

Assessment of Antimicrobial Resistance Diagnostic Capacity and Antibiotic Use in 10 Counties in Kenya



DHARC - JKUAT 2023

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List of Abbreviations

AADCAUC	assessment of antimicrobial resistance diagnostics capacity and antibiotic use in counties
Abx	Antibiotics
AMC	Antimicrobial consumption
AMR	Antimicrobial resistance
AMS	Antimicrobial stewardship
AMU	Antimicrobial use
ASP	Antimicrobial stewardship programs
AST	antimicrobial susceptibility testing
AWaRe	Access, Watch, Reserve
CA-UTI	community acquired urinary tract infection
CASIC	County Antimicrobial Stewardship Interagency Committee
CCU	critical care unit
CHMT	County Health Management Team
CHU	community health unit
CME	continuing medical education
CSF	Cerebrospinal fluid
cUTI	complicated UTI
DHARC	Digital Health Applied Research Centre
EML	Essential Medicines List
EMLc	Essential Medicines for Children
FBO	Faith-based organization
FDA	Food and Drug Administration
FIND	Foundation for Innovative New Diagnostics
GARDP	Global Antibiotic Research and Development Partnership
GDP	gross domestic product
HCW	healthcare worker
HCU	high dependancy unit
HF	Health Facility
HIS	Health Information system
HND	higher national diploma
HPT	health products and technologies
HRH	human resource for health
HuQAS	Human Quality Assessment Services
HVS	High Vaginal Swab
IAI	intra-abdominal infection
ICU	intensive care unit
ID	identification
IPC	infection prevention and control
IV	Intravenous
KEMCL	Kenya Essential Medical Laboratory Commodities List
KEML	Kenya Essential Medicines List
KEMRI	Kenya Medical Research Institute

KEMSA	Kenya Medical Supplies Agency
KEMSL	Kenya Essential Medical Supplies List
KENAS	Kenya Accreditation Service
KEPH	Kenya Essential Package for Health
KNEQAS	Kenya External Quality Assessment Scheme
KNH	Kenyatta National Hospital
KUTRRH	Kenyatta University Teaching Referral and Research Hospital
LIS	Laboratory Information System
LMICs	Low- and middle-income countries
MEDS	Mission for Essential Drugs and Supplies
MIC	Minimum inhibitory concentration
MLO	Medical Laboratory Officer
MoH-K	Ministry of Health Kenya
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>
MTC	Medicines and Therapeutics Committee
NASIC	National Antimicrobial Stewardship Interagency Committee
NAT	nucleic acid tests
NBU	new born unit
NMTC	National Medicines and Therapeutics Committee
ODK	Open Data Kit
OJT	on-job training
PCR	polymerase chain reaction
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
POCT	Point of care testing
PPB	Pharmacy and Poisons Board
QA/QC	Quality assurance / quality control
SAGAs	Semi-Autonomous Government Agencies
SDG	Sustainable Development Goal
SLIPTA	Stepwise Laboratory Quality Improvement Process Towards Accreditation
SLMTA	Strengthening Laboratory Management Toward Accreditation
SOP	standard operating procedure
SSI	surgical site infection
SSTI	skin and soft-tissue infection
TAT	Turn Around Time
UPS	Uninterruptible Power Supply
UTI	urinary tract infection
VEN	vital, essential and non-essential
VRE	Vancomycin-resistant <i>Enterococci</i>
WHO	World Health Organization

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1 INTRODUCTION

1.1 BACKGROUND

Antimicrobial resistance (AMR) is a growing threat to world public health that puts in peril the prevention and treatment of diseases caused by bacteria. The global plan of action by the World Health Organization (WHO) against AMR and the global strategy of one health considers sensitization and understanding of antimicrobial resistance an essential priority for adoption, deployment and putting in place the national action plans against AMR. Antimicrobials, as such antibiotics, are substances that kill or arrest the growth of microorganisms such as bacteria, viruses and fungi. Antibiotics are specifically used to target bacteria responsible for an infection or ailment and are currently used in human and veterinary medicine. However, the emergence of bacteria that are resistant through continuous or perhaps blind use of antibiotics by humans and animals constitute a grave risk for public health.

One of the biggest threats to global health, food security, and development today is antibiotic resistance. Although it occurs naturally through genetic changes, the incidence of AMR is accelerated by the improper use of antibiotics in humans, animals and plants. AMR occurs through an evolutionary process that is accentuated by a multiplicity of factors. The development of AMR is attributed to the overuse, misuse, improper disposal, use of antimicrobials in animal production, counterfeiting of antimicrobials and lack of AMR action plans among other factors. Ultimately, micro-organisms become resistant to drugs thereby reducing the effectiveness of treatment [10]. In addition, lack of clean water and sanitation and inadequate infection prevention and control (IPC) promotes the spread of microbes, some of which can be resistant to antimicrobial treatment. Because of AMR, a growing number of infections - such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis - are becoming harder to treat as the antibiotics used to treat them become less effective. Subsequently, this resistance to antibiotics leads to longer hospital stays, higher medical costs and increased mortality and disability. In 2019, about 1.3 million deaths were attributed to drug-resistant infections globally.

It is projected that by 2050 the health consequences and economic costs of AMR will be 10 million human deaths and a 2 to 3.5% decrease in gross domestic product (GDP) worldwide. This has seen AMR emerge as one of the leading global public health and development threat expected to deter the achievement of Sustainable Development Goals (SDGs), especially in the Low- and middle-income countries (LMICs) if urgent and united multi-sectoral actions are not taken. Indeed, in 2019, the WHO declared AMR as one of the top 10 global public health threats facing humanity ¹. To counter the effects of AMR, there is need to develop a multi-sectoral approach that strengthens human and animal health systems and agricultural practices to foster appropriate use and access to antimicrobial agents. The requirement of a global coordinated action plan is imperative especially in situations where the full burden of AMR is unknown and surveillance activities are minimal compounded by paucity of data.

Kenya has carried out few AMR surveillance activities through the Kenya Medical Research Institute (KEMRI), select central reference laboratories, a few high-volume facilities, and sentinel sites set up to address specific pathogens of major public health concern [17]. However, data from these activities does not give the landscape of AMR nationally. Limited AMR surveillance activities have been attributed to restricted laboratory capacity for AMR diagnostics and especially on pathogen identification (ID) and antimicrobial susceptibility testing (AST). In addition, poor reporting by facilities has constrained access to AMR-related data, nationally. For instance, as of 2021, 12 health facilities were serving as AMR

¹<https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance>

surveillance sites and were connected to the national AMR surveillance system and database in Kenya. However, only 6 facilities were actively submitting AMR data as required [6].

AMR surveillance data collected at a private tertiary hospital between 2012 and 2015 revealed that resistance of *Klebsiella pneumoniae* to aminoglycosides, carbapenems and third generation cephalosporins increased from 58%-75%, 3%-23% and 61%-88%, respectively, while resistance to aminopenicillins has been documented to be as high as 100%². The 2015 annual surveillance data from inpatients at a level-6 health facility (Kenyatta National Hospital) in Nairobi, showed that multi-drug resistance and extensive drug resistance levels among all pathogens analyzed were 88% and 26%, respectively. The study also reported high levels of non-susceptibility of *E. coli*, *K. pneumoniae* and *S. aureus* to commonly used antibiotics such as penicillin (52-92%, 67-73% and 55-97%, respectively) and cephalosporins (57-80%, 64-84% and 30%, respectively) [20]. These surveillance data rely primarily on clinical isolates collected from tertiary-level health facilities. Little is known about the prevalence of AMR in community settings in Kenya. A laboratory-based surveillance of AMR in Kenya study in 2022 by Moirongo et al. Moirongo et al. [13] identified key gaps in laboratory information management technology, external quality assurance and material and equipment among the surveyed health facilities.

Antimicrobial resistance can be minimized effectively through coherent surveillance that facilitates continuous capture and onward sharing of reliable data for the development of targeted interventions at local, national, and global levels (1-3). In addition, improving basic hygiene and sanitation will reduce the spread of resistant organisms. Primarily, laboratory testing is the foundation for detecting resistance [9] and providing essential information for clinicians to institute appropriate treatment regimens for patients, thereby limiting potential misuse of drugs. Where quality laboratory services are not always available, treatment often involves untargeted empirical administration of antimicrobials, including broad-spectrum agents, accelerating the development, and spread of drug resistant microorganisms. Where available, these tests are largely inaccessible to majority of clients due to high costs.

It is evident that AMR awareness and knowledge in Kenya is low even among healthcare workers. There is no evidence of a national survey addressing AMR and antimicrobial use. Antimicrobial stewardship programs (ASP) are poorly developed at the sub-national levels. A robust ASP should foster appropriate use of antimicrobials (including antibiotics), improve patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms. The national Antimicrobial Stewardship guidelines for healthcare settings in Kenya highlight 5 objective areas: i) public awareness and evaluation, ii) surveillance and monitoring, iii) infection prevention and control, iv) appropriate use of antimicrobials and v) research and development. Some cross-sectional studies and point prevalence surveys (PPS) have been conducted in hospitals across the country, and they reflect a high prevalence of antibiotic use (45-69%); irrational antibiotic prescription across wards, especially regarding third generation cephalosporins and extended-spectrum penicillins; and limited or no use of culture and sensitivity tests to guide therapy [7].

A situation analysis on AMR in Kenya conducted by the Global Antibiotic Resistance Partnership in 2011 and updated in 2016 recommended a coordinated national surveillance mechanism and strengthened laboratory capacity to provide the necessary data for risk assessment of AMR. Kenya has since developed a national policy on prevention and containment of antimicrobial resistance in 2017 [8]. The objectives of the policy are to Improve awareness and understanding of AMR through effective communication, education, and training, strengthen the knowledge and evidence base through surveillance and research,

²<https://resistancemap.onehealthtrust.org/AntibioticResistance.php>

reduce the incidence of infection through effective sanitation, hygiene, and infection prevention and control measures, optimize the use of antimicrobials in animals and humans; and develop an economic case for sustainable investment that takes into account Kenya's needs, and increase investment in new medicines, diagnostic tools, vaccines, and other interventions [8].

The National Antimicrobial Stewardship Interagency Committee (NASIC) was established in 2017. The steering committee formed in 2019, includes representatives from six government ministries, including the Ministries of Health, Agriculture, Livestock, Fisheries and Co-operatives and is responsible for overseeing policy direction and resource allocation on AMR. A second tier coordinating system, the County Antimicrobial Stewardship Interagency Committees (CASICs) were created in 8 of the 47 counties to oversee AMR-related activities, monitor National Action Plan on AMR implementation and allocate resources at the county level. NASIC and CASICs have developed communication and awareness strategies, surveillance strategies and standard operating procedures [13].

This project carried out an assessment of AMR diagnostic capacity and use, challenges, antibiotic use, and antimicrobial stewardship practices in 28 health facilities (public, private and faith-based) within 10 counties to provide a better understanding of the respective capacities and current practices.

1.2 RATIONAL

Effective antimicrobial drugs are vital for both preventive and curative measures and protecting patients from potentially fatal diseases. The misuse and overuse of antimicrobials in human medicine and food production are likely to put countries at risk of AMR considering that very few antimicrobial agents are currently in development. Without concerted and immediate action using a multi-sectorial approach at a national and county level, the country stands to diminish the tremendous gains made in the fight against infectious diseases.

Currently, most innovations around AMR are focused on pathogen ID and AST technologies that aim at providing the highest sensitivity or the fastest turnaround time. A high level of technological constraint was put on such platforms in order to compete with the comprehensiveness of conventional laboratory assays. Direct testing without culture, combination of ID and AST on the same platform or the ability to provide Minimum inhibitory concentration (MIC) results the same day can be cited among the most constraining features. The downside of such technologies is that they have been designed for high income markets with a focus on high medical value applications (e.g. bloodstream infection). Therefore, their implementation in LMICs is not always possible for several reasons such as high cost, incompatibility with existing infrastructure and equipment or lack of a clear and complete patient management flow that can really showcase the added value of a disruptive tool.

These aforementioned challenges compounded by lack of proper ASP and by paucity of data on AMR diagnostics in different private and public health facilities in different counties across the country. The aim of this work was to conduct an assessment of the AMR laboratory capacity, antibiotic use and existing Stewardship practices in selected 28 health facilities in Kenya. Findings from this assessment will aid in the preparation for introduction of **cefiderocol** (and other antibiotics) and new low blood culture and molecular point of care treatment platforms in Kenya.

1.3 ASSESSMENT OBJECTIVES

This project was about assessment of antimicrobial resistance diagnostics capacity and antibiotic use in counties (AADCAUC). The aim of this project was to assess AMR diagnostic capacity, antibiotic use and existing antimicrobial stewardship practices to prepare for introduction of cefiderocol (and other antibiotics) and new low blood culture and molecular Point of care testing (POCT) platforms in Kenya. The objective was be considered under two broad components, diagnostic- and therapeutic-components.

1.3.1 THE DIAGNOSTIC COMPONENT COMPRISED THE FOLLOWING SUB-OBJECTIVES

- (i) To determine the current AMR diagnostics in the selected counties in Kenya
- (ii) To determine the supply of equipment and testing commodities
- (iii) To determine the gaps in AMR diagnosis continuum in the selected counties in Kenya
- (iv) To Establish the average cost and mode of payment for AMR diagnosis in the selected counties
- (v) To document use cases for AMR diagnostics, current practices and determine the level of adherence to regulatory needs

This enabled understanding of current AMR diagnostics, supply and gaps, current use cases for AMR diagnostics, practices, regulatory needs, and willingness to pay for AMR diagnostic services in the selected counties.

1.3.2 THE THERAPEUTIC COMPONENT COMPRISED THE FOLLOWING SUB-OBJECTIVES

- (i) To understand current reserve antibiotic supply, use cases, and gaps in the selected counties in Kenya.
- (ii) To identify access pathways for new reserve antibiotics.
- (iii) To map potential early adoption sites, capacities, and barriers.
- (iv) To develop relationships with early adoption partners.

2 TECHNICAL APPROACH

2.1 DATA SOURCE

This was a laboratory assessment for AMR diagnostic capacity, antibiotic use, and antimicrobial stewardship carried out in selected Health Facilities (HFs) in the country. 30 HFs were sampled for data collection for this project. 28 HFs were responsive and data was collected through interviews using 2 data collection tools, one mapping AMR Dx capacity and the other mapping Antibiotics (Abx) use and Antimicrobial stewardship (AMS) (See Appendix F and G).

2.2 ASSESSMENT SITES

The assessment was carried out in 28 selected health facilities from 10 Counties in Kenya. These health facilities were both private and public hospitals.

2.2.1 PARTICIPATING COUNTIES

The 10 participating counties were Nairobi, Kajiado, Kilifi, Kirinyaga, Nyeri, Laikipia, Isiolo, Vihiga, Nandi and Kericho. Nairobi, Kajiado and Kirinyaga counties are found in the central region of Kenya, while Vihiga, Kericho and Nandi are found within the western region of Kenya. Nyeri, Laikipia and Isiolo counties are to the north while Kilifi is found in the southern region of Kenya. Figure 1 shows the participating counties.

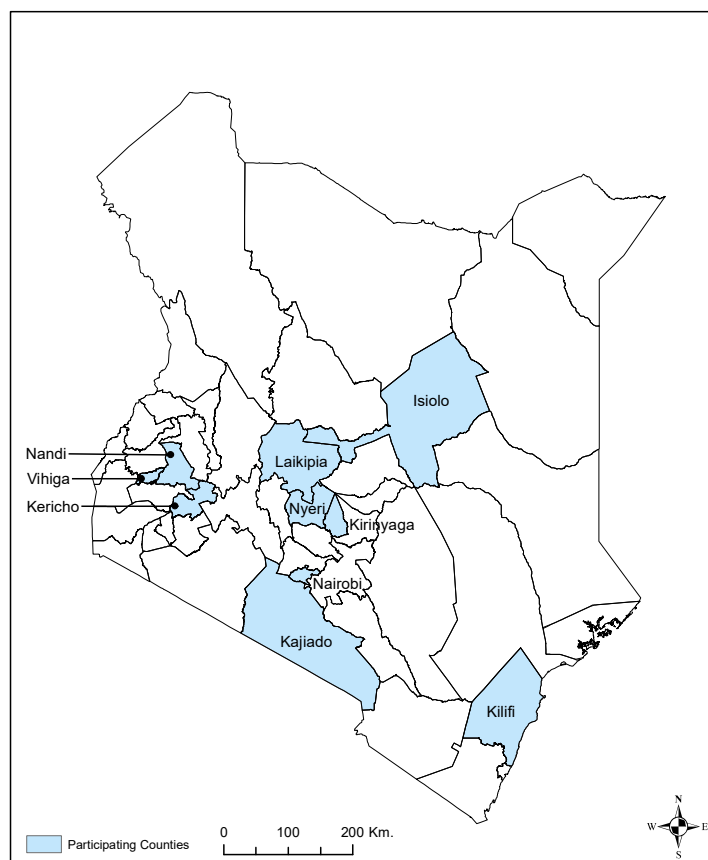


FIGURE 1: MAP OF ASSESSMENT SITES

30 HFs were randomly selected by Kenya Essential Package for Health (KEPH) level from counties. The 10 counties (Nairobi, Kajiado, Kilifi, Kirinyaga, Nyeri, Laikipia, Isiolo, Vihiga, Nandi and Kericho). The

distribution of implementation sites is as follows: 2 level 6 HF's owned by the Ministry of Health Kenya (MoH-K), 4 level 5 facilities (1 MoH-K, 1 Faith-based organization (FBO), 2 private), 24 level 4 facilities (12 MoH-K, 5 FBO, 6 private)

2.2.2 EXCLUSION CRITERIA:

Two HF's where the approval process was too long were excluded since by the time the assessment was closing, they had not given an indication as to when the assessment could be carried out.

2.2.3 PARTICIPATING HEALTH FACILITIES

The 30 participating health facilities were randomly selected based on the KEPH level from the participating counties. The KEPH is a package of services that the government of Kenya is providing or is aspiring to provide to its citizens in an equitable manner. This essential package is expected to achieve multiple goals: improved efficiency, equity, political empowerment, accountability, and altogether more effective care. Health facilities in Kenya are government of Kenya (MoH-K), FBO or privately managed. The health delivery system in Kenya is organized into 6 levels: Level 1: community health units (CHUs), Level 2: dispensaries and private clinics, Level 3: health centres, Level 4: sub-County hospitals and nursing homes, Level 5: County referral and teaching hospitals, private hospitals, and Level 6: national referral hospitals. Based on the health delivery levels in Kenya, the participating health facilities were grouped as follows; three level 6 (owned by the MoH-K), 9 level 5 (4 MoH-K, 3 FBO, 2 private), and eighteen level 4 facilities (10 MoH-K, 5 FBO and 2 private). Table 1 below shows the number and distribution of the health facilities based on their counties, administrative wards, and health delivery level.

TABLE 1: LIST OF PARTICIPATING HFS BY COUNTY, SUB-COUNTY AND WARD

County	Sub county	Ward	Name of health facility	Level	Ownership
Isiolo	Isiolo	Bulla Pesa	Anka Hospital Isiolo	Level 4	Private
Isiolo	Isiolo	Bulla Pesa	MaterCare Maternity Hospital	Level 4	Faith Based Organisation
Isiolo	Isiolo	Wabera	Isiolo County and Referral Hospital	Level 4	Public
Kajiado	Kajiado Central	Ildamat	Kajiado County Referral Hospital	Level 4	Public
Kajiado	Kajiado East	Kitengela	Kitengela Medical Services	Level 4	Private
Kajiado	Kajiado North	Ngong	Ngong Sub-County Hospital	Level 4	Public
Kericho	Ainamoi	Kipchebor	Kericho County Referral Hospital	Level 5	Public
Kericho	Bureti	Litein	AIC Litein Mission Hospital	Level 5	Faith Based Organisation
Kilifi	Kaloleni	Mariakani	Mariakani Sub County Hospital	Level 4	Public
Kilifi	Kilifi North	Sokoni	Kilifi County Hospital	Level 4	Public
Kilifi	Malindi	Barani	Tawfiq Hospital	Level 4	Faith Based Organisation
Kirinyaga	Kirinyaga Central	Kerugoya	Kerugoya County Referral Hospital	Level 5	Public
Kirinyaga	Kirinyaga Central	Kerugoya	Mt Kenya (ACK) Hospital	Level 4	Faith Based Organisation
Kirinyaga	Kirinyaga South	Tebere	Afya Link Medical Centre	Level 4	Private
Laikipia	Laikipia East	Nanyuki	Nanyuki teaching and Referral Hospital	Level 4	Public
Laikipia	Laikipia west	Igwamiti	Pope Benedict XVI Hospital	Level 4	Faith Based Organisation
Nairobi	Dagoreti North	Kilimani	Coptic Hospital	Level 4	Faith Based Organisation
Nairobi	Embakasi Central	Komarock	Mama Lucy Kibaki Hospital (Embakasi)	Level 5	Public
Nairobi	Roysambu	Kahawa	Kenyatta University Teaching Referral and Research Hospital	Level 6	Public
Nairobi	Ruaraka	Korogocho	Mama Margaret Uhuru Hospital	Level 4	Public
Nairobi	Starehe	Nairobi South	The Mater Misericordiae Hospital (Mukuru)	Level 5	Faith Based Organisation
Nandi	Chesumei	Chemundu/Kapng'etunyi	Kapsabet Health Care Centre	Level 4	Private
Nandi	Emgwen	Kapsabet	Kapsabet County Referral Hospital	Level 5	Public
Nandi	Mosop	Chepterwai	Chepterwai Sub-County Hospital	Level 4	Public
Nyeri	Nyeri South	Iria-ini	KNH Othaya Annex	Level 6	Public
Vihiga	Hamisi	Shiru	Jumuia Mission Hospital Kaimosi	Level 5	Faith Based Organisation
Vihiga	Luanda	Emabungo	Emuhaya Sub County Referral Hospital	Level 4	Public
Vihiga	Vihiga	Lugaga-wamuluma	Vihiga County Referral Hospital	Level 4	Public

2.3 HEALTH FACILITY WORKFORCE ENGAGED DURING THE ASSESSMENT

The following cadre of healthcare workers from the participating HFs were engaged to aid in data collection or as respondents, Head Physicians (or facility AMR focal persons), Medical Laboratory Managers and/ or Medical Microbiologists, Head Nursing Officers, Head Pharmacists and Hospital Administrators. The first activity undertaken in seeking buy-in from stakeholders in preparation for the launch of the project was stakeholder engagement.

2.4 STAKEHOLDER ENGAGEMENT

To foster effective collaboration, coordination and implementation of project activities, key stakeholders in the space of AMR were engaged. These stakeholders included officials at the national level (MoH-K), County levels (County Health Management Teams (CHMTs)), leadership of select public and private health facilities, private-sector players and Faith-Based Organizations (FBOs) leadership in health.

The project undertook various sensitization meetings as part of its entry and buy-in strategies to onboard various stakeholders and partners. These meetings also provided opportunities for engagement of stakeholders aimed at alignment of the protocol, the data collection tools and for national and county-level approvals.

The first sensitization was carried out at the national level. This consisted of presenting the aims and objectives of the assessment to the Director General of Health and NASIC membership. The second sensitization meeting was held with the representatives of the CHMTs from the 10 participating Counties and leadership of the participating HFs (public, private and FBO owned). This strategy ensured seamless approval and implementation of the project in the Counties and participating HFs by onboarding all key stakeholders.

2.5 PROJECT IMPLEMENTATION AND MANAGEMENT

The project team partnered directly with NASIC to ensure smooth implementation of the project. Their key responsibilities were to provide strategic guidance and technical expertise for the project. The two teams prepared a work breakdown structure highlighting the deliverable and work packages in a time bound manner. Biweekly meetings with partners (Foundation for Innovative New Diagnostics (FIND) and Global Antibiotic Research and Development Partnership (GARDP)) were undertaken to ensure that all implementing partners were sufficiently informed about the overall project progress. These regular interactions provided a forum for exchange of ideas and insights, tracked progress and course-correction whenever necessary in the implementation strategies were applicable. The implementation team prepared regular reports to appraise the stakeholders on the progress of the pilot.

2.6 DEVELOPMENT AND PILOTING OF THE DATA COLLECTION TOOLS

The assessment tool was digitized on Open Data Kit (ODK) and data aggregation was done using the Kobo toolbox. The tool was made available through *KoboCollect application* which was installed in tablets that were provided to each of the assessors. Collected data was transmitted and stored in the Digital Health Applied Research Centre (DHARC) server for analysis.

2.7 DEVELOPMENT OF TRAINING MATERIALS

Training and sensitization materials were developed covering the following areas.

1. AMR diagnostic assessment.
2. Stepwise navigation of the digitized data collection tools.
3. Harmonisation of the interview guides for collecting qualitative information
4. The assessment protocol for data collection.

2.8 TRAINING ASSESSORS AND SENSITIZATION OF HF PARTICIPANTS

Assessors identified by NASIC were trained on the assessment of AMR diagnostic capacity and use of the digitized data collection tool. During the training all AADCAUC questions were reviewed in advance to establish familiarity with the sections, contents and flow of the questionnaires, and all necessary clarifications and amendments made. The HF personnel who were earmarked to participate in this assessment were also sensitized on the various sections in the assessment tool prior to visiting the HF.

2.9 STUDY WORKFLOW

The study was carried out as shown in the schematic workflow in Figure 2 below. The flow diagram shows the continuum of the study by highlighting the key phases of development of the data collection tools, preparation of the team of assessors and data collection at the HF.

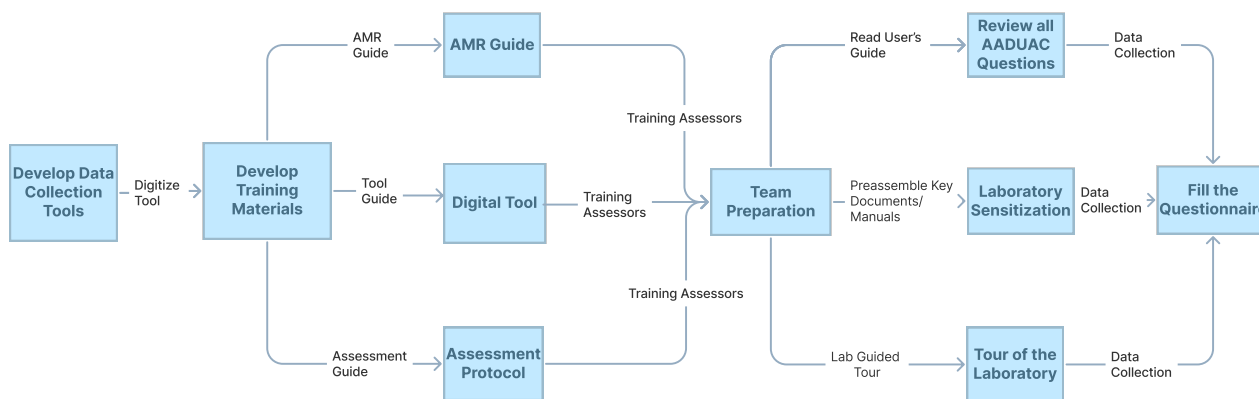


FIGURE 2: ASSESSMENT WORKFLOW

The following steps were followed during the assessment

2.9.1 HF AND LABORATORY SENSITIZATION

A week in advance of the assessment, an agenda was shared with the participating HFs and specifically the laboratory and pharmacy departments for alignment on the expectations that would assist in planning for data collection. This included a request that the HFs pre-assemble key documents and manuals for review. Doing so saved a significant amount of time during the actual assessment.

2.9.2 HEALTH FACILITY STAFF BRIEFING

Prior to the commencement of the HF assessment, a brief meeting was held with facility and laboratory leadership, and staff with the main purpose of reviewing the agenda of the visit and ensure that the assessment purpose, process, and expected outcome are understood and aligned. The briefing helped to clarify that the assessment activity was intended to unveil areas requiring improvement, and not a “regulatory inspection” by the national government.

2.9.3 TOUR OF THE LABORATORY

After the HF staff briefing, the assessment team had a guided tour of the laboratory, in preparation of documentation and data collection.

2.9.4 REVIEW OF DOCUMENTS, FILLING OF THE QUESTIONNAIRES AND INTERVIEWS WITH HF ADMINISTRATION

Upon completion of the tour, the assessment process commenced with the assessor interviewing the key identified respondents. For the diagnostic component of the assessment, a Medical Laboratory Officer (MLO) was the lead assessor, and (s)he led the project team in data collection and review of documentation during the laboratory assessment session which mainly focused on the microbiology capacity in the laboratory.

For the therapeutic component of the assessment, a pharmacist was the lead assessor, and (s)he led the project team in data collection and review of documentation during the pharmacy and antibiotic use assessment session which focused on antibiotic use, enquirers on the hospital antibiogram, empiric antibiotic use, and utilization of microbiology results in the management of various infectious diseases was made. Data collection was collected and stored in the digitized tool during the face-to-face interviews with HF pharmacist and his team.

Tablets were used for the digitised responses, and notes were taken alongside this for the qualitative insights that arose during the discussions, especially with HF administrators and other relevant staff including nurse in charge, medical superintendents or human resource manager depending on the setup of the specific HF.

3 DATA ANALYSIS AND RESULTS

3.1 OVERVIEW OF THE ASSESSMENT SITES

As shown in Table 1, 28 HFIs participated in the assessment. 3 of the HFIs were level 6 and MoH-K owned, two in Nairobi county and the other in Nyeri County. Of the level 6 HFIs, 2 were annexes of Kenyatta National Hospital (KNH), the oldest hospital in Kenya. One of the level 6 hospitals, Mama Margaret Kenyatta Hospital-KNH Annex, started operations in March 2022. 7 of the HFIs were level 5, 4 being MoH-K owned and 3 owned by FBOs. The remaining 18 HFIs were level 4, 9 owned by MoH-K, 5 owned by FBOs and 4 owned by private enterprises. Table 2 details the bed capacities and workloads for the participating HFIs. For the one year period under consideration, a total of 2,872,935 patients were seen,

TABLE 2: BED CAPACITIES AND WORKLOADS FOR PARTICIPATING HFIS

KEPH/Ownership	No. of HFIs	Bed capacity	Average bed occupancy rate	Inpatient/ Year	Outpatient/ Year	Total workload	% of inpatient	overall % of inpatient
Level 4	18	2,238	60.5	99,221	1,356,270	1,455,491	7.3%	34.27%
NGO/Faith-based/Donors	5	544	59.0	32,074	261,731	293,805	12.3%	11.08%
Private	4	234	54.5	9,006	150,396	159,402	6.0%	3.11%
Public/Government	9	1460	64.0	58,141	944,143	1,002,284	6.2%	20.08%
Level 5	7	1,538	50.9	174,019	993,754	1,167,773	17.5%	60.10%
NGO/Faith-based/Donors	3	468	33.6	24,603	307,330	331,933	8.0%	8.50%
Public/Government	4	1,070	63.9	149,416	686,424	835,840	21.8%	51.60%
Level 6	3	1,350	45.7	16,304	233,367	249,671	7.0%	5.63%
Public/Government	3	1,350	45.7	16,304	233,367	249,671	7.0%	5.63%
Total	28	5,126	56.5	289,544	2,583,391	2,872,935	11.2%	100.00%

with 11.2% (289,580) being inpatient cases. 59% of the inpatient cases seen at level 4 were admitted at government owned HFIs, 32% at FBOs-owned and 9% at private hospitals. For outpatient cases, 69.6% of those seen at level 4 went to public HFIs, 19.3% to FBO owned and 11.1% to private HFIs. At level 5 HFIs, 85.8% of the inpatient cases were seen at public HFIs and 14.2% at FBOs owned HFIs. For the outpatient cases, 69.1% were seen at public HFIs and 30.9% at FBO owned HFIs. Overall, 60.1% of the inpatient cases were seen at level 5, 34.6% at level 4 and 5.3% at level 6.

Bed occupancy rates were highest at level 4 with an average of 50.9%. Government owned HFIs at both levels 4 and 5 stood at 64% and, with the highest occupancy rate being reported by Mama Lucy Kibaki Hospital at 182%. The lowest bed occupancy rates were observed in the 3 level 5 FBO-owned HFIs. The overall average bed occupancy rate for all the HFIs considered was 56.5% (Table 2).

The AADCAUC was considered under two broad components, the diagnostic which focused mainly on AMR diagnostic capacity and the therapeutic component which focused mainly on Abx use. These are discussed in detail in the sections below.

3.2 DIAGNOSTIC COMPONENT

The findings from analysis relating to this component enabled understanding of current AMR diagnostics, supply and gaps, current use cases for AMR diagnostics, practices, regulatory needs, and willingness to pay for AMR diagnostic services in the selected counties. Reporting was aligned with specific sub-objectives as discussed in the sections below.

3.2.1 CURRENT AMR DIAGNOSTICS IN THE SELECTED COUNTIES

In order to understand the AMR diagnostics in the counties, the assessment considered the laboratory human resource establishment including their levels of training, the number of HFs able to perform cultures and the different types of diagnostic equipment available.

LABORATORY STAFF ESTABLISHMENT

In many countries, especially in LMICs, there is scarcity of skilled professionals, capable of generating quality AST laboratory results, interpreting AMR data, or designing relevant and representative AMR surveillance protocols that are required for solid AMR surveillance systems. Efforts to address the laboratory workforce shortage are further complicated by the fact that competency standards for AMR surveillance are not well defined, even in reference laboratories [2]. One of the ways of bridging this gap is in ensuring availability of adequate laboratory staff in HF with requisite and relevant trainings.

TABLE 3: LABORATORY STAFF ESTABLISHMENT AT THE PARTICIPATING HFS

KEPH/Ownership	No. of HFs	Total staff	GoK Employed	Paid by other organization	Aged 20-35	Aged 36-50	Aged over 50
Level 4	18	194	117	5.7%	59.8%	35.1%	6.7%
NGO/Faith-based/Donors	5	58	-	0.0%	75.9%	20.7%	3.4%
Private	4	11	-	0.0%	63.6%	18.2%	18.2%
Public/Government	9	125	117	8.8%	52.0%	43.2%	7.2%
Level 5	7	173	99	1.7%	51.4%	41.6%	6.9%
NGO/Faith-based/Donors	3	71	-	0.0%	57.7%	38.0%	4.2%
Public/Government	4	102	99	2.9%	47.1%	44.1%	8.8%
Level 6	3	79	64	19.0%	53.2%	43.0%	3.8%
Public/Government	3	79	64	19.0%	53.2%	43.0%	3.8%
Grand Total	28	446	280	6.5%	55.4%	39.0%	6.3%

From the assessment, we see from the summary provided in Table 3 that there were a total of 446 laboratory staff available at all the participating HFs. 55.4% of the laboratory staff are in the 20-35 age bracket, 39% in the 36-50 and only 6.3% are aged over 50. Level 4 HFs have a slightly higher number of the younger laboratory staff. Overall, 6.5% of the laboratory staff in government owned HFs are paid for by other organisations. 19% of the

laboratory staff working in level 6 HFs that were assessed are paid for by other organisations, 2.9% of

Level 6 HFs had an average of 27 laboratory staff per HFs. The average number of laboratory staff at MOH owned level 5 HFs is 26, and for the FBO owned is 24. For level 4 HFs, the average numbers are 14 for MOH-K owned, 3 for private and 12 for FBO owned HFs.

those in level 5 and 8.8% of those in level 4 are also paid for by other organisations. To obtain the average number of lab staff reported in the text box, the total staff numbers were distributed across the HFs visited for the assessment as summarised in Table 3.

A well-trained laboratory workforce is critical in ensuring that laboratories have the requisite capacity to perform the critical activities that are needed to competently and effectively safeguard the health of members of public. Laboratory competencies include general domains that apply to the responsibilities of all public health laboratory professionals, including bench scientists, laboratory managers and leaders and other laboratory staff. This general domain covers ethics, management and leadership, emergency response, communication, security and work force training. Laboratory competencies also cover cross-cutting technical domains that apply to all laboratory scientists regardless of the discipline in which they work such as general laboratory practices, safety, surveillance and informatics. Finally, laboratory competencies also cover specialized domains specific to laboratory scientists who work in particular scientific disciplines or specialized functional areas such as chemistry, microbiology, bioinformatics and research [5].

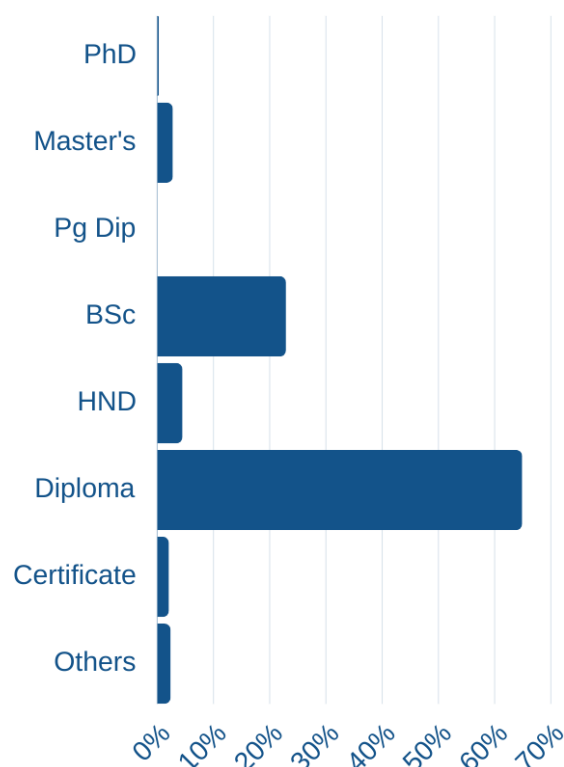


FIGURE 3: DIFFERENT LEVELS OF TRAINING FOR LABORATORY STAFF

Concerning education and training levels, 64.9% of the laboratory staff from assessed HFs held a diploma, 22.9% held a Bachelor of science (BSc.) and 4.5% had a higher national diploma (HND), either in medical microbiology or medical laboratory sciences. Other levels of training included PhD. (1 staff from one of the level 5 FBO HF), Masters (2.8%), certificate (2.1%) and a cluster of unspecified trainings (2.4%) (Figure 3).

On workplace skills development, 8 out of 28 (28.6%) HFs reported that there were no standardized process for training new employees. For the remaining HFs, the training process for new employees was mainly through on-job training (OJT), staff orientation using standard operating procedures (SOPs), competency trainings, mentorship and continuing medical education (CME) sessions. 18 (64.3%) of the HFs reported that their staff received annual competency trainings which involved review of the laboratory test menu.

LABORATORY CERTIFICATION, MENTORSHIP AND OPERATIONS

Laboratory certifications are important for verifying that the laboratory staff have sufficient knowledge of laboratory practices and regulations to meet care and safety standards for HFs. Through certification preparation, training and renewal, the laboratory personnel remain updated on new developments for laboratory standards and systems. Medical laboratory accreditation is a means of determining the technical competence of a medical laboratory to perform specific types of testing, measurement, and calibration of equipment. Medical laboratory accreditation also provides a formal recognition to competent laboratories, thus providing a ready means for customers to identify and select reliable testing

and measurement services able to meet the customers' needs [12].

The Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA) is a programme that trains laboratory managers to improve laboratory operations using available resources and achieve international accreditation standards. It provides a stepwise approach to measuring progress towards accreditation. Strengthening Laboratory Management Toward Accreditation (SLMTA) is a U.S. President's Emergency Plan for AIDS Relief (PEPFAR) flagship program for strengthening laboratory systems. SLMTA is an international laboratory improvement program designed for LMICs. While SLIPTA measures the laboratory quality by conducting audits, SLMTA provides the how-to with training and mentoring. These 2 programs complement each other and together they provide the tools and processes needed to turn the aspirations of lab accreditation into reality [4, 18].

TABLE 4: LABORATORY CERTIFICATION

KEPH/Ownership	No. of HFs	SLIPTA/SLMTA	None	Ongoing Registration	valid ISO 15189	Functioning Backup for critical equipment	UPS for critical equipment
Level 4	18	2	16	0	3	8	6
NGO/Faith-based/Donors	5	0	5	0	1	2	1
Private	4	0	4	0		2	2
Public/Government	9	2	7	0	2	4	3
Level 5	7	5	2	2	3	3	2
NGO/Faith-based/Donors	3	1	2	1	1	2	1
Public/Government	4	4	0	1	2	1	1
Level 6	3	0	3	0	0	1	1
Public/Government	3	0	3	0	0	1	1
Grand Total	28	7	21	2	6	12	9

This assessment sought to establish which HFs had obtained the SLIPTA and /or SLMTA certification by the time of the assessment and whether this certification had been obtained within the last 2 years of the assessment or 2 years prior. It also sought to establish if the HFs had obtained a valid ISO 15189 certification. From Table 4, only 7 (21.4%) HFs had enrolled in either the SLIPTA or SLMTA mentorship programme or both. 2 HFs reported that they had commenced the enrolment process into the SLIPTA and/or SLMTA programmes. With respect to laboratory certification, only 6 HFs had a valid ISO 15189 certification. None of the 3 level 6 HFs assessed had obtained either of the certifications or a valid ISO 15189 certification. All the 4 MoH-K owned level 5 HFs and 2 out of the 9 MoH-K owned level 4 HF visited had the SLIPTA or SLMTA certification. All HFs with SLIPTA or SLMTA had received their certification more than 2 years prior to the assessment date. Of these, only 3 indicated the star levels for their latest SLIPTA audits. One had a 5 star rating, one a 3 start and the last one a 2 star rating. In addition, Only 14.3% (4) of the HFs had enrolled for the Kenya External Quality Assessment Scheme (KNEQAS) programme, one enrolled in 2019, another in 2021 and the other two in 2023. Another 2 HFs were enrolled in the Human Quality Assessment Services (HuQAS) programme.

The assessment also covered whether the laboratories had a functioning back-up or Uninterruptible Power Supply (UPS) for critical equipment. For this, 12 (42.9%) HFs had a functioning back-up system, and

TABLE 5: HFS ENROLLED IN SLIPTA AND SLMTA PROGRAMMES**(a) ENROLLED FOR SLIPTA**

County	Sub-county	Ward	Name of HF	KEPH Level	Ownership
Nandi	Emgwen	Kapsabet	Kapsabet County Referral Hospital	Level 5	Public
Kericho	Ainamoi	Kipchebor	Kericho County Referral Hospital	Level 5	Public
Vihiga	Hamisi	Shiru	Jumuia Mission Hospital Kaimosi	Level 5	FBO

(b) ENROLLED FOR SLMTA

County	Sub-county	Ward	Name of HF	KEPH Level	Ownership
Kericho	Ainamoi	Kipchebor	Kericho County Referral Hospital	Level 5	Public
Kilifi	Kaloleni	Mariakani	Mariakani Sub County Hospital	Level 4	Public
Kilifi	Kilifi North	Sokoni	Kilifi County Hospital	Level 4	Public

9 (32.1%) had a UPS for critical equipment. The assessment also investigated what tests were covered by the ISO 15189. Only one HF specified that their ISO certification covered AST, urine Cultures and organism identification. The ISO 15189 certification for the laboratories had been awarded by Kenya Accreditation Service (KENAS). In addition, from the assessment it was established that 89.3% (25) of the HFs had an inventory control system, out of which 80% (20 out of 25) used a manual system. Only 3 HF reported to have a software for inventory control.

ABILITY TO PERFORM CULTURES

The majority of infectious diseases are bacterial in origin. In the care continuum, the ability of a laboratory to culture these microorganisms and determine the sensitivity and resistance of specific pathogens to a wide range of antimicrobial agents becomes the best way to determine the bacterial pathogens associated with diseases and to guide selection of the appropriate antimicrobial by the healthcare provider[3, 19]. The HFs that were involved in the assessment exercise were asked whether they had the ability to perform cultures. Out of the 28, only 15 (53.6%) had the ability to perform cultures, and only 4 (14.3%) had the ability to perform fungal cultures (see Table 6). 2 of

TABLE 6: PROPORTION OF HFS WITH ABILITY TO PERFORM CULTURES

KEPH/Ownership	No. of HFs	Ability to perform cultures	Ability to perform fungal cultures	Proportion of workload
Level 4	19	31.6%	5.3%	50.9%
NGO/Faith-based/Donors	5	80.0%	20.0%	10.2%
Private	4	0.0%	0.0%	5.5%
Public/Government	9	22.2%	0.0%	35.2%
Level 5	7	100.0%	28.6%	40.6%
NGO/Faith-based/Donors	3	100.0%	33.3%	11.6%
Public/Government	4	100.0%	25.0%	29.1%
Level 6	3	66.7%	33.3%	8.4%
Public/Government	3	66.7%	33.3%	8.4%
Total	28	53.6%	14.3%	100.0%

the 3 level 6 HFs and all the level 5 HFs and capacity to perform cultures. The largest gap with respect to the ability to conduct cultures was seen in level 4 HFs with only 31.6% having the ability to perform cultures even as 50.9% of the total population served by the HFs considered in this assessment are seen in the level 4 HFs. 80% of FBO owned level 4 HFs had the ability, and only 20% of the MoH-K owned facilities were able to perform cultures. From Table 6, it was noted that of the 4 level 4 private HFs assessed, none

were able to perform any cultures.

Table 7 shows a list of the HF's that had the ability to perform cultures. The 15 HF's could be mapped from all the 10 Counties that participated meaning all the 10 counties were represented, even if not by a similar number of HF's. 2 of them were level 6, 7 were level 5 and 6 were level 4 HF's. Of all the HF's visited, no privately owned HF's had the ability to perform cultures. 7 of the HF's were FBO owned, and 8 were public or government owned.

TABLE 7: LIST HF'S WITH ABILITY TO PERFORM CULTURES

County	Sub county	Ward	Name of health facility	HF LEVEL	HF OWNERSHIP
Nairobi	Roysambu	Kahawa	Kenyatta University Teaching Referral and Research Hospital	Level 6	Public/Government
Nyeri	Nyeri South	Iria-ini	KNH Othaya Annex	Level 6	Public/Government
Kericho	Bureti	Litein	AIC Litein Mission Hospital	Level 5	NGO/Faith-based/Donors
Vihiga	Hamisi	Shiru	Jumuia Mission Hospital Kaimosi	Level 5	NGO/Faith-based/Donors
Nandi	Emgwen	Kapsabet	Kapsabet County Referral Hospital	Level 5	Public/Government
Kericho	Ainamoi	Kipchebor	Kericho County Referral Hospital	Level 5	Public/Government
Kirinyaga	Kirinyaga Central	Kerugoya	Kerugoya County Referral Hospital	Level 5	Public/Government
Nairobi	Embakasi Central	Komarock	Mama Lucy Kibaki Hospital (Embakasi)	Level 5	Public/Government
Nairobi	Starehe	Nairobi South	The Mater Misericordiae Hospital (Mukuru)	Level 5	NGO/Faith-based/Donors
Nairobi	Dagoreti North	Kilimani	Coptic Hospital	Level 4	NGO/Faith-based/Donors
Kajiado	Kajiado Central	Ildamat	Kajiado County Referral Hospital	Level 4	Public/Government
Isiolo	Isiolo	Bulla Pesa	MaterCare Maternity Hospital	Level 4	NGO/Faith-based/Donors
Laikipia	Laikipia East	Nanyuki	Nanyuki teaching and Referral Hospital	Level 4	Public/Government
Laikipia	Laikipia west	Igwamiti	Pope Benedict XVI Hospital	Level 4	NGO/Faith-based/Donors
Kilifi	Malindi	Barani	Tawfiq Hospital	Level 4	NGO/Faith-based/Donors

The assessment further investigated which HF's had capacity for the cultures listed in Figure 4. Of the 28 HF's visited, 13 (46.4%) did not have capacity to perform any cultures; only 8 (28.6%) could perform blood and lower respiratory cultures; 11 (39.3%) could perform Cerebrospinal fluid (CSF) cultures, 12 (42.9%) could perform upper respiratory and sterile body fluid cultures, 14 (50%) could perform urine, genital, High Vaginal Swab (HVS) and pus, aspirates and tissue cultures, 15 (53.6%) HF's could perform stool cultures and none of the facilities indicated that they performed TB cultures. The HF's further indicated that

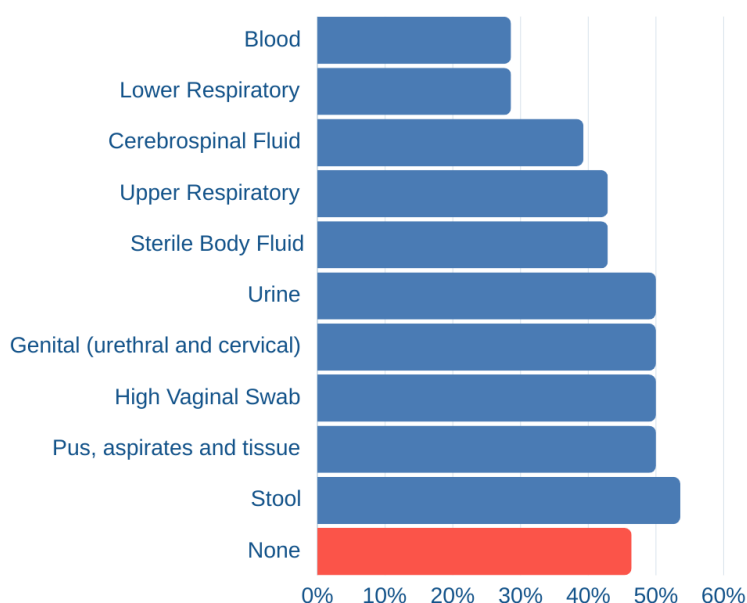


FIGURE 4: NO. OF HF'S WITH LISTED CULTURES

Samples for blood cultures were only collected by either the lab personnel or the clinical phlebotomist.

ABILITY TO PERFORM BLOOD CULTURES

Table 8 provides a list of the 8 HF's that had the ability to perform blood cultures including the type of equipment they owned. Of the 8, 5 used an automated blood culture machine while the other 3 used a manual one. Of the 5 with automated blood culture machines, 4 used Bactec (KUTRRH, Kajiado CRH,

Kericho CRH and Mater Misericordiae Hospital), and 2 used BacT/ALERT (Coptic Hospital and Kericho CRH) (Kericho CRH had both). None of the HF's used the TDR automated blood culture system.

TABLE 8: HFS WITH ABILITY TO PERFORM BLOOD CULTURES

County	Sub-county	Equipment	Name of HF	KEPH Level	Ownership
Nairobi	Roysambu	Bactec	KUTRRH	Level 6	GoK
Nyeri	Nyeri South	Manual	KNH Othaya	Level 6	GoK
Kericho	Bureti	Manual	AIC Litein	Level 5	FBO
Kericho	Ainamoi	Bactec & BacT/ALERT	Kericho CRH	Level 5	GoK
Nairobi	Starehe	Bactec	Mater Hospital	Level 5	FBO
Nairobi	Dagoreti North	BacT/ALERT	Coptic Hospital	Level 4	FBO
Kajiado	Kajiado Central	Bactec	Kajiado CRH	Level 4	GoK
Laikipia	Laikipia East	Manual	Nanyuki TRH	Level 4	GoK

In order to determine operational levels or deficiencies on the laboratories that had the ability to carry out cultures, the assessment sought to establish whether in the last six months preceding the assessment, the HF's had experienced any prolonged power failures that disrupted their operations, whether they had carried out Quality assurance / quality control (QA/QC), whether they had experienced stock-outs, and how this had affected their operations. For this period, among the 15 HF's with the ability to perform different cultures, it was observed that they had not experienced any Prolonged power failure that disrupted their ability to provide routine bacteriology services, only 8 had carried out a QA/QC audit, 6 had however experienced stock-outs for specimen collection materials, 4 had experienced stock-outs of consumables such as gloves, agar plates, another 4 had experienced stock-outs of antibiotic disks or strips, and 2 had experienced stock-outs of either ID or AST cards/trays for automated instruments. From the assessment, 14 had the ability to perform AST,

3.2.2 RESULTS FROM SOME OF THE CULTURES PERFORMED

Table 9 shows some results from the cultures that were performed in the HF's in the last 12 months prior to the assessment (August 2022 to September 2023). The largest number of cultures performed were blood cultures while genital cultures were the least performed. There were some data quality issues on the test results since some tests seemed not to have been

TABLE 9: RESULTS FROM CULTURES PERFORMED

Culture	Average TAT in hrs	No. Performed in last 12 months	No. of Positives	No. of Negatives	No. Contaminated	Unaccounted
Blood	202.4	4608	606 (13.2%)	1815	293	1894 (41.1%)
Urine	80.6	5186	1321 (25.5%)	2709	34	1122 (21.6%)
Stool	88	2933	877 (29.9%)	1758	50	248 (8.5%)
Lower Respiratory	84	725	149 (20.6%)	375	0	201 (27.7%)
Upper Respiratory	90	944	160 (16.9%)	380	0	404 (42.8%)
CSF	78.5	886	100 (11.3%)	774	2	10 (1.1%)
Sterile Body Fluid	84	862	61 (7.1%)	661	0	140 (16.2%)
Genital (urethral and cervical)	84	641	122 (19%)	245	11	263 (41%)
High Vaginal Swab	84	1447	345 (23.8%)	1065	8	29 (2%)
Pus, aspirates and tissue	84	1937	625 (32.3%)	1168	7	137 (7.1%)

accounted for. The largest non accounted for tests were blood cultures, where 4,608 cultures were done, but only 59% were accounted for in terms of positive, negative and contaminated samples. Others with large amounts of incomplete data included genital, upper respiratory, lower respiratory, and urine cultures.

This data incompleteness could be largely attributed to the use of paper based laboratory reporting systems. From Table 9, it can also be noted that blood cultures had the longest Turn Around Time (TAT) (8 to 10 days) of all the cultures considered. The others all averaged from 3 to 5 days TAT.

3.2.3 GRAM STAINING AND AST

Gram

Staining is the common, important, and commonly used differential staining technique in microbiology. This test differentiates the bacteria into Gram Positive and Gram Negative, which helps in the classification and differentiation of microorganisms and is useful for guiding empiric clinical management for bacterial infections pending definitive

TABLE 10: CAPACITY FOR GRAM STAINING AND AST

KEPH/Ownership	No. of HFs	Gram staining	AST Capacity	AST referral	Patient referral	Isolates referral
Level 4	18	68.4%	31.6%	63.2%	58.3%	66.7%
NGO/Faith-based/Donors	5	100.0%	80.0%	20.0%	0.0%	100.0%
Private	4	25.0%	0.0%	100.0%	50.0%	75.0%
Public/Government	9	70.0%	20.0%	70.0%	71.4%	57.1%
Level 5	7	100.0%	85.7%	0.0%		
NGO/Faith-based/Donors	3	100.0%	100.0%	0.0%		
Public/Government	4	100.0%	75.0%	0.0%		
Level 6	3	100.0%	100.0%	0.0%		
Public/Government	3	100.0%	100.0%	0.0%		
Total	28	78.6%	50.0%	42.9%	58.3%	66.7%

culture and/or molecular data. Table 10 shows the capacities available for gram staining and AST, including the existing referral approaches for patients or isolates where the capacity lacked. Out of the 28 HFs who participated in the assessment, 78.6 (22) had capacity to perform gram staining and 50% (14) had capacity for AST. All the level 6, level 5 and FBO owned level 4 HFs had capacity for gram staining.

Of the 14 HFs who did not have capacity for AST, 12 (42.9%) of them relied on referral of either patients or isolates. Of the 12 who referred for AST, 7 (58.3%) referred their patients while 8 (66.7%) referred isolates. Some HFs did both. Referral only happened at the level 4 HFs. Given that most of the referrals originated from level 4, where the privately owned HFs were referring for all their AST needs, 30.8% of the referrals were to private laboratories with another 23.1% going to other private hospitals implying that private establishments received more than 50% of the total referrals. 23.1% of the referrals were also going to other public level 5 hospitals (county referral hospitals) and about 15.4% were sent to the national microbiology reference lab. 7.7% of the referrals ended up in other public level 4 HFs.

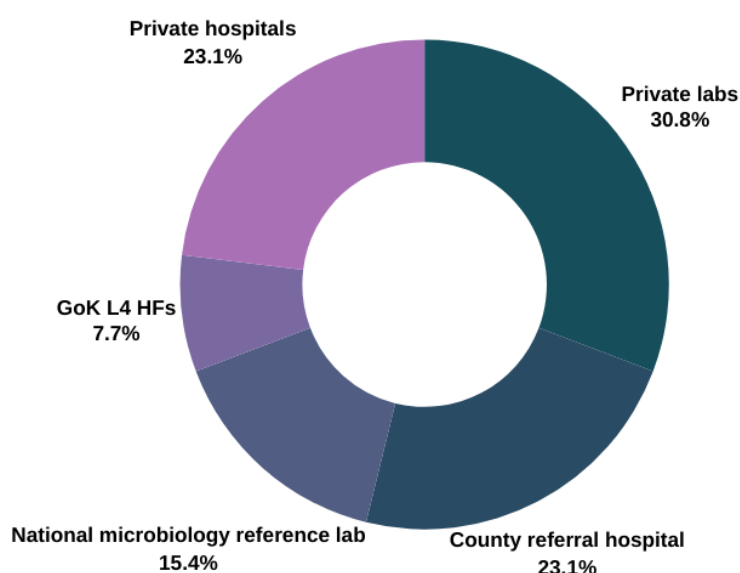


FIGURE 5: AST REFERRAL PATHWAYS FOR PATIENTS OR ISOLATES

3.2.4 SUPPLY OF EQUIPMENT AND TESTING COMMODITIES IN THE SELECTED COUNTIES

EQUIPMENT USED FOR AUTOMATED BLOOD CULTURE

Automated blood culture systems are intended to make the processing of blood cultures more efficient. They enhance the speed of the blood culture report and hence provide improved therapeutic results since they are more sensitive and rapid in detecting septicaemia in patients. 5 of the 8 HFs with the ability to perform blood cultures used an automated machine (See Table 8), and the equipment are as summarised in Table 11. The average TAT on the Bactec was 138 hours, and

TABLE 11: AUTOMATED BLOOD CULTURE MACHINES

HF LEVEL	Ownership	Blood culture machine	Manufacturer
Level 4	FBO	BacT/ALERT	Biomerieux
	Public	Bactec	BD
Level 5	Public	Bactec, BacT/ALERT	BD/Biomerieux
	FBO	Bactec	BD
Level 6	Public	Bactec	BD

all of them were functional on the assessment day. 75% (3) of HFs had routine maintenance records, 75% had vendor maintenance records, but there were no service contract in place. Procurement of the Bactec machines was through County government, donor and hospital budgets for different HFs. 75% of HFs using Bactec cited consumable supply constraint as a key challenge in addition to availability of a service contract and trained staff. All Bactec machines were manufactured by BD, and they had all been re-calibrated in 2023 (within the year of assessment).

The average TAT on the BacT/ALERT was 204 hours, all were functional on the assessment day, user manuals, routine and vendor maintenance records were present, and the service contracts were in place. The BacT/ALERT machines had been re-calibrated within 3 months of the assessment date. They had been purchased by county government and hospital budgets. 50% of HFs who had the BacT/ALERT had also experienced a consumables supply constraint. The BacT/ALERT machines were manufactured by Biomerieux.

EQUIPMENT USED FOR AST

14 HFs had the ability to perform AST either using manual or automated systems or both. It was noted that none of the HFs used Chromagar to detect antibiotic resistant organisms. In addition, none of the labs had a polymerase chain reaction (PCR) (or other nucleic acid tests (NAT)) instruments or machines used for detecting antibiotic resistance genes. Only one HF conducted specific testing for the detection of methicillin-resistant

TABLE 12: AST MACHINES

HF LEVEL	HF OWNERSHIP	Manual AST			Automated AST		
		Disk diffusion	Gradient strip	Agar dilution	Vitek	Phoenix	BIOMIC
Level 4	FBO	4			1		
	Public	2			1	1	
Level 5	FBO	3		1	1		
	Public	3			2	1	
Level 6	Public	2	1		1		1

Staphylococcus aureus (MRSA), Vancomycin-resistant Enterococci (VRE), carbapenem and/or 3rd generation cephalosporin resistance, and they used Phenotypic (Chromogenic media, CarbaNP). This was Jumuia Mission Hospital Kaimosi. 4 of the HFs visited reported to receive samples from other HFs for

culture and AST, but none of the HFs received isolates from other HFs. The various equipment used for AST are summarised in Table 12.

The most preferred manual AST method was disk diffusion (87.5%). Agar dilution and gradient strip accounted for 6.3% each. None of the HFs used either broth micro-dilution (96-well tray or tube method). On the other hand, the most preferred automated AST method was Vitek (66.7%) followed by Phoenix (22.2%) and finally BIOMIC at 11.2%. None of the HFs used either microscan or SIRScan.

LABORATORY INFORMATION SYSTEMS

The assessment also focused on existing Laboratory Information Systems (LISs) and their functionalities or capabilities. LIS programs or software can be used to prevent medical errors in the transfer of information or administration of testing, help to retrieve lab results in addition to and helping the day-to-day operations of a medical laboratory to run more smoothly.

21 (75%) of the HFs visited had a LIS for recording AST data. For the 21, all except one facility had data updated on the system by data entry lab personnel. One HF had data updated by the microbiologist in charge. There was no data entry by student/interns, data entry clerks, IT personnel. Only 19% of the HFs had a LIS. The most popular forms of recording systems were a combination of electronic and paper-based (38.1%) and paper-based (33.3%). A smaller number (9.5%) used an electronic but not LIS. The systems

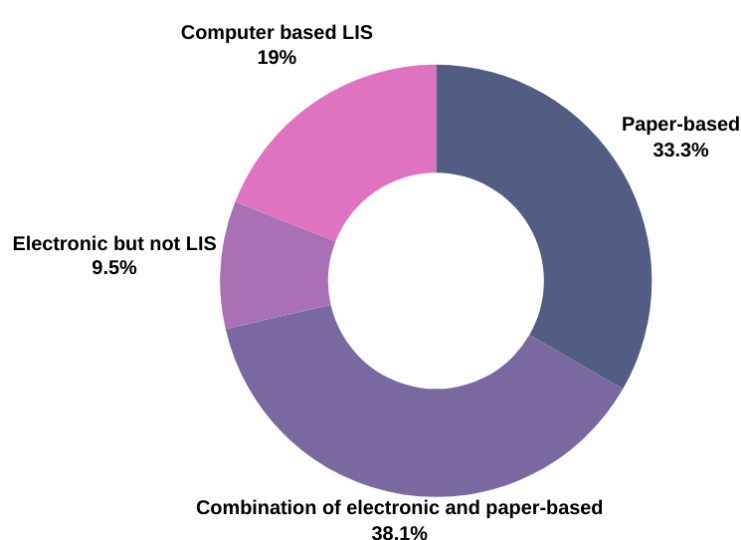


FIGURE 6: LIS USED IN THE HFS

did not record the AST method (with the exception of one HF), did not automatically interpret the inhibition zone, did not produce a cumulative antibiogram (with the exception of 1 HF which was able to develop this quarterly) and were not interfaced with the automated AST instruments. 50% of the combined electronic and paper-based systems interfaced with the Health Information systems (HISs) available at some of the HFs, and were used to report to the clinician as well as the clients.

3.2.5 GAPS IN AMR DIAGNOSIS CONTINUUM IN THE SELECTED COUNTIES IN KENYA

In order to implement a coherent system for AMR surveillance, it is critical for the laboratory to have adequate capacity. The assessment of laboratory capacity to establish capacity for culture and sensitivity, focus should be on infrastructure and resource capacities and management and AMR surveillance practices. In terms of infrastructure and resource capacities, it is important to consider materials and equipment, staffing levels, microbiology competency, safety training, safe environment and certification. Under AMR surveillance practices, the key considerations are quality assurance and management and dissemination of data [13].

From the assessment, 13 HFs did not have the ability to perform cultures. The main reason for lack of capacity to perform cultures was lack of equipment and reagents and consumables. Lack of mentorship accounted for 8.7% of these reasons (Figure 7). These barriers were also assessed for HF that did not have

the ability to perform blood cultures specifically, and the reasons for these gaps were broken down equipment (2.9%), testing costs (2.9%), human resource for health (HRH) shortages (5.9%), training and mentorship (11.8%), lack of reagents and consumables (14.7%), low requests from clinicians (14.7%) and lack of equipment (38.2%) (Figure 8). Below, we discuss the specific gaps under the two broad subcategories.

GAPS IN INFRASTRUCTURE AND RESOURCE CAPACITIES

For starters, the 13 HF that could not perform blood cultures lacked the equipment and the materials for culture and sensitivity testing. For the 8 HF with the capacity to perform blood cultures, only 5 had the automated machines, and of those with the Bactec, they did not have a service contract in place in addition to 75% of them experiencing consumable supply constraints and lack of trained staff (shortage in microbiology competency). 50% of those HF using the BacT/ALERT machine also experienced consumable supply constraints. Staff training and mentorship was also a barrier to accessing. One of the biggest barriers was certification and enrolment into various training programmes like SLIPTA and/ or SLMTA. Only 6 HF had enrolled into the SLIPTA program, and only 6 HF had a valid ISO 15189 certification. In terms of ability to operate smoothly even despite power disruptions or outages, only 12 HF had a functioning backup for critical equipment, and only 9 had UPS for critical equipment.

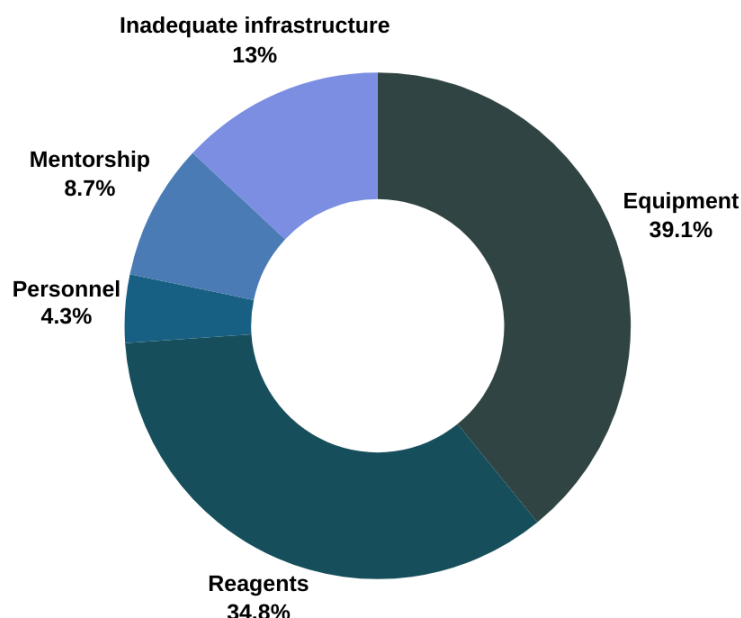


FIGURE 7: BARRIERS TO PERFORMING CULTURES

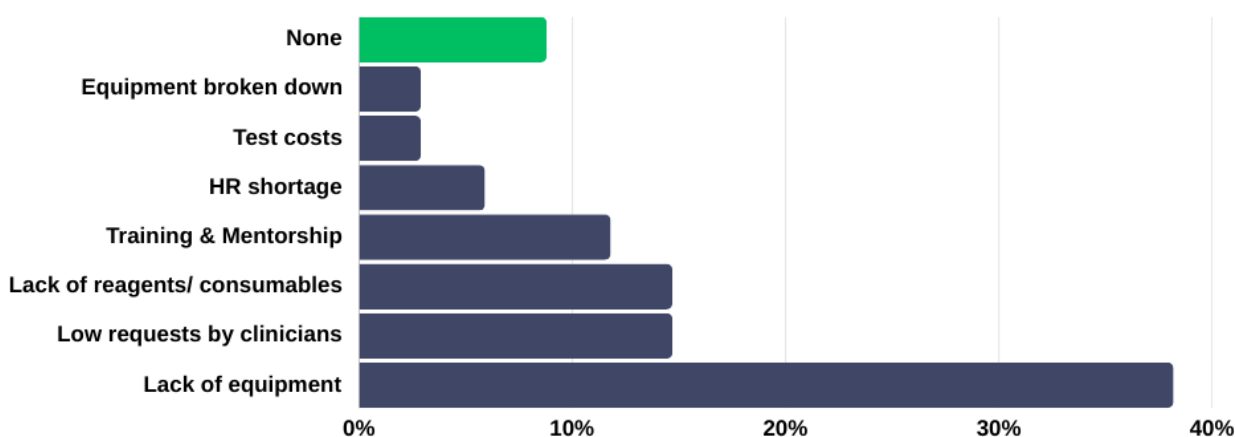


FIGURE 8: BARRIERS TO PERFORMING BLOOD CULTURES

GAPS IN AMR SURVEILLANCE PRACTICES

The biggest gap here was the over reliance on paper based tool and lack of a LIS. Only 19% of the HF had a computer based LIS, and this contributed to the data management processes experienced in the HF. There

were numerous data gaps, and for example 41% of the blood culture tests during the period under review were not accounted for (Table 9). The systems did not record the AST method (with the exception of one HF), did not automatically interpret the inhibition zone, did not produce a cumulative antibiogram (with the exception of 1 HF which was able to develop this quarterly) and were not interfaced with the automated AST instruments. Other barriers included low requests from blood cultures by clinicians.

3.2.6 AVERAGE COST AND MODE OF PAYMENT FOR AMR DIAGNOSIS IN THE SELECTED COUNTIES

In the healthcare continuum, culture and sensitivity tests are essential diagnostic tools for identification of the presence of bacterial or fungal infections in patients. the testing involves collection of samples from body fluids such as blood, urine or sputum, or tissue, and growing it in a laboratory to observe the growth and activities of microorganisms. In LMICs the costs for culture and AST may at times hinder access to these services since in most cases the patients have to pay for them. From the assessment, it was noted that most of the the culture and sensitivity testing is paid for from

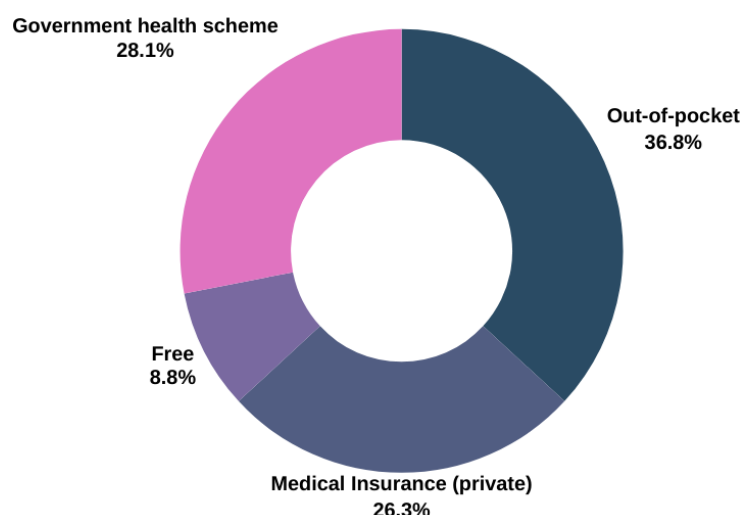


FIGURE 9: MODES OF PAYMENT FOR DIAGNOSTIC TESTS

out-of-pocket (36.8%) followed by government health schemes (28.1%), private medical insurance (26.3%) with only 8.8% getting this as a free service. For paying clients, the average cost are Shs. 1,513.6 with prices ranging from as low as Shs. 200 and going as high as Shs. 2,900. With respect to blood culture specifically, paying clients spend on average Shs. 1,900 with prices ranging from Shs 1,000 upto Shs. 6,000.

3.3 THERAPEUTIC COMPONENT

When prescribing antimicrobial therapy, it is important to consider obtaining an accurate diagnosis of infection; understanding the difference between empiric and definitive therapy, identifying opportunities to switch to narrow-spectrum, cost-effective agents that will be used for the shortest duration possible where necessary; understanding drug characteristics that are peculiar to antimicrobial agents ; taking into account the host characteristics that influence antimicrobial activity; and recognizing the adverse effects of antimicrobial agents on the host. Some of the most widely, and often injudiciously, used therapeutic drugs the world over are antimicrobial agents [11].

The findings from this assessment will help map and identify the practices in the utilization of antimicrobial therapy in the participating HFs, and help identify pathways for introduction of new reserve antimicrobial therapeutics such as **Cefiderocol (S-649266)**, a novel combination of a catechol-type siderophore and a cephalosporin antibiotic which recently received US Food and Drug Administration (FDA) approval for the treatment of complicated urinary tract infections (UTIs), including pyelonephritis [22].

3.3.1 STAFF STRENGTH, WARD INFRASTRUCTURE AND DRUG DISPENSATION

WHO recommends that health systems engage adequate HRH given that they constitute the building blocks for a well functioning health system for delivery of improved population health [15]. WHO recommends a health workforce density of 44.5 doctors, nurses and midwives per 10,000 population if the SDGs are to be achievable [14].

However, there is a chronic shortage of health workers globally;

We see from Table 13 that there were a total of 5 (0.6%) infectious disease specialists out of all the 28 HF's assessed. Only 1 FBO owned level 4 had an infectious disease specialist. All the private and public HF's had none in post during the assessment period. Most of the physician capacity was constituted by medical officers (54.1%) and interns (41.3%). There were a total of 33 (4%) physicians from all the HF's combined.

TABLE 13: STAFF STRENGTH, WARD INFRASTRUCTURE AND DRUG DISPENSATION

KEPH/ Ownership	No. of HF's	Infectious disease specialists	Physicians at ICU	Medical Officers	Interns	Nurses in medical unit	Medical unit bed capacity	Medical unit patient nurse ratio	Nurses in surgical unit	Surgical unit bed capacity	Surgical unit patient nurse ratio	Nurses in ICU	ICU bed capacity	ICU patient nurse ratio	Nurses in HDU	HDU bed capacity	HDU patient nurse ratio	Pharmacists in HF's	No. of pharm techs in HF's	Nearby 24 Hr pharmacies
Level 4	19	1	19	156	218	229	762	7.4	145	553	4.8	51	44	3.8	52	44	7	47	110	19
FBO	5	1	11	32	1	84	178	4.8	38	81	5	16	17	6.5	10	10	6.5	8	24	5
Private	4	0	0	8	0	13	28	4.9	8	30	2.6	0	0	0	0	0	0	0	11	2
Public	10	0	8	116	217	132	556	9.8	99	442	4.8	35	27	2.1	42	34	7.2	39	75	12
Level 5	7	3	3	95	81	61	210	4.4	48	213	2.4	24	31	3.2	15	14	4.4	21	80	6
FBO	3	2	1	56	11	15	90	5.7	14	98	1.3	16	14	2.5	8	6	3.6	6	70	4
Public	4	1	2	39	70	46	120	3.7	34	118	3.4	8	17	4.6	7	8	5.2	15	10	2
Level 6	2	1	11	110	44	80	152	1.8	48	152	2	37	46	6.4	0	0	0	31	31	3
Public	2	1	11	198	44	90	152	1.8	48	152	2	37	46	6.4	0	0	0	31	31	3
Total/Average	28	5	33	449	343	340	1124	6.5	241	918	4.5	112	121	3.8	67	58	5.6	99	221	29

Most of the nursing staff were found in the medical unit (44.7%) followed by the surgical unit (34.7%), then nurses in intensive care unit (ICU) (14.7%) and high dependancy unit (HDU) (8.8%). The current practice at level 6 HF's is that the ICU and HDU units are combined into one critical care unit (CCU) and so the nursing staff available for both units were collapsed into one under ICU in Table 13. For pharmaceutical staff,

all HF's combined had 221 (69.1%) pharmaceutical technologists and 99 (30.9%) pharmacists. In Figure 10, every different shade of colour represents a different classification of staff considered in total. Dirty green represents physician staff of different cadres, the green represents nursing staff in different departments and the purple represents the pharmacy staff. Details of the pharmacists and satellite pharmacies including nearby 24 hour pharmacies are in Table 38. Table 13 also summarises the total bed capacities and patient nurse ratios in the various departments disaggregated by KEPH level and ownership. Patient nurse ratios are higher at level 4 than the other levels despite the fact that lower bed capacities as individual facilities.

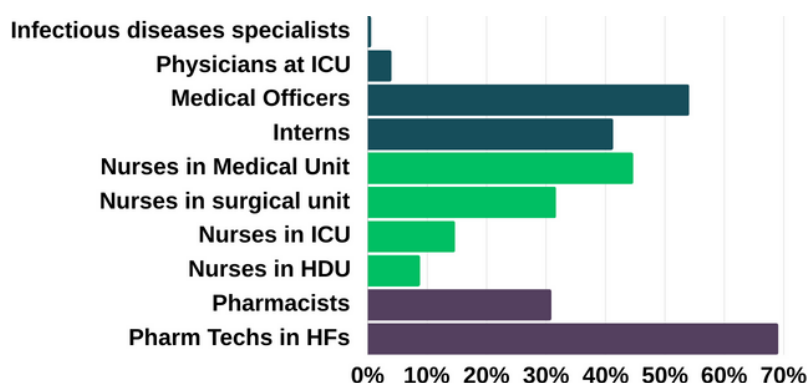


FIGURE 10: DISTRIBUTION OF PHYSICIAN, NURSING AND PHARMACEUTICAL STAFF

3.3.2 ANTIBIOTIC GUIDELINES AND ANTIBIOGRAM

Antibiotics are key in the treat infections and have saved and continue to countless lives. However, whenever they are used, and depending on how they are used, they can cause side effects and contribute to AMR. Too many antibiotics are prescribed unnecessarily and misused, which threatens the usefulness of these

important therapeutics. This is why guidelines on antibiotic use are important so that they are used only when necessary. An antibiogram is key resource for HFs to track changes in AMR and to guide empirical antimicrobial therapy. The cumulative antibiogram is a periodic profile of antimicrobial susceptibilities of various organisms isolated from patients within a HFs or within a broader geographical area areas.

The assessment sought to determine whether HFs had antibiotic guidelines and antibiograms. From the assessment, 11 out of the 28 (39.3%) had antibiotic guidelines, with 7 (25%) of them using national guidelines and the other 4 (14.3%) using facility level guidelines. In addition, only 2 (7.1%) HFs had an antibiogram, and this was disaggregated to the HF level (Table 14). Both health facilities are FBO owned; one, a level 4 in Isiolo county and the other a level 5 in Nairobi county respectively. One of the 2 HFs reported that their antibiogram had never been updated since they were developed in 2021, while the other reported that the antibiogram was updated monthly. The antibiograms were available online, at the clinic (consultation room), at the pharmacy, ward and nursing station, and were not shared with other HFs. One of the HF reported that they issued the antibiogram during orientation of new healthcare workers (HCWs) such as medical officers, nurses, pharmacists, clinical officers, lab personnel and even consultants, while the other did not provide the antibiogram during orientation of new HCWs. Both facilities did not avail their antibiogram to the public.

TABLE 14: ANTIBIOTIC GUIDELINES USED IN THE HFS

KEPH/ Ownership	National	HF Specific
Level 4	4	1
Faith based organisation	1	0
Private	0	0
Public	3	1
Level 5	2	1
Faith based organisation	1	1
Public	1	0
Level 6	1	2
Public	1	2
Total	7 (63.6%)	4 (36.4%)

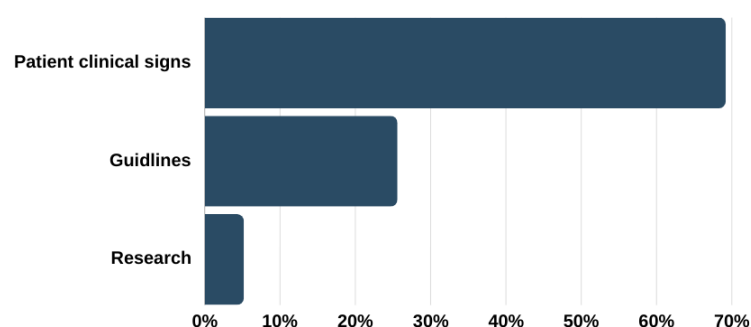


FIGURE 11: REASONS THAT GUIDE CLINICIANS TO REQUEST FOR BACTERIOLOGY TESTS

The assessment also sought to find out what guided clinicians to request for bacteriology tests. From this assessment, it was also established that the main basis for clinicians requesting for bacteriology tests during care and treatment was patient clinical signs (69.2%) followed by guidelines (25.6%). 5.2% of the requests were guided buy research (see Figure 11). An antimicrobial formulary provides a simplified list of available antimicrobials within a hospital, potentially including: accepted indications for use, dosing schedules, drug interactions and side effects. The formulary should include a sub-set of restricted antimicrobials. With respect to updating the antibiotic formulary, only 7 HFs responded in the affirmative, 1 updated in 2013, 1 in 2019, 2 in 2021, 1 in 2022 and 2 in 2023. Only 7 (25%) HFs reported that the available guidelines matched their antibiotic formulary.

3.3.3 THE CURRENT RESERVE ANTIBIOTIC SUPPLY AND GAPS IN THE SELECTED COUNTIES

Inappropriate use and overuse of antibiotics are driving a global increase in AMR and have an unfavourable impact on the effectiveness of these critical medicines. The remedy to this is in the improvement of antibiotic prescribing globally. The Access, Watch, Reserve (AWaRe) classification of antibiotics was developed for the treatment of 31 priority bacterial infections in 2017 by the WHO Expert Committee on Selection and Use of Essential Medicines as a tool to support antibiotic stewardship efforts at local, national and global levels. This list classifies antibiotics into three groups, Access, Watch and Reserve, taking into account the impact of different antibiotics and antibiotic classes on AMR, to emphasize the importance of their appropriate use. It is updated every 2 years. The AWaRe classification is intended as a tool for monitoring antibiotic consumption, defining targets and monitoring the effects of stewardship policies that aim to optimize antibiotic use and curb AMR [21].

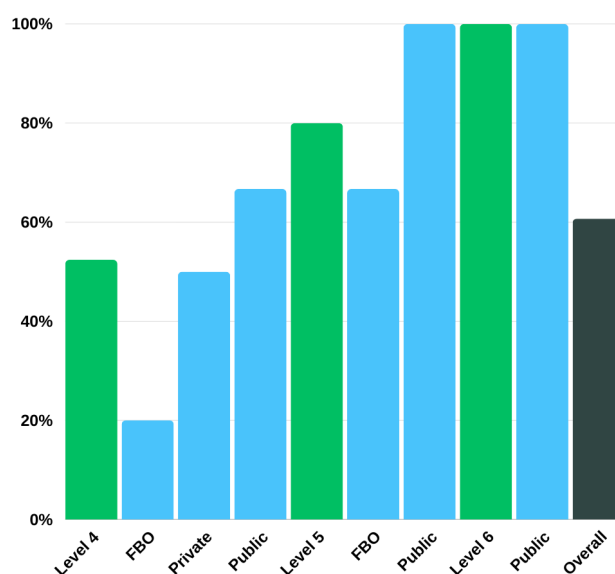


FIGURE 12: LEVELS OF AWARENESS OF WHO AWARE LIST

With the AWaRe classification, WHO seeks to make the Essential Medicines List (EML) and Essential Medicines for Children (EMLc) more helpful to prescribers. To promote responsible use of antibiotics and slow the spread of AMR, the WHO Global Programme of Work includes a target that at least “60% of total antibiotic prescribing at the country level should be Access antibiotics by 2023” [16]. Since its inception, significant progress has been made in different parts of the world in implementing the AWaRe framework [1]. Figure 12 and Table 15 show the level of awareness of the WHO AWaRe list at the HFs. The green bars represent disaggregation by KEPH level, the blue bars represent disaggregation by ownership and the dirty green bar gives the overall levels of awareness. 52.4% (11 out of the 21) of the level 4 HFs visited were aware of the WHO AWaRe list (2021 AWaRe classification) of antibiotics. Lowest levels of awareness were noted among the FBO owned (20%) followed by the privately owned (50%), and finally the public HFs where 66.7% were aware of the WHO antibiotic classification. 80% (4 out of 5) of the level 5 HFs were aware of the AWaRe list. All public level 5 HFs visited were aware and 66.7% (2 out of 3) of the FBO owned HFs visited were aware. All level 6 HFs were aware of the WHO AWaRe list. Overall, 60.7% (17) were aware of the list.

TABLE 15: LEVEL OF AWARENESS OF THE WHO AWARE CLASSIFICATION

KEPH/ Ownership	No	Yes
Level 4	9 (50.0%)	9 (50.0%)
Faith based organisation	4 (80.0%)	1 (20.0%)
Private	2 (50.0%)	2 (50.0%)
Public	3 (33.3%)	6 (66.7%)
Level 5	1 (14.3%)	85.7%
Faith based organisation	1 (33.3%)	2 (66.7%)
Public	0	4 (100%)
Level 6	1 (33.3%)	2 (66.7%)
Public	1 (33.3%)	2 (66.7%)
Total	11 (39.3%)	17 (60.7%)

ACCESS ANTIBIOTICS

Access antibiotics are antibiotics with a narrow spectrum of activity, generally with less side-effects, a lower potential for the selection of antimicrobial resistance and of lower cost. They are recommended for the empiric treatment of most common infections and should be widely available [23]. Access antibiotics are first- or second-line treatments for common infections and should be widely accessible. The WHO EML AWaRe (2021 AWaRe classification) lists 87 antibiotics in the access category. Of these, only 30 (34.5%) were available in the HFs where the assessment was undertaken (See Table 16).

TABLE 16: LIST OF ACCESS ANTIBIOTICS IN THE HFS

S No.	Antibiotic	No. of HFs	Percentage	S No.	Antibiotic	No. of HFs	Percentage
1	Amoxicillin	28	100.0%	16	Tetracycline	17	60.7%
2	Cloxacillin	28	100.0%	17	Tinidazole_oral	14	50.0%
3	Flucloxacillin	28	100.0%	18	Cefalexin	12	42.9%
4	Metronidazole_IV	28	100.0%	19	Cefadroxil	10	35.7%
5	Oxacillin	28	100.0%	20	Ornidazole_oral	9	32.1%
6	Amoxicillin/clavulanic-acid	27	96.4%	21	Cefazolin	8	28.6%
7	Doxycycline	27	96.4%	22	Ampicillin	7	25.0%
8	Metronidazole_oral	27	96.4%	23	Sulfadiazine	7	25.0%
9	Sulfamethoxazole	27	96.4%	24	Phenoxymethylpenicillin	6	21.4%
10	Sulfamethoxazole/trimethoprim	27	96.4%	25	Sulfadiazine/trimethoprim	5	17.9%
11	Trimethoprim	27	96.4%	26	Sulbactam	4	14.3%
12	Nitrofurantoin	25	89.3%	27	Ampicillin/sulbactam	3	10.7%
13	Clindamycin	20	71.4%	28	Spectinomycin	2	7.1%
14	Amikacin	19	67.9%	29	Cefroxadine	1	3.6%
15	Secnidazole	18	64.3%	30	Chloramphenicol	1	3.6%

The first 12 listed in Table 16 were available in almost all the HFs visited by the team of assessors. Table 17 maps the distribution of the access antibiotics in HFs disaggregated by KEPH level. From Table 17, the ones shaded green are the list of 22 antibiotics available in at-least one HF at all the levels, with most of them being available in all the HFs. The ones shaded blue are available only at some level 4 and 5 HFs, whereas the ones shaded orange are only available in at least 1 level 4 HF

Given that this is the class of antibiotics for most of the common infections, there is an opportunity in improving the supply chain in order to expand the level of access to them and improve availability from the current 34.5%.

WATCH ANTIBIOTICS

Watch antibiotics generally have a higher potential for the selection of antimicrobial resistance and are more commonly used in sicker patients in the hospital facility setting. They include most of the highest priority agents among the critically important antimicrobials for Human Medicine. Their use should be carefully monitored to avoid overuse [23]. These antibiotics in Watch group should be prioritized as key targets of stewardship programs and monitoring. The WHO EML AWaRe list (2021 AWaRe classification) of antibiotics lists 141 watch antibiotics. Out of these, 40 (28.4%) of them were available in the 28 HFs where the assessment was undertaken. 37 (26.2%) were available in level 4 HFs, 31 (22%) in level 5 and 26 (18.4%) in level 6.

TABLE 17: DISTRIBUTION OF ACCESS ANTIBIOTICS IN THE HFS

Level 4 HFs		Level 5 HFs		Level 6 HFs	
Oxacillin	21	Amoxicillin	5	Amikacin	2
Metronidazole_IV	21	Amoxicillin/clavulanic-acid	5	Amoxicillin	2
Flucloxacillin	21	Cloxacillin	5	Cefazolin	2
Cloxacillin	21	Doxycycline	5	Clindamycin	2
Amoxicillin/clavulanic-acid	21	Flucloxacillin	5	Cloxacillin	2
Amoxicillin	21	Metronidazole_IV	5	Doxycycline	2
Trimethoprim	20	Metronidazole_oral	5	Flucloxacillin	2
Sulfamethoxazole/trimethoprim	20	Oxacillin	5	Metronidazole_IV	2
Sulfamethoxazole	20	Sulfamethoxazole	5	Metronidazole_oral	2
Metronidazole_oral	20	Sulfamethoxazole/trimethoprim	5	Nitrofurantoin	2
Doxycycline	20	Tetracycline	5	Oxacillin	2
Nitrofurantoin	19	Trimethoprim	5	Secnidazole	2
Clindamycin	15	Nitrofurantoin	4	Sulfamethoxazole	2
Amikacin	14	Secnidazole	4	Sulfamethoxazole/trimethoprim	2
Tetracycline	12	Amikacin	3	Trimethoprim	2
Secnidazole	12	Cefadroxil	3	Amoxicillin/clavulanic-acid	1
Tinidazole_oral	10	Cefalexin	3	Ampicillin	1
Cefalexin	9	Clindamycin	3	Ampicillin/sulbactam	1
Ornidazole_oral	6	Sulfadiazine	3	Cefadroxil	1
Cefadroxil	6	Tinidazole_oral	3	Ornidazole_oral	1
Phenoxymethylpenicillin	5	Ampicillin	2	Sulbactam	1
Sulfadiazine	4	Cefazolin	2	Tinidazole_oral	1
Cefazolin	4	Ornidazole_oral	2		
Ampicillin	4	Sulfadiazine/trimethoprim	2		
Sulfadiazine/trimethoprim	3	Ampicillin/sulbactam	1		
Sulbactam	2	Phenoxymethylpenicillin	1		
Spectinomycin	1	Spectinomycin	1		
Chloramphenicol	1	Sulbactam	1		
Cefroxadine	1				
Ampicillin/sulbactam	1				

TABLE 18: LIST OF WATCH ANTIBIOTICS IN THE HFS

S No.	Antibiotic	No. of HFs	Percentage	S No.	Antibiotic	No. of HFs	Percentage
1	Azithromycin	28	100.0%	21	Fusidic-acid	5	17.9%
2	Ofloxacin	28	100.0%	22	Imipenem/cilastatin	5	17.9%
3	Ceftriaxone	27	96.4%	23	Rifabutin	5	17.9%
4	Ciprofloxacin	27	96.4%	24	Teicoplanin	5	17.9%
5	Levofloxacin	25	89.3%	25	Cefaclor	4	14.3%
6	Cefixime	24	85.7%	26	Cefpodoxime-proxetil	4	14.3%
7	Cefuroxime	22	78.6%	27	Kanamycin_IV	3	10.7%
8	Clarithromycin	22	78.6%	28	Fosfomycin_oral	2	7.1%
9	Ceftazidime	20	71.4%	29	Kanamycin_oral	2	7.1%
10	Vancomycin_IV	18	64.3%	30	Lincomycin	2	7.1%
11	Erythromycin	17	60.7%	31	Rifaximin	2	7.1%
12	Meropenem	17	60.7%	32	Streptomycin_IV	2	7.1%
13	Piperacillin	14	50.0%	33	Vancomycin_oral	2	7.1%
14	Piperacillin/tazobactam	14	50.0%	34	Cefoperazone	1	3.6%
15	Tazobactam	14	50.0%	35	Doripenem	1	3.6%
16	Norfloxacin	11	39.3%	36	Ertapenem	1	3.6%
17	Rifampicin	11	39.3%	37	Lymecycline	1	3.6%
18	Cefotaxime	6	21.4%	38	Neomycin_oral	1	3.6%
19	Moxifloxacin	6	21.4%	38	Rifamycin_oral	1	3.6%
20	Cefepime	5	17.9%	40	Tobramycin	1	3.6%

The observation that more of these watch antibiotics are available in level 4 HF where access to culture and AST is the lowest should be of great concern. One of the easiest interventions would be to further strengthen mentorship and AMS opportunities to guide Antimicrobial use (AMU) and strengthen the monitoring of utilization of these antibiotics and AMR surveillance efforts.

TABLE 19: DISTRIBUTION OF WATCH ANTIBIOTICS IN THE HFS

Level 4 HFs		Level 5 HFs		Level 6 HFs	
Azithromycin	21	Azithromycin	5	Azithromycin	2
Ceftriaxone	21	Cefixime	5	Cefaclor	2
Ciprofloxacin	21	Ceftazidime	5	Ceftazidime	2
Ofloxacin	21	Ceftriaxone	5	Cefuroxime	2
Levofloxacin	19	Levofloxacin	5	Ciprofloxacin	2
Cefixime	18	Meropenem	5	Moxifloxacin	2
Clarithromycin	18	Ofloxacin	5	Ofloxacin	2
Cefuroxime	16	Cefuroxime	4	Piperacillin	2
Ceftazidime	13	Ciprofloxacin	4	Piperacillin/tazobactam	2
Erythromycin	13	Rifampicin	4	Tazobactam	2
Vancomycin_IV	12	Vancomycin_IV	4	Vancomycin_IV	2
Meropenem	11	Clarithromycin	3	Cefepime	1
Piperacillin	9	Erythromycin	3	Cefixime	1
Piperacillin/tazobactam	9	Fusidic-acid	3	Cefotaxime	1
Tazobactam	9	Piperacillin	3	Ceftriaxone	1
Norfloxacin	8	Piperacillin/tazobactam	3	Clarithromycin	1
Rifampicin	7	Tazobactam	3	Erythromycin	1
Cefotaxime	3	Cefepime	2	Imipenem/cilastatin	1
Imipenem/cilastatin	3	Cefotaxime	2	Kanamycin_IV	1
Moxifloxacin	3	Cefpodoxime-proxetil	2	Levofloxacin	1
Teicoplanin	3	Norfloxacin	2	Lincomycin	1
Cefepime	2	Rifabutin	2	Meropenem	1
Cefpodoxime-proxetil	2	Cefaclor	1	Norfloxacin	1
Fosfomycin_oral	2	Doripenem	1	Rifabutin	1
Fusidic-acid	2	Ertapenem	1	Rifaximin	1
Kanamycin_IV	2	Imipenem/cilastatin	1	Teicoplanin	1
Kanamycin_oral	2	Lincomycin	1		
Rifabutin	2	Moxifloxacin	1		
Cefaclor	1	Streptomycin_IV	1		
Cefoperazone	1	Teicoplanin	1		
Lymecycline	1	Vancomycin_oral	1		
Neomycin_oral	1				
Rifamycin_oral	1				
Rifaximin	1				
Streptomycin_IV	1				
Tobramycin	1				
Vancomycin_oral	1				

RESERVE ANTIBIOTICS

Reserve antibiotics are last-resort antibiotics that should only be used to treat severe infections caused by multidrug-resistant pathogens [23]. They should be reserved for treatment of confirmed or suspected infections due to multi-drug-resistant organisms. The WHO AWaRe list (2021 AWaRe classification) lists 29 antibiotics as reserve or last-resort therapeutics. Out of these, only 6 (20.7%) of the listed ones are available. Level 4 HFs again recorded the highest availability where they had 6 of the antibiotics distributed across. Level 5 had 4 of the listed antibiotics distributed across and level 6 had 5 of the antibiotics (See Table 20). The most common reserve antibiotic was linezolid, which was available in 32.1% of the facilities, while the least common was daptomycin found in only 1 of the HFs.

TABLE 20: RESERVE ANTIBIOTICS AVAILABLE AT HFS**(a) LIST OF RESERVE ANTIBIOTICS IN THE HFS**

S No.	Antibiotic	No. of HFs	Percentage
1	Linezolid	9	32.1%
2	Colistin_IV	4	14.3%
3	Fosfomycin_IV	3	10.7%
4	Tigecycline	3	10.7%
5	Polymyxin-B_IV	2	7.1%
6	Daptomycin	1	3.6%

(b) DISTRIBUTION OF RESERVE ANTIBIOTICS IN THE HFS

Level 4		Level 5		Level 6	
Linezolid	5	Linezolid	2	Linezolid	2
Colistin_IV	2	Colistin_IV	1	Colistin_IV	1
Daptomycin	1	Fosfomycin_IV	1	Fosfomycin_IV	1
Fosfomycin_IV	1	Tigecycline	1	Polymyxin-B_IV	1
Polymyxin-B_IV	1			Tigecycline	1
Tigecycline	1				

3.3.4 EMPIRIC ANTIBIOTIC USE

Empiric antimicrobial therapy is treatment given based on experience, directed against an anticipated and likely cause of infectious disease. It is used when antimicrobials are given to a person before the specific bacterium or fungus causing an infection is known. Emergency conditions sometimes require empirical treatment, such as when a dangerous infection by an unknown organism is treated with a broad-spectrum antibiotic while the results of bacterial culture and other tests are awaited. The assessment looked into empiric Abx use at the HFs. To find out the empiric antibiotics preferentially prescribed by physicians for varying conditions among the 28 facilities in the study, as well as the need to send samples to microbiology, seven conditions were considered, namely sepsis, pneumonia, community acquired complicated UTI (cUTI), intra-abdominal infection (IAI), surgical site infection, skin and soft tissue infection and bone & joint infection. Table 21 lists the antibiotics that were cited by the

TABLE 21: LIST OF EMPIRIC ANTIBIOTICS PRESCRIBED IN HFS

Amoxicillin	Amikacin	Amphotericin
Amoxiclav	Amoxiclav	Azithromycin/Nitrofurantoin
Ampiclox	Ampicillin	Benzylpenicillin
Azithromycin	Ampicillin/Cloxacillin	Cefalexin
Ceftriaxone	Cefazolin	Cefazoline
Cefuroxime	Cefipime	Cefepime
Ciprofloxacin	cefixime	Cefixime/Cefuroxime
Clarithromycin	Ceftazidime	Ceftazime
Clindamycin	Ceftriaxone.	Ceftriaxone
CoAmoxiclav	Cloxacillin	Ciprofloxin
Flucloxacillin	Doxycycline	Clarithromycin
FluCloxacillin/Amoxicillin	Flagyl	Erythromycin
Gentamycin	Flucloxacilin	Imipenem
Levofloxacin	Fluconazole	Klindamycin
Metronidazole	Fluoroquinolone	Metronizole
Nitrofurantoin	Fosfomycin	Ornidazole/ofloxacin
Penicillin	Linezolid	PhenoxymethylPenicillin
Piperacillin/Tazobactam	Macrolide	Piperacillin
Vancomycin	Meropenem	Tazobactam

physicians among the 28 health facilities visited. Based on the WHO AWaRe classification, 49% of the empiric antibiotics prescribed were found in the Access list while the other 49% were on the watch list (see Table 43 in the appendix). Linezolid is the only reserve antibiotic that was found to be empirically prescribed. As far as the specific infections were concerned, some antibiotics stood out as being preferentially pre-scribed based on individual responses. For instance, in the question of community and hospital acquired sepsis, the top three empiric antibiotics were ceftriaxone, metronidazole and amoxiclav for community acquired sepsis and ceftriaxone, piperacillin/tazobactam and meropenem for hospital

acquired sepsis. The tables that follow show the number of facilities that preferentially prescribe specific antibiotics for the above listed conditions. The most commonly prescribed antibiotic was ceftriaxone, a watch antibiotic, prescribed 19% of the time (see Table 44 in the appendix).

PRESCRIPTION FOR SEPSIS

Sepsis is a serious condition in which the body responds improperly to an infection. Bacterial infections are the main cause of sepsis, though it can also be a result of other infections, including viral infections, or fungal infections. The infection-fighting processes turn on the body, causing the organs to work poorly, and it may at times progress to septic shock. Most people who develop sepsis have at least one underlying medical condition. It can either be community or hospital acquired. Table 22 provides a summary for the most common prescriptions for both community acquired and hospital acquired sepsis. Community-acquired sepsis is a life-threatening systemic reaction, mainly caused by bacteria, which starts within 72 hours of hospital admittance in an infected patient without recent exposure to healthcare risks.

For both community and hospital acquired sepsis, ceftriaxone stood out as largely prescribed to the extent that nearly 50 percent of the HFs visited have it as a preferred empiric antibiotic.

Before the administration of any antibiotic, it is recommended that samples are taken to the laboratory for microbiology. It was important to investigate how often this is done in the health facilities that were visited during the assessment. The overall capacity to perform cultures has a direct bearing on the general practice to send samples to microbiology.

By way of establishing the percentage of time samples are taken to microbiology for testing, as was the case for both community and hospital acquired sepsis, only two facilities reported as having sent samples 100%

TABLE 22: EMPIRIC ANTIBIOTICS FOR SEPSIS

(a) COMMUNITY ACQUIRED SEPSIS

Antibiotic	No of HFs
Ceftriaxone	16
Metronidazole	6
Amoxiclav	3
Amoxicillin	3
Flucloxacillin	2
Azithromycin	2
Gentamycin	2
Ampiclox	1
Levofloxacin	1
Benzylpenicillin	1
Phenoxymethylpenicillin	1
Cefazoline	1

(b) HOSPITAL ACQUIRED SEPSIS

Antibiotic	No of HFs
Ceftriaxone	13
Piperacillin/tazobactam	6
Meropenem	6
Metronidazole	5
Ceftazidime	5
Penicillin	4
Flucloxacillin	3
Gentamycin	2
Vancomycin	2
Amikacin	2
Cefipime	1
Ciprofloxacin	1
Imipenem	1
Clindamycin	1
Fosfomycin	1
Cefepime	1
Cefalexin	1
Clarithromycin	1
Amoxicillin	1

of the time, while another six (6) HFs sent samples 50% of the time. The rest (20 HFs) either sent under 30% of the time or did not send at all. Samples were taken to microbiology 43% of the time. Further to this, it was established those that do send samples to microbiology do so after various considerations; only if the patient deteriorates or there are signs of new infection, when clinical symptoms persist, if there is no response to empirical treatment within five days as well as the patients' ability to afford the service. Microbiology results were however received within 48 hours only 29% of the time.

PRESCRIPTION FOR PNEUMONIA

From Table 23, we see that for community acquired pneumonia, amoxicillin was prescribed by all the 28 (100%) HFs. Only one health facility sent samples for microbiology over 70% of the time for community acquired pneumonia. The rest either sent samples 30% of the time or did not send at all. This is done when clinical symptoms persisted as well as when the patient could afford. However, for community acquired pneumonia, clinicians received microbiology results within 48 hours only 15% of the time. Ceftriaxone was prescribed most of the time (50%) for hospital acquired pneumonia. In addition seven (25%) HFs sent samples to the laboratory 80% to 100% of the time. Overall, samples were sent to microbiology 31% of the time. This is done when there was no clinical improvement of the patient.

Microbiology results were received within 48 hours only 21% of the time for ventilator associated pneumonia.

TABLE 23: EMPIRIC ANTIBIOTICS FOR PNEUMONIA

(a) COMMUNITY ACQUIRED PNEUMONIA

Antibiotic	No of HFs
Amoxicillin	28
Azithromycin	12
Penicillin	5
Gentamycin	5
Ceftriaxone	4
Erythromycin	2
Clarithromycin	2
Macrolide	1
Ampicillin	1
Cefuroxime	1
phenoxymethylpenicillin	1

(b) HOSPITAL ACQUIRED PNEUMONIA

Antibiotic	No of HFs
Ceftriaxone	13
Gentamycin	5
Piperacillin/tazobactam	3
Vancomycin	2
Azithromycin	2
Amoxicillin	2
Meropenem	5
Amikacin	2
Penicillin	6
Metronidazole	2
Ceftazidime	7
Erythromycin	1
Clarithromycin	1
Ciprofloxacin	1
Piperacillin	1
Tazobactam	1
Cefazolin	1

PRESCRIPTION FOR COMPLICATED UTI

A cUTI is a UTI that carries a higher risk of treatment failure, and typically requires longer courses of treatment, different antibiotics, and sometimes additional workups. From Table 24, ciprofloxacin was the most preferred empirical antibiotic by 12 of the 28 HFs visited for community acquired cUTI. Others were nitrofurantoin and amoxicillin. Samples were sent to microbiology only 28% of the time.

TABLE 24: EMPIRIC ANTIBIOTICS FOR CUTI**(a) COMMUNITY ACQUIRED CUTI**

Antibiotic	No of HFs
Ciprofloxacin	12
Nitrofurantoin	9
Amoxicillin	6
Ceftriaxone	6
Cefuroxime	5
Levofloxacin	5
Cefixime	4
Metronidazole	2
Erythromycin	2
Doxycycline	2
Cefuroxime	1
Nitrofurantoin	1
Fluoroquinolone	1
Fosfomycin	1
Flucloxacillin	1
Vancomycin	1
Azithromycin	1

(b) HOSPITAL ACQUIRED CUTI

Antibiotic	No of HFs
Ceftriaxone	19
Levofloxacin	6
Ciprofloxacin	5
Metronidazole	5
Gentamycin	2
Vancomycin	2
Amoxicillin	2
Piperacillin/tazobactam	1
Fluroquinolone	1
Fluconazole	1
Meropenem	1
Clindamycin	1
Cefixime	1
Cefuroxime	1
Amikacin	1

Samples were sent to microbiology 28% of the time. In the course of infection, some HFs send samples for microbiology when clinical symptoms persist, on suspected recurrence, when there's no response to antibiotics given or suspected drug resistance. Microbiology results are received 23% of the time within 48 hours of infection.

PRESCRIPTION FOR INTRA-ABDOMINAL INFECTION (IAI)

IAI are a group of infections that occur within the abdominal cavity. Infections within the abdominal cavity typically arise because of inflammation or disruption of the gastrointestinal tract, and successful treatment is based on early and appropriate source recognition, containment and antimicrobial coverage. Table 25 summarises the empiric antimicrobials that were prescribed by the HFs that were assessed. The most commonly used antibiotics for both community and hospital acquired IAI were metronidazole and ceftriaxone.

TABLE 25: EMPIRIC ANTIBIOTICS FOR IAI**(a) COMMUNITY ACQUIRED IAI**

Antibiotic	No of HFs
Metronidazole	14
Ceftriaxone	13
Amoxicillin	5
Flucloxacillin	2
Cefuroxime	2
Levofloxacin	2
Ciprofloxacin	2
Flagyl	1
Doxycycline	1
Ornidazole	1
Ofloxacin	1
Doxycycline	1
Cefixime	1
Meropenem	1

(b) HOSPITAL ACQUIRED IAI

Antibiotic	No of HFs
Ceftriaxone	21
Metronidazole	14
Meropenem	4
Flucloxacillin	3
Piperacillin/tazobactam	2
Ceftazidime	2
Gentamycin	1
Amikacin	1
Clindamycin	1
Cefazoline	1
Flagyl	1
Levofloxacin	1
Amoxicillin	1
Vancomycin	1

PRESCRIPTION FOR SURGICAL SITE INFECTION

Surgical site infections (SSIs) are infections that occur after surgery in the part of the body where the surgery took place. sometimes be superficial infections involving the skin only, or more serious that they involve tissues under the skin, organs, or implanted material. Pathogens can infect a surgical wound through various forms of contact, including from the touch of a contaminated caregiver or surgical instrument, through germs in the air, or through germs that are already on or in your body and then spread into the wound. The main antibiotics used for SSIs in the assessed HFs are flucloxacillin and metronidazole, whether they are hospital or community acquired (Table 26).

PRESCRIPTION FOR SKIN AND SOFT TISSUE INFECTION

Skin and soft-tissue infections (SSTIs), which include infections of skin, subcutaneous tissue, fascia, and muscle, encompass a wide spectrum of clinical presentations, ranging from simple cellulitis to rapidly progressive necrotizing fasciitis. Diagnosing the exact extent of the disease is critical for successful management of a patient of soft-tissue infection. They may be caused by any of a formidable number of pathogenic microorganisms, and they may be either mono-microbial or poly-microbial³. They can also be

³<https://emedicine.medscape.com/article/1830144-overview?form=fpf>

TABLE 26: EMPIRIC ANTIBIOTICS FOR SURGICAL SITE INFECTION**(a) COMMUNITY ACQUIRED
SURGICAL SITE INFECTION**

Antibiotic	No of HFs
Flucloxacillin	22
Metronidazole	15
Ceftriaxone	6
Clindamycin	4
Amoxicillin	3
Ampicillin	2
Cloxacillin	2
Cefuroxime	2
Linezolid	1
Cefazolin	1
Gentamycin	1
Doxycycline	1
Azithromycin	1
Meropenem	1

**(b) HOSPITAL ACQUIRED
SURGICAL SITE INFECTION**

Antibiotic	No of HFs
Flucloxacillin	17
Metronidazole	15
Ceftriaxone	13
Clindamycin	5
Meropenem	3
Amoxicillin	2
Gentamycin	2
Linezolid	1
Cefazolin	1
Ampiclox	1

classified as complicated and uncomplicated, and can be acquired in the community or at the hospital. Table 27 provides a summary of the empiric antibiotics prescribed by the HFs visited in this assessment.

PRESCRIPTION FOR BONE AND JOINT INFECTION

Bone infections, also known as osteomyelitis, are infections of any bone within the body. Joint infections are infections of the joints, the areas where bones meet. Most bone and joint infections come from bacteria, but fungal infections also can happen. Infections also can occur in other parts of the body and work their way to the bones through the bloodstream. Some of the infections can also happen after surgery. Table 28 provides a summary of the antibiotics prescribed for bone and joint infections in the HFs assessed. The most commonly prescribed antibiotic was clindamycin.

3.3.5 IV ADMINISTRATION

Intravenous (IV) administration was also part of the assessment and 19 out of 28 (67.9%) of the HFs reported that the highest frequency of IV administration was done in the medical unit, 6 (21.4%) reported that the

TABLE 27: EMPIRIC ANTIBIOTICS FOR SKIN AND SOFT TISSUE INFECTION**(a) COMMUNITY ACQUIRED
SKIN AND SOFT TISSUE
INFECTION**

Antibiotic	No of HFs
Flucloxacillin	28
Metronidazole	7
Clindamycin	7
Amoxicillin	6
Doxycycline	2
Ampiclox	1
Phenoxymethylpenicillin	1
Ciprofloxacin	1
Ampicillin	1
Cloxacillin	1
Cefuroxime	1

**(b) HOSPITAL ACQUIRED
SKIN AND SOFT TISSUE
INFECTION**

Antibiotic	No of HFs
Flucloxacillin	23
Clindamycin	10
Metronidazole	10
Ceftriaxone	7
Amoxicillin	4
Piperacillin/tazobactam	2
Vancomycin	2
Cefuroxime	2
Gentamycin	1
Phenoxymethylpenicillin	1
Meropenem	1
Ciprofloxacin	1
Levofloxacin	1
Fluconazole	1
Amphotericin-B	1
Doxycycline	1

highest administration is in the surgical unit and 2 (7.1%) reported that the highest frequency is in the ICU. One L4 public health facility did not respond to this question. 54.4% of the available IV pumps in the HFs are in the ICU departments, 28.9% in the HDU, 11.7% in the medical units and 5% in the surgical departments. The distribution of the IV pumps across the HFs is shown in Table 39.

3.3.6 ACCESS PATHWAYS FOR NEW RESERVE ANTIBIOTICS

Access for reserve antibiotics depends on several factors. Information from key informants indicated that access pathways were partly a function of the ownership of the facility and the available resources. The scenario in public facilities is one in which the medicines are ordered by the pharmacists in charge. Orders for reserve antibiotics are made through the Kenya Medical Supplies Agency (KEMSA) and through the Mission for Essential Drugs and Supplies (MEDS). Procurement of medicines in public facilities is prioritized based on whether the medicines are vital, essential and non-essential (VEN). Essential and vital medicines are part of the Access and Watch list, while Reserve antibiotics are classified as non-essential in the priority list.

In ideal situations, the Medicines and Therapeutics Committee (MTC) meets and discusses the need for the introduction of a new reserve antibiotic, and once it is agreed upon, then it is introduced into the Formulary. This is informed by the antibiogram and the cost of the medicines. The MTC is chaired by the physician in the facility, the pharmacist being the secretary and with membership from other departments.

TABLE 28: LIST OF EMPIRIC ANTIBIOTICS FOR HOSPITAL ACQUIRED BONE AND JOINT INFECTION

Antibiotic	No of HFs
Clindamycin	20
Flucloxacillin	12
Ceftriaxone	6
Metronidazole	6
Gentamycin	2
Amoxicillin	1
Levofloxacin	1
Cefazolin	1
Linezolid	1
Cloxacillin	1
Clindamicin	1
Ceftazidime	1
Meropenem	1

Level 4 and 5 HFs are evaluated on a scorecard based on the establishment and status of MTCs. However, in some cases, patients get a prescription from a physician and are advised to buy the drugs from a pharmacy. In this case, the patient may access a reserve antibiotic without the Pharmacy Department being made aware of this. The introduction of a new reserve antibiotic may also be driven by the pharmaceutical industry through marketing by medical representatives.

The MTC operates at the facility level whereas the National Medicines and Therapeutics Committee (NMTC) at the national level. The role of NMTC is to identify appropriate drugs and other health products and technologies (HPT) for use throughout the system and to guide use. The NMTC undertakes the review and revision of the Clinical Management and Referral Guidelines and national essential HPT lists such as the Kenya Essential Medicines List (KEML), Kenya Essential Medical Supplies List (KEMSL) and the Kenya Essential Medical Laboratory Commodities List (KEMCL). The NMTC is appointed by the Director General for Health (DG) and has membership from all key MoH-K Directorates and MoH-K-affiliate Semi-Autonomous Government Agencies (SAGAs) with direct relevance to HPT supply and regulation, such as KEMSA and the Pharmacy and Poisons Board (PPB)). The introduction of new products in healthcare is guided by this committee.

3.3.7 MAPPING POTENTIAL EARLY ADOPTION SITES, CAPACITIES, AND BARRIERS

Potential early adoption sites were deemed likely by virtue of their preparedness to have optimal laboratory and clinical/medical practices. This preparedness was a function of having the relevant training required for the health workforce. Furthermore, the readiness of a health facility to be a potential early adopter was also based on the availability of antimicrobial stewardship guidelines and policies and the adherence to these guidelines.

Of the 28 HFs, 13 (46.4%) had staff who had AMS training. Of the 13 HFs, 2 (15.4%) were faith-based level 4 facilities (MT Kenya ACK Hospital and Tawfiq Hospital), 7 (53.8%) were public level 4 facilities (Isiolo County referral Hospital, Kericho County Referral Hospital, Kilifi County Referral Hospital, Mama Margaret Uhuru Hospital, Mariakani Subcounty Hospital, Vihiga County Referral Hospital and Nanyuki Teaching and referral hospital), 3 (23. 1%) were level 5 FBO (AIC Litein Mission Hospital, Jumuia Mission Hospital Kaimosi and Mater Misericordia Hospital), while 1 (7. 7%) was a public level 6 hospital (Kenyatta University Teaching, Referral and Research Hospital). These are facilities that are identified as early adoption sites.

Regarding antimicrobial stewardship guidelines, 12 (42. 9%) HFs had antimicrobial stewardship committees. Of the 12 HFs 8 (66.7%) were level 4 HFs (Kapsabet County Referral Hospital, Kericho County Referral Hospital, Kilifi County Hospital, Mariakani Sub County Hospital, Mt Kenya (ACK) Hospital (FBO), Nanyuki Teaching and Referral Hospital, Ngong Sub-County Hospital, Vihiga County Referral Hospital), 3 (25.0%) were Level 5 facilities (Jumuia Mission Hospital Kaimosi (FBO), Mama Lucy Kibaki Hospital (Embakasi), The Mater Misericordiae Hospital (Mukuru) (FBO)) while 1 (8.3%) was a Level 6 facility (Kenyatta University Teaching Referral and Research Hospital). Most of these committees were established in 2023, the earliest being established in 2016. However, only 1 of these committees was functional.

Stewardship guidelines and policies were recorded in 7 (25.0%) of the 28 HFs. Of the 7 HFs, 3 (42.9%) were Level 4 HFs (Kapsabet County Referral Hospital, Kilifi County Hospital, Vihiga County Referral Hospital), 2 (28.6%) were Level 5 facilities (Mama Lucy Kibaki Hospital (Embakasi), Mater Misericordiae Hospital) and another 2 (28.6%) were Level 6 HFs (Kenyatta University Teaching Referral and Research Hospital and Kenyatta National Hospital-Othaya Annex).

The opportunities for early adoption of new reserve antibiotics lie in the establishment of the governance framework coupled with requisite HRH that would support rational and judicious use of antibiotics. The HFs that have already moved in this direction are potential early adopters.

3.3.8 BARRIERS TO POTENTIAL EARLY ADOPTION OF NEW RESERVE ANTIBIOTICS

There are several barriers to adoption including; health facilities with a low number of relevant staff members and those who have not received any AMR training. In addition, the lack of Antimicrobial Stewardship Committees, antimicrobial stewardship guidelines, and policies is a barrier to adoption. However, these barriers are surmountable and may be turned into opportunities through proper mentorship programs from NASIC, respective CASICs and via peer-to-peer learning from already functional sites/HFs. Other barriers specific to this work and beyond this work include:

- (i) Weak pharmaceutical information management systems
- (ii) Weak documentation at facility level

- (iii) Lack of capacity for optimal use of laboratory services and laboratory networks
- (iv) Inadequate reviews of schedules of antimicrobials agents
- (v) Inadequate restriction of use of some antimicrobials
- (vi) Lack of hospital-specific antibiograms
- (vii) Inadequate regulation of pharmacy practice
- (viii) Lack of standardized treatment protocols between the public and private sector
- (ix) Weak commodity management systems
- (x) Lack of awareness in the community on AMR
- (xi) Weak feedback mechanisms to healthcare workers/providers on AMS gains and updates to develop relationships with early adoption partners.
- (xii) Ineffective M&E systems for AMS
- (xiii) Insufficient resources to implement programs, including IT, human, and financial resources.
- (xiv) Lack of national baseline data on AMU and Antimicrobial consumption (AMC)
- (xv) Lack of operational research that addresses the issues AMR

3.3.9 DEVELOPING RELATIONSHIPS WITH EARLY ADOPTION PARTNERS

Early adoption partners will benefit enormously from the mentoring provided through the two-tier coordination mechanism of NASIC and CASICs aimed at strengthening the AMS committees within health facilities. Strengthened AMS committees will in turn ensure that the MTCs become functional. Functional MTCs will further foster and institutionalize good antibiotic use and antimicrobial stewardship practices by partly ensuring that there are up-to-date antibiograms and antibiotic formularies in place. Capacity strengthening through training of relevant staff on AMS-related areas for laboratory personnel, clinicians and pharmacists. The results of this evaluation indicated that of the 28 participating facilities, only 13 (46.4%) had attended training related to AMS. It is noteworthy that no private health facility evaluated reported having staff trained on AMS. Involvement of partners in the space of AMR in the areas of knowledge exchange and sharing is essential. In addition, it is imperative to maintain a reliable commodity supply chain to avoid stock-outs.

3.4 ANTIMICROBIAL STEWARDSHIP

Misuse and overuse of antimicrobials is one of the world's most pressing public health problems. Infectious organisms adapt to the antimicrobials designed to kill them, making the drugs ineffective. Antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobials, improves patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms.

AMS training equips clinicians who frequently prescribe antimicrobials with knowledge and tools to improve their use of these essential medications in daily clinical practice. These trainings highlight how antimicrobial stewardship principles can be applied to common clinical scenarios. Staff from 13 out of 28 (46.4%) HFs had attend AMS training. Of these 13, 69.2% are level 4, 23.1% level 5 and 7.7% level 6. The

TABLE 29: AMS TRAINING ATTENDANCE

KEPH Level/Ownership	No	Yes
Level 4	12	9
Faith Based Organisation	3	2
Coptic Hospital	✓	
MaterCare Maternity Hospital	✓	
Mt Kenya (ACK) Hospital		✓
Pope Benedict XVI Hospital	✓	
Tawfiq Hospital		✓
Private	4	
Afya Link Medical Centre	✓	
Anka Hospital Isiolo	✓	
Kapsabet Health Care Centre	✓	
Kitengela Medical Services	✓	
Public	5	7
Chepterwai Sub-County Hospital	✓	
Emuhaya Sub County Referral Hospital	✓	
Isiolo County and Referral Hospital		✓
Kajiado County Referral Hospital	✓	
Kapsabet County Referral Hospital	✓	
Kericho County Referral Hospital		✓
Kilifi County Hospital		✓
Mama Margaret Uhuru Hospital		✓
Mariakani Sub County Hospital		✓
Nanyuki teaching and Referral Hospital		✓
Ngong Sub-County Hospital	✓	
Vihiga County Referral Hospital		✓
Level 5	2	3
Faith Based Organisation		3
AIC Litein Mission Hospital		✓
Jumuia Mission Hospital Kaimosi		✓
The Mater Misericordiae Hospital (Mukuru)		✓
Public	2	
Kerugoya County Refferal Hospital	✓	
Mama Lucy Kibaki Hospital (Embakasi)	✓	
Level 6	1	1
Public	1	1
Kenyatta University Teaching Refferal and Research Hospital		✓
KNH Othaya Annex	✓	
Total	15	13

facilities are shown on Table 29.

7 out of 28 (25%) of the HFs had stewardship guidelines/policies: the 2 level 6, 2 level 5 and 3 level 4 HFs respectively. 12 (42.9%) HFs had an existing stewardship committee: 1 level 6, 3 level 5 and 8 level 4 HFs respectively. The distribution of the HFs is shown in Table 45 in the appendix. All AMS committees were functional at the time of assessment except the AMS committee at Nanyuki teaching and referral hospital.

The AMS committees are involved in a number of activities amongst them;

- (i) Public campaigns on rational use of antibiotics
- (ii) Advice on procurement of antibiotics in the facility
- (iii) Sensitization of proper disposal of antibiotics in the environment.
- (iv) Antibiotics use audit
- (v) Treatment sheets review
- (vi) Antibiotics clinical ward round
- (vii) Integration with infection prevention control committee,
- (viii) Developing of antibiotics formulary
- (ix) Launch of antimicrobial empiric use guidelines and policy
- (x) Point prevalence survey
- (xi) Antimicrobial use surveys
- (xii) Development of facility antibiogram
- (xiii) Sensitization of the policies and guidelines to clinicians
- (xiv) Awareness creation by celebrating WAAW and patient safety
- (xv) Continuous medical education on antimicrobial Use
- (xvi) Grant writing
- (xvii) Antimicrobial case reviews and reports
- (xviii) Advocate for more culture and sensitivity tests
- (xix) Patient management review of treatment within 72hours
- (xx) Reviewing of formulary
- (xxi) Susceptibility, resistance patterns, audits adherence on guidelines UTI, Cs prophylaxis, disinfection audit of brands, cessation cef

8 (28.6%) HFs have stewardship intervention on formulary restrictions for various antibiotics such as: Ceftriaxone, Meropenem, Vancomycin, linezolid, Clindamycin, Ceftazidime, Amikacin, Polymyxin B, Aztreonam, Tigecycline, Piperacillin/tazobactam, Cefepime, Colistin and generally for reserve antibiotics. The restrictions state the following

1. Has to have a prescription by qualified personnel within the hospital: Consultant, medical officer, physician, clinical pharmacists
2. No dispensing without culture and sensitivity,
3. Antibiotics are always under lock and key
4. Prescription should be provided to dispense
5. 72 hours timeout / Reserve antibiotics to be reviewed every 72 hours
6. Need to justify use of tabs with high SE profile,

TABLE 30: HFS WITH STEWARDSHIP INTERVENTION ON FORMULARY RESTRICTIONS

KEPH Level/Ownership	Antibiotics	Stewardship intervention
Level 4		
Public		
Emuhaya Sub County Referral Hospital	Ceftriaxone	Prescription by qualified personnel within the hospital
Kapsabet County Referral Hospital	Meropenem, Vancomycin, linezolid	No dispensing without culture and sensitivity, consultant only prescription, always under lock and key
Ngong Sub-County Hospital	Clindamycin, and Ceftazidime on restriction on use. The Obs/gyn was against the use of Ceftazidime,	Adherence to first line and second line What antibiotics can be used for which disease Prophylactic drugs, Duration/number of days on antibiotics eg restriction on the use of Amikacin for community acquired pneumonia
Vihiga County Referral Hospital	Vancomycin for MRSA and renal patients ,Ceftazidime for pseudomonas, Amikacin for pediatrics	Only Medical officers and Consultants can prescribe Vancomycin and Ceftazidime, prescription should be provided to dispense
Level 5		
Faith Based Organisation		
The Mater Misericordiae Hospital (Mukuru)	Ceftriaxone not used in IP except paed	72 hours timeout, susceptibility test results
Public		
Mama Lucy Kibaki Hospital (Embakasi)	Reserve antibiotics	Need to justify use of tabs with high SE profile, Adherence to 1st line, 2nd line.
Level 6		
Public		
Kenyatta University Teaching Referral and Research Hospital	Reserve antibiotics	Reserve antibiotics to be reviewed every 72 hours Prescribing of antibiotics to be done by a physician /ID specialist/clinical pharmacist
KNH Othaya Annex	Linezolid, Polymyxin B, Vancomycin, Aztreonam, Tigecycline, Piperacillin/tazobactam, Cefepime, Colistin	Only prescribed by consultants

7. Adherence to 1st line, 2nd line.

This is summarized in Table 30

13 (46.4%) HF's require preauthorization for the following antibiotics: Ceftriaxone, Ceftazidime, Meropenem , Piperacillin/ Tazobactam, Vancomycin iv, Ceftazidime iv, linezolid, Amikacin, tigecycline, levofloxacin, Polymyxin B, Aztreonam, Cefepime, Colistin and generally reserve antibiotics. The personnel who do preauthorization include medical officers, clinical officers, consultants and pharmacists. It is mainly done verbally and in written format.

TABLE 31: PRE-AUTHORIZATION OF ANTIBIOTICS

KEPH Level/Ownership	Personnel					Mode		Preauthorized antibiotics
	Required	Medical Officers	Clinical Officers	Pharmacists	Consultants	Verbally	Manually (written)	Antibiotics
Level 4	9	3	2	4	5	6	8	
Faith Based Organisation	1	0	1	0	0	1	0	
MaterCare Maternity Hospital	✓		1			1		Ceftriaxone, Ceftazidime
Private	2	1	0	0	1	1	2	
Anka Hospital Isiolo	✓	1					1	Meropenem , Piperacillin/ Tazobactam
Kapsabet Health Care Centre	✓				1	1	1	Vancomycin iv, Ceftazidime iv
Public	6	2	1	4	4	4	6	
Emuhaya Sub County Referral Hospital	✓	1	1			1	1	Ceftriaxone
Kajiado County Referral Hospital	✓			1	1	1	1	Meropenem, piperacillin/ tazobactam ,Vancomycin
Kapsabet County Referral Hospital	✓			1	1	1	1	Meropenem, Vancomycin, linezolid
Kilifi County Hospital	✓			1			1	Meropenem, piperacillin tazobactam, Vancomycin
Mama Margaret Uhuru Hospital	✓				1		1	Meropenem, Vancomycin
Vihiga County Referral Hospital	✓	1		1	1	1	1	Vancomycin, Ceftazidime, Amikacin
Level 5	2	0	0	1	2	2	2	
Public	2	0	0	1	2	2	2	
Kerugoya County Referral Hospital	✓				1	1	1	Vancomycin, Meropenem, Ceftazidime, Linezolid
Mama Lucy Kibaki Hospital (Embakasi)	✓			1	1	1	1	Ceftazidime, Tigecycline, Levofloxacin inj, Meropenem, Vancomycin
Level 6	2	0	0	1	2	1	2	
Public	2	0	0	1	2	1	2	
Kenyatta University Teaching Referral and Research Hospital	✓				1		1	Reserve antibiotics
KNH Othaya Annex	✓			1	1	1	1	Linezolid, Polymyxin B, Vancomycin, Aztreonam, Tigecycline, Piperacillin tazobactam, Cefepime, Colistin
Grand Total	13	3	2	6	9	9	12	

8 (28.6%) HF's do prospective audits for a range of antibiotics including; Clindamycin iv, piperacillin/tazobactam, Ceftriaxone, Ceftazidime, Vancomycin, Ceftriaxone_IV, Metronidazole_IV, Flucloxacillin_IV. Some HF's reported to conduct prospective audits on all antibiotics. The audit is mainly

done in the surgical, medical, pediatric, maternity, HDU, ICU and new born unit (NBU) wards. The personnel in charge includes; consultant surgeons, pharmaceutical technologists, pharmacists, medical officers, medical consultants, lab in charge, nurses and generally members of the AMS committees. This is summarized in Table 32

TABLE 32: PROSPECTIVE AUDIT OF ANTIBIOTICS

KEPH Level/Ownership	Audit	Medical Unit	Surgical Unit	ICU	HDU	Paediatric	Maternity	NBU	Personnel in charge	Audited antibiotics
Level 4	5	4	5	1	2	3	1	1		
Private	1	0	1	0	0	0	0	0		
Kapsabet Health Care Centre	✓		1						Consultant Surgeon	Clindamycin iv, Piperacillin/tazobactam
Public	4	4	4	1	2	3	1	1		
Emuhaya Sub County Referral Hospital	✓	1	1			1			Pharmaceutical technologist	Ceftriaxone
Kapsabet County Referral Hospital	✓	1	1	1					Pharmacist, Medical officers, consultants pharmacist, Medical consultants	Ceftriaxone, Cefazidime
Nanyuki teaching and Referral Hospital	✓	1	1		1	1	1	1	AMS committee	All antibiotics
Vihiga County Referral Hospital	✓	1	1		1	1			Clinical pharmacist	Vancomycin, Cefazidime
Level 5	3	2	2	0	0	1	1	0		
Faith Based Organisation	2	1	1	0	0	1	1	0		
Jumua Mission Hospital Kaimosi	✓	1	1			1	1		Medical officers, lab incharge, pharmacy incharge, nurse incharge	Ceftriaxone iv, Metronidazole iv, Flucloxacillin iv
The Mater Misericordiae Hospital (Mukuru)	✓								AMS committee	All antibiotics prescribed in the out patient
Public	1	1	1	0	0	0	0	0		
Mama Lucy Kibaki Hospital (Embakasi)	✓	1	1						Pharmacists	All antibiotics
Grand Total	8	6	7	1	2	4	2	1		

5 (17.9%) HF's reported to conduct stewardship rounds in the medical, surgical, ICU, HDU, paediatric and maternity wards. The personnel in charge includes medical officers, clinical officers, nurses, pharmacists, lab in charge, consultants and generally the AMS committee members. This information is shown in Table 33

TABLE 33: STEWARDSHIP ROUNDS IN HF'S

KEPH Level/Ownership	Medical Unit	Surgical Unit	ICU	HDU	Paediatric	Maternity	Personnel in charge	Frequency	Date of latest round
Level 4	2	2	1	1	2	0			
Public	2	2	1	1	2	0			
Emuhaya Sub County Referral Hospital					1		Medical officers, Clinical officer, nurses	Two years ago	2021-06-01
Kapsabet County Referral Hospital	1	1	1				Pharmacists, AMR focal person		2023-08-31
Vihiga County Referral Hospital	1	1		1	1		AMS committee	Quarterly	2023-07-31
Level 5	1	1	0	0	0	1			
Faith Based Organisation	1	1	0	0	0	1			
Jumua Mission Hospital Kaimosi	1	1			1	1	Medical officers, laboratory incharge, pharmacy incharge	Every fortnight	2023-09-13
Level 6	1	1	1	0	0	0			
Public	1	1	1	0	0	0			
KNH Othaya Annex	1	1	1				Infection disease specialist, consultant, medical officer, Pharmacist	Twice weekly	2023-09-25
Grand Total	4	4	2	1	2	1			

11 (39.3%) HF's reported that retrospective audit is done on selected antibiotics. The audit is mainly done in the medical, surgical, ICU, paediatric, maternity and outpatient units. The personnel involved include; PTs, Cos, consultants, nurses, MOs, pharmacists, health records officers and the general AMS committee. The information on retrospective audits across the HF's is shown in Table 34.

In terms of IPC measures, there were a total of 811 handwashing stations spread across the HF's.

TABLE 34: RETROSPECTIVE AUDITS IN THEN HFS

KEPH Level/Ownership	Medical Unit	Surgical Unit	ICU	HDU	Paediatric	Maternity	Outpatient	Personnel	Antibiotics	Frequency
Level 4	2	3	1	0	1		2			
Faith Based Organisation	1	1	0	0						
MaterCare Maternity Hospital								Pharmaceutical technologist, Clinical officer	No specific antibiotic	Weekly
Mt Kenya (ACK) Hospital	1	1	0	0				pharmaceutical technologist, Healthrecords officer	Penicillin Amoxicillin, Amoxicillin Clavulanic acid, cephalosporins Ceftriaxone, cefixime, cefuroxime	
Private	0	1	0	0						
Kapsabet Health Care Centre	0	1	0	0				consultant, nurses, clinical officer, laboratory technologist	Ceftriaxone iv,	Quarterly
Public	1	1	1	0	1		2			
Emuhaya Sub County Referral Hospital	0	0	0	0	1			Clinical officer, medical officer, nurses	Penicillin, Flucloxacillin,	Done two years ago in the pediatrics wards
Kapsabet County Referral Hospital	1	1	1	0					Ceftriaxone, Cefazidime	
Mariakani Sub County Hospital	0	0	0	0			1	AMS Committee		
Vihiga County Referral Hospital	0	0	0	0			1	AMS Committee	Azithromycin, Amoxicillin for pediatric,	Quarterly
Level 5	3	2	0	0	1	1				
Faith Based Organisation	2	2	0	0	1	1				
Jumua Mission Hospital Kaimosi	1	1	0	0	1	1		AMS Committee	Ceftriaxone, Metronidazole iv, Flucloxacillin iv	Fortnight
The Mater Misericordiae Hospital (Mukuru)	1	1	0	0				AMS Committee	Antibiotics prescribed for CS prophylaxis, UTI	
Public	1	0	0	0						
Mama Lucy Kibaki Hospital (Embakasi)	1	0	0	0				Pharmacist	All antibiotics	
Level 6	1	1	1	0	1					
Public	1	1	1	0	1					
Kenyatta University Teaching Referral and Research Hospital	1	1	1	0	1			Pharmacy department	All antibiotics	Annually
Grand Total	6	6	2	0	3	1	2			

TABLE 35: HANDWASHING STATIONS ACROSS THE HFS

KEPH Level/Ownership	No. of handwash stations
Level 4	529
FBO	172
Private	59
Public	298
Level 5	150
FBO	31
Public	119
Level 6	132
Public	132
Grand Total	811

9 out of 28 (32.1%) HF report various hospital acquired infections through carried reporting channels as shown in Table 36

11 out of 28 (39.3%) HF do cohorting/ isolating of patients with AMR for various resistance profiles. Out of the 11 only 4 (36.4%) have their isolation procedures clearly displayed.

TABLE 36: HOSPITAL ACQUIRED INFECTIONS

KEPH Level/Ownership	Reported Infections	Reporting channel
Level 4		
Faith Based Organisation		
Coptic Hospital Private	Surgical site, catheter related uti	Report to medical team via email, meeting with minutes
Anka Hospital Isiolo	Sepsis for surgical ward	In staff meetings held monthly or whenever necessary
Kapsabet Health Care Centre Public	Surgical site infection in surgical ward, hospital acquired pneumonia in surgical ward and medical ward	Multi disciplinary Clinical meetings in quarterly basis
Kapsabet County Referral Hospital	Nbu-neonatal sepsis,maternity& surgical ward-SSI	Intergrated departmental meetings inclusive of IPC committee
Mama Margaret Uhuru Hospital	Catheter related infections	Phone
Level 5		
Faith Based Organisation		
The Mater Misericordiae Hospital (Mukuru) Public	Infections after delivery, catheter associated infections	Escalation matrix in written form
Mama Lucy Kibaki Hospital (Embakasi)	None yet	By phone to SC PHO
Level 6		
Public		
Kenyatta University Teaching Referral and Research Hospital	Wards NICU PICU and ICU MRSA, VRE, ESBLA, MDR organisms, CRE	Through phone calls from lab to the director clinical services, doctor , nurse in the wards and the IPC committee
KNH Othaya Annex	Surgical site infections Hospital acquired pneumonia Ventilator acquired pneumonia Klebsiella in NBU	First to primary doctor and nurse, then to others during handover

TABLE 37: COHORTING/ISOLATION PROCEDURES

KEPH Level/Ownership	No	Yes	Resistance profile	Cohorting/Isolation procedures
Level 4	6	2		
Faith Based Organisation	1	1		
Coptic Hospital		✓	All that may occur	Communicate with the relative ward, preparation of ward for patient inform housekeeping and relevant departments
Pope Benedict XVI Hospital	✓		Tuberculosis	From casualty the doctor notifies the isolation team (nurse, clinician, nutritionist, housekeeper) which then wheels patient to isolation room.
Private	1			
Kapsabet Health Care Centre	✓		Pseudomonas aeruginosa, MRSA	If the patients has not being responding to any sensitivity, both to aerobic and anaerobic bacteria upon treatment, take swab for culture sensitivity. Then take them to isolation ward as management is on going with the antibiotics awaiting microbiology results
Public	4	1		
Chepterwai Sub-County Hospital	✓		Tuberculosis	Isolated the patient in the Medical ward
Kapsabet County Referral Hospital	✓		Tuberculosis (MDR)	Incase during medical ward rounds a patient is diagnosed with a antimicrobial resistant strain eg MDR they are moved to the isolation cube within the Medical ward.
Kericho County Referral Hospital	✓		E coli, staph aureus, pseudomonas	Not available
Mama Margaret Uhuru Hospital	✓		HAI catheter related	Patient is referred to KNH for isolation
Vihiga County Referral Hospital		✓	Cephalosporin, extended Beta lactam	They were mostly placed in the isolation room
Level 5		1		
Faith Based Organisation		1		
The Mater Misericordiae Hospital (Mukuru)		✓	All	There is an escalation matrix involving other specialists, culture taken
Public				
Level 6	1	1		
Public	1	1		
Kenyatta University Teaching Referral and Research Hospital		✓	MDR TB, MRSA, CRE, ESBL, VRE	Have an isolation policy document awaiting approval
KNH Othaya Annex	✓		Tuberculosis	Once resistance results are received the nurses move patient to isolation unit. This is communicated to the clinical team. No SOP. IPC guidelines used.
Grand Total	7	4		

3.5 USE CASES FOR AMR DX AND ABX USE

Use-cases were summarized in a tabular form to address various domains as presented below. Within the body of the report, select use-cases are presented while the remainder are repositied within the appendix.

3.5.1 USE CASE 1: COPTIC HOSPITAL (LEVEL 4 FBO)

For Coptic Hospital, 2 reserve antibiotics are listed as being used empirically. Fosfomycin is used empirically in the treatment of community acquired urinary tract infection (CA-UTI). On the other hand, Linezolid is used empirically in the treatment of both community and hospital acquired surgical site infections.

Category	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed	Amoxicillin, Clavulanic, Ceftriaxone	Meropenem, Cefipime
Percentage of time samples sent to microbiology	100%	100%
When, during the course of infection are samples sent to microbiology	Day 1	Day 1
Percentage of the time micro results are received within 48hours	100%	100%
Category	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed	Amoxicillin, Clavulanic, Macrolide	Meropenem, Vancomycin, Amikacin
Percentage of time samples sent to microbiology for:-	30%	100%
When during the course of infection are samples sent to microbiology	Day 5	Day 1
Percentage of the time micro results are received within 48hours	90%	90%
Category	CA-UTI	Hospital acquired UTI
Empiric antibiotics prescribed	Fluoroquinolone, Nitrofurantoin, Fosfomycin, Cefuroxime	Ceftriaxone, Gentamycin, Fluroquinolone
Percentage of time samples sent to microbiology for:-	40%	100%
When during the course of infection are samples sent to microbiology	Day 7	Day 1
Percentage of the time micro results are received within 48hours	90%	90%

Category	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed	Ceftriaxone, Metronidazole	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology	Day 1	Day 1
Percentage of the time micro results are received within 48hours	90%	90%
Category	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed	Clindamycin, Ceftriaxone, Metronidazole, Amoxicillin, Clavulanic, Linezolid	Clindamycin, Ceftriaxone, Metronidazole, Amoxicillin, Clavulanic, Linezolid
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology	Day 1	Day 1
Percentage of the time micro results are received within 48hours	90%	90%
Category	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed	Phenoxymethylpenicillin, Flucloxacillin, Clindamycin	Phenoxymethylpenicillin, Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	40%	100%
When during the course of infection are samples sent to microbiology	Day 7	Day 1
Percentage of the time micro results are received within 48hours	90%	90%
Category		Hospital acquired bone and joint infection
Empiric antibiotics prescribed		Clindamycin, Flucloxacillin
Percentage of time samples sent to microbiology for:-		100%
When during the course of infection are samples sent to microbiology		Day 1
Percentage of the time micro results are received within 48hours		90%
If the patient is not improving on empiric antibiotics within 24 hours, what do you do?		Await 48 hours culture then reevaluate
For patients not improving on empiric antibiotics within 24 hours what do you do?		Complete the course of the broad spectrum antibiotic

3.5.2 USE CASE 2: KERUGOYA COUNTY REFERRAL HOSPITAL (PUBLIC L5 HOSPITAL)

In Kerugoya county Referral Hospital, 1 reserve antibiotic was listed as being used empirically. Linezolid is used empirically in the treatment of Hospital acquired bone and joint infections.

Category	Community acquired sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed	Ceftriaxone	Ceftriaxone, Ceftazidime, Meropenem
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology	Upon diagnosis	When symptoms persist
Percentage of the time micro results are received within 48hours	0%	0%
Category	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed	Ceftriaxone and/or Azithromycin or Ceftriaxone and/or Clarithromycin	Ceftazidime or Meropenem With or without Vancomycin
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology	Not sent	When symptoms persist
Percentage of the time micro results are received within 48hours	0%	0%
Category	CA-UTI	Hospital acquired UTI
Empiric antibiotics prescribed	Ceftriaxone or Ciprofloxacin	Ceftriaxone
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology	When clinical symptoms persist	When clinical symptoms persist
Percentage of the time micro results are received within 48hours	0%	0%
Category	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed	Ceftriaxone and flagyl	Ceftriaxone and flagyl or Meropenem
Percentage of time samples sent to microbiology for:-	20%	20%
When during the course of infection are samples sent to microbiology	When symptoms persist	When symptoms persist
Percentage of the time micro results are received within 48hours	0%	0%

Category	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed	Flucloxacillin, Clindamycin	Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology	When clinical symptoms persist	When clinical symptoms persist
Percentage of the time micro results are received within 48hours	0%	0%
Category	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed	Flucloxacillin, Clindamycin	Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology	When clinical symptoms persist	When clinical symptoms persist
Percentage of the time micro results are received within 48hours	0%	0%
Category		Hospital acquired bone and joint infection
Empiric antibiotics prescribed		Clindamycin, Linezolid
Percentage of time samples sent to microbiology for:-		10%
When during the course of infection are samples sent to microbiology		When symptoms persist
Percentage of the time micro results are received within 48hours		0%

3.5.3 USE CASE 3: KENYATTA UNIVERSITY TEACHING REFERRAL AND RESEARCH HOSPITAL (PUBLIC L6)

For Kenyatta University Teaching Referral and Research Hospital (KUTRRH), there was no record of empirical use of a reserve antibiotic for the treatment of any of the scenarios recorded.

Category	Community acquired sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed	e	Piperacillin/Tazobactam, Meropenem
Percentage of time samples sent to microbiology for:-		80%
When during the course of infection are samples sent to microbiology		Prior to initiation of antibiotics t
Percentage of the time micro results are received within 48hours		90%

Category	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed	Amoxicillin, Ceftriaxone, Azithromycin	Piperacillin/Tazobactam, Meropenem
Percentage of time samples sent to microbiology for:-	20%	100%
When during the course of infection are samples sent to microbiology	Prior to initiation of treatment	Prior to initiation of treatment
Percentage of the time micro results are received within 48hours	20%	80%
Category	CA-UTI	Hospital acquired UTI
Empiric antibiotics prescribed	Amoxicillin, ciprofloxacin, Levofloxacin	Ceftriaxone, Meropenem, Levofloxacin
Percentage of time samples sent to microbiology for:-	50%	80%
When during the course of infection are samples sent to microbiology	Prior to initiation of treatment	Prior to initiation of treatment
Percentage of the time micro results are received within 48hours	20%	80%
Category	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed	Ceftriaxone, Metronidazole	Meropenem
Percentage of time samples sent to microbiology for:-	10%	40%
When during the course of infection are samples sent to microbiology	Prior to initiation of treatment	Prior to initiation of treatment
Percentage of the time micro results are received within 48hours	10%	80%
Category	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed	Amoxicillin, Clavulate, Clindamycin, Flucloxacillin	Clindamycin
Percentage of time samples sent to microbiology for:-	50%	80%
When during the course of infection are samples sent to microbiology	Prior to initiation of treatment	Prior to initiation of treatment
Percentage of the time micro results are received within 48hours	70%	80%

Category	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed	Flucloxacillin, Amoxicillin, Clindamycin	Clindamycin, Piperacillin/tazobactam
Percentage of time samples sent to microbiology for:-	0%	10%
When during the course of infection are samples sent to microbiology	Prior to initiation of treatment	Prior to initiation of treatment
Percentage of the time micro results are received within 48hours	10%	10%
Category		Hospital acquired bone and joint infection
Empiric antibiotics prescribed		Clindamycin
Percentage of time samples sent to microbiology for:-		20%
When during the course of infection are samples sent to microbiology		Prior to initiation of treatment
Percentage of the time micro results are received within 48hours		20%

REFERENCES

- [1] Itunuoluwa Adekoya et al. "Comparison of antibiotics included in national essential medicines lists of 138 countries using the WHO Access, Watch, Reserve (AWaRe) classification: A cross-sectional study". In: *The Lancet Infectious Diseases* 21.10 (2021), pp. 1429–1440.
- [2] African society for Laboratory Medicine (ASLM). *Qualifying the Workforce for AMR Surveillance in Africa and Asia*. 2023. URL: <https://aslm.org/what-we-do/amr/qwars/> (visited on 12/14/2023).
- [3] Marlon L Bayot and Bradley N Bragg. "Antimicrobial susceptibility testing". In: (2019).
- [4] CDC. *CDC's Laboratory Management Training and Accreditation Program Prepares Countries for COVID-19 Response*. 2023. URL: <https://www.cdc.gov/globalhealth/stories/2022/cdc-laboratory-program-prepares-countries-COVID-19.html> (visited on 12/14/2023).
- [5] CDC. *Competency Guidelines for Laboratory Professionals*. 2024. URL: <https://www.who.int/news/item/01-10-2019-who-releases-the-2019-aware-classification-antibiotics>.
- [6] GoK. "Kenya National Action Plan on Antimicrobial Resistance". In: *Government of Kenya, Nairobi, Kenya* (2022).
- [7] GoK. "National Antimicrobial Stewardship guidelines for healthcare settings in Kenya". In: *Government of Kenya, Nairobi, Kenya* (2020).
- [8] GoK. "National Policy for the Prevention and Containment of Antimicrobial Resistance". In: *Government of Kenya, Nairobi, Kenya* (2017).
- [9] James H Jorgensen and Mary Jane Ferraro. "Antimicrobial susceptibility testing: general principles and contemporary practices". In: *Clinical Infectious Diseases* (1998), pp. 973–980.
- [10] Georgia D Kaprou et al. "Rapid methods for antimicrobial resistance diagnostics". In: *Antibiotics* 10.2 (2021), p. 209.
- [11] Surbhi Leekha, Christine L Terrell, and Randall S Edson. "General principles of antimicrobial therapy". In: *Mayo clinic proceedings*. Vol. 86. 2. Elsevier. 2011, pp. 156–167.
- [12] Medical Laboratory Accreditation. *ACCREDITATION TO ISO 15189:2012*. 2023. URL: <https://www.kenas.go.ke/medical-laboratory-accreditation/> (visited on 12/15/2023).
- [13] Rehema Moraa Moirongo et al. "Laboratory-based surveillance of antimicrobial resistance in regions of Kenya: an assessment of capacities, practices, and barriers by means of multi-facility survey". In: *Frontiers in public health* 10 (2022), p. 1003178.
- [14] World Health Organization et al. "Global strategy on human resources for health: workforce 2030". In: (2016).
- [15] World Health Organization et al. *Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies*. World Health Organization, 2010.
- [16] World Health Organization et al. "WHO Access, Watch, Reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use, 2021". In: *WHO access, watch, reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use, 2021*. 2021.
- [17] G Revathi and C Mailu. "Kenya's perspective on antibiotic resistance". In: *International Journal of Infectious Diseases* 45 (2016), p. 10.
- [18] SLMTA. *What is SLMTA?* 2023. URL: <https://slmta.org/> (visited on 12/14/2023).
- [19] Veterinary Diagnostic Laboratory. *Importance of Antimicrobial susceptibility Testing*. 2023. URL: <https://cvm.msu.edu/vdl/laboratory-sections/bacteriology-mycology/culture-and-sensitivity> (visited on 12/15/2023).

- [20] Frederick K Wangai et al. "Bridging antimicrobial resistance knowledge gaps: the East African perspective on a global problem". In: *PLoS One* 14.2 (2019), e0212131.
- [21] WHO. *AWaRe classification of antibiotics for evaluation and monitoring of use*, 2023. 2024. URL: <https://www.who.int/publications-detail-redirect/WHO-MHP-HPS-EML-2023.04#:~:text=The%20AWaRe%20classification%20of%20antibiotics,Reserve%2C%20taking%20into%20account%20the.>
- [22] Janet Y Wu, Pavithra Srinivas, and Jason M Pogue. "Cefiderocol: a novel agent for the management of multidrug-resistant Gram-negative organisms". In: *Infectious diseases and therapy* 9 (2020), pp. 17–40.
- [23] Veronica Zanichelli et al. "The WHO AWaRe (Access, Watch, Reserve) antibiotic book and prevention of antimicrobial resistance". In: (2023).

A PHARMACEUTICAL STAFF AND SATELLITE PHARMACIES

TABLE 38: PHARMACEUTICAL STAFF AND SATELLITE PHARMACIES

KEPH Level/Ownership	Pharmacists in HF	Pharmaceutical technologists in HF	Medical unit	Surgical department	ICU	HDU	Nearby 24hr pharmacies
Level 4	47	110	6	2	0	0	19
Faith Based Organisation	8	24	2	0	0	0	5
Coptic Hospital	8	5	1	0	0	0	1
MaterCare Maternity Hospital	0	1	0	0	0	0	0
Mt Kenya (ACK) Hospital	0	4	0	0	0	0	1
Pope Benedict XVI Hospital	0	7	0	0	0	0	2
Tawfiq Hospital	0	7	1	0	0	0	1
Private	0	11	0	0	0	0	2
Afya Link Medical Centre	0	2	0	0	0	0	1
Anka Hospital Isiolo	0	1	0	0	0	0	0
Kapsabet Health Care Centre	0	2	0	0	0	0	0
Kitengela Medical Services	0	6			0	0	1
Public	39	75	4	2	0	0	12
Chepterwai Sub-County Hospital	0	2	0	0	0	0	1
Emuhaya Sub County Referral Hospital	0	4	0	0	0	0	0
Isiolo County and Referral Hospital	3	6	0	0	0	0	1
Kajiado County Referral Hospital	3	5	0	0	0	0	1
Kapsabet County Referral Hospital	4	11	1	0	0	0	2
Kericho County Referral Hospital	6	16	0	1	0	0	2
Kilifi County Hospital	3	3	1	1	0	0	1
Mama Margaret Uhuru Hospital	1	5	1	0	0	0	1
Mariakani Sub County Hospital	2	3	0	0	0	0	1
Nanyuki teaching and Referral Hospital	12	6	0	0	0	0	1
Ngong Sub-County Hospital	2	3	0		0	0	0
Vihiga County Referral Hospital	3	11	1	0	0	0	1
Level 5	21	80	1	0	0	0	6
Faith Based Organisation	6	70	0	0	0	0	4
AIC Litein Mission Hospital	2	21	0	0	0	0	2
Jumua Mission Hospital Kaimosi	1	4	0	0	0	0	1
The Mater Misericordiae Hospital (Mukuru)	3	45	0	0	0	0	1
Public	15	10	1	0	0	0	2
Kerugoya County Referral Hospital	7	4	0	0	0	0	1
Mama Lucy Kibaki Hospital (Embakasi)	8	6	1	0	0	0	1
Level 6	31	31	1	1	2	1	3
Public	31	31	1	1	2	1	3
Kenyatta University Teaching Referral and Research Hospital	22	26	0	0	1	0	2
KNH Othaya Annex	9	5	1	1	1	1	1
Total	99	221	8	3	2	1	28

B IV PUMPS AVAILABLE AT HFS

TABLE 39: IV PUMPS AVAILABLE ACROSS THE HFS

KEPH Level/Ownership	Highest frequency of IV administration			No. of IV pumps available				
	ICU	Medical Unit	Surgical Unit	Medical department	Surgical department	ICU department	HDU	Total
Level 4	1	14	5	22	6	79	48	155
Faith Based Organisation	1	3	1	4	4	13	13	34
Coptic Hospital	✓			3	3	9	9	24
MaterCare Maternity Hospital			✓	0	0	0	0	0
Mt Kenya (ACK) Hospital		✓		0	0	0	0	0
Pope Benedict XVI Hospital		✓		0	0	4	4	8
Tawfiq Hospital		✓		1	1	0	0	2
Private		2	2	0	0	0	0	0
Afiya Link Medical Centre		✓		0	0	0	0	0
Anka Hospital Isiolo			✓	0	0	0	0	0
Kapsabet Health Care Centre			✓	0	0	0	0	0
Kitengela Medical Services		✓		0	0	0	0	0
Public		9	2	18	2	66	35	121
Chepterwai Sub-County Hospital		✓		0	0	0	0	0
Emuhaya Sub County Referral Hospital		✓		0	0	0	0	0
Isiolo County and Referral Hospital			✓	2	1	14	13	30
Kajiado County Referral Hospital		✓		0	0	1	0	1
Kapsabet County Referral Hospital		✓		0	0	4	0	4
Kericho County Referral Hospital		✓		0	0	30	0	30
Kilifi County Hospital		✓		6	1	17	11	35
Mama Margaret Uhuru Hospital		✓		10	0	0	0	10
Mariakani Sub County Hospital			✓	0	0	0	0	0
Nanyuki teaching and Referral Hospital		✓		0	0	0	6	6
Ngong Sub-County Hospital				0	0	0	0	0
Vihiga County Referral Hospital		✓		0	0	0	5	5
Level 5	1	4		6	6	41	21	74
Faith Based Organisation	1	2		6	6	38	20	70
AIC Litein Mission Hospital		✓		0	0	8	0	8
Jumuia Mission Hospital Kaimosi		✓		0	0	0	0	0
The Mater Misericordiae Hospital (Mukuru)	✓			6	6	30	20	62
Public		2		0	0	3	1	4
Kerugoya County Referral Hospital		✓		0	0	0	0	0
Mama Lucy Kibaki Hospital (Embakasi)		✓		0	0	3	1	4
Level 6		1	1	0	0	10	0	10
Public		1	1	0	0	10	0	10
Kenyatta University Teaching Referral and Research Hospital			✓	0	0	0	0	0
KNH Othaya Annex		✓		0	0	10	0	10
Total	2	19	6	28	12	130	69	239

C LIST OF AVAILABLE ANTIBIOTICS IN VARIOUS HFS

TABLE 40: ACCESS GROUP ANTIBIOTICS AVAILABLE IN THE HFS

Antibiotic/	Level 4	Faith Based Organisation	Private	Public	Level 5	Faith Based Organisation	Public	Level 6	Public	Total no. of HFs	Percentage of HFs
Amikacin	14	4	2	8	3	1	2	2	2	19	67.9%
Amoxicillin	21	5	4	12	5	3	2	2	2	28	100.0%
Amoxicillin/Clavulanic-acid	21	5	4	12	5	3	2	1	1	27	96.4%
Ampicillin	4	1	1	2	2	2	0	1	1	7	25.0%
Ampicillin/sulbactam	1	0	1	0	1	1	0	1	1	3	10.7%
Benzathine-Penicillin	15	4	3	8	5	3	2	1	1	21	75.0%
Penicillin	21	5	4	12	5	3	2	2	2	28	100.0%
Cefadroxil	6	2	1	3	3	3	0	1	1	10	35.7%
Cefalexin	9	5	2	2	3	3	0	0	0	12	42.9%
Cefazolin	4	1	1	2	2	2	0	2	2	8	28.6%
Cefroxadine	1	0	0	1	0	0	0	0	0	1	3.6%
Chloramphenicol	1	0	0	1	0	0	0	0	0	1	3.6%
Clindamycin	15	4	3	8	3	2	1	2	2	20	71.4%
Cloxacillin	2	1	0	1	2	2	0	0	0	4	14.3%
Doxycycline	20	5	4	11	5	3	2	2	2	27	96.4%
Flucloxacillin	21	5	4	12	5	3	2	2	2	28	100.0%
Gentamycin	20	4	4	12	5	3	2	2	2	27	96.4%
Metronidazole_IV	21	5	4	12	5	3	2	2	2	28	100.0%
Metronidazole_oral	20	5	4	11	5	3	2	2	2	27	96.4%
Nitrofurantoin	19	5	4	10	4	3	1	2	2	25	89.3%
Ornidazole_oral	6	3	1	2	2	2	0	1	1	9	32.1%
PhenoxymethylPenicillin	5	2	0	3	1	1	0	0	0	6	21.4%
Procaine-Penicillin	0	0	0	0	2	2	0	0	0	2	7.1%
Secnidazole	12	4	3	5	4	3	1	2	2	18	64.3%
Spectinomycin	1	0	1	0	1	1	0	0	0	2	7.1%
Sulbactam	1	1	0	0	0	0	0	0	0	1	3.6%
Sulfadiazine	1	1	0	0	1	0	1	0	0	2	7.1%
Sulfadiazine/trimethoprim	3	0	0	3	2	2	0	0	0	5	17.9%
Sulfamethoxazole/trimethoprim	20	4	4	12	5	3	2	2	2	27	96.4%
Tetracycline	12	4	1	7	5	3	2	0	0	17	60.7%
Tinidazole_oral	10	2	3	5	3	2	1	1	1	14	50.0%

TABLE 41: WATCH GROUP ANTIBIOTICS AVAILABLE IN THE HFS

Antibiotic	Level 4	Faith Based Organisation	Private	Public	Level 5	Faith Based Organisation	Public	Level 6	Public	Total no. of HFs	Percentage of HFs
Azithromycin	21	5	4	12	5	3	2	2	2	28	100.0%
Cefaclor	1	0	0	1	1	1	0	2	2	4	14.3%
Cefepime	2	1	0	1	2	2	0	1	1	5	17.9%
Cefixime	18	4	3	11	5	3	2	1	1	24	85.7%
Cefoperazone	1	1	0	0	0	0	0	0	0	1	3.6%
Cefotaxime	3	2	0	1	2	2	0	1	1	6	21.4%
Cefpodoxime-proxetil	2	1	1	0	2	2	0	0	0	4	14.3%
Ceftazidime	13	4	1	8	5	3	2	2	2	20	71.4%
Ceftriaxone	21	5	4	12	5	3	2	1	1	27	96.4%
Cefuroxime	16	4	4	8	4	2	2	2	2	22	78.6%
Ciprofloxacin	21	5	4	12	4	2	2	2	2	27	96.4%
Clarithromycin	18	5	3	10	3	2	1	1	1	22	78.6%
Doripenem	0	0	0	0	1	1	0	0	0	1	3.6%
Erythromycin	13	3	3	7	3	2	1	1	1	17	60.7%
Ertapenem	0	0	0	0	1	1	0	0	0	1	3.6%
Fosfomycin_oral	2	1	0	1	0	0	0	0	0	2	7.1%
Fusidic-acid	2	2	0	0	3	2	1	0	0	5	17.9%
Imipenem/cilastatin	3	2	0	1	1	1	0	1	1	5	17.9%
Kanamycin_IV	2	0	0	2	0	0	0	1	1	3	10.7%
Kanamycin_oral	2	0	0	2	0	0	0	0	0	2	7.1%
Levofloxacin	19	5	4	10	5	3	2	1	1	25	89.3%
Lincomycin	0	0	0	0	1	1	0	1	1	2	7.1%
Lymecycline	1	1	0	0	0	0	0	0	0	1	3.6%
Meropenem	11	3	1	7	5	3	2	1	1	17	60.7%
Vancomycin_oral	1	0	0	1	1	1	0	0	0	2	7.1%
Vancomycin_IV	12	3	1	8	4	2	2	2	2	18	64.3%
Tobramycin	1	1	0	0	0	0	0	0	0	1	3.6%
Teicoplanin	3	2	0	1	1	1	0	1	1	5	17.9%
Tazobactam	1	1	0	0	1	1	0	0	0	2	7.1%
Streptomycin_IV	1	0	0	1	1	1	0	0	0	2	7.1%
Rifaximin	1	1	0	0	0	0	0	1	1	2	7.1%
Rifamycin_oral	1	0	0	1	0	0	0	0	0	1	3.6%
Rifampicin	7	2	0	5	4	3	1	0	0	11	39.3%
Rifabutin	2	0	0	2	2	1	1	1	1	5	17.9%
Piperacillin	9	3	1	5	3	2	1	2	2	14	50.0%
Piperacillin/tazobactam	9	3	1	5	3	2	1	2	2	14	50.0%
Ofloxacin	5	5	0	0	2	2	0	1	1	8	28.6%
Norfloxacin	8	2	3	3	2	2	0	1	1	11	39.3%

TABLE 42: RESERVE GROUP ANTIBIOTICS AVAILABLE IN THE HFS

Antibiotic	Level 4	Faith Based Organisation	Private	Public	Level 5	Faith Based Organisation	Public	Level 6	Public	Total no. of HFs	Percentage of HFs
Linezolid	5	2		3	2	1	1	2	2	9	32.1%
Tigecycline	1	1		0	1	0	1	1	1	3	10.7%
Polymyxin-B_IV	1	1		0	0	0	0	1	1	2	7.1%
Daptomycin	1	0		1	0	0	0	0	0	1	3.6%
Fosfomycin_IV	1	0		1	1	1	0	1	1	3	10.7%
Colistin_IV	2	1		1	1	1	0	1	1	4	14.3%

TABLE 43: EMPIRICALLY PRESCRIBED ANTIBIOTICS BY WHO AWARE CLASSIFICATION

Access	Watch	Reserve
Flucloxacillin	Ceftriaxone	Linezolid
Metronidazole_IV	Ciprofloxacin	
Amoxicillin	Meropenem	
Clindamycin	Azithromycin	
Gentamycin	Levofloxacin	
Phenoxymethylpenicillin	Ceftazidime	
Nitrofurantoin	Cefuroxime	
Doxycycline	Piperacillin/tazobactam	
Amikacin	Vancomycin_IV	
Ampicillin	Cefixime	
Cefazolin	Erythromycin	
Cloxacillin	Clarithromycin	
Cefalexin	Cefepime	
Ornidazole_oral	Ofloxacin	
Flagyl	Fluoroquinolone	
BenzylPhenoxymethylpenicillin	Fosfomycin	
Ampiclox	Imipenem	
Cefazoline	Macrolide	
Fluconazole	Amphotericin-B	

TABLE 44: EMPIRICALLY PRESCRIBED ANTIBIOTICS BY WHO AWARE CLASSIFICATION

Empiric Abx	Abx Prescription rate
Ceftriaxone	18.98%
Flucloxacillin	15.65%
Metronidazole_IV	13.99%
Amoxicillin	9.28%
Clindamycin	6.93%
Ciprofloxacin	3.19%
Meropenem	3.19%
Gentamycin	3.19%
Phenoxymethylpenicillin	2.63%
Azithromycin	2.49%
Levofloxacin	2.35%
Ceftazidime	2.08%
Cefuroxime	2.08%
Piperacillin/tazobactam	2.08%
Vancomycin_IV	1.39%
Nitrofurantoin	1.39%
Doxycycline	1.11%
Cefixime	0.83%
Amikacin	0.83%
Erythromycin	0.69%
Clarithromycin	0.55%
Ampicillin	0.55%
Cefazolin	0.55%
Cloxacillin	0.55%
Ampiclox	0.42%
Linezolid	0.42%
Cefazoline	0.28%
Flagyl	0.28%
Fluconazole	0.28%
Fluoroquinolone	0.28%
Fosfomycin	0.28%
Cefepime	0.28%
Amphotericin-B	0.14%
BenzylPhenoxymethylpenicillin	0.14%
Imipenem	0.14%
Macrolide	0.14%
Ofloxacin	0.14%
Cefalexin	0.14%
Ornidazole_oral	0.14%

For Table 44, the green labels represent Access antibiotics, the amber coloured are Watch, and the red are Reserve antibiotics.

D ANTIMICROBIAL STEWARDSHIP

TABLE 45: AMS TRAINING AND STEWARDSHIP GUIDELINES

	Availability of stewardship guidelines/policies		Existence of AMS committee		Date AMS committee formed
	No	Yes	No	Yes	
KEPH Level/Ownership					
Level 4	18	3	13	8	
Faith Based Organisation	5		4	1	
Coptic Hospital	1		1		
MaterCare Maternity Hospital	1		1		
Mt Kenya (ACK) Hospital	1			1	2023-05-15
Pope Benedict XVI Hospital	1		1		
Tawfiq Hospital	1		1		
Private	4		4		
Afya Link Medical Centre	1		1		
Anka Hospital Isiolo	1		1		
Kapsabet Health Care Centre	1		1		
Kitengela Medical Services	1		1		
Public	9	3	5	7	
Chepterwai Sub-County Hospital	1		1		
Emuhaya Sub County Referral Hospital	1		1		
Isiolo County and Referral Hospital	1		1		
Kajiado County Referral Hospital	1		1		
Kapsabet County Referral Hospital		1		1	2023-02-01
Kericho County Referral Hospital	1			1	2023-08-04
Kilifi County Hospital		1		1	2021-08-03
Mama Margaret Uhuru Hospital	1		1		
Mariakani Sub County Hospital	1			1	2021-03-25
Nanyuki teaching and Referral Hospital	1			1	2023-08-01
Ngong Sub-County Hospital	1			1	2023-09-20
Vihiga County Referral Hospital		1		1	2018-01-01
Level 5	3	2	2	3	
Faith Based Organisation	2	1	1	2	
AIC Litein Mission Hospital	1		1		
Jumuiya Mission Hospital Kaimosi	1			1	2023-03-01
The Mater Misericordiae Hospital (Mukuru)		1		1	2016-06-01
Public	1	1	1	1	

E ADDITIONAL USE-CASES FOR AMR DX AND ABX USE

Use Case 1: Level 4, Kilifi County Hospital, Sokoni Ward, Kilifi North Sub county, Kilifi County (Public)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Azithromycin	Phenoxymethylpenicillin, Ceftriaxone
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	During consultation. If symptoms persist 48 to 72 hours later	At first contact with patient 48 to 72 hours after initiation of treatment when there is no improvement
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin as first line in paediatrics Amoxicillin Clavulanic acid or Azithromycin for adults	Phenoxymethylpenicillin Or Ceftriaxone if the patient has a concomitant infection
Percentage of time samples sent to microbiology for:-	0%	8%
When during the course of infection are samples sent to microbiology for:-	When there is recurrence	When there is no clinical improvement at 48 to 72 hours
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Nitrofurantoin or Ciprofloxacin	Ceftriaxone or Amoxicillin Clavulanic acid I.v
Percentage of time samples sent to microbiology for:-	10%	90%
When during the course of infection are samples sent to microbiology for:-	After urinalysis if suggestive of uti or if there is recurrence	After urinalysis if suggestive of UTI
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Amoxicillin Clavulanic acid or doxycycline	Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	55%
When during the course of infection are samples sent to microbiology for:-	No samples collected	When symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Doxycycline, Metronidazole, Azithromycin	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	55%
When during the course of infection are samples sent to microbiology for:-	Samples not collected	24 hours after initiation of treatment
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Doxycycline, Clindamycin	Flucloxacillin, Doxycycline, Clindamycin, Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	45%
When during the course of infection are samples sent to microbiology for:-	Samples not collected	Before initiation of treatment or 72hours after initiation of treatment depending on the patients presentation in maternity No samples collected for surgical patients in other wards
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Clindamycin
Percentage of time samples sent to microbiology for:-	40%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Continue with treatment till 48 hours, Review patient and collect sample for AST and change the treatment
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Continue with the current antibiotic till the course is comp

Use Case 2: Level 5, The Mater Misericordiae Hospital (Mukuru), Nairobi South Ward, Starehe Sub county, Nairobi County (FBO)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Cefazoline	Amoxicillin, Clavulanic
Percentage of time samples sent to microbiology for:-	70%	100%
When during the course of infection are samples sent to microbiology for:-	Day 2	Day 1
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin Clavulanic	Cefazolin, Meropenem
Percentage of time samples sent to microbiology for:-	70%	100%
When during the course of infection are samples sent to microbiology for:-	Day 2	Day 1
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Nitrofurantoin	Ciprofloxacin
Percentage of time samples sent to microbiology for:-	50%	100%
When during the course of infection are samples sent to microbiology for:-	Day 3	Day 1
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Meropenem	Meropenem
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	Day 1	Day 1
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Meropenem, Flucloxacillin	Meropenem, Flucloxacillin
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	Day 1	Day 1
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Amoxicillin, Clavulanic	Flucloxacillin, Amoxicillin,
Percentage of time samples sent to microbiology for:-	50%	100%
When during the course of infection are samples sent to microbiology for:-	Day 3	Day 1
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Meropenem, Clindamycin
Percentage of time samples sent to microbiology for:-	100%
When during the course of infection are samples sent to microbiology for:-	Day 1
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Send for culture, escalate to specialist or team of medics, review medication
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	De-escalate treatment to narrow spectrum gram negative sensitive antibiotics

Use Case 3: Level 5, AIC Litein Mission Hospital, Litein Ward, Bureti Sub county, Kericho County (FBO)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-		Piperacillin/Tazobactam, Vancomycin
Percentage of time samples sent to microbiology for:-	90%	90%
When during the course of infection are samples sent to microbiology for:-	Point of diagnosis, unless critical	As soon as an infection is suspected/ recognised
Percentage of the time micro results are received within 48hours for:-	10%	10%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Azithromycin Amoxicillin	Ceftriaxone, piperacillin/Tazobactam and Vancomycin
Percentage of time samples sent to microbiology for:-	5%	5%
When during the course of infection are samples sent to microbiology for:-	Unless it's tuberculosis, they are not sent to microbiology	
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Ceuroxime, Nitrofurantoin	Ceftriaxone, piperacillin/Tazobactam, Levofloxacin
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology for:-	If there is a suspected drug resistance	If there is a suspected drug resistance
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftriaxone, Metronidazole, Piperacillin/Tazobactam
Percentage of time samples sent to microbiology for:-	70%	100%
When during the course of infection are samples sent to microbiology for:-	At diagnosis	At diagnosis or when there is a suspected recurrence
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Flucloxacillin, Amoxicillin/Clavulate, Metronidazole
Percentage of time samples sent to microbiology for:-	50%	100%
When during the course of infection are samples sent to microbiology for:-	If not responding to initial management	At diagnosis
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Flucloxacillin, Piperacillin/tazobactam, Clindamycin
Percentage of time samples sent to microbiology for:-	30%	100%
When during the course of infection are samples sent to microbiology for:-	Persistence of symptoms	At diagnosis of the skin and/ soft tissue infection
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Amoxicillin, Clindamycin
Percentage of time samples sent to microbiology for:-	100%
When during the course of infection are samples sent to microbiology for:-	At diagnosis of the bone or joint Infection
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Advise the patient to continue with medications
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	De escalate to a lower class and less costly antibiotic

Use Case 4: Level 4, Afya Link Medical Centre, Tebere Ward, Kirinyaga South Sub county, Kirinyaga County (Private)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Flucloxacillin, Ampiclox	Phenoxymethylpenicillin, Ceftriaxone, Gentamycin
Percentage of time samples sent to microbiology for:-	5%	5%
When during the course of infection are samples sent to microbiology for:-	Immediately	After 5 days if the patient doesn't improve
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Phenoxymethylpenicillin and Gentamycin	Ceftriaxone and /or Gentamycin
Percentage of time samples sent to microbiology for:-	0%	5%
When during the course of infection are samples sent to microbiology for:-	Immediately	When there is recurrence
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Phenoxymethylpenicillin and Gentamycin	Ceftriaxone and /or Gentamycin
Percentage of time samples sent to microbiology for:-	0%	5%
When during the course of infection are samples sent to microbiology for:-	Immediately	When there is recurrence
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Amoxicillin-Clavulanic potassium	Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	10%
When during the course of infection are samples sent to microbiology for:-	Hardly send samples	When symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Flucloxacillin	I.v Flucloxacillin or Ceftriaxone and/or Gentamycin
Percentage of time samples sent to microbiology for:-	5%	5%
When during the course of infection are samples sent to microbiology for:-	When symptoms persist	When symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Ceftriaxone
Percentage of time samples sent to microbiology for:-	5%	5%
When during the course of infection are samples sent to microbiology for:-	When symptoms persist	When symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Ampiclox, Flucloxacillin	Ceftriaxone, Gentamycin
Percentage of time samples sent to microbiology for:-	5%	5%
When during the course of infection are samples sent to microbiology for:-	When there is persistence	When symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Ceftriaxone, Gentamycin, Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	5%
When during the course of infection are samples sent to microbiology for:-	When symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Continue with treatment till 48 to 72 hours then change the treatment
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Change to Ciprofloxacin

Use Case 5: Level 4, Anka Hospital Isiolo, Bulla Pesa Ward, Isiolo Sub county, Isiolo County (Private)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Amoxicillin, Levofloxacin, Azithromycin	Ceftriaxone, Flucloxacillin
Percentage of time samples sent to microbiology for:-	50%	80%
When during the course of infection are samples sent to microbiology for:-		If patient deteriorates or there are signs of a new infection.
Percentage of the time micro results are received within 48hours for:-	40%	60%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin, Azithromycin	Ceftriaxone, IV Azithromycin
Percentage of time samples sent to microbiology for:-	30%	50%
When during the course of infection are samples sent to microbiology for:-		If no response to empirical treatment or if there's worsening of infection
Percentage of the time micro results are received within 48hours for:-	40%	60%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Oral Ciprofloxacin with oral Metronidazole	IV Ciprofloxacin and IV Metronidazole
Percentage of time samples sent to microbiology for:-	30%	40%
When during the course of infection are samples sent to microbiology for:-	When there's no response to antibiotics given. Or recurrence	When there's no response to antibiotics
Percentage of the time micro results are received within 48hours for:-	20%	40%
	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Depends on presentation e.g Flucloxacillin or Clindamycin for skin abscess Amoxicillin and Metronidazole for dental abscess	IV Flucloxacillin, IV Metronidazole
Percentage of time samples sent to microbiology for:-	10%	25%
When during the course of infection are samples sent to microbiology for:-	On failure to improve or patient worsening	On failure to improve or patient worsening
Percentage of the time micro results are received within 48hours for:-	20%	40%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Flucloxacillin oral or I.V.
Percentage of time samples sent to microbiology for:-	10%	30%
When during the course of infection are samples sent to microbiology for:-	When there's no response or condition is worsening	When there's no response or condition worsening
Percentage of the time micro results are received within 48hours for:-	20%	50%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Amoxicillin, Metronidazole, Flucloxacillin	Amoxicillin, Metronidazole, Flucloxacillin
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology for:-	50% of the time samples taken before of treatment, for the rest if there's no response to antibiotics or there's worsening of infection	50% of the time samples taken before of treatment, for the rest if there's no response to antibiotics or there's worsening of infection
Percentage of the time micro results are received within 48hours for:-	40%	50%

	Hospital acquired bone and joint infection
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Empiric antibiotics prescribed for:-	Flucloxacillin , Metronidazole
Percentage of time samples sent to microbiology for:-	50%
When during the course of infection are samples sent to microbiology for:-	50% before initiating antibiotics, 50% if there's no response to antibiotics
Percentage of the time micro results are received within 48hours for:-	50%

For patients not improving on empiric antibiotics within 24 hours what do you do?	If patient is not worsening within 24 hours treatment is continued, if worsening samples are taken and antibiotics changed.
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Continue with initiated drug to completion.

Use Case 6: Level 4, Chepterwai Sub-County Hospital, Chepterwai Ward, Mosop Sub county, Nandi County (Public)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole, Amoxicillin, Clavulanic	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-		When clinical symptoms persist refer patients to Kapsabet county hospital or Moi referral hospital for management
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Phenoxymethylpenicillin, Gentamycin, Amoxicillin, Clavulanic	Ceftriaxone, Amoxicillin, Clavulanic
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-		When clinical symptoms persist then referred to kapsabet county hospital or moi teaching and referral hospital for management
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Ciprofloxacin, nitrofurantoin, cefixime or Cefuroxime	Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Never done culture and sensitivity however upon recurrence they referred to Kapsabet county hospital or moi teaching and referral hospital	When clinical symptoms persist the patients referred to Kapsabet referral hospital or Moi teaching and referral hospital
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, patients are referred to Kapsabet county hospital or Moi teaching and referral hospital	When clinical symptoms persist, patients will be referred to Kapsabet county hospital or Moi teaching referral hospital
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Metronidazole	Flucloxacillin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist the patients is referred to Kapsabet county hospital or Moi teaching and referral hospital	When clinical symptoms persist the patients is referred to Kapsabet county hospital or Moi teaching and referral hospital
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Flucloxacillin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist the patients is referred to Kapsabet county hospital or Moi teaching and referral hospital	When clinical symptoms persist the patients is referred to Kapsabet county hospital or Moi teaching and referral hospital
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Flucloxacillin
Percentage of time samples sent to microbiology for:-	0%
When during the course of infection are samples sent to microbiology for:-	The patients is referred almost immediately
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	If the patients is on Phenoxymethylpenicillin iv Switch to Ceftriaxone if no improvement then Refer to Kapsabet county hospital or Moi teaching and referral hospital
How would you manage a patient improving from sepsis on broad spectrum Abx, and microbiology results show BSI with pan-sensitive E coli?	Switch from Ceftriaxone to oral antibiotics like cefixime or Cefuroxime

Use Case 7: Level 4, Emuhaya Sub County Referral Hospital, Emabungo Ward, Luanda Sub county, Vihiga County (Public)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, there is no response to any antibiotics in the facility, affordability of the patients since the service is outsourced in private facility	When clinical symptoms persist, there is no response to any antibiotics in the facility, affordability of the patients since the service is outsourced in private facility
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin, Phenoxymethylpenicillin, Gentamycin	Phenoxymethylpenicillin, Gentamycin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	The health care provider has never requested for microbiology in pneumonia however they would request if clinical symptoms persist	The health care provider has never requested for microbiology in pneumonia however they would request if clinical symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Nitrofurantoin, Levofloxacin, Erythromycin	Ceftriaxone
Percentage of time samples sent to microbiology for:-	40%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist or recurrence of infection with no response	When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	The facility has not sent for microbiology test in IAI, they refer patients to Vihiga county hospital for specialist medical care	The facility has not sent for microbiology test in IAI ,they refer patients to Vihiga county hospital for specialist medical care
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Metronidazole, Ceftriaxone	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist the patients is referred to Vihiga county hospital for specialist medical care	When clinical symptoms persist the patient's referred to Vihiga county hospital for specialist medical care
Percentage of the time micro results are received within 48hours for:-	0%	0%
	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin oral, Metronidazole oral	Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist the patient is referred to Vihiga county hospital for specialist medical care	When clinical symptoms persist the patient is referred to Vihiga county hospital for specialist medical care
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Metronidazole, Clindamycin
Percentage of time samples sent to microbiology for:-	0%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist refer patients to Vihiga county hospital for specialist medical care
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Upscale treatment to broad spectrum incase of clinical symptoms persist refer
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Make sure complete dosage

Use Case 8: Level 4, Isiolo County and Referral Hospital, Wabera Ward, Isiolo Sub county, Isiolo County (Public)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	50%	30%
When during the course of infection are samples sent to microbiology for:-		If recurrent
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin	Ceftriaxone and Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	0	N/A
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Ciprofloxacin	Ceftriaxone and Metronidazole
Percentage of time samples sent to microbiology for:-	30%	40%
When during the course of infection are samples sent to microbiology for:-		If recurrent
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	CoAmoxicillin or Cefuroxime	Ceftriaxone and Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Immediately	On recurrence
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	30%	30%
When during the course of infection are samples sent to microbiology for:-	Immediately	After trying a course of antibiotics; first Metronidazole and Ceftriaxone, then Clindamycin. Samples sent if there's no response
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-		If recurrent and not improving on empirical antibiotics
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	80%
When during the course of infection are samples sent to microbiology for:-	If no response to antibiotics
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Continue with antibiotic. Cut off of 1 week to determine if it's working
How would you manage a patient improving from sepsis on broad spectrum Abx, and microbiology results show BSI with pan-sensitive E coli?	Continue with broad spectrum antibiotic

Use Case 9: Level 5, Jumuia Mission Hospital Kaimosi, Shiru Ward, Hamisi Sub county, Vihiga County (FBO)

-	<u>Community acquired Sepsis</u>	<u>Hospital acquired sepsis</u>
Empiric antibiotics prescribed for:-	Ceftriaxone	Ceftriaxone, Metronidazole, Ciprofloxacin
Percentage of time samples sent to microbiology for:-	30%	5%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, recurrence and affordability of the patients since some can't afford opting for broad spectrum antibiotics	When clinical symptoms persist ,recurrences Affordability of the patients since some can't afford hence settle for empirical treatment of broad spectrum antibiotics
Percentage of the time micro results are received within 48hours for:-	100%	100%
	<u>Community acquired Pneumonia</u>	<u>Hospital acquired Pneumonia</u>
Empiric antibiotics prescribed for:-	Amoxicillin, Ceftriaxone, Azithromycin, Phenoxymethylpenicillin, Gentamycin	
Percentage of time samples sent to microbiology for:-	20%	5%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, affordability of the patients since the service might not be affordable to the patients so opting for empirical broad spectrum antibiotics	Rarely do they get HAI infections ,no sample sent for that so far for hospital acquired pneumonia
Percentage of the time micro results are received within 48hours for:-	100%	100%

	<u>Community acquired cUTI</u>	<u>Hospital acquired cUTI</u>
Empiric antibiotics prescribed for:-	Ciprofloxacin, Metronidazole, nitrofuratoin	
Percentage of time samples sent to microbiology for:-	30%	5%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, recurrence, affordability of the patients for the service hence opting for empirical management by broad spectrum antibiotics	Rarely do they get HAI however when clinical symptoms persist, recurrence
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, affordability of the patients since the service is quite expensive opting for empirical treatment by broad spectrum antibiotics	When clinical symptoms persist, affordability of the patients since the service is pricy opting for empirical treatment by broad spectrum antibiotics
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Metronidazole	Flucloxacillin
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist. However Christian Hospital Association of Kenya support culture and sensitivity for Surgical site infection hence affordability due to subsidy	When clinical symptoms persist or recurrence However Christian Health Association of Kenya supports culture and sensitivity for Surgical site infection hence affordability due to subsidy
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Metronidazole	Flucloxacillin, Metronidazole
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist, recurrence However CHAK support culture and sensitivity of soft skin infections hence affordability due to subsidy	When clinical symptoms persist CHAK support Culture sensitivity of Skin and soft infection hence affordability due to subsidy.
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	100%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist or recurrence Affordability is not a issue because for bone infection culture and sensitivity is subsided by CHAK.
Percentage of the time micro results are received within 48hours for:-	100%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Opt for second line antibiotics; Ceftazidime iv,
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Switch to oral antibiotics Eg move from Ceftriaxone iv to cefalexin oral

Use Case 10: Level 4, Kajiado County Referral Hospital, Ildamat Ward, Kajiado Central Sub county, Kajiado County (Public)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-		Flucloxacillin, Ceftazidime
Percentage of time samples sent to microbiology for:-		50%
When during the course of infection are samples sent to microbiology for:-		On diagnosis
Percentage of the time micro results are received within 48hours for:-		90%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin/Clavulate,Ampicillin	Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	0%	10%
When during the course of infection are samples sent to microbiology for:-	Rarely sent	Rarely sent
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Ceftriaxone	Ceftriaxone
Percentage of time samples sent to microbiology for:-	80%	80%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms re-occur	On non response to empiric treatment
Percentage of the time micro results are received within 48hours for:-	20%	20%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-		Ceftriaxone as first line, escalate to Meropenem if not improving
Percentage of time samples sent to microbiology for:-	10%	10%
When during the course of infection are samples sent to microbiology for:-	On encounter	After 48 hours if patient is not responding
Percentage of the time micro results are received within 48hours for:-	20%	20%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Ceftriaxone, Flucloxacillin	Ceftriaxone, Meropenem
Percentage of time samples sent to microbiology for:-	20%	60%
When during the course of infection are samples sent to microbiology for:-	On encounter	After 48 hours of non response to empiric treatment
Percentage of the time micro results are received within 48hours for:-	20%	60%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin	Flucloxacillin, Meropenem
Percentage of time samples sent to microbiology for:-	20%	60%
When during the course of infection are samples sent to microbiology for:-	During a recurrence	Non response to treatment, on recurrence
Percentage of the time micro results are received within 48hours for:-	20%	20%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Ceftriaxone
Percentage of time samples sent to microbiology for:-	20%
When during the course of infection are samples sent to microbiology for:-	Recurrence of an infection , non response to treatment
Percentage of the time micro results are received within 48hours for:-	10%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Check on the dose and frequency and consider escalation of antibiotics and sample to culture and sensitivity
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Give an access antibiotic that is available

**Use Case 11: Level 4, Kapsabet County Referral Hospital, Kapsabet Ward, Emgwen Sub county,
Nandi County (Public)**

-	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole	Ceftazidime, Amikacin
Percentage of time samples sent to microbiology for:-	5%	15%
When during the course of infection are samples sent to microbiology for:-		Clinical symptoms persistent after 10 days, resistance to 2nd line antibiotics ie Ceftazidime and Amikacin,
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin, Azithromycin, Ceftriaxone, Amoxicillin, Clavulanic	Ceftriaxone, Ceftazidime, Amikacin
Percentage of time samples sent to microbiology for:-	5%	15%
When during the course of infection are samples sent to microbiology for:-		Immediately upon admission to ICU ,CLINICAL Symptom persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Cefuroxime, cefixime	Ceftriaxone, ciprofloxacin
Percentage of time samples sent to microbiology for:-	5%	15%
When during the course of infection are samples sent to microbiology for:-	Not routine, however when Clinical symptoms persist or recurrence of infection	When clinical symptoms persist, upon resistance of second line ie Ceftazidime and Amikacin
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Ceftriaxone, metronidazole	Ceftazidime, Amikacin
Percentage of time samples sent to microbiology for:-	5%	15%
When during the course of infection are samples sent to microbiology for:-	Rarely does community acquired infections are sent for microbiology however if clinical symptoms persist or recurrence	Clinical symptoms persist, 2nd line antibiotics are resistance ie Ceftazidime and Amikacin
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Metronidazole	Ceftriaxone, Clindamycin
Percentage of time samples sent to microbiology for:-	5%	15%
When during the course of infection are samples sent to microbiology for:-	Rarely do we send culture and sensitivity in community acquired however if clinical symptoms persist	Clinical symptoms persist or resistance to 2nd line antibiotics Amikacin, Ceftazidime
Percentage of the time micro results are received within 48hours for:-	0%	0%
	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Metronidazole	Flucloxacillin, Metronidazole
Percentage of time samples sent to microbiology for:-	5%	15%
When during the course of infection are samples sent to microbiology for:-	Rarely do we send community acquired for culture and sensitivity however upon recurrence of infection or clinical symptoms persist	When clinical symptoms persist , when second line antibiotics resist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Clindamycin, Levofloxacin
Percentage of time samples sent to microbiology for:-	15%
When during the course of infection are samples sent to microbiology for:-	Rarely the department inclines to empirical treatment unless clinical symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	To switch antibiotics to 2nd line ie Ceftazidime and Amikacin
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Down grade to specific antibiotics or switch to orals .However its a multi disciplinary decision to switch to oral Ce

Use Case 12: Level 4, Kapsabet Health Care Centre, Chemundu/Kapng'etunyi Ward, Chesumei Sub county, Nandi County (Private)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-	Ceftriaxone, Metronidazole, Ceftriaxone, Gentamycin	Ceftazidime, Meropenem
Percentage of time samples sent to microbiology for:-	25%	70%
When during the course of infection are samples sent to microbiology for:-		When clinical symptoms persist
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin, Clavulanic, Azithromycin	Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	10%
When during the course of infection are samples sent to microbiology for:-		When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Nitrofurantoin, Doxycycline, cefixime/Cefuroxime	Gentamycin ,Ceftriaxone, fluconazole
Percentage of time samples sent to microbiology for:-	5%	20%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist or recurrence of infection	When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Metronidazole, Levofloxacin,	Metronidazole, Ceftriaxone, Piperacillin/Tazobactam, Ceftazidime
Percentage of time samples sent to microbiology for:-	5%	40%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist or recurrence of infection	When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Ampicillin/Cloxacillin, Metronidazole	Flucloxacillin, Ceftriaxone, Metronidazole
Percentage of time samples sent to microbiology for:-	10%	40%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persistent, recurrence of the infection	When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%	0%
	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Metronidazole, Ciprofloxacin	Metronidazole, Ceftriaxone, Flucloxacillin, Clindamycin
Percentage of time samples sent to microbiology for:-	10%	40%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist or recurrence of infection	When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Gentamycin, Ceftriaxone, Clindamycin, Flucloxacillin
Percentage of time samples sent to microbiology for:-	20%
When during the course of infection are samples sent to microbiology for:-	When clinical symptoms persist or recurrence of infection
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Proceed to second line in the facility ie Ceftriaxone ,Metronidazole iv ,Gentamycin targeting synergizing from single antibiotic used in first line
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Downgrade from iv to oral antibiotics like Levofloxacin or Amoxicillin -Clavulonic

**Use Case 13: Level 4, Kericho County Referral Hospital, Kipchebor Ward, Ainamoi Sub county,
Kericho County (Public)**

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-		Meropenem, Piperacillin/Tazobactam, Imipenem, Clindamycin, Fosfomycin
Percentage of time samples sent to microbiology for:-		100%
When during the course of infection are samples sent to microbiology for:-		On diagnosis and response to treatment
Percentage of the time micro results are received within 48hours for:-		100%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin, Azithromycin, Amoxycylav, Cefuroxime Erythromycin	Ceftriaxone, Meropenem, Ceftazidime
Percentage of time samples sent to microbiology for:-	0%	100%
When during the course of infection are samples sent to microbiology for:-	At diagnosis	At diagnosis, on poor response to response
Percentage of the time micro results are received within 48hours for:-	0%	100%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Ceftriaxone, Flucloxacillin/Amoxicillin, Vancomycin	Vancomycin, Clindamycin,
Percentage of time samples sent to microbiology for:-	10%	100%
When during the course of infection are samples sent to microbiology for:-	During a recurrence	When clinical symptoms persist, within 24 hours
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-		Ceftriaxone, Metronidazole and Clindamycin and Cefazoline
Percentage of time samples sent to microbiology for:-		100%
When during the course of infection are samples sent to microbiology for:-		On diagnosis
Percentage of the time micro results are received within 48hours for:-		100%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Ceftriaxone, Cefazolin, Flucloxacillin, Metronidazole, Gentamycin	Ceftriaxone, Cefazolin, Flucloxacillin, Metronidazole, Gentamycin
Percentage of time samples sent to microbiology for:-	0%	100%
When during the course of infection are samples sent to microbiology for:-	When the patient conditions deteriorates	When the patient conditions deteriorates
Percentage of the time micro results are received within 48hours for:-	100%	100%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Amoxicillin	Ceftriaxone, Vancomycin, Ciprofloxacin, Levofloxacin, Fluconazole, Amphotericin-B
Percentage of time samples sent to microbiology for:-	100%	100%
When during the course of infection are samples sent to microbiology for:-	Not commonly observed so not articulated	When type patients condition deteriorates
Percentage of the time micro results are received within 48hours for:-	0%	100%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Clindamycin, Cefazolin
Percentage of time samples sent to microbiology for:-	100%
When during the course of infection are samples sent to microbiology for:-	When the patient condition deteriorates
Percentage of the time micro results are received within 48hours for:-	100%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Take a sample and escalate the antibiotic,(ICU physician), Releases the patient and do other investigations for other comorbid conditions, confirm the dose (paediatrician)
How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli?	Will continue with the broad-spectrum antibiotic to completion

Use Case 14: Level 4, Kitengela Medical Services, Kitengela Ward, Kajiado East Sub county, Kajiado County (Private)

	Community acquired Sepsis	Hospital acquired sepsis
Empiric antibiotics prescribed for:-		Phenoxymethylpenicillin, Ceftriaxone
Percentage of time samples sent to microbiology for:-		10%
When during the course of infection are samples sent to microbiology for:-		On diagnosis
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired Pneumonia	Hospital acquired Pneumonia
Empiric antibiotics prescribed for:-	Amoxicillin, Erythromycin, Azithromycin	Phenoxymethylpenicillin, Gentamycin, Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Rarely sent	Rarely sent
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired cUTI	Hospital acquired cUTI
Empiric antibiotics prescribed for:-	Ciprofloxacin, Nitrofurantoin, Erythromycin	Ceftriaxone, Levofloxacin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Rarely sent..	On recurrence
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired IAI	Hospital acquired IAI
Empiric antibiotics prescribed for:-	Ciprofloxacin, Levofloxacin, Metronidazole, ornidazole/ofloxacin	Metronidazole, Levofloxacin, Ceftriaxone
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Rarely sent	Rarely sent
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired surgical site infection	Hospital acquired surgical site infection
Empiric antibiotics prescribed for:-	Clindamycin, Metronidazole, Flucloxacillin	Clindamycin, Metronidazole, Flucloxacillin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Rare sent	On diagnosis
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Community acquired skin and soft tissue infection	Hospital acquired skin and soft tissue infection
Empiric antibiotics prescribed for:-	Flucloxacillin, Ampicillin, Cloxacillin, Flucloxacillin, Amoxicillin	Flucloxacillin, Clindamycin, Metronidazole, Amoxicillin
Percentage of time samples sent to microbiology for:-	0%	0%
When during the course of infection are samples sent to microbiology for:-	Rarely sent	Rarely sent
Percentage of the time micro results are received within 48hours for:-	0%	0%

	Hospital acquired bone and joint infection
Empiric antibiotics prescribed for:-	Cloxacillin, Ceftriaxone, Metronidazole, Clindamycin
Percentage of time samples sent to microbiology for:-	0%
When during the course of infection are samples sent to microbiology for:-	Rarely sent
Percentage of the time micro results are received within 48hours for:-	0%

For patients not improving on empiric antibiotics within 24 hours what do you do?	Wait for response after 48 hours
How would you manage a patient improving from sepsis on broad spectrum Abx, and microbiology results show BSI with pan-sensitive E coli?	Maintain the dosage as it is and continue to reassess

F AMR DX CAPACITY ASSESSMENT IN COUNTIES

AMR Dx Capacity assessment in counties

The Ministry of Health, in collaboration with JKUAT, FIND, the global alliance for diagnostics, and GARDP is carrying out an activity to assess AMR diagnostic capacity, antibiotic use and existing antimicrobial stewardship practices in preparation for the introduction of cefiderocol (and other antibiotics) and new low blood culture and molecular Point of care testing (POCT) platforms in Kenya. The activity is taking place at selected levels 4,5 and 6 of health facilities in Isiolo, Laikipia, Vihiga, Nyeri, Nairobi, Kirinyaga, Kericho, Kajiado, Nandi and Kilifi counties.

Please complete this questionnaire for the facilities that you are reporting on, and where indicated, provide additional details on your selected responses.

Findings will be published by MoH, Isiolo, Laikipia, Vihiga, Nyeri, Nairobi, Kirinyaga, Kericho, Kajiado, Nandi and Kilifi Counties, as well as JKUAT, FIND and GARDP.

A PRELIMINARY INFORMATION

County

☐ Isiolo

☐ Laikipia

☐ Vihiga

☐ Nyeri

☐ Nairobi

☐ Kirinyaga

☐ Kericho

☐ Kajiado

☐ Nandi

☐ Kilifi


Sub county

Ward

Name of health facility

Facility code

Assessor name

GPS coordinates	
latitude (x.y °)	
longitude (x.y °)	
altitude (m)	
accuracy (m)	
Assessment date	
yyyy-mm-dd	

B FACILITY CHARACTERISTICS

b1. Level of the health facility <input type="radio"/> Level 4 <input type="radio"/> Level 5 <input type="radio"/> Level 6
b2. Ownership of health facility <input type="radio"/> Public/Government <input type="radio"/> Private <input type="radio"/> NGO/Faith-based/Donors <input type="radio"/> Other
b2.1 Other (specify)

<p>b3. Primary laboratory affiliation</p> <p><input type="radio"/> University teaching hospital/ Medical College</p> <p><input type="radio"/> National referral hospital</p> <p><input type="radio"/> County referral hospital</p> <p><input type="radio"/> Sub_county hospital</p> <p><input type="radio"/> Private hospital</p> <p><input type="radio"/> Faith-based hospital</p>
<p>b4. Number of beds in the health facility</p> <p>.....</p>
<p>b5. What is the average bed occupancy rate</p> <p>.....</p>
<p>b6. Approximate number of people treated in the facility over the last 12 months (Inpatient) <i>consider august 2022 as the reference month</i></p> <p>.....</p>
<p>b7. Approximate number of people treated in the facility over the past 12 months (Outpatient) <i>consider august 2022 as the reference month</i></p> <p>.....</p>
<p>b8. Facility Phone Number</p> <p>.....</p>
<p>b9. Facility email address</p> <p>.....</p>
<p>b10. Name of the lab manager</p> <p>.....</p>
<p>b11. Phone number of the lab manager</p> <p>.....</p>
<p>b12. Lab manager's email address</p> <p>.....</p>

C LABORATORY WORKFORCE

c1. Total number of laboratory staff

c2. Total number of laboratory staff employed by the government

c3. Total number of laboratory staff employed but paid by organizations other than government

c4. Number of staff between ages 20-35 years

c5. Number of staff between ages 36-50 years

c6. Number of staff over 50 years old

D TEST MENU AND WORKLOAD

d.1 Does the lab have capacity to perform cultures

☐ Yes

☐ No

d1.1 Does the lab have capacity to perform fungal cultures

☐ Yes

☐ No

d1.2 What is the main reason why the lab does not perform cultures

d2. Does the lab perform the following cultures

- ☐ Blood
- ☐ Urine
- ☐ Stool
- ☐ Lower Respiratory
- ☐ Upper Respiratory
- ☐ Cerebrospinal Fluid
- ☐ Sterile Body Fluid (pleural, pericardial, peritoneal, synovial)
- ☐ Genital (urethral and cervical)
- ☐ High Vaginal Swab
- ☐ Pus, aspirates and tissue
- ☐ TB

d8. Does the lab conduct manual or automated blood cultures?

- ☐ Automated
- ☐ Manual

d9. What blood culture machine is available?

- ☐ Bactec
- ☐ BacT/ALERT
- ☐ TDR automated blood culture system

d21 Does the lab use any other blood culture machine not listed above

- ☐ Yes
- ☐ No

d22 How many other Blood culture machines are available other than those mentioned above?

indicate a 0 if none

» d23 List the other blood culture machines

d39 Does the lab conduct gram staining?

- ☐ Yes
☐ No

d40 Does the lab conduct antimicrobial susceptibility testing (AST)?

- ☐ Yes
☐ No

d40.1 Does the lab refer samples for AST

- ☐ Patient to another lab
☐ Isolates to another lab

d40.2 Where does the lab refer for AST testing?

- ☐ National referral hospital
☐ County referral hospital
☐ National microbiology reference lab
☐ Private hospitals
☐ Private labs
☐ University teaching hospital/ medical college
☐ Government level 4 hospitals
☐ NGO owned hospital
☐ FBO owned hospital

d41 What manual AST methods are in use?

- ☐ Disk diffusion
- ☐ Gradient strip (e.g Etest/Liofilchem)
- ☐ Broth microdilution (96-well tray)
- ☐ Broth microdilution (tube method)
- ☐ Agar dilution

d42 What automated AST methods are in use?

Leave blank if none applies

- ☐ Vitek
- ☐ Phoenix
- ☐ Microscan
- ☐ SIRScan
- ☐ BIOMIC

d49 Does the lab use any other automated AST methods different from the ones listed above?

- ☐ Yes
- ☐ No

d50 How many other automated AST machines are available other than those mentioned above?

indicate a 0 if none

» d51 List the other automated AST machines

d60 Does the lab use chromagar (chromogenic culture media) to detect antibiotic resistant organisms?

- ☐ Yes
- ☐ No

d61 Does the lab have a PCR (or other nucleic acid tests (NAT)) instrument/Machine used for detecting antibiotic resistance genes?

- ☐ Yes
- ☐ No

d62 What is the machine in use?

d63 What is the TaT (in hours) on this machine?

d64 Is the machine functional today?

☐ Yes

☐ No

d65 Is the user manual present?

☐ Yes

☐ No

d66 Are the routine (user) maintenance records present?

☐ Yes

☐ No

d67 Are the vendor maintenance records present?

☐ Yes

☐ No

d68 Is a service contract in place?

☐ Yes

☐ No

d69 When was the machine last calibrated?

yyyy-mm-dd

d70 Do you conduct specific testing for the detection of MRSA, VRE, carbapenem and/or 3rd gen cephalosporin resistance using phenotypic (chromogenic media, CarbaNP) or genotypic (e.g. Cepheid cartridge) methods?

☐ Yes

☐ No

d71 Mention the tests

☐ Phenotypic (Chromogenic media, CarbaNP)

☐ Genotypic (e.g. Cepheid cartridge) methods

d732 Does the facility receive samples from other facilities for culture and AST?

☐ Yes

☐ No

d73 Indicate the number of samples submitted in 2021

d74 Indicate the number of samples submitted in 2022

d75 Name the facility which sends the highest volume of samples

d76 Does the facility receive isolates from other facilities for AST?

☐ Yes

☐ No

d77 Indicate the number of samples submitted in 2021

d78 Indicate the number of samples submitted in 2022

d79 Name the facility which sends the highest volume of isolates

d80 Who collects samples for blood culture test?

- ☐ Clinician
- ☐ Phlebotomist
- ☐ Lab Personnel
- ☐ Others

d80.1 Other (Specify)

E LIS AND DATA USE

e1. What is the laboratory system for recording culture and AST results?

- ☐ Computer-based laboratory information system (LIS)a. Computer-based laboratory information system (LIS)
- ☐ Electronic but not LIS (e.g word, excel)
- ☐ Handwritten paperwork card
- ☐ Combination of electronic and handwritten

e2. Who is responsible for entering the data in the selected option above?

- ☐ Microbiologist in charge
- ☐ Data clerk
- ☐ Microbiology students/interns
- ☐ IT personnels
- ☐ IT students/interns
- ☐ Lab Personnel

e3. Does the LIS record the AST method used to obtain each individual antibiotic result?

- ☐ Yes
- ☐ No

e4. Does the LIS automatically interpret inhibition zone diameters/MICs into Susceptible, Intermediate, Resistant?

- ☐ Yes
- ☐ No

<p>e5. Does the LIS produce a cumulative antibiogram ?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e6.1 If yes, how often is it updated?</p> <p><input type="radio"/> Quarterly</p> <p><input type="radio"/> Half_yearly</p> <p><input type="radio"/> Annually</p>
<p>e7. Does the LIS interface with automated AST instruments?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e8. Does the LIS interface with hospital information system (HIS)?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e9. What is the laboratory system for reporting to the clinician/client?</p> <p><input type="radio"/> Fully electronic</p> <p><input type="radio"/> Combination of paper and electronic reporting</p> <p><input type="radio"/> Fully paper based</p>
<p>e10. Does the LIS export isolate-based AST data (line list) to .txt or .csv?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e11. Does the facility develop cumulative antibiogram reports using the AMR data?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e11.1 How often?</p> <p><input type="radio"/> Quarterly</p> <p><input type="radio"/> Half_yearly</p> <p><input type="radio"/> Annually</p>

<p>e12. Is the cumulative antibiogram reviewed annually by either AMS or pharmacy and therapeutics committee?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e13. Is the cumulative antibiogram distributed to all physicians?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e13.1 How is the antibiogram distributed?</p> <p><input type="radio"/> Hardcopy</p> <p><input type="radio"/> Electronically</p>
<p>e14. Is the cumulative antibiogram report produced disaggregated by the hospital unit?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e15. Is the cumulative antibiogram report produced limited to a number of pathogens or only specific pathogens?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>e15.1 If yes, what are the reasons?</p> <p>.....</p>
<p>e15.2 Which are these pathogens?</p> <p>.....</p>

F DIAGNOSTIC TEST COST

f1. How does the patient pay for culture and sensitivity testing?

- ☐ Out-of-pocket
- ☐ Medical Insurance (private)
- ☐ Government health scheme (NHIF, UHC, ESIC, CGHS)
- ☐ Free
- ☐ Not Applicable/Bacteriology services not offered

f2. What is the cost to the patient for culture and sensitivity testing for a single patient sample?

f3. What is the cost of a blood culture?

f4. What is the cost to the patient on a PCR/NAT test?

G LABORATORY STAFF EDUCATION

Among laboratory leadership and technical staff in bacteriology, indicate the number that fall in each training level category

g1. Advanced degree in medical microbiology or medical laboratory sciences (PhD)

g2. Master's degree in medical microbiology or medical laboratory sciences

g3L1c. Postgraduate diploma in medical microbiology or medical laboratory sciences

g4. Bachelor's degree in medical microbiology or medical laboratory sciences

g5. Higher National Diploma in medical microbiology or medical laboratory sciences

g6. Diploma in medical laboratory sciences
g7. Certificate in medical laboratory sciences
g8. Indicate other trainings
g9. Does the lab have a standardized process of training new employees? <input type="radio"/> Yes <input type="radio"/> No
g9.1 Please specify
g10. Do employees receive annual competency assessment? (Review lab test menu) <input type="radio"/> Yes <input type="radio"/> No

H QMS MENTORING PROGRAM

h1. Has the laboratory been enrolled to any of the following mentorship programmes <input type="checkbox"/> SLIPTA program <input type="checkbox"/> SLMTA program <input type="checkbox"/> SLIPTA program enrollment ongoing <input type="checkbox"/> SLMTA program enrollment ongoing <input type="checkbox"/> None
h1.1 Other (Please specify)
h1.2 For either SLIPTA or SLMTA, when was the most recent certification awarded? <input type="radio"/> Within the last 2 years <input type="radio"/> More than 2 years ago

h2 What is the star level of the latest SLIPTA audit? *Check certificate*

- ☐ 0 Star
- ☐ 1 Star
- ☐ 2 Stars
- ☐ 3 Stars
- ☐ 4 Stars
- ☐ 5 Stars

h3. Has the laboratory been enrolled in the KNEQAS bacteriology program?

- ☐ Yes
- ☐ No

h3.1 If yes, which year?

h4 What was the last overall percentage score?

- ☐ >90%
- ☐ 70%-89%
- ☐ 50%-69%
- ☐ <49%

h5. Has the laboratory ever been enrolled in any other mentorship program for laboratory quality management?

- ☐ Yes
- ☐ No

h5.1 Mention the program

h5.2 Mention when

yyyy-mm-dd

I ACCREDITATION AND CERTIFICATION

i1 Does the lab possess a valid ISO 15189 accreditation certificate?

Only select yes after confirming the certificate

- ☐ Yes
- ☐ No

i2 Which of the following cultures are covered by the accreditation certificate

- ☐ Blood Cultures
- ☐ Stool Cultures
- ☐ Urine Cultures
- ☐ Organism Identification
- ☐ Antibiotic Susceptibility Testing
- ☐ Other

Specify other.

i3 Who awarded the accreditation?

- ☐ International Laboratory Accreditation Cooperation
- ☐ KENAS
- ☐ NABL
- ☐ JCI
- ☐ Other

i3.1 Other (Please specify)

» J GENERAL FACILITY

j1 Are critical equipment (e.g automated blood culture) supported by a functioning backup system?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

j2 Are critical equipment (e.g automated blood culture) attached to uninterrupted power supply (UPS)?
(Provides temporary power until back-up is activated)

- ☐ Yes
- ☐ No
- ☐ Not Applicable

j3 In the last 6 months, has prolonged power failure disrupted the ability to provide routine bacteriology services?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

j4 Has QA/QC been done in the last 6 months?

- ☐ Yes
- ☐ No

» K INVENTORY AND STOCK OUTS

k1. Does the lab have an inventory control system in place?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

k1.1 If yes, is the inventory management system manual or using software?

- ☐ manual
- ☐ software

k2. In the last 6 months, has the lab experienced stockouts for specimen collection materials? E.g blood culture bottles

- ☐ Yes
- ☐ No
- ☐ Not Applicable

k3. In the last 6 months, has the lab experienced stockouts of consumables? E.g gloves, agar plates

- ☐ Yes
- ☐ No
- ☐ Not Applicable

k4. In the last 6 months, has the lab experienced stockouts of antibiotic disks or strips?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

k5. In the last 6 months, has the lab experienced stockouts of ID or AST cards/trays for automated instruments?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

k6. In the last 6 months, has any stockouts disrupted the lab's ability to provide routine bacteriology services?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

k7. Apart from stock outs, what other challenges hinder you from conducting blood culture in your facility?

Thank you for taking the time out of your day to participate in this assessment. We highly appreciate the information you have provided.

G ABX USE ASSESSMENT IN COUNTIES

ABX Use Assessment in Counties


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A PRELIMINARY INFORMATION

County	*
<input type="radio"/> Isiolo <input type="radio"/> Laikipia <input type="radio"/> Vihiga	
<input type="radio"/> Nyeri <input type="radio"/> Nairobi <input type="radio"/> Kirinyaga	
<input type="radio"/> Kericho <input type="radio"/> Kajiado <input type="radio"/> Nandi	
<input type="radio"/> Kilifi	
Sub county	*
Ward	*
Name of health facility	*
Facility code	*
Name of assessor	*

GPS coordinates	
latitude (x.y °)	
longitude (x.y °)	
altitude (m)	
accuracy (m)	
Assessment date *	
yyyy-mm-dd	

B FACILITY ASSESSMENT

Health Facility Assesment
<p>b1 What is the ownership of the health facility</p> <p> <input type="radio"/> Public <input type="radio"/> Private <input type="radio"/> Faith Based Organisation </p>
<p>b2 What is the level of the health facility</p> <p> <input type="radio"/> Level 4 <input type="radio"/> Level 5 <input type="radio"/> Level 6 </p>
<p>b3 What is the bed capacity of the health facility</p>

<p>b4 What is the bed occupancy rate of the health facility</p> <p><i>Give this as a percentage</i></p> <p>.....</p>
<p>b5 What guides clinicians to request for a bacteriology test?</p> <p><input type="checkbox"/> Patient clinical signs</p> <p><input type="checkbox"/> Guidelines</p> <p><input type="checkbox"/> Research driven</p> <p><input type="checkbox"/> Other</p>
<p>Specify other.</p> <p>.....</p>
<p>b6 Does the health facility have antibiotic guidelines</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>b7 Are the guidelines global, national, county or health facility specific?</p> <p><input type="radio"/> Global</p> <p><input type="radio"/> National</p> <p><input type="radio"/> County</p> <p><input type="radio"/> Health Facility specific</p>
<p>Antibiogram Details</p> <p>.....</p>
<p>b8 Does the health facility have an antibiogram?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>b9 What is the level of disaggregation of the antibiogram details?</p> <p><i>Regional could for example mean the former provinces or one from a level 6 health facility</i></p> <p><input type="radio"/> Country</p> <p><input type="radio"/> Regional</p> <p><input type="radio"/> County</p> <p><input type="radio"/> Health Facility</p>

<p>b10 Take a photograph of the antibiogram</p> <p>Click here to upload file. (< 10MB)</p> <hr/>
<p>b11 How often is the antibiogram updated</p> <p><input type="radio"/> Quarterly</p> <p><input type="radio"/> Semi-annually</p> <p><input type="radio"/> Annually</p> <p><input type="radio"/> Other</p>
<p>Specify other.</p> <hr/>
<p>b12 Where is the antibiogram available</p> <p><input type="checkbox"/> Clinic (Consultation room)</p> <p><input type="checkbox"/> Hospital ward</p> <p><input type="checkbox"/> Hospital Pharmacy</p> <p><input type="checkbox"/> Available Online</p> <p><input type="checkbox"/> Other</p>
<p>Specify other.</p> <hr/>
<p>b13 Is the antibiogram shared with any other facilities/ hospitals?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>
<p>b14 Does the hospital issue an antibiogram during orientation?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>

b15 Who are issued with an antibiogram during orientation?

- ☐ Nurses
- ☐ Medical Officers
- ☐ Clinical Officers
- ☐ Pharmacists
- ☐ Consultants
- ☐ Interns
- ☐ Lab Personnel

b16 Is the antibiogram available to the public?

- ☐ Yes
- ☐ No

Antibiotic formulary

b17 Are you aware about the WHO EML AWaRe list? (2021 AWaRe classification (who.int))

- ☐ Yes
- ☐ No

b18 Select the antibiotics available at the health facility pharmacy from the Access group antibiotics listed

- | | | |
|----------------------------------------------------|--------------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Amikacin | <input type="checkbox"/> Amoxicillin | <input type="checkbox"/> Amoxicillin/clavulanic-acid |
| <input type="checkbox"/> Ampicillin | <input type="checkbox"/> Ampicillin/sulbactam | <input type="checkbox"/> Azidocillin |
| <input type="checkbox"/> Bacampicillin | <input type="checkbox"/> Benzathine-benzylpenicillin | <input type="checkbox"/> Benzylpenicillin |
| <input type="checkbox"/> Brodimoprim | <input type="checkbox"/> Cefacetrile | <input type="checkbox"/> Cefadroxil |
| <input type="checkbox"/> Cefalexin | <input type="checkbox"/> Cefaloridine | <input type="checkbox"/> Cefalotin |
| <input type="checkbox"/> Cefapirin | <input type="checkbox"/> Cefatrizine | <input type="checkbox"/> Cefazedone |
| <input type="checkbox"/> Cefazolin | <input type="checkbox"/> Cefradine | <input type="checkbox"/> Cefroxadine |
| <input type="checkbox"/> Ceftezole | <input type="checkbox"/> Chloramphenicol | <input type="checkbox"/> Clindamycin |
| <input type="checkbox"/> Clometocillin | <input type="checkbox"/> Cloxacillin | <input type="checkbox"/> Dicloxacillin |
| <input type="checkbox"/> Doxycycline | <input type="checkbox"/> Epicillin | <input type="checkbox"/> Flucloxacillin |
| <input type="checkbox"/> Furazidin | <input type="checkbox"/> Gentamicin | <input type="checkbox"/> Hetacillin |
| <input type="checkbox"/> Mecillinam | <input type="checkbox"/> Metampicillin | <input type="checkbox"/> Meticillin |
| <input type="checkbox"/> Metronidazole_IV | <input type="checkbox"/> Metronidazole_oral | <input type="checkbox"/> Nafcillin |
| <input type="checkbox"/> Nifurtinol | <input type="checkbox"/> Nitrofurantoin | <input type="checkbox"/> Ornidazole_IV |
| <input type="checkbox"/> Ornidazole_oral | <input type="checkbox"/> Oxacillin | <input type="checkbox"/> Penamecillin |
| <input type="checkbox"/> Phenoxymethylpenicillin | <input type="checkbox"/> Pivampicillin | <input type="checkbox"/> Pivmecillinam |
| <input type="checkbox"/> Procaine-benzylpenicillin | <input type="checkbox"/> Propicillin | <input type="checkbox"/> Secnidazole |
| <input type="checkbox"/> Spectinomycin | <input type="checkbox"/> Sulbactam | <input type="checkbox"/> Sulfadiazine |
| <input type="checkbox"/> Sulfadiazine/tetroxoprim | <input type="checkbox"/> Sulfadiazine/trimethoprim | <input type="checkbox"/> Sulfadimethoxine |
| <input type="checkbox"/> Sulfadimidine | <input type="checkbox"/> Sulfadimidine/trimethoprim | <input type="checkbox"/> Sulfafurazole |
| <input type="checkbox"/> Sulfaisodimidine | <input type="checkbox"/> Sulfalene | <input type="checkbox"/> Sulfamazone |
| <input type="checkbox"/> Sulfamerazine | <input type="checkbox"/> Sulfamerazine/trimethoprim | <input type="checkbox"/> Sulfamethizole |
| <input type="checkbox"/> Sulfamethoxazole | <input type="checkbox"/> Sulfamethoxazole/trimethoprim | <input type="checkbox"/> Sulfamethoxypyridazine |
| <input type="checkbox"/> Sulfametomidine | <input type="checkbox"/> Sulfametoxydiazine | <input type="checkbox"/> Sulfametrole/trimethoprim |
| <input type="checkbox"/> Sulfamoxole | <input type="checkbox"/> Sulfamoxole/trimethoprim | <input type="checkbox"/> Sulfanilamide |
| <input type="checkbox"/> Sulfaperin | <input type="checkbox"/> Sulfaphenazole | <input type="checkbox"/> Sulfapyridine |
| <input type="checkbox"/> Sulfathiazole | <input type="checkbox"/> Sulfathiourea | <input type="checkbox"/> Sultamicillin |
| <input type="checkbox"/> Talampicillin | <input type="checkbox"/> Tetracycline | <input type="checkbox"/> Thiamphenicol |
| <input type="checkbox"/> Tinidazole_IV | <input type="checkbox"/> Tinidazole_oral | <input type="checkbox"/> Trimethoprim |

b19 Select the antibiotics available at the health facility pharmacy from the Watch group antibiotics listed

- | | | |
|----------------------------------------------|--------------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> Arbekacin | <input type="checkbox"/> Aspoxicillin | <input type="checkbox"/> Azithromycin |
| <input type="checkbox"/> Azlocillin | <input type="checkbox"/> Bekanamycin | <input type="checkbox"/> Biapenem |
| <input type="checkbox"/> Carbenicillin | <input type="checkbox"/> Carindacillin | <input type="checkbox"/> Cefaclor |
| <input type="checkbox"/> Cefamandole | <input type="checkbox"/> Cefbuperazone | <input type="checkbox"/> Cefcapene-pivoxil |
| <input type="checkbox"/> Cefdinir | <input type="checkbox"/> Cefditoren-pivoxil | <input type="checkbox"/> Cefepime |
| <input type="checkbox"/> Cefetamet-pivoxil | <input type="checkbox"/> Cefixime | <input type="checkbox"/> Cefmenoxime |
| <input type="checkbox"/> Cefmetazole | <input type="checkbox"/> Cefminox | <input type="checkbox"/> Cefodizime |
| <input type="checkbox"/> Cefonicid | <input type="checkbox"/> Cefoperazone | <input type="checkbox"/> Ceforanide |
| <input type="checkbox"/> Cefoselis | <input type="checkbox"/> Cefotaxime | <input type="checkbox"/> Cefotetan |
| <input type="checkbox"/> Cefotiam | <input type="checkbox"/> Cefoxitin | <input type="checkbox"/> Cefozopran |
| <input type="checkbox"/> Cefpiramide | <input type="checkbox"/> Cefpirome | <input type="checkbox"/> Cefpodoxime-proxetil |
| <input type="checkbox"/> Cefprozil | <input type="checkbox"/> Cefsulodin | <input type="checkbox"/> Ceftazidime |
| <input type="checkbox"/> Cefteram-pivoxil | <input type="checkbox"/> Ceftibuten | <input type="checkbox"/> Ceftizoxime |
| <input type="checkbox"/> Ceftriaxone | <input type="checkbox"/> Cefuroxime | <input type="checkbox"/> Chlortetracycline |
| <input type="checkbox"/> Cinoxacin | <input type="checkbox"/> Ciprofloxacin | <input type="checkbox"/> Clarithromycin |
| <input type="checkbox"/> Clofoctol | <input type="checkbox"/> Clomocycline | <input type="checkbox"/> Delafloxacin |
| <input type="checkbox"/> Demeclocycline | <input type="checkbox"/> Dibekacin | <input type="checkbox"/> Dirithromycin |
| <input type="checkbox"/> Doripenem | <input type="checkbox"/> Enoxacin | <input type="checkbox"/> Ertapenem |
| <input type="checkbox"/> Erythromycin | <input type="checkbox"/> Fidaxomicin | <input type="checkbox"/> Fleroxacin |
| <input type="checkbox"/> Flomoxef | <input type="checkbox"/> Flumequine | <input type="checkbox"/> Flurithromycin |
| <input type="checkbox"/> Fosfomycin_oral | <input type="checkbox"/> Fusidic-acid | <input type="checkbox"/> Garenoxacin |
| <input type="checkbox"/> Gatifloxacin | <input type="checkbox"/> Gemifloxacin | <input type="checkbox"/> Grepafloxacin |
| <input type="checkbox"/> Imipenem/cilastatin | <input type="checkbox"/> Isepamicin | <input type="checkbox"/> Josamycin |
| <input type="checkbox"/> Kanamycin_IV | <input type="checkbox"/> Kanamycin_oral | <input type="checkbox"/> Lascufloxacin |
| <input type="checkbox"/> Latamoxef | <input type="checkbox"/> Levofloxacin | <input type="checkbox"/> Levonadifloxacin |
| <input type="checkbox"/> Lincomycin | <input type="checkbox"/> Lomefloxacin | <input type="checkbox"/> Loracarbef |
| <input type="checkbox"/> Lymecycline | <input type="checkbox"/> Meropenem | <input type="checkbox"/> Metacycline |
| <input type="checkbox"/> Mezlocillin | <input type="checkbox"/> Micronomicin | <input type="checkbox"/> Midecamycin |
| <input type="checkbox"/> Minocycline_oral | <input type="checkbox"/> Miocamycin | <input type="checkbox"/> Moxifloxacin |
| <input type="checkbox"/> Nemonoxacin | <input type="checkbox"/> Neomycin_IV | <input type="checkbox"/> Neomycin_oral |
| <input type="checkbox"/> Netilmicin | <input type="checkbox"/> Norfloxacin | <input type="checkbox"/> Ofloxacin |
| <input type="checkbox"/> Oleandomycin | <input type="checkbox"/> Oxolinic-acid | <input type="checkbox"/> Oxytetracycline |
| <input type="checkbox"/> Panipenem | <input type="checkbox"/> Pazufloxacin | <input type="checkbox"/> Pefloxacin |
| <input type="checkbox"/> Penimepicycline | <input type="checkbox"/> Pheneticillin | <input type="checkbox"/> Pipemidic-acid |
| <input type="checkbox"/> Piperacillin | <input type="checkbox"/> Piperacillin/tazobactam | <input type="checkbox"/> Pivoxilic acid |

<input type="checkbox"/> Piperacillin	<input type="checkbox"/> Piperacillin/tazobactam	<input type="checkbox"/> Piromidic-acid
<input type="checkbox"/> Pristinamycin	<input type="checkbox"/> Prulifloxacin	<input type="checkbox"/> Ribostamycin
<input type="checkbox"/> Rifabutin	<input type="checkbox"/> Rifampicin	<input type="checkbox"/> Rifamycin_IV
<input type="checkbox"/> Rifamycin_oral	<input type="checkbox"/> Rifaximin	<input type="checkbox"/> Rokitamycin
<input type="checkbox"/> Rolitetracycline	<input type="checkbox"/> Rosoxacin	<input type="checkbox"/> Roxithromycin
<input type="checkbox"/> Rufloxacin	<input type="checkbox"/> Sarecycline	<input type="checkbox"/> Sisomicin
<input type="checkbox"/> Sitafloracin	<input type="checkbox"/> Solithromycin	<input type="checkbox"/> Sparfloxacin
<input type="checkbox"/> Spiramycin	<input type="checkbox"/> Streptoduocin	<input type="checkbox"/> Streptomycin_IV
<input type="checkbox"/> Streptomycin_oral	<input type="checkbox"/> Sulbenicillin	<input type="checkbox"/> Tazobactam
<input type="checkbox"/> Tebipenem	<input type="checkbox"/> Teicoplanin	<input type="checkbox"/> Telithromycin
<input type="checkbox"/> Temafloxacin	<input type="checkbox"/> Temocillin	<input type="checkbox"/> Ticarcillin
<input type="checkbox"/> Tobramycin	<input type="checkbox"/> Tosufloxacin	<input type="checkbox"/> Troleandomycin
<input type="checkbox"/> Trovafloxacin	<input type="checkbox"/> Vancomycin_IV	<input type="checkbox"/> Vancomycin_oral

b20 Select the antibiotics available at the health facility pharmacy from the Reserve group antibiotics listed

<input type="checkbox"/> Aztreonam	<input type="checkbox"/> Carumonam	<input type="checkbox"/> Cefiderocol
<input type="checkbox"/> Ceftaroline-fosamil	<input type="checkbox"/> Ceftazidime/avibactam	<input type="checkbox"/> Ceftobiprole-medocaril
<input type="checkbox"/> Ceftolozane/tazobactam	<input type="checkbox"/> Colistin_IV	<input type="checkbox"/> Colistin_oral
<input type="checkbox"/> Dalbavancin	<input type="checkbox"/> Dalfopristin/quinupristin	<input type="checkbox"/> Daptomycin
<input type="checkbox"/> Eravacycline	<input type="checkbox"/> Faropenem	<input type="checkbox"/> Fosfomycin_IV
<input type="checkbox"/> Iclaprim	<input type="checkbox"/> Imipenem/cilastatin/relebactam	<input type="checkbox"/> Lefamulin
<input type="checkbox"/> Linezolid	<input type="checkbox"/> Meropenem/vaborbactam	<input type="checkbox"/> Minocycline_IV
<input type="checkbox"/> Omadacycline	<input type="checkbox"/> Oritavancin	<input type="checkbox"/> Plazomicin
<input type="checkbox"/> Polymyxin-B_IV	<input type="checkbox"/> Polymyxin-B_oral	<input type="checkbox"/> Tedizolid
<input type="checkbox"/> Telavancin	<input type="checkbox"/> Tigecycline	

b21 When was the existing antibiotic formulary last updated

yyyy-mm-dd

b22 Do available guidelines match formulary?

☐ Yes

☐ No

» B2. Staff Strength

Physician capacity
b22 What is the number of Infectious disease specialists
b22.1 What is the number of medical officers
b23 What is the number of Interns
b24 What is the number of physicians at the ICU
Nursing staff available
b25 What is the number of nurses in the medical unit
b26 What is the bed capacity of the medical unit
The patient to nurse ratio in the medical unit is NaN
b27 What is the number of nurses in the surgical unit
b28 What is the bed capacity of the surgical unit
The patient to nurse ratio in the surgical unit is NaN
b29 What is the number of nurses in the ICU

b30 What is the bed capacity in the ICU
The patient to nurse ratio in the ICU is NaN
b31 What is the number of nurses in the HDU
b32 What is the bed capacity in the HDU
The patient to nurse ratio in the HDU is NaN
Nursing Staff Clinical capabilities
b33 Where is the highest frequency of IV administration <input type="radio"/> Medical Unit <input type="radio"/> Surgical Unit <input type="radio"/> ICU <input type="radio"/> HDU

» **B3. Infrastructure available**

Ward infrastructure
b34 What is the number of IV pumps available in the medial department
b35 What is the number of IV pumps available in the surgical department
b36 What is the number of IV pumps available in the ICU department
b37 What is the number of IV pumps available in the HDU

Drug dispensation
b38 How many satellite pharmacies are in the medical unit
b39 How many satellite pharmacies are in the surgical department
b40 How many satellite pharmacies are in the ICU
b41 How many satellite pharmacies are in the HDU

C Pharmacy (Questions for Pharmacists)

c1 How many pharmacies, either on site or nearby operate for 24 hours?
c2 What is the total number of pharmacists in the health facility?
c3 What is the total number of pharmaceutical technologists in the health facility?
c4 Have the staff attended any AMS training(s) in the course of their work? <input type="radio"/> Yes <input type="radio"/> No
c4.1 List the AMS trainings attended by the Pharmacists;
c4.2 List the AMS trainings attended by the Pharmaceutical technologists;

c5 Who does the reconstitution of antibiotics?

- ☐ Pharmacist
- ☐ Pharmaceutical technologist
- ☐ Nurses
- ☐ Clinicians
- ☐ Other

Specify other.

.....

c6 Who provides drug information?

- ☐ Pharmacist
- ☐ Pharmaceutical technologist
- ☐ Nurses
- ☐ Clinicians
- ☐ Other

Specify other.

.....

D Stewardship (Questions for Physicians and Microbiologists)

d1 Are stewardship guidelines or policies available

- ☐ Yes
- ☐ No

d2 Do you have an existing Antimicrobial Stewardship Committee?

- ☐ Yes
- ☐ No

d3 When was it formed?

yyyy-mm-dd

.....

d4 Has it been functional?

- ☐ Yes
- ☐ No

d5 List out few of the key activities the Antimicrobial Stewardship Committee have been involved in;

d6 Do you have stewardship interventions on the formulary restrictions?

- ☐ Yes
- ☐ No

d7 What antibiotics have the stewardship intervention on the formulary restrictions?

d8 What do the restrictions state?

d9 Is preauthorisation required?

- ☐ Yes
- ☐ No

d10 What antibiotics are preauthorised?

d11 Who provides preauthorization?

- ☐ Medical Officers
- ☐ Clinical Officers
- ☐ Pharmacists
- ☐ Consultants
- ☐ Other

Specify other.

d12 How is preauthorization provided?

- ☐ Electronically
- ☐ Verbally
- ☐ Manually (written)
- ☐ Other

Specify other.

d13 Is there a prospective audit?

- ☐ Yes
- ☐ No

d14 For which antibiotics?

d15 For which wards?

- ☐ Medical Unit
- ☐ Surgical Unit
- ☐ ICU
- ☐ HDU
- ☐ Other

Specify other.

d16 Who performs prospective audit?

d17 Do you carry out stewardship rounds?

- ☐ Yes
- ☐ No

d18 Who performs stewardship rounds?

d19 What is the frequency of the stewardship rounds?

e.g monthly, quarterly, yearly...

d20 Which wards have stewardship rounds?

- ☐ Medical Unit
- ☐ Surgical Unit
- ☐ ICU
- ☐ HDU
- ☐ Other

Specify other.

d21 When was the last stewardship ward round conducted?

yyyy-mm-dd

d22 Is there retrospective audit?

- ☐ Yes
- ☐ No

d23 For which antibiotics?

d24 What is the frequency of the retrospective audits?

e.g monthly, quarterly, yearly...

d25 For which wards?

- ☐ Medical Unit
- ☐ Surgical Unit
- ☐ ICU
- ☐ HDU
- ☐ Other

Specify other.

d26 Who performs retrospective audit

E Infection Prevention and Control

e1 How many handwashing stations are available outside and inside wards?

e.g 13 stations for 10 wards

e2 Do you report hospital acquired infections?

☐ Yes

☐ No

e3 Which infections per ward?

e4 How are these results communicated to clinical and nursing staff?

e5 Do you do cohorting or isolation of patients with AMR?

☐ Yes

☐ No

e6 For which resistance profiles?

e7 Describe cohorting or isolation procedures (SOPs)

e8 Are isolation procedures clearly displayed?

- ☐ Yes
- ☐ No

e9 How are payments for patients made?

- ☐ Cash
- ☐ Medical insurance (private)
- ☐ Government health scheme (NHIF, UHC, ESIC, CGHS)
- ☐ Free

F Qualitative Assessment- (Questions for Physicians)

f1 What is the field of specialization

f2 Years of experience

f3 Ward

f4 Do you have access to the hospital antibiogram if available?

- ☐ Yes
- ☐ No

f5 How often do you use the hospital antibiogram?

f6 Do you have access to antibiotic guidelines?

- ☐ Yes
- ☐ No

f7 Which guidelines do you use?

- ☐ National Guidelines
- ☐ WHO Guidelines
- ☐ County Guidelines
- ☐ Hospital Guidelines
- ☐ Other

Specify other.

f8 Do you share the Hospital antibiogram with any other nearby facility or Hospital

☐ Yes

☐ No

G Sepsis infection

g1 What empiric antibiotics (if any) do you prescribe for community acquired Sepsis?

g2 What empiric antibiotics (if any) do you prescribe for hospital acquired Sepsis?

g3 What percentage of the time do you send samples to microbiology for community acquired Sepsis?

g4 What percentage of the time do you send samples to microbiology for hospital acquired Sepsis?

g5 When during the course of infection do you send samples for community acquired Sepsis?

g6 When during the course of infection do you send samples for hospital acquired Sepsis?

g7 What percentage of the time do you receive micro results within 48hours for community acquired Sepsis?

g8 What percentage of the time do you receive micro results within 48hours for hospital acquired Sepsis?

Pneumonia infection

h1 What empiric antibiotics (if any) do you prescribe for community acquired Pneumonia?

h2 What empiric antibiotics (if any) do you prescribe for hospital acquired/ventilator associated Pneumonia?

h3 What percentage of the time do you send samples to microbiology for community acquired Pneumonia?

h4 What percentage of the time do you send samples to microbiology for hospital acquired/ventilator associated Pneumonia?

h5 When during the course of infection do you send samples for community acquired Pneumonia?

h6 When during the course of infection do you send samples for hospital acquired/ventilator associated Pneumonia?

h7 What percentage of the time do you receive micro results within 48hours for community acquired Pneumonia?

h8 What percentage of the time do you receive micro results within 48hours for hospital acquired/ventilator associated Pneumonia?

I cUTI

i1 What empiric antibiotics (if any) do you prescribe for community acquired cUTI?

i2 What empiric antibiotics (if any) do you prescribe for hospital acquired cUTI?

i3 What percentage of the time do you send samples to microbiology for community acquired cUTI?
i4 What percentage of the time do you send samples to microbiology for hospital acquired cUTI?
i5 When during the course of infection do you send samples for community acquired cUTI? <i>e.g. when clinical symptoms persist or during a recurrence</i>
i6 When during the course of infection do you send samples for hospital acquired cUTI?
i7 What percentage of the time do you receive micro results within 48hours for community acquired cUTI?
i8 What percentage of the time do you receive micro results within 48hours for hospital acquired cUTI?

IAI

j1 What empiric antibiotics (if any) do you prescribe for community acquired IAI?
j2 What empiric antibiotics (if any) do you prescribe for hospital acquired IAI?
j3 What percentage of the time do you send samples to microbiology for community acquired IAI?
j4 What percentage of the time do you send samples to microbiology for hospital acquired IAI?
j5 When during the course of infection do you send samples for community acquired IAI? <i>e.g. when clinical symptoms persist or during a recurrence</i>
j6 When during the course of infection do you send samples for hospital acquired IAI?

j7 What percentage of the time do you receive micro results within 48hours for community acquired IAI?

j8 What percentage of the time do you receive micro results within 48hours for hospital acquired IAI?

K Surgical site infection

k1 What empiric antibiotics (if any) do you prescribe for community acquired Surgical site infection?

k2 What empiric antibiotics (if any) do you prescribe for hospital acquired Surgical site infection?

k3 What percentage of the time do you send samples to microbiology for community acquired Surgical site infection?

k4 What percentage of the time do you send samples to microbiology for hospital acquired Surgical site infection?

k5 When during the course of infection do you send samples for community acquired Surgical site infection?

e.g. when clinical symptoms persist or during a recurrence

k6 When during the course of infection do you send samples for hospital acquired Surgical site infection?

k7 What percentage of the time do you receive micro results within 48hours for community acquired Surgical site infection?

k8 What percentage of the time do you receive micro results within 48hours for hospital acquired Surgical site infection?

L Skin and soft tissue infection

I1 What empiric antibiotics (if any) do you prescribe for community acquired Skin and soft tissue infection?

I2 What empiric antibiotics (if any) do you prescribe for hospital acquired Skin and soft tissue infection?

I3 What percentage of the time do you send samples to microbiology for community acquired Skin and soft tissue infection?

I4 What percentage of the time do you send samples to microbiology for hospital acquired Skin and soft tissue infection?

I5 When during the course of infection do you send samples for community acquired Skin and soft tissue infection?

e.g. when clinical symptoms persist or during a recurrence

I6 When during the course of infection do you send samples for hospital acquired Skin and soft tissue infection?

I7 What percentage of the time do you receive micro results within 48hours for community acquired Skin and soft tissue infection?

I8 What percentage of the time do you receive micro results within 48hours for hospital acquired Skin and soft tissue infection?

M Bone and joint infection

m1 What empiric antibiotics (if any) do you prescribe for hospital acquired Bone and joint infection?

m2 What percentage of the time do you send samples to microbiology for hospital acquired Bone and joint infection?

m3 When during the course of infection do you send samples for hospital acquired Bone and joint infection?

e.g. when clinical symptoms persist or during a recurrence

m4 What percentage of the time do you receive micro results within 48hours for hospital acquired Bone and joint infection?

n1 If the patient is not improving on empiric antibiotics within 24 hours what do you do?

n2 How would you manage a patient improving from sepsis on broad spectrum abx, and microbiology results show BSI with pan-sensitive E coli

n3 Detail out the Challenges/ barriers in implementing the proper Antibiotic usage in your facility.

- ☐ Patient behavior in using antibiotics ☐ Lack of appropriate implementation of guidelines
☐ Lack of specific antibiogram for primary care ☐ Competition amongst clinicians
☐ Lack of departmental co-ordination ☐ Unclear clinical presentation ☐ Lack of diagnostic capability
☐ Restricted time of consultation ☐ Clinician knowledge and practices ☐ Other

Specify other.

n4 What steps can be taken to improve the existing scenario (click on 'NEXT' then 'Add' to continue or 'Do not add' to end)

1

n5 Please list 3 to 5 major steps

e.g. continuous training

Thank you for taking the time out of your day to participate in this assessment. We highly appreciate the information you have provided.
