Standard operating procedures (SOPs) for personnel at each level of the mortality data system (e.g. CRVS, verbal autopsy (VA), health facility/community death reporting etc.)
- Current plans for mortality surveillance system rollout or improvement, such as current strategic action plan
- Reports, descriptions or evaluations of various mortality data systems published by government, non-governmental organizations, academia, or other sources.
- Available statistical reports from mortality data systems
- Other relevant documents

The document review aims to identify systems that record deaths in the country, along with their characteristics related to their design and performance. The key elements to be examined during the document review include:

- Business process for death recording, reporting, data compilation, storage, analysis and dissemination
- Policies that guide management and coordination of system operations
- Laws and regulations for implementation
- Availability of infrastructure, information technology and human resources

3.3 System design assessment

At first, the assessment team should identify all mortality data recording sources within the country. The following is a list of data sources that could be present:

1. Foundational Systems
    a. Civil Registration and Vital Statistics systems
    b. Routine Health Information Systems
        i. Health facility death reporting systems
        ii. Community death reporting systems
        iii. DHIS2, which may compile data from both facilities and the community
        iv. Information systems that compile data on causes of death
2. Systems that can complement the Foundational Systems
    a. Integrated Disease Surveillance and Response System (IDSR)
    b. Maternal and Perinatal Death Surveillance and Response System (MPDSR)
    c. Disease-specific surveillance programs (e.g. HIV/AIDS, TB, Malaria)
    d. Cancer registries
    e. Police reports/medico-legal cases
    f. Burial sites
    g. Morgue surveillance
    h. Mortality surveillance during outbreaks/rapid mortality surveillance (RMS) programs
3. Other data sources that provide data and/or ongoing data triangulation
    a. Health and Demographic Surveillance Systems (HDSS)
    b. Sample Vital Registration (SRS) System with verbal autopsy cause of death [e.g., Sample registration system methods with verbal autopsy (SAVVY), Countrywide mortality surveillance for action (COMSA)]
    c. Regular sample survey programs [Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), STEPwise approach to non-communicable disease risk factor surveillance (STEPS)]
4. National censuses are an important data source for population denominators, and NSOs also provide intercensal population projections/estimates. The availability of population data / estimates at national and sub national level should also be assessed.

Countries should first assess the foundational data systems since they are expected to compile mortality records continuously across age and gender. The following parameters should be examined during the assessment, and the findings recorded in Annex A:

a. List of variables recorded (check availability from the list in table 2). *Consider adequate if all essential variables in Table 2 are recorded. Countries could adapt this list to exclude cause of death as an essential variable, in case there are challenges in implementing protocols to record valid data for this variable*
b. Population coverage (if not across whole country, specify provinces, etc.)
c. Availability of individual record data
d. Timeliness of event reporting for surveillance purposes
e. Mandates/practices for sharing preliminary/provisional data for surveillance purposes
f. Frequency/periodicity of data reporting at local, district, province, regional and national levels for routine statistical purposes
g. Digitization capacity
h. Operational aspects
    i. Lead institution
    ii. Supporting institutions

iii. Coordination committee/technical working group
iv. Legal provisions [1]
v. Implementation rules and regulations [1]
vi. Infrastructure [1]
vii. Human resources [1]

The CRVS system is the optimal data source but can be constrained by reporting coverage, i.e. although legally mandated across the country, only some regions submit data/reports regularly. Also, the availability of individual record data could be a challenge where digital processes are not in place. In regard to the health sector, mortality information is often not compiled from private health facilities, and community death recording is not a systematic feature in many national health management information systems.

Also, causes of death should be recorded using the WHO International Form for Medical Certification of Causes of Death (MCCD), which should be coded and compiled according to the guidelines prescribed by the prevailing version of the International Classification of Diseases and Related Health Problems (ICD).[2] The assessments should examine these features and identify opportunities for interventions to address some of these gaps, which could significantly improve system performance.

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[1] United Nations Statistics Division. Handbook on Civil Registration and Vital Statistics Systems: Management, Operation and Maintenance - Revision 1. Mrkic S, Cobos MI, editors. New York: Department of Economic and Social Affairs: United Nations Statistics Division; 2018. Available from: https://unstats.un.org/unsd/demographic-social/Standards-and-Methods/files/Handbooks/crvs/crvs-mgt-E.pdf

[2] World Health Organization. International Classification of Diseases and Related Health Problems (ICD) Geneva. 2023 [Available from: https://www.who.int/standards/classifications/classification-of-diseases.

Table 2: Variables required for a mortality surveillance program

Category		Variables	Remarks
ESSENTIAL VARIABLES	Identity/demographic data	• Name(s)[3] • Date of birth / Age • Sex • Address of usual residence • National ID number (if available)	• Full names • Age in completed years • Complete address
	Event data	• Date of death occurrence • Address of occurrence • Place of death (home/hospital) • Name of hospital • Date of registration in civil registry	• Verify date/month of death and death registration • Complete address • Name of institution
	Causes of death	• Medically certified death (yes/no) • If yes, data from MCCD (multiple causes with duration for each cause) • Verbal autopsy CoD • The family lay reported CoD	• Data entry of complete MCCD forms • Specify source of VA diagnosis (physician/computer)
OPTIONAL VARIABLES	Other health related data	• Variables to facilitate in-depth epidemic mortality surveillance such as diagnostic confirmation, vaccination status, and access to health care during terminal illness, among others	• This would require additional data collection from health information systems, where available

[3] Names are collected in the RMS only for verification purposes, especially when collating death records for the reference population from parallel data sources

When assessing the complementary mortality recording systems, it should be borne in mind that there may be some variations in the scope and level of detail of information recorded in them. While the variables of interest for mortality surveillance (table 2) must be the same for these systems too, the additional parameters that need to be examined are as follows, and the findings should be entered in Annex B:

1. Age and Sex groups covered by the system
2. Availability of individual-level records
3. Prospective and continuous death recording
4. Compatibility with standard data collection protocols for death recording (e.g. CRVS, ICD)
5. Nationwide or nationally representative population samples
6. System sustainability (organizational structure, capacity, resources)
7. Linked to CRVS/potential mechanisms for linkage
8. Data security and confidentiality
9. Digitisation of individual death records

Assessment teams might encounter challenges in obtaining all the above information from a single reliable source document for several of these complementary systems. In this case, there may be a need to directly engage with key informant stakeholders at either national or local level for deriving the required information. One particular aspect is that there may be limited access to individual record data at regional or national levels. The assessment team should explore the potential for such records to be available from locally maintained disease surveillance registers and the possibility of the mortality surveillance program acquiring such data, which might be facilitated by data digitization.

The third category of data sources offers limited potential to support mortality surveillance programs directly. However, they can contribute in terms of exploring different data collection strategies, or by providing information on deaths that could be used to triangulate/ validate information from the basis systems. For HDSS programs, the assessment team should evaluate the potential for linkage with local CRVS and/or health information systems.

In countries where Sample Registration Systems are in place or are under consideration, the assessment team should examine the design features relevant to the basis systems and identify opportunities for linkage with CRVS within the system design.

3.4 System performance assessment

The performance of mortality data systems needs to be assessed in terms of the adequacy of each of its functions. Essentially, an efficient mortality data recording system should identify and record a death event as soon as it occurs, notify the event to the responsible local authority, ensure accurate ascertainment of the cause(s) of death, and transmit the death record to the national mortality surveillance system. The system should utilise standard data recording tools with all relevant variables, and implement appropriate processes for digitization, transmission and compilation. Finally, the system should apply standardised protocols for data analysis, dissemination and use. The performance of the data system for each functions should be quantified through an indicator that measures current status as a proportion of an ideal / benchmark score.

Table 3, adapted from the Continental Framework, lists these core functions of mortality surveillance with some activity descriptions and sample indicators to be used for performance assessment. The assessment team should evaluate each system for these core functions according to the sample indicators, and enter the score findings for each indicator in Annex C.

The sample indicators used for some functions have specific data requirements. For example, the indicator for detection and recording is based on estimating the expected number of deaths in a given population over a defined period, which can be calculated using background information on the estimated crude or age specific death rate for the targeted population.

The prescribed timelines for notification of the instance of death under the IDSR program are 24 hours for facility deaths, and 48 hours for community deaths. In specific epidemic situations, there could be guidance for immediate notification to the mortality surveillance system as soon as the event is detected, without waiting for the permitted 24-hour or 48-hour interval. In addition to death notification to the mortality surveillance system, the assessment team should review the notification performance according to the timelines for routine death reporting to the CRVS or health information systems.

An important aspect of performance assessment is the review of existing data from each mortality data system, in terms of the potential to analyse mortality by person, place and time. Such performance assessment in terms of data quality as well as potential to generate mortality outcome indicators could be performed using a range of available data analysis tools.[4] This will indicate the system performance in terms of its data production and utility.

The activity descriptions and sample indicators of the other core mortality surveillance functions are self-explanatory. Still, additional information is available from the reference resources provided at the end of this section. Such performance assessment would need to be conducted for each mortality data source considered for inclusion in the mortality surveillance system.

3.5 Systems analysis

The assessment team should convene a workshop to review the findings documented from the mortality data systems assessments in Annexes A and B. The review should follow the methodology of Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis with the results entered into the table 4.

It is recommended that the SWOT analysis should be undertaken only for the two foundational systems. This will guide the decision on nominating the preferred foundational system to serve as the primary platform for the overall mortality surveillance program, along with the integration of mortality records from the other foundational and complementary systems.

The findings from the design and performance assessments for the complementary and other mortality data systems could be utilized to inform the potential mechanisms that could be developed for including their mortality records into the mortality surveillance program.

[4] Mortality data quality assessment and analysis tools

a. https://www.who.int/standards/classifications/classification-of-diseases/services/analysing-mortality-levels-and-causes-of-death
b. https://score.tools.who.int/tools/count-births-deaths-and-causes-of-death/tool/analysing-mortality-levels-and-causes-of-death-anacoda-121/
c. https://www.who.int/standards/classifications/classification-of-diseases/services/codedit-tool

Table 1: Sample indicators for performance assessment of a mortality data/surveillance system

Core system/surveillance functions	Activity Description	Sample indicator
Detection and recording	Identify and record all death events occurring both in the health facility and community	Proportion of expected deaths in a defined time period that have been detected and recorded
Notification	All recorded deaths should be notified to the next level of the mortality surveillance system	Proportion of deaths that have been notified to the next level
Timeliness of Notification	Immediate case-based reporting to the next level to flag the event and trigger follow up actions.	Proportion of deaths notified within the prescribed timelines to the mortality surveillance system
Assign Cause of Death (CoD)	Review facility deaths to certify COD Conduct VA interviews for community deaths to determine probable CoD	• Proportion of deaths certified with MCCD • Proportion of community deaths with VA interviews conducted
Submission of CoD data	Submit the cause of death data collected to the next level	Proportion of deaths in the mortality surveillance system with cause of death from MCCD/VA
Data quality assessment	Evaluate the completeness and accuracy of mortality data	• Completeness: Proportion of estimated deaths in the population that have been notified to the MS system • Accuracy: Proportion of deaths assigned ill-defined causes (<10%)
Analysis	Perform epidemiological analyses of the reported data and interpret them to inform interventions	Proportion of reports over the past two years showing evidence of analysis by person, place and time
Dissemination	Sharing of information with data producers as well as users on a periodic basis	Proportion of reports published over the past two years according to mandated frequency for the specified mortality data system
Monitoring and evaluation	Availability of documented M & E framework	Yes/No

Table 2: SWOT tool to be used for analysis of design and performance of foundational systems

N^{O}	Strategic Area	Strengths	Weaknesses (Existing Gaps)	Opportunities	Threats
1	Leadership and governance				
2	Policy and legal framework				
3	Advocacy and awareness raising				
4	Staffing and capacity building				
5	Technical feasibility				
5.1	Community death reporting				
5.2	Health facility death reporting				
5.3	MCCD				
5.4	Civil registration of deaths				
5.5	Routine mortality data analysis (community and facility levels)				
5.6	Mortality surveillance during outbreaks and recovery period				
5.7	Dissemination and use of routine mortality data				
5	Monitoring and Evaluation				
6	Verbal autopsy				

3.6 Finalize the systems assessment report

The assessment team should draft and present the report to the TWG for validation. Assessment report template is provided in Annex D[5]. After vetting it, the TWG should present the report to stakeholders at a workshop to obtain their views. The report should be modified based on key stakeholder input and then finalized as needed. The core team should submit the finalized report to the TWG for final approval, and the approved report should go to the High-level Interagency MS Coordination Committee for endorsement.

[5] Mrkic S, Cobos MI, (Eds). Evaluation of the quality of civil registration and vital statistics systems. Handbook on Civil Registration and Vital Statistics Systems: Management, Operation and Maintenance - Revision 1. New York: Department of Economic and Social Affairs: United Nations Statistics Division; 2018. p. 72-101. Available from: https://unstats.un.org/unsd/demographic-social/Standards-and-Methods/files/Handbooks/crvs/crvs-mgt-E.pdf.

ANNEX A: Mortality surveillance systems design assessment (1)

Type of mortality surveillance system	System exists (Yes/No)	List of variables recorded (Adequate / inadequate)	Population coverage (Total/partial /representative)	Availability of individual record data (Yes/No)	Mandates/practices for sharing with CRVS/ HMIS (Yes/No)	Frequency/periodicity of data reporting (Weekly /Monthly/ Quarterly/Annual)	Digitization capacity (Yes/No)
Civil Registration and Vital Statistics (CRVS)							
Health Management Information System (HMIS)							
Health and Demographic Surveillance System (HDSS)							
Countrywide Mortality Surveillance for Action (COMSA)							
Maternal and Perinatal Death Surveillance and Response (MPDSR)							
Child Health and Mortality Prevention Surveillance (CHAMPS)							
Morgue / burial site surveillance							
Integrated Disease Surveillance and Response (IDSR)							
Rapid mortality surveillance (RMS) systems							

ANNEX A: Mortality surveillance systems design assessment (2)

Type of mortality surveillance system	Lead Institution (Name)	Supporting Institutions (Names)	Coordination Committee (Yes/No)	Legal Provisions (Adequate/inadequate)	Implementation rules/regulations (Adequate/inadequate)	Infrastructure (Available/not available)	Human Resources (Adequate/inadequate)
Civil Registration and Vital Statistics (CRVS)							
Health Management Information System (HMIS)							
Health and Demographic Surveillance System (HDSS)							
Countrywide Mortality Surveillance for Action (COMSA)							
Maternal and Perinatal Death Surveillance and Response (MPDSR)							
Child Health and Mortality Prevention Surveillance (CHAMPS)							
Morgue/burial site surveillance							
Integrated Disease Surveillance and Response (IDSR)							
Rapid mortality surveillance systems (RMS)							

ANNEX B: Mortality surveillance system attributes and readiness

Type of mortality surveillance system	Attributes and readiness for basis mortality surveillance system								
	Universal/All cause	Individual Level	Prospective	Continuous	Timely	Nationwide/nationally representative	Sustainable	Linked to CRVS	Secure & confidential
Civil Registration and Vital Statistics (CRVS)									
Health Management Information System (HMIS)									
Child Health and Mortality Prevention Surveillance (CHAMPS)									
Health and Demographic Surveillance System (HDSS)									
Countrywide Mortality Surveillance for Action (COMSA)									
Maternal and Perinatal Death Surveillance and Response (MPDSR)									
Rapid Mortality Surveillance (RMS)									
Integrated Disease Surveillance and Response (IDSR)									
Others									

ANNEX C: Systems performance assessment

	Performance scores (%)									
Type of mortality surveillance system	Detection and recording	Notification	Timeliness of Notification	Assign CoD	Submission of COD data	Data completeness	Proportion of ill-defined causes of death	Analysis	Dissemination	M&E Y/N
Civil Registration and Vital Statistics (CRVS)										
Health Management Information System (HMIS)										
Child Health and Mortality Prevention Surveillance (CHAMPS)										
Health and Demographic Surveillance System (HDSS)										
Countrywide Mortality Surveillance for Action (COMSA)										
Maternal and Perinatal Death Surveillance and Response (MPDSR)										
Rapid Mortality Surveillance (RMS)										
Integrated Disease Surveillance and Response (IDSR)										
Others										

*For the assessment of the performance, please ensure that indicator for the function meet the required criteria mention in the Table 3

ANNEXE D: Outline for mortality data systems assessment report

Background

Objectives of the assessment exercise

Approach and methodology for the assessment

- Document review
- Key informant interviews
- Field visits / focus group discussions
- Analytical workshops

Assessment team composition

- Relationship with sub-working groups for systems assessment
- Any sub-working groups formed for
    - CRVS assessment
    - HMIS assessment
    - Other systems

Schedule of activities with timelines

- Systems review
- Systems analysis
- Final workshop for synthesis and dissemination of final report

Assessment findings

- Brief narrative report on CRVS systems design and performance according to the parameters provided in Operational guide, with summary findings entered in the Annexes A and B
- Brief narrative report on all health sector information systems (HMIS, DHIS 2, disease programs etc.) systems design and performance according to the parameters provided in Operational guide, with summary findings entered in the Annexes A and B
- Narrative summarising all complementary and other sources, with findings entered in Annex A and B

Systems analysis

- Convening of analytical workshop attended by all members of assessment team and other relevant stakeholders (host institutions for systems, academic partners, government decision makers, international agencies)
- Discussions for SWOT analysis for CRVS and Health sector, including entering findings in SWOT template for each
- Decision on which system could serve as primary platform for mortality surveillance system
- Defining the host institution within the preferred primary MS platform, which will serve as the data repository as well as perform the functions of data compilation, quality assessment, dissemination, and use (including feedback to all data contributing partners)
- Recommendations for activities/interventions to strengthen the primary platform as well as the other basis system, to improve the potential data quality, timeliness etc

- Discussions on mechanisms for linkage between the two basis systems to ensure direct inclusion (Integration) of records, with appropriate electronic linkage and protocols for de-duplication
- Guidance on mechanisms for data submission and flow within primary data systems as well as to the repository hosting the mortality surveillance system
- Decisions on potential mechanisms for the mortality surveillance system to acquire mortality records from all complementary and other data systems
- Guidance on data quality checks, monitoring and evaluation at institutional level as well as across the hierarchy of data flow within institutions and into the mortality surveillance system repository

System report recommendations

- Recommend the need for a final business process model/map for the mortality surveillance system, which includes relevant information on institutions, personnel, clearly defined roles, processes for data flow, data repository
- Recommendations for technical support for stakeholders to develop SOPs for all above functions
- Nomination of academic and other technical institutions who will undertake capacity building for all mortality surveillance activities within their areas of jurisdiction
- Recommendations on timelines for developing the final system design, schedule for implementation, and expected time frame for delivering a 'proof of concept' for production of required mortality surveillance outputs for a defined pilot study population

The assessment report should provide information on the following:

- The basis system for mortality surveillance implementation may be either HMIS or CRVS system. The strength of the system influences the decision based on the assessment findings.
- The assessment will identify the gaps in both the CRVS and mainly the health system.
- The decision on which system to strengthen will be based on the resources available, time available and the feasibility of the interventions to strengthen the system.

IV. RECOMMENDATIONS FOR DESIGN OF MORTALITY DATA SYSTEMS

The assessment report should have identified the foundational system to consider for mortality surveillance implementation, which may be either HMIS or CRVS system. The strength of the system influences the decision on the foundational system based on the assessment findings, the resources available, and the feasibility of the interventions to address any remaining gaps in the apparently stronger foundational system. Ideally the stronger system (CRVS or HMIS) should be strengthened in all aspects while the weaker system is strengthened in data linkage and sharing across the two systems. Also, it is desirable that the stronger system with the mandate for mortality surveillance should host the data repository. However, a memorandum of understanding (MOU) for data sharing among all death data systems (complementary systems) should be established.

The next step would be to develop the formal design of the mortality surveillance program. This should incorporate the two foundational systems (CRVS and HMIS) and potential mechanisms for linkage and data sharing with complementary and other mortality data systems identified and reviewed during the assessment. This mortality surveillance system design will need to be accomplished by the assessment team supported by a separate team of experts who will be convened to function under the TWG sub-working group for Systems Design and Digitalization. The composition of this committee could include the following:

- Technical experts from both CRVS and the health sector with knowledge and field experience
- Individuals with expertise in planning and coordination
- Government decision-makers who could take forward the consensus built within the group into advocacy and action, through policy and process
- Legal experts who can advise on alignment with national legal provisions for mortality recording, data security and confidentiality
- Data analysts who can advise on aspects of data quality assurance and control to be built into the design elements of the surveillance program
- Academic and research institutions who could advise on capacity building, protocols for data dissemination, and data use
- Information technology specialists who have knowledge of data systems architecture and can advise on adaptations to existing systems rather than create new infrastructure

The terms of reference for the sub-working group are as follows:

- Review the systems assessment report and make decisions on the MS system design
- Assign responsibilities to committee members to various tasks for development and implementation of interventions
- Establish timelines for completion of tasks
- Schedule feedback sessions for review and consensus building
- Prepare the final system design report for advocacy and implementation

4.1 Specific activities and tasks

The assessment team supported by other experts will:

1. Review the assessment forms and the SWOT analysis to determine the gaps and weaknesses in the fundamental systems that need attention
2. Design interventions to strengthen basis system functions for mortality recording and processing. The following tool could be used to guide this task, which includes some examples of systemic gaps and potential interventions (Table 5)

Table 5: Examples of systemic gaps and potential interventions for core mortality surveillance functions

Function	Gap	Intervention
Detection and recording	• Missing variables of forms • Lack of knowledge in field workers • Duplication of forms across different programs	• Rectify/standardise single form • Capacity building programs • Harmonization for single point data reporting for all systems
Notification	• Incomplete filling of forms • Lack of clear reporting channels • Forms not submitted by local offices	• Capacity building • Develop/adapt SOP for correct reporting channels • Monitoring of submission
Timeliness of notification	• Absence of timelines or non-adherence to prescribed timelines	• Define timelines • Feedback mechanisms to improve timeliness
Assign CoD	• Lack of standard tools • Inadequate personnel • Partial/poor quality MCCD/VA	• Adapt available standard tools e.g. WHO • Resource allocation • Capacity building
Submission of CoD	• Incomplete/irregular data submission	• Monitoring and feedback to improve performance
Data quality assessment	• Lack of resources or capacity for analysis of data quality	• Allocation of technical resources and human capacity building
Data Audit	• Lack of resources or capacity for data audit	• Allocation of technical resources and human capacity building
Analysis	• Insufficient technical capacity for epidemiological data analysis	• Development of a reporting template specifying indicators of interest • Capacity building
Dissemination	• Absence of dissemination frequency/non-adherence to prescribed timelines	• Establish dissemination frequency schedule • Monitoring and feedback on dissemination practices

3. Establish the business process for the core functions of the mortality surveillance systems, covering death reporting from health facilities, communities and other locations (e.g. accident sites, public places etc.). Figure 2 provides a generic depiction of the processes for death recording and data compilation within a district.

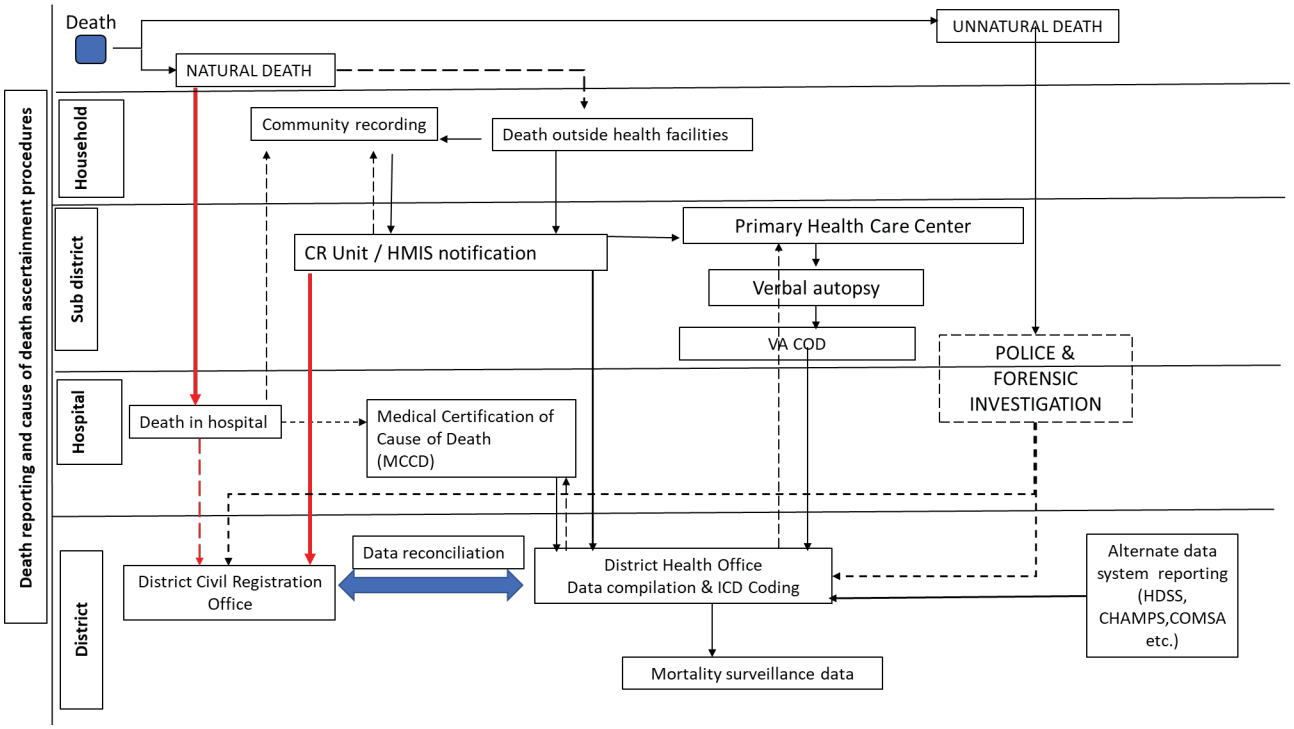

Figure 2: Generic flow chart depicting processes for death recording, cause of death ascertainment and data compilation at different levels within a district

The diagram shows the functions of death reporting for events outside health facilities, which are notified to local civil registration or health sector units at the first level (which could potentially be the sub-district). The event may be further investigated to ascertain the cause through verbal autopsy, usually handled by the government primary health care centres, and the completed death records with verbal autopsy diagnoses are compiled across all sub-districts by the district health offices.

In parallel, community death recording practices could require notification to local civil registration units located at village, sub-district or district levels. For events that occur in health facilities, the reporting processes could be three-fold; i.e. directly to the district health office; or reported back via the household for community-based death recording (as for deaths outside health facilities); or directly to the respective civil registration unit at sub-district or district levels. It is expected that the systems design team would investigate and develop a consensus on the most appropriate reporting channels for deaths at the local level, to cover those in health facilities, the community, and those that are considered unnatural deaths that require medico-legal attention.

Where local procedures involve reporting through both civil registration and health sector channels, there might be a need to establish a process for periodic data linkage across the two sources, with identification and elimination of duplicated events. The final reconciled dataset could be used for mortality analysis to derive surveillance analytical outputs of age, sex and cause-specific mortality indicators by person, place and time.

4. Once the design team has established consensus around the business process model for death reporting and data compilation at the district level, the team should define the following:
    a. Designation and role of community level notifiers (e.g. community health worker, volunteer etc.)
    b. Designation and role of any local event endorsement authority (village headman, local police etc.)
    c. Designation of the registration unit at sub-district level (Civil Registration (CR)/HMIS); including designation of responsible staff for this function
    d. Designation of health centre staff who will need to conduct VA
    e. Responsibility of hospital physicians in certifying death and the cause of death
    f. Responsibility of hospital directors in ensuring data submission to the civil registration authority and/or the district health office
    g. Designation and responsibilities of local police authorities for investigation and reporting of unnatural deaths
    h. Define responsibilities and duties of District Registration Office, and designation of responsible personnel
    i. Explain functions for data reconciliation between District Health and Registration Offices
    j. Define responsibilities and duties of the District Health Office, including nomination of personnel for data compilation, ICD coding, statistical analysis, data submission

The description of the above operational and functional elements of the mortality data recording and compilation activities at the district level would then serve as a basis for the system implementation team to develop SOPs for each of these functions, along with relevant training materials, capacity-building programs, and monitoring and evaluation protocols for these functions.

4.2 Developing the tools and timelines for death detection, recording and reporting

At community level, a standard death notification form aligned with the official CRVS form should be used. Attention should be paid to updating the form if any essential variables are unavailable. The completed death notification form must be submitted to the local authority at the sub-district level within the stipulated timeline set by the mortality surveillance system (48 hours for community deaths).

The sub-district authority should make an entry in a community death register with follow up submission of the death notification form to the District Civil Registration Office, where the death notification should be computerised. Alternatively, the computerization could be accomplished at the sub district level. The national system design team would need to plan and develop the reporting tools and processes as per the availability of resources, ensuring that death recording and data computerisation is accomplished with sufficient accuracy and efficiency.

For community deaths requiring verbal autopsy, local adaptation of WHO VA instruments would need to be developed and implemented by trained local personnel from primary health centres

(using preferably electronic hand-held tools) within a period of 4 to 6 weeks after the death occurrence, with onward data submission to the District Health Office.

Facility deaths should use the same official death notification forms and the national adaptation of the WHO MCCD form and be reported within 24 hours of occurrence. Where feasible, health facilities should computerize death records and submit electronic data. The digitization protocol for the mortality surveillance program should develop and supply relevant electronic tools/hardware/software to the field staff/institutions to enable efficient data capture and transmission.

4.3 Define the network of institutions and their roles

The system design should include the establishment of a district mortality surveillance coordination committee, which will facilitate program implementation and oversee operations regularly. The committee would consist of membership from relevant local stakeholders from CRVS, health departments, and complementary mortality data systems to ensure efficient data linkages, timely data sharing, and other data quality assurance and control functions. The roles of the committee and its members might be more intensive during the design and initial implementation phase, and should foster institutionalisation of procedures during maintenance. The committee should also develop a sustainability plan and establish surge capacity for surveillance operations during sudden emergencies and epidemics.

The mortality surveillance function should be designed to operate alongside the routine primary data compilation program at the district level. In other words, a separate function would need to be established to periodically access data from the District Health Office to prepare the mortality surveillance report per prescribed timelines. Based on availability of resources, this mortality surveillance function could be designed as an additional role to be performed by a staff member or unit within the District Health Office with similar responsibilities.

4.4 Develop data transmission pathway and linkages

The system design should define the pathways and protocols for mortality surveillance data submission from local to national level, along with designation of institutions and personnel with their duties and responsibilities. Figure 3 shows a national data flow pathway for data compilation, analysis and dissemination at each level. Although the diagram depicts the incorporation of data from alternate reporting systems (e.g. HDSS, CHAMPS etc.) only at the district level, there may also be some alternate data sources from where mortality records might be available at higher levels e.g. insurance databases, inter-province migrant population events, or deaths in foreign locations.

The diagram also depicts the requirement for production of surveillance reports at each level, and for this, the system design team participants from academic institutions would need to develop relevant training programs, analytical tools, and reporting templates for this function.

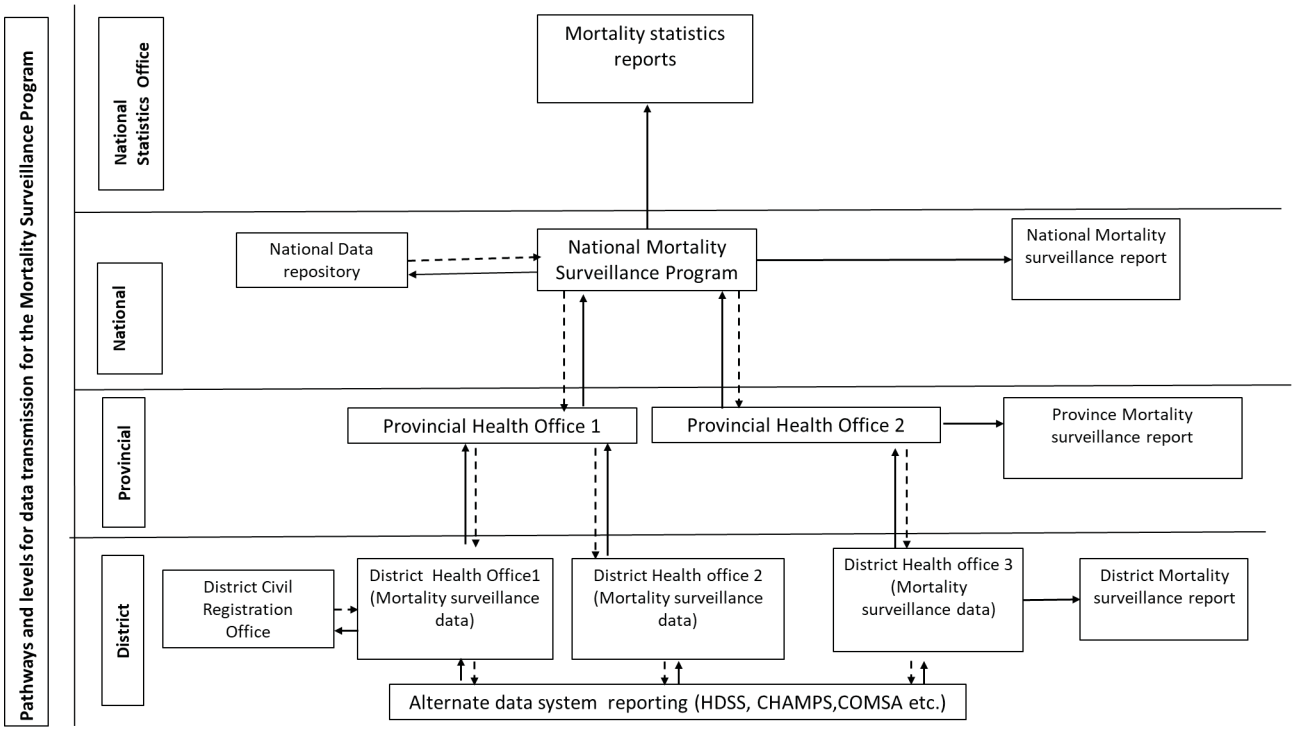

Figure 3: Pathways and levels for data transmission for the mortality surveillance programs

The information on the mortality data will be stored at different levels of the system and utilized in data cleaning, validation, and analysis. Individual data sources will be responsible for digitising individual mortality records, including all (or as many as possible) essential variables for each record. This could be done through direct digitization at the point of record capture, or subsequent data entry from paper-based records, depending on existing procedures.

- The characteristics of digitisation processes for each data source will be noted during the systems assessment activity, along with recommendations to strengthen any gaps or limitations.
- In particular, local mortality recording systems that only report aggregated data should be upgraded to ensure recording and reporting of all essential variables for each identified death
- In case of paper-based recording, responsible stakeholders will be encouraged to enhance system efficiency through electronic data capture at the periphery with protocols for data transmission and compilation at higher levels e.g. (district/province etc.)

The surveillance program should nominate a specific agency that will design and host a mortality surveillance database for data management, analysis, storage and dissemination.

In design, the mortality surveillance database will essentially import and incorporate primary mortality records provided from each data source in an electronic format periodically, with relevant procedures for data integration across sources (including verification, removal of duplicates, and final compilation); data analysis, and dissemination.

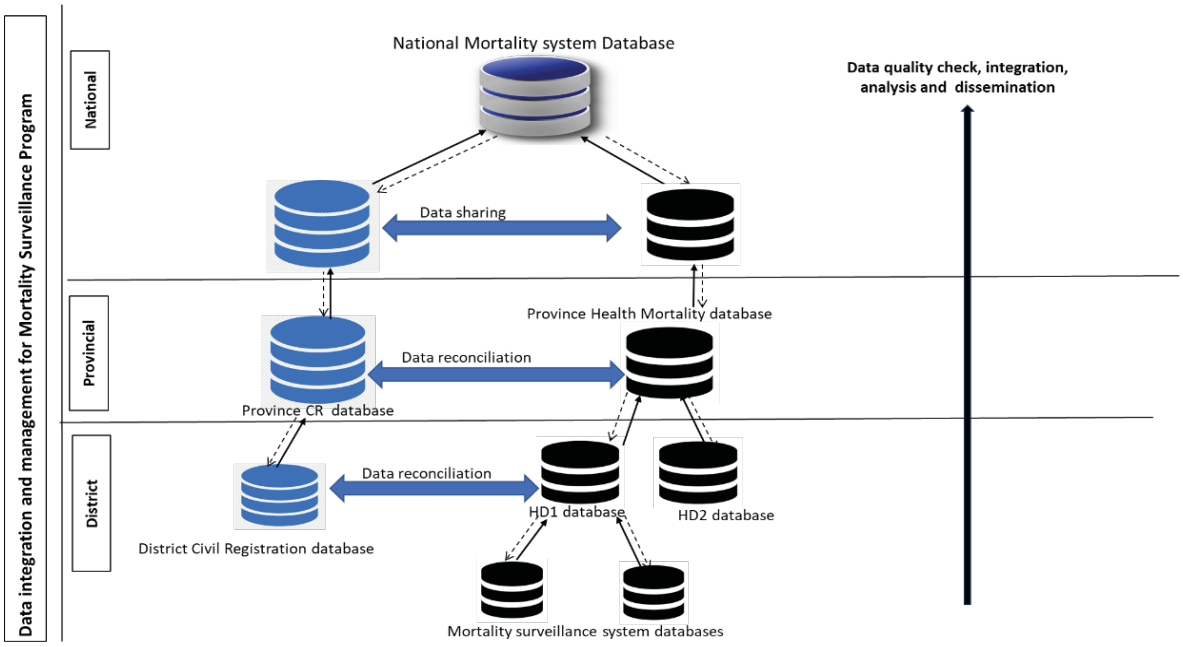

Figure 4: Structure of mortality surveillance data management

The surveillance database design should also include tools for data quality assessment and feedback mechanisms to primary data sources for quality assurance and control. The surveillance database could be designed to operate at central/regional/provincial/district level, depending on the overall surveillance program design for data recording, compilation and flow (see figure 4).

Specific details of database design, tools, and analytical functionalities could be developed by country mortality surveillance teams, which should include information technology specialists to advise and be responsible for these technical specifications. As the system evolves with an enhancement of digital systems across primary data sources, the mortality surveillance platform could be strengthened to establish direct systems interoperability with primary data sources to create a seamless and simultaneous data capture, integration, analysis and dissemination cycle.

4.5 Design features for data quality assurance and evaluation

The system design should incorporate features at the field level for supervision, monitoring of performance, and review of data quality in completed forms. The specific aspects of data quality at the point of data capture should be emphasised in training programs and supporting implementation guides and standard operating procedures for each function. The financial resources for field supervision and monitoring should be accounted for in program budgets at the local, sub-district, district and national levels.

All electronic tools should include specific design features for quality assurance in the form of appropriate range checks and logical checks for specific fields, and these should be developed

in collaboration with the digitization team. Similarly, the system design team should also guide the development of specific electronic tools and dashboards for data quality monitoring and data management, which should be designed as built-in features of the electronic mortality surveillance tools and databases.

4.6 Population coverage, personnel requirements and resources

The system design team would first decide the population the mortality surveillance program will cover. Where basis systems are yet under development, or adequate financial, technical or human resources may not be available, the team would need to decide on some form of partial population coverage across the country, the selection of which could be according to parameters such as national representativeness, availability of resources, or according to specific areas for which there is an urgency of need for data. Where partial population coverage is necessary, it is recommended that the primary population cluster should be at the district level for administrative ease in implementation.

Table 6 below provides some guidance on the likely workload in terms of estimated numbers of deaths that would need to be recorded in the surveillance program, which vary according to potential population sizes of districts.

The table 6 presents four scenarios of district population sizes, varying from a quarter of a million to a million people.

Table 6: Estimated numbers of deaths recorded in a mortality surveillance program

Population	Deaths per year	Deaths per month	Deaths per week	Deaths in all health facilities (20% MCCD /week)	Community deaths requiring VA /week	Primary health centres (1 PHC / 25,000 pop)	Number of VA / PHC per week
1,000,000	8000	667	154	31	123	40	3
750000	6000	500	115	23	92	30	3
500000	4000	333	77	15	62	20	3
250000	2000	167	38	8	31	10	3

The assumption used for getting these results can be summarized as followed:

- 8 deaths per 1000 population
- 20% hospital deaths
- 8 primary health centres per 250,000 population

For example, in a district with a population of 500,000, a crude death rate of 8 per 1000 population would result in 4000 deaths each year, which translates into 77 deaths per week. Of these, about 20% would occur in

all health facilities within the district, where they would be notified along with a MCCD. The remainder of cases would need verbal autopsies, which would be distributed across the expected 20 primary health centres in the district (assuming 1 PHC per 25,000 pop), resulting in a VA workload of 3 cases per week.

These estimated numbers of deaths in community/facility/estimated cases of VA per week in health Centre areas etc., could be used by the implementation team to estimate resource needs, capacity building load, and other administrative functions for implementation.

In summary, the system design should provide guidance on the planned population coverage of the mortality surveillance program, along with the identified population clusters, which the implementation planners would then use for their tasks.

4.7 Surveillance timelines and analytical functions at each level

The system design should prescribe specific timelines for data reporting and submission across the different levels of the system. Table 7 illustrates some timelines that could be applied for functions such as death notification, cause of death ascertainment and reporting, and data analysis and dissemination.

The prescribed timelines for death notification for both facility and community deaths must be strictly followed. However, as can be seen, varying timelines could be applied for medical certification for facility deaths and verbal autopsy, depending on the availability of resources and skilled capacity. All these timelines would need to be specified in the implementation guides, SOPs and training materials for each function.

Table 7 also indicates the nature of epidemiological analysis that would need to be undertaken at district, province and national levels, along with a recommended periodicity of release of analytical reports. These design features would guide the planning and provision of relevant resources and capacity for data analysis and dissemination.

Table 7: Mortality Surveillance function and timelines at each level of the surveillance system

FUNCTION	ADMINISTRATIVE LEVEL					
	Community level	Health facility	Sub-district	District	Provincial	National
Detection and recording	Detect and record within one week	Detect and record within one week	N/A	N/A	N/A	N/A
Reporting timeline (fact of death)	Within 48hrs to subdistrict	Within 24hr to district	Within 48 hr to district	Within one week to provincial level	Within 1 week to national level	Within 1 month to Africa CDC
Reporting timeline (cause of death)	N/A	Within six week to district level	N/A	Within one week to provincial level	Within 1 week to national level	Within 1 month to Africa CDC
Reporting timeline (Verbal autopsy)	N/A	N/A	Within four weeks to district level	Within four weeks to provincial level	Within 1 week to provincial level	Within 1 month to Africa CDC
Analysis	N/A	• Descriptive (Person, place and time) • Cause of death	N/A	• Descriptive (Person, place and time) • Cause of death	• Descriptive (Person, place and time) • Cause of death	• Descriptive (Person, place and time) • Cause of death
Dissemination	N/A	Monthly	N/A	Weekly	Weekly	Weekly
Inform Decision		Inform decision	N/A	Inform decision	Inform decision	Inform decision
Public health action	Implement	Implement	Implement	Implement	Implement	Implement

Note: In the event of an outbreak, detection, notification/reporting and analysis of data must be immediate (within 24 hours upon occurrence of the death) to inform decision and actions

V. DEVELOP A HARMONIZED STRATEGIC PLAN OF ACTION

This section aims to support Member States in developing harmonized national strategies and action plans based on the assessments of the country's existing mortality data collection systems and processes, as well as on the proposed new / modified system design of the national mortality surveillance program.

5.1 Develop a harmonized strategic plan of action

1. Identify government-wide short-, medium-, and long-term priorities for mortality measurement.
    a. Set harmonized national mortality surveillance priorities from a clear understanding of the different existing mortality data systems and operational processes, including needed capacities and resources (based on outcome of the assessments from chapter 3).
    b. Use SWOT, root-cause analyses, or other tools to identify required inputs, intermediate processes, desired outputs, outcomes, and expected impacts.
2. Establish a Five-Year Mortality Surveillance Development/Improvement Strategy
    a. Strategy must include details of considering the planning elements, programme inputs, expected outputs, outcomes, and intended impact of the MS programme.
    b. Table 8 could be a scaffold for developing related operational instructions (Refer to table 6 of the Continental Framework).
    c. Use this scaffold to also set short-, medium- and long-term priorities for each element.
    d. In some instances, developing a harmonized strategic plan of action could involve integration of databases from different sources.
    e. Where necessary, the instructions in the Operational Guide could refer to the principles that underpin the national strategy, including:
        - Alignment with CRVS systems
        - Need to generate nationally representative data even in the short term
        - Prioritizing 'early wins' or identify specific conditions of public health importance
        - An emphasis on timeliness of data

Table 3: Mortality surveillance priority planning

Action Area	Strategic actions for consideration	Short term (1-2 years)	Medium-term (3-4 years)	Long term (≥5 years)
Planning	High level advocacy for political commitment			
	Situation analysis			
	Stakeholder engagement			
	Develop policy & legal frameworks			
	Resource mobilization			
	Coordination plans			
	Development of tools and processes for data collection, processing, reporting, analysis, interpretation, and dissemination			
	Capacity building			
	Implementation schedule or roadmap			
Input	Personnel			
	Finances			
	Equipment			
	Materials: e.g. Data collection tools, standard operating procedures (SOPs), etc.			
	Information, communication, and technology (ICT) needs for data capture, transmission, analysis & storage			
	Institutional capacity			
	Other needed resources			
Output	Data on fact of death available			
	Data on cause of death available			
	Target population coverage achieved			
Outcome	Improved quality of mortality data			
Impact	Informed decisions for public health programming			

5.2 Implementation Stage

The five-year mortality surveillance development strategy should be embedded within a series of implementation activities tailored to the design of the overall mortality surveillance programme. At the stage of implementation, the following core principles must be built into the overall activity plan as well as in specific activities:

1. Local leadership
    a. Within each implementation field unit (e.g., CRVS office; community health centre; health facility), a designated person should be tasked with responsibilities for MS operations and coordinating all MS functions within their facility.

    b. Within the local area (district/township/municipality), a local coordination committee with relevant stakeholder membership should be established to guide and coordinate all MS implementation activities.

    c. Social mobilization: A communication strategy should be developed to engage local communities in informing citizens about the objectives and methodology of the mortality data; the program should be in common language terms while emphasizing the attention towards data confidentiality and privacy. This strategy should be developed and implemented in consultation with local stakeholders to promote community participation.
2. Management oversight
    a. The national coordination committee with the technical support from the TWG should establish protocols for periodic contact with local sub-working groups to provide guidance, arrange relevant resources and capacity building programmes, and other technical/administrative support to ensure all field implementation.
    b. All field units must be provided with guidelines and instructions on the M&E protocols to be followed, particularly regarding coverage and timeliness of data.
3. Standard Operating Procedures should be developed for each institutional/personnel role within the MS business process model.
    a. The SOPs should cover all the functions, from reporting/recording vital events to the production/dissemination of vital statistics.
    b. SOPs could include references to existing technical guides or tools that provide necessary details. For example:
        - WHO document describing health sector contributions to strengthen birth and death registration[6].
        - Manuals for medical certification of cause of death[7], verbal autopsy[8], data quality evaluation[9], and data analysis. MS programme managers could use the content from these manuals in preparation of SOPs for these functions.
    c. SOPs should be sufficiently detailed to facilitate institutionalization of processes and, provide contingency plans with minimal additional guidance.
4. Personnel training: There should be training on the system processes and the application of SOP. This capacity building should include all stakeholders involved in the use of the system.
    a. To optimize quality and local-level management, the implementation plan should identify and include local academic institutions (e.g. public health institutes, medical/nursing schools, community staff colleges) to provide capacity building and undertake operational research.
    b. Personnel training should also be addressed through inclusion of mortality surveillance program content in regular pre-service and in-service training modules, along with provision of relevant resources

[6] https://iris.who.int/handle/10665/341911

[7] https://iris.who.int/handle/10665/40557

[8] https://www.who.int/publications/m/item/verbal-autopsy-standards-the-2016-who-verbal-autopsy-instrument

[9] https://measureevaluation.org/resources/publications/ms-17-117.html

5. Deployment and implementation: This should include pilot testing at the commencement of each phase
    a. Implementation instructions should cover compliance requirements for the M&E framework, including roles, responsibilities and timelines for such compliance, across institutions and personnel.
    b. The lessons learnt from the pilot will inform scale up.
6. CRVS integration: Implementation instructions should emphasize the necessity for all vital events identified by the MS programme to be reported to local CRVS offices; and where required, to support all elements of CRVS operations.
7. Electronic data compilation: the national coordination committee with the technical support from the TWG must ensure the deployment of an integrated database that promptly captures all mortality surveillance records from the field, along with suitable instructions for its operation by nominated personnel, which should be specified in the institutional SOPs. (See section below on digital solutions)
8. Data management: Instructions should be provided for data verification, management, and compilation and dissemination of statistics.
9. Data analysis: The mortality outcome indicators table to be reported by mortality surveillance programs is in Annex E. (see details in section below titled 'Data analysis')
10. Data access protocols for different stakeholders and at different programme levels (institutional/district/national).
11. Vital statistics reports should be produced from the MS data regularly and periodically, providing national and major subnational-level mortality indicators. All vital statistics reports should include a separate chapter on data quality assessment, and where feasible and necessary, any summary findings from system quality assurance activities (infrastructure audits; personnel recruitment; changes to laws/regulations/ operational instructions; and capacity building activities for various MS functions, among others).
12. Data dissemination and usage: Specific guidance should be provided for data dissemination and usage at all levels, with case scenarios of data utility for health programmes. Vital statistics reports and data dissemination protocols should also include modalities for compliance with international public health reporting requirements.
13. Performance monitoring and optimization; Indicators to monitor both system and personnel functions should be developed, to ensure continuous system improvement.

5.3 Recommendations for a phased approach to implementing integrated mortality surveillance at the national level

Although it is ideal for the routine MS programme to cover entire national populations, the programme design in each country would dictate the need for a phased approach towards system strengthening and expansion of coverage, particularly in countries with larger populations (> 25 million), and/or limited human/technical/financial resources.

- An essential initial phase in all settings should be to compile and analyse all existing data.
- The analysis should produce standard mortality indicators by age, sex and cause of death to inform how to set or scale up the surveillance system.
- The indicators from initial analysis should be evaluated for sources of bias (e.g., incomplete death reporting; missing / inaccurate data variables; validity of reported causes of death etc.).
- Utilize the findings from the analysis of bias to identify any weaknesses in the system design, availability of resources, or inadequate training, among others.

- The analytical findings (including data quality results) should be disseminated to local stakeholders with simple explanations to help them understand/interpret local mortality patterns, as well as inform them of corrective actions that are required to improve data quality and/or system efficiency

Such data analyses and system design assessments might likely have been completed during the systems assessment phase, as described in chapter 3 of this guide. However, there may be a need for the implementation team to conduct or relate this analysis at the stage of adaptation of the routine business process model to the local setting. The team should use the findings to understand the design and functional status of the different elements of the routine MS model, and then develop the activity plan for implementation, which must be built into the relevant SOPs.

Subsequently, the phased approach could take one of two forms, the first of which is phased health sector-based mortality surveillance; the second is phased population-based mortality surveillance.

5.3.1 Health sector-based surveillance

The Continental Framework provides an example across five phases, outlining the incremental coverage of community health centres/health facilities with increasing system expansion and the likely utility of surveillance data for each phase. While this approach is potentially easier to implement since it is entirely operated within the remit of the health sector institutional framework, some health facilities do not map directly to catchment populations, to derive population mortality rates. Nevertheless, if this approach is relevant, the preparatory activities outlined above must be conducted for each phase, ensuring adequate system performance at the end of each phase prior to transition.

After completing the critical initial phase of business process model adaptation and compilation/analysis of existing data, specific instructions for such a phased approach could include the following:

- Establishment of a nominal timeline for the phased approach, specifying the period required for each phase and the expected time to complete national coverage.
- Preparation of a list of health facilities and community health centres for the first phase
- Nomination of personnel in coordination roles in each institution to be responsible for local implementation
- For each phase, convene a working committee for technical support, management, and implementation oversight, potentially drawing upon institutional membership.
- Define each reporting institution's local business process model, including reporting procedures and periods, and the model for coordination across all institutions involved in each phase.
- Development of SOPs for various functions for each reporting institution and coordination
- Provision of relevant infrastructure and capacity building of personnel
- Implementing a data management programme to cover all the reporting facilities for the phase, including data compilation and analysis.
- Monitoring and evaluation of system performance during and at the end of the nominated period for each phase
- Establish criteria to guide transition from one phase to the next, particularly regarding adequacy of system coverage and data quality.

5.3.2 Population-based mortality surveillance

The second phased approach is to use a sample population for a country to initiate the routine MS programme and then expand coverage across the country. This will enable computation of mortality indicators, using the resident population as denominators. The MS implementation strategy should specify whether the approach would first initiate the activity in a sentinel site or a set of sentinel clusters or if the surveillance population is representative of national or subnational characteristics. In case of the sentinel site approach, further expansion could be planned to have representative samples. In all instances, the guidance for preparation and phased implementation would generally follow the same steps outlined in the earlier sections.

5.4 Recommendations for implementing a nationwide sample-based mortality surveillance

Additional considerations to be accounted for in establishing sample-based mortality surveillance are, as follows:

1. Sample size estimation: The Implementation team must undertake a statistical exercise to estimate the representative sample size for the MS programme, based on a selected mortality indicator of interest and the tolerable margin of error. The team could consult an experienced statistician for this task and consider the following:
    a. Requirement of estimates by sex, age, specific causes of death.
    b. The derived sample size needs to be fitted to the population sample as distributed in national and sub-national levels (villages, townships, municipalities, districts etc.).
    c. The selection of population clusters must be such that each cluster completely maps to existing CRVS registration units, which has administrative advantages for aligning with death recording and data management/compilation practices. This also helps facilitate data integration across a range of local data sources.
    d. As outlined in the next section, the eventual sample size and distribution should be used as inputs for evaluating resource needs.
2. The SOPs for the sample-based mortality surveillance must ensure intersectoral collaboration and data sharing with the local CRVS programme.
3. The implementation design must specify the remit of data collection practices within each cluster, i.e., whether to only record routine characteristics of deaths in standard notification forms by sex, age, and location, or also extend to include the causes of death as derived from medical certification or VA.
    a. The sample-based MS programme must use existing CRVS tools and procedures for event recording and reporting.
4. The implementation team should plan and conduct comprehensive capacity-building programmes for all stakeholder institutions and personnel involved in the sample-based programme.
    a. Since indicators from the sample-based would be generalized to the entire population, the data collection and management strategies must compile high-quality data with adequate precision.
5. The M&E component must periodically assess data timeliness, quality, and vital statistics/indicators production.

6. The sampling plan should include a logical strategy for scaling up the programme in a phased manner to increase coverage while retaining representativeness at national/subnational levels from a statistical perspective. It should also enable periodic data releases for policy use for each phase of the expansion.

In summary, for countries with larger populations (>25 million), the national MS implementation teams must develop a strategy for establishing a phased approach of health sector-based surveillance in hospitals and community health centres health facilities or population-based surveillance in sentinel sites or representative population clusters. The phased approach should include a plan for incremental expansion with a production of vital statistics for the surveillance population in each phase.

5.5 Digital solutions for mortality surveillance implementation

When developing a new surveillance system or enhancing a current one, it is important to consider the benefits of digital approaches, whether this is done during the initial set-up or in further development. It is anticipated that the country assessment will lead to a system design and implementation process, including a digital solution and integration. It is important to align the digitisation of the mortality surveillance system with a country's core digital health and information technology (IT) processes. A priority aim for any digital approach for mortality surveillance is the ability to trigger a public health response on account of signals in the mortality data. Such triggers can come in the form of thresholds, alerts, or automated reports to aid in rapidly disseminating reliable information. With digital solutions and integration, countries can improve data accuracy, timeliness, and accessibility, improving evidence-based decision-making and public health interventions.

Countries will need to establish policies and regulations to implement digital mortality surveillance. These existing policies and strategies could include digital health strategies, data sharing agreement protocols, standards, regulations, and coordination mechanisms. There are likely to be existing digital health governance committees or technical groups within national Ministries of Health that have focussed attention/responsibilities for the digitisation of health systems. This technical group could be assigned tasks for enabling appropriate digitisation of the mortality surveillance program. Such technical groups must be engaged early and often in the MS process to gain stakeholder buy-in and work within existing approval chains.

At the broad level, actions would be required to establish and/or implement a national central repository, for example a national data warehouse or health observatory. It is anticipated that each independent mortality data source (e.g. CRVS/HMIS/DHIS2/disease surveillance programs etc.) would have existing electronic data platforms from where data would need to be accessed and compiled in a standardised mortality surveillance database. To enable such data compilation, specific actions would need to be undertaken to address each element in the processes for database design, data acquisition, analysis and dissemination described below. For smooth design and operations, SOPs should be developed for each element in the information cycle of the MS database described below.

5.5.1 Database design and data import functions

The mortality surveillance TWG should nominate a specialist IT Working Group to design the surveillance database, and prepare SOPs for its operations at the host agency. Specific details of database design, tools, and analytical functionalities could be developed by the TWG, which should include information technology specialists along with public health professionals to advise on technical specifications, data quality protocols, and data analysis/output production and dissemination. The database should specify the metadata characteristics for each essential variable (data type e.g. text/number; field length etc.); along with specific range and logical checks for data quality assurance and control.

5.5.2 Data acquisition

The database management team should develop an import function for acquiring records from individual data sources. The import function should be styled according to a specific tabular format of individual 'line lists' of mortality records which will be provided as an output from each data source. Each data source should be provided this format and advised to prepare an export function to generate an output file to be shared with the mortality surveillance database.

In addition to the essential variables for each record, the output file format from each source should include variables defining the data source, as well as the data/time reference period/location details for the records contained therein.

5.5.3 Data integration protocols

The surveillance database program should include a 'record linkage' procedure that will validate records accessed via the import function, assess and remove duplicate records, and subsequently integrate/annex all valid and unique records to the overall records database.

Where necessary, the integration protocols may be based on deterministic/probabilistic criteria to enable record matching, linkage and verification prior to integration, and the database functions should incorporate these protocols.

5.5.4 Data quality assessment

The import processes could also generate data quality reports from individual data sources (i.e. missing/invalid variables) that could be used for monitoring and evaluation and shared with each data source. Where relevant, the database could also create supplementary files at the import stage for temporary storage of records, which need further interventions to assess duplication and/or validity of specific variables. These temporary files need a separate data management protocol for investigation and adjudication.

Following verification and integration into files with unique records for specified periods, the database could also generate separate files with matched and unmatched records across different sources, which could be used to assess death record completeness from each source using 'capture-recapture' methods.

VI. ADOPTION OF DATA STANDARDS

6.1 Data standards

Member states are encouraged to adopt the Africa CDC Health Information Exchange (HIE) standards for mortality surveillance data. This involves aligning their data collection, storage, and sharing practices with the standardized formats, protocols, and interoperability requirements defined by Africa CDC regardless of the type of software or tool used by each Member State.

6.1.1 Data privacy and sharing protocols

Protocols should be developed to enable data sharing across various stakeholders. Adequate provisions for data confidentiality should be built into the protocols, maximising the use of de-identified data for analytical purposes.

6.1.2 Data back-up and archival

The database should have an inbuilt mechanism for automatic daily/weekly back up operations, which should also be reviewed periodically to ensure appropriate functioning towards minimizing risk of data loss in case of an adverse event of a machine, data, or infrastructural failure. There should also be a facility for permanent archival of records, with facilities for search and retrieval of specific lots of records (e.g. by time period/location/sex/age etc.) for relevant analysis.

6.2 Data analysis and dissemination

Annex E lists mortality indicators that must be computed to interpret mortality outcomes in the resident population. The table comprises a list of indicators relevant to reporting within a mortality surveillance program. The indicators are categorized by objective or programmatic area. For each indicator, information is provided on the definition, data/method/formula for calculation, recommended frequency of reporting, and additional notes.

The broad purposes of this table of indicators are to:

- Orient readers to the range of total and cause-specific mortality indicators that are conventionally used for health sector purposes;
- Describe the various functions and programs within the health sector that need specific mortality indicators from the overall list;
- Explain essential characteristics for each indicator using both technical and simplified terminology, along with relevant attributes in terms of recommended frequency of measurement, categories for disaggregated analysis, etc.;
- Highlight the specific data variables that are required for measurement of each indicator and associated characteristics for detailed analysis;

The following points should be noted when referring to this table:

- All the mortality indicators must be qualified with accurate reference populations and time periods for correct interpretation and use.

- Most indicators can be directly calculated from the surveillance program data and corresponding denominators (e.g., populations, births). Still, some indicators, such as life expectancies or risks of dying between specific ages, need to be estimated through life tables constructed from surveillance program data. Hence, there is a need for adequate national capacity for such analysis.
- Relevant mortality data quality assessments such as completeness and validity of specific variables should be conducted, and appropriate statistical adjustments should be included in the indicator analysis. In such instances, information on the reported value, degree of bias, and adjusted value should be provided somewhere in the statistical report.
- While most of the indicators in the table can be available from a national mortality surveillance program, there may be limitations in precision or representativeness if the program is based on nationally representative samples or sentinel sites.
- Some program-specific indicators (e.g., tuberculosis case-fatality ratios) require additional information (e.g., disease prevalence) which would need to be accessed from the disease-specific surveillance program of routine health information system.
- A list of references has been provided from where most of the information for these indicators was sourced. Almost all the indicators are included in the UN Sustainable Development Goals framework or the WHO General Program of Work for 2019-2023.
- This table is only a guide; users could also include additional indicators of national importance that may not be specified in this table.

During the initial phases of implementation, the TWG could appoint a specialist team drawn from the national public health institute, academic partners, and National Statistics Office to convene activities related to data analysis, including the following:

- Review the indicator table in Annex E and guide discussions among national stakeholders towards prioritizing specific indicators that ought to be measured by the national mortality surveillance program.
- Plan for relevant data sources that need to be strengthened to enable routine/periodic measurement of national priority mortality indicators.
- Obtain sex and age-specific population estimates for the reference population under surveillance from national censuses or census-based population projections for reporting period.
- Develop basic computational tools to calculate various sets of indicators (e.g. life table templates; detailed under-five mortality analysis tools; age-standardized mortality calculators etc.) along with simple stepwise instructions for their use, preferably documented in a user manual.
- Establish national/local capacity to undertake such analysis, with linked output indicator formats for dissemination.
- Ensure that relevant data quality assessments are conducted periodically and reported alongside outcome indicator reports. Where such assessments are undertaken, the data dissemination should include information on indicators from the reported data as well as the estimated indicator adjusted for quality biases.
- Undertake consultations with other national experts or international partner agencies periodically to discuss surveillance-based statistical outcome measures, their interpretation and utilization to guide policy responses, and determine surveillance program functions that need to be strengthened to improve data quality.

- The surveillance database should also incorporate functions for data dissemination, the results from which could be shared with electronic dashboards, public health agencies, health policy analysts and decision-makers, among others.
- Member states are encouraged to provide regular and timely reports on mortality surveillance data to Africa CDC. This includes submitting data according to the agreed-upon reporting schedules, data formats, and data submission protocols. Regular reporting ensures that accurate and up-to-date data is available for analysis and decision-making at the continental level.
- Member states should actively collaborate and share knowledge with Africa CDC and other member states regarding best practices, lessons learned, and innovative approaches in mortality surveillance.

A time schedule should be developed for each step of the MS database functions. A monitoring and evaluation plan should be designed for the surveillance database operations.

6.3 Evaluating resource needs for implementing a mortality surveillance system

Individual data sources are likely to receive financial allocations for data digitization. The TWG should explore potential to pool financial resources from various sources for the surveillance database design and operations. The benefits of the digitized mortality surveillance system for all stakeholders could be used as an incentive for stakeholders to pool resources to derive comprehensive, validated, and timely data for analytical purposes. Hence, a financial mapping across digitization of health information systems should be undertaken to develop a resource mobilization plan for digitizing the mortality surveillance system.

Once the national mortality surveillance programme has been designed with all details of core functions and processes, along with roles and responsibilities of different stakeholders for implementation, monitoring, and evaluation, there is a need to assess the resource needs, and plan for resource mobilization. The assessment should be aimed at:

1. Assessing the existing resources and identifying resource gaps by conducting a comprehensive needs assessment to identify the specific resource requirements.
    a. This will involve evaluating the existing infrastructure, services, data collection tools, standards and SOPs, personnel skills, technologies, and any gaps or deficiencies that need to be addressed.
    b. Also, conduct an inventory of personnel, equipment, software licences, infrastructure, and budget allocations.
2. Costing all implementation activities, processes, and resource requirements for establishing or strengthening the system.
3. Identifying potential funding sources for establishing and strengthening the system (e.g., government ministries and agencies, international development partners, philanthropic institutions).
4. Undertake a gap analysis with guidance from the steps below:
    a. Determine resource criteria or metrics to evaluate the adequacy or sufficiency of the available resources.
    b. Measure and quantify the resource gaps identified.

c. Prioritize the resource gaps based on their significance and impact on the system functionality.
d. Investigate the underlying causes of the identified resource gaps.
e. Formulate strategies and action plans to address the identified resource gaps.
f. Execute the resource gap mitigation strategies and closely monitor their progress and effectiveness.
g. Periodically review and reassess the resource gaps as the project or system evolves. Adjust the resource allocation and mitigation strategies based on changing needs, priorities, or external factors.

5. Clearly communicate recommendations for addressing the gaps and provide supporting evidence from the assessment.

The analysis of resource gaps can be guided by table 9 below (adapted from Rao et al.[10])

Table 9: Resource gap analysis template (1)

Setting	Function	Resource need
Community	(1) Identification of deaths (2) Reporting/notification of deaths	• Community leaders • Local notifier networks* • Notification form • Telephones • Register • Communication tools/internet • SOPs • Personnel • Capacity building • Monitoring • Supervision
Civil registration office	(1) Death registration (2) Data sharing with local government health centre	• Civil registrars • Local police • Notification form • Telephones • Register • Computers • Communication tools/internet • SOPs • Capacity building • Monitoring • Supervision
Community health centres	(1) VA interview (2) Assigning causes of death (3) Data compilation and submission	• Paramedical staff • Physicians • Data managers • Notification form • Telephones • Register • Communication tools/internet • SOPs • Capacity building • Monitoring • Supervision

[10] *Rao C, Usman Y, Kelly M, Angkasawati T, Kosen S. Building Capacity for Mortality Statistics Programs: Perspectives from the Indonesian Experience. J Epidemiol Glob Health [Internet]. 2019 [cited[10] 2023 Jun 27]; Available from: https://www.atlantis-press.com/article/125906449*

Table 9: Resource gap analysis template (2)

Hospitals	(1) Medical certification of cause of death (2) Coding multiple/underlying causes (3) Data verification and submission	• Physicians • Coding experts • Medical records staff • Notification form • Telephones/laptop/Tablets • Register • Communication tools/internet • SOPs • Capacity building • Monitoring • Supervision
District/city health offices	(1) Coding and data compilation (2) Monitoring reporting timeliness / quality (3) Statistical reports and interpretation of performance/ mortality measures (4) Logistic/technical assistance to field units	• Physicians • Coding experts • Medical records staff • Notification form • Telephones/laptop/Tablets • Register • Communication tools/internet • SOPs • Capacity building • Monitoring • Supervision
Province/state health departments	(1) Data compilation and quality control (2) Data analysis and interpretation (3) Mortality statistics/ programme governance/resource allocation/ capacity building	• Statistical staff • Data analysts • Health programme managers • Regional health director • Telephones/laptop/Tablets • Equipment • Register • Airtime/ internet • Procedures • Capacity building • Monitoring • Supervision
National health planning/statistics office	(1) Use of mortality data/measures for - Health situation and trend assessment - Health programme evaluation (2) Liaison with academia and research bodies (3) Representation on international forums	• Epidemiologists • Health economists • Health policy bureaucrats • International health staff • Telephones/laptop/Tablets • Equipment • Register • Airtime/ internet • Procedures • Capacity building • Monitoring • Supervision

**Local notifier network usually includes village health workers, religious leaders, police, and local social service agencies.*

6.3.1 Costing

The steps below provide a guide for costing implementation activities and resource requirements for establishing or strengthening the mortality surveillance system:

1. Clearly define the scope of the system implementation, including its objectives, deliverables, and timeline.
2. Identify the major cost categories relevant to the programme, such as hardware, software, personnel, training, infrastructure, maintenance, supervision, meetings and workshops, contingencies, and programme implementation and management.
3. Estimate the costs associated with each cost category or item. This can be done through research, vendor quotes, historical data, expert opinion, or industry benchmarks. Consider both one-time (initial) costs and recurring (ongoing) costs.
4. Allocate the estimated costs to different cost categories and create a comprehensive budget plan. Ensure that the budget aligns with the available resources and any funding constraints or organizational guidelines.
5. Review the costing and budgeting plan with stakeholders or financial managers. Seek their input and approval before finalizing the plan.
6. Continuously monitor and control implementation expenditures against the budget plan. Regularly review the actual costs and compare them with the estimated costs. Identify any deviations and take necessary actions to manage the budget effectively.
7. Remember to document and maintain a record of all the cost estimates, assumptions, and calculations for transparency and reference purposes.

6.3.2 Identifying Potential Funding Sources for the Programme

It may be useful to consider the following factors to identify potential Funding Sources.

1. Clearly define the system's objectives, scope, deliverables, timeline, and budget.
2. Evaluate the availability of internal resources within the country that can be allocated to the programme.
3. Map stakeholders who may have an interest in supporting the programme financially.
4. Research and identify government funding programmes at various levels that align with programme objectives and priorities.
5. Investigate private and corporate funding opportunities.
6. Seek research philanthropic organizations and foundations that support projects in the specific field or industry.
7. Engage in networking activities and connect with potential funding sources.
8. Develop a comprehensive funding proposal that clearly communicates the project's objectives, timeline, expected outcomes, budget, and impact.
9. Submit funding applications to the identified funding sources, following their specific guidelines and deadlines.
10. Follow-up on submitted applications and maintain ongoing communication with the funding sources.
11. Consider multiple funding sources simultaneously to diversify the funding base.
12. Regularly review the funding strategy and adjust the approach based on feedback, outcomes, and changing circumstances.

Remember that identifying funding sources requires patience, persistence, and proactive outreach. It's essential to align goals with the priorities and criteria of potential funding sources to increase the chances of securing funding.

6.3.3 Accountability and resource maximization

From a strategic perspective, the MS Program should leverage existing resources and structures to avoid duplication and redundancy. Attention to this aspect should be given at all levels, for all functions, and within each participating/responsible institution.

ANNEX E: Indicators for mortality surveillance to guide the development of a national strategy for mortality surveillance

Within this guide, a table of mortality indicators has been developed to aid users of the Framework in defining the structure, functions, and expected outcomes of their respective national mortality surveillance programs.

The broad purposes of the table of indicators are to:

1. Orient readers to the range of total and cause-specific mortality indicators that are conventionally used for health sector purposes;
2. Describe the various functions and programs within the health sector that need specific mortality indicators from the overall list;
3. Explain essential characteristics for each indicator using both technical and simplified terminology, along with relevant attributes in terms of recommended frequency of measurement, categories for disaggregated analysis, etc.;
4. Highlight the specific data variables that are required for measurement of each indicator, and associated characteristics for detailed analysis;
5. Guide discussions among national stakeholders towards prioritizing specific indicators that ought to be measured by the morality surveillance program with consideration to indicators and other analytic functionalities that are more appropriately provided by the program-specific stakeholders (e.g., a disease-specific surveillance program) to meet their data needs; and
6. Plan for relevant data sources that need to be strengthened to enable routine / periodic measurement of national priority mortality indicators.

The table is comprised of a list of indicators relevant for reporting within a mortality surveillance program. The indicators are categorized by objective or programmatic area. For each indicator, information is provided on the definition, data/method/formula for calculation, recommended frequency of reporting, level of difficulty for reporting (to be added), surveillance outputs, and additional notes. The table will be reviewed for input by various subject matter experts to ensure it is fit for purpose and accurately captures the desired content for consideration as the structure, functions, and expected outcomes for mortality surveillance programs are defined. Additional notes for consideration are listed on page 2.

The following points should be noted when referring to this table:

1. A list of references has been provided from where most of the information for these indicators was sourced. Almost all the indicators are included in the UN Sustainable Development Goals framework or in the WHO General Program of Work for 2019-2023.
2. All the mortality indicators need to be qualified with accurate reference populations and periods, for their correct interpretation and use.
3. The primary data inputs for calculating almost all indicators (except those marked as ‘Advanced’) can be calculated using basic data compiled from the mortality surveillance program, in terms of deaths by age, sex and where required the underlying cause of death. As mentioned in the table footnote, the advanced indicators require information extraneous to the mortality surveillance program.
4. For practical purposes, a set of programmed spreadsheets will be provided to enable easy computation of most indicators, across the different categories

5. Relevant mortality data quality assessments such as completeness and validity of specific variables should be conducted, and appropriate statistical adjustments should be included in the indicator analysis. In such instances, information on the reported value, degree of bias, and adjusted value should be provided in the statistical report.
6. While most of the indicators in the table can be available from a national mortality surveillance program, there may be limitations in precision or representativeness, if the program is based on nationally representative samples or sentinel sites.
7. In all instances, indicators must be presented along with 95% confidence intervals derived through direct estimation of standard errors (rather than through use of non-parametric methods)
8. Most indicators can be directly calculated from the surveillance program data and corresponding denominators (e.g., populations, births). Still, some indicators, such as life expectancies or risks of dying between specific ages, need to be estimated through life tables constructed from surveillance program data. Hence, there is a need for adequate national capacity for such analysis.
9. Some program-specific indicators (e.g., tuberculosis case-fatality ratios) require additional information (e.g., disease prevalence) which would need to be accessed from the disease-specific surveillance program of routine health information system.
10. This table is only a guide; users could also include additional indicators of national importance that may not be specified in this table.

Annex E

Table 10: Characteristics of indicators to be reported by mortality surveillance programs

Indicator	Definition	Data / method / formula	Frequency	Notes / Surveillance outputs
EPIDEMIC SURVEILLANCE				
Numbers of deaths	• Observed events in defined community/health facility • OR aggregated numbers by date of death	Line lists of individual deaths with age, sex, address, date of death, place of death (facility name), vaccination status (if relevant)	Daily/weekly / monthly	• Trends in deaths by age / sex • Deaths by vaccination status • Geographic / socioeconomic trends
Deaths from particular cause of interest	Based on a specific case definition	Same as above	Daily/weekly/monthly	• Trend analysis by sex, age, place of death
Case fatality rate (CFR)	Proportion of deaths among total number of cases of a specific disease within a defined time period	CFR = $\frac{deaths}{cases}$ x 100	Weekly	• Clear-cut case definition • CFR by age and sex • Place of death / geographic / socio-economic comparisons, as required
Excess mortality * (EM)	Difference between observed and expected deaths in the population over a defined period	EM = Obs dths – Exp dths	Monthly/annual	• Expected deaths from projections based on historical data averaged across 3-5 years
GENERAL MORTALITY SURVEILLANCE				
Crude death rate (CDR)	*Deaths in a defined geographical area during a given year, per 1,000 mid-year* population.	CDR = $\frac{deaths}{mid\ yr\ pop}$ x 1000	Annual	• By sex • Urban / rural / geographic disaggregation

Age-specific death rates for defined age group (e.g 15-29y)	Deaths in a defined age group per 1000 mid year population for the same age group	ASDR = $\frac{deaths\ (15-29y)}{mid\ yr\ pop\ (15-29y}$ x 1000	Annual/every 3 years	• By sex • By age (0, 1-4, 5 – 9, 10 – 14, ….75 – 79, 80 - 84, 85+)
Risk of child (under five) mortality	Probability of a child dying before the fifth birthday	Estimated as life table mortality risk from observed age-specific death rates	Annual	• By sex • Dissemination with sampling error • Validation with DHS rates
Adolescent mortality rate (10 – 19 yrs)	Number of deaths among adolescents (10–19 years old) per 100 000 adolescent population.	$\frac{deaths\ in\ 10-19\ age\ group}{mid\ yr\ pop\ for\ 10-19\ yrs}$ x 1000	Annual/ once every 3 years	• For SDG monitoring • Should be analysed according to causes of death, with a focus on external causes
Risk of adult mortality ((15 – 60 yrs)	Probability of a 15 year old individual dying before their 60th birthday	$\frac{deaths\ (15-60y)}{pop\ at\ exact\ age\ 15\ yrs}$ X 1000	Annual/ once every 3 years	• WHO standard indicator for international / subnational comparison
Life expectancy at birth	Number of years a birth today could live if exposed to current sex- and age-specific death rates	Life expectancy at birth is derived from life tables and is based on age-specific death rates across all ages.	Annual/ once every 3 years	• By sex • National / urban / rural / geographic / socio-economic disaggregation
Life expectancy at age 60 years	Years that a person of 60 years of age today could live based on current mortality patterns	Life expectancy at age 60 years is derived from life tables and is based on age-specific death rates across all ages	Annual/ once every 3 years	• By sex • National / urban / rural / geographic / socio-economic disaggregation
REPRODUCTIVE HEALTH SURVEILLANCE				
Maternal mortality ratio	Female deaths at ages 12-49 years related to or aggravated by pregnancy OR during	$\frac{maternal\ deaths}{live\ births}$ X 100,000	Once every 3 years	• By urban / rural / Health facility area • Potential for ethnic dimensions • Need for careful differentiation

	childbirth OR within 42 days of termination			of maternal v other causes; at these ages
Stillbirth rate	Number of stillbirths among all births	$\frac{stillbirths}{live\ and\ stillbirths}$ x 1000	Annual	• By age of mother • By duration of gestation • Socio-economic disaggregation
Perinatal mortality rate	Stillbirths and early neonatal deaths (<7 days) among all live and stillbirths	$\frac{still\ births+deaths\ 0-7\ days}{total\ live\ and\ still\ births}$ x 1000	Annual	• By age of mother • By duration of gestation • By birthweight • Socio-economic disaggregation
Neonatal mortality rate	Neonatal deaths among live births during the first 28 completed days of life	$\frac{deaths\ (0-28\ days)}{live\ births}$ x 1000	Annual	Early neonatal deaths = < 7 days Late neonatal deaths = 7 to 28 d • By age of mother • By duration of gestation • By birthweight • Socio-economic disaggregation
Infant mortality rate	Probability of dying between birth and age of 1 year	$\frac{deaths\ below\ 1\ year}{live\ births}$ x 1000	Annual	• By sex • By age of mother • National / urban / rural / geographic / socio-economic disaggregation
INFECTIOUS DISEASE SURVEILLANCE				
AIDS-related mortality rate	Estimated number of adults and children who have died due to AIDS-related causes in a specific year in a defined population	$\frac{AIDS\ related\ deaths}{total\ pop}$ X 100000	Annual	• Sex - age-specific • Age-standardized to account for differences in pop age structure, for comparisons • By tuberculosis status
Malaria mortality rate	Rate of deaths from malaria	$\frac{malaria\ deaths}{total\ pop}$ X 100000	Annual	• Focus on child deaths

Tuberculosis case fatality ratio *	TB deaths (including HIV-positive TB deaths) out of TB incident cases in same year	$\frac{TB + (HIV + ve\ TB) deaths}{annual\ TB\ incident\ cases} X\ 100$	Annual	• Denominators from TB surveillance program OR from epidemiological studies
Tuberculosis mortality rate	Rate of deaths due to TB (all forms) in a given year, excluding deaths in HIV positive TB cases.	$\frac{TB\ \ deaths}{total\ pop}$ X 100000	Annual	• Sex - age-specific • Age-standardized to account for differences in pop age structure, for comparisons
COVID mortality rate	Rate of COVID +ve deaths in a given year	$\frac{COVID+ve\ deaths}{total\ pop}$ X 100000	Annual	• Age-sex distributions • Underlying vs associated cause analysis • Analysis by co morbidities
Mortality from other infectious diseases of local significance e.g. Ebola, Dengue, Japanese Encephalitis, Diarrhoeal diseases etc; same as for malaria				
NON-COMMUNICABLE DISEASES SURVEILLANCE				
Premature NCD mortality	Unconditional probability of death between ages 30 and 70 years from cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases	$\frac{NCD\ deaths\ at\ 30\ to\ 70\ yrs}{pop\ at\ exact\ age\ 30\ yrs} X\ 1000$	Annual / once every 3 years	• For SDG monitoring • Can be analysed separately for each condition
Chronic kidney disease (CKD)	Rate of death from chronic kidney disease	$\frac{All\ CKD\ deaths}{total\ pop} X\ 100000$	Annual / once every 3 years	• CKD identified as a multiple cause • Sex-age specific • Age-standardized for comparisons
It is anticipated that mortality from specific NCDs (site specific cancers, stroke, IHD etc) will be reported among the leading causes of death				
EXTERNAL CAUSES SURVEILLANCE				

Death rate due to road traffic injuries	Rate of road traffic injury fatalities	$\frac{All\ road\ traffic\ injury\ deaths}{total\ pop} X\ 100000$	Annual	• Sex-age specific • Sub national data highly recommended • Analysis according to type of vehicle / characteristics of victim
Suicide rate	Rate of suicide deaths	$\frac{All\ suicide\ deaths}{total\ pop} X\ 100000$	Annual	• SDG tracer indicator for mental health • Sex-age specific • Sub national data highly recommended • Follow up psychological autopsy studies
Mortality rate due to homicide	Rate of homicide deaths Excludes cases where the perpetrator was merely reckless or negligent, or due to legal intervention /war	$\frac{All\ homicide\ deaths}{total\ pop} X\ 100000$	Annual	• SDG monitoring • Sex – age specific • ? are deaths from terrorism included here, or considered as war deaths?
Mortality rate from unintentional poisoning	Rate of death from unintentional poisoning (? drug overdose deaths are to be included)	$\frac{All\ deaths\ from\ unintentional\ poisoning}{total\ pop} X\ 100000$	Once every three years	• For SDG monitoring • Sex-age specific • Age standardized for comparisons
ENVIRONMENTAL IMPACT ON HEALTH *				
Mortality from household and ambient air pollution	Can be expressed as number of deaths or death rates	Deaths from lower respiratory infections, chronic obstructive lung disease, lung cancer, ischemic heart disease and cerebrovascular disease can be attributed to air pollution	Annual	• For SDG monitoring • Sex-age specific • Numbers of deaths are usually reported

				• Requires information on exposures
Mortality from unsafe water, unsafe sanitation, & lack of hygiene	Can be expressed as number of deaths or death rates	Deaths from diarrhoeal diseases	Annual	• For SDG monitoring • Sex-age specific • Numbers of deaths are usually reported • Requires information on exposures
Mortality from disasters	Number who died / missing during the disaster, or after, as a direct result of the disaster	Definition of missing person varies across countries Definition could be modified for special circumstances	Annual	• SDG monitoring • Type of disaster (cyclone / earthquake etc • Details in WHO indicator handbook
POPULATION HEALTH ASSESSMENT				
Leading causes of death	Numbers or proportions	Ranks of top ten or twenty causes of death	Annual	• By sex / broad ages
Age-standardized cause-specific death rates	Weighted average of age-specific mortality rates from a specific cause, using standard population weights	Age-specific death rates from the cause of interest from each location are applied to standard age-specific populations to derive expected deaths in the standard population; for comparative analysis	Annual	Age standardization accounts for differences in population age structure, hence facilitates comparative mortality analysis
Expected Years of Life Lost (total and cause-specific)	Years of life lost (YLL) is a measure of premature mortality that takes into account both the frequency of deaths and the age at which it occurs.	A global standard table of life expectancies at each age is used to derive the YLL factor for each age, which is applied to the numbers of deaths from the cause of interest at each age from a specific cause to derive age-specific YLLS, which are then summed across all ages to derive the total YLLs from the cause of interest	Once every 3-5 years	YLLs account for two-third to three-fourth of population disease burden in most countries experiencing demographic and epidemiological transition

* Calculation of these indicators will require information from outside the mortality surveillance program

VII. MORTALITY SURVEILLANCE SYSTEM MONITORING AND EVALUATION

7.1 Introduction

The overall goal of the MS system monitoring and evaluation program is to assess the progress in implementation, identify data quality gaps, and guide improvement activities. All these elements could be considered as functions of data quality management. Therefore, mortality surveillance systems should include a comprehensive data quality management process with several sequential components. Several assessment and analytical activities would be required for each element. Those activities would enable regular monitoring of progress in implementation, evaluation of functional status and performance of implementation, and guide system modifications or strengthening activities to improve data quality. More description has been provided in the subsequent sections of this chapter. A sample logical framework to guide member states can be found in annex F.

7.2 M&E coordination committee

The mortality surveillance Technical Working Group may establish a sub-working group to coordinate the M&E activities of the MS system, with membership from key stakeholders responsible for various implementation aspects. The TWG or the sub-working group should develop a M&E plan built into the MS design and implementation, to ensure that relevant technical and other resources are suitably developed. For example, various IT functionalities that could readily generate M&E outputs (as defined in the following sections) could be built into the system design, with results directly available as dashboards of system quality and performance indicators. The TWG or sub-working group could also guide planning for special M&E activities such as periodic field inspections, validation studies, surveys, review workshops, identifying the institutions/teams responsible for the same, and the required administrative and financial resources.

7.3 Monitoring MS system implementation

The comprehensive features of the mortality surveillance system design and plan of activities for the phased program for system implementation have been described in the previous chapters of this Operational Guide. In particular, the implementation plan would include a detailed timeline of activities and targets for the different elements of the program. The TWG or the Sub-working groups should request for relevant staff within stakeholder institutions to monitor and report by timely achievement of targets and satisfactory completion of each activity in the overall system design and implementation plan. Table 10 below provides a snapshot of the nature of the M&E activities that would be required to monitor the overall MS system implementation plan. National M&E teams could adapt this template to local needs.

Table 11: Sample chart for monitoring MS design and implementation

Steps	Organization Responsible	Expected completion Date	On time completion (Yes/ No)	Remarks (If no expected time to completion and the reason for the non-completion)
Step1: Stakeholder Engagement				
Establish a national TWG	MoH	3 months		
Assignment of sub-working groups and activity timelines	MoH	1 month		
Steps 2: Establishment of governance mechanisms				
Draft framework of leadership and intersectoral coordination				
Issuance of official government regulations for MS system				
Step 3: Situational assessment of existing systems/sub-systems mechanisms				
Prepare list of systems for assessment				
Business process analysis for all systems				
Step 4: Develop mortality surveillance system design				
SWOT analysis and recommendations				
Proposed MS system design and institutional network				
Step 5: Phased program of implementation				
First stage objectives e.g. number of districts covered				

7.4 Quality assurance of the MS system

The data quality management program should also assess various structures, tools, resources and processes for implementing mortality surveillance activities. This can be considered to be an evaluation of the quality assurance of the system, because the adequacy of such elements and availability of necessary resources are a foundation for field implementation and are essential to assuring high-quality data from the MS system.

The evaluation should examine the organizational structure, capacity, resources, and operations within and across institutions with MS responsibilities in each local area. The evaluation process could use a check list or questionnaire for recording findings from the quality assurance assessment. Different elements that should be investigated include:

1. Institutional network, capacity and readiness

a. Distribution of participating institutions in each area (e.g. local CRVS units; health facilities, district registration/health offices; statistics agencies), with assessment of adequacy in terms of community accessibility for provision of registration services; as well as appropriateness of staff workload in terms of population coverage
b. Within each institution, presence of institutional structures and organization for leadership and management of MS operations (e.g. is there a dedicated/nominated coordinator with supporting structures for work delegation /financial management/technical supervision etc.)
c. Nature of funding mechanisms and availability for local functions (i.e. is there a regular funding process or issues which may hinder business continuity
d. Institutional SOPs for each set of tasks, to maintain consistency of operations and provide support during staff turnover
e. Protocols for collaboration with other institutions within and across sectors and levels/hierarchies

2. Infrastructure and resources
   a. Availability of adequate operational resources (e.g. office space, furniture, electricity, stationery, training facilities etc.)
   b. Technical equipment – computers, internet access, hand held devices for field staff, printers, projectors, telecommunication)
   c. Human resources – adequate staff numbers, training in respective roles, back up/replacements for staff turnover
3. Tools and processes for data collection, compilation, management
   a. Availability of paper forms/hard copy registers OR electronic data entry systems linked to local/remote databases.
   b. If electronic evaluate functional status/availability of troubleshooting support or back up equipment
   c. Assess implementation of protocols for local data entry/data quality checks/data compilation and submission
   d. Evaluate if proper data standards are in use at field as well as office levels (e.g. for neonatal deaths, is age being recorded in days? OR in the data entry process for causes of death; are complete text entries being made i.e. without abbreviations?)
   e. Assess compliance with protocols for record verification / field review / record correction/updates and feedback

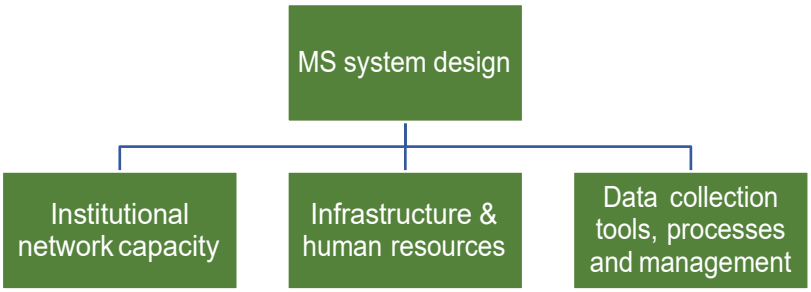

Figure 5: Evaluation of quality assurance elements of mortality surveillance systems

7.5 Elements of Data quality for mortality surveillance

Following commencement of implementation, there is a need to regularly monitor its progress, in terms of various parameters of efficiency of performance, and others regarding the quality of data generated by the mortality surveillance system. As shown in Figure 6, various dimensions of data quality need to be tracked regularly, with some dimensions having multiple perspectives. Country teams should also note that various data quality limitations could result from weaknesses in quality assurance elements (Section 7.4). Hence, the analysis of M&E results should also include the identification of linkages between data quality and system design/infrastructure/resources to guide interventions to strengthen quality.

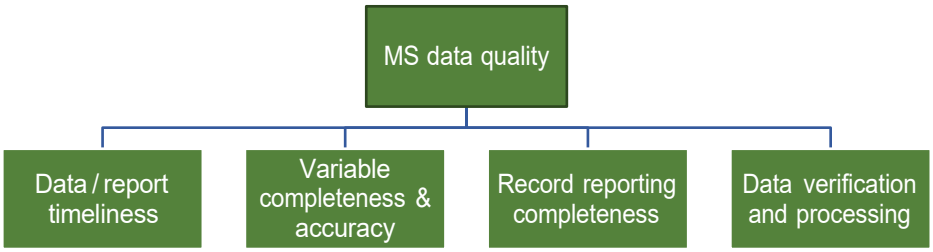

Figure 6: Monitoring and evaluation of MS data quality

A sample of indicators that could be used for monitoring data quality for the various dimensions is provided below:

1. Timeliness of data
    a. Proportion of deaths that are notified with specified time after occurrence (same day, within three days etc.)
    b. Proportion of surveillance units that submit daily/ weekly reports within specified time limits
    c. Timeliness of national/sub-national unit data report dissemination (e.g. within one month/three months of data reference period)
2. Variable completeness and accuracy
    a. Proportion of variables with missing/incomplete information (e.g. missing age/sex; incomplete address/date of death; missing unique ID number etc.)
    b. Proportion of records with missing/incomplete variables from each surveillance unit/site
    c. The proportion of deaths assigned ill-defined causes from medical certification of cause of death or verbal autopsy
    d. Plausibility and reliability of data regarding age-sex mortality patterns (and age patterns for specific causes, if data is available)
3. Record reporting completeness
    a. proportion of reported deaths out of expected deaths in the study population during a defined reference period

b. proportion of surveillance units that submit data for an annual period
c. Proportions of districts/provinces/states for which data are included in a surveillance data dissemination report

4. Data verification and processing
    a. Review of all records with missing variables/incomplete information
    b. Field validation of sample of records, to confirm information recorded for specific variables – e.g. date of death; causes of death etc.
    c. Review of quality of data compilation/integration from different sources (e.g. identification and removal of duplicates; cross verification of data for specific variables from alternate/multiple sources
    d. Review of quality of ICD coding of causes of death
    e. Monitoring of data aggregation and quality evaluation at district/ province/ national levels

7.6 Data analysis, reporting and dissemination

Following data verification, there is a need to implement quality control mechanisms to update individual records with missing or corrected information. At another level, quality control could apply adjustment factors to specific variables at an aggregated level, mainly where particular data biases have been measured from a sample of records. For example, an analysis of record reporting completeness could have been conducted in a representative selection of villages/districts, and the findings of age/sex measures of completeness could be applicable across the study population.

Similarly, findings from a cause of death validation study could be used to correct the cause profile for deaths with ill-defined causes. In general, these adjustment techniques are based on application of findings from quality monitoring and verification; hence can be considered as data quality control methods. Such data corrections and adjustments are also a function of data analysis. Still, since they are reliant on results from monitoring and evaluation, they could be considered in this section. They should be applied to maximize the potential reliability and utility of mortality surveillance programme data.

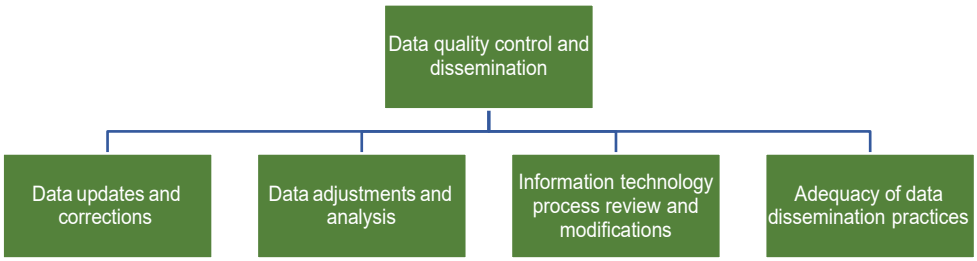

Figure 7: M&E functions related to MS data quality control and dissemination

The following activities could be considered as functions for M&E of data quality control and dissemination:

1. Protocols for updating records based on findings from field verification, and monitoring the implementation of these protocols regularly. Such protocols could be built into the Information Technology functionalities of the MS system
2. Implementation of statistical adjustments based on findings from the M&E program on data quality, at the stage of data analysis.
3. Regular monitoring of timeliness and adequacy of data dissemination via electronic dashboards, periodic reporting and/or analytical summaries
4. Periodic analysis of IT aspects of data flow and management through analysis of business processes, system interoperability, and data integration protocols

7.7 Methods for monitoring and evaluation of MS systems

A range of methods would need to be used to implement M&E activities for MS systems. In the current era of digitisation, there are good opportunities to build various M&E functions into the electronic systems, with results of data timeliness, quality compilation at different levels being displayed through regularly updated dashboards. For this reason, the M&E team must participate in discussions with the Information Technology team, to guide the design of system functionalities that can generate the required information.

Other basic system design, implementation and operations could be investigated through a range of alternate methods including:

a. Questionnaires
b. Field validation/verification studies
c. Observational analyses during field inspections and supervision
d. Special surveys
e. Secondary data review e.g. results from data linkage and integration across sources which could be used to update missing variables or validate information
f. Statistical analyses of reporting timeliness (e.g. use of capture-recapture methods)
g. Focus group discussions and key informant interviews

The overall M&E plan must include a schedule of activities that should be conducted on a continuous or periodic basis at each node as well as at each level of the MS system (e.g. CRVS unit, community health centre, health facility, MoH disease surveillance programs, district office, statistics office, mortality surveillance data centre etc.). Annex F provides a template for a logical framework for implementing the M & E plan, which national MS teams could adapt for local purposes. The template could be designed to monitor national strategic objectives and activities by specifying indicators and levels where such monitoring is required, as well as the responsible institutions, measurement methods, and frequency of measurement, among other details. Such a logical framework could be helpful for countries where similar M & E activities are not part of existing HIS programs. Required tools, materials and resources for implementing M&E activities should be made available. Also, specific training should be imparted to all relevant field staff, along with documented SOPs and field guidelines for M&E activities, interpretation of findings,

and follow up activities for data verification, quality control, and quality improvement. Findings from data quality assessment must be included as a separate chapter in all vital statistics reports.

7.8 Interventions for data quality improvement

Although not directly a function of Monitoring and Evaluation, it is necessary that the findings and outcomes of M&E activities should feed into the information cycle of MS systems, in the form of data quality improvement activities. For example, shortfalls in data completeness or timeliness from specific reporting units or facilities must be followed up by interventions to fill these data gaps into the future. Similarly, inadequacies in data accuracy for specific variables must be addressed through strengthening processes and resources.

Data quality can be improved through:

a. Using findings from M&E to introduce electronic processes to ensure data quality at the point of record capture for specific variables (e.g., logic checks, range checks, etc.)
b. Introduction of data quality audits in various participating institutions e.g. CRVS units, health facilities etc. that will ensure review of missing or incomplete variables prior to data submission
c. Specialised audit checks e.g. quality assessment of medical certification of cause of death in medical records departments of hospitals, to ensure compliance with standard certification and coding guidelines
d. Establishment of feedback loops at different levels through data verification queries an data quality reports
e. Organizing site visits/discussions to examine gaps in the system and identify solutions
f. Inclusion of dedicated information-sharing sessions on data collection and reporting gaps during refresher training courses, so that field staff can understand and implement best practices.
g. All MS data reports should include a chapter presenting findings from the M&E activities, along with an interpretation of linkages between data quality shortcomings and specific system design/resource aspects that could be the target of specific improvement actions through system redesign and/or capacity building.
h. Where appropriate, the chapter could also mention any improvements that have occurred since the previous M&E report, as evidence that the M&E programme is truly effective.

7.9 Budgeting for M&E

While planning for the mortality surveillance program, each Member State should consider having a budget line for M&E activities. It is usually recommended that this should be 5% of the total program's budget. The allocated budget should be used to fund M&E activities, such as tools development, personnel recruitment, capacity building, data base development, field visits, evaluation studies, etc.

There is a range of funding sources for M&E activities. All health sector service delivery programs, including disease-specific interventions, include a budget item for M&E. Since mortality data is a key outcome indicator for such programs and purposes, and since the data collection could also include information from health information systems or disease

surveillance programs, there could be overlap in activities that could be used as a basis for obtaining funding for M&E of mortality surveillance.

The MS TWG as well as the sub-working groups for M&E should ascertain the availability of such funding, and link it to specific activities within the implementation plan. There are no specific guidelines or examples for such access with the financing, but it is anticipated that subsequent iterations of the MS Operational Guide would include some country experiences and examples to guide program development activities into the future.

Annex F: Log frame for M&E

Project Name	Routine Mortality Surveillance											
Goal	To help countries improve timely and reliable information that enables early detection of public health threats, guide responses for epidemic control and ensure evidence-based policy and practice										Performance	
Main Activity	Priority activities	S/n	Level of Indicator (Input, Output, Outcome	Indicator	Calculation (if applicable)	Unit of Measurement	Level of Disaggregation	Frequency	Data Source	Responsible	Baseline Value	Year 1
							Sub national	Monthly	National Mortality Register			

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