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राष्ट्रीय आयुर्विज्ञान आयोग

National Medical Commission

# National Action Plan on Antimicrobial Resistance (NAP-AMR) Module for Non-Prescribers

2024

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# Antimicrobial Resistance (AMR)

## A Module for Non-Prescribers

राष्ट्रीय आयुर्विज्ञान आयोग
**National Medical Commission**

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# *From Editor's Desk*

I am deeply grateful to Prof. S.C Sharma the Former Chairmen, of the National Medical Commission (NMC) and Ex. Head of the Department of Otorhinolaryngology-Head and Neck Surgery at All India Institute of Medical Science, New Delhi for assigning this task, which brought me closure to my field of microbiology and providing necessary support and guidance for accomplishing this task.

Antimicrobial resistance (AMR) has been identified by the World Health Organization (WHO) as one of the top 10 global public health threats against humanity. Misuse and overuse of antimicrobials are the main drivers in developing drug-resistant pathogens. AMR is a "One Health" issue, its containment requires the active participation of various stakeholders, ministries, and departments.

The Ministry of Health and Family Welfare developed the National Action Plan on AMR (NAP-AMR) in alignment with the Global Action Plan on AMR (GAP-AMR) with a "One Health" approach at the National level. The NAP-AMR sets out six strategic priorities. Under each strategic priority, specific objectives of key focus areas with elaborate interventions, activities and key outputs, responsible agencies, and expected timelines have been stated. The NMC has been assigned objectives under strategic priorities 1 and 4 of the NAP-AMR.

It's my pleasure to introduce the second module in line which is the non-prescriber's module, produced with the help of subject experts, in the field of Microbiology, Medicine, Pharmacology, and Community Medicine from various medical colleges and Institutions of the country. The non-prescribers' module is primarily for allied health professionals working in Government and private medical colleges and institutions across the country. The module can also be used by any health care practitioner in the country comprising of nurses, technicians & pharmacists belonging to a significant group responsible for handling anti-microbial, preparing anti-microbial reports and audits for antimicrobial use in medical colleges and institutions. One more module in the series is currently in the pipeline, which is the "AMR module for undergraduate medical students and interns to create an awareness of AMR".

These modules are being developed as per the NAP-AMR strategic priorities assigned to NMC and the guidelines provided under NAP-AMR. Modules and Toolkits will help Allied health



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professionals acquire the requisite knowledge and skills along with a positive shift in attitude towards responsible antimicrobial use. I am confident that this module will serve as an excellent guide for the non-prescribers in the fight against AMR by updating their knowledge on key aspects of antimicrobial resistance such as. Background and objective, basics of medical pathogens; common infection syndromes; use of antimicrobials & Emergence of resistance; their contributions in diagnostic stewardship; quality management in the laboratory, in antimicrobial stewardship, etc.; Their role in infection control, storage and discarding of leftover antimicrobials and finally role in maintaining medicine as per local policies and guidelines.

These modules are written in very simple and understandable language suitable to any cadre of health professional for their understanding or teaching purposes. The PPTs are given chapter-wise to help the nodal officers modify the imparting training and teaching in their respective workplaces according to the need. We aim to train all cadre of health professionals systematically and structured. After the release of this module, the one duty of regional coordinators is to train the nodal officers to give them an insight into the purpose, content, utility, and use of the module and help further propagate the idea to the allied health professionals in the medical institutions.

With this, I acknowledge the sincere efforts of all the contributors and supporters to make this document see the light of the day.

With Regards and best wishes,

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We are thankful to Padma Shri Prof.. B. N. Gangadhar Chairman, NMC for providing guidance, strength and support in fulfilling this task.

We are grateful to our esteemed Former Presidents and Members of all four boards for this consent encouragement and continued input which has been very useful for formulating the module. We thank Dr Vijay Oza, President of PGMEB, for attending the meeting and providing on-the-spot inputs and suggestions for taking forward the program to all institution in the country. We are also greatly appreciative of the contribution from Dr. Aruna V. Vanikar, President of UGMEB, for her encouragement, valuable comments and suggestions.

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We were fortunate to have a panel of esteemed Experts who, with the help of their vast knowledge, experience and skill had devoted their time and energy to giving the present shape to the module. We are grateful to them.

I would like to extend my great appreciation to the Publication Division of NMC for their unwavering support in creating and printing this module.

Last but not least, we thank all our staff who worked behind the screen relentlessly to enable the document to see the light of the day.

Lastly, we thank the almighty for His blessings.


राष्ट्रीय आयुर्विज्ञान आयोग

**National Medical Commission**

# Antimicrobial Resistance (AMR) Module for Non-Prescribers

**- 2024 -**



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# A module on Antimicrobial Resistance for Non-Prescribers

# Abbreviations

| | |
|---|---|
| 3GCEB | Third Generation Cephalosporin Resistant Enterobacterales |
| AMR | Antimicrobial Resistance |
| AMSP | Antimicrobial Stewardship Programme |
| AST | Antimicrobial Susceptibility Testing |
| AWaRe | Access, Watch and Reserve Classification of Antibiotics by WHO |
| CLSI | Clinical and Laboratory Standards Institute |
| CRAB | Carbapenem Resistant *Acinetobacter baumannii* |
| DRI | Drug Resistant Infection |
| ESBL | Extended Spectrum Beta-Lactamase |
| EWS | Early Warning Score |
| GAP-AMR | Global Action Plan on Antimicrobial Resistance |
| HAI | Healthcare Associated Infections/Hospital-Acquired Infections |
| HICC | Hospital Infection Control Committee |
| ICMR | Indian Council of Medical Research |
| ICU | Intensive Care Unit |
| IPD | In Patient Department |
| IPC | Infection Prevention and Control |
| MDRO | Multi-Drug Resistant Organism |
| MRSA | Methicillin Resistant *Staphylococcus aureus* |
| NAP-AMR | National Action Plan on Antimicrobial Resistance |
| OPD | OutPatient Department |
| OTC | Over-the-counter |
| PCR | Polymerase Chain Reaction |
| SARS | Severe Acute Respiratory Syndrome |
| VRE | Vancomycin-Resistant Enterococci |
| WHO | World Health Organization |
| XDR | Extensively Drug-Resistant |

# Overview of AMR

1

Antimicrobials are compounds that act against microorganisms, killing them or inhibiting their growth. These are further divided into antibiotics (against bacteria), antifungals (against fungi), antivirals (against viruses), and antiparasitic (against parasites). The discovery of antimicrobials was an important landmark in modern medicine as it became possible to cure patients suffering from life-threatening and other debilitating infectious diseases. The use of antimicrobials, however, brought forward the issue of antimicrobial resistance (AMR) since the very beginning.

AMR occurs when bacteria, viruses, fungi, and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness, and death. It makes standard treatments ineffective, prolonging infections that can increase the risk of spread to others. The resistant microbes are able to grow/multiply in the presence of drugs that would normally kill them or limit their growth.

Some bacteria inherently do not respond to certain drugs (intrinsic resistance) while others may stop responding to a drug to which it is originally sensitive (acquired resistance). In acquired resistance, the bacteria may stop responding to a drug to which it is originally sensitive by various mechanisms.

The impact of AMR is as follows:

- Increased morbidity and mortality from infections.
- Longer hospital stays and higher healthcare costs.
- Limited treatment options for common infections.
- The emergence of untreatable "superbugs".

As microorganisms started getting increasingly resistant against commonly used antibiotics, thereby resulting in difficulty in treating the patients, the concurrent discovery of newer, more effective antimicrobials resulted in the shift towards the use of these antimicrobials. More and more organisms, thus, kept on gaining resistance against these antimicrobials, and eventually, the world witnessed the emergence of multi-drug resistant (MDR) pathogens that were resistant to multiple classes of antimicrobials. Also, the discovery of new antimicrobials slowed down

considerably in the last few decades, and this further compounded the challenges faced due to AMR and MDR pathogens.

Antimicrobial use goes far beyond the scope of treating human infections. They are used in various other sectors as well, such as animals (including the dairy industry), poultry, fisheries, and crop industry for crop production.

Factors driving antimicrobial resistance are:

- Misuse and overuse of antimicrobials- Unnecessary use of antimicrobials along with improper dosage or duration of treatment aids the development of AMR.
- Use in animals- Around 70% of all medically important antimicrobials are used in animals, dairy, poultry, and fishery products. These products when consumed by humans act as an invisible source of antimicrobial intake.
- Inconsistent infection control practices contribute to the development of AMR by way of the use of antimicrobials for treating hospital-acquired infections that could otherwise have been avoided.

The One Health approach deserves a special mention here as it is clear from the above facts that the interconnection between humans, plants, animals and the environment needs to be recognized as a whole unit and, therefore, improving the health outcome of the human population requires a multisectoral collaboration and a transdisciplinary approach of various sectors and stakeholders dealing with humans, animals, plants and the environment. The One Health concept addresses this.

**Background and Objectives**

In 2015, understanding the gravity of the problem of antimicrobial resistance (AMR), the World Health Assembly (WHA) adopted the Global Action Plan on AMR (GAP-AMR) in collaboration with the World Health Organization (WHO), Food & Agricultural Organization (FAO) & World Organization for Animal Health (WOAH). The WHA has outlined five core objectives for NAP-AMR:

1. Improve awareness and understanding of antimicrobial resistance;
2. Strengthen knowledge through surveillance and research;
3. Reduce the incidence of infection;

4. Optimize the use of antimicrobial agents in health, animal, and food sectors; and
5. Develop the economic case for sustainable investment that takes account of the needs of all countries, and increases investment in new medicines, diagnostic tools, vaccines, and other interventions.

The Ministry of Health and Family Welfare (MoHFW) developed the "National Action Plan on AMR" and launched it in April 2017. Later in May 2017, the WHO resolution urged member states to align National Action Plans on AMR (NAP-AMR) with GAP-AMR.

The strategic objectives of NAP-AMR are aligned with the GAP-AMR based on national needs & priorities. The NAP-AMR sets out six strategic priorities (**Fig 1**) and under each strategic priority, specific objectives of key focus areas with elaborate interventions, activities, and key outputs along with responsible agencies and expected timelines, have been stated.


**Fig 1: Six strategic priorities in the national action plan for antimicrobial resistance in India**

**Objectives under the National Medical Commission**

NMC is responsible for following specific objectives under priority 1 and 4 for human health

**Strategic priority 1- Improve awareness and understanding of AMR through effective education and training**

Target audience: Medical students, Doctors (Residents, Faculty, Medical officers, etc.), **allied health professionals (Nurses, Pharmacists, Laboratory Technicians, etc.),** and administrators.

This is to be achieved by-

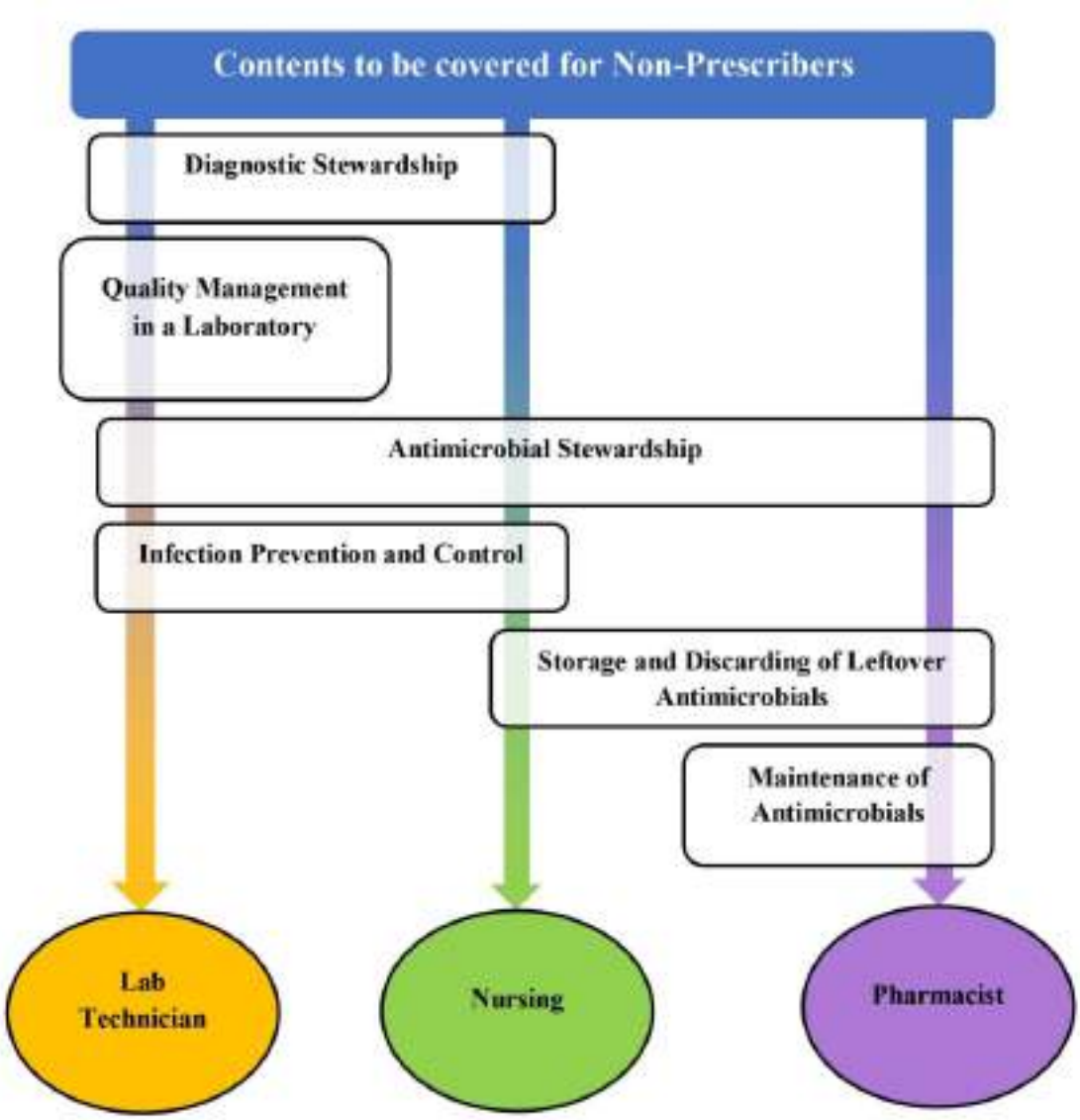
- Reviewing and revising curricula of undergraduate medical Professionals-Undergraduate module (*due for release*).
- Reviewing and developing training modules for in-service medical professionals – Prescribers' module **(*released on 14-06-2024*).**
- **Reviewing and developing training modules for allied health professionals- Non-prescribers' module** (*present module*).

**Strategic priority 4- Optimise the use of antimicrobial agents in human health**

This objective is mainly for the prescribers; however, the allied health professionals' contribution is required for optimizing the same. This is already covered in depth in the prescribers' module.

This Non-prescribers module aims to facilitate institutions and allied health professionals in developing an understanding of AMR and its importance in patient care, care during the processing of samples in the laboratory, and dispensing of drugs. This training module will assist in imparting the required knowledge and skills of the non-prescribers for their contribution to combating antimicrobial resistance.

The following vertical grid and horizontal spine are to be used for the training of non-prescribers (**Fig 2**). The vertical grids represent the course type/ category of non-prescribers such as nurses, Laboratory technicians, or Pharmacists while the horizontal spine represents the topic to be covered. The horizontal spine overlaps the vertical grid of non-prescriber category/ course type to represent whom to be taught/ sensitized. Alternatively, the vertical grid can be followed to check the topics to be covered for each type of course/ category of non-prescriber.




**The Vertical grid and horizontal spine for the training of non-prescribers**

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# Basics of Microbial Pathogens

2

## Learning Objectives

At the end of the session, the non-prescriber will be able to:

- Describe the types of microorganisms causing human infections
- Define opportunistic pathogens
- Differentiate between community and healthcare-associated infections
- Describe the common organisms causing community and healthcare-associated infections

Infections are an important cause of morbidity and mortality across the globe. These are caused by a variety of micro-organisms that can be broadly categorized into one of the following four major types: (1) Bacteria that are prokaryotic organisms, (2) Fungi, (3) Parasites, and (4) Viruses. Many bacteria and fungi can be isolated from the patient's specimen in the microbiology laboratory on an artificial culture media while the parasites can be directly observed under the microscope or detected by a serological test (for the presence of antigen or antibody) and/ or molecular test such as polymerase chain reaction (PCR). Viruses cannot be grown on an artificial medium and are not visible under a light microscope due to their extremely small size. The diagnosis of viral infections/ diseases thus relies mainly on serology and/ or molecular tests.

Not all microorganisms are capable of causing disease in a healthy individual. There are less virulent pathogens, called opportunistic pathogens, that can cause disease only in an immunocompromised host (individual with a weakened immunity as a result of exposure to drugs such as steroids or chemotherapy, metabolic disorders such as diabetes, HIV infection, advanced age, cancer, etc.).

Infections are broadly classified as community-acquired and hospital-acquired. Infections contracted outside the hospital or those that become apparent within 48 hours of hospital admission are called community-acquired infections. The hospital-acquired infections (HAIs), now more commonly known as healthcare-associated infections, are those infections acquired in the hospital by a patient admitted for a reason other than infection, infection should not be present at the time of admission, and the symptoms should appear at least after 48 hours of admission. The common causative agents of community-acquired

infections are given in **Table 1**.

**Table 1: Common causative agents of community-acquired infections**

| **Infection** | **Organisms** |
|---|---|
| Respiratory tract infections | *Streptococcus pneumoniae, Haemophilus influenzae, Neisseria meningitidis* |
| Urinary tract infections | *E.coli, Enterococcus spp, proteus spp* |
| Gastrointestinal infections | Adeno viruses, *Giardia, E.coli, Shigella* spp |

Healthcare-associated infections can be caused by almost any microorganism but those that survive in the hospital environment for a long period and develop resistance to antimicrobials and disinfectants are particularly important. The organisms responsible for a large number of healthcare-associated infections in the modern era represent the multi-drug resistant (MDR) isolates. The common organisms causing important healthcare-associated infections are as follows (**table 2**):

**Table 2: Common causative agents of some important healthcare-associated infections**

| **Infection** | **Organisms** |
|---|---|
| Urinary tract infections | *E.coli, Pseudomonas aeruginosa, Klebsiella* spp, *Serratia, Enterococcus* spp. |
| Respiratory tract infections | *Haemophilus influenzae, Streptococcus pneumoniae, Staphylococcus aureus* |
| Wound infections | *Staphylococcus aureus, Pseudomonas, E.coli* |
| Gastrointestinal infections | *Clostridium difficile, Salmonella, Shigella* |

**Transmission:** The microorganisms spread through several modes such as direct or indirect contact, airborne transmission and ingestion of contaminated food and water.

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# Common Infection Syndromes

3

**Learning Objectives**

At the end of the session, the non-prescriber will be able to:

- Define infection and sepsis
- Describe signs and symptoms of sepsis
- Describe common infection syndromes and appropriate specimens for culture sensitivity testing

## Infection and Sepsis

Infection is the invasion of a disease-producing microorganism into the host tissue, their multiplication, and the reaction of host tissue to these microorganisms and the toxin they produce. Sepsis is the body's extreme response to an infection. It is life-threatening, and without timely treatment, sepsis can rapidly lead to tissue damage, organ failure, and death. Sepsis, now defined as life-threatening organ dysfunction due to a dysregulated host response to infection, was recently recognized by the WHO as a global health priority. Detecting sepsis early and starting immediate treatment is often the difference between life and death. The signs and symptoms of sepsis can include a combination of any of the following:

- confusion or disorientation
- shortness of breath
- high heart rate
- fever, or shivering, or feeling very cold
- extreme pain or discomfort
- clammy or sweaty skin

Infectious diseases commonly increase the number of mature and immature circulating neutrophils. Mechanisms include demargination and release of immature granulocytes from bone marrow, interleukin-1– and interleukin–6–mediated release of neutrophils from bone marrow, and colony-stimulating factors elaborated by macrophages, lymphocytes, and other tissues. Exaggeration of these phenomena (e.g., in trauma, inflammation, and similar stresses) can result in the release of excessive numbers of immature leukocytes into the circulation (leukemoid reaction), with leukocyte counts up to 25,000 to 30,000/mcL (25 to 30 × $10^9$/L).

Conversely, some infections (e.g., typhoid fever, brucellosis) commonly cause leukopenia. In overwhelming, severe infections, profound leukopenia is often a poor prognostic sign. Serious infection may cause thrombocytopenia and disseminated intravascular coagulation (DIC).

Pulmonary compliance may decrease, progressing to acute respiratory distress syndrome (ARDS) and respiratory muscle failure. Renal manifestations range from minimal proteinuria to acute renal failure, which can result from shock and acute tubular necrosis, glomerulonephritis, or tubulointerstitial disease. Hepatic dysfunction, including cholestatic jaundice (often a poor prognostic sign) or hepatocellular dysfunction, occurs with many infections, even though the infection does not localize to the liver. Gastrointestinal (GI) manifestations include upper GI bleeding due to stress ulceration that may occur during sepsis. Hypoglycemia occurs infrequently in sepsis, but adrenal insufficiency should be considered in patients with hypoglycemia and sepsis. Hyperglycemia may be an early sign of infection in diabetics.

**Importance of "Early Warning Score" to Prevent Mortality**

These should be used to assess worsening or improvement in patients' clinical status over time. Higher scores are associated with a need for further treatment or escalation to intensive care unit (ICU) or high dependency unit (HDU) care. Early warning score (EWS) encompasses respiratory rate (RR), oxygen saturation (SpO2), temperature, blood pressure (BP), and heart rate (HR). Consciousness level is also often assessed and typically uses the alert/responds to voice/pain/unresponsive (AVPU) system.

**Checklist to Detect the Signs of Worsening**

Temperature: if high (>100°F), worsening of infection. If low (<96°F), may indicate septic shock. Pulse rate: if high (tachycardia), worsening of infection. If irregular: electrolyte imbalance. Low BP may indicate septic shock. High respiratory rate: the patient may be reactive or signs of aspiration. Low respiratory rate/labored breathing: drowsy due to CO2 retention, and metabolic acidosis. Low urine output is another sign of worsening the disease.

**Table 3: The clinical features and presentation of patients with common infections**

| Clinical presentation and features | Suggested infection | To find potential sources of infection |
|---|---|---|
| Burning sensation during micturition, frequency of micturition, back pain | Urinary tract infection | Urine for routine examination, culture-sensitivity (C/S) |
| Cough and cold, fever with:<br><br>Sore throat<br>Productive cough | Respiratory tract infection (RTI)<br>Upper RTI<br>Lower RTI | <br><br>Throat swab C/S<br>Sputum C/S |
| Nausea, vomiting, diarrhea | Gastroenteritis | Stool C/S |
| Boil, carbuncle, pus/ discharge from a wound | Skin and soft tissue infection | Pus for C/S<br>Wound swab for C/S |
| Fever, irritable, headache, intolerance to light, neck rigidity | Meningitis | CSF for microscopy and C/S |

**Case-based learning examples**

**i. To demonstrate the ability to use early warning score for infection/sepsis.**

A 45-year-old female was admitted to a hospital with a urinary tract infection. Suddenly she becomes restless and talkative.

1. What are the parameters to be checked?
2. How to interpret the parameters by using an early warning score?

**ii. To demonstrate ability in alerting clinicians for referring patients that require further review by physicians**

The following cases have to be referred for review by physicians on an emergency basis:

1. A 53-year-old male patient admitted to a hospital with pneumonia, is complaining of chest discomfort. His O2 saturation is 92.
2. A 61-year-old female patient complaining of slight bleeding from bed sore.
3. A 15-year-old female patient admitted due to acute gastroenteritis, is now complaining of fever, pain, and redness over the area where the peripheral line was inserted.
4. A 75-year-old patient was admitted due to chest pain. He was diagnosed with ischemic heart disease and on aspirin with other medication. He is now complaining of melena.

★★★★★

# Use of Antimicrobials and Emergence of Resistance

4

## Learning Objectives

At the end of the session, the non-prescriber will be able to:

- Describe the mechanism of action of antimicrobials
- Discuss mechanism of antimicrobial resistance
- Describe drivers of antimicrobial resistance
- Describe important antimicrobial resistant pathogens

The increasing use (including misuse and overuse) of antimicrobials contributes to the emergence of antimicrobial resistance.

### Mechanism of Action of Antimicrobials

Antimicrobials act on bacteria in multiple ways. They can kill the cell (bactericidal) or retard its multiplication (bacteriostatic) (**Table 4**). They can act by following mechanisms (**Fig 3**):

- Inhibition of cell wall or cell membrane synthesis in microbes.
- Disruption of essential processes such as protein synthesis of microbes.
- Disruption of nucleic acid synthesis in microbes.

**Table 4: Bactericidal and bacteriostatic antimicrobials**

| Bactericidal | Bacteriostatic |
|---|---|
| Beta lactams | Macrolides |
| Glycopeptides | Clindamycin |
| Cyclic lipopeptides | Tigecyclines |
| Aminoglycosides | Tetracyclines |
| Fluoroquinolones | Linezolid |

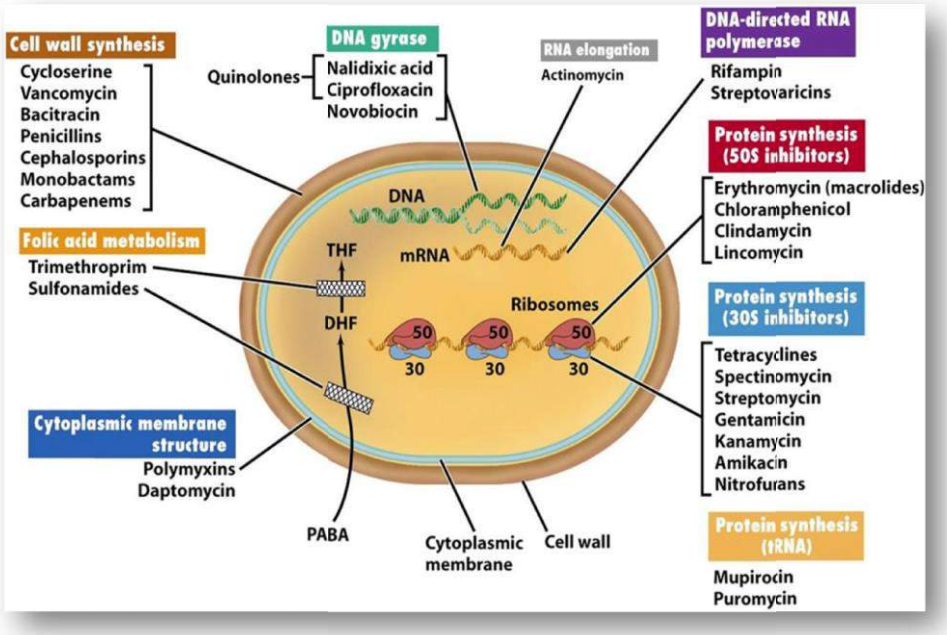


**Fig 3: Mechanisms of Antimicrobial Action**

***Reference- Figure 20-14. In: Brock Biology of Microorganisms 11/e. 2006. Pearson Prentice Hall, Inc***

## Mechanism of Antimicrobial Resistance

Bacteria may stop responding to a drug to which it is originally sensitive by any of the following actions:

- Production of enzymes that destroy the antibacterial drug (e.g., beta-lactamases in penicillin and cephalosporins).
- Expression of efflux systems that prevent the drug from reaching its intracellular target (e.g., efflux pump mechanism [fluoroquinolone resistance]).
- Reduction of permeability of drug through mutation of porin proteins (as seen with aminoglycosides).
- Modification of the drug's target site (e.g., penicillin-binding protein).
- Production of an alternative metabolic pathway that evades the action of the drug (e.g., folate metabolism).

## Drivers of Antimicrobial Resistance

The development of AMR is multifactorial. The risk factors most commonly found to be associated with the development of antimicrobial resistance are:

1. Excessive and irrational prescriptions of antimicrobials in community and hospitals.
2. Increase in invasive procedures, transplants surgeries and immunosuppressive therapy.
3. Increase use of prosthetic devices amenable to super-infection and resistant bacteria.
4. Lack of effective preventive infection control measures such as hand hygiene, isolation procedures of patients with multi drug resistant organisms.
5. Lack of effective antimicrobial stewardship programs restricting antimicrobial usage in community and hospitals.
6. Use of antimicrobial in agriculture sector, animal husbandries and fisheries.
7. Improper disposal of antimicrobials and antimicrobial residues which leads to finding their way in community and entering food chain through food, animals and water.

**Key Antimicrobial Resistant Pathogens**

The WHO has identified a list of priority pathogens that pose a critical threat to human health due to their resistance to antimicrobials. These pathogens as per the recent 2024 list include:

- **Carbapenem Resistant Enterobacterales (CRE)** - These include *Klebsiella* spp. and *Escherichia coli* are resistant to carbapenems and are placed atop the critical list of priority pathogens.
- **Third Generation Cephalosporin-Resistant Enterobacterales (3GCREB) -** Gram-negative bacteria resistant to third-generation cephalosporins, a broad class of antibiotics used to treat many different types of infections.
- **Carbapenem Resistant *Acinetobacter baumannii* (CRAB)** - The emergence of CRAB poses a formidable challenge due to limited treatment options, particularly in ICU settings.
- **Methicillin-resistant *Staphylococcus aureus* (MRSA)** – *S, aureus* resistant to many common antibiotics, making it difficult to treat skin infections, pneumonia, and bloodstream infections.
- **Vancomycin-resistant *Enterococcus* (VRE) -** one of the last-resort antibiotics used to treat serious infections.

- **Fluoroquinolone-Resistant Bacteria** - This includes strains of *E. coli*, *Salmonella,* and *Campylobacter* that are resistant to fluoroquinolones, commonly used to treat urinary tract infections, diarrhoea, and respiratory infections.

**To Mitigate the Impact of AMR**

To reduce the clinical and economic burden of drug-resistant infections (DRIs) and healthcare-associated infections (HAIs), several strategies are crucial:

- Antimicrobial Stewardship
- Infection Prevention and Control
- Surveillance
- Research and Development of new antibiotics, diagnostics, and vaccines to combat DRIs and HAIs.

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# Contribution to Diagnostic Stewardship

5

**Recommended for**:

- Nursing Professionals
- Laboratory Technicians

**Learning Objectives**

At the end of the session, the non-prescriber will be able to:

- understand the difference between infection and colonization
- collect, transport, and process the clinical samples for microbiological investigations

Diagnostic stewardship: There is a major role of nursing and laboratory technicians in reaching the final diagnosis as the sample is collected by the nursing professionals, processed by the technical persons, and drugs are dispensed by the pharmacist based on the prescription of a prescriber. Diagnostic stewardship refers to "coordinated guidance and interventions to improve appropriate use of microbiological diagnostics to guide therapeutic decisions. It should promote appropriate, timely diagnostic testing, including specimen collection, and pathogen identification, and accurate, timely reporting of results to guide patient treatment."

**Sample Collection and Transport** (For detailed sample collection and transport, refer to the prescribers' module uploaded on the NMC website on 14.06.2024)

**Correct Sample for Correct Report**

- The microbiology laboratories must be effectively utilized for the diagnosis of infections and determining their antimicrobial susceptibility.
- Appropriate selection of samples, their proper collection, and transport help to improve the diagnostic performance of a microbiology laboratory.
- The turn-around time for laboratory investigations must be known to all.
- The ability to distinguish between viral and bacterial infection is also useful since patients with viral infections do not require antimicrobials in ordinary circumstances.
- Many pathogenic microorganisms may be found as part of the normal commensal flora. Isolation of these organisms may not necessarily indicate infection. Likewise, many

body sites have a normal commensal flora and samples sent to the laboratory in the absence of signs or symptoms of infection may be difficult to interpret. So, proper sample collection is of utmost importance.

- A blood culture can easily be contaminated with skin organisms at the time that the sample is being taken. Patients with contaminated blood cultures are often commenced on unnecessary antimicrobial therapy while the issue is being investigated.

**General Precautions While Collecting Samples**

- The sample for bacterial culture must be collected before antimicrobial therapy whenever possible.
- Appropriate specimens from the suspected site of infection must be collected in the correct container according to the case definition as per the prescriber.
- The sample must be collected by trained staff after precise instructions to the patient.
- It must be transported within 1-2 hours after collection, in the correct package.
- Blood and CSF should never be refrigerated, can be kept at room temperature (37ºC) at the collection site, and transported at room temperature.
- All samples should be labeled properly and clearly along with unique ID numbers to avoid any mix-up of the samples leading to erroneous reports.
- All samples must be accompanied by a request form with complete clinical, demographic, and epidemiological information.

**Colonization and Infection**

- Most organisms that colonize are harmless commensals.
- An organism isolated from a sample taken from a normally sterile site like the CSF, blood, pleural fluid, etc. is likely to be a true invader and the causative pathogen.
- An organism isolated from a non-sterile specimen like sputum or a wound swab may be a colonizer.

## Sample Collection Techniques

### Blood

- The nursing professional/ technical staff should coordinate with the laboratory for the appropriate container before the collection of blood samples and must follow the instructions provided by the laboratory for maintaining the same pre and post-collection of samples.
- They must follow the clear instructions of the prescriber for the collection of samples.
- Wear gloves, and thoroughly disinfect the venepuncture site.
- Cleanse an area about 50 mm in diameter with 70% ethanol and allow to air-dry.
- Apply 2% tincture of iodine or chlorhexidine/alcohol-based disinfectant in a circular action, swab the area beginning at the point where the needle will enter the vein.
- Allow the disinfectant to dry on the skin for at least 1 minute.
- Wipe the top of the bottle cap using an ethanol swab and allow to dry before injecting the sample aseptically into the bottle.
- Inoculated blood culture bottles should be transported to the laboratory immediately or held at room temperature until they reach the laboratory.

### CSF

An initial CSF sample should be collected before antimicrobial therapy for the highest diagnostic sensitivity. **The nursing professional and/ or laboratory staff should help the prescribers in this procedure as instructed**. Lumbar puncture should be done by a trained professional authorized for the same. Refer to the module for prescribers for details of the procedure. The vials/ containers should be properly labelled, and transported to the laboratory immediately without delay.

### Sterile Body Fluids

- **The nursing professional and/ or laboratory staff should help the prescribers in this procedure as instructed**.
- Normally sterile body fluids such as pleural, pericardial, peritoneal, synovial, etc. should be collected with a needle and syringe using a sterile technique.

- The aspirated material (1-5ml) should be transferred to a sterile screw-capped tube or a paediatric isolator tube.
- Samples should not be submitted in a syringe with a needle attached.
- Swab specimens are inferior and should NEVER be used if fluid specimens can be obtained.

**Urine**

- Preferably, early morning first midstream urine (2-5ml) to be collected in a sterile, wide mouth, leak-proof container.
- In a Catheterized Patient, Clamp the catheter, clean the catheter wall vigorously with 70% ethanol, and aspirate 5 to 10 ml of urine via a sterile needle and syringe above the clamp. Nursing professionals must take care that they should not collect urine samples from the urine collection bag or by disconnecting the catheter from the tube of the urine collection bag.
- Instructions to the patients should be given before the collection of the sample:
  - Female: Wash the hands, cleanse the area around the urethral opening with soap and water, and collect the midstream urine in a sterile container with the labia held apart.
  - Male: Wash the hands, retract the foreskin, cleanse the glans with soap and water, and collect midstream urine in the sterile container.
- Urine samples must be sent to the laboratory as soon as possible (within 2 hours of collection). In case of delay, the sample must be refrigerated.
- The patient should also be instructed to avoid soiling the container from the outside.

**Sputum**

- Instructions to the patients should be given before the collection of the sample.
- A clean, wide-mouth leak-proof container should be provided to the patient, and instruct to collect the sample preferably in the early morning after rinsing the mouth with water but before brushing, fluid or food intake.
- Patient should be instructed to cough deeply after taking a deep breath.
- Care should be taken that the specimen must be sputum, not saliva.

- Sputum samples must be sent to the laboratory as soon as possible (within 2 hours of collection). In case of delay, the sample should be refrigerated (except in case if *Streptococcus pneumoniae* and/or *Haemophilus influenzae* infection is suspected). In case of external soiling of the sample container with sample, a phenol-containing disinfectant should be used to wipe the outside of the container.

**Throat/ Oropharyngeal Swabs**

Refer to the module for prescribers for details of the procedure.

**Stool**

- Use a clean, wide mouth leak-proof container, to collect the stool sample.
- The sample should not be collected from the bedpan.
- Collect at least 5 ml of sample in case of liquid stool, approximately 1 g (walnut-sized) sample in case of semi-formed or formed stool.

**Pus/ Tissue Biopsy Aspirate**

- **The nursing professional and/ or laboratory staff should help the prescribers in this procedure as instructed**.
- In case of open wounds, debridement to clear overlying debris with a scalpel and swabs or sponges should be done by a competent professional, and thoroughly rinsed with sterile saline before collection of samples. Collect biopsy or curette sample from the base or advancing margin of the lesion. The specimen must never be sent in formalin for culture.
- In case of closed wounds, disinfect the area for collection of blood sample collection before aspiration. Refer to blood sample collection for details.
- Pus from an abscess is best collected at the time the abscess is incised and drained, or after it has ruptured naturally. At least 1 ml of pus should be collected. The swab is not an appropriate/ preferred sample for culture.

**Genital Swabs**

- The excess mucus is cleaned with a cleaning swab and discarded.
- The swab is inserted into the cervical canal and rotated for 15-30 seconds.

- The swab should be immediately broken off swab into the transport tube.

**Sample Rejection Criteria**:

- Samples collected in incorrect containers or broken, poorly sealed, and leaking containers.
- Unlabeled specimens or mismatch between sample requisition form and container.
- Unacceptable delay between specimen collection and arrival at the laboratory.
- Sample stored incorrectly before or during transport.
- Inadequate quantity of specimens.
- 24 hours urine collection.
- Foley's catheter tips and endotracheal tube tips.
- Urine from the bag of a catheterized patient.

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# Contribution to Quality Management in Laboratory 6

**Recommended for**:

- Laboratory Technicians

## Learning Objectives

At the end of the session, the non-prescriber will be able to:

- Understand the importance of transcription errors in specimen handling and its potential implication for patient management.
- Understand the purpose of ISO15189 NABL standards.
- Describe the principles behind quality management systems for laboratories.
- Describe the importance of internal and external quality assurance and methods of reporting failures in quality assessment (consumables, equipment calibration/ maintenance, and processes) to appropriate authorities.
- Know the WHO Laboratory Quality Stepwise Implementation tool (LQSI).

A medical laboratory serves as an important part of the decision-making process for the majority (>70%) of the patients. So, an accurate report is indispensable for providing quality care to the patient without causing harm. Yet, errors might occur in a medical laboratory during the specimen testing process which can be divided into three phases:

i. pre-analytical phase (sample requisition, collection, and transport, sample reception and storage in the laboratory)
ii. analytical phase (sample testing and interpretation of testing results)
iii. post-analytical phase (preparation of report containing the result and its inter-predation, authorization of the report for its release, and the transmission of the report to the lab user, i.e. patient and/ or the clinician)

The accuracy and quality of a test report are dependent on the following parameters:

- Quality of specimen collection and transport procedure.

- Adequate and accurate information in test requisition form.
- Testing procedure meeting the quality norms.
- Trained and competent staff.
- Good quality, calibrated equipment and reagents.
- Temperature and humidity control in the facility.
- Adequate, clean space for testing equipment and staff in the laboratory.
- Careful recording and reporting of results.
- Safety aspects including fire safety, biohazard safety, etc.

To establish this on an international scale, an ISO15189:2022 requirement must be followed to establish and control the work processes, starting from ordering the test to sample collection, through sample testing to the transmission of the test report. It also involves the management of all laboratory resources, namely staff, facility, and equipment, conducting evaluations or audits, and making continual improvements to ensure quality results. These are managed by a system of processes known as the quality management system (QMS).

All laboratory processes and procedures can be broadly grouped under 12 understandable structures, called quality system essentials, and these serve as the building blocks of the QMS. These include: (i) Organization, (ii) Personnel, (iii) Equipment, (iv) Purchasing and inventory, (v) Process control, (vi) Information management, (vii) Documents and records, (viii) Occurrence management, (ix) Assessment, (x) Process improvement, (xi) Customer service and (xii) Facilities and safety.

Such processes must be implemented and ensured throughout the laboratory. The implementation of these 12 quality system essentials is flexible and can be achieved in any order suitable to the laboratory. Such implementation can be approached in a variety of different ways depending upon the local factors.

Laboratory accreditation is a procedure by which an authoritative body (e.g. NABL in India) formally recognizes the technical competence for specific tests/ measurements, based on third party assessment and following international standards, i.e. ISO15189. The laboratory accreditation improves the accuracy and speed of diagnostics and reduces errors in the laboratory processes, thereby improving the patient treatment outcomes.

To facilitate this, WHO came up with a Laboratory Quality Stepwise Implementation tool (LQSI) tool. This tool has been created as a website by the Royal Tropical Institute for WHO and it helps in the implementation of QMS as per ISO15189 standards for a medical laboratory in a planned, stepwise manner.

To rationally implement the QMS in a laboratory, the user instructions tab of the LQSI tool website explains four phases of implementation by dividing the activities in such a manner that each phase carries a specific focus.

Phase 1: Ensuring that the primary process of the laboratory operates correctly and safely
Phase 2: Controlling and assuring quality and creating traceability
Phase 3: Ensuring proper management, leadership and organization
Phase 4: Create continuous improvement and prepare for accreditation

To view the activities in each phase, one can choose between two types of frameworks.

i) **Roadmaps**: showing all the activities in an ideal sequence for day-to-day implementation.

ii) **Quality System Essential framework**: showing the activities sorted per quality system essential (as formulated by the Clinical and Laboratory Standards Institute).

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# Contribution to the Antimicrobial Stewardship Program

7

## Learning Objectives

At the end of the session, the non-prescriber will be able to understand:

- The basics of the Anti-microbial stewardship program
- Their role in AMSP
- The procedures for storage, preparation, administration, disposal, and recording of antimicrobial agents

**Antimicrobial stewardship** has been defined as ***"coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration".***

The goals can be briefly described as:

- Ensure the best clinical outcome, for treatment or prevention of infection
- Minimize unintended consequences of antimicrobial use such as adverse drug reactions, emergence of clones of antimicrobial resistance
- Minimize healthcare costs without compromising quality of care
- Accurate diagnostics and diagnostic pathways

It focuses on the right drug in dose at the right time for the right duration and right de-escalation. It comprises various core and supplemental interventions that include but are not limited to antibiotic consumption analysis, formulary restrictions, laboratory surveillance and feedback, parenteral to oral conversion, and de-escalation of antimicrobial therapy.

**Antimicrobial Consumption Analysis (Recommended for Pharmacist and Nursing)**

- Quantitative Analysis of Antimicrobial Consumption: It should be collected from pharmacy purchase stores which will give proxy data of overall consumption of antimicrobials in the hospital (antimicrobial consumption surveillance).

- Qualitative Analysis of Appropriateness of Prescription: Information regarding which patients are being given what antibiotics, their indications, dose, and duration is collected using point prevalence surveys. It gives antimicrobial use surveillance. This can be done in the hospital wards etc.

- The role of pharmacists is crucial in the generation of this data. Depending upon the load on the pharmacy, periodic data should be entered by the pharmacist preferably in a digital format such as Microsoft Excel sheets or its equivalent, so that antimicrobial consumption analysis can be performed from this data. A sample data entry format is given below (**Fig 4** and **Fig 5**). Pharmacies/ Hospitals can develop a format that is suited to their needs, ensuring that the quality of data generated is ensured.

**Fig 4: Sample Sheet Containing Data of Antibiotics Dispensed in a Month at a Pharmacy**

Name of Hospital, City

Month-wise antibiotic consumption data of hospital

Month:June 2024 Pharmacy name and location: Central Pharmacy, B-block

| Antibiotic name | Route (Oral/ injection) | Quantity dispensed | Quantity available |
|---|---|---|---|
| Ciprofloxacin | Oral | 1286 tablets | 2438 tablets |
| Ciprofloxacin | Injection | 74 vials | 20 vials |
| Amoxy-Clav | Oral | 1473 tablets | 597 tablets |
| Ampicillin | Oral | 478 tablets | 62 tablets |
| Ampicillin | Injection | 54 vials | 46 vials |
| Penicillin | Injection | 129 vials | 271 vials |
| Nitrofurantoin | Oral | 870 tablets | 130 tablets |

Pharmacist name

**Fig 5: Sample Sheet Containing Data of Antibiotics Dispensed to an Individual Patient in a Ward or from a Pharmacy**

Name of Hospital, City
Daily consumption of antibiotics
Date: 20-12-2023 Pharmacy/ OPD/ Ward name and location: Central Pharmacy, B-block

| Antibiotic name | Route (Oral/ injection | Dose | Patient (OPD/ IPD/ ICU) | Patient Reg. No./ UID/ CR No. | Specialty | Clinician name | Quantity dispensed |
|---|---|---|---|---|---|---|---|
| Ciprofloxacin | Oral | 500mg | OPD | 2303 | Medicine | Dr. ABC | 10 tablets |
| Azithromycin | Oral | 500mg | IPD | 6512 | Medicine | Dr. XYZ | 3 tablets |
| Ceftriaxone | Injection | 1gm | OPD | 2461 | Surgery | Dr. DEF | 1 vial |
| | | | | | | | |

Nursing Officer/ Pharmacist name

**Formulary Restriction (Recommended for Pharmacist)**

- Antimicrobials included on the hospital formulary should be divided into three groups:
  1**. Unrestricted: may be prescribed by any clinician**
  **2. Consultant only: may only be prescribed by a consultant**
  **3. Restricted: may only be prescribed following prior discussion with, and approval by, the antimicrobial stewardship team**
- This list should be reviewed by the antibiotic policy team, AMSP team, and clinicians from the concerned specialty periodically preferably every year on the basis of antimicrobial usage data and rates of antimicrobial resistance.
- The pharmacists should be thoroughly briefed regarding this list and a copy should be available in the pharmacy so that they can discuss the prescription with the prescribing clinicians if the antimicrobials prescribed are not in accordance with the formulary restriction policies.
- Antimicrobials should never be added to the near-expiry list of drugs and circulated in the hospital to encourage consumption of the stock before expiry.

**Laboratory Surveillance and Feedback (Recommended for Laboratory Technicians)**

The microbiology laboratory must share antimicrobial susceptibility data as an antibiogram with the prescribers. Also, feedback on follow-up cultures must be promptly provided to allow timely review of antimicrobial prescriptions.

Utility of Antibiograms:

- Empiric antimicrobial therapy is started by clinicians to provide initial control of a presumed infection of unknown cause. Hence, local cumulative antibiograms are required to select appropriate empiric antimicrobials for patients with common infections.
- It also provides a broad overview of local antimicrobial resistance over time (e.g. the proportion of *S. aureus* isolates that are methicillin-resistant).
- Can provide an overview of the emergence of antimicrobial resistance in particular settings over time.

It can assist in managing infections due to multidrug-resistant organisms.

**Parenteral to Oral Conversion (Recommended for Nursing Professionals)**

- Always review intravenous prescription after 48 hours (at least) and switch to oral if possible.
- Early switch from intravenous (IV) agents to the equivalent oral preparation offers several benefits:
  - Decreased total cost of therapy,
  - Decreased potential for line-associated infections,
  - Potential for decreased length of stay and patient preference,
  - Increased patient comfort and mobility,
  - Savings in nursing time spent preparing and administering intravenous doses.
- Nursing staff provides round-the-clock care to the patients so an alert staff can bring a clinician's attention to the patient(s) who have been on IV antimicrobials for the past 48 hours.

**Streamlining or De-escalation of Therapy (Recommended for Nursing Professionals)**

- All empiric antimicrobial therapy should be reviewed daily by the clinician responsible for the patient's care. Special attention must be paid to factors such as:
  - Antimicrobial combinations with an overlapping spectrum of activity.
  - Prolonged use of broad-spectrum antimicrobials.

- Unauthorized use of restricted agents.
- Antimicrobial use is not in accordance with the hospital's antimicrobial policy.
- Clear criteria for prescribing intravenous antimicrobials.

The nursing professional posted in the ward can effectively contribute to the de-escalation by maintaining a list of the patients that are on antimicrobial therapy, containing details such as the name of the antimicrobial, its duration, route of administration, the date of latest culture sensitivity result (if available) so that the decision on de-escalation can be taken in a timely manner.

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# Role in Infection Control

8

**Recommended for**:

- Nursing Professionals
- Laboratory Technicians
- Operation Theatre Technician
- Medical Radio Imaging Technology
- Optometry
- Other Paramedical Courses

## Learning Objectives

At the end of the session, the non-prescriber will be able to:

- Define and describe the elements of standard precautions
- Describe moments and steps of hand hygiene
- Perform hand hygiene audit
- Define and describe transmission-based precautions
- Define and describe the role of infection control nurse in IPC
- Define and describe various segregation methods of biomedical waste and their disposal as per BMW rules.
- Define device-associated infections
- Describe care bundles for different types of devices associated with infections

For any infection to occur, a sequence of events occurs that transmits an infectious microorganism to a susceptible host. Three things are necessary for an infection to occur:

- **Source:** Places where infectious agents (germs) live (e.g., sinks, surfaces, human skin, water, food)
- **Susceptible Person** with a way for germs to enter the body
- **Transmission:** a way germs are moved to the susceptible person

Interactions are more common in hospital environments and provide microorganisms an opportunity to cause infection in susceptible hosts. Healthcare-associated infections (HAIs/ HCAIs) are influenced by the interplay between host, pathogen, and environmental factors. This chain of transmission is favored by healthcare workers who form a link between the

hospital environment, host, and agent. In order to prevent HAIs, this chain of transmission needs to be broken by appropriate infection control Practices. Infection control prevents or stops the spread of infections in healthcare settings. There are 2 tiers of recommended precautions to prevent the spread of infections in healthcare settings: Standard precautions and transmission-based precautions.

**Elements of Standard Precautions (Recommended for all Non-Prescribers)**

The basis of standard precautions is that it presumes all specimens are potentially infectious. Standard precautions apply to blood, semen, vaginal secretions, synovial fluid, cerebrospinal fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid. They do not apply to feces, nasal secretions, sputum, sweat, tears, urine, vomitus, and saliva. Given below are the elements of standard precautions:

- Hand Hygiene
- Personal Protection Equipment or PPE (gown, mask, face protection, gloves, goggles etc.)
- Safe injection practices
- Sharp management
- Spill Management
- Patient Care Equipment/ Devices management
- Environmental Control
- Respiratory hygiene/cough etiquette
- Proper disposal of biomedical waste

**Hand Hygiene**

- Hand hygiene is the single most important strategy in preventing HAIs. Clean hands prevent infections and this applies in any setting, at home, at school, or work.
- In healthcare settings, handwashing is the simple and most effective way to prevent potentially fatal infections from spreading from patient to patient and from patient to healthcare worker and vice versa. However, this is often overlooked by most healthcare personnel.
- Hence, it is essential to emphasize its importance and educate the personnel about the correct technique of handwashing.

- Key points where hand hygiene should be performed are known as the five moments of hand hygiene as given below:
  - ✓ Before touching a patient, even if gloves are to be worn,
  - ✓ Before coming out of the patient's care area after touching the patient or the patient's immediate environment,
  - ✓ After contact with blood, body fluids or excretions or wound dressings,
  - ✓ Prior to performing any aseptic task (e.g., placing an intravenous line or preparing an injection),
  - ✓ If hands are likely to move from a contaminated body site to a clean body site during patient care; and after removal of gloves
    - ➢ The 5 moments of hand hygiene are given in **Fig 6**

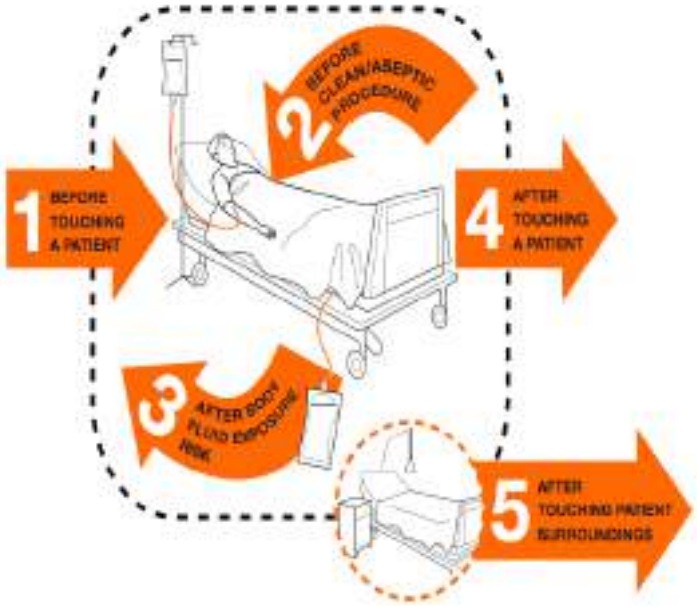


**Fig 6: The WHO 5 moments of hand hygiene**

(*Source: https://openwho.org/courses/IPC-HH-en*)

**Hand Hygiene Using Soap and Water**

- Good hand hygiene practices, which include the use of alcohol-based hand rubs and washing with soap and water, are critical to reducing the risk of spreading infections in ambulatory care settings.

- The process takes around 40–60 seconds in its entirety. Steps of hand washing are given in **Fig 7**.

- Hands must be fully dried, as moisture can breed microorganisms. A cloth towel should not be used as the organisms can remain and be transmitted. If possible, a paper towel should be used to turn off the tap and dry hands. The unwashed hands of a healthcare worker are loaded with bacteria.


**Fig 7: Steps of handwashing**

*(Source:https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene/training-tools)*

**Hand Hygiene Using Hand Rub**

- If soap and water are not available and the hands are not visibly dirty, then alcohol-based hand sanitizer (hand rub) should be used to clean hands.
- Using a hand rub generally reduces the time to around 15–20 seconds (**Fig. 8**).
- When using an alcohol-based hand sanitizer: Apply the product to the palm of one hand, rub hands together, and then rub the product over all surfaces of hands and fingers until hands are dry.


*(Source: Guideline on Hand Hygiene in Health Care in the Context of Filovirus Disease Outbreak Response, WHO, 2014)*

**Fig 8: Steps of hand rub**

**Personal Protective Equipment (PPE)**

- As per OSHA (Occupational Safety and Health Act) PPE is defined as “Specialized clothing or equipment worn by an employee for protection against infectious materials”.
- It refers to wearable equipment intended to improve healthcare workers' safety from exposure to or contact with infectious agents.
- A full PPE is required while providing care to patients who have highly infectious diseases like COVID-19, Ebola, and Nipah virus infections, which require isolation and barrier nursing in containment areas of the hospital.
- The group of items used in PPE can be used separately or in combination, acting as a barrier to prevent contact between health workers and a patient/object/environment. Recommendations on the use of PPE are based on expert opinions regarding disease transmissions, known portals of entry, perception of risk, and severity of transmission.
- All PPE should be made of standard impervious material.

**Components of PPE**

- Gowns and aprons: The same gown should not be worn for the care of more than one patient.
- Safety eyewear such as glasses, wraparounds, and goggles: Personal glasses are not a substitute for goggles. The safety eyewear should fit snugly over and around the eyes. To wear, the goggles must be positioned over the eyes and secured to the head using the ear pieces or headband.
- Face protectors and face shields: These should cover the forehead, extend below the chin, and wrap around the side of the face. To wear a face shield, position it over your face and secure your brow with a headband. It should be then adjusted to fit comfortably covering the entire face and the wearer does not require additional eye protection or a mask to guard against droplet-transmissible agents. Mouth, nose, and eye protection should be in place during procedures likely to generate splashes or sprays of blood or other body fluids.
- Masks: The efficiency of masks reduces with moisture and should be changed frequently. Masks can be surgical or N-95 NIOSH or CDC certified. The exterior of the

mask should not be touched while in use. The mask should be removed by looping the ear loops or by untying cords.

- Boots, jumpsuits, overalls, and hoods: These do not provide any added protection but only prevent the soiling of clothes or street shoes.
- Gloves: With reference to gloves, the following precautions are recommended:
- Gloves should be worn when there is a possibility of contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment.
- The gloves should be placed on top of the cuff of the gown while using long-sleeve gowns.
- Gloves should always be changed between patients or if they develop breaks or tears.
- Gloves should not be washed for reuse.
- Under no circumstance should glove use replace hand hygiene.
- Hand hygiene should be performed immediately after removing the gloves.

There are two methods of wearing sterile gloves:

- Closed gloving: In this method, the hands are covered by the gown sleeves. The hands remain inside the cuff and the gloves are worn one hand after another.
- Open gloves: The gloves are worn by touching the inner surface of the gloves for one hand followed by the outer sterile surface for the other hand.

**Donning of PPE**

- Before donning PPE (**Fig 9**), make sure that hair is tied and all jewelry is removed. The worker must ensure that the PPE is of the correct size before breaking open the seal.
- The PPE must be worn in the following order: Gown---Mask—Eye protection--gloves.


**Fig 9: Donning of PPE (source: https://www.cdc.gov>hai>pdfs>ppe-sequences)**

**Doffing of PPE**

- PPE should be removed in an order that minimizes the potential for cross-contamination.
- PPE should be doffed in the following order as shown in **Fig 10**.


**Fig 10: Doffing of PPE**

**Safe Injection Practices**

Safe injection practices prevent transmission of infectious diseases between patients and between patients and healthcare workers during the preparation and administration of parenteral medications. The following are recommended:

- Aseptic techniques should be used when preparing and administering medications.
- Access diaphragms of medication vials should be cleaned with 70% alcohol before inserting a device into the vial.
- Medications should never be administered from the same syringe to multiple patients.
- A used syringe should not be used to draw medication from a vial or solution.
- Fluid infusion or administration sets (e.g., intravenous tubing) should not be used for more than one patient.
- Multi-dose vials should be dedicated to a single patient whenever possible

**Sharp Management**

- Sharps like needles and syringes have to be rendered unusable and disinfected immediately on use at the source before disposal.
- Containers should be available at the point of use or generation point. Sharps or needles should not be purposely bent or broken by hand.
- The needle is put inside the disposal container with the sharp end first.
- Never push or force in with the hand.
- Have a clear view of the container opening and the inside of the container during disposal. Used needles should not be re-capped on any account. One-hand scoop technique can be done if needed.
- If a needle and syringe need to be transported from one area to another, then a rigid-walled container must be used.
- The sharps container must be removed when half-filled. The lids must be securely closed.

**Sharp Injury**

In the event of a needlestick injury/splash of blood or body fluid into the eye, the area should be washed with running tap water or with an eye wash. In the event of a needlestick or sharp

injury, the following protocol needs to be followed immediately to prevent transmission of HBV, HCV, and HIV.

- The event needs to be reported to the infection control nurse and medical officer in charge/infection control officer. As a part of the injury reporting system, the source patient's status should be verified. (If the status is not known, and with the consent of the patient, the person may be tested for HIV, hepatitis B, and hepatitis C.)
- If the patient is known to be HIV-positive or if the status is unknown, post-exposure prophylaxis (PEP) is initiated (according to NACO, CDC and WHO guidelines).
- Hepatitis B—if the healthcare worker is vaccinated, no treatment is required, but if not vaccinated, HBIg and HB vaccine are initiated as per guidelines.
- Hepatitis C—no treatment is currently recommended.

**Spill Management**

- Body fluid spills can be spills that are visibly contaminated with blood and those that are not. Both types of spills require the same treatment.
- Exposure to blood and other body fluids poses a risk of infection to healthcare persons and patients. Spillages of blood must be dealt with immediately.
- Any splashes of blood or body fluids on the skin must be washed off immediately with soap and water.

**Procedure for Spill Management**

- Spillage of less than 30 ml is treated as small and more than 30 ml as a large spill.
- Infection control nurse must be informed in case of a large spill after immediate action has been taken by the concerned department.
- Staff must be trained in proper procedures to manage spills.
- Spill management protocols must also be displayed at prominent locations (sample given in **Fig 11**) in the hospital especially at the point of use as a ready reference for the staff for the management of spills.

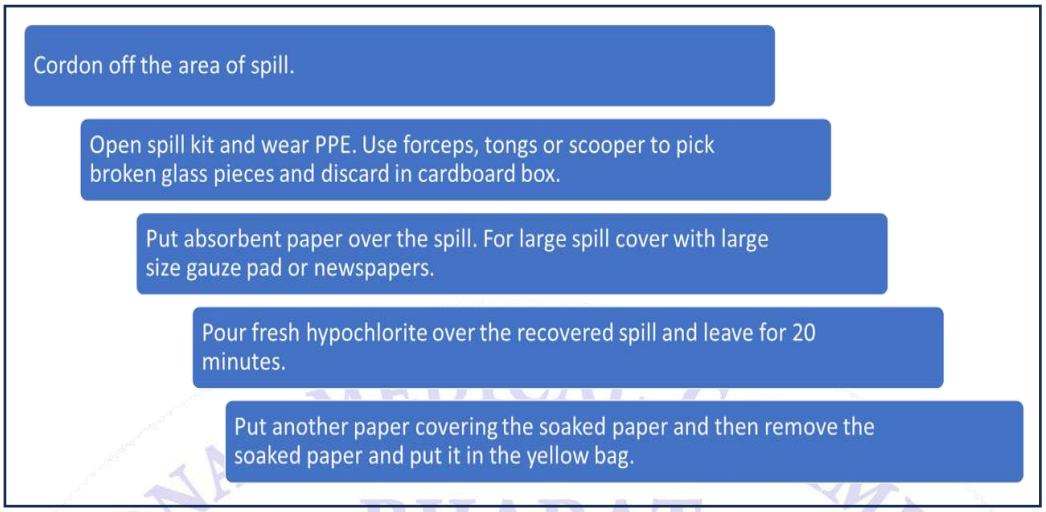


**Fig 11: Steps in spill management**

**Spill kit:** A spill kit must be readily available with all departments especially where risk of spill is more, like laboratory, sample collection room, wards etc. Spill kit must have (**Table 5**):

**Table 5: Contents of a spill kit**

| | |
|---|---|
| • Gloves-2 pairs<br>• Apron<br>• Mask<br>• Shoe covers<br>• Absorbent material like newspaper or blotting paper | • Waste disposal bag<br>• Cleaning equipment – bucket, mop, cloth, soap etc.<br>• Freshly prepared 1% sodium hypochlorite solution<br>• Forceps, tongs or scooper |

**Patient Care Equipment/ Devices Management**

- Medical equipment may be reusable or meant for single use. Reusable medical equipment (e.g., endoscopes) come with instructions for their cleaning and disinfection or sterilisation, as appropriate. Single-use devices are labelled by the manufacturer for one-time use and come with reprocessing instructions.
- Reusable medical equipment (e.g., blood glucose meters and other point-of-care devices, surgical instruments, endoscopes) is cleaned and reprocessed appropriately before being used on another patient.

- Soiled patient care equipment: Wear gloves if visibly contaminated and practice routine hand hygiene. Follow procedures for routine care, cleaning and disinfection of environment surface, especially frequently touched surfaces in patient care areas.

**Environmental Cleaning**

- Cleaning refers to the removal of visible soil and organic contamination from a device or environmental surface with appropriate chemical agents. This process removes large number of microorganisms from surfaces and must always be performed before disinfection.
- Handling soiled or contaminated linen: Gloves should be used at all times. The linen must be inspected for any needles, or syringes etc. while stripping. Linen should not to be placed on floor but in a yellow doubled plastic bag sealed by a knot.
- **Terminal disinfection** is the method of thorough cleaning of the patient bed, surroundings, and the patient utilities after the discharge of the patient. Do not admit another patient in the same room for at least 12 hours.

**Respiratory Hygiene/Cough Etiquette**

This refers to the standard precautions to be taken by any individual with signs of illness including cough, congestion, rhinorrhoea or increased production of respiratory secretions. Such individuals need to be promptly identified to prevent transmission of respiratory infections.

The elements of Respiratory Hygiene/Cough Etiquette include:

- Education of staff, patients, and visitors in a Health Care Facility (HCF).
- Posted signs (in languages understood by the population served), with instructions to patients and accompanying family members/ friends beginning at the point of initial encounter in a HCF (e.g., triage, reception and waiting areas in emergency departments, outpatient clinics and physician offices).
- Source control measures (covering the mouth/nose with a tissue while coughing with prompt disposal of used tissues or using surgical masks on the coughing person as appropriate).
- Hand hygiene after contact with respiratory secretions.

- Spatial separation (ideally >3 feet), of persons with respiratory infections in common waiting areas when possible.
- Health Care Practitioners (HCPs) are advised to observe Droplet Precautions and perform hand hygiene when caring for such patients.
- HCPs who have a respiratory infection are advised to avoid direct patient contact, especially with high-risk patients. At least a mask should be worn while providing patient care.
- Provide tissues and no-touch receptacles (e.g., foot-pedal operated lid or open, plastic-lined waste basket) for disposal of tissues.

**Transmission Based Precautions (Recommended for all Non-Prescribers)**

The standard precautions as mentioned earlier apply to all irrespective of their disease status while transmission-based precautions are to be followed in case the patient is a known case or is suspected to be infected or colonized with infectious agents. As these patients carry a high risk of transmitting the pathogen to the healthcare worker and adjacent patients, further measures are needed in addition to standard precautions to prevent transmission of infection. Usually, these patients must be isolated and the appropriate transmission-based precautions must be used. Following transmission-based precautions are followed in addition to standard precautions:

- Airborne precautions
- Droplet precautions
- Contact precautions

**Airborne Precautions**

- These are to be followed for droplet nuclei <5µm, e.g., tuberculosis, chicken pox, measles, and influenza. This requires:
- Isolation of patients in individual rooms with adequate ventilation: This includes, where possible, negative pressure; door closed; at least twelve air exchanges per hour; exhaust to outside placed away from intake ducts
- Staff wearing high-efficiency masks in the room

### Droplet Precautions

These are to be followed for droplet nuclei >5 µm (meningococcal meningitis, diphtheria, respiratory syncytial virus). The following procedures are required:

- Individual rooms should be made available for the patient, if possible.
- Staff should wear surgical masks while caring for patients.
- Patient should wear a surgical mask if leaving the room
- The patient should be taught to follow respiratory hygiene/cough etiquette.

### Contact Precautions

- Direct contact occurs when performing patient-care activities that require touching the patient's skin. Indirect contact occurs when touching potentially contaminated environmental surfaces or equipment in the patient's environment Individual room for the patient if available; grouping patients if possible. The following procedures are required:

- Staff wear gloves on entering the room; a gown for patient contact or contact with contaminated surfaces or material
- Wash hands before and after contact with the patient, and on leaving the room
- Restrict patient movement outside the room
    - Appropriate environmental and equipment cleaning, disinfection, and sterilization

Contact Precautions are to be followed for patients infected with organisms capable of transmission through either direct or indirect contact, e.g., patients with enteric infections and diarrhoea which cannot be controlled or skin lesions which cannot be contained, and multidrug-resistant organisms (MDRO).

**Table 6: Elements of specific precautions**

| Specific precautions | Source Control: patient to wear a mask | Isolation of patient | Restriction of movement of patients | Appropriate PPE to be used | Disposable or dedicated patient equipment | Prioritize cleaning or disinfection of patient rooms |
|---|---|---|---|---|---|---|
| **Contact Precautions** | No | No | Limit movement outside the room. | Gloves and gown | Yes | Daily and no room and material should be |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Follow contact precautions if transfer is needed covering colonized areas of the patient's body. | | | allowed to be used by another patient before cleaning. |
| **Droplet Precautions** | MUST wear a mask. | In a single room possibly. | Yes | Gloves, apron, and mask | Yes | -do- |
| **Airborne Precautions** | Fit-tested NIOSH-approved N95 or higher-level respirator for healthcare personnel. | In airborne infection isolation room with negative pressure. If not possible then mask the patient and place in a private room with the door closed | Yes | Full PPE with fit-tested NIOS-approved N95 or higher-level respirator for healthcare personnel. | Yes | -do- |

**Isolation of Patients (Recommended for all Non-Prescribers)**

- All patients admitted with contagious infections must be isolated. Patients infected with MRSA and multi-drug-resistant organisms, which are resistant to three or more classes of antibiotics, need to be isolated and treated by barrier nursing.
- The nursing care is individualized so that the infection does not spread to other patients via the nurse.
- All personal protective equipment is dedicated to single use.
- For isolated patients, transmission-based precautions must be followed in addition to the standard precautions.

**Table 7** shows patients who should be isolated into separate rooms or wards are those with:

**Table 7: Patients with clinical presentations/ diseases that require isolation**

| | |
|---|---|
| • Undiagnosed rashes and fevers<br>• Chickenpox<br>• Measles<br>• Severe acute respiratory syndrome (SARS) | • Influenza<br>• Patients are known to be colonized with MRSA, VRE, and other multi-drug-resistant organisms<br>• Multidrug-resistant tuberculosis (MDR-TB) |

- Protective isolation or reverse barrier nursing) is practiced when the patient requires protection. **Reverse barrier nursing** works by protecting vulnerable patients, such as those with impaired immune systems (immune- compromised), against infection by medical staff.

**Proper Disposal of Biomedical Waste (Recommended for all Non-Prescribers)**

Biomedical or hospital waste refers to any waste generated while providing health care, performing research, and undertaking investigations or related procedures on human beings or animals in hospitals, clinics, laboratories, or similar establishments (Management and Handling Rules: Government of India, 2016). The objectives of biomedical waste management are to prevent harm resulting from waste, minimize its volume, retrieve reusable materials, and ensure safe and economical disposal.

**Reduction** in the volume of waste can be achieved by proper planning and using reusable items wherever safely possible.

**Segregation** refers to the separation of waste at the point of generation into various types with respect to their category and mode. Segregated waste must be put into different colored containers, as prescribed in the rules, for appropriate treatment. These guidelines were modified in 2018. The color coding is shown in **Table 8**.

**Storage** refers to the measures taken to ensure that biomedical waste is kept safely at the point of generation before being sent to the biomedical waste treatment facility.

- **Treatment** of waste means all the procedures and processes intended to reduce the bulk of the waste and make it non-infectious and harmless.

**Table 8: Colour-Coded Bags for Biomedical Waste Segregation**

| Colour of the bag | Type of waste | Waste treatment |
|---|---|---|
| Yellow | a) Human anatomical waste<br>b) Animal anatomical waste<br>c) Soiled waste | Incineration or plasma pyrolysis or deep burial |
| | d) Expired or discarded medicines | Returned to the manufacturer or supplier for incineration at temperature >1,200°C |
| | e) Chemical waste | Incineration, plasma pyrolysis, deep burial, or encapsulation |
| | f) Chemical liquid waste | Pre-treatment and then disposal |
| | g) Discarded linen, mattresses, and beddings contaminated with blood or body fluids | Non-chlorinated chemical disinfection followed by incineration or plasma pyrolysis |
| | h) Microbiology, biotechnology, and other clinical laboratory waste | Pre-treat to sterilize with non-chlorinated chemicals on-site as per NACO or WHO guidelines and thereafter send for incineration |
| Red | Contaminated waste (recyclable) like plastic bags, bottles, pipes, or containers | Autoclaving or microwaving/ hydroclaving followed by shredding or mutilation<br>Treated waste to be sent to registered or autoclaved recyclers or for energy recovery of plastics to diesel or fuel oil or for road-making |
| White, translucent | Waste sharps including metals: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades | Autoclaving or dry-heat sterilization; followed by shredding mutilation or encapsulation in a metal container or cement concrete sent for final disposal to iron foundries (having consent to operate from the state pollution control committees) or sanitary landfill or designated concrete waste sharp pit |
| Blue cardboard box with a blue label or blue leak- and puncture-proof container | Glassware: Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes; metallic body implants | Disinfection (by soaking the washed glass waste after cleaning with detergent and sodium hypochlorite treatment) or through autoclaving or microwaving or hydroclaving, then sent for recycling |

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# Preventive bundles for Device associated infections (Recommended for Nursing)

**Definitions**

Device Associated Infections

- These healthcare-associated infections are infections that can be associated with the devices used in medical procedures, such as catheters or ventilators. These include central line-associated bloodstream infections (CLABSI), catheter-associated urinary tract infections (CAUTI), and ventilator-associated pneumonia (VAP).

Care Bundles

- These are a set of interventions that when applied together result in better prevention of device-associated infections than individual elements implemented alone.
- Some recommended preventive bundles are given below. The hospitals may modify these bundles according to their availability of resources and other logistics.

**Care Bundle for Prevention of CLABSI**

- Hand Hygiene
- Maximal barrier Precautions upon insertion/Manipulation
- PI/Alcohol/Chlorhexidine Skin Antisepsis
- Optimal Catheter site selection, with avoidance of the Femoral Vein for central venous access in adult patients
- Daily review of line necessity with prompt removal of unnecessary lines

**Care Bundle for CAUTI**

- Catheterize only if necessary
- Reduce the duration of catheterization
- Closed drainage
- Intermittent catheterization
- External collection devices

- Ensure dependent drainage
- Use of systemic antimicrobials: Only if the patient is symptomatic and culture suggests UTI
- Compared with latex catheters, silastic catheter has a decreased incidence of urethritis and possibly urethral strictures. However, because of its lower cost and similar long-term outcomes, latex is preferably used for long-term catheterization.
- Remove catheters as early as possible

**Recommended Elements of Preventive Bundle for VAP**

- Avoid unnecessary antibiotics
- Avoid unnecessary stress ulcer prophylaxis
- Sucralfate for stress ulcer prophylaxis
- Oral intubation
- Selective digestive decontamination
- Short-course parenteral antibiotics
- Appropriate hand disinfection
- Appropriate staffing
- Avoid tracheal intubation
- Shorten duration of mechanical ventilation
- Semi-recumbent positioning
- Avoid gastric overdistention
- Subglottic suctioning
- Avoid ventilator circuit changes/manipulation
- Drain ventilator circuit condensate
- Prevent accidental extubation

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# Leftover Antimicrobials- Storage and Discarding

9

**Recommended for**:

- Pharmacists
- Nursing

**Learning Objectives**

At the end of the session, the non-prescriber will be able to understand:

- Effects of using leftover antimicrobials
- Storing and handling leftover antimicrobials

In the event of leftover antimicrobials, their further use by the same patient or another patient is documented to contribute to the spread of AMR and potential adverse drug reactions. This makes the leftover antimicrobial a significant barrier to antimicrobial stewardship. It is therefore recommended never to store leftover antibiotics for future use.

Unused or expired medicines including antimicrobial agents are categorized as biomedical waste & should be discarded in a yellow container. These expired or unused antimicrobial agents therefore should be safely disposed of as per the latest BMW management rules so as to reduce the toxic and polluting effect on the environment and also the development of AMR.

It is recommended that all healthcare workers including pharmacists should be competent in the safe handling and disposal of biomedical waste. Color-coded bins should be available at all sites of the hospital, along with material showing the color coding and type of waste to be discarded in each bin.

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# Role in Maintaining Medicine as per Local Policies and Guidelines

10

**Recommended for**:

- Pharmacists

**Learning Objectives**

At the end of the session, the non-prescriber will be able to understand:

- What is the National List of Essential Medicines
- Maintaining medicines as per local policies and guidelines

The National List of Essential Medicines (NLEM) 2022 contains the list of anti-infectives (antimicrobials) considered as essential medicines and a stock of these medicines should be available in the Institute pharmacy. Besides NLEM, the stock of antimicrobials should be maintained as per the prescription trends and antibiotic policy of the Institute The pharmacists shall audit the stock of antimicrobials periodically to ensure that the stock of antimicrobials is not completely exhausted leading to challenges in the completion of the full course of the antibiotics.

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# Non-Prescribers' toolkit for combating AMR

11

**Table 9: The competencies, learning objectives, and the assessment methods**

| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 1. Background and Objectives | 1.1 Understand the present burden of AMR<br><br>1.2 Understand the concept of this national program<br><br>1.3 Assist in implementing this program | K | All Non-Prescribers | Theory session- 30 min | Written: MCQ, SAQ |
| 2. Basics of Microbial Pathogens | 2.1 Describe the types of microorganisms causing human infections<br><br>2.2 Define opportunistic pathogens<br><br>2.3 Differentiate between community and healthcare-associated infections<br><br>2.4 Describe common organisms causing community and healthcare-associated infections | K | All Non-Prescribers | Exploratory and interactive theory session - 30 min | Written: MCQ -Case-based discussion Clinical problem solving |
| 3. Common Infection Syndromes | 3.1 Define infection and sepsis<br><br>3.2 Describe signs and symptoms of sepsis<br><br>3.3 Describe common infection syndromes and appropriate specimens for culture sensitivity testing | K, S, A | All Non-Prescribers | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ |
| 4. Use of Antimicrobials and Emergence of Resistance | 4.1 Describe the mechanism of action of antimicrobials<br><br>4.2 Discuss the mechanism of antimicrobial resistance<br><br>4.3 Describe drivers of antimicrobial resistance<br><br>4.4 Describe important antimicrobial-resistant pathogens | K, S | All Non-Prescribers | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ, Case discussion, AST problem solving |

| | | | | | |
|---|---|---|---|---|---|
| 5. Contribution to Diagnostic Stewardship | 5.1 Understand the difference between infection and colonization<br><br>5.2 Collect, transport, and process the clinical samples for microbiological investigations | K | Nursing and Laboratory Technician | Exploratory and interactive theory session with demonstration of collection containers, videos for collection - 60min | Written: SAQ, MCQ |
| 6. Contribution to Quality Management in the Laboratory | 6.1 Understand the importance of transcription errors in specimen handling and their potential implications for patient management.<br><br>6.2 Understand the purpose of ISO15189 NABL standards.<br><br>6.3 Describe the principles behind quality management systems for laboratories.<br><br>6.4 Describe the importance of internal and external quality assurance and methods of reporting failures in quality assessment (consumables, equipment calibration/ maintenance, and processes) to appropriate authorities.<br><br>6.5 Have knowledge of the WHO Laboratory Quality Stepwise Implementation tool (LQSI) | K | Laboratory Technician | Exploratory and interactive theory session - 60 min | Written: SAQ, MCQ |
| 7. Contribution to Antimicrobial Stewardship | 7.1 Understand the basics of the Anti-microbial stewardship program<br><br>7.2 Understand their role in AMSP<br><br>7.3 Demonstrate the procedures for storage, preparation, administration, disposal and recording of antimicrobial agents | K, S | All Non-Prescribers | Exploratory and interactive theory session with examples of antibiograms, antibiotic consumption recording, etc. -120 min | Written: SAQ, MCQ, Case based problem |

| | | | | | |
|---|---|---|---|---|---|
| 8. Role in Infection control | 8.1 Define and describe the elements of standard precautions<br><br>8.2 Describe moments and steps of hand hygiene<br><br>8.3 Perform hand hygiene audit<br><br>8.4 Define and describe transmission-based precautions<br><br>8.5 Define and describe the role of infection control nurse in IPC<br><br>8.6 Define and describe various segregation methods of biomedical waste and their disposal as per BMW rules.<br><br>8.7 Define device-associated infections<br><br>8.8 Describe care bundles for different types of devices associated with infections | K | All Non-Prescribers | Exploratory and interactive theory session- 15 + 15 + 15 + 15 min = 60 min.<br>DOAP session – 60 min | Written: SAQ, MCQ, DOAP |
| 9. Leftover Antimicrobials- Storage and Discarding | 9.1 Understand the effects of using leftover antimicrobials<br><br>9.2 Understand storing and handling leftover antimicrobials | K | Nursing and Pharmacist | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ |
| 10. Role in Maintaining Medicine as per Local Policies and Guidelines | 10.1 Understand the National List of Essential Medicines<br><br>10.2 Understand how to maintain medicines as per local policies and guidelines | K | Pharmacist | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ |

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# Powerpoint Presentations on NAP-AMR Module for Non – Prescribers

(The presentations are based on modules, non-prescribers can modify according to their need)

1

# 1. Background and Objectives

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

On completion of this chapter, the non-prescriber should be able to:

- Understand the gravity of problem of AMR
- Understand the concept of this program
- Assist in implementing this program

# Background

- Antimicrobials are compounds that act against micro-organisms and can either kill them or inhibit their growth.
- These are further divided into:
  - Antibiotics (against bacteria)
  - Antifungals (against fungi)
  - Antivirals (against viruses)
  - Antiparasitic (against parasites)
- In 2010, India was the largest user of antimicrobials among the BRICS (Brazil, Russia, India, and China) countries.





- The chances of developing antimicrobial resistance (AMR) is high due to excessive use of antimicrobials.
- AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines.
- This makes infections harder to treat and increasing the risk of disease spread, severe illness and death.
- Challenging factors that contribute to the AMR burden in India include-
  - a high prevalence of infectious diseases,
  - incompatible IPC practices,
  - easy access to antibiotics without prescriptions,
  - lack of awareness,
  - limited laboratory resources for disease-based diagnosis etc.

- Factors driving antimicrobial resistance are:\

  - *Misuse and overuse of antimicrobials*- Unnecessary use of antimicrobials along with improper dosage or duration of treatment aids the development of AMR.

  - *Use in animals*- Around 70% of all medically important antimicrobials are used in animals, dairy, poultry and fishery products.
    - These products when consumed by human's act as an invisible source of antimicrobial intake.

  - *Inconsistent infection control practices* contribute to development of AMR by way of use of antimicrobials for treating this hospital acquired infections that could otherwise have been avoided.

1. Background and Objectives



# GAP-AMR

- In Year 2015, understanding the gravity of the problem of AMR, the World Health Assembly (WHA) has adopted the GAP on AMR including antibiotic resistance in collaboration with WHO, Food & Agricultural Organization (FAO) & World Organization for Animal Health (OIE)

- In February 2016, an International Conference "Combating AMR A Public Health Challenge & Priority" was organised by Government of India & WHO

- In May 2017, the WHO Resolution urges Member States to align NAP on AMR with GAP-AMR

1. Background and Objectives

## AMR Global Action Plan (GAP)


- Adopted by World Health Assembly in May 2015
- Technical blueprint on what to do
  - Consolidates global scientific consensus & draws upon countries, FAO, OIE, civil society & others
- Reflects stepwise approach recognizing countries have different starting points, priorities

The goal of the plan is to ensure continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality assured, used in responsible way and accessible to all who need them-

1. Background and Objectives



## NAP-AMR

- The Core Working Group notified by MoHFW drafted "National Action Plan on AMR" ( NAP-AMR)
- The Strategic Objective of NAP-AMR are aligned with the GAP based on National needs & priorities
- In addition to the 5 priorities of GAP- AMR
- India has a **India specific sixth priority** including International, National and Sub-national Collaboration on AMR.

1. Background and Objectives

# National Action Plan on AMR (NAP-AMR)

- Developed by Ministry of Health and Family Welfare which needs to be launched across the country so as to bring about an alignment with the Global Action Plan on AMR with a "One Health" approach.
- The NAP-AMR Strategic intervention activity (1.2.1.1; 1.2.1.4 & 4.6.1.1) under NMC, can be accessed at http://www.ncdc.gov.in/writeReadData/linkimages/AMR/File545.pdf
- NAP-AMR released in April 2017;

Cover all five objectives as listed in GAP-AMR and adds an additional objective related to strengthening India's Leadership on AMR


1. Background and Objectives



# Alignment of NAP-AMR and GAP-AMR

**National action Plan on AMR (NAP-AMR): 6 strategic priorities**


The 5 objectives outlined in the GAP-AMR, along with India specific one additional objective

1. Background and Objectives

## Strategy 1. Improve awareness and understanding of AMR through effective communication, education and training

**Objective 1.2 Improve knowledge and capacity of key stakeholders regarding AMR and related topics.**

Strategic intervention and activity

1.2.1 Strengthen and consolidate AMR and related topics as core components of professional education and training.

- **1.2.1.1. Review and revise curricula of professionals in human health**
- **1.2.1.4. Review and develop curriculum and resources for in-service training of different professionals and allied services**
- **Develop a module on AMR to bring together the segmented knowledge being imparted under different subjects (Microbiology, Pharmacology, Medicine, PSM, etc.)**

Key outputs

- Professional curricula revised
- Training module developed on AMR (of in-service and pre-service trainings)

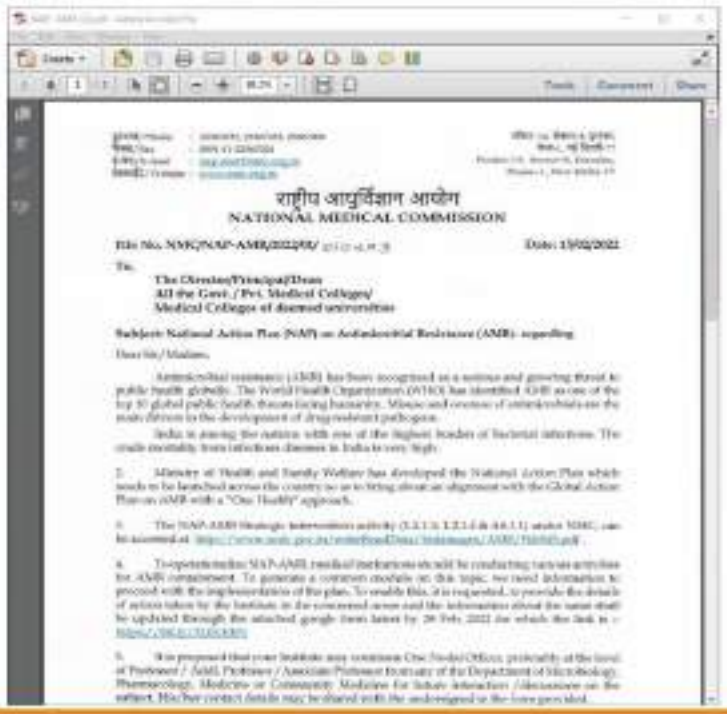


## Strategy 4. Optimize the use of antimicrobial agents in health, animals and food.

**Objective 4.6 Improve knowledge and skills of prescribers, dispensers and medical trainees.**

Strategic intervention and activity-

- 4.6.1. Develop structured (and mandatory) training programmes on optimal antimicrobial use
- 4.6.1.1. Collaborate with regulatory bodies to mandate periodic training to optimise antibiotic use through pre-service and in-service trainings.



राष्ट्रीय आयुर्विज्ञान आयोग
NATIONAL MEDICAL COMMISSION

File No. NMC/NAP-AMR/2022/01/ Date: 15/02/2022

To,
The Director/Principal/Dean
All the Govt./Pvt. Medical Colleges/
Medical Colleges of deemed universities

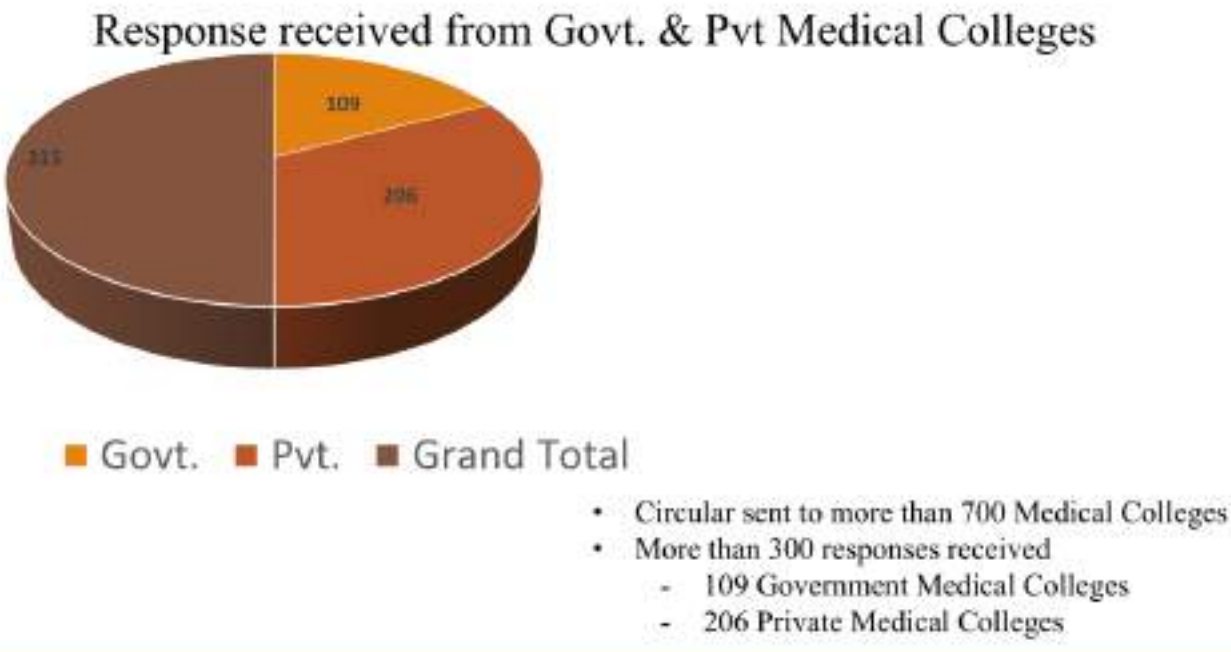
Subject: National Action Plan (NAP) on Antimicrobial Resistance (AMR)- regarding

Dear Sir/Madam,

Circulated to all Medical colleges & INIs on 15.02.2022 to-

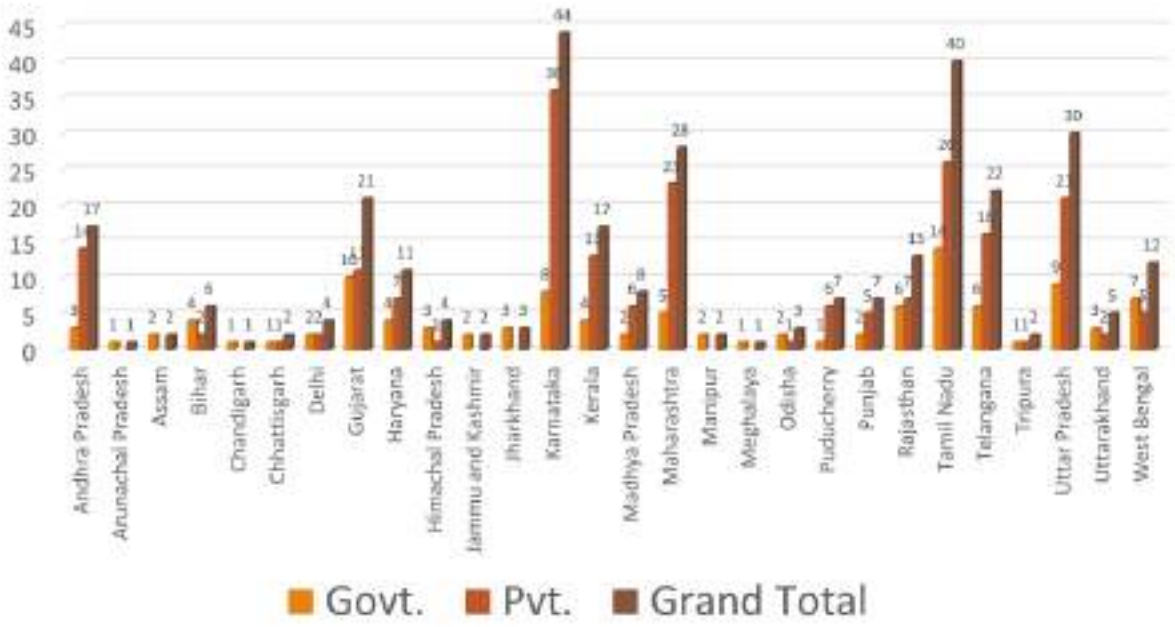
- Collect base line ongoing AMR activities in Medical Colleges & INIs
- Nomination of the Nodal officer from Microbiology/ Pharmacology/ Medicine/ Community Medicine of each Medical Colleges & INIs

1. Background and Objectives



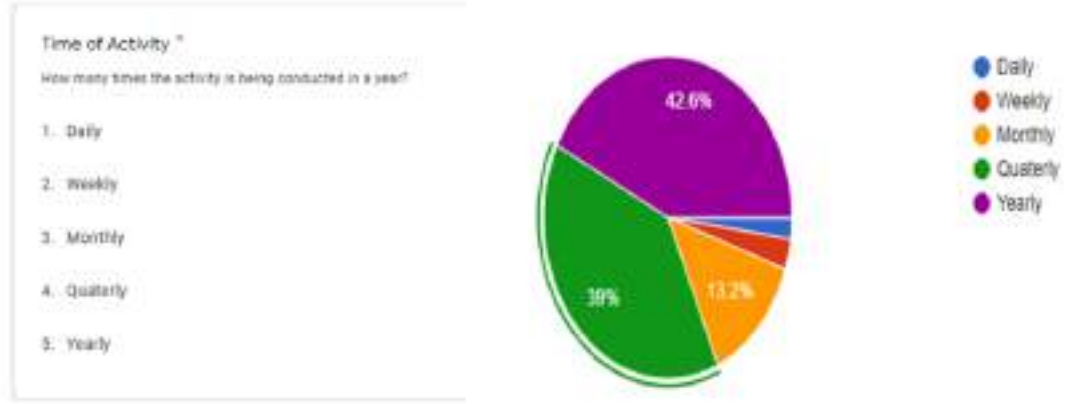

- Circular sent to more than 700 Medical Colleges
- More than 300 responses received
  - 109 Government Medical Colleges
  - 206 Private Medical Colleges

1. Background and Objectives



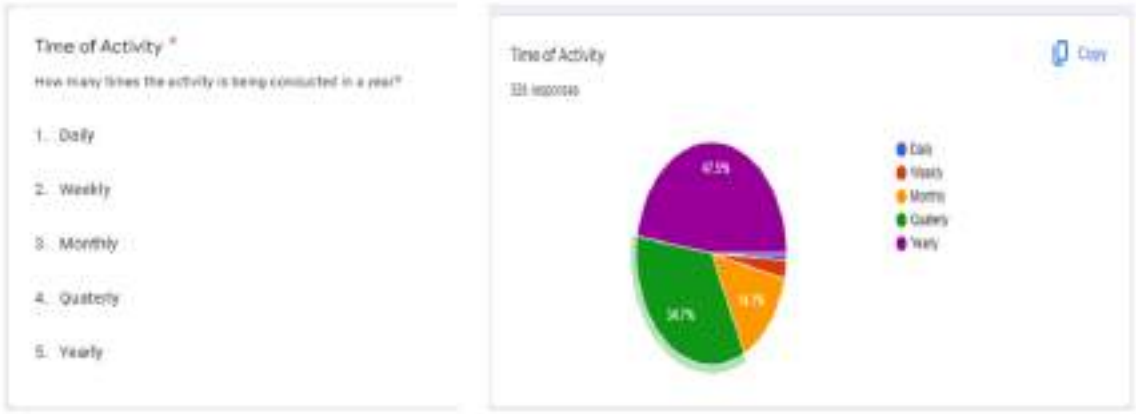

Response Received from Different States

**Objective 1.** To Improve awareness and understanding of AMR among Undergraduate, Postgraduate students, and Teaching professionals



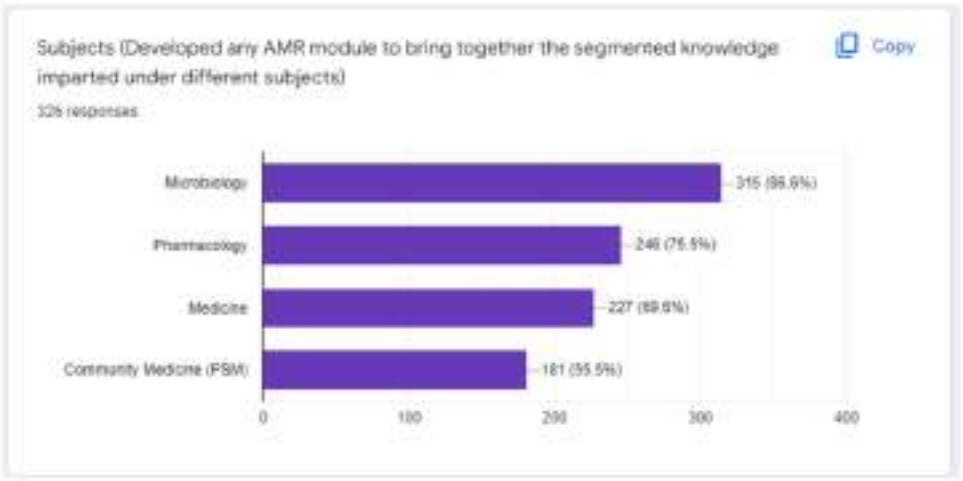

1. Background and Objectives

## 2. To Improve Awareness and Understanding of AMR Among Allied Health Professionals




1. Background and Objectives

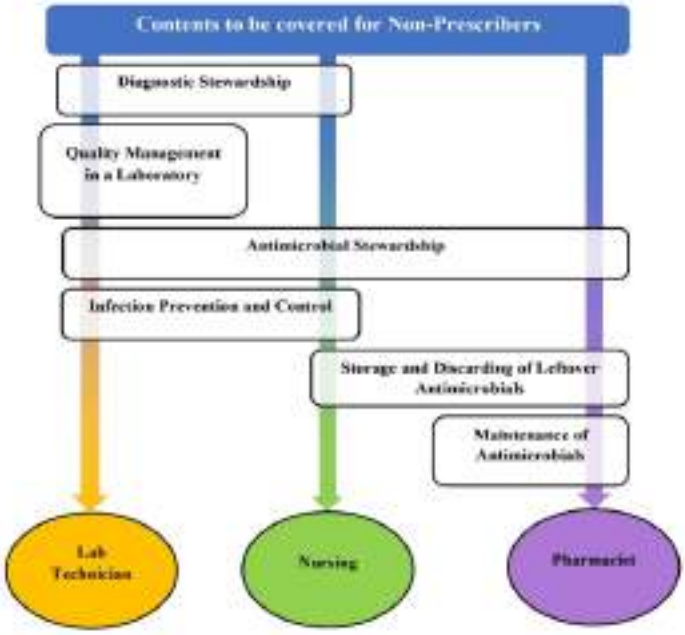
## 3. Developed any AMR module to bring together the segmented knowledge imparted under different subjects




1. Background and Objectives

The vertical grid and horizontal spine to be used for the training of non-prescribers.

The vertical grids represent the course type/ category of non-prescriber such as Nursing, Laboratory Technician or Pharmacist while the horizontal spine represents the topic to be covered.




1. Background and Objectives



THANK YOU

1. Background and Objectives

2

# 2. Basics of Microbial Pathogens

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to:
  - Describe the types of microorganisms causing human infections
  - Define opportunistic pathogens
  - Differentiate between community and healthcare associated infections
  - Describe the common organisms causing community and healthcare associated infections

# Microbial Pathogens

- Infections are important cause of morbidity and mortality across the globe.
- These are caused by a variety of micro-organisms that can be broadly categorized into one of the following four major types:
  - (1) Bacteria (prokaryotic)
  - (2) Fungi
  - (3) Parasites
  - (4) Viruses.

2. Basics of Microbial Pathogens



- Many bacteria and fungi can be isolated from the patient's specimen in the microbiology laboratory on an artificial culture media.
- Parasites can be directly observed under the microscope or detected by a serological test (for presence of antigen or antibody) and/ or molecular test such as polymerase chain reaction (PCR).
- Viruses cannot be grown on an artificial medium and are not visible under a light microscope due to their extremely small size.
- The diagnosis of viral infections/ diseases thus relies mainly on serology and/ or molecular tests.

2. Basics of Microbial Pathogens

- Infections are broadly classified as:
  - community acquired
  - hospital acquired.

- Infections contracted outside the hospital or those that become apparent within 48 hours of the hospital admission are called **community acquired infections**.

- The **hospital acquired infections** (HAIs), now more commonly known as **healthcare associated infections**, are those infections acquired in the hospital by a patient admitted for a reason other than infection, infection should not be present at the time of admission, and the symptoms should appear at least after 48 hours of admission





## Common causative agents of community acquired infections

| Infection | Organisms |
|---|---|
| Respiratory tract infections | *Streptococcus pneumoniae, Haemophilus influenzae, Neisseria meningitidis* |
| Urinary tract infections | *E.coli, Enterococcus spp, Proteus spp* |
| Gastrointestinal infections | Adeno viruses, *Giardia, E.coli, Shigella* spp |

# Common causative agents of some important healthcare associated infections

| Infection | Organisms |
|---|---|
| Urinary tract infections | *E.coli, Pseudomonas aeruginosa, Klebsiella spp, Serratia, Enterococcus spp.* |
| Respiratory tract infections | *Haemophillus influenzae, Streptococcus pneumoniae, Staphylococcus aureus* |
| Wound infections | *Staphylococcus aureus, Pseudomonas spp, E.coli* |
| Gastrointestinal infections | *Clostridium difficile, Salmonella spp, Shigella spp* |





THANK YOU

3

# 3. Common Infections Syndromes

NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the Non-Prescriber will be able to:
  - Define infection and sepsis
  - Describe signs and symptoms of sepsis
  - Describe common infection syndromes and appropriate specimen for culture sensitivity testing

# Infection and Sepsis

- Infection is the invasion of a disease producing microorganism into the host tissue, their multiplication and the reaction of host tissue to these micro-organisms and the toxin they produce.
- Sepsis is the body's extreme response to an infection.
- It is life-threatening, and without timely treatment, sepsis can rapidly lead to tissue damage, organ failure, and death.

3. Common Infection Syndromes



- Sepsis, now defined as life-threatening organ dysfunction due to a dysregulated host response to infection.
- Recognized by the WHO as a global health priority.
- Detecting sepsis early and starting immediate treatment is often the difference between life and death.

3. Common Infection Syndromes

- The signs and symptoms of sepsis can include a combination of any of the following:
  - confusion or disorientation
  - shortness of breath
  - high heart rate
  - fever, or shivering, or feeling very cold
  - extreme pain or discomfort
  - clammy or sweaty skin

3. Common Infection Syndromes



## Early Warning Score and its Significance

- These should be used to assess worsening or improvement in patients' clinical status over time.
- Higher scores are associated with a need for further treatment or escalation to intensive care unit (ICU) or high dependency unit (HDU) care.
- Early warning score (EWS) encompass:
  - respiratory rate (RR),
  - oxygen saturation (SpO2),
  - temperature,
  - blood pressure (BP),
  - heart rate (HR).
  - Consciousness level is also often assessed and typically uses the alert/responds to voice/pain/unresponsive (AVPU) system.

3. Common Infection Syndromes

# Checklist to Detect the Signs of Worsening

- Temperature: if high (>100°F), worsening of infection.
  - If low (<96°F), may indicate septic shock.
- Pulse rate: if high (tachycardia), worsening of infection.
  - If irregular: electrolyte imbalance.
- Low BP may indicate septic shock.
- High respiratory rate: patient may be reactive or sign of aspiration.
  - Low respiratory rate/ laboured breathing: drowsy due to CO2 retention, metabolic acidosis.
- Low urine output is another sign of worsening the disease

3. Common Infection Syndromes



# Clinical Features and Presentation of Common Infections

| Clinical presentation and features | Suggested infection | To find potential source of infection |
|---|---|---|
| Burning sensation during micturition, frequency of micturition, back pain | Urinary tract infection | Urine for routine examination, culture-sensitivity (C/S) |
| Cough and cold, fever with:<br><br>Sore throat<br>Productive cough | Respiratory tract infection (RTI)<br>Upper RTI<br>Lower RTI | <br><br>Throat swab C/S<br>Sputum C/S |
| Nausea, vomiting, diarrhoea | Gastroenteritis | Stool C/S |
| Boil, carbuncle, pus/ discharge from wound | Skin and soft tissue infection | Pus for C/S<br>Wound swab for C/S |
| Fever, irritable, headache, intolerance to light, neck rigidity | Meningitis | CSF for microscopy and C/S |

3. Common Infection Syndromes

THANK YOU

4

# 4. Use of Antimicrobials and Emergence of Resistance

NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to:
  - Describe the mechanism of action of antimicrobials
  - Discuss mechanism of antimicrobial resistance
  - Describe drivers of antimicrobial resistance
  - Describe important antimicrobial resistant pathogens

# Antimicrobials- Mechanism of Action

- Inhibition or disruption of:
  - Cell wall or cell membrane synthesis of microbes
  - Protein synthesis of microbes
  - Nucleic acid synthesis in microbes
  - Metabolism or enzyme

| Bactericidal | Bacteriostatic |
|---|---|
| Beta lactams | Macrolides |
| Glycopeptides | Clindamycin |
| Cyclic lipopeptides | Tigecyclines |
| Aminoglycosides | Tetracyclines |
| Fluoroquinolones | Linezolid |

4. Use of Antimicrobials and Emergence of Resistance



# Mechanism of AMR Cont..

**Acquired resistance**: Bacteria may stop responding to a drug to which it is originally sensitive by any of the following actions:

- Production of enzymes that destroy the antibacterial drug (e.g., beta-lactamases)
- Expression of efflux systems that prevent the drug from reaching its intracellular target (e.g., fluoroquinolone resistance)
- Reduction of permeability of drug through mutation of porin proteins (aminoglycosides)
- Modification of the drug's target site (e.g., penicillin-binding protein)
- Production of an alternative metabolic pathway that evades the action of the drug (e.g., folate metabolism).

4. Use of Antimicrobials and Emergence of Resistance

## Drivers of AMR

- The development of AMR is multifactorial.
- The risk factors most commonly found to be associated with development of antimicrobial resistance are:
  - Excessive and irrational prescriptions of antimicrobials in community and hospitals
  - Increase in invasive procedures, transplants surgeries and immunosuppressive therapy.
  - Increase use of prosthetic devices amenable to superinfection and resistant bacteria.

4. Use of Antimicrobials and Emergence of Resistance

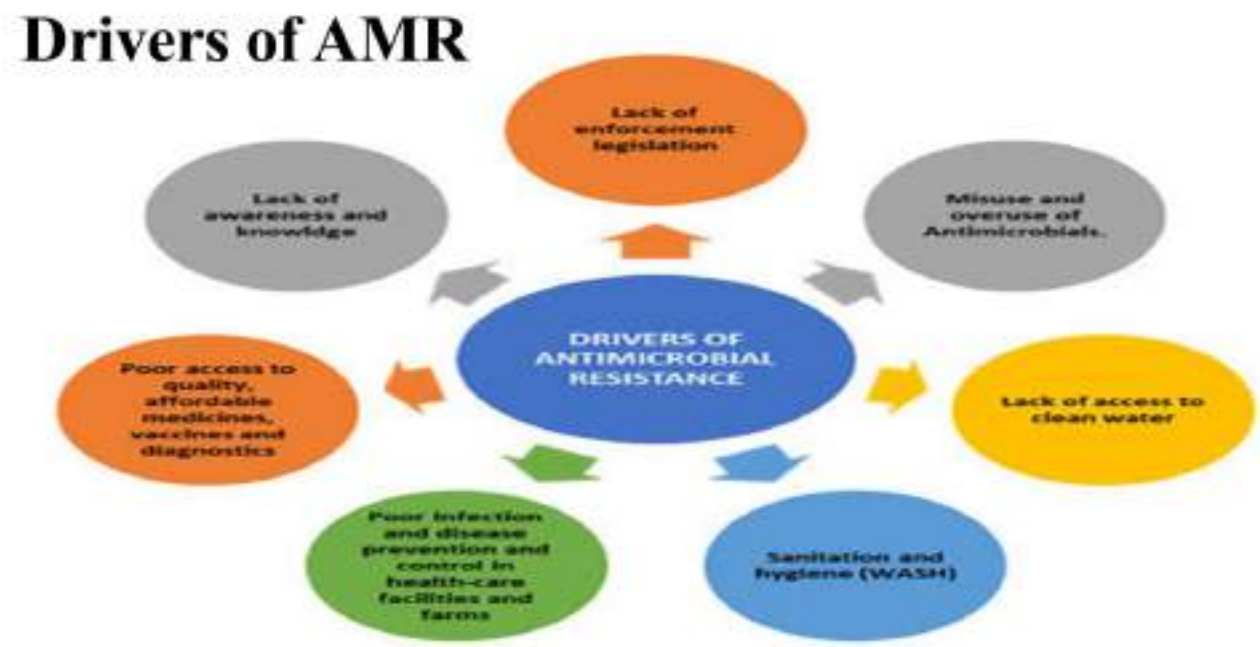


## Drivers of AMR cont..

Risk factors (continued):

- Lack of effective preventive infection control measures such as hand hygiene, isolation procedures of patients with multi drug resistant organisms.
- Lack of effective antimicrobial stewardship programs restricting antimicrobial usage in community and hospitals.
- Use of antimicrobial in agriculture sector, animal husbandries and fisheries.
- Improper disposal of antimicrobials and antimicrobial residues which leads to finding their way in community and entering food chain through food, animals and water.

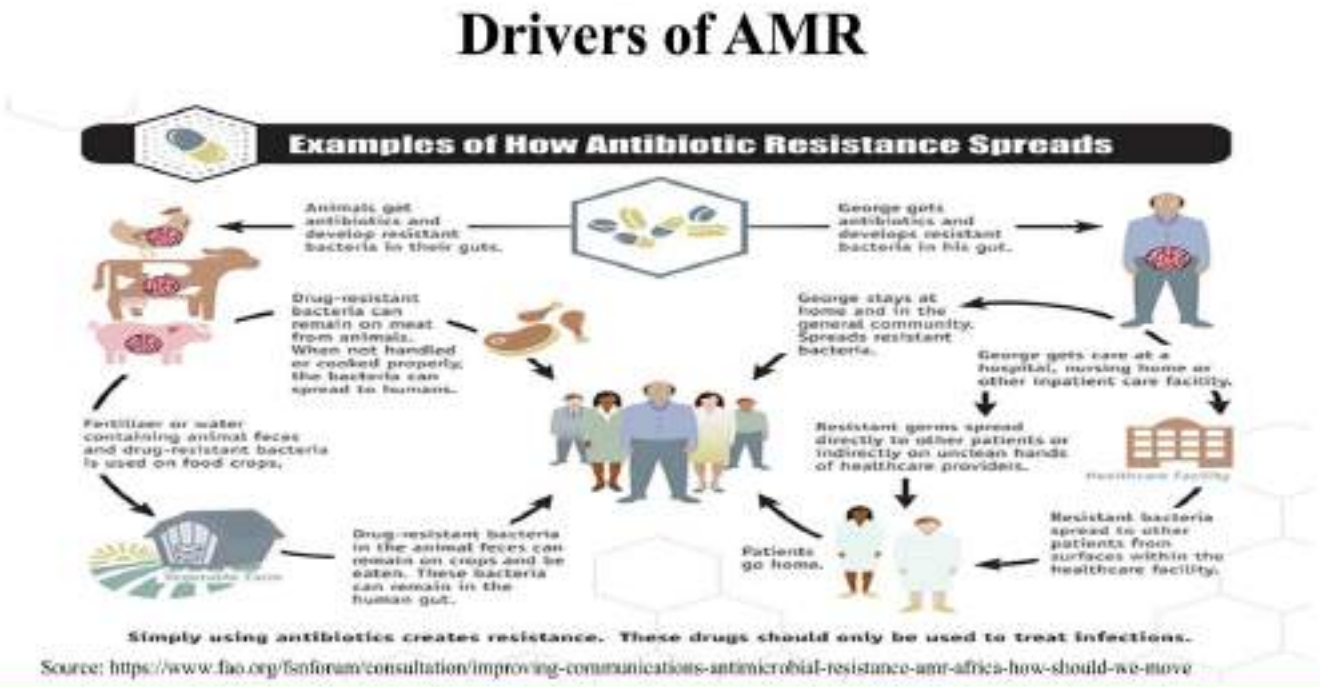
4. Use of Antimicrobials and Emergence of Resistance




Source: CDC - Drivers of resistance in healthcare settings and community level

4. Use of Antimicrobials and Emergence of Resistance






Source: https://www.fao.org/fsnforum/consultation/improving-communications-antimicrobial-resistance-amr-africa-how-should-we-move

4. Use of Antimicrobials and Emergence of Resistance

# Key Antimicrobial Resistant Pathogens

- WHO priority list 2024 lists drug resistant pathogens that pose a critical threat to human health due to their resistance to antimicrobials.
- **Carbapenem Resistant Enterobacterales (CRE)** These include *Klebsiella* spp. and *Escherichia coli* that are resistant to carbapenems and are placed atop in the critical list of priority pathogens.
- **Third Generation Cephalosporin-Resistant Enterobacterales (3GCREB)** - Gram-negative bacteria resistant to third-generation cephalosporins, a broad class of antibiotics used to treat many different types of infections.
- **Carbapenem Resistant Acinetobacter Baumannii (CRAB)** - The emergence of CRAB poses a formidable challenge due to limited treatment options particularly in ICU settings.





- **Methicillin-Resistant *Staphylococcus aureus* (MRSA)** – *S. aureus* resistant to many common antibiotics, making it difficult to treat skin infections, pneumonia, and bloodstream infections.
- **Vancomycin-Resistant *Enterococcus* (VRE)** - one of the last-resort antibiotics used to treat serious infections.
- **Fluoroquinolone-Resistant bacteria** - This includes strains of *E. coli*, *Salmonella* and *Campylobacter* that are resistant to fluoroquinolones, commonly used to treat urinary tract infections, diarrhoea, and respiratory infections.

## Steps To Mitigate Impact of AMR

- To reduce the clinical and economic burden of drug resistant infections (DRIs) and healthcare associated infections (HAIs), several strategies are crucial:
- Antimicrobial Stewardship
- Infection Prevention and Control
- Surveillance
- Research and Development of new antibiotics, diagnostics, and vaccines to combat DRIs and HAIs





## THANK YOU

5

# 5. Contribution in Diagnostic Stewardship
## Sample Collection and Transport

NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to:
  - Understand the difference between infection and colonization
  - Collect, transport and process the clinical samples for microbiological investigations

# Diagnostic Stewardship

**"Co-ordinated guidance and interventions to improve appropriate use of microbiological diagnostics to guide therapeutic decisions. It should promote appropriate, timely diagnostic testing, including specimen collection, and pathogen identification and accurate, timely reporting of results to guide patient treatment."**

5. Contribution in Diagnostic Stewardship



## Correct Sample for Correct Report

- The Microbiology laboratories must be effectively utilized for diagnosis of infections and determining their antimicrobial susceptibility.
- Appropriate selection of samples, their proper collection and transport helps to improve the diagnostic performance of a Microbiology laboratory.
- The turn-around time for laboratory investigations must be known to all.
- Many pathogenic microorganisms may be found as part of the normal commensal flora. Isolation of these organisms may not necessarily indicate infection.

5. Contribution in Diagnostic Stewardship

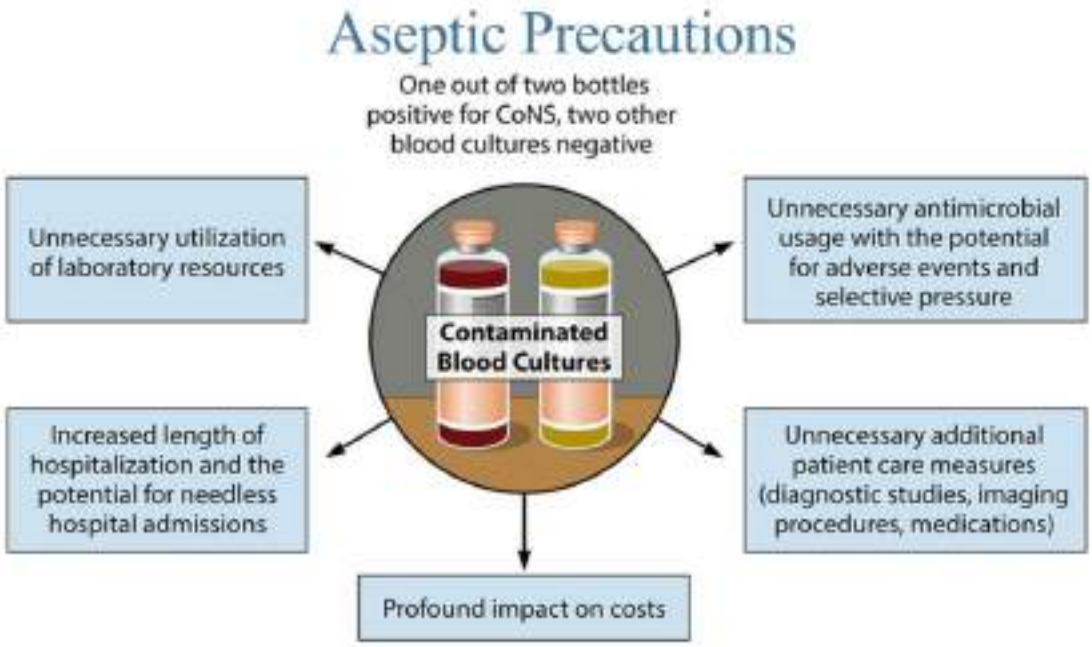
- Likewise, many body sites have a normal commensal flora and samples sent to the laboratory in the absence of signs or symptoms of infection may be difficult to interpret.
- So, proper sample collection is of utmost importance.
- A blood culture can easily be contaminated with skin organisms at the time that the sample is being taken.
- Patients with contaminated blood cultures are often commenced on unnecessary antimicrobial therapy while the issue is being investigated.





## General Precautions while Collecting Samples

- **Bacterial culture** must be collected prior to antimicrobial therapy.
- Always choose **correct container** as per case definition.
- Collection should be done by **trained staff** after precise instructions to the patient.
- Transported **within 2 hours** after collection, in the correct package.
- Blood and CSF should never be refrigerated.
- All samples must be **accompanied by completely filled request form.**




5. Contribution in Diagnostic Stewardship

## Infection v. Colonization

- Most organisms which colonize are **harmless commensals and should not be treated.**
- An organism isolated from a sample taken from a normally sterile site like the CSF, blood, pleural fluid etc. is likely to be a **true invader and the causative pathogen.**
- An organism isolated from a non-sterile specimen like sputum or a wound swab **may be a colonizer.**
- If the organism is persistently isolated despite 'effective' systemically administered therapy, careful clinical decision must be taken keeping in mind the organism may be a multidrug resistant pathogen or simply a colonizer.

5. Contribution in Diagnostic Stewardship

# Sample Collection Techniques

5. Contribution in Diagnostic Stewardship



## 1. Blood

- Preferably collect paired blood samples for culture from two different sites (e.g. right and left ante cubital fossa).
- Dilution ratio: 1 ml of blood to 10 ml of culture media (If automated blood culture bottle, the volume should be as per instructions)
  - Wear gloves, thoroughly disinfect the venepuncture site.
  - Cleanse an area about 50 mm in diameter with 70% ethanol and allow it to air-dry.
  - Apply 2% tincture of iodine or chlorhexidine/ alcohol based disinfectant in a circular action, swab the area beginning at the point where the needle will enter the vein.
  - Allow the disinfectant to dry on the skin for at least 1 minute.
  - Wipe the top of the bottle cap using an ethanol swab and allow it to dry before injecting the sample aseptically into the bottle.
  - Inoculated blood culture bottles should be transported to the laboratory immediately or held at room temperature until they reach the laboratory.

5. Contribution in Diagnostic Stewardship

## 2. Cerebrospinal Fluid

### Lumbar Puncture

The nursing professional and/ or laboratory staff should help the prescribers in this procedure as instructed.

Lumbar puncture should be done by a trained professional authorized for the same. Refer to the module for prescribers for details of the procedure.

The vials/ containers should be properly labelled, and transported to the laboratory immediately without delay.





## 3. Sterile Body Fluids

- The nursing professional and/ or laboratory staff should help the prescribers in this procedure as instructed.
- Normally sterile body fluids such as pleural, pericardial, peritoneal, synovial, etc. should be collected with needle and syringe using sterile technique.
- The aspirated material (1-5ml) should be transferred to a sterile screw-capped tube or a paediatric Isolator tube.
- Samples should not be submitted in syringe with a needle attached.

# 4. Urine: Midstream Sample

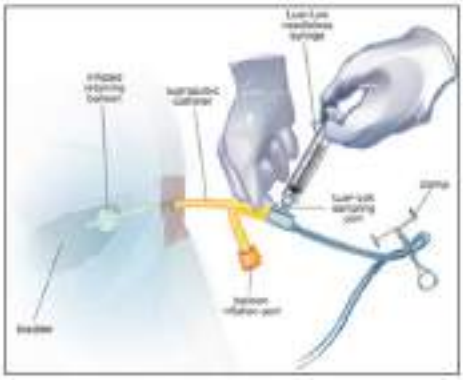
- Preferably, early morning first midstream urine (2-5ml) in sterile, wide mouth, leak proof container.
- Instructions to patients:
  - **Female**: Wash the hands, cleanse the area around the urethral opening with soap and water,, and collect the midstream urine in a sterile container with the labia held apart.
  - **Male**: Wash the hands, retract the foreskin, cleanse the glans with soap and water, collect midstream urine in the sterile container.
- Transport to the laboratory within 2 hours of collection. Refrigerate if delayed.



5. Contribution in Diagnostic Stewardship

# Urine: Catheterized Patient

- Clamp the catheter, clean the catheter wall vigorously with 70% ethanol and aspirate 5 to 10 ml of urine via a sterile needle and syringe above the clamp.
- Never collect urine sample from the urine collection bag or by disconnecting the catheter from the tube of the urine collection bag.



https://lenablog.org/health/services/when-a-suprapubic-catheter-is-necessary/

5. Contribution in Diagnostic Stewardship

## 5. Sputum

- Use a clean, wide-mouthed leak-proof container,
- Collect preferably during early morning after rinsing mouth with water but before brushing, fluid or food intake.
- Instruct patient to cough deeply after taking a deep breath.
- External soiling of container with sample: Clean with phenol-containing disinfectant to wipe the outside of the container.

**Specimen must be sputum, not Saliva.**

**Transport**

- Send within 2 hours of collection.
- Refrigerate if delay (except in case if *S. pneumoniae* and/or *H. influenzae* infection suspected).



ET tip, suction tip-set recommended

5. Contribution in Diagnostic Stewardship

## 6. Throat Swab: Posterior Pharyngeal Wall

- Hold tongue away with tongue depressor.
- Locate areas of inflammation and exudate in posterior pharynx, tonsillar region of throat behind uvula.
- Avoid swabbing soft palate; do not touch tongue.
- Rub area back and forth with cotton or Daron swab. Replace it in the tube.


https://idsp.mohfw.gov.in/WriteReadData/1892s/29900297861565252769.pdf

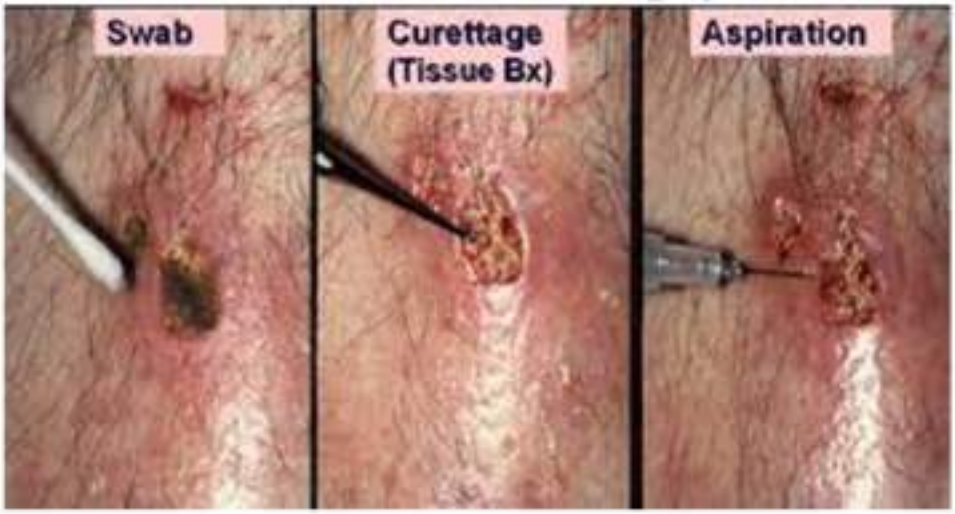
5. Contribution in Diagnostic Stewardship

## 7. Stool

- Use a clean, wide-mouthed leak-proof container, to collect the stool sample.
- NEVER collect from the bedpan/toilet bowl.
- Collect at least 5 ml of sample in case of liquid stool, approximately 1 g (walnut-sized) sample in case of semi-formed or formed stool.
- Transport immediately for microscopy.

5. Contribution in Diagnostic Stewardship

## 8. Pus/Tissue Biopsy




https://www.vicniss.org.au/media/1926/1500-rod-james-skin-and-soft-tissue-swabs-2.pdf

5. Contribution in Diagnostic Stewardship

# Pus/ tissue Biopsy Aspirate

**Open wounds**

- Debride to clear overlying debris with scalpel and swabs or sponges, and thoroughly rinse with sterile saline prior to collection of sample.
- Collect biopsy or curette sample from base or advancing margin of the lesion. The specimen must never be sent in formalin for culture.

**Closed wounds**

- Disinfect the area as for collection of blood sample collection before aspiration.
- Pus from an abscess is best collected at the time the abscess is incised and drained, or after it has ruptured naturally. At least 1ml of pus should be collected.

***Swab is not an appropriate/ preferred sample for culture.***

5. Contribution in Diagnostic Stewardship



# 9. Genital Swabs

- Excess mucus is cleaned with cleaning swab and discarded.
- Swab is inserted into the cervical canal and rotated for 15-30 seconds.
- Swab should be Immediately broken off swab into the transport tube.

5. Contribution in Diagnostic Stewardship

# Sample Rejection Criteria

- Samples collected in incorrect containers or in broken, poorly sealed and leaking containers.
- Unlabelled specimens or mismatch between sample requisition form and container.
- Unacceptable delay between specimen collection and arrival at laboratory
- Sample stored incorrectly before or during transport.
- Inadequate quantity of specimen.
- 24 hours urine collection.
- Foley's catheter tips and endotracheal tube tips.
- Urine from the bag of a catheterized patient.

5. Contribution in Diagnostic Stewardship 21



# Summary of Sample Collection and Transport

| Sample | Collection | Transport | Remarks |
|---|---|---|---|
| Blood | 1ml blood per 10ml media | Immediately or at room temperature | If automated blood culture bottle, the volume should be as per instructions |
| CSF | 1-3 ml in sterile container | Immediately or at room temperature | Never refrigerate |
| Sterile body fluids (Pleural, Pericardial, peritoneal etc) | 1-5 ml sterile container | Immediately or refrigerate if delay up to 4 hours | Do not transport in capped syringe |
| Urine | 2-5ml | Immediately or refrigerate if delay up to 2 hours | Give proper instructions for collection and transport to patient |
| Sputum | Mucoid sample coughed up into container | Immediately or at room temperature | |
| Throat/ Oropharyngeal swabs | Two swabs (culture and microscopy) | Immediately before drying, in VTM for viral diagnostics | Wear Appropriate PPE |
| Stool | 1g (formed stool) to 5ml (liquid stool) | Immediately or at room temperature | Sample to be sent to the laboratory within 15 minutes for trophozoites |
| Pus/ Tissue biopsy/ Aspirates | Sterile wide mouth container | Immediately or refrigerate if delay up to 4 hours | Do not add formalin or saline |
| Genital swabs | Dacron or rayon swabs | Immediately | Add to VTM if viral diagnostics is required. |

5. Contribution in Diagnostic Stewardship 22

THANK YOU

5. Contribution in Diagnostic Stewardship 21

6

# 6. Role in Quality Management in Laboratory

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to:
  - Understand the importance of transcription errors in specimen handling and its potential implication for patient management.
  - Understand the purpose of ISO15189 NABL standards.
  - Describe the principles behind quality management systems for laboratories.
  - Describe the importance of internal and external quality assurance and methods of reporting failures in quality assessment (consumables, equipment calibration/ maintenance and processes) to appropriate authorities.
  - Have knowledge of the WHO Laboratory Quality Stepwise Implementation tool (LQSI).

# Role in Quality Management in Lab

- A medical laboratory in the present times serves as an important part of clinical decision making process for majority (>70%) of the patients.
- An accurate report is indispensible for providing quality care to the patient without causing harm.
- Errors might occur in a medical laboratory during the specimen testing process that can be divided into three phases:
  - i) the pre-analytical phase
  - ii) analytical phase and
  - iii) post-analytical phase.



- Transcription errors are the errors that occur due to incorrect entry or data handling at any stage of the testing process be like:
  - recording the patient details,
  - recording the result of the test
  - transmitting the report by entering the data in the laboratory information system (LIS) or the patient test result format sheet.
- Wrongly reported test parameters might alter the entire course of treatment provided to the patient.
- Transcription errors could have potentially life threatening consequences for the patient.

6. Role in Quality Management in Laboratory

- The accuracy and quality of a test report is dependent on multiple factors.
- It is very important to establish certain parameters based on which the quality of the reports issued by a medical laboratory can be certified to meet those defined standards.
- Meeting those parameters is a way of demonstrating that the report is of established minimum standards and can be trusted.
- To establish this on an International scale, the International Standards Organization (ISO) came up with the international standards document, i.e. ISO15189 document for medical and testing laboratories.

6. Role in Quality Management in Laboratory



- Based on these principles, a laboratory must set up a Quality Management System (QMS) which is defined by ISO as well as CLSI as

> "*coordinated activities to direct and control an organization with regard to quality*"

- It includes a systematic set of actions to establish and control the work processes, starting from ordering the test to sample collection, through sample testing till the transmission of the test report.
- Involves the management of all laboratory resources, namely staff, facility and equipment, conducting evaluations or audits, and making continual improvements to ensure quality results.

6. Role in Quality Management in Laboratory

- Many elements of a medical laboratory needs to be addressed to assure quality in a medical laboratory.

- These include but are not limited to:
  - Quality of specimen collection and transport procedure.
  - Adequate and accurate information in test requisition form.
  - Testing procedure meeting the quality norms.
  - Trained and competent staff.
  - Good quality, calibrated equipment and reagents.
  - Temperature and humidity control in the facility.
  - Adequate, clean space for testing equipment and staff in the laboratory.
  - Careful recording and reporting of results.
  - Safety aspect including fire safety, biohazard safety etc.

6. Role in Quality Management in Laboratory



- All laboratory processes and procedures can be broadly grouped under 12 understandable structures, called quality system essentials, and these serve as the building blocks of the QMS.

- These include:
  (i) Organization,
  (ii) Personnel,
  (iii) Equipment,
  (iv) Purchasing and inventory,
  (v) Process control,
  (vi) Information management,
  (vii) Documents and records,
  (viii) Occurrence management,
  (ix) Assessment,
  (x) Process improvement,
  (xi) Customer service,
  (xii) Facilities and safety

6. Role in Quality Management in Laboratory

# Steps in Implementing QMS in a Lab

- In the absence of a good QMS in a laboratory, many errors and issues could occur go undetected.
- Implementation of QMS ensures not only error free laboratory practices, it also ensures that any unintended error is timely detected and a corrected.
- In the QMS model, every quality system essentials mentioned above must be addressed.
- The implementation of these 12 quality system essentials is flexible and can be achieved in any order suitable to the laboratory depending upon the local factors.





# WHO LQSI

- To facilitate this, WHO came up with a Laboratory Quality Stepwise Implementation tool (LQSI) tool.
- This tool has been created as a website by the Royal Tropical Institute for WHO.
- It helps in the implementation of QMS as per ISO15189 standards for a medical laboratory in a planned, stepwise manner.

- To rationally implement the QMS in a laboratory, the user instructions tab of the LQSI tool website explain four phases of implementation by dividing the activities in such a manner that each phase carries a specific focus.
  - Phase 1: Ensuring that the primary process of the laboratory operates correctly and safely
  - Phase 2: Controlling and assuring quality and creating traceability
  - Phase 3: Ensuring proper management, leadership and organization
  - Phase 4: Create continuous improvement and prepare for accreditation

6. Role in Quality Management in Laboratory



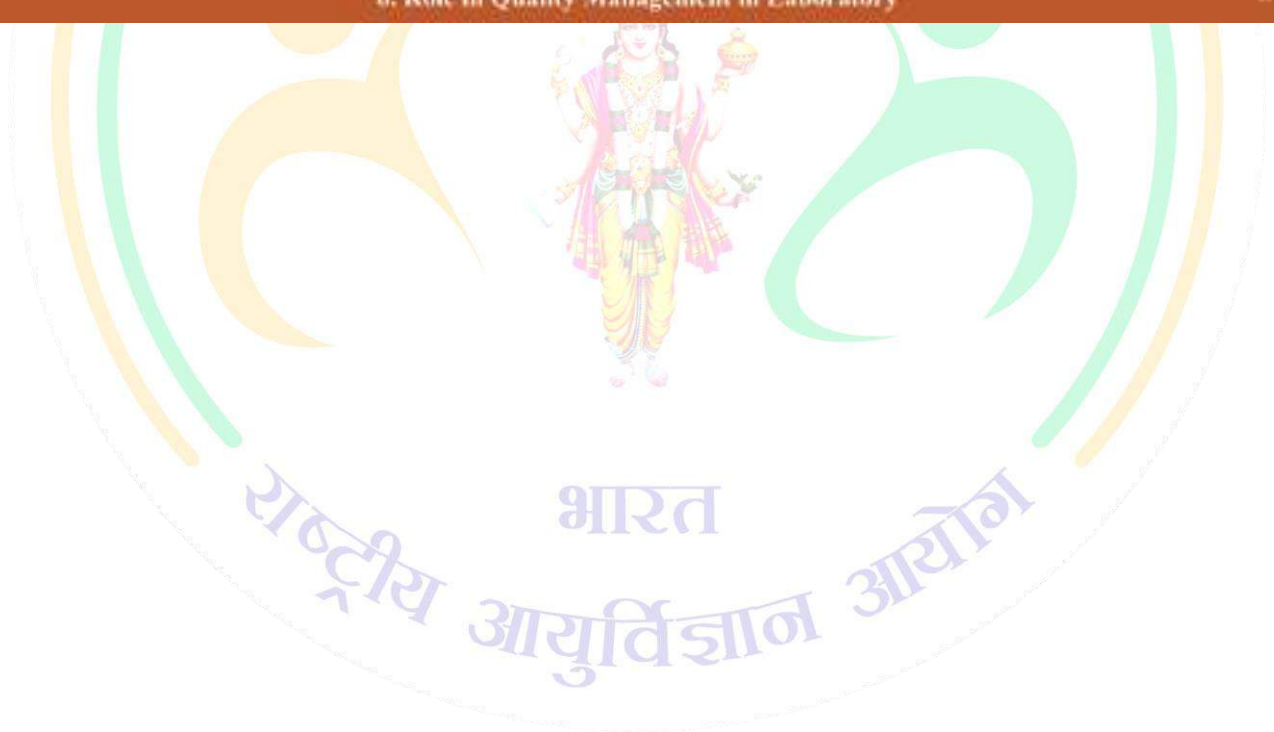
- To view the activities in each phase, one can choose between two types of frameworks.

  i) Roadmaps: showing all the activities in an ideal sequence for day-to-day implementation.

  ii) Quality System Essential framework: showing the activities sorted per quality system essential (as formulated by the Clinical and Laboratory Standards Institute).

6. Role in Quality Management in Laboratory

# THANK YOU

7

# 7. Role in Antimicrobial Stewardship Program

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to understand:
  - The basics of Anti-microbial stewardship program
  - Their role in AMSP
  - The procedures for storage, preparation, administration, disposal and recording of antimicrobial agents

# Role in Antimicrobial Stewardship Program

- Antimicrobial stewardship has been defined as

> *"coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration"*

7. Role in Antimicrobial Stewardship Program



- The goals can be briefly described as:
  - Ensure the best clinical outcome, for treatment or prevention of infection
  - Minimize unintended consequences of antimicrobial use such as adverse drug reactions, emergence of clones of antimicrobial resistance
  - Minimize healthcare costs without compromising quality of care
  - Accurate diagnostics and diagnostic pathways
- It focuses on the right drug and dose at the right time for the right duration and right de-escalation.

7. Role in Antimicrobial Stewardship Program

- It comprises of various core and supplemental interventions that include but are not limited to the:
  - antibiotic consumption analysis (contribution of pharmacist and nursing professional)
  - formulary restrictions (contribution of pharmacist)
  - laboratory surveillance and feedback (contribution of laboratory technician)
  - parenteral to oral conversion (contribution of nursing professional)
  - de-escalation of antimicrobial therapy (contribution of nursing professional)

7. Role in Antimicrobial Stewardship Program



## Antimicrobial Consumption Analysis

- Quantitative analysis of antimicrobial consumption:
  - It should be collected from pharmacy purchase stores
  - Includes proxy data of overall consumption of antimicrobials by the patient (antimicrobial consumption surveillance).
- Qualitative analysis of appropriateness of prescription:
  - Information regarding which patients are being given what antibiotics, their indications, dose and duration is collected using point prevalence surveys.
  - It gives antimicrobial use surveillance.

7. Role in Antimicrobial Stewardship Program

- The role of pharmacist (in pharmacy) and nursing (in wards) professionals are crucial in the generation of this data.
- Depending upon the load on the pharmacy, periodic data should be entered preferably in a digital format such as Microsoft excel sheets or its equivalent.
- Antimicrobial consumption analysis can be performed from this data.





## Sample Monthly Consumption Record from a Pharmacy

Name of Hospital, City
Month wise antibiotic consumption data of hospital

Month: June 2024 Pharmacy name and location: Central pharmacy, B-block

| Antibiotic name | Route (Oral/ injection) | Quantity dispensed | Quantity available |
|---|---|---|---|
| Ciprofloxacin | Oral | 1286 tablets | 2438 tablets |
| Ciprofloxacin | Injection | 74 vials | 20 vials |
| Amoxy-Clav | Oral | 1473 tablets | 597 tablets |
| Ampicillin | Oral | 478 tablets | 62 tablets |
| Ampicillin | Injection | 54 vials | 46 vials |
| Penicillin | Injection | 129 vials | 271 vials |
| Nitrofurantoin | Oral | 870 tablets | 130 tablets |

Pharmacist name

7. Role in Antimicrobial Stewardship Program

## Sample Daily Consumption Record from a Pharmacy/ward

Name of Hospital, City
Daily consumption of antibiotics
Date: 20-12-2023 Pharmacy/ OPD/ Ward name and location: Central pharmacy, B-block

| Antibiotic name | Route (Oral/ injection | Dose | Patient (OPD/ IPD/ ICU) | Patient Reg. No./ UID/ CR No. | Speciality | Clinician name | Quantity dispensed |
|---|---|---|---|---|---|---|---|
| Ciprofloxacin | Oral | 500mg | OPD | 2303 | Medicine | Dr. ABC | 10 tablets |
| Azithromycin | Oral | 500mg | IPD | 6512 | Medicine | Dr. XYZ | 3 tablets |
| Ceftriaxone | Injection | 1gm | OPD | 2461 | Surgery | Dr. DEF | 1 vial |
| | | | | | | | |

Nursing officer/ Pharmacist name

7. Role in Antimicrobial Stewardship Program

## Formulary Restriction

- Antimicrobials included on the hospital formulary should be divided into three groups:

  1. Unrestricted: may be prescribed by any clinician

  2. Consultant only: may only be prescribed by a consultant

  3. Restricted: may only be prescribed following prior discussion with, and approval by, the antimicrobial stewardship team

- This list should be reviewed by the antibiotic policy team, AMSP team and clinicians from the concerned speciality periodically preferably every year on the basis of antimicrobial usage data and rates of antimicrobial resistance

7. Role in Antimicrobial Stewardship Program

- The pharmacists should be thoroughly briefed regarding this list.
- A copy of list of such drugs should be available in the pharmacy.
- This allows the pharmacists to discuss the prescription with the prescribing clinicians if the antimicrobials prescribed are not in accordance with the formulary restriction policies.

7. Role in Antimicrobial Stewardship Program

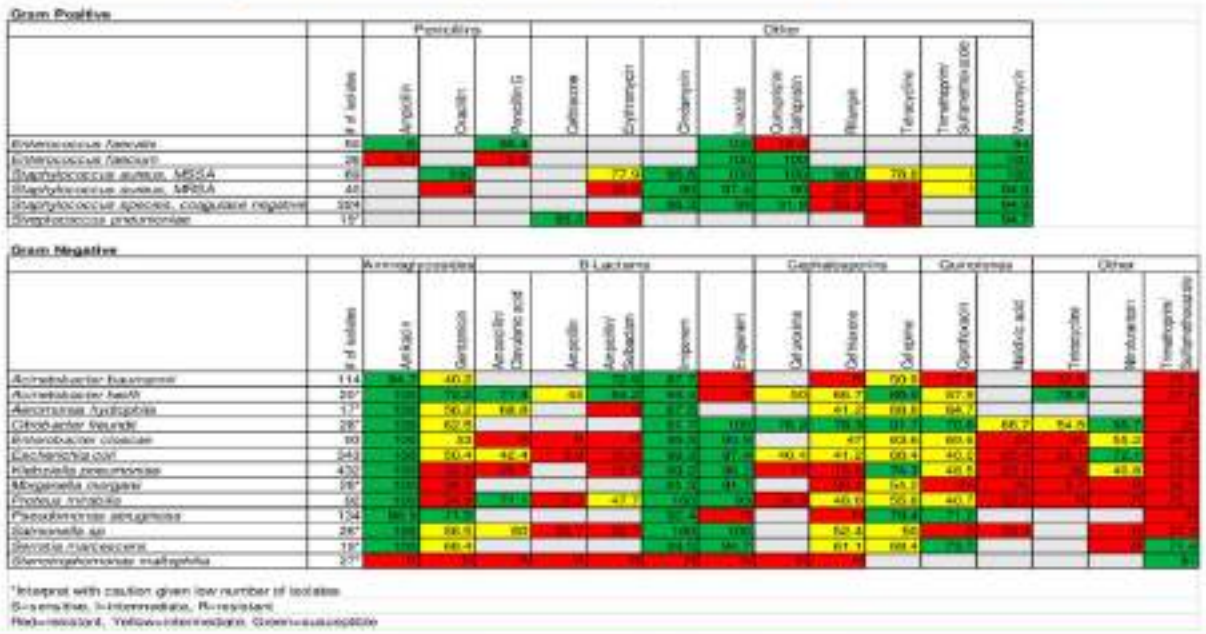


## Laboratory Surveillance and Feedback

- The Microbiology laboratory must share antimicrobial susceptibility data as an *antibiogram* with the prescribers.
- These antibiograms can also be displayed at a suitable location in the laboratory.
- Also, feedback on follow up cultures must be promptly provided to allow timely review of antimicrobial prescriptions.

7. Role in Antimicrobial stewardship Program

Antibiogram Source: https://www.mdpi.com/2079-6382/10/7/782




7. Role in Antimicrobial Stewardship Program

- Utility of Antibiograms:
  - Empiric antimicrobial therapy is started by clinicians to provide initial control of a presumed infection of unknown cause.
  - Hence, local cumulative antibiograms are required to select appropriate empiric antimicrobials for patients with common infections.
  - It also provides a broad overview of local antimicrobial resistance over time (e.g. the proportion of *S. aureus* isolates that are methicillin-resistant).
  - Can provide an overview of the emergence of antimicrobial resistance in particular settings over time.
  - It can assist in managing infections due to multidrug-resistant organisms

7. Role in Antimicrobial Stewardship Program

# Parenteral to Oral Conversion

- Always review intravenous prescription after 48 hours (at least) and switch to oral if possible.
- Early switch from intravenous (IV) agents to the equivalent oral preparation offers several benefits:
  - Decreased total cost of therapy,
  - Decreased potential for line associated infections,
  - Potential for decreased length of stay and patient preference,
  - Increased patient comfort and mobility,
  - Savings in nursing time spent preparing and administering intravenous doses.
- Nursing staff provides round the clock care to the patients so an alert staff can bring a clinician's attention to the patient(s) who are on i.v. antimicrobials for the past 48 hours.

7. Role in Antimicrobial Stewardship Program



# Streamlining or De-escalation of Therapy

- All empiric antimicrobial therapy should be reviewed on a daily basis by the clinician responsible for the patient's care.
- Special attention must be paid to factors such as:
  - Antimicrobial combinations with overlapping spectrum of activity.
  - Prolonged use of broad spectrum antimicrobials
  - Unauthorised use of restricted agents
  - Antimicrobial use not in accordance with hospital antimicrobial policy.
  - Clear criteria for prescribing intravenous antimicrobials.

7. Role in Antimicrobial Stewardship Program

THANK YOU

8

# 8. Role in Infection Control

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to:
  - Define and describe the elements of standard precautions
  - Describe moments and steps of hand hygiene
  - Perform hand hygiene audit
  - Define and describe transmission-based precautions
  - Define and describe the role of infection control nurse in IPC
  - Define and describe various segregation methods of biomedical waste and their disposal as per BMW rules.
  - Define device associated infections
  - Describe care bundles for different types of devices associated infections

# Role in Infection Control

- For any infection to occur, a sequence of events occur that transmit an infectious microorganism to a susceptible host.
- Three things are necessary for an infection to occur:
  - **Source:** Places where infectious agents (germs) live (e.g., sinks, surfaces, human skin, water, food)
  - **Susceptible Person** with a way for germs to enter the body
  - **Transmission:** a way germs are moved to the susceptible person

8. Role in Infection Control



- Healthcare-associated infections (HAIs/ HCAIs) are influenced by the interplay between host, pathogen and environmental factors.
- This chain of transmission is favoured by health care workers who form a link between hospital environment, host and agent.
- In order to prevent HAIs, this chain of transmission needs to be broken by appropriate infection control Practices.
- Infection control prevents or stops the spread of infections in healthcare settings.
- There are 2 tiers of recommended precautions to prevent the spread of infections in healthcare settings:
  - Standard precautions
  - transmission-based precautions.

8. Role in Infection Control

# A) Standard Precautions





## Standard Precautions

- **Elements of Standard Precautions:**
  - Hand Hygiene
  - Personal Protection Equipment or PPE (gown, mask, face protection, gloves, goggles etc.)
  - Safe injection practices
  - Sharp management
  - Spill Management
  - Patient Care Equipment/ Devices anagement
  - Environmental Control
  - Respiratory hygiene/cough etiquettes
  - Proper disposal of biomedical waste

# Hand Hygiene

**Hand Hygiene-**

- A general term that applies to either -handwashing, antiseptic handwash, antiseptic handrub, or surgical hand antisepsis
- Alcohol-based handrubs reduce bacterial counts on hands more effectively than plain soaps, and in a majority of studies more effectively than antimicrobial soaps.

8. Role in Infection Control



- It is one of the basic measures of standard precaution
- Hand hygiene is the simplest, most effective measure for preventing nosocomial infections, however it is the most neglected one too.

8. Role in Infection Control

**Hand Rub**

- Alcohol based Hand sanitizers
- 20-30 seconds

**Hand wash**

- Using Soap & Water
- 40-60 seconds
- Hands soiled


*(Source: https://openwho.org/courses/IPC-HH-en)*

8. Role in Infection Control



## Routine Hand Washing Tips

Jewelry

- Rings should either be removed or moved to ensure washing underneath them.
- Rings can make donning gloves more difficult and may cause gloves to tear more readily.

8. Role in Infection Control

# Condition of Nails and of Hands

- Artificial nails should be avoided.
- Nails should be kept short, rounded, and unvarnished, and the routine use of nail brushes should be avoided.
- The hands, including the nails, should be inflammation free

8. Role in Infection Control

## Activity 1:- Demonstration of Steps of Handrub


*(Source: Guideline on Hand Hygiene in Health Care in the Context of Filovirus Disease Outbreak Response, WHO, 2014)*

8. Role in Infection Control


8. Role in Infection Control

# PPE

- It refers to wearable equipment intended to improve healthcare workers safety from exposure to or contact with infectious agents.
- A full PPE is required while providing care to patients who have highly infectious diseases like COVID, Ebola and Nipah virus infections, which require isolation and barrier nursing in containment areas of the hospital.
- The group of items used in PPE can be used separately or in combination.
- Recommendations on use of PPE are based on the expert opinions regarding disease transmissions, known portals of entry, perception of risk and severity of transmission

8. Role in Infection Control

## Donning of PPE

(source: https://www.cdc.gov>hai>pdfs>ppe-sequences)


**Activity 2**:- Donning of PPE

8. Role in Infection Control

## Doffing of PPE

source: https://www.cdc.gov>hai>pdfs>ppe-sequences


**Activity 3**:- Doffing of PPE

8. Role in Infection Control

# Inoculation Precautions- Injection Safety

- Rational/ Safe Injection Practices
- Safe procedures for handling sharps
- Recapping of needle should be avoided
- Metallic waste disposed into a puncture resistant container.
- Have maximum visibility & properly position the patient during exposure-prone procedures such as phlebotomy.
- Fingers must be protected from injury by using forceps for holding suturing needles.

8. Role in Infection Control

# Spill Management

Cordon off the area of spill.

Open spill kit and wear PPE. Use forceps, tongs or scooper to pick broken glass pieces and discard in cardboard box.

Put absorbent paper over the spill. For large spill cover with large size gauze pad or newspapers.

Pour fresh hypochlorite over the recovered spill and leave for 20 minutes.

Put another paper covering the soaked paper and then remove the soaked paper and put it in the yellow bag.

8. Role in Infection Control

- Spill Kit: A Spill kit must be readily available with all departments especially where risk of spill is more, like laboratory, sample collection room, wards etc. Spill Kit must have:
  - Gloves-2 pairs
  - Apron
  - Mask
  - Shoe covers
  - Absorbent material like newspaper or blotting paper
  - Waste disposal bag
  - Cleaning equipment – bucket, mop, cloth, soap etc.
  - Freshly prepared 1% sodium hypochlorite solution
  - Forceps, tongs or scooper

8. Role in Infection Control



## Activity 4- Demonstration of Spill Management

- You are the medical officer in hospital emergency. A RTA victim is brought to the emergency with an open left femur fracture and was bleeding profusely. After initial investigations & treatment the patient was stabilized and transferred to the Orthopaedics department for further management.
- You observe that about 50-60 ml spilled blood is present in the cubicle where this patient was received.
- How will you manage this blood spill?
- What are the steps in managing such a spill?

8. Role in Infection Control

## Patient Care Equipment/ Devices Management

- Reusable medical equipment (e.g., blood glucose meters and other point-of-care devices, surgical instruments, endoscopes) should be cleaned and reprocessed appropriately before being used on another patient.
- Single-use devices are labelled by the manufacturer for one-time use and come with reprocessing instructions.
- Medical devices have to be disinfected/ sterilized according to the level of risk posed by these equipment if they are not decontaminated properly.
- This is called Spaulding's classification.

8. Role in Infection Control 21



## Environmental Cleaning

- Cleaning refers to the removal of visible soil and organic contamination from a device or environmental surface to remove large numbers of microorganisms from surfaces
- Must always be performed before disinfection.
- Handling soiled or contaminated linen: Gloves should be used at all times.
- The linen must be inspected for any needles, or syringes etc. while stripping.

8. Role in Infection Control 22

- Linen should not be placed on the floor but in a yellow doubled plastic bag sealed by a knot.
- **Terminal disinfection** is thorough cleaning of the patient bed, surroundings, and the patient utilities after the discharge of the patient.
- The bedpan, rubber sheets, linen, patient clothing and floors should be disinfected.
- Admission of another patient in the same room should be avoided for the next 12 hours.

8. Role in Infection Control



## Respiratory Hygiene/Cough Etiquette

- The elements of Respiratory Hygiene/Cough Etiquette include:
  - Education of staff, patients, and visitors in a HCF.
  - Source control measures (covering the mouth/nose with a tissue while coughing with prompt disposal of used tissues or using surgical masks on the coughing person as appropriate).
  - Hand hygiene after contact with respiratory secretions.
  - Spatial separation (ideally >3 feet), of persons with respiratory infections in common waiting areas when possible.
  - Health care workers must owear a mask) and perform hand hygiene when caring for such patients.

8. Role in Infection Control

# B) Transmission Based Precautions





## Airborne Precautions

- These are to be followed for droplet nuclei <5µm, e.g., tuberculosis, chicken pox, measles and influenza. This requires:
- Isolation of patients in individual room with adequate ventilation: This includes, where possible, negative pressure; door closed; at least twelve air exchanges per hour; exhaust to outside placed away from intake ducts
- Staff wearing high-efficiency masks in room

# Droplet Precautions

- These are to be followed for droplet nuclei >5 µm, e.g., meningococcal meningitis, diphtheria, respiratory syncytial virus. The following procedures are required:
- Individual room for the patient, if available
- Surgical mask for healthcare workers
- Restricted circulation for the patient; patient wears a surgical mask if leaving the room
- Teach the patient to follow respiratory hygiene/cough etiquette.

8. Role in Infection Control

# Contact Precautions

- Direct contact occurs when performing patient- care activities that require touching the patient's skin. Indirect contact occurs when touching potentially contaminated environmental surfaces or equipment in the patients' environment Individual room for the patient if available; grouping patients if possible
- Staff wear gloves on entering the room; a gown for patient contact or contact with contaminated surfaces or material
- Wash hands before and after contact with the patient, and on leaving the room
- Restrict patient movement outside the room
- Appropriate environmental and equipment cleaning, disinfection, and sterilisation

8. Role in Infection Control

## Summary

| Type | Isolation room or cohorting | Hand Hygiene | Gloves | Gown | Mask | Eye protection | Handling of equipment | Visitors |
|---|---|---|---|---|---|---|---|---|
| **Standard** | Not required | Yes | Possible contact with blood/body fluid | If soiling likely | For aerosol generating procedures | For aerosol generating procedures | Single use or reprocessed | No additional precautions |
| **Contact** | Essential | Yes | Essential | Essential | For aerosol generating procedures | For aerosol generating procedures | Preferential single use/ patient dedicated equipment | Same as HCW's |
| **Droplet** | Essential | Yes | Possible contact with blood/body fluid | If soiling likely | Surgical mask | For aerosol generating procedures | Single use or reprocessed | Restricted visitor policy. Precautions same as HCW's |
| **Airborne** | Negative Pressure | Yes | Possible contact with blood/body fluid | If soiling likely | N 95 mask | For aerosol generating procedures | Single use or reprocessed | Restricted visitor policy. Same as HCW's |

8. Role in Infection Control



## Biomedical Waste Management

8. Role in Infection Control

## Definition

Any waste generated while providing health care, performing research and undertaking investigations or related procedures on human beings or animals in hospitals, clinics, laboratories or similar establishments.

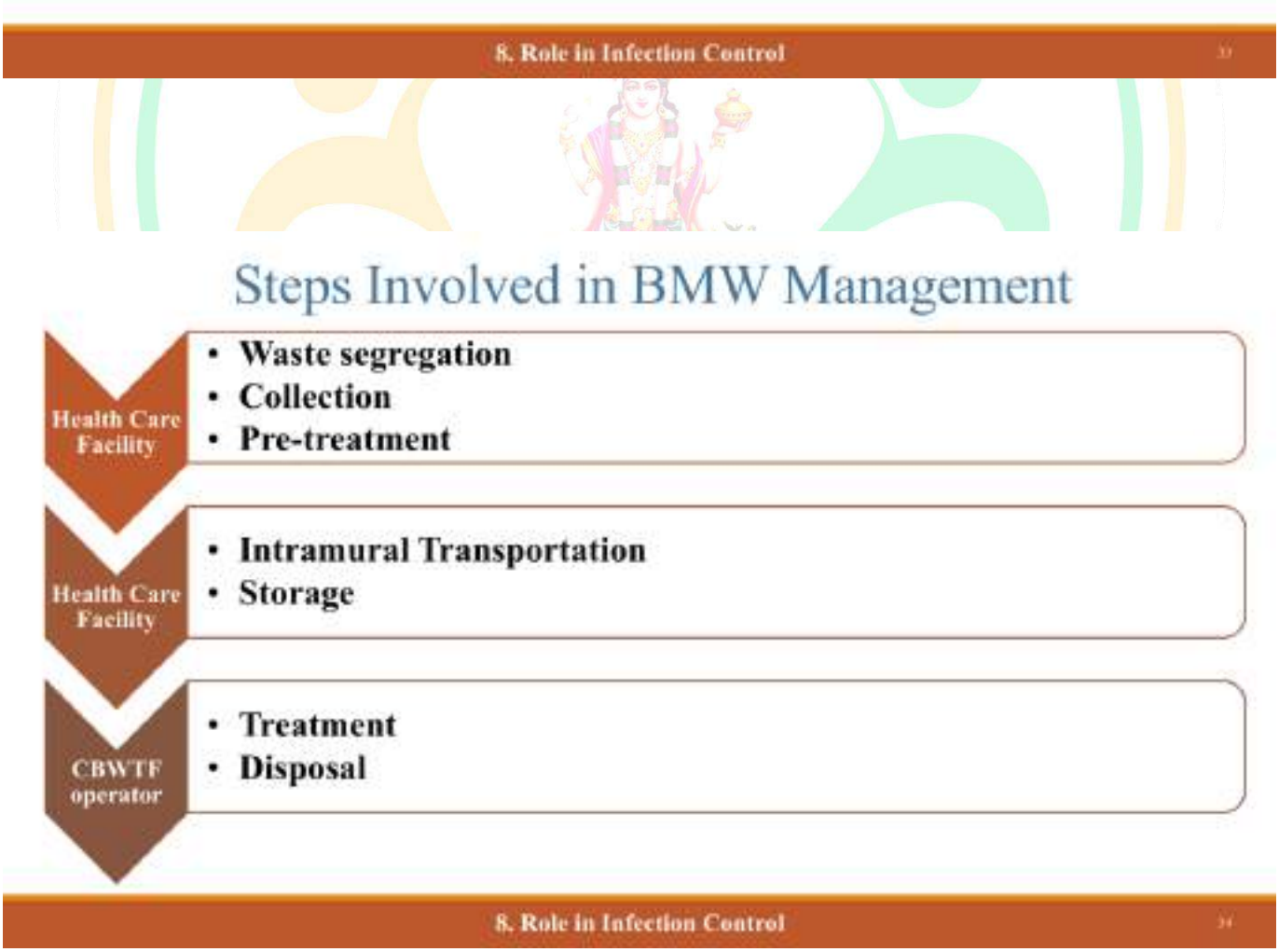




## Non-Compliance

The occupier is liable for penalty for contravention of the provisions of the Act and the Rules, orders and directions as specified in Rule 15. of the E(P)Act,1986,

"whosoever fails to comply or contravenes any of the provisions of the Act and the Rules, orders and directions be punishable with imprisonment for a term which may extend to five years or with fine which may extend to one lakhs rupees or both"

# Segregation at Source

- Segregated at the point of generation

| Yellow bag and bin | Red bag and bin | Blue container or box | White puncture proof container |
|---|---|---|---|
| | | | |

- Four colour coded containers/bags as per BMW guideline
- Non-chlorinated colour coded bags of 55 microns are used

8. Role in Infection Control



- The bags should be labelled with ward and date before placing into the bin
- All patient care areas and laboratories will be provided with appropriate colour coded bags placed in appropriate bins.
- Infection control nursing officer will be responsible to ensure that proper
- Guidelines are followed during the segregation of wastes.

8. Role in Infection Control

| YELLOW BAG (non-chlorinated plastic bag) | RED COLOUR (non–chlorinated plastic bag) Contaminated Waste (Recyclable) | Blue (Cardboard boxes with blue colored marking) | White (Translucent Puncture proof container) |
|---|---|---|---|
| **(a) Human Anatomical Waste**<br>**(b)Animal Anatomical Waste**<br>**(c) Soiled Waste**<br>**d) Expired or Discarded Medicines**<br>**(e) Chemical Waste**<br>**(f) Chemical Liquid Waste**<br>**(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.**<br>**h) Microbiology, Biotechnology and other clinical laboratory waste** | Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and Vaccutainers with their needles cut) and gloves. | **(a) Glassware:** Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.<br>**(b) Metallic Body Implants** | **Waste sharps including Metals:** Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps |

8. Role in Infection Control

**YELLOW BAG** (non-chlorinated plastic bag)

**(a) Human Anatomical Waste:**

Human tissues, organs, body parts and foetus below the viability period (as per the Medical Termination of Pregnancy Act 1971, amended from time to time).

**(b) Animal Anatomical Waste :**

Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.

**(c) Soiled Waste:**

Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.

8. Role in Infection Control

**(d) Expired or Discarded Medicines:**

Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.

**(e) Chemical Waste:**

Chemicals used in production of biological and used or discarded disinfectants.

**(f) Chemical Liquid Waste :**

Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activities etc.

8. Role in Infection Control



**(g)** Discarded linen, mattresses, beddings contaminated with blood or body fluid.

**(h) Microbiology, Biotechnology and other clinical laboratory waste:**

Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures.

8. Role in Infection Control

**RED COLOUR (non–chlorinated plastic bag)**

- **Contaminated Waste (Recyclable)**

(a) Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and Vaccutainers with their needles cut) and gloves.

8. Role in Infection Control 41

**White (Translucent Puncture proof container)**

**Waste sharps including Metals:**

- Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps

8. Role in Infection Control 42

**Blue** (Cardboard boxes with blue colored marking)

(a) **Glassware:**

Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.

(b) **Metallic Body Implants**


8. Role in Infection Control



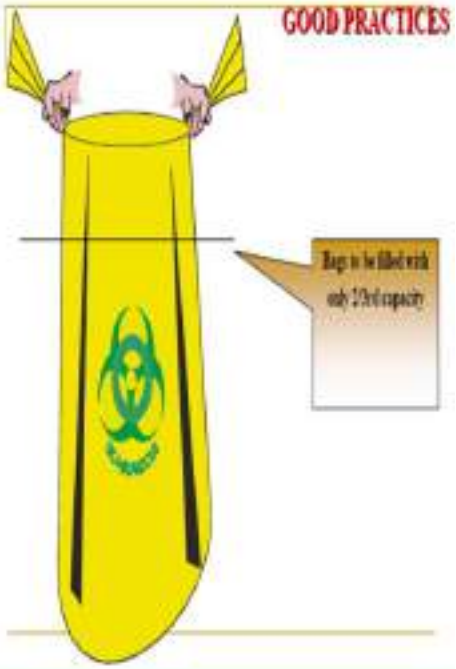
## Handling and Transport

- The staff handling and transporting the bio-medical waste should wear appropriate PPE including boots and to prevent occupational hazard.
- All bins containing BMW should have biohazard label on them in accordance with Schedule IV Part A.
- Posters indicating waste segregation will be made available at all areas of patient care.
- Microbiology and all other clinical laboratory waste should be pre-treated by sterilisation before packing and sending to the common bio-medical waste treatment facility.

8. Role in Infection Control

## Handling and Transport cont..

- When waste bag/containers are ¾th full, they should be sealed.
- Foot operated or lidded bins should be used and in good working condition.
- Plastic waste bags should be fully enclosed within the bins.
- Origin of the waste is marked on the waste bag.






## Storage

- A dedicated, well ventilated and clean area for storage of BMW within the hospital premises should be there.
- No untreated Bio medical waste will be kept stored beyond a period of **48 hours.**
- Each bag/container is weighed and the weight recorded in record sheet which has to be signed by appropriate personnel.
- At the end of month the record sheet will be submitted to the waste management committee for record keeping.

# Transport


- Transport to be carried out on daily basis from central storage to CBMTF.
- Closed type transport vehicle
- Trained driver in basic handling of BMW.

8. Role in Infection Control

# Preventive Bundles for Device Associated Infections

8. Role in Infection Control

## Device Associated Infections

- These healthcare–associated infections are infections that can be associated with the devices used in medical procedures, such as catheters or ventilators .



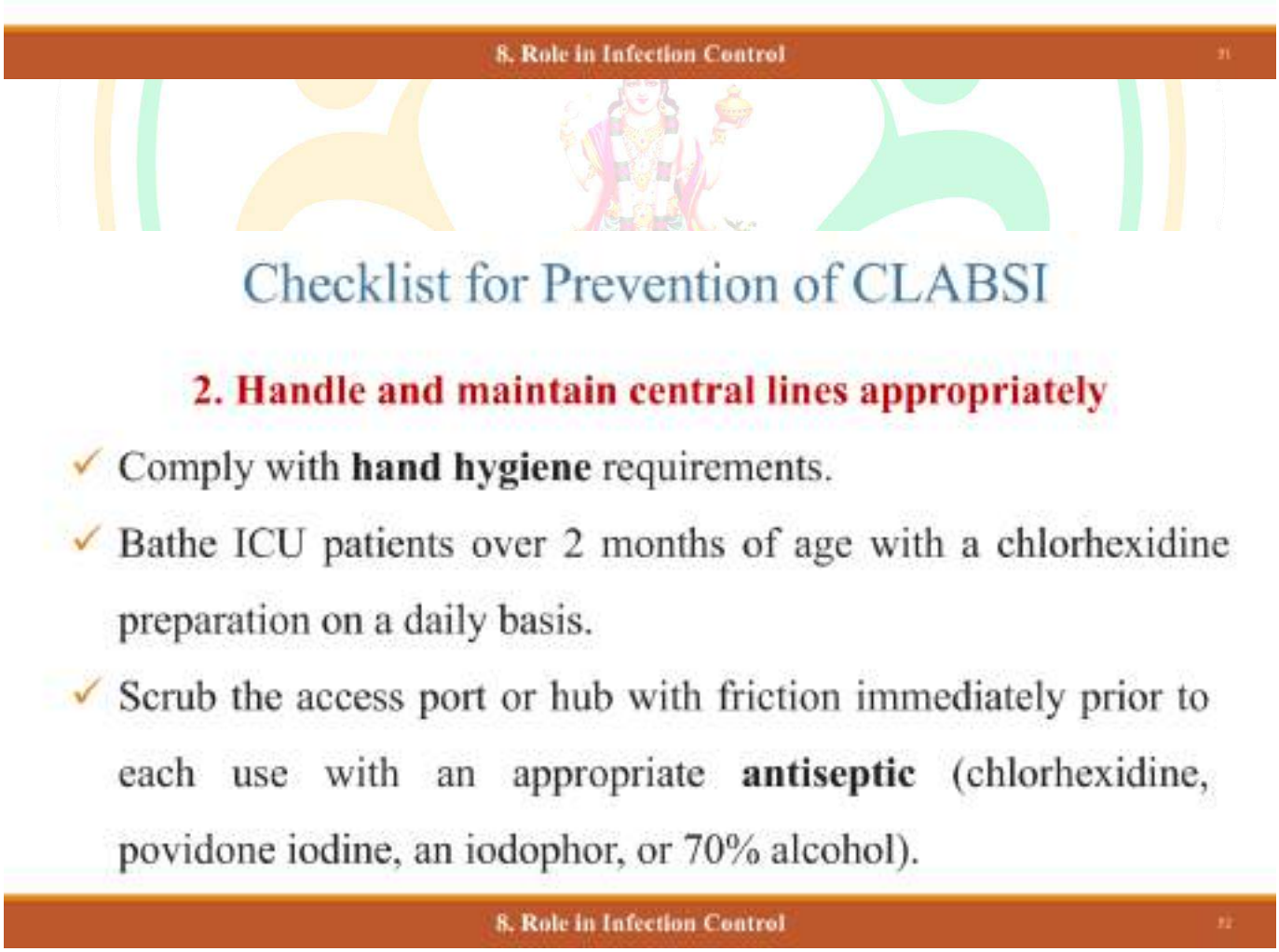


## Care Bundles

- These are a **set of interventions** that when applied together result in better prevention of device associated infections than individual elements implemented alone.
- Some recommended preventive bundles are given below. The hospital may modify these bundles according to their availability of resources and other logistics.

These include:

- Bundles for the prevention of central line-associated bloodstream infections (CLABSI)
- Bundle for the prevention of catheter-associated urinary tract infections (CAUTI)
- Bundle for the prevention of ventilator associated pneumonia (VAP)



- Use only sterile devices to access catheters.
- Immediately replace dressings that are wet, soiled, or dislodged.
- Perform routine dressing changes using aseptic technique with clean or sterile gloves.
  - Change gauze dressings at least every two days or semipermeable dressings at least every seven days.

8. Role in Infection Control



- Change administrations sets for continuous infusions no more frequently than every 4 days, but at least every 7 days.
  - If blood or blood products or fat emulsions are administered change tubing every 24 hours.
  - If propofol is administered, change tubing every 6-12 hours or when the vial is changed.
  - Perform daily audits to assess whether each central line is still needed.

8. Role in Infection Control

# Catheter Associated Urinary Tract Infections (CAUTI)





## CAUTI- Definition

**Catheter-associated UTI (CAUTI):** A UTI where an indwelling urinary catheter (IUC) was in place for more than **two consecutive days** in an inpatient location on the date of event or the day before, with day of device placement being Day 1.

## Core Prevention Strategies- CAUTI

- Insert catheters only for appropriate indications
- Leave catheters in place only as long as needed
- Ensure that only properly trained persons insert and maintain catheters
- Insert catheters using aseptic technique and sterile equipment (acute care setting)
- Following aseptic insertion, maintain a closed drainage system
- Maintain unobstructed urine flow.
- Hand hygiene and Standard (or appropriate isolation) Precautions.

8. Role in Infection Control



## Supplemental Prevention Strategies

- Consideration of alternatives to indwelling urinary catheterization.
- Use of portable ultrasound devices for assessing urine volume to reduce unnecessary catheterizations.
- Use of antimicrobial/antiseptic-impregnated catheters (after first implementing core recommendations for use, insertion, and maintenance).

8. Role in Infection Control

# Ventilator Associated Pneumonia (VAP)





## Supplemental Prevention Strategies

**Ventilator Associated Pneumonia (VAP):**

A pneumonia where the patient is on mechanical ventilation for > 2 consecutive calendar days on the date of event, with day of ventilator placement being Day 1 AND the ventilator was in place on the date of event or the day before.

## Maintenance Care Bundle for Mechanical Ventilation

- Adherence to hand hygiene
- Elevation of head of the bed to 30-45°
- Daily oral care with Chlorhexidine 2% solution
- Need of Peptic ulcer disease prophylaxis to be assessed daily- If needed sucralfate should be given
- DVT prophylaxis should be provided
- Daily assessment of readiness to remove mechanical ventilator must be documented.





## THANK YOU

# 9. Leftover Antimicrobials- Storage and Discarding

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the non-prescriber will be able to understand:
  - Effects of using leftover antimicrobials
  - Storing and handling leftover antimicrobials

# Leftover Antimicrobials- Storage and Discarding

- In the event of leftover antimicrobials, their further use by the same patient or another patient is documented to contribute to the spread of AMR and potential adverse drug reactions.
- This makes the leftover antimicrobial a significant barrier to antimicrobial stewardship.
- It is therefore recommended never to store leftover antibiotics for future use.
- Unused or expired medicines including antimicrobial agents are categorized as biomedical waste & should be discarded in yellow container.

9. Leftover antimicrobials- Storage and discarding



- These expired or unused antimicrobial agents therefore should be safely disposed as per the BMW management rules so as to reduce the toxic and polluting effect on environment and also development of AMR.
- It is recommended that all healthcare workers including pharmacists should be competent in safe handling and disposal of biomedical waste.
- Color coded bins should be available at all sites of the hospital, along with material showing the color coding and type of waste to be discarded in each bin.

9. Leftover Antimicrobials-Storage and Discarding

# THANK YOU

9. Leftover Antimicrobials- Storage and Discarding



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10

# 10. Role in Maintaining Medicine as per Local Policies and Guidelines

## NMC Module on AMR for Non-Prescribers





## Learning Objectives

- At the end of the session, the Non-Prescriber will be able to understand:
  - What is National List of Essential Medicines
  - Maintaining Medicines as per Local Policies and Guidelines

- The National List of Essential Medicines (NLEM) 2022 contains the list of anti-infectives (antimicrobials) considered as essential medicines and a stock of these medicines should be available in the Institute pharmacy.
- Besides NLEM, stock of antimicrobials should be maintained as per the prescription trends and antibiotic policy of the Institute.
- The pharmacists shall audit the stock of antimicrobials periodically to ensure that the stock of antimicrobials is not completely exhausted leading to challenges in the completion of the full course of the antibiotics.





THANK YOU

10. Role in Maintaining Medicine as per Local Policies and Guidelines

11

# 11. Toolkit for Training of Non-Prescribers

## NMC Module on AMR for Non-Prescribers



| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 1. Background and Objectives | 1.1 Understand the present burden of AMR<br><br>1.2 Understand the concept of this national program<br><br>1.3 Assist in implementing this program | K | All Non Prescribers | Theory session- 30 min | Written: MCQ, SAQ |
| 2. Basics of Microbial Pathogens | 2.1 Describe the types of microorganisms causing human infections<br><br>2.2 Define opportunistic pathogens<br><br>2.3 Differentiate between community and healthcare associated infections<br><br>2.4 Describe common organisms causing community and healthcare associated infections | K | All Non Prescribers | Exploratory and interactive theory session - 30 min | Written: MCQ<br>-Case based discussion<br>Clinical problem solving |

| S. No. and Competency addressed | Learning Objectives | Domain | Target audience | Teaching learning Methods (TLM) | Assessment Method |
|---|---|---|---|---|---|
| 3. Common Infection Syndromes | 3.1 Define infection and sepsis<br><br>3.2 Describe signs and symptoms of sepsis<br><br>3.3 Describe common infection syndromes and appropriate specimen for culture sensitivity testing | K, S, A | All Non Prescribers | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ |
| 4. Use of Antimicrobials and Emergence of Resistance | 4.1 Describe the mechanism of action of antimicrobials<br><br>4.2 Discuss mechanism of antimicrobial resistance<br><br>4.3 Describe drivers of antimicrobial resistance<br><br>4.4 Describe important antimicrobial resistant pathogens | K, S | All Non Prescribers | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ, Case discussion, AST problem solving |





| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 5. Contribution in Diagnostic Stewardship | 5.1 Understand the difference between infection and colonization<br><br>5.2 Collect, transport and process the clinical samples for microbiological investigations | K | Nursing and Laboratory Technician | Exploratory and interactive theory session with demonstration of collection containers, videos for collection -60min | Written: SAQ, MCQ |

| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 6. Contribution in Quality Management in Laboratory | 6.1 Understand the importance of transcription errors in specimen handling and its potential implication for patient management.<br>6.2 Understand the purpose of ISO15189 NABL standards.<br>6.3 Describe the principles behind quality management systems for laboratories.<br>6.4 Describe the importance of internal and external quality assurance and methods of reporting failures in quality assessment (consumables, equipment calibration/ maintenance and processes) to appropriate authorities.<br>6.5 Have knowledge of the WHO Laboratory Quality Stepwise Implementation tool (LQSI) | K | Laboratory Technician | Exploratory and interactive theory session - 60 min | Written: SAQ, MCQ |





| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 7. Contribution in Antimicrobial Stewardship | 7.1 Understand the basics of Anti-microbial stewardship program<br>7.2 Understand their role in AMSP<br>7.3 Demonstrate the procedures for storage, preparation, administration, disposal and recording of antimicrobial agents | K, S | All Non Prescribers | Exploratory and interactive theory session with examples of antibiograms, antibiotic consumption recording etc. -120 min | Written: SAQ, MCQ, Case based problem |

| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 8. Role in Infection control | 8.1 Define and describe the elements of standard precautions<br>8.2 Describe moments and steps of hand hygiene<br>8.3 Perform hand hygiene audit<br>8.4 Define and describe transmission-based precautions<br>8.5 Define and describe the role of infection control nurse in IPC<br>8.6 Define and describe various segregation methods of biomedical waste and their disposal as per BMW rules.<br>8.7 Define device associated infections<br>8.8 Describe care bundles for different types of devices associated infections | K | All Non Prescribers | Exploratory and interactive theory session- 15 + 15 + 15 + 15 min = 60 min.<br>DOAP session – 60 min | Written: SAQ, MCQ, DOAP |



| S. No. and Competency addressed | Learning objectives | Domain | Target audience | Teaching learning methods (TLM) | Assessment method |
|---|---|---|---|---|---|
| 9. Leftover Antimicrobials- Storage and Discarding | 9.1 Understand the effects of using leftover antimicrobials<br><br>9.2 Understand storing and handling leftover antimicrobials | K | Nursing and Pharmacist | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ |
| 10. Role in Maintaining Medicine as per Local Policies and Guidelines | 10.1 Understand what is National List of Essential Medicines<br><br>10.2 Understand how to maintain medicines as per local policies and guidelines | K | Pharmacist | Exploratory and interactive theory session - 30 min | Written: SAQ, MCQ |

THANK YOU

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