Module 4: Antimicrobial Stewardship Interventions and Diagnostic Stewardship

Learning Objectives

By the end of this module, you should be able to:

1. Outline the priority and other antimicrobial stewardship (AMS) interventions.
2. Describe how AMS teams can utilize AWaRe classification to guide antimicrobial prescribing and promote responsible use.
3. Recognize the role of AMS in reducing irrational antibiotic use and combating antimicrobial resistance (AMR).

Introduction

- Globally, antibiotics are:
  - **Overused** and **misused** due to poor prescribing practices (in many settings >50% of antibiotic prescriptions are inappropriate).
  - **Underused** due to poor access to needed medicines.
- Access to, and appropriate use of good quality antimicrobials is a key priority of global strategies to combat antimicrobial resistance (AMR).

Priority AMS Interventions

1. Clinical Review and Direct Prescriber Feedback

This refers to the assessment of antimicrobial prescriptions with structured feedback to prescribers to improve appropriateness of use (WHO, 2019).

Priority AMS Interventions

Clinical Review and Direct Prescriber Feedback can take several forms:

- **Multidisciplinary Team (MDT) Ward Rounds:** Real-time bedside reviews of antimicrobial prescriptions by an MDT (e.g., clinician, pharmacist, microbiology team, nurse), with immediate feedback to the prescriber. Key focus areas include: redundant or duplicate therapy, adherence to guidelines or culture results, dose optimization, intravenous (IV)-to-oral switch, and appropriate duration.
- **Prospective Audit with Feedback:** A real-time or near-real-time external review of antimicrobial prescriptions by trained AMS personnel, followed by recommendations to optimize therapy. This approach supports learning and behavioral change and can be adapted based on available expertise, national AMS protocols and antimicrobial surveillance methodologies.
- **Retrospective Audit with Feedback:** A review conducted after therapy has been completed, focusing on trends, guideline compliance, and outcomes. Findings inform prescriber feedback, guideline updates, and quality improvement activities.

Priority AMS Interventions…

2. Restricted availability of antimicrobials and pre-authorisation: Certain antibiotics are subject to restricted use and require expert approval before initiation due to their critical role in treating severe or drug-resistant infections and their high potential to develop resistance. (Watch and Reserve antibiotics) This approach ensures optimal dosing, prevents inappropriate use, protects against resistance and helps preserve the effectiveness of these antibiotics for when they are truly needed. (*AWaRe classification is discussed later in the module*)

Priority AMS Interventions…

3. Guidelines and clinical pathways for antimicrobial use: Antibiotic prescribing should be guided by evidence-based guidelines to ensure appropriate selection, dosing, and duration—especially for common infections. While national guidelines provide a foundation, hospital-specific recommendations should also account for local resistance and susceptibility patterns, available formulary options, and the patient population served.

Clinician & Pharmacy-based Interventions

1. **Antimicrobial timeout:** This is a structured reassessment of the ongoing need, spectrum, and route of antimicrobial therapy once more clinical and diagnostic information becomes available—typically within **48 to 72 hours** of initiation. Based on the clinical reassessment, the outcome may involve one of the following interventions:
   - **Streamlining or De-escalation of Therapy:** involves narrowing the spectrum of antimicrobial coverage or reducing the number of agents used, based on confirmed culture results and clinical improvement. For example, switching from broad-spectrum empiric therapy to a targeted agent directed at a specific pathogen. It reduces unnecessary exposure to broad-spectrum antibiotics and minimizes the risk of AMR, adverse effects, and cost
   - **Escalation of Therapy:** If the patient is not responding clinically or if diagnostic tests indicate a more severe or resistant infection, therapy may be broadened or intensified to ensure adequate treatment
   - **Discontinuation of Therapy:** If it is determined that an infection is unlikely, or the clinical situation improves and no longer requires antimicrobials, therapy is stopped. This avoids unnecessary treatment, reduces side effects, and supports good stewardship by preventing overuse

Clinician & Pharmacy-based Interventions…

2. Documentation of indication: Requiring an indication for every prescription to facilitate prospective audit and feedback, and improve antimicrobial use and review.

3. Intravenous (IV) to oral switch: in appropriate situations and for antibiotics with good absorption (e.g., metronidazole, fluoroquinolones, linezolid, etc.) switch to oral therapy is recommended. It improves patient safety by reducing the need for intravenous access.

4. Dose adjustment: should be considered in cases of organ dysfunction, particularly renal impairment, or based on results from therapeutic drug monitoring (TDM).

Clinician & Pharmacy-based Interventions…

5. Dose optimization: involves strategies such as extended-infusion administration of beta-lactams, especially in critically ill patients or those infected with drug-resistant pathogens, to enhance pharmacodynamic effectiveness.

6. Duplicative therapy alerts: Alerts to clinicians where prescriptions may be overlapping spectra of activity or duplicative (e.g., overlapping anaerobic activity)

7. Time-sensitive or automatic stop orders: For certain antibiotic prescriptions (e.g., surgical prophylaxis) therapy is automatically discontinued based on recommended durations outlined in clinical guidelines. This applies whether or not the prescriber specifies a duration, and is done to ensure antibiotics are not continued longer than necessary.

Clinician & Pharmacy-based Interventions…

8. Detection and prevention of antibiotic-related drug-drug interactions: such as interactions between some orally administered fluoroquinolones and certain vitamins.

Microbiology-based Interventions

1. **Selective reporting:** involves tailoring laboratory reports to display only those antibiotics that align with hospital treatment guidelines or are recommended by the antimicrobial stewardship program, thereby promoting appropriate prescribing and minimizing unnecessary broad-spectrum antibiotic use.
2. **Comments in microbiology results:** the microbiology team can include comments such as indicating when an isolated organism is likely to represent colonization or contamination—to help guide appropriate antimicrobial use.

Nursing-based interventions

1. **Optimizing microbiology cultures:** Ensuring techniques to reduce contamination and indications for when to obtain cultures, especially urine cultures
2. **Intravenous to oral switch transitions:** Nurses, being closely involved in patient care, are often the first to recognize when a patient can tolerate oral medications and can initiate discussions on switching from IV to oral antibiotics
3. **Prompting antimicrobial reviews:** Nurses are often well-informed about the duration of antibiotic therapy, the patient's clinical progress, and the anticipated availability of laboratory results. They are well-placed to prompt timely re-evaluations of antimicrobial therapy, either at specified intervals or when clinically appropriate

Other Basic AMS Interventions

- Educate prescribers and health personnel involved in antibiotic use.
- Develop and update a standardized medical record and medical chart to ensure that information on antimicrobial therapy is all in one place.
- Development and use of prescribing aids

Community-based AMS Interventions

1. **Education and training:**
   - **Prescriber Education:** Engage private practitioners and other prescribers on antimicrobial stewardship (AMS) principles and appropriate prescribing practices.
   - **Patient and Public Education:** Promote responsible use, storage, and disposal of antimicrobials, and raise awareness on infection prevention strategies such as hand hygiene, vaccination, and hygiene practices.
   - **Community Health Practitioners (CHPs):** Train CHPs on patient counselling, infection prevention, safe disposal of antimicrobials, and timely referral of suspected infections to appropriate healthcare providers.

Community-based AMS Interventions…

2. **Dissemination of prescribing aids:** Disseminate standard guidelines/treatment algorithms in multiple formats e.g., electronic, hard-copy – including pocket cards, through targeted education initiatives to improve awareness and adherence
3. **Maintain good inventory practices:** Utilize antimicrobial registers and support national surveillance of antimicrobials.
4. **Alternative therapies:** Recommend therapies other than antimicrobials for minor ailments, particularly for cold and flus which are largely caused by viruses.
5. **Preventative care**: Engage in preventive care activities and services that promote public health and prevent infectious diseases.

Access, Watch, and Reserve (AWaRe) Categorization

- The **AWaRe** classification of antibiotics was developed 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.
- The AWaRe classification is a tool for monitoring antibiotic consumption, defining targets and monitoring the effects of stewardship policies that aim to optimize antibiotic use and curb antimicrobial resistance.

Categorization of Antibiotics

- WHO developed antibiotic classification to improve access to appropriate treatment and reduce inappropriate use of antibiotics.
- Antibiotics are classified into three groups, ***Access, Watch and Reserve***, taking into account the impact of different antibiotics and antibiotic classes on antimicrobial resistance, to emphasize the importance of their appropriate use.
- The classification is updated every 2 years by WHO.
- *AWaRe* should be applied to a country's essential medicines list (EML), where antibiotics are placed into one of these three primary categories.
- The classification for antibiotics is designed to integrate antibiotic stewardship efforts to reduce and control antimicrobial resistance on a global scale.

Goals of AWaRe Categorization

Overall goal

To optimise the use of antibiotics and reduce AMR by limiting the use of antibiotics in the ***Watch*** and ***Reserve*** groups (the antibiotics most crucial for human medicine and at higher risk of resistance) and to promote the use of ***Access*** antibiotics as first line or second line treatment where necessary

Specific goals

1. At least 70% of antibiotics used for human health globally should be in the WHO ***Access*** category (UNGA HLM on AMR, 2024)
2. Reduce antibiotic prescribing and consumption from the ***Watch*** and ***Reserve*** categories

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Advantages of AWaRe Categorization

- **Increased access, reduced costs**: many of the antibiotics in the ***Access*** list are among the most affordable.
- **Better therapeutic results**: the ***AWaRe*** categories specify which antibiotics to use for specific syndromes, including when a laboratory diagnosis is not available.
- **Public health gains**: antibiotics, one of the biggest advancements in modern medicine, will maintain their life-saving effectiveness by increasing use of medicines on the ***Access*** list and reducing the use of those on ***Watch*** and ***Reserve*** lists.

  – The WHO AWaRe (Access, Watch, Reserve) antibiotic book

Classification of Antibiotics - Access Group

- Are effective against a broad range of commonly encountered susceptible pathogens and have a low potential for developing resistance.
- They are the preferred choice for treating the most common infectious diseases.
- They should always be available, affordable, and quality-assured.
- WHO Global Programme of Work includes a target that at least 60% of total antibiotic prescribing at the country level should be Access antibiotics.

Examples

- Amoxicillin + clavulanic acid
- Ampicillin
- Benzathine
- Benzylpenicillin
- Cefalexin
- Cefazolin
- Doxycycline
- Metronidazole
- Nitrofurantoin
- Phenoxymethylpenicillin (Penicillin V)
- Tinidazole

Kenya essential medicines list

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Categorization of Antibiotics - Watch Group

- Are broader-spectrum antibiotics.
- Essential first-choice or second-choice empirical treatment options, but only for a limited number of specific infectious diseases.
- Are recommended as first-choice options for patients with more severe clinical presentations or for infections where the causative pathogens are more likely to be resistant.
- They have a higher potential for resistance or greater toxicity concerns hence should be prioritized as key targets for national and local AMR stewardship programs and monitoring efforts.

- **Examples**
- Azithromycin
- Cefixime
- Cefotaxime
- Ceftazidime
- Ceftriaxone
- Cefuroxime
- Ciprofloxacin
- Clarithromycin
- Clindamycin
- Cotrimoxazole
- (Sulfamethoxazole + Trimethoprim)
- Erythromycin
- Piperacillin + Tazobactam

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Categorization of Antibiotics- Reserve

- Reserve antibiotics should be reserved for treating confirmed infections caused by multidrug-resistant bacteria.
- They should be used as a **last resort** when other antibiotics fail or are unsuitable in highly specific patients and clinical settings.
- They should be protected and prioritized as key targets for AMR stewardship programs, involving monitoring and utilization reporting, to preserve their effectiveness.

Examples

- Ceftazidime + avibactam
- Colistin
- Fosfomycin
- Linezolid
- Meropenem
- Polymyxin B
- Teicoplanin
- Tigecycline
- Vancomycin

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Special Category- Discouraged Antibiotics

- WHO included a fourth category which, technically is not part of the AWaRe categorization, but is an important category to know for those who are selecting medicines for EML.
- Mostly includes antibiotic fixed-dose combinations
- They do not have any reasonable indications for the treatment of infectious diseases in humans and may negatively affect the control of AMR and patient safety.
- Consequently, WHO recommends that these combination antibiotics be excluded from national EMLs.

Examples

- Azithromycin+cefixime,
- Ofloxacin+ornidazole,
- Cefpodoxime+levofloxacin,
- Ceftriaxone/sulbactam
- Amoxicillin/cloxacillin,
- Amoxicillin/flucloxacillin,
- Amoxicillin/metronidazole,
- Cefadroxil/clavulanic acid

Considerations for Antimicrobial Prescribing

1. **Diagnose:** What is the clinical diagnosis? Is there evidence of a significant bacterial infection?
2. **Decide**: Are antibiotics necessary? Should I collect cultures or perform other tests?
3. **Drug (Medicine)**: Which antibiotic should be prescribed? Is it categorized as Access, Watch, or Reserve? Are there any allergies, drug interactions, or other contraindications?
4. **Dose**: What is the appropriate dose and frequency? Are dose adjustments required, such as in cases of renal impairment?

Considerations for Antimicrobial Prescribing…

5. **Delivery**: Which formulation should be used? Is the product of good quality? If intravenous treatment is needed, when can a step-down to oral delivery occur?
6. **Duration**: How long should the treatment last? What is the stop date?
7. **Discuss:** Inform the patient about the diagnosis, expected duration of symptoms, and any relevant medication information.
8. **Document** – write down all decisions and the management plan

Diagnostic Stewardship

Diagnostic stewardship refers to a series of coordinated guidance and interventions to improve appropriate use of microbiological diagnostics to guide therapeutic decisions.
WHO Manual on Diagnostic Stewardship, 2016

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Objectives of Diagnostic Stewardship

Promote appropriate, timely diagnostic testing, including specimen collection and pathogen identification.

Support patient management guided by timely microbiological data.

Support provision of accurate and representative AMR surveillance data to inform treatment guidelines.

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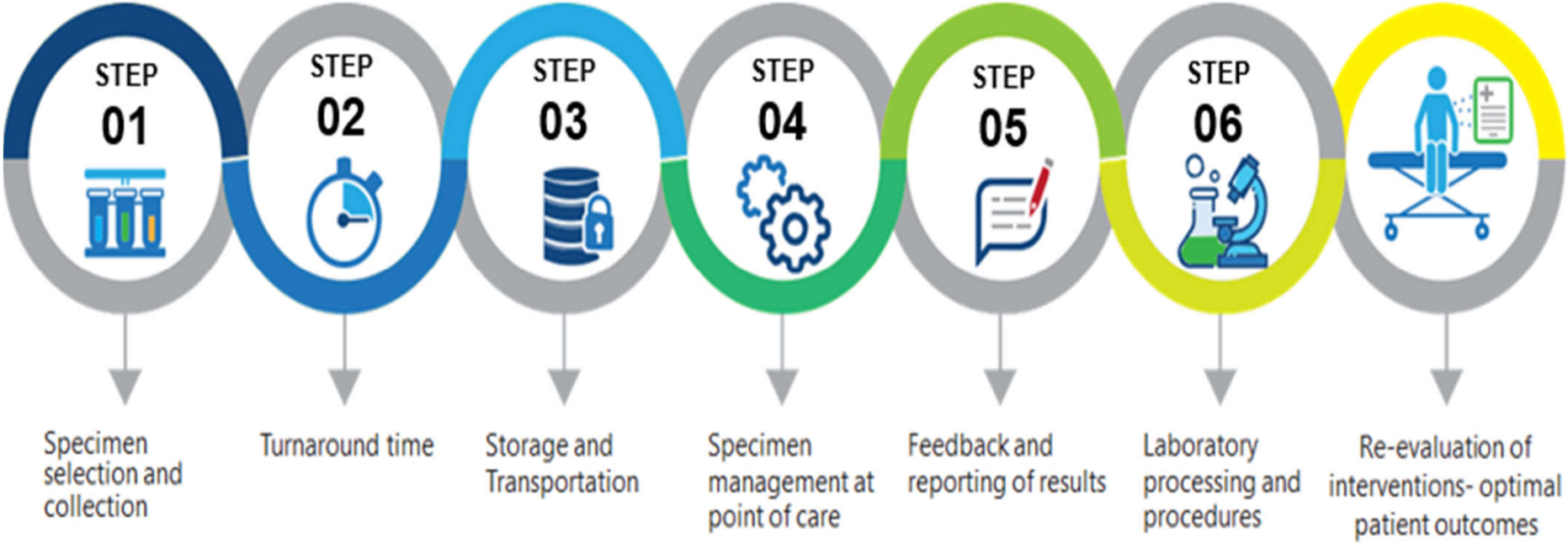
Steps in Diagnostic Stewardship



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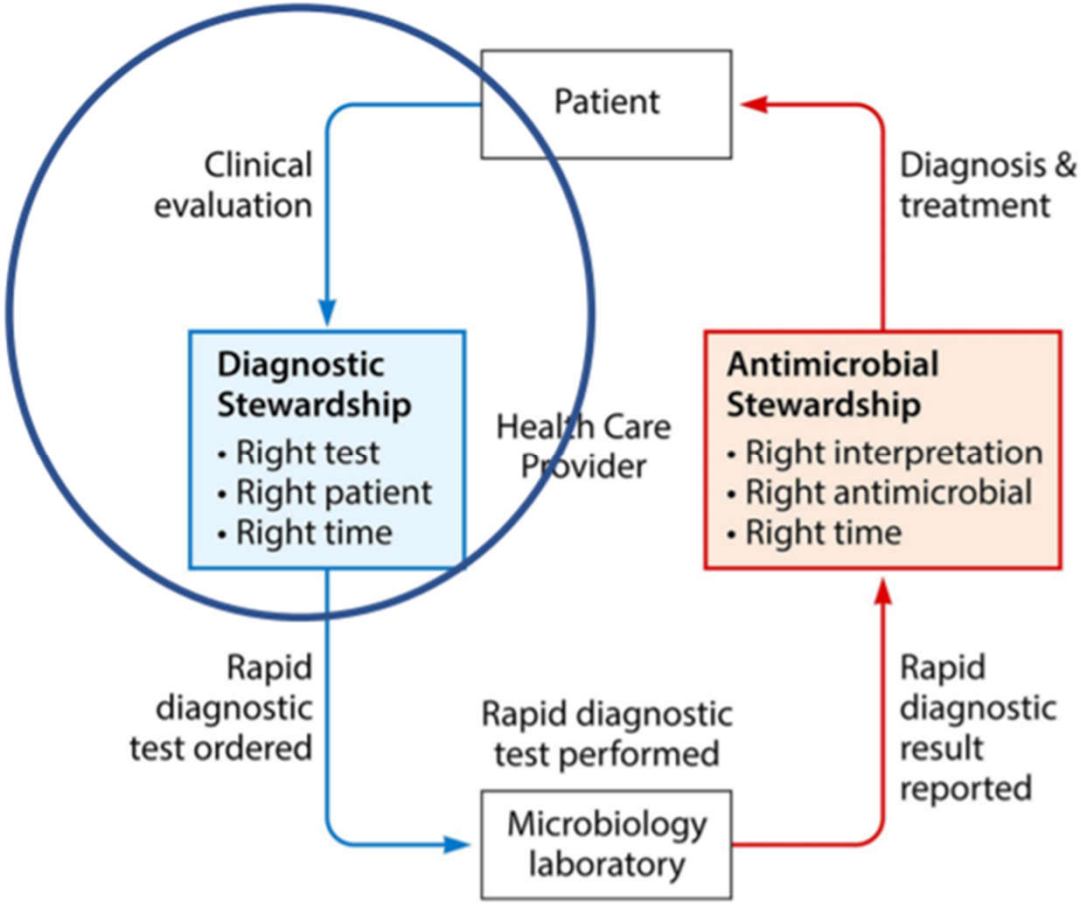
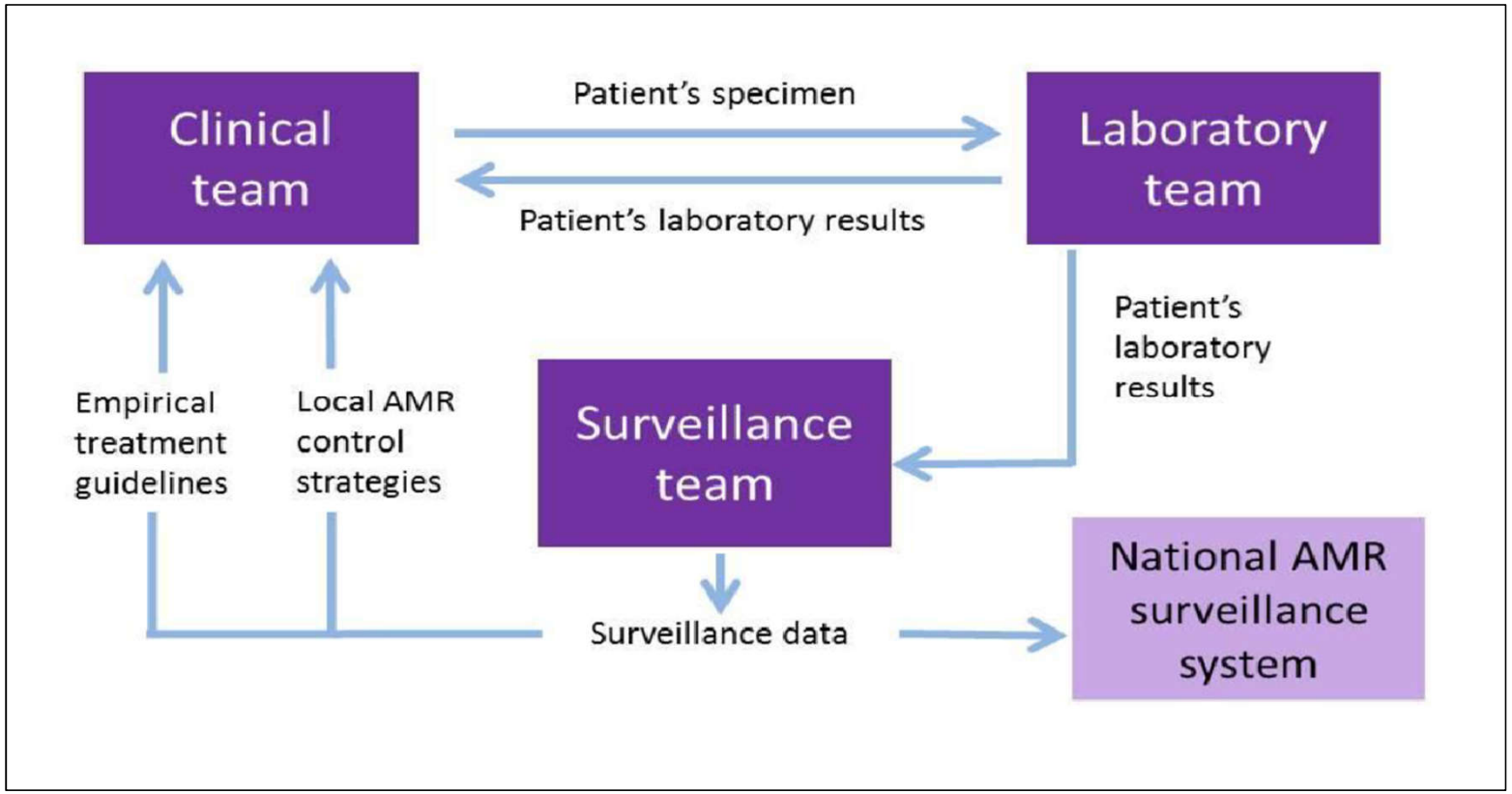
Steps in Diagnostic Stewardship…



Relationship Between Surveillance and Patient Care



Organizational Aspects of Diagnostic Stewardship

- Access to laboratory
- Initial review of SOPs and other materials
- Resources and costs estimation
- Roles and responsibilities
- Communication
- Training
- Monitoring and evaluation

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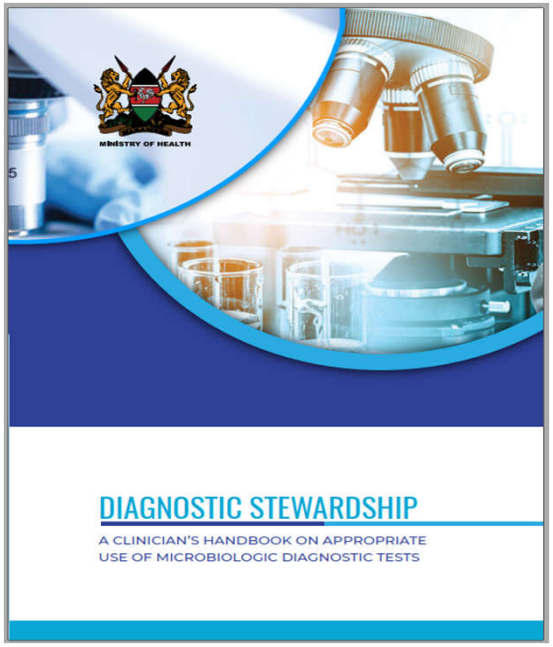
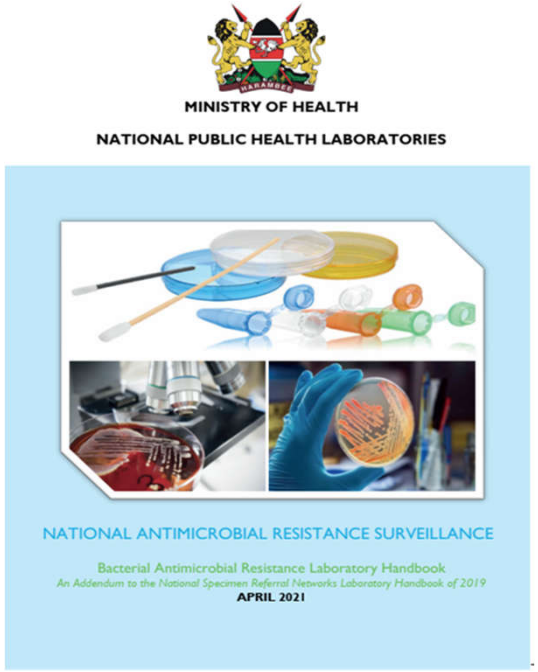
Resources for Diagnostic Stewardship



Clinician's handbook on appropriate use of microbiological diagnostic tests



Laboratory handbook on bacteriology specimen management

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General Considerations for Bacteriology Specimen

- Provide adequate clinical history including current and previous antibiotics use, if any
- Give site of specimen collection especially for wound or abscess specimens
- Indicate date and time of specimen collection
- Collect whenever possible before antibiotics therapy
- Follow aseptic collection methods
- Plan for processing specimens that are urgent and those collected outside normal working hours, e.g., blood cultures, CSF
- Prompt delivery to the laboratory after collection

Key Points

1. AMS strategies in healthcare facilities include prescriber feedback, pharmacy optimization, and microbiology-driven decision support
2. Community-level AMS focuses on education, awareness, and discouraging non-prescription antibiotic use
3. The WHO AWaRe classification guides safer antibiotic prescribing and targets increased use of Access antibiotics (≥60%)
4. AMS efforts are central to reducing antimicrobial resistance (AMR) and preserving antibiotic effectiveness

The End

You have come to the end of this module. Kindly attempt module 4 quiz before proceeding to module 5