THE WORLD BANK

PEACE, PROSPERITY AND REGIONAL INTEGRATION

AfricaCDC
Centres for Disease Control and Prevention

REGIONAL IMPLEMENTATION GUIDE ON HEALTHCARE ASSOCIATED INFECTIONS SURVEILLANCE AND PREVENTION AND CONTAINMENT OF MULTI-DRUG-RESISTANT ORGANISMS

FOREWORD

Globally, healthcare-associated infections (HAIs) affect hundreds of thousands of patients every year. According to the World Health Organization (WHO), in high-income countries, approximately 7 out of every 100 hospitalized patients acquire at least one HAI, while in low- and middle-income countries, this figure is much higher —about 15 out of every 100 patients. The African region faces a growing challenge from healthcare-associated infections (HAIs) and multidrug-resistant organisms (MDROs), threatening the health of patients, undermining health system resilience, and exacerbating the burden of antimicrobial resistance (AMR).

WHO estimates that antimicrobial resistance (AMR) causes at least 700,000 deaths globally each year, with projections that this number could rise to 10 million annually by 2050 if no action is taken In the African region, studies suggest the burden of HAIs is particularly severe. Recent point prevalence surveys indicate HAI prevalence rates ranging from 12% to 20% in many African hospitals. Common types of HAIs include surgical site infections, bloodstream infections, and urinary tract infections, with increasing evidence of high resistance rates to commonly used antibiotics such as third-generation cephalosporins, fluoroquinolones, and carbapenems. Multidrug-resistant organisms (MDROs) significantly contribute to the burden of HAIs.

Africa CDC's assessments show that surveillance systems for HAIs and MDROs are still under development in most African Union Member States, with gaps in laboratory capacity, data reporting, and integration into national AMR action plans. In 2021, 21.36 million people died globally for whom sepsis was an immediate cause of death or was in the chain of events leading to their death of these, 5.17 million deaths occurred in Sub-Saharan Africa. Strengthening surveillance, prevention, and response capacities is therefore critical to protect patient safety and combat the rising threat of AMR in the region.

This regional guidance document provides a timely and critical framework to guide African countries in strengthening surveillance, prevention, and control strategies for HAIs and MDROs. It builds on global and regional commitments, including the WHO Global Action Plan on AMR and IPC and the Africa CDC initiatives, while reflecting the unique contexts, challenges, and innovations across African healthcare systems.

We commend the collaborative efforts of national governments, technical experts, regional institutions, and international partners who have contributed to this document. Together, we aim to foster stronger surveillance systems, improve infection prevention practices, and enhance our collective capacity to protect patients and communities from the rising threat of drug-resistant infections.

Dr. Ntuli A. Kapologwe
Director General,
East Central and Southern Africa Health Community

ACKNOWLEDGEMENT

This guidance document was developed through the collaborative efforts of numerous stakeholders across the ECSA region. We express our deep appreciation to the national experts, policymakers, healthcare workers, and laboratory personnel from member states who contributed insights, data, and best practices. Special thanks go to the regional and international partners, including Africa CDC, Inter Governmental Authority for Development, WHO AFRO and other technical agencies, for their invaluable support and expertise.

We also acknowledge the leadership and coordination provided by the regional Communities of Practice sub working group on IPC whose dedication ensured the successful development of this document.

We acknowledge the technical and financial support of the World Bank Funded Health Emergency Preparedness, Response and Resilience Project, AFE Health Emergency Preparedness, Response and Resilience MPA (P180127) that made this work possible.

EXECUTIVE SUMMARY

Healthcare-associated infections (HAIs) and multidrug-resistant organisms (MDROs) pose a growing threat to patient safety, healthcare systems, and public health in the African region. This Regional Guidance Document provides a comprehensive framework to support countries in establishing, strengthening, and sustaining surveillance systems for HAIs and prevention strategies targeting MDROs.

The document opens with an Introduction outlining the burden, impact, and urgent need for coordinated action on HAIs and MDROs in Africa. It emphasizes the importance of aligning national efforts with global strategies, such as the WHO Global Action Plan on AMR, while tailoring interventions to local contexts. The Objectives section defines the guide's main aims: to provide evidence-based, practical guidance for setting up effective surveillance systems, inform national policies, and promote harmonized approaches across the region.

Governance and Coordination are recognized as critical pillars, underscoring the need for strong national leadership, multisectoral collaboration, and integration with broader infection prevention and control (IPC) and AMR programs. The Principles of HAI and MDRO Surveillance Systems section outlines the key components of effective surveillance, including standard definitions, laboratory capacity, data management, and feedback mechanisms.

The document details Methods of HAI Surveillance, covering various approaches such as point prevalence surveys, targeted surveillance of high-risk units, and device- or procedure- associated infection tracking. It also provides guidance on Data Analysis to ensure collected data are translated into meaningful, actionable insights. A dedicated section on the Essential Elements of HAI and MDRO Surveillance highlights the need for standardization, workforce capacity, quality assurance, and continuous improvement processes. Recognizing the increasing threat of resistant pathogens, the document outlines Prevention and Control Strategies for Priority MDROs, including tailored interventions, antibiotic stewardship, and environmental hygiene measures.

The Step-wise Implementation section provides a roadmap for countries at varying stages of system maturity, allowing for gradual scaling up based on available resources and national priorities. To ensure accountability and learning, Key Monitoring and Evaluation (M&E) Aspects are detailed, offering indicators, tools, and processes for assessing progress and impact. Sustainability is addressed through Resource Mobilization and Sustainability strategies, emphasizing the importance of securing political commitment, integrating efforts into national plans, and leveraging partnerships and funding opportunities.

The guide includes Case Studies and Regional Best Practices from countries such as Ethiopia, Burundi, Tanzania, Malawi, and Kenya, offering practical examples and lessons learned from the African region to inspire and inform implementation.
Overall, this document serves as a vital resource for policymakers, healthcare leaders, and practitioners across Africa, offering a unified framework to strengthen HAI surveillance and combat the spread of MDROs, ultimately enhancing patient safety and health system resilience across the continent.

ABBREVIATIONS

AMR	Antimicrobial Resistance
CAUTI	Catheter Associated Urinary Tract Infection
CLABSI	Central Line Associated Blood Stream Infections
CPE	Carbapenemase-Producing Enterobacterales
CRAB	Carbapenem-Resistant *Acinetobacter baumannii*
CRE	Carbapenem-Resistant Enterobacterales
CRPsA	Carbapenem-Resistant *Pseudomona aeruginosa*
EHR	Electronic Health Record
ESBLs	Extended Spectrum Beta Lactamases
GLASS	Global Antimicrobial Resistance Surveillance System
HAI	Healthcare-Associated Infections
ICU	Intensive Care Unit
IHR	International Health Regulations
IPC	Infection Prevention and Control
LMIC	Low- and Middle-Income Countries
MDRO	Multidrug-Resistant Organism
MOH	Ministry of Health
MRSA	Methicillin Resistant *Staphylococcus areus*
NMRA	National Medicines Regulatory Authority
PHC	Primary Health Care
PHEIC	Public Health Emergency of International Concern
PPP	Public Private Partnership
QA/QC	Quality Assurance/ Quality Control
SOP	Standard Operating Procedure
SSI	Surgical Site Infections
VRE	Vancomycin Resistant Enterococci
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization

TABLE OF CONTENTS

01: INTRODUCTION

BACKGROUND ON HEALTHCARE-ASSOCIATED INFECTIONS (HAIS) AND MULTIDRUG RESISTANT ORGANISMS (MDROS)

Healthcare-associated infections (HAIs) are infections acquired while receiving care in a hospital or other healthcare setting that were not present or incubating at admission (1).They are a major problem for patient safety and its impact can result in prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobial agents, a massive additional financial burden for the health system, high costs for patients and their families, and excess deaths. The risk to acquire HAI is universal and pervades every health-care facility and system worldwide, but the true burden remains unknown in many nations, particularly in developing countries (2).

In developed countries, 5–15% of hospitalized patients and more than 50% of patients in intensive care units (ICUs) develop HAIs. In resource-limited countries, the magnitude of HAIs is underestimated or unknown due to the absence of a well-established surveillance system. The burden of HAIs is assumed to be high in less developed countries because of health-care system deficiencies such as lack of infection control policies, overcrowding in healthcare settings, understaffing, poor infection prevention and control practices (3).

A critical and closely related challenge is the emergence and spread of multidrug-resistant organisms (MDROs), pathogens resistant to multiple classes of antibiotics. Common MDROs include methicillin-resistant Staphylococcus aureus (MRSA), extended-spectrum beta-lactamase (ESBL)- producing Escherichia coli and Klebsiella pneumoniae, and carbapenem-resistant Enterobacterales. These organisms compromise treatment efficacy, resulting in longer hospital stays, higher morbidity and mortality, and increased costs(4).

Global and Regional Statistics on HAI and MDROs

Multidrug-resistant organisms (MDROs) significantly contribute to the burden of HAIs. WHO estimates that antimicrobial resistance (AMR) causes at least 700,000 deaths globally each year, with projections that this number could rise to 10 million annually by 2050 if no action is taken.

In May 2023, WHO presented and adopted its global strategy on IPC at the 76th World Health Assembly. This strategy aims to strengthen IPC programs across all health care settings, including acute and long-term care, as well as primary, secondary, and tertiary facilities in both the public and private sectors. The vision is that "by 2030, everyone accessing or providing health care is safe from HAIs". Among the eight strategic directions, the fifth one (data for action) focuses on HAI surveillance. The direction provides guidance on establishing effective surveillance systems and utilizing collected data to inform IPC improvement actions (5).

Burden of HAIs and MDROs in the African region (with regional statistics)

Burden of HAI

HAIs have a significant impact on in-hospital mortality, the length of extra hospital stays, and extra costs for medical care. Global data highlight a substantial variation in HAI prevalence. A 2022 WHO review reported pooled HAI prevalence rates of 12.9% in South-East Asia, 12.5% in the Eastern Mediterranean, 9.7% in the Western Pacific, and 27% in the African region, the highest among all WHO regions. In comparison, prevalence rates were 8.0% in EU/EEA countries, 9.6% in the Americas, 7.9% in Canada, and just 3.2% in the United States. In intensive care units, HAI incidence can be 2–20 times higher in LMICs than in high-income settings, with up to 30% of ICU patients affected. Notably, nearly 24% of all hospital-treated sepsis cases are healthcare-associated, with close to half of ICU-treated sepsis with organ dysfunction originating from healthcare facilities (6) .
The pooled prevalence of HAIs in Africa is reported at 12.8% which is higher than the prevalence reported in Asia (9.0%), Europe (6.5%) and the United States (4.0%) (7). According to the World Health Organization (WHO) and other researchers, 10% of patients in emerging and developing economies acquire at least one type of HAIs, and of these patients, 10% die (8).

Burden of Multi Drug Resistace Organisms

Multidrug-resistant organisms such as Carbapenem-resistant gram-negative bacteria, namely, CRE (for example, Klebsiella pneumoniae, Escherichia coli), CRAB, and CRPsA, are an emerging cause of HAI that pose a significant threat to public health (9). These bacteria are difficult to treat due to high levels of AMR and are associated with high mortality. Importantly, they have the potential for widespread transmission of resistance via mobile genetic elements (10).

During the last decade, there has been an alarming global increase in the incidence and prevalence of carbapenem-resistant gram-negative bacteria (11). According to the 2014 global report on AMR, carbapenem-resistant *K. pneumoniae* were reported from all WHO regions, although only 37% of Member States could provide data (12). This included two regions with some countries reporting up to 50% of *K. pneumoniae* resistant to carbapenems.

Mortality and clinical outcomes associated with carbapenem-resistant gram-negative bacteria can be severe. A meta-analysis evaluating the number of deaths attributable to CRE infections found that 26-44% of deaths across seven studies were attributable to carbapenem resistance. Among these, the number of deaths among CRE-infected patients was two-fold higher than those attributed to carbapenem-susceptible *Enterobacterales* (13). In the African region, studies suggest the burden of HAIs is particularly severe. Recent point prevalence surveys indicate HAI prevalence rates ranging from 12% to 20% in many African hospitals. Common types of HAIs include surgical site infections, bloodstream infections, and urinary tract infections, with increasing evidence of high resistance rates to commonly used antibiotics such as third-generation cephalosporins, fluoroquinolones, and carbapenems.

Despite these challenges, most countries in Eastern, Central, and Southern Africa lack functional, standardized national surveillance systems for HAIs and MDROs. Weak laboratory capacity, fragmented reporting, and human resource constraints hinder the detection and response to these threats. Strengthening HAI and MDRO surveillance is therefore critical to improving patient safety and healthcare outcomes across the region.

Challenges and Opportunities for HAI and MDRO surveillance in the region

Through interactive sessions among the communities of practice the following shared barriers, infrastructure gaps, and regional opportunities for enhancing healthcare-associated infections (HAI) and multidrug-resistant organism (MDRO) surveillance in the East, Central and Southern Africa (ECSA) region were shared.

Key Challenges

1. Human Resources: Majority of the countries, reported critical shortages of trained IPC and surveillance personnel.
2. Lack of Surveillance Protocols: Participants acknowledged the absence of standardized guidelines or manuals to guide national or facility-level surveillance efforts.
3. Data Gaps:
    - Data from lower-level health facilities is either missing or unreliable, despite these facilities managing most patients.
    - Health workers at lower levels may not know what or how to report, leading to underreporting. Consequently, most standard case definitions are clinical based
4. Laboratory Infrastructure: Inadequate microbiology laboratory capacity to support HAI surveillance and the prevention and control of MDROs. Additionally, underutilization of microbiology laboratory was also reported where these exist
5. Cross-Border Surveillance: Patient travel and trade across borders contribute to MDRO transmission, yet regional surveillance systems for tracking such movement are weak or non-existent.
6. Sustainability: There is a risk of project-based surveillance collapsing once donor support ends, pointing to a lack of sustainable funding and ownership.
7. Inadequate resources. Most countries reported inadequate funding to implement IPC and AMR interventions including HAI surveillance.

Opportunities and Recommendations:

1. System Integration:
    - There is a need to integrate HAI and MDRO surveillance with existing health information systems like and other disease surveillance platforms
    - Aligning AMR efforts with broader IPC and disease control systems can enhance efficiency.
2. Partner Support:
    - Development partners and donors are actively supporting regional surveillance efforts with financial and technical resources.
    - Member states should capitalize on this support while working to institutionalize programs for long-term sustainability.
3. Data Sharing and Policy Advocacy:
    - Strengthening internal and cross-border data sharing mechanisms can improve preparedness and outbreak response.
    - Evidence generated from surveillance data should be used to inform national policy and resource allocation.
4. Peer Learning and Mentorship:
    - Countries with successful models should support others through peer mentorship programs, promoting regional solidarity and shared growth.
5. Sustainability Emphasis:
    - All guidelines, tools, and programs developed should prioritize long-term sustainability, including local financing and capacity building.

Rationale for a Regional Guide

One key action in the WHO global action plan is to establish or strengthen national surveillance systems for HAI and related AMR, particularly by involving tertiary and secondary health care facilities in a national surveillance network. Most importantly, HAI and AMR surveillance were prioritized among the top core targets in the IPC monitoring framework through a Delphi study including IPC international experts and national focal points, followed by subsequent consultations with Member States prior to approval by the World Health Assembly. These core targets are:

1. Increasing the proportion of countries with a national HAI and related AMR surveillance system, including for early warning to detect epidemic- and pandemic-prone pathogens causing HAIs to 30% by 2026, 50% by 2028, and over 80% by 2030;
2. 1. Increasing the proportion of tertiary/secondary health care facilities having a surveillance system for HAI and related AMR, including for early warning to detect epidemic- and pandemic-prone pathogens to 30% by 2026, 50% by 2028, and over 80% by 2030 (14).

The estimates of HAI prevalence have been hindered by underreporting, poor data quality, and a lack of standardized methods and protocols, resulting in a scarcity of reliable data, particularly in LMICs (15). Therefore, Development of a "Regional implementation Guide on HAIs Surveillance and Prevention and Containment of Multidrug Resistant Organisms (MDROs) is crucial. This document has been developed in alignment with several global and regional commitments aimed at improving Infection Prevention and Control (IPC), preventing and containing HAI and MDROs.

This document therefore, provides standardized guidance on HAI surveillance in the AFRO region, helping healthcare professionals and policymakers to design effective monitoring systems and offers best practices for IPC, enabling healthcare facilities to reduce infection risks and improve patient safety. This guide focuses on the four most frequent and commonly reported types of HAI: bloodstream infections (BSI), urinary tract infections (UTI), surgical site infection (SSI) and pneumonia. The guide uses WHO validated case definitions to make HAI surveillance more feasible

and ensure accurate and reproducible data and for use to assess the effectiveness of interventions in resource-limited settings. It also addresses surveillance of priority multidrug-resistant pathogens to help guide appropriate antibiotic use and resistance management. Surveillance and feedback of infection rates to healthcare workers and other stakeholders has been a cornerstone of quality improvement in HAI prevention programs (16).

This guide is essential to address the rising burden of HAIs and MDROs in AFRO Region. It would standardize surveillance methods, improve IPC practices, and strengthen early detection and response to outbreaks. The guide supports capacity building, policy harmonization, HAI and MDRO prevention strategies, data comparability, and resource mobilization. It promotes accountability, benchmarking, and preparedness for public health emergencies, ultimately improving patient safety and health system resilience across the region.

Link to global, and regional commitments

The Regional Implementation Guide on HAI Surveillance and Prevention and Containment of MDROs is a practical tool developed to align with and operationalize global and regional commitments in IPC.

This document will guide countries in the implementation of various world health assembly declarations such as the WHA11.18 on quality of care: Patient Safety (2002), WHA72.6 on Global Action on Patient Safety (2019), and 76th WHA adoption of the Global strategy on infection prevention and control (2023) which emphasize on the implementation of strategies to reduce of HAI and AMR to enhance patient safety.

Additionally, HAI surveillance is a core capacity for the International Health Regulations (IHR) required for countries to effectively detect, assess, notify, and respond to public health risks and emergencies of national and international concern. The 2022 WHO's global Report on IPC emphasizes the need for standardized IPC measures to reduce HAIs and AMR, and Africa CDC has promoted this strategy. East, Central, and Southern Africa Health Community (ECSA-HC) advocates for regional collaboration in healthcare quality improvement, harmonizing health policies. All these initiatives align with International Health Regulations (IHR) requirements for countries to strengthen their health systems to prevent and control infectious diseases.

By promoting standardized surveillance frameworks and preventive measures, the guide helps countries in the region to strengthen health security, improve patient safety, and enhance preparedness for infectious disease threats.

Purpose and Scope of the Guide

This guide is developed to support Ministries of Health, national infection prevention and control (IPC) programs, and stakeholders involved in antimicrobial resistance (AMR) containment in establishing or strengthening national health care-associated infection (HAI) surveillance systems. The guide provides a step-by-step framework for the development and implementation of a National HAI Surveillance Guide including the prevention and control of Multi Drug Resistance Organisms, drawing on global standards, regional priorities, and practical field experiences from low- and middle-income countries.

It focuses on enabling countries to systematically collect, analyze, and use HAI data to inform policy decisions, drive improvements in clinical practice, and support early detection and containment of outbreaks, particularly those involving multidrug-resistant organisms (MDROs). The scope of the guide includes both facility-based and national-level interventions and aligns with the WHO Global IPC Strategy, the Global Action Plan on AMR, and the Africa CDC AMR Surveillance Framework.

Objectives

This guide is intended to:

1. **Provide practical guidance on developing a National HAI Surveillance Plan** Assist countries in creating context-specific documents that outline national goals, indicators, case definitions, data collection methods, roles, and responsibilities for HAI surveillance.
2. **Provide practical guidance on the establishment of a national HAI surveillance system** Offer stepwise instructions on the design, implementation, and scale-up of an effective surveillance system including selection of sentinel sites, workforce training, data management, and feedback loops.
3. **Provide guidance on prevention of HAIs** Highlight evidence-based IPC interventions, standard precautions, and facility-level practices that prevent the occurrence and spread of HAIs.
4. **Provide practical guidance for the prevention and containment of priority multidrug-resistant organisms (MDROs)** Support the implementation of early detection, isolation, cohorting, and antimicrobial stewardship strategies to manage MDRO threats, with a focus on regionally prevalent pathogens such as ESBL, CRE, and MRSA.

Target Audience

This guide is primarily intended for:

1. **National IPC Units and AMR Coordinating Committees** – for strategic planning, system design, and coordination.
2. **Public health authorities and policy makers** – for integration of HAI surveillance into national health strategies and resource allocation.
3. **Hospital administrators and IPC focal persons** – for implementation and monitoring of HAI surveillance at the facility level.
4. **Laboratory personnel and microbiologists** – for standardized specimen collection, diagnostics, and data reporting.
5. **Epidemiologists and surveillance officers** – for case definition application, data analysis, and reporting.
6. **Clinicians, nurses, and allied healthcare workers** – for case identification, implementation of IPC practices, and feedback mechanisms.
7. **Development partners and stakeholders** – supporting system development, training, and sustainability planning.

02. GOVERNANCE AND COORDINATION OF HAI SURVEILLANCE SYSTEMS

Effective governance and coordination are fundamental pillars for the successful implementation of national healthcare-associated infection (HAI) surveillance systems. A well-structured governance framework ensures clarity in leadership, roles, and accountability across all levels of the health system—from national authorities to facility-based teams. Coordinated surveillance efforts require robust institutional mechanisms, multisectoral collaboration, standard operating procedures, and alignment with national infection prevention and control (IPC) and antimicrobial resistance (AMR) strategies. Strengthening governance enhances data standardization, ensures efficient resource allocation, promotes sustainability, and enables timely use of surveillance data for decision-making and public health response. A clearly defined governance and coordination structure also fosters trust and engagement among stakeholders, thereby driving improved patient safety and healthcare quality.

Governance and Coordination Mechanisms

The Surveillance of HAI and MDRO containment should be integrated into existing IPC governance and coordination mechanisms at the national and subnational levels.

The following institutions and stakeholders can be considered for the successful implementation of HAI surveillance and prevention, and MDRO surveillance and containment.

A. National level

Ministry of Health (MOH); Ministry of Agriculture (MOA); Environmental Protection Agency (EPA);National medicines regulatory authorities; National Research Institutes; National Public Health institutions; National Reference Laboratories; Central medical supplies Agencies; Developmental partners; Implementing partners; Private sector; Relevant regulatory bodies; National health insurance and Civil society organizations.

B. Sub-national Level

Local Government authority; Health Facility and Implementing partners.

Roles and responsibilities of the coordination mechanisms at national and subnational levels.

National Level	Sub-national Level
Advocate for legislative support and funding	Allocate funds for HAI surveillance and prevention, and MDRO surveillance and containment
Develop and disseminate national HAI surveillance and prevention, and MDRO surveillance and containment policies, strategic plans, and guidelines	Establish an IPC program at the healthcare facilities in line with the national IPC policy
Integrate HAI and MDRO surveillance in the existing relevant surveillance systems	Adaptation & Implementation of the national HAI surveillance and prevention, and MDRO surveillance and containment policies, strategic plans, and guidelines
Monitor national HAI and MDRO trends, and program outcomes	Avail the necessary commodities and infrastructure for HAI surveillance and prevention, and MDRO surveillance and containment
Strengthen the multisectoral involvement	Monitor, evaluate and report HAI surveillance and prevention, and MDRO surveillance and containment implementation at the facilities
Capacity build health workers on HAI surveillance and prevention, and MDRO surveillance and containment	Capacity build health workers on HAI surveillance and prevention, and MDRO surveillance and containment
Conduct operational research on HAI and MDRO	Use HAI and MDRO surveillance data to inform interventions and policies
Avail the necessary commodities and infrastructure for HAI surveillance and prevention, and MDRO surveillance and containment	Conduct operational research on HAI and MDRO
Disseminate national HAI and MDRO surveillance data to the relevant stakeholders	
Use HAI and MDRO surveillance data to inform action and policies	

Institutional frameworks for the implementation of HAI surveillance and MDRO surveillance, and containment.

A. Africa CDC IPC legal framework

The framework mandates the establishment of surveillance systems for HAIs and AMR at national, sub-national, and healthcare facility levels. This includes the development of standard operating procedures (SOPs) for data collection, analysis, and reporting, ensuring timely detection and response to infection outbreaks.

B. Legislation/regulation and accreditation

The application of national legislation and regulations can support the enforcement of guidelines and standards' implementation at the sub-national and facility level. The IPC core components national level implementation manual also makes specific reference to the importance of considering accountability frameworks, accreditation and monitoring, and reward systems. Surveillance data and other assessment results should be used for improvement rather than in a punitive manner, while strong accountability mechanisms should be in place to make national and local authorities (including facility leadership in both public and private sectors) responsible for the implementation of the recommendation for HAI and MDRO prevention and control.

C. Education

Action at the facility level to prevent and control MDROs depends on effective training and education of the health workforce. National IPC programs should support education and training of the health workforce (including pre-employment and at pre- and postgraduate level) as one of its core functions within the context of a multimodal strategy and taking into account the availability of training materials in the local language.

One critical focus of training of those in charge of IPC programs is the ability to use and interpret the data made available by the national or local surveillance system. It is essential to spend time to critically review the data and identify appropriate actions to be made accordingly. Specific expertise is required for these tasks. If the country does not yet have this existing capacity, international training opportunities and support should be sought as soon as possible.

The training package should be standardized across the country and ideally rolled out by national authorities. The content should help healthcare workers to understand the epidemiology and terminology related to HAI and MDROs, as well as transmission, risk assessment, detection, and prevention measures.

The national IPC program should coordinate training activities with medical/nursing education bodies and national or regional education accreditation agencies. Available training and education organization, and opportunities should be used to embed specific training on HAI and MDRO at the national and regional levels.

D. Public reporting

Public reporting of HAI surveillance data is used in some countries with the purpose to increase transparency and data sharing. For example, in the USA, mandatory reporting of HAI is required in all states and using public reporting of HAI surveillance was associated with a significant reduction in CLABSI rates 13–18 months after the introduction of this federal policy within states. African countries can adopt this surveillance framework by empowering members of the public to report cases of HAI and MDRO.

E. Digital or automated HAI and MDRO surveillance systems

Conventional 'manual' surveillance of HAI and MDRO is usually done through a manual review of patients' medical records to identify HAI and MDRO according to standardized HAI and MDRO surveillance case definitions. Manual HAI and MDRO surveillance is, therefore, associated with a high workload and a potentially limited interrater reliability. As a result, manual surveillance is often restricted to presumed high-risk areas and selected types of infections. Digitalization of health care data creates novel opportunities for enhancing HAI and MDRO surveillance. Digital tools can support HAI and MDRO surveillance in different ways. For example, digital applications can support electronic data entry of information to avoid manual data entry, save time and minimize errors in data entry. Applications can also be developed to extract patient data from electronic health information systems (excluding patient identifiers). This applies to settings with functioning hospital information systems.

03. PRINCIPLES OF HAI AND MDRO SURVEILLANCE SYSTEM

Healthcare-associated infection (HAI) and multidrug-resistant organism (MDRO) surveillance systems are built on core public health and epidemiological principles that ensure the generation of high-quality, actionable data to inform infection prevention and control (IPC) strategies. At their foundation, these systems must be standardized, systematic, timely, and sustainable. Key principles include case definition consistency, accurate case ascertainment, representativeness of surveillance data, confidentiality, and ethical use of information. Effective surveillance should be integrated into routine health system functions, guided by national priorities, and adaptable to emerging threats. For MDRO surveillance specifically, microbiological confirmation, antimicrobial susceptibility testing, and laboratory quality assurance are essential. Together, these principles enable early detection of outbreaks, trend monitoring, benchmarking, and data-driven interventions to reduce the burden of HAIs and limit the spread of antimicrobial resistance.

The following principles should guide the development and operation of a national HAI and MDRO surveillance system:

National Level

1. Governance: Ministries, Departments and Agencies responsible for of health must establish a clear governance structure for the national HAI and MDRO surveillance system
2. Resource allocation: Adequate resources, (Financial, Human, Infrastructural) to support including financial and human resources allocation to support the functioning and sustainability of the HAI and MDRO surveillance system at all levels
3. Integration with other surveillance programmes: Establishment of linkages between HAI and AMR surveillance, and other relevant surveillance programmes e.g Integrated Disease Surveillance and Response Systems, particularly AMR surveillance
4. Monitoring and oversight: Monitoring the implementation of the national HAI and MDRO surveillance plan by responsible MDAs by the national IPC committee

Facility Level

1. Governance: The health care facility administration should establish a clear governance structure for HAI and MDRO surveillance.
2. Alignment with national policies: Health care facilities should implement their own HAI and MDRO surveillance as per the policies, plans and procedures that align with the national HAI surveillance plan/guidelines.
3. Resource allocation: The facility administration should allocate adequate financial and otherresources to support HAI and MDRO surveillance activities.
4. Integration with other facility surveillance Systems: Health care facilities conducting HAI and MDRO surveillance should integrate their efforts with other facility surveillance system.
5. Action plans: Facilities should develop and regularly update tailored prevention activities based on surveillance data, documented in a formal action plan.
6. Subnational plans: Health care facilities should align their surveillance efforts with the respective subnational plans.
7. Medical records: Ensure patient medical charts and records are thoroughly and accurately maintained to supporteffective HAI and MDRO surveillance.
8. Primary health facility considerations: Should follow national or subnational plans if available, particularlyin detecting and reporting community outbreaks.

Methods of Healthcare-associated Infections Surveillance

The selection of the methods of HAI surveillance at national and facility levels depends on the surveillance capacities across different resource settings, regions and health care systems. Member States should identify the surveillance strategy and approach that meets their situation and local context.

The choice of the type of surveillance relies on various factors related to the status and capabilities of the IPC program at national and facility levels, the experience and level of training of the professionals that will be responsible for implementing the surveillance, the clinical, laboratory, radiology and data management services available, and the information technology available at the country and health care facility level.

An important element is the capacity of the healthcare facility microbiology laboratory and its ability to reliably diagnose infections and describe the antimicrobial susceptibility profile of identified pathogens. Additional investigations that are important include radiological investigations and other imaging to support the diagnosis of pneumonia or organ-space SSI.

Active versus passive surveillance

Active surveillance

Active surveillance is the best option to identify and detect HAI. Data is specifically collected prospectively by trained personnel searching for infections according to HAI case definitions. Active surveillance can be resource- intensive, requiring trained professionals (IPC and/or surveillance teams) and time dedication. In addition, adequate and quality-assured microbiology laboratory and radiology services are critical to identifying infections in a systematic way.

Passive surveillance

Passive surveillance relies on data sources not specifically intended for active surveillance and is often retrospective and not conducted by trained surveillance staff. However, although this method is less demanding than active surveillance and may be the only feasible method in settings that lack expertise in surveillance and resources, it is the least sensitive way to detect infections. Notably, it is associated with higher levels of underreporting as it relies on information provided from health care providers whose responsibilities are centered on patient care and who are less familiar with the application of HAI case definitions. Passive surveillance systems may not provide high-quality data or timely information on changes in the risk of HAI.

Patient-based versus laboratory-based surveillance

Patient-based surveillance

Patient-based surveillance links the laboratory with clinical data and patient information. It estimates the frequency of HAI and assesses risk factors. This type of surveillance provides useful epidemiological data to be used for developing IPC prevention strategies. Patient-based surveillance requires visits to patient care areas and review of patient medical charts and records.

Laboratory-based surveillance

A laboratory-based surveillance means that infection identification is based solely on positive laboratory findings from the patient's clinical specimens (blood, urine, swab, etc.), without a link to patient clinical records, results of other diagnostic tests (for example X-ray), or patient characteristics. This type of surveillance describes the pathogens and their resistance pattern detected by the hospital laboratory. It can also help to identify the most frequently isolated pathogens in inpatients and the extent of AMR within the health care facility.

Note that if the date of patient admission to the health care facility is not available in the laboratory data, it will be difficult to distinguish a community infection from an HAI. Lack of additional data within the laboratory, such as specimen collection source or clinical signs or symptoms, makes the use of laboratory-based approach limited for HAI surveillance.

Comprehensive versus targeted (focused) surveillance

Health care facility populations under surveillance can differ according to the specified national and facility-level objectives of the HAI surveillance plan. Two approaches can be considered:

Comprehensive or facility-wide surveillance

It refers to an approach where all patients are observed (that is, all patient populations under surveillance). Comprehensive surveillance involves the collection of data across all or most wards and patient populations, including a wide range or all types of infections. This type of surveillance is more feasible for point prevalence surveys but may be labour-intensive in the case of prospective surveillance.

Targeted or focused surveillance

This is an approach where selected wards, patients or types of HAI are observed (for example, specific patient populations or specific HAI are deemed particularly relevant to put under surveillance).

The approach is particularly relevant for prospective longitudinal surveillance. It involves a more focused, narrow-spectrum approach, concentrating on specific selected infections, patient populations at risk or departments within the health care facility to enable them to address specific challenges and risks. It allows for more efficient resource allocation and more focused IPC interventions. However, it can miss clusters or outbreaks in other patients.

Considerations for targeted/focused surveillance

1. Prevalence and incidence: There should be a focus on infections with the highest occurrence rates in the facility as they represent significant areas of concern.
2. Severity and impact: infections that lead to severe patient outcomes such as high morbidity, mortality or prolonged hospital stays, should be prioritized.
3. Resource availability: The availability of resources such as staff, time, and financial resources, should be considered to ensure the feasibility of sustained surveillance.
4. Risk factors: Patient populations or units at higher risk for specific infections, such as ICUs, surgical wards or immunocompromised patients should be identified.
5. Outbreak history: Areas with a history of outbreaks or clusters of infections require more intensive monitoring. Regulatory requirements: Surveillance targets should be aligned with national or regional public health mandates and reporting requirements.
6. Preventability: Infections that have well-established prevention strategies and interventions should be focused upon to maximize the impact of IPC measures.
7. Diagnostic capabilities: The facility should ensure that they have the necessary diagnostic tools and laboratory capacity to accurately identify and monitor the targeted infections.
8. Stakeholder priorities: Engagement with health care providers, IPC teams and administrators is important to incorporate their insights and address their specific concerns and priorities.
9. Benchmarking: Infections that are commonly monitored in other facilities or regions should be considered, thus allowing for comparison and benchmarking against broader data sets.

Prevalence versus incidence

Prevalence of health care-associated infections

The prevalence of HAI refers to the proportion of the patient population within a health care facility who have acquired an infection while receiving medical care. It is typically expressed as a percentage (proportion). Prevalence surveys of HAI estimate active infections in a health care facility only at the time they are conducted, for example, either on a single day (point prevalence) or over a specified number of days (period prevalence). They can also be used to target specific areas or wards in the health facility where infection rates are known or suspected to be high. Data from each patient are collected only once during the time of the survey. Prevalence surveys can be repeated at regular intervals to show change. They may be quicker and less expensive than incidence.

Advantages of health care-associated infections prevalence surveys

1. Prevalence surveys can be used on a national level where they provide accurate and reproducible data. They are also an appropriate method to collect data on all (or multiple) types of HAI at facility-wide level.
2. Prevalence surveys provide a quantitative measure of the extent of HAI within a specific country, if a random sample of health care facilities is included in the surveys.
3. Prevalence surveys provide a qualitative measure of the extent of HAI within a specific health care facility, helping to assess the magnitude of the problem.
4. They are rapid, relatively low-cost way to estimate the magnitude of HAI at a single point in time at a health care facility or at national level.
5. Prevalence data can allow for benchmarking and the comparison of proportions of infections across different health care facilities or time periods and help to identify areas for IPC quality improvement.
6. Regular prevalence surveys enable to track trends of infection over time and help health care providers and policy-makers to implement targeted interventions and evaluate the impact of IPC.
7. Through prevalence data, targets for additional surveillance activities may be identified.
8. Data obtained from prevalence surveys can guide quality improvement initiatives, fostering a culture of continuous improvement in IPC practices. By understanding the prevalence of HAI, health care facilities can identify priority areas for IPC and allocate resources more effectively.

Limitations of health care-associated infections prevalence surveys

1. The accuracy of the infection estimate might be compromised by the seasonality of the infection. For example, a prevalence survey for HAI respiratory infections during the winter months for health care-acquired respiratory infections might suggest an increased risk, given the seasonal pattern of such occurrences.
2. Pre-valence surveys provide only a snapshot of infections at a specific point in time, making it challenging to capture dynamic changes and trends over shorter time intervals. On average, patients with HAI may have longer hospital stays and a higher likelihood of being observed in a prevalence survey, thus potentially overestimating the prevalence of HAI at that point in time.
3. Limited utility in identifying outbreaks.

Incidence of health care-associated infections

The incidence of HAI refers to the rate or frequency of new infections that occur within a health care facility over a defined period of time. Conducting surveillance using incidence is prospective, more reliable, but resource intensive, as it requires well-trained and dedicated teams to systematically screen entire patient charts and perform data collection and interpretation. Case finding by a well- trained surveillance team increases HAI detection. Incidence is the best way to track trends of HAI over time and to study specific types of infection which require follow-up with patients at risk.

Advantages of health care-associated infections incidence surveys

1. Tracks infection rates over time, identifying seasonal variations and long-term changes.
2. Provides up-to-date information on infection risks.
3. Assesses the effectiveness of IPC interventions by comparing pre- and post- intervention infection rates.
4. Informs better planning and allocation of resources.
5. Supports continuous quality improvement in patient safety and infection control.
6. Monitors incidence to detect and respond to outbreaks promptly.
7. Helps to identify risk factors associated with HAI for targeted prevention strategies.
8. Enables comparisons with historical data and other institutions, supporting best practices.
9. Offers more precise infection estimates at the hospital level compared to prevalence surveys.

Limitations of health care-associated infections incidence surveys

1. Requires significant resources, including trained personnel, time, and funding.
2. Often limited to high-risk areas, which may not reflect the full infection picture in the healthcare facility.
3. Potential sources of bias
4. Limited capacity (both in terms of availability and quality control) of microbiology laboratories and limited expertise in results' interpretation can affect the accuracy of point prevalence findings.
5. The cost of diagnostics often falls on patients, and thus they are often underused to limit out-of-pocket expenses.
6. The degree of consistency and agreement in using criteria for HAI diagnosis among data collectors can infer bias and influence data comparability among different facilities or countries.
7. Underreporting is a significant source of bias
8. More severe or clinically evident infections are more likely to be reported than milder cases. This can lead to an overestimation of the severity of HAI and an underestimation of its true incidence.

Description and calculation of HAI incidence key measures (Adopted from the WHO Surveillance of health care-associated infections at national and facility levels: practical Handbook)

Incidence Rate		
Description	A general term used to express the probability of a HAI occurring within a population over a specified time period.	
Calculation/notes	Note: Encompasses both incidence proportion and incidence density as specific measures.	
Incidence proportion (also known as 'cumulative incidence')		
Description	Measures the proportion of patients who develop a HAI within a defined surveillance period.	
Calculation	Number of patients who developed a HAI Total number of patients admitted	Note: To express the result as a whole number, multiply the proportion by a constant. For proportions, this constant is often 100, which converts the proportion into a percentage
Incidence density		
Description	Measure of the frequency with which new cases of HAI occur in a population over a specified period, considering the time each patient is at risk.	
Calculation	Number of patients who developed a HAI Total patient-days	Note: To express the result as a whole number, multiply the proportion by a constant
Device-specific incidence density		
Description	Measure of the frequency of HAI among patients with a specific device in place, considering the total number of days the device was used.	
Calculation	Number of patients with a device who developed a HAI Total device-days	Note: To express the result as a whole number, multiply the proportion by a constant.
Other epidemiological measures: Device utilization ratio		
Description	Measures the proportion of patients who have a specific device in place during a surveillance period.	
Calculation	Total number of device-days Total number of patient-days	

04. ESSENTIAL ELEMENTS OF HAI AND MDRO SURVEILLANCE

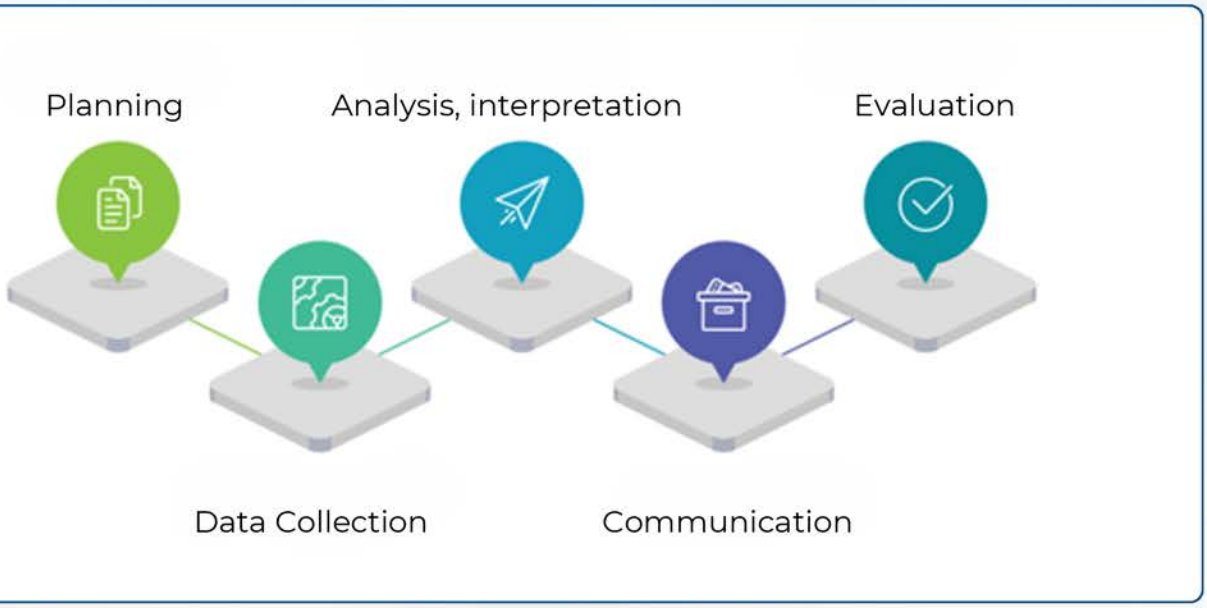
Effective HAI and MDRO surveillance is a critical strategy for reducing the burden of HAI and controlling the spread of resistant pathogens. At the national level, the World Health Organization recommends the establishment of HAI surveillance programs and networks that provide timely data feedback and support benchmarking to inform policy and improve outcomes.

HAI surveillance is not a minimum requirement at the primary and secondary facility level, but should follow national or sub-national plans. At the tertiary level, active HAI surveillance should be conducted and include information on AMR.

At the facility level, surveillance should be implemented to guide IPC interventions, detect outbreaks, including those involving MDROs, and ensure prompt dissemination of findings to healthcare workers and stakeholders through coordinated national systems.

This section outlines the six essential elements of a robust HAI surveillance system drawing on principles of public health surveillance to enhance facility and national response capacities:

Essential elements of HAI Surveillance



1. Planning of HAI & MDRO Surveillance

Surveillance planning lays the groundwork for effective detection, prevention, and control of HAI and MDROs. It requires a clear, written plan at both national and facility levels that defines scope, roles, methods, and resources.

National Level	Facility Level
Written Surveillance Plan: • Articulate overarching goals (e.g., enhance patient safety, reduce HAI/MDRO rates) and SMART objectives • A ssign a national surveillance lead/team, supported by a multidisciplinary technical group (epidemiologists, IPC specialists, microbiologists, data managers and IT specialists). • Specify roles for design, implementation, monitoring,evaluation and outbreak response.	Alignment and Tailoring: • Draft a facility-specific plan that mirrors national goals but focuses on local priorities—services offered, patient mix, common procedures and prevalent infections (including MDROs). • Use WHO's IPCAF tools to assess baseline IPC and surveillance capacity and to measure progress.
System Design & Methods: • Map the healthcare structure to determine which facilities (tertiary hospitals, surgical centres, ICUs or underserved areas) and regions to include. • Choose surveillance approaches—active vs. passive, patient vs. laboratory-based, comprehensive vs. targeted, and incidence vs. prevalence surveys. • Define time frames (continuous incidence surveillance; periodic prevalence surveys annually or every 2–5 years).	Roles and Responsibilities: • Designate the IPC team or a dedicated HAI/MDRO surveillance team, supported by laboratory staff, clinicians and nursing leads, to develop and implement the plan. • Ensure the team size matches the expected workload and provides clear accountability.
Standardization & Adaptability: • Adopt WHO-validated case definitions for HAIs and key MDROs to ensure comparability. • Build flexibility into the plan so it can be tailored to varying facility capacities and updated as needs evolve.	Methods and Case Definitions: • Follow national protocols for surveillance methods and timelines. • Apply the national standardized case definitions without modification for all monitored HAIs and MDROs.
Resource Mobilization: • Develop a comprehensive budget covering personnel, training, data tools, IT infrastructure, and emergency funds. • Secure funding from government, donors, NGOs, and private partners; establish subnational networks with their technical support and reporting mechanisms.	Resource Allocation: • Budget for staff time, training, data collection tools (ideally electronic), IT support, and periodic audits. • Invest in IT infrastructure, including computers, secure internet access, and software needed for timely data entry and reporting
	Integration and Feedback • Establish mechanisms for regular internal review and feedback to clinical teams and administration, ensuring surveillance data guide IPC interventions. Link facility reports into the national network for benchmarking and collective learning.

2. Data Collection

Robust data collection underpins effective surveillance of HAIs and MDROs. Both national and facility levels must use standardized tools, clear roles, and quality controls to gather actionable data.

At the national level, there should be an IT-enabled national data platform that aggregates HAI/MDRO reports from all enrolled facilities. Uniform data collection protocols and electronic or paper-based tools to guide facility reporting, ensure consistency, and support subnational analysis.

Facilities must implement the national data collection protocol in full, capturing accurate HAI/MDRO events, patient demographics, device usage, and laboratory results, to feed into the national system.

National Level	Facility Level
Standardized Protocols & Tools: • Define a minimum data set: patient ID, admission/discharge dates, device days, infection site, pathogen and resistance profile. • Incorporate standard HAI/MDRO case definitions and ethics requirements. • Specify data quality indicators (completeness, timeliness, validity) andreporting frequency (e.g. monthly).	Adoption of National Tools: • Implement the exact national data collection forms—paper or electronic—and customize only for local language or format as permitted.
Designation of Data Leads: • Issue guidelines for appointing a facility data focal person or team, based on IPC capacity, and outline their responsibilities in national protocols.	Formation of a Data Collection Team Assign a surveillance lead (often the IPC coordinator) plus designated clinical, nursing, and lab staff who: • Conduct daily or weekly case finding (review charts, lab alerts). • Enter data into registers or electronic systems. • Verify completeness before submission.
Data Source Mapping:	**Comprehensive Data Sourcing:**
Medical charts, lab registers, electronic health records, nursing/physician notes, microbiology logs	• Establish routine procedures to capture device utilization (central lines, catheters), surgical procedures and post-op infections, and laboratory-confirmed MDROs via liaison with the microbiology department. Maintain logbooks or digital dashboards to track pending culture results.
Reporting Infrastructure: Deploy secure electronic submission portals or standardized spreadsheets. Enforce regulatory mandates for timely facility-to-national reporting and track compliance.	Internal Reporting Workflows: • Define clear timelines (e.g., collect by day 5 of the following month). • Route completed forms to the surveillance committee for preliminary analysis before national submission. Present interim findings at monthly IPC meetings to drive local interventions.

Quality Assurance & Validation: • Completeness checks: audit missing fields against source records. • Consistency reviews: compare definitions and coding across facilities. • Accuracy audits: periodically validate a sample of reports against raw data.	Local Quality Control: • Data completeness audit: each month, randomly select 10 % of records to check against source documents. • Timeliness metric: measure time from infection onset to data entry and flag delays for corrective action • Error logs: document common mistakes and retrain staff as needed.
Centralized Database Management: Design or procure software to integrate and store national HAI/MDRO data, enabling analytics and benchmarking	Supportive Infrastructure: • Secure dedicated computers or tablets for data entry, reliable internet access, and backup power where needed. Use simple databases (Excel or DHIS2 modules) if national software is unavailable.
Capacity Building & Ethics Compliance: • Deliver regular training on data tools, confidentiality, and local data protection laws. Provide refresher courses and on-site support for facility teams.	Ongoing Training & Feedback: • Require facility data teams to attend national refresher workshops. • Share facility-level dashboards illustrating trends in HAI and MDRO rates, enabling staff to see the impact and maintain engagement.

3. Analysis

National analysis synthesizes facility-submitted HAI and MDRO data to map countrywide infection incidence and prevalence, detect high-risk regions or facility types, and quantify antimicrobial-resistance patterns. This broad perspective supports prioritization of IPC interventions, equitable resource distribution, and formulation of national guidelines.
Facilities must analyze their own HAI and MDRO data—ideally monthly or quarterly—using methods aligned with national protocols. The depth of analysis can vary by capacity, from basic rate calculations and trend charts to more advanced stratification by ward, patient group, or device utilization.

National Level	Facility Level
Regular Analysis: • Analyze aggregated HAI and MDRO data at least annually (preferably quarterly) to maintain an up-to-date epidemiological picture.	Routine Data Reviews: • Conduct monthly or quarterly analyses of local HAI/MDRO rates, focusing on wards or services with the highest burden.
Standardized Analytical Methods: • Apply consistent formulas for incidence and prevalence and uniform stratification (by facility type, region, device days) to ensure comparability.	Basic Analytic Tools: • Use spreadsheets or simple statistical packages to calculate infection incidence, prevalence, device utilization ratios, and plot trends over time.

Indicator Development: Define key national metrics: • Overall HAI rate, device-associated infection rates, MDRO prevalence, and resistance phenotypes.	Local Indicator Selection: • Identify facility-relevant metrics (e.g., ICU CLABSI rate, postoperative SSI rate, MRSA colonization prevalence) to drivetargeted action.
Risk-Factor & Trend Identification: • Use time-series analyses to spot seasonal peaks or outbreaks and multivariate methods to uncover associations (e.g. high device use, surgical volume).	Comparative Assessment: • Benchmark facility data against national reference values or peer facilities to identify performance gaps.
Demographic & Facility Stratification: • Break down data by age, gender, comorbidities, facility level (primary vs. tertiary) and service line to target high- impact interventions	Trend Visualization: • Create line charts and bar graphs to illustrate temporal changes and highlight sudden increases for rapid response.
Benchmarking: • Compare national indicators against global/national historical data and WHO GLASS benchmarks to evaluate performance	Action Triggering: • Link analysis outputs to IPC decision- making: flag wards exceeding thresholds, trigger outbreak investigations, and allocate resources (e.g., staff education, auditing).
Capacity Building: • Train national and regional analysts in advanced epidemiology tools (software, regression techniques) and data visualization.	Skill Development: • Provide facility IPC teams with hands-on training in data entry, formula use, chart generation, and basic interpretation so they can own continuous surveillance.

4. Interpretation

Interpreting HAI and MDRO data at the national scale enables public health authorities to set priorities, adapt IPC policies, and allocate resources where they can achieve the greatest impact. Contextual analysis—including demographic, geographic, and health-system variables—helps explain variations in infection rates and guide targeted interventions.
At the facility level, IPC teams analyze surveillance outputs to understand local transmission dynamics, detect clusters early, and measure the effectiveness of control measures. Collaborative interpretation with clinical and laboratory staff ensures that findings are grounded in patient-care realities and inform actionable improvements.

National Level	**Facility Level**
Contextual Trend Analysis:	*Local Contextualization:*
• Situate HAI/MDRO trends within broader national health indicators—e.g., hospital bed-occupancy rates or antimicrobial usage patterns —to uncover systemic drivers.	• Interpret HAI/MDRO data against facility-specific factors—patient case-mix, service lines (e.g., ICU vs. surgical wards), and staffing ratios —to pinpoint vulnerabilities.

Benchmarking and Risk-Factor Identification: • Compare national HAI/MDRO metrics against global standards (e.g., WHO GLASS) and historical data to evaluate performance and detect emerging threats. Analyze risk factors—such as device utilization ratios or high-risk procedures— to informprioritization of IPC interventions.	Frontline Collaboration: • Convene multidisciplinary meetings where IPC, nursing, physicians, and microbiology staff jointly review trends and hypothesize underlying causes.
Time-Series and Seasonality: • Conduct longitudinal analyses to reveal seasonal or long-term shifts in infection rates, guiding the timing of preventive campaigns.	Targeted Departmental Analysis: • Narrow down to department-level data (e.g., neonatal unit CLABSI rates) to design focused interventions and allocate resources efficiently.
Policy Translation: • Translate analytical insights into evidence-based policy recommendations and updates to national IPC guidelines.	Actionable Insights: • Convert interpreted data into clear, prioritized action plans—such as enhanced hand-hygiene audits or device-care protocols—and assign responsibilities with deadlines.
Multisectoral Reporting: • Disseminate interpreted findings through national bulletins and dashboards, engaging ministries, professional societies, and funders in a unified response.	Continuous Quality Improvement: • Embed interpretation findings into the facility's QI cycle, revisiting and refining IPC strategies based on subsequent data and staff feedback.
	Transparent Communication: • Share interpreted results with all stakeholders —frontline staff, management, and patients (where appropriate)—using simplified dashboards or scorecards to maintain engagement and accountability.

5. Communication

Effective national communication ensures that aggregate HAI/MDRO data drive IPC policy, guide resource allocation, and support outbreak preparedness. Transparent reporting builds trust and accountability among ministries, public health agencies, and funders.

At the facility level, clear, timely feedback of HAI and MDRO metrics motivates healthcare workers to adopt evidence-based IPC practices and rapidly address emerging threats. Regular updates strengthen the link between surveillance findings and improvements in patient safety.

National Level	Facility Level
Structured Communication Plan: • Define audiences (e.g., policy-makers, facility leads, public) and communication	Facility-Specific Reports:
channels (dashboards, bulletins, webinars) with specified frequency.	• Produce concise monthly reports featuring key HAI/MDRO indicators, trend lines, and heat maps to visualize hotspots.
Regular National Reports: • Issue quarterly or annual reports summarizing HAI/MDRO trends, national indicators, and evidence-based IPC recommendations, using clear languagem and visualizations.	Frontline Engagement: • Hold brief, recurring meetings with clinical, nursing, and support staff to discuss recent data, celebrate successes, and plan IPC actions.
Stakeholder Engagement: • Organize periodic webinars and workshops to review findings, gather feedback, and harmonize messaging across regional networks.	Multi-Channel Dissemination: • Use email alerts, intranet postings, bulletin boards, and mobile apps to ensure all staff, from housekeeping to administration, access relevant data.
Data Transparency: • Maintain an online platform with anonymized, near-real-time HAI and MDRO dashboards to foster external accountability andmultisectoral collaboration.	Timely Feedback Loops: • Implement rapid feedback (within one week) for critical events—such as MDRO clusters or device-associated infections— to enable prompt corrective action.
Tailored Facility Feedback: • Provide each facility with bespoke scorecards comparing their performance against national benchmarks, highlighting strengths and gaps.	Actionable Recommendations: • Accompany data reports with prioritized, context-specific IPC interventions—hand hygiene audits, environmental cleaning checks, or antimicrobial stewardship reviews—aligned with facility trends.
• Integration into National Training: Embed surveillance insights into national IPC curricula and continuing-education modules for healthcare professionals.	Continuous Education: • Integrate surveillance findings into in-service training, using real cases to illustrate the direct impact of IPC on patient outcomes.

6. Monitoring and Evaluation of HAI & MDRO Surveillance Systems

Regular monitoring and evaluation (M&E) of national HAI and MDRO surveillance systems are essential to verify data quality, measure the effectiveness of IPC measures, and inform policy decisions. The national IPC committee, together with the technical multidisciplinary surveillance group, should oversee periodic system assessments, ensuring adaptability to new challenges and optimal allocation of resources.

At the facility level, M&E ensures that surveillance data are used to drive IPC improvements and reduce HAI/MDRO rates. The facility IPC committee should conduct regular reviews—at least annually—to realign objectives, identify gaps, and evaluate how surveillance findings translate into reduced infection risks.

National Level	Facility Level
Periodic System Reviews: • Schedule formal reviews (e.g., annually) using predefined indicators	Scheduled Evaluations: • Conduct regular (e.g., annual) reviews of the surveillance system using metrics such as infection rates, data quality, and reporting timeliness.
Facility Compliance Monitoring: • Track health-care facilities' adherence to surveillance protocols and reporting mandates;	Objective Reappraisal: • Periodically reassess and adjust facility- level surveillance goals
Timeliness Assessments: • Measure lag times from data collection to analysis and dissemination;	Impact Analysis: • Evaluate how surveillance data have driven changes in IPC practices
Continuous System Updates: • Incorporate emerging technologies (e.g., automated lab alerts, digital dashboards) to maintain system relevance.	Multidisciplinary Involvement: • Engage clinical, nursing, laboratory, and administrative stakeholders in the M&E process
Outcome Evaluation: • Annually evaluate the impact of surveillance on HAI and MDRO incidence and patient outcomes	Documentation & Feedback: • Document evaluation findings in facility reports and share them in IPC meetings
Stakeholder Reporting: • Disseminate M&E findings through national reports and workshops,	Utility Assessment: • Use specific criteria to assess system utility: detection of clusters/outbreaks, influence on care practices, efficacy of interventions, and value of monitoring low-incidence infections

Case Definitions

Case definitions are a set of uniformly applied criteria for determining whether a person should be identified as having a particular disease, injury, or other health related condition. It must be clear, simple, and concise, allowing it to be easily applied to all individuals in the population of interest. Standardized and validated HAI case definitions are essential for effective surveillance and monitoring of HAI.

HAI case definition:

An infection occurring in a patient during the process of care in a hospital or other health care facility, which was not present or incubating at the time of admission. Health care-associated infections can also appear after discharge. They represent the most frequent adverse event associated with patient care.

The WHO definitions cover the four most frequent and commonly reported types of HAI, namely bloodstream infection (BSI), surgical site infection (SSI), urinary tract infection (UTI) and pneumonia (PNM).

Bloodstream Infection (S) (BSI)

Bloodstream infections occur when microorganisms (bacteria, viruses, fungi, and protozoa) enter the bloodstream, potentially leading to severe complications like sepsis, organ dysfunction, or septic shock.

Bloodstream infections
Confirmed BSI (BSI-A1) One positive blood culture for a recognized pathogen. It excludes common skin commensals such as coagulase-negative staphylococci, *Micrococcus sp., Propionibacterium acnes, Bacillus sp., Corynebacterium sp.*
Confirmed BSI (BSI-A2) Patient has at least one of the following signs or symptoms: fever (> 38°C) OR chills OR hypotension (systolic pressure ≤ 90 mmHg); **AND** Two positive blood cultures for a common skin commensal(s) (from two separate blood samples) within 48 hours. Common skin contaminants include coagulase-negative staphylococci, *Micrococcus sp., Propionibacterium acnes, Bacillus sp., Corynebacterium sp*
Suspected BSI (BSI-B) Patient has at least one of the following signs or symptoms: fever (> 38°C) OR chills OR hypotension (systolic pressure ≤ 90 mmHg); **AND** Treatment for infection is instituted (that is, on the day of sample collection, physician documentation of antimicrobial treatment for suspected infection); **AND** One positive blood culture for a common skin commensal(s). Common skin contaminants include coagulase-negative staphylococci, *Micrococcus sp., Propionibacterium acnes, Bacillus sp., Corynebacterium sp.*
Central vascular catheter-associated BSI (CVC-BSI) BSI-A1 OR BSI-A2 OR BSI-B definition met **AND** a central vascular catheter in place ≤ 2 days prior to first meeting a component of the confirmed BSI definition.

Suspected unidentified systemic infection (SUSI)
Patient has at least one of the following signs or symptoms: fever (> 38°C) OR chills OR hypotension (systolic pressure ≤ 90 mmHg); **AND** treatment for infection is instituted (physician documentation of antimicrobial treatment for suspected infection); **AND** blood culture not done

Urinary Tract Infection(s) (UTI)

UTI is an infection that can affect any part of the urinary system, including the urethra, bladder, ureters, and kidney.

Urinary tract infection(s) (UTI)
Microbiologically-confirmed symptomatic UTI (UTI-A) Patient has at least one of the following signs or symptoms with no other recognized cause: fever (> 38°C); OR urinary urgency; OR increased urinary frequency; OR dysuria; OR flank pain; OR supra-pubic pain; OR suprapubic tenderness; **AND**
a positive urine culture (≥ 105 microorganisms per mL of urine with no more than two species of microorganisms)
Not microbiologically-confirmed symptomatic UTI (UTI-B) Patient has at least two of the following signs or symptoms with no other recognized cause: fever (> 38°C); OR urinary urgency; OR increased urinary frequency; OR dysuria; OR flank pain; OR supra-pubic pain; OR suprapubic tenderness; **AND** at least one of the following findings: positive dipstick for leukocyte esterase and/or nitrate; OR pyuria with ≥ 10 white blood cell (WBC)/mL or ≥ 3 WBC/high-power field of unspun urine; OR microorganisms seen on Gram stain of unspun urine; OR at least two urine cultures with repeated isolation of the same uropathogen (Gram-negative bacteria or *Staphylococcus saprophyticus*) with ≥ 102 colonies/mL urine in non-voided specimens; OR ≤ 105 colonies/mL of a single uropathogen (Gram-negative bacteria or *S. saprophyticus)* in a patient being treated with an effective antimicrobial agent for a UTI.
Not microbiologically-confirmed symptomatic UTI (UTI-C) Patient has at least three of the following signs or symptoms with no other recognized cause: fever (> 38°C); OR urinary urgency; OR increased urinary frequency; OR dysuria; OR flank pain; OR supra-pubic pain; OR suprapubic tenderness; AND clinician diagnosis of a UTI OR clinician institutes therapy for a UTI.
Catheter-associated UTI (CAUTI) UTI-A OR UTI-B OR UTI-C definitions; AND An indwelling urinary tract catheter in place ≤ 2 days prior to first meeting a component of the confirmed UTI definition.

Surgical site infection

They are among the most common complications following surgical procedures, whether in hospitalized patients or those undergoing surgery in outpatient services

Can be superficial infections involving the skin and subcutaneous tissue or more serious, involving deeper tissues, organs, or implanted material.

Urinary tract infection(s) (UTI)
Microbiologically-confirmed symptomatic UTI (UTI-A) Patient has at least one of the following signs or symptoms with no other recognized cause: fever (> 38°C); OR urinary urgency; OR increased urinary frequency; OR dysuria; OR flank pain; OR supra-pubic pain; OR suprapubic tenderness; **AND**

Surgical site infections (SSI)
SSI type A (SSI-A) Postoperative patients within 30 days following a surgical procedure with evidence of SSI based on microbiology (for positive culture); OR radiology (suggestive of infection); OR histopathologic criteria (for abscess or similar findings). Stratify by depth if the following information is available: a) Superficial: AND infection involves only skin and subcutaneous tissue of the incision; b) Deep incisional: AND infection involves deep soft tissue (for example, fascia, muscle) of the incision; c) Organ/space: AND infection involves any part of the anatomy (for example, organs and spaces) other than the incision that was opened or manipulated during a surgical procedure.
SSI type B (SSI-B)
Postoperative patients within 30 days following a surgical procedure with reopening of the wound for suspected infection OR abscess (or similar findings) found during direct examination or during reoperation (for deep and organ/space SSI). Stratify by depth if the following information is available: a) Superficial: AND infection involves only skin and subcutaneous tissue of the incision; b) Deep incisional: AND infection involves deep soft tissue (for example, fascia, muscle) of the incision; c) Organ/space: AND infection involves any part of the anatomy (for example, organs and spaces) other than the incision that was opened or manipulated during a surgical procedure.
SSI type C (SSI-C) Postoperative patients within 30 days following a surgical procedure with evidence of purulent discharge at the incision or surgical site. Stratify by depth if the following information is available: a) Superficial: AND infection involves only the skin and subcutaneous tissue of the incision; b) Deep incisional: AND infection involves deep soft tissue (for example, fascia, muscle) of the incision; c) Organ/space: AND infection involves any part of the anatomy (for example, organs and spaces) other than the incision that was opened or manipulated during a surgical procedure.
SSI type D (SSI-D) Postoperative patient within 30 days following a surgical procedure; **AND** Diagnosis of an SSI is made by the surgeon or attending physician, or designee.

Pneumonia (PNM)

It occurs when infectious agents such as bacteria, viruses or fungi enter the lungs, leading to infection.

Pneumonia (PNM)
Microbiologically-confirmed PNM (PNM-A) Patient has at least two of the following: fever (>38°C); OR cough; OR purulent sputum; OR tachypnoea (respiratory rate >20 bpm); OR worsening gas exchange (SpO2 3%, new or increased need for supplemental O2); OR documented auscultation indicative of pneumonia; OR compatible findings such as "crackles" or "bronchial breath sounds"; **AND** chest X-ray OR computed tomography (CT) scan suggestive of pneumonia; **AND** microorganisms isolated from any positive microbiology from the respiratory sample (quantitative or non-quantitative, including serology, antigen in urine, etc.); **AND/OR** blood culture.
Radiologically-confirmed PNM (PNM-B) Patient has at least two of the following: fever (>38°C); OR cough; OR purulent sputum; OR tachypnoea (respiratory rate > 20 bpm); OR worsening gas exchange (SpO2 3%, new or

increased need for supplemental O2); OR documented auscultation indicative of pneumonia; OR compatible findings such as "crackles" or "bronchial breath sounds"; AND chest X-ray OR CT scan suggestive of pneumonia.
Clinical PNM (PNM-C) Patient has at least three of the following: fever (>38OC); OR cough; OR purulent sputum; OR tachypnoea (respiratory rate > 20 bpm); OR worsening gas exchange (SpO2 3% or new or increased need for supplemental O2); OR documented auscultation indicative of pneumonia; OR compatible findings such as "crackles" or "bronchial breath sounds".
Ventilator-associated pneumonia (VAP) PNM-A OR PNM-B OR PNM-C; **AND** Mechanical ventilation/intubation in place ≤ 2 days prior to first meeting a component of the pneumonia definition.

05: MULTIDRUG-RESISTANT ORGANISMS (MDROS)

Multidrug-resistant organism is an organism that is resistant to one or more agents in at least three classes of antibiotics, or that exhibits a classification of resistance that is of epidemiological concern (e.g., MRSA, VRE, ESBL, CRE). The MDROs can be transmitted directly from person to person through contact, or through the environment via contaminated surfaces or equipment. Case definitions of MDRO are: Patients with laboratory evidence of infection or colonization with any of the following:

- MRSA: Methicillin-resistant *Staphylococcus aureus*; and /or
- ESBL: Extended-Spectrum Beta-Lactamases; and /or
- Vancomycin-resistant *Enterococcus* (VRE); and /or
- Vancomycin-resistant *Staphylococcus aureus* (VRSA); and /or
- Carbapenem-resistant *Enterobacterales* (CRE); and /or
- Carbapenemase-producing organisms (CPO); and /or
- Carbapenem-resistant *Psuedomonas aeruginosa* (CRPA); and /or
- Carbapenem-resistant *Acinetobacter baumannii* (CRAB) and /or
- *Clostridioides difficile*; and /or
- *Candida auris* resistant to antifungals (fluconazole, amphotericin B, or echinocandins)

Prevention and Control Strategies for Priority MDROs

Priority list of MDRO pathogens

The priority list of MDRO pathogens is categorized into three groups based on the following criteria:

- Mortality
- Incidence
- Non-fatal health burden
- Trend of disease
- Transmissibility
- Preventability in health care setting and community
- Treatability
- Pipeline

A. Critical Priority

Antibiotic-resistant pathogens that pose the highest threat to public health due to limited treatment options, high disease burden (mortality and morbidity), and increasing trends in antibacterial resistance, with few or no promising candidates in the pipeline. Infections with pathogens in the critical category may also be uniquely difficult to prevent and are highly transmissible; the pathogens may have global mechanisms of resistance and/ or MDR strains in certain populations or geographical areas

B. High Priority

Antibiotic-resistant pathogens that are significantly difficult to treat, cause a substantial disease burden (mortality and morbidity), show increasing trends in resistance, are uniquely difficult to prevent, are highly transmissible and for which there are few potential treatments in the development pipeline. Although they may not be critical globally, pathogens in this category could be critical for some populations and in specific geographical areas.

C. Medium Priority

Antibiotic-resistant bacterial pathogens that are associated with moderate difficulty for treatment, a moderate disease burden (mortality and morbidity) and moderate trends in resistance, with unique issues for preventability or transmissibility and relatively more candidates for treatment in the pipeline. Similarly, while they may not be critical globally, pathogens in this category could be critical for some populations and in specific geographical areas.

WHO Regional Bacterial Priority Pathogens List, 2024

No.	Priority Multi-drug-Resistant Organisms
	CRITICAL PRIORITY
1	Carbapenem-resistant *Acinetobacter baumannii* (CRAB)
2	Carbapenem-resistant Enterobacterales (CRE)
3	Third-generation cephalosporin-resistant Enterobacterales (3GCRE)
4	*Mycobacterium tuberculosis*, rifampicin-resistant
	HIGH PRIORITY
5	Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA)
6	Methicillin-resistant *Staphylococcus aureus* (MRSA)
7	*Salmonella Typhi* fluoroquinolone-resistant
8	*Shigella spp.* fluoroquinolone-resistant
9	*Neisseria gonorrhoeae* third-generation cephalosporin, and/or fluoroquinolone-resistant
10	*Enterococcus faecium* vancomycin-resistant
	MEDIUM PRIORITY
11	Group A Streptococci macrolide-resistant
12	*Streptococcus pneumoniae* macrolide-resistant
13	*Haemophilus influenzae* ampicillin-resistant
14	Group B Streptococci penicillin-resistant

Source: WHO Bacterial Priority Pathogens List, 2024

Prevention and Control of Healthcare-associated Infections

Prevention of healthcare-associated infections involves implementing practices and policies that reduce the risk of infections occurring in healthcare settings. These infections can be caused by bacteria, viruses, fungi, and often result from invasive procedures, antibiotic misuse, or poor infection prevention and control practices. Compliance with IPC precautions and HAI care bundles is critical in reducing the risk of contracting HAI.

Standard Precautions

They are the basic level of IPC measures that reduce the risk of transmission of pathogens from both recognized and unrecognized sources and are to be used in the care of ALL patients at ALL times by ALL healthcare workers. They Include:

- Hand hygiene: Cleaning of hands using soap and running water or alcohol-based hand rub based on the WHO 5 moments of hand hygiene and technique.
- Proper use of personal protective equipment (PPE): Perform the risk assessment on the anticipated risk of exposure to determine the PPE to use.
- Safe injection practices: Safe handling and proper disposal of sharps
- Reprocessing of reusable medical devices: Proper decontamination of reusable medical devices.
- Environmental cleaning: Regular cleaning with appropriate cleaning detergents and disinfection when applicable.
- Waste management: Proper segregation, storage, transportation, and disposal of healthcare waste
- Linen and laundry management: Proper reprocessing of linen
- Respiratory hygiene and cough etiquette: Covering mouth and nose when coughing or sneezing, use a tissue to cover the mouth and nose, and hand hygiene

Transmission-Based or Additional Precautions

The second tier of infection control measures is used in addition to standard precautions for patients who are confirmed or suspected to have an infection and are based on the mode of transmission of the infectious agent. They include:

Contact precautions: To prevent microorganisms from being transferred from one infected person to another person or object through contact e.g., cholera and MRSA. For contact precautions, the following preventive measures should be observed:

- Place in a single room or a cohort with patients with similar pathogens
- Perform hand hygiene as per the WHO 5 moments of hand hygiene
- PPE to be used: Gloves and gown at a minimum
- Use dedicated or disposable equipment
- Clean and disinfect reusable medical equipment before use on each patient
- Place “contact precautions” signage at the entrance of the room

Droplet precautions: To prevent the spread of pathogens that can be transmitted by the droplet route, e.g., influenza, COVID-19. The preventive measure includes

- Place the patient in a single room, or if no single room is available, cohort the patients and separate patients by distance of at least 1 meter between patients
- Hand hygiene as per the WHO 5 moments of hand hygiene
- The main PPE to be used is a surgical mask
- One can also wear or a shield if performing a procedure leading to aerosolization
- Patient to wear a surgical mask when exiting the isolation room

Airborne precautions: To prevent the spread of pathogens that can be transmitted by the droplet route, e.g., Mycobacterium tuberculosis, measles. The following preventive measures should be implemented:

- Patient to be isolated in a single room or (ideally, a negative pressure room if available), if no single room is available, cohort the patients
- The door remains closed
- If applicable, windows are to be opened
- Hand hygiene as per the WHO 5 moments of hand hygiene
- HCW to wear an N95 or higher-level respirator. Don a N95 mask before entering the patient's room and only remove it after exiting
- Patient to wear a surgical mask when exiting their room

Isolation precautions: Isolation of a patient suspected or confirmed to have an infectious disease in a single room. If a single room is not available, cohort patients with similar infections. There are two types of isolation:

- Source isolation: Isolating a patient with a confirmed or suspected infectious condition/disease based on the mode of transmission e.g., contact precautions patients infected with MDROs,
- Protective isolation: Isolating an immunosuppressed patient to avoid infections from other people and /or the environment e.g., patients suffering from cystic fibrosis, chemotherapy patients, transplant patients

Healthcare-associated Infections Care Bundles

A care bundle is a set (typically 3–5) of evidence-based, patient-centered interventions designed to improve patient outcomes when implemented together and consistently. Care bundles provide a structured approach to managing specific aspects of care, aiming to enhance both the care process and outcomes more effectively than individual interventions alone.

Healthcare-associated Infections Care Bundles	
Surgical Site Infection Care Bundles • Hand scrubbing: Proper surgical hand scrub by the surgical team prior to the surgical procedure. • Appropriate use of prophylactic antibiotics: Select the right antibiotic as per the national guidelines. • Appropriate hair removal • Controlled preoperative and postoperative serum glucose • Perioperative and immediate postoperative normothermia in surgery patients • Proper skin antisepsis	**Catheter-Associated Urinary Tract Infection Care Bundles** • Hand hygiene • Avoid unnecessary urinary catheters • Insert using aseptic technique • Maintain catheters based on recommended guidelines (daily care) • Review catheter necessity daily and remove promptly if deemed inappropriate.
Central Line Bloodstream Infection Care Bundle Elements • Hand hygiene • Maximal barrier precautions during insertion • Chlorhexidine skin antisepsis • Optimal catheter site selection, with the subclavian vein as the preferred site for non-tunnelled catheters in adults. • Daily review of line necessity with prompt removal o	**Ventilator-Associated Pneumonia Care Bundle Elements** • Hand hygiene • Elevation of the head of the bed to 30°- 45° to reduce esophageal reflux and pulmonary aspiration. • Daily sedation interruption and daily assessment of readiness to extubate (sedation vacation): • Peptic ulcer disease prophylaxis (PUD) • Deep venous thrombosis (DVT) prophylaxis if not contraindicated • Oral care

Capacity Building and Workforce Development

Capacity building and workforce development are essential pillars in preventing and controlling healthcare-associated infections (HAIs). They focus on strengthening human resources, skills, knowledge, and institutional capabilities to ensure effective infection prevention and control (IPC) across all levels of the healthcare system. Capacity building aims to strengthen infection prevention culture at all health system levels, building a skilled and confident IPC workforce, ensuring sustainability of IPC programs and ultimately reducing HAI incidence and antimicrobial resistance (AMR).
HAI capacity building should include the following activities/ strategies:

A. Comprehensive training programs: develop and implement education and training programmes for IPC teams covering HAI surveillance methodologies, data collection, analysis, interpretation, communication, and evaluation. Ongoing professional development is critical to keeping staff informed of the latest best practices.

B. Collaboration with academic institutions: Academic institutions and professional organizations can create specialized courses and certifications in HAI surveillance, ensuring a well-trained cadre of professionals at the national and facility levels.
Incorporation of IPC in pre-service training in health training colleges/universities.

C. Health care facility support: The national IPC program, in collaboration with stakeholders, should provide technical assistance, standardized protocols, and resources to health care facilities. Facilitating peer learning and knowledge exchange among facilities can foster continuous improvement in surveillance practices.

D. On-site mentorship: Implement a system of intensive on-site mentorship and regular visits to participating hospitals to maintain consistency and ensure data quality across the board.

E. Online learning and facility-based training: Utilizing virtual continuous professional development (CPD) and facility-based continuous capacity building programs.

Prevention and Containment of Multidrug-Resistant Organisms

Infection prevention and control play a critical role in the reduction of both the spread of antibiotic-resistant organisms and the occurrence of infection. Strong and effective IPC programmes in all countries and the successful implementation of interventions to prevent and contain MDRO are crucial for combating AMR. The following interventions are recommended for the prevention and containment of MDRO.

Implementation of multimodal infection prevention and control strategies

- An IPC programme consisting of multimodal strategies to prevent and control the acquisition of and infection with MDRO should be in place in all acute health care facilities.
- Implementation of multimodal infection prevention and control strategies to prevent and control MDRO infection or colonization, and should consist of at least the following:
- Hand hygiene according to the WHO "5 moments of hand hygiene". Hand hygiene compliance is considered fundamental to all good IPC programs and the control of HAI and MDRO.
- Surveillance for MDRO and surveillance cultures for asymptomatic MDRO colonization. Contact precautions for patients suspected or confirmed to have MDRO
- Patient isolation (single room isolation or cohorting) of patients suspected to be infected or colonized with MDRO
- Environmental cleaning of the patient zone of patients colonized or infected with MDRO

Surveillance of MDRO infection and surveillance cultures for asymptomatic MDRO colonization

- Surveillance of MDROS infection(s) should be performed based on country guidelines, protocols, and strategies.
- Surveillance cultures for asymptomatic MDRO colonization should also be performed, guided by local epidemiology and risk assessment.
- Populations to be considered for such surveillance include:
    - Patients with previous MDRO colonization,
    - Patient contacts of MDRO colonized or infected patients
    - Patients with a history of recent hospitalization in endemic MDRO settings
    - Patients transferred in from critical care units, e.g., ICU, dialysis units, from other facilities

A. Contact precautions

Contact precautions should be considered as a standard of care for patients colonized or infected with MDRO in the vast majority of health systems.

Health care worker education regarding the principles of IPC and monitoring of contact precautions is crucial.

Depending on the individual risk assessment of some patients, pre-emptive isolation/cohorting and the use of contact precautions may be necessary until the results of surveillance cultures for MDRO are available, especially for patients with a history of recent hospitalization in regions where the local epidemiology of MDRO suggests an increased risk of MDRO acquisition.

They include:

- Appropriate patient placement: single room isolation or cohorting
- Use of personal protective equipment, including gloves and gowns;
- Limiting the transport and movement of patients;
- Use of disposable or dedicated patient-care equipment;
- Proper cleaning and disinfection of patient rooms.

Clear communication regarding a patient's colonization/infection status is important, it should be flagged in the medical chart.

B. Patient isolation

The aim of separating colonized/infected patients from non-colonized/ non-infected patients is to reduce cross-transmission, including separating patients with different resistant organisms. Colonized/infected patients should be managed in single rooms where possible. Cohorting is reserved for situations where there are insufficient single rooms or where cohorting of patients colonized or infected with the same pathogen is a more efficient use of hospital rooms and resources.

In an outbreak situation, pre-emptive isolation/cohorting and use of contact precautions may be necessary in some situations until the results of surveillance cultures for MDRO are available (for example, patients with a history of recent hospitalization in regions where the local epidemiology of CRE suggests an increased risk of CRE acquisition). Patient isolation should always apply in an outbreak situation.

C. Environmental cleaning

The optimal cleaning agent for environmental cleaning protocols of the immediate surrounding area of patients colonized or infected with MDRO has not yet been defined.

Disinfection with hypochlorite is used (generally a concentration of 5000 parts per million [ppm]) as an agent to undertake environmental cleaning.

Appropriate educational programmes for hospital cleaning staff are crucial to achieve good environmental cleaning.

The use of multimodal strategies to implement environmental cleaning is considered essential. This includes institutional policies, structured education and monitoring compliance with cleaning protocols.

Assessment of cleaning process effectiveness using glow germ or adenosine triphosphate.

In some outbreak situations, temporary ward closures were necessary to allow for enhanced cleaning.

D. Surveillance cultures of the environment for MDROs colonization/contamination
Surveillance cultures of the environment for MDROs may be considered when epidemiologically indicated.

Correlation of environmental surveillance culture results to the rates of patient colonization/infection with MDROs should be undertaken with caution and depends on an understanding of the local clinical epidemiological data and resources.

E. Monitoring, auditing, and feedback
Monitoring, auditing and feedback of IPC interventions are a fundamental component of any effective intervention and especially important for strategies to control MDRO.
Appropriate training of staff who undertake monitoring and feedback of results is crucial. All components of the multimodal strategy intervention should be regularly monitored, including hand hygiene compliance.
Monitoring, auditing and feedback of multimodal strategies are a key component of all IPC educational programmes. IPC monitoring should encourage improvement and promote learning from experience in a non- punitive institutional culture, thus contributing to better patient care and quality outcomes.

F. Antimicrobial Stewardship
The overuse and misuse of antimicrobials contribute significantly to the development of AMR and infections by MDRO. Proper antimicrobial use is crucial in both community and healthcare settings. To optimize antimicrobial use, healthcare facilities should establish a multidisciplinary Antimicrobial Stewardship (AMS) team, which may include infectious diseases physicians, clinical pharmacists, microbiologists, epidemiologists, infection prevention professionals, and IT specialists.

Antimicrobial stewardship programs are key in reducing MDRO, improving clinical outcomes, and lowering healthcare costs. These programs guide antimicrobial use through interventions before or after prescriptions, promoting evidence-based actions such as appropriate diagnostics, microbiological sample collection, treatment escalation or de-escalation, using narrow-spectrum agents when possible and avoiding prolonged therapy and reserving broad-spectrum antimicrobials for serious infections.

Successful AMR control depends on collaboration between AMS teams, infection control, pharmacies, IT, and microbiology laboratories. Combining stewardship with strong infection control practices is effective in curbing resistance.

Multimodal Strategy for the implementation of IPC interventions
The multimodal strategy consists of several elements (3 or more; usually 5) implemented in an integrated way to guide action and provide a clear focus. Multimodal strategies should be implemented to improve practices and reduce HAI and AMR. The use of multiple approaches that, in combination, will contribute to influencing the behaviour of the target audience (usually health care workers) towards the necessary improvements that will impact on patient outcome and contribute to organizational culture change. The multimodal strategies comprise of 5 key elements as shown on the image below:

SYSTEM CHANGE "BUILD IT" 	• Put in place/improve laboratory capacity and diagnostic stewardship to reliably detect CR and carbapenemase production • Put in place/improve a sustainable system to reliably procure and deliver microbiology laboratory equipment tests and reagents • Develop SOPs describing appropriate procedures for surveillance and screening. Reinforce capabilities and procedures for sample management and (if needed) sample storage and transport to a reference laboratory (off-site). • Align and link surveillance systems with GLASS, including use of standardized definitions.

TRAINING AND EDUCATION "TEACH IT" 	• Assess local training needs especially for sample collection and CRO identification in the laboratory and antibiogram interpretation
	• Put in place/improve a reliable mechanism for producing/using updated training resources and information for staff on · Put in place/improve a reliable mechanism for producing/using updated training resources and information for staff on
	  ◦ the importance of diagnostics and diagnostic stewardship;
	  ◦ most appropriate laboratory methods for CR and carbapenemase production detection;
	  ◦ specimen collection, management (processing-storage-transport);
	  ◦ use of microbiological results to establish appropriate IPC measures.
	• Promote clinical discussion on the importance of surveillance and contact tracing for the early detection and control of spread and outbreaks.

MONITORING AND FEEDBACK "CHECK IT" 	• Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding:
	  ◦ reliable availability of microbiology laboratory equipment tests and reagents;
	  ◦ compliance with surveillance and screening SOPs/protocols;
	  ◦ documentation processes (including degree of Clinical Microbiology Laboratory [CML] utilization), adherence to surveillance, isolation and treatment guidance relevant to safety climate and culture change.
	• Conduct regular point prevalence studies (especially in LMICs) if longitudinal screening for CRE is not yet in place.
	• Document process improvement and monitor efficiency of the surveillance system.
	• Consider how to engage health facilities to utilize surveillance results to inform treatment guidelines and put in place antibiotic stewardship programmes.

COMMUNICATION AND REMINDERS "SELL IT" 	• Identify and put in place effective and rapid mechanisms to communicate about a patient's colonization/ infection status at the point of care, for example, electronic reminders/alerts, other flagging systems (on admission/discharge/ readmission), taking account of the need to address cultural aspects and local languages. • Use data from surveillance to communicate about the importance of the problem and of action for improvement (for example, if there is no ongoing surveillance and screening system, perform annual point prevalence studies and use the results to communicate and remind health care workers and hospital managers about CRO). • Flag the CRO infection/colonization status of the patient in the clinical chart or the electronic record and link it to IPC activities and antibiotic therapy prescription for appropriate action Disseminate the results of screening once available. • Highlight unnecessary screening as surveillance activities and subsequent isolation and contact precautions can involve potential harms or unintended consequences for the patient with ethical implications (effective communication is paramount).
SAFETY CLIMATE AND CULTURE CHANGE "LIVE IT" 	• Discuss the problem of CROs with senior management by providing data on epidemiology and costs, but also patient stories, to highlight it as a serious patient safety issue that requires tangible action - first of all in the ability of the facility to reliably detect it. • Motivate senior clinicians and nurses to follow SOPs for surveillance and screening by explaining the importance of the problem and the implications of surveillance for prevention and control as well as for correct antibiotic treatment. • Identify champions to promote and role model SOPs for surveillance and screening.

06: STEP-WISE IMPLEMENTATION

Stepwise Implementation Plan for HAI Surveillance and MDRO Prevention in the Region

Step 1: Situation Assessment and Baseline Mapping

Conduct a national situational analysis to identify existing HAI surveillance systems and MDRO monitoring activities.

- Map facilities with laboratory capacity (microbiology testing for priority organisms, staffing and their competency, IT system, supplies and equipment) and Infection Prevention and Control (IPC) programs.
- Identify gaps in HAI and MDRO policies, human resources, diagnostics, and reporting systems.

Step 2: Establish National and Facility-Level Governance

- Form or strengthen a national AMR/IPC/HAI technical working group (TWG).
- Designate focal persons for HAI and MDRO surveillance at national and facility levels.
- Develop or update national guidelines aligned with WHO and regional recommendations.

Step 3: Develop Surveillance Framework and Tools

- Define priority HAIs (e.g., CLABSI, CAUTI, VAP, SSI) and MDRO MRSA, ESBLs).
- Standardize case definitions and laboratory protocols.
- Create or adapt surveillance forms and electronic data collection systems.

Step 4: Build Laboratory and Diagnostic Capacity

- Strengthen microbiology laboratory infrastructure, especially culture and sensitivity testing.
- Train laboratory staff on MDRO detection and quality assurance.
- Introduce standard antimicrobial susceptibility testing (AST) protocols (e.g., CLSI, EUCAST).

Step 5: Train Health Workers and IPC Teams

- Provide training for IPC committee and healthcare workers on HAI surveillance, data reporting, and IPC practices.
- Develop continuous education programs and mentorship models.
- Engage leadership in fostering a culture of safety and accountability.

Step 6: Pilot Surveillance in Sentinel Sites

- Launch surveillance activities in selected hospitals (tiered approach).
- Collect data on priority HAIs and MDROs.
- Evaluate feasibility, acceptability, and quality of data collection tools.

Step 7: Data Management, Analysis, and Reporting

- Develop Standadized Data collection protocols and tools
- Set up centralized data management systems for aggregation and analysis.
- Establish a reporting mechanism to ensure regular feedback loops from national to facility level.
- Use data to generate facility scorecards and national surveillance bulletins.

Step 8: Implement Targeted IPC Interventions

- Link surveillance findings to action: reinforce hand hygiene, environmental cleaning, antimicrobial stewardship.
- Develop MDRO containment protocols including isolation precautions and cohorting.
- Monitor compliance with IPC practices through audits and feedback.

Step 9: Scale-Up and Integration

- Gradually expand surveillance to other facilities across regions.
- Integrate HAI and MDRO surveillance into broader health information systems and UHC strategies.
- Align with emergency preparedness, AMR National Action Plans, and global health security frameworks (e.g., JEE).

Step 10: Monitor, Evaluate, and Sustain

- Establish regular evaluation cycles to assess impact and identify bottlenecks.
- Secure long-term financing through national budgets, donor support, and partner engagement.
- Promote regional collaboration and peer learning through WHO AFRO, ECSA-HC and Africa CDC platforms.

07: MONITORING AND EVALUATION

Monitoring and evaluation (M&E) are essential pillars in the effective implementation, assessment, and continuous improvement of national and regional strategies to prevent and control healthcare-associated infections (HAIs) and contain multidrug-resistant organisms (MDROs). A robust M&E system ensures accountability, promotes data-driven decision-making, and supports adaptive management of interventions at facility, national, and regional levels. This chapter provides considerations for tracking progress, identifying gaps, and measuring the impact of HAI and MDRO containment strategies across East, Central, and Southern Africa. It emphasizes harmonized indicators, standard data collection tools, periodic evaluations, and real-time feedback loops to enhance the quality, safety, and resilience of health systems. In alignment with WHO standards and regional health security goals, the M&E considerations outlined here fosters a culture of continuous quality improvement and learning across One Health sectors.

Development of M&E Framework

- Define overarching goals, outcomes, outputs, and activities for each step.
- Develop a results framework with clear indicators
- Align the M&E framework with existing national, regional, and global M&E frameworks

Key performance indicators for consideration

Input Indicators,

- Existence of a national AMR/HAI/IPC Technical Working Group
- Availability of national HAI surveillance and MDROs prevention and containment guidelines
- % of health facilities with a designated IPC focal person
- % of facilities with microbiology laboratories capable of performing AST
- % of facilities with access to standardized HAI surveillance and MDRO prevention and containment tools

Process Indicators,

- % of health facilities actively reporting HAI and MDRO data
- % of facilities conducting scheduled IPC program assessment
- % of laboratories ISO 15189 accredited

Output Indicators

- % of facilities with functional data dashboards or scorecards for HAI/MDRO trends
- % of laboratories consistently contributing to the AMR data into the national database and global platforms (e.g., WHONET, GLASS)
- % of facilities with up-to-date antibiograms

Outcome Indicators

- % reduction in incidence of priority HAIs (e.g., SSI, CLABSI, CAUTI)
- % reduction in prevalence of key MDROs (e.g., MRSA, ESBL, CRE)

Impact Indicators

- Reduction in morbidity and mortality attributable to HAIs, including MDRO
- Decrease in national antimicrobial resistance burden (e.g., % of bloodstream infections caused by MDROs)

Evaluation and Learning

- Conduct mid-term and end-term evaluations
- Use findings to:
  - Revise guidelines and SOPs
  - Identify and replicate best practices
  - Improve training, reporting, and data use processes

08. RESOURCE MOBILIZATION AND SUSTAINABILITY

Effective implementation and long-term sustainability of Healthcare-Associated Infection (HAI) surveillance systems require dedicated and strategic resource mobilization. This involves securing both financial and in-kind support from government budgets, development partners, and public-private partnerships. National authorities should integrate HAI surveillance into broader health and infection prevention and control (IPC) strategies to ensure it receives continuous funding and policy prioritization.

Sustainability also depends on building local capacity through workforce development, institutionalizing surveillance systems within health information platforms, and establishing clear governance and accountability mechanisms. Mobilizing resources must go hand-in-hand with efficient use, local ownership, and innovative approaches—including leveraging digital technologies—to maintain momentum and ensure the HAI surveillance system is responsive, resilient, and aligned with national health goals.

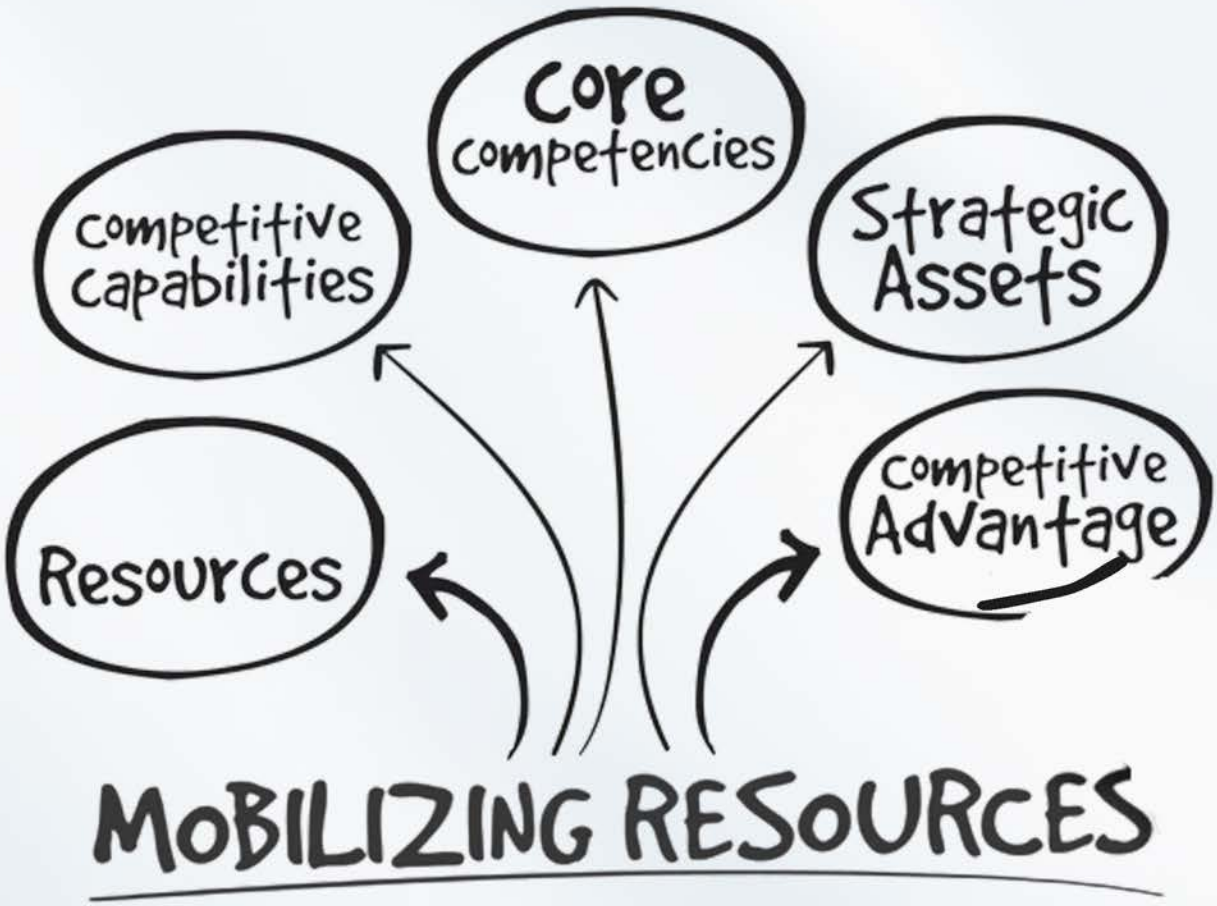
Cost drivers for establishing HAI surveillance & MDRO prevention

- Information and technology infrastructure
- Human resources
- Workforce capacity building
- Diagnostics (Laboratory, radiology)
- IPC commodities
- Infrastructure - isolation areas/space

Strategies for resource mobilization for HAI surveillance and MDRO prevention and containment

- Generate and use evidence to build the investment case
- Conduct economic evaluations and burden-of-disease studies to describe the financial impact of HAIs and undertake to help increase political will and understanding of the problem.
- Use national HAI/AMR surveillance data to demonstrate funding gaps and priorities using policy briefs
- Advocate using success stories and return-on-investment data from pilot programs, such as cost-effectiveness studies, to show the benefit of surveillance and IPC to control MDRO spread
- Advocate for dedicated budget lines for IPC within the Ministry of Health and hospital budgets.
- Engage Ministries of Finance using evidence of cost-effectiveness and return on investment.

- Include IPC and HAI/MDRO indicators in results-based financing (RBF) and performance-based budgeting frameworks.
- Empower hospitals to allocate internal budgets for IPC (e.g., through quality improvement programs).
- Include IPC in health facility accreditation and licensing requirements, linked to budget allocations.
- Integrate HAI/MDRO prevention into national health and financing plans
- Ensure HAIs and MDROs prevention strategies are included in national health strategies, Universal Health Coverage (UHC) roadmaps and National Action Plans on AMR
- Align with donor and development partner priorities
- Tap into global health security and AMR-focused donor platforms, such as:
- Encourage co-financing models where partners fund infrastructure and governments fund recurring costs.
- Leverage Public–Private Partnerships (PPPs)
- Partner with private entities such as pharmaceutical and medical supply companies to:
  - Provide IPC commodities (e.g., disinfectants, hand hygiene products)
  - Train healthcare worker
  - Support laboratory strengthening
- Collaborate with the private health sector to enhance IPC standards, e.g., infrastructure and funding mechanisms.



09: CASE STUDIES

This section of the guidance highlights selected case studies to illustrate practical and contextually relevant approaches to the design, implementation, and scale-up of HAI surveillance and multidrug-resistant organism (MDRO) containment strategies across diverse healthcare systems. By drawing on experiences from within the East, Central and Southern Africa (ECSA) region and beyond, the case studies showcase successful models of governance, data use, multisectoral collaboration, digital innovation, workforce training, and sustainability.

These examples serve as valuable learning tools for countries seeking to strengthen or establish their own HAI surveillance systems. They demonstrate how local adaptation, strong leadership, and strategic partnerships can overcome resource limitations, enhance surveillance data quality, improve infection prevention, and contribute to broader antimicrobial resistance (AMR) control efforts. The aim is to inspire replication, foster peer learning, and promote harmonization of best practices across the region.

Examples of successful HAI/MDRO programs in Sub-Saharan Africa

Ethiopia

Ethiopia has demonstrated government commitment to IPC by allocating domestic funding to implement a comprehensive program that includes national IPC policies, an integrated IPC and strategic plan, monitoring and evaluation (M&E) frameworks, and standardized guidelines. Ethiopia has established a national surveillance network for antimicrobial resistance (AMR), supported by a coordination and governance mechanism. AMR data is collected from 26 designated sentinel laboratories across the country[2].

Tanzania

Tanzania has demonstrated substantial improvement in IPC and HAI surveillance. Starting with a 2% compliance rate in 2020, national IPC performance improved to 65% by 2023. A nationwide HAI surveillance initiative began with surgical site infections (SSIs) and now includes over 130 primary healthcare facilities. Over 300 healthcare workers have been trained on IPC, and IPC data integration into the DHIS2 system has started. Monthly virtual knowledge-sharing sessions, targeted mentorship, and data quality checks have played a key role in driving improvements. These efforts reflect Tanzania's commitment to expanding surveillance and embedding IPC in national health systems.

Namibia

Namibia has made notable progress in combating healthcare-associated infections (HAIs) and multidrug-resistant organisms (MDRO) through strong national surveillance, policy frameworks, and capacity building. Key achievements include the development of a national IPC and AMR plan, establishment of IPC focal persons in all public hospitals, a national training curriculum, data dashboard for monitoring and reporting to GLASS. Despite challenges like limited funding and specialized staff, Namibia leverages partner support and has launched a postgraduate IPC program. The country's structured, data-driven approach offers a model for effective HAI/MDRO control in Sub-Saharan Africa.

South Africa

The National Institute for Communicable Diseases (NICD) Centre for Healthcare-Associated Infections, Antimicrobial Resistance and Mycoses focuses on surveillance, research, and response to HAIs and antimicrobial resistance. The NICD collaborates with regional partners to enhance laboratory capabilities and strengthen HAI surveillance systems across the continent. They pioneered a National Antimicrobial Resistance Strategy Framework (2014–2024)[1], complemented by nationwide IPC programs. Institutions like Tygerberg Hospital and Charlotte Maxeke Johannesburg Academic Hospital implemented antimicrobial stewardship and MDRO containment measures, including regular audits, data feedback, and dedicated IPC units. The result has been a sustained decrease in MDRO transmission, particularly carbapenem-resistant Enterobacterales (CRE) and methicillin- resistant *Staphylococcus aureus* (MRSA).

10: APPLYING CONTINUOUS QUALITY IMPROVEMENT IN HAI SURVEILLANCE AND MDRO PREVENTION

Applying Continuous Quality Improvement (CQI) in Implementing HAI Surveillance and MDRO Prevention and Control at National and Facility Level is important in tracking implementation, effectiveness and impact of interventions. The implementation of healthcare-associated infection (HAI) surveillance systems and multidrug-resistant organism (MDRO) prevention and control programs benefits significantly from the application of Continuous Quality Improvement (CQI) principles. CQI is a structured, data-driven process aimed at improving the quality, safety, and efficiency of healthcare services. When applied to HAI and MDRO interventions, CQI ensures that activities are responsive, evidence-based, and aligned with national priorities and facility-level realities.

Through surveillance and continuous improvement, CQI methods allow healthcare providers to detect and address issues in infection control, ensuring that evidence-based guidelines and best practices are consistently followed. This approach not only helps in controlling and responding to infection outbreaks but also builds resilience in the health system by continuously improving the quality and safety of care delivery processes.

At the National Level

Policy alignment and standardization

CQI facilitates the development and regular review of national HAI and MDRO surveillance policies, guidelines, and standard operating procedures (SOPs). Through routine feedback loops, national authorities can assess the implementation fidelity and make timely adjustments.

Capacity building and system strengthening

CQI supports systematic capacity building through ongoing training, mentorship, and supportive supervision. It ensures that national teams use data from surveillance systems to identify training needs, update tools, and refine interventions.

Monitoring and Evaluation

National IPC programs can establish CQI dashboards to track key indicators, including HAI incidence rates, MDRO prevalence, and reporting timeliness. Data is analyzed routinely to identify bottlenecks and opportunities for improvement.

Learning Networks and Knowledge Sharing

CQI encourages collaboration among regions and facilities through national learning collaboratives. These platforms facilitate peer learning, dissemination of best practices, and harmonization of responses to identified gaps.

At the Facility Level
Establishing Quality Improvement (QI) Teams to support monitoring HAI trends and implementing MDRO control measures. These teams should apply the Plan-Do-Study-Act (PDSA) cycle to test and refine local interventions.

Routine Data Review
Facilities should collect standardized HAI and MDRO data and review it monthly to inform practice. Data use for decision-making should be institutionalized through regular review meetings and QI huddles.

Root Cause Analysis (RCA)
Applying CQI methods like RCA can help identify systemic causes of HAI outbreaks or MDRO transmission within healthcare settings. Findings guide the development of targeted interventions and process redesigns.

Patient and Staff Engagement
Frontline health workers and patients should be involved in QI processes to ensure ownership and sustainability. This includes using patient satisfaction surveys, infection reports, and feedback tools to inform priorities.

Recognition and Motivation
Facilities can establish incentive systems to recognize departments or teams that demonstrate significant improvements in IPC practices and surveillance reporting. This motivates continued participation in quality improvement.

Applying CQI to HAI surveillance and MDRO prevention ensures that national strategies and facility-level interventions are continuously optimized. It promotes a culture of safety, accountability, and excellence, contributing to the overall resilience of health systems.

REFERENCES

1. *World Health Organization (2022). Global Report on Infection Prevention and Control. Geneva: WHO. https://www.who.int/publications/i/item/9789240051164).*
2. *Report on the Burden of Endemic Health Care-Associated Infection Worldwide Clean Care is Safer Care [Internet]. 2011. Available from: www.who.int*
3. *Chernet AZ, Dasta K, Belachew F, Zewdu B, Melese M, Ali MM. Burden of healthcare-associated infections and associated risk factors at Adama hospital medical college, Adama, Oromia, Ethiopia. Drug Health Patient Saf. 2020;12:177–85.*
4. *CDC (2023). Antibiotic Resistance Threats in the United States. Atlanta: U.S. Centers for Disease Control and Prevention*
5. *Surveillance of healthcare-associated infections at national and facility levels: practical handbook. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.*
6. *Rudd,K.E. et al. (2020). Global, regional, and national sepsis incidence and mortality, 1990–2017. The Lancet, 395(10219), 200–211.)*
7. *Abubakar U, Amir O, Rodríguez-Baño J. Healthcare-associated infections in Africa: a systematic review and meta-analysis of point prevalence studies. Vol. 15, Journal of Pharmaceutical Policy, and Practice. BioMed Central Ltd; 2022.*
8. *Haque M, McKimm J, Sartelli M, Dhingra S, Labricciosa FM, Islam S, et al. Strategies to prevent healthcare-associated infections: A narrative overview. Vol. 13, Risk Management and Healthcare Policy. Dove Medical Press Ltd; 2020. p. 1765–80.*
9. *Facility guidance for control of carbapenem-resistant Enterobacteriaceae (CRE): November 2015 update - CRE toolkit 2015. Atlanta. Centers for Disease Control and Prevention;2015 (https://www.cdc.gov/hai/organisms/cre/cre-toolkit/index.html, accessed 26 October 2017).*
10. *Tangden T, Giske CG. Global dissemination of extensively drug-resistant carbapenemaseproducing Enterobacteriaceae: clinical perspectives on detection, treatment and infection control. J Int Med. 2015;277(5): 501-12.*
11. *Antimicrobial resistance surveillance in Europe: technical report. Stockholm: European Centre for Disease Prevention and Control; 2015 (https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/antimicrobialresistance-europe-2015.pdf,*
12. *Antimicrobial resistance: global report on surveillance 2014. Geneva: World Health Organization; 2014*
13. *Falagas ME, Tansarli GS, Karageorgopoulos DE, Vardakas KZ. Deaths attributable to carbapenem- resistant Enterobacteriaceae infections. Emerg Infect Dis. 2014;20(7): 1170-5.*
14. *Global strategy on infection prevention and control. Geneva: World Health Organization; 2023 (https:// www.who.int/publications/i/item/9789240080515).*
15. *Surveillance of health care-associated infections at national and facility levels: practical handbook. World Health Organization 2024*
16. *Haley RW, Culver DH, White J Wet al. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals.Am J Epidemiol 1985; 121:182–205*

Get In Touch

Plot 157, Olorien, Njiro road
P.O.Box 1009, Arusha-Tanzania

Tel: +255 272549362/5/6

regsec@ecsahc.org

www.ecsahc.org