Basics of Antimicrobial Stewardship in Hospitals

Ugwuja Anthony C. →







Team Members



Pharm. Nenzarmwa Makan
Preceptor



Pharm. Ugwuja Anthony
Presenter



Pharm. Bara'atu Junaidu
Supervisor



Pharm. Abubakar Hussaini
Supervisor



Pharm. Rita Ohyoma
Supervisor



Pharm. Dapan Pankwat Livinus
Member



Pharm. Ugwu Blessing
Member



Pharm. Rabiat Abdulrazzaq
Member



Pharm. Ugwu Stanley
Member

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INTRODUCTION

What is Antimicrobial?

Antimicrobials are agents that either kill microorganisms (biocidal effect) or inhibit their growth (biostatic effect).

Antimicrobials include agents that act against viruses, fungi, parasites, and bacterials.

Gram-Positive vs Gram-Negative Bacteria

Bacteria are broadly classified into: **Gram-positive** (e.g. *Staphylococcus aureus*) and **Gram-negative** (e.g. *E. coli, Klebsiella*) based on their cell wall structure.

- **Gram-Positive:** Thick peptidoglycan wall, no outer membrane.
- **Gram-Negative:** Thin wall + outer membrane; often more resistant due to efflux pumps & enzymes.

Major Organisms that Pose Serious Threat to Current Antimicrobial Therapies

Gram-Negative Bacteria

Critical urgent threats

Carbapenem-resistant Enterobacteriaceae (CRE) (e.g. *K. pneumoniae, E. coli*)

Resistant to nearly all beta-lactams, including carbapenems

Extended-Spectrum Beta-Lactamases (ESBL)-producing *Enterobacteriaceae*

Inactivate 3rd-gen cephalosporins

Gram-Positive Bacteria

High Priority

MRSA (Methicillin-resistant *Staphylococcus aureus)*

Resistant to most beta-lactams

VRE (Vancomycin-resistant Enterococci)

Resistant to vancomycin, often multidrug-resistant

Drug-resistant *Streptococcus pneumoniae*

Resistance to penicillin, macrolides

Other Emerging Threats

Neisseria gonorrhoeae

Resistance to fluoroquinolones, cephalosporins, azithromycin

Salmonella (including Typhi)

MDR and extensively drug-resistant (XDR) strains

Mycobacterium tuberculosis (MDR-TB, XDR-TB)

Resistance to rifampicin and isoniazid (MDR); fluoroquinolones and injectable drugs (XDR)



These resistant organisms challenge treatment and highlight the urgent need for **Antimicrobial Stewardship** to preserve antibiotic effectiveness.

What is Antimicrobial Stewardship (AMS)?

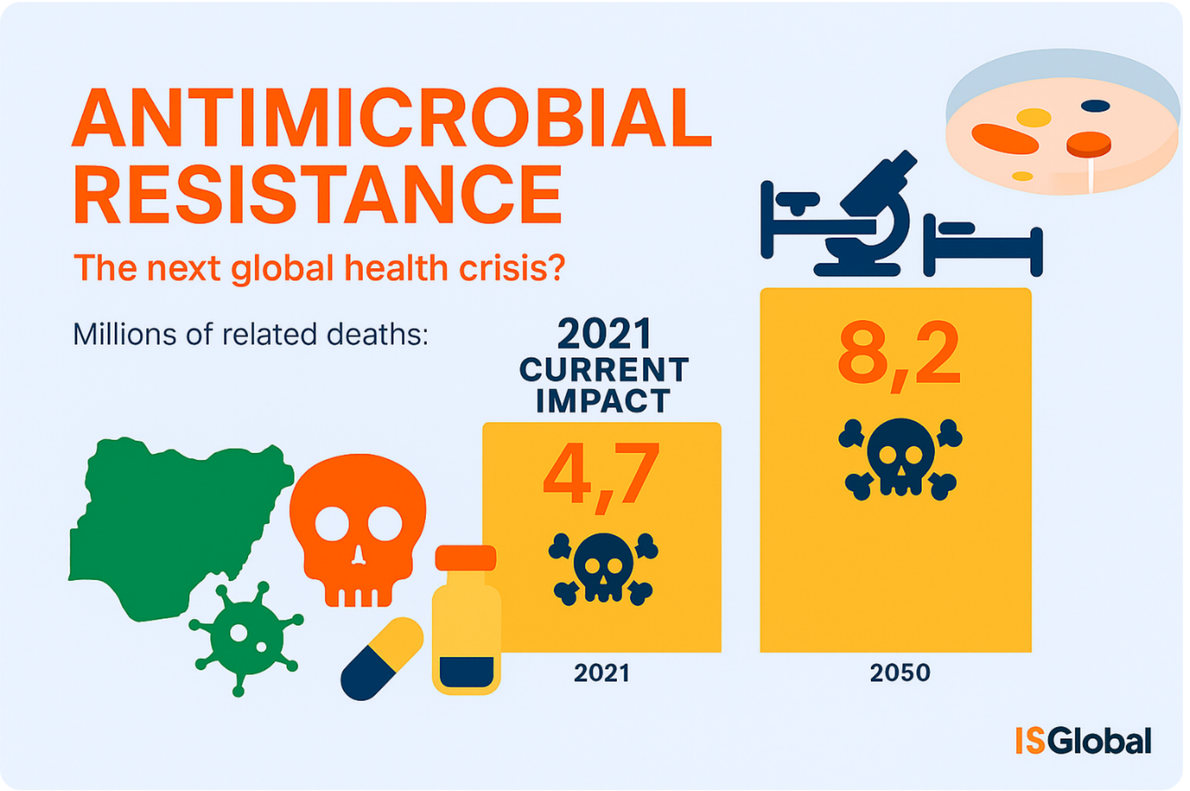


Antimicrobial Stewardship (AMS) is a coordinated program involving healthcare professionals (multidisciplinary) that seeks to promote;

- The **appropriate use** of antimicrobials
- **Improves patient outcomes** through optimized treatment
- Helps **reduce antimicrobial resistance**
- Limits the **spread of infections** from multidrug-resistant organisms

Why AMS in the Hospitals

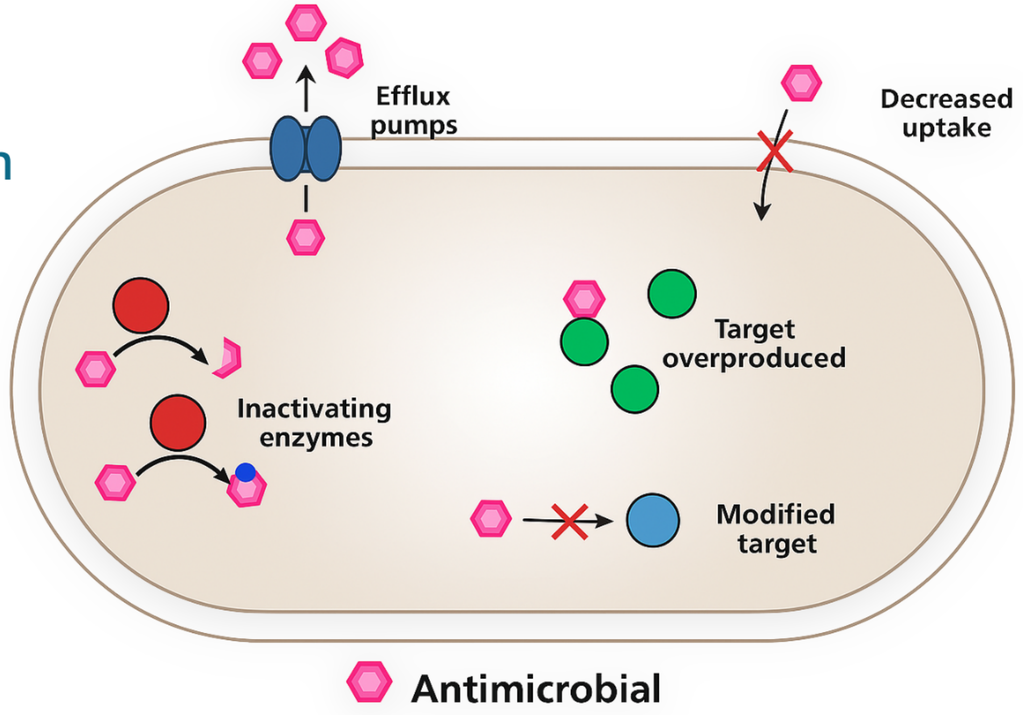
- **4.7 million deaths as at 2021** associated with bacterial AMR globally
- **8.2 million deaths by 2050** if unaddressed
- **50–70% of hospitalized patients** receive antimicrobials (WHO)
- Increasing local AMR rates leading to **hard to treat infections**
- **Resource constraints**: ICU beds, lab diagnostics
- **Economic pressure**: Costs of last-line drugs and extended stays
- Alignment with **Nigeria AMR National Action Plan 2024–2028**



Antimicrobial Resistance (AMR)

- **Antimicrobial Resistance (AMR)** occurs when bacteria, viruses, fungi and parasites no longer respond to antimicrobial medicines (WHO).
- **1.27 million deaths** directly attributed to drug-resistant infections in 2019; **~5 million deaths** associated overall (Murray et al., 2022).
- In **Nigeria alone**, ≈263,000 AMR-related deaths in 2019 surpassing malaria and respiratory infections locally (Murray et al., 2022).

- Resistance mechanism



Principles of Antimicrobial Stewardship

- Appropriate Use of Antimicrobials
- Education and Awareness
- Policy and Guideline Development
- Audit and Feedback Mechanisms
- Multidisciplinary Collaboration
- Surveillance and Monitoring

Antimicrobial Stewardship Evolution: Global to Nigerian Context

Global Evolution

- 1940s: Fleming's resistance warning
- 2007: IDSA core strategy
- 2016: WHO global endorsement
- Mid-2010s: Global mandates

Nigeria Response

- 2017-22: NAP-1.0 (44% completed)
- Priorities: ASPs, Surveillance
- 2024: NAP-2.0 launch
- One Health approach

Hospital Implementation

- 13-35% have ASP teams
- 12% enforce reviews
- 24% have guidelines
- Barriers: Training, Staffing, Support

WHO AWaRe Classification for Antimicrobials/Antibiotics

- **WHO grouped antibiotics into Access, Watch, and Reserve to guide usage.**

Access Group

First-line narrow-spectrum

1. Amoxicillin (Amoxil®)
2. Cotrimoxazole (Septrin®)
3. Nitrofurantoin (Macrodantin®)
4. Cloxacillin (Cloxapen®)
5. Benzylpenicillin (Crystapen®)

Watch Group

Higher resistance potential

1. **Co-amoxiclav** (Augmentin®)
2. Ciprofloxacin (Ciprotab®)
3. Ceftriaxone (Rocephin®)
4. Azithromycin (Zithromax®)
5. Cefuroxime (Zinnat®)

Reserve Group

Last-resort agents

1. Meropenem (Meronem®)
2. Colistin (Colimycin®)
3. Linezolid (Zyvox®)
4. Vancomycin (Vancox®)
5. Tigecycline (Tygacil®)

🔒 Restricted use (consultant approval)

Prioritizing Access antibiotics reduces gut flora disruption and lowers ***C. difficile infection (CDI) risk***

The 4C antibiotics: (**Clindamycin, Cephalosporins, Co-amoxiclav, Ciprofloxacin**)

AMS Techniques

Front-End Interventions

Pre-Authorization Strategy

🔒

Approval Required Before Prescribing

Who approves:

- Medical Doctor
- Pharmacist

Pros:

✓ Immediate control of high-risk drugs

✓ Prevents inappropriate use upfront

Cons:

✗ May delay therapy in emergencies

✗ Adds administrative burden

Back-End Interventions

Audit & Feedback Strategy

🔍

Review After Antibiotic Initiation

Who reviews:

- Pharmacist
- Stewardship team

Pros:

✓ Prescriber autonomy preserved

✓ High educational value

Cons:

✗ Labor-intensive

✗ Slower impact (48-72h)

Evidence and Outcomes

- Both strategies are core components of Antimicrobial Stewardship Programs (ASPs)
- **Hybrid models are common:**
- Pre-authorization works well for Reserve drugs
- Audit/feedback is usually practiced on broad-spectrum use
- Studies show reduced resistance and improved prescribing behavior

The “4 Ds” of Antimicrobial Prescribing

- The 4Ds of Antimicrobial Prescribing is simply the appropriate use of antimicrobial with respect to the drug, dose, duration and diagnosis.

💊 1.Right Drug

- Select the most targeted antimicrobial/antibiotic for the infection.
- Avoid broad-spectrum agents unless absolutely necessary.
- Consider local resistance patterns and patient allergies.
- *Example: Use nitrofurantoin for uncomplicated urinary tract infections instead of a fluoroquinolone like ciprofloxacin.*

📏 2. Right Dose

- Tailor the dose to:
- Patient weight
- Renal and hepatic function
- Severity of infection
- Underdosing risks treatment failure; overdosing risks toxicity.
- *Vancomycin dose reduced to once daily in a patient with kidney impairment to prevent toxicity.*

The “4 Ds” of Antimicrobial Prescribing cont’d…

⏳ 3. Right Duration

- Prescribe for the shortest effective course possible.
- Overly long durations increase risk of resistance and side effects.
- Reassess therapy at 48–72 hours and adjust based on clinical response.
- *Example: Community-acquired pneumonia often requires 5–7 days, not 10+.*

🔄 4. De-escalation/Diagnosis

- Once culture and susceptibility results are available:
- Stop unnecessary antibiotics
- Switch from broad-spectrum to narrow-spectrum agents
- De-escalation reduces collateral damage to the microbiome and lowers resistance risk.
- *Example: If vancomycin was started empirically for MRSA, but cultures show MSSA, switch to nafcillin or cefazolin.*

PHARMACEUTICAL IMPORTANCE OF AMS

PHARMACEUTICAL IMPORTANCE OF ANTIMICROBIAL STEWARDSHIP

- 💊 Ensures rational drug use and prescribing accuracy
- 🦠 Reduces antimicrobial resistance and *C. difficile* infection rates
- 💰 Promotes cost-effective therapy and optimal patient outcomes
- 🌍 Aligns with global frameworks (WHO AWaRe categories)

Pharmacist-Led Stewardship Activities

Pharmacist-Led Stewardship Activities

Formulary Development

Leverage AWaRe categories and local antibiogram data to determine antibiotic stocking and restrictions.

Drug Audits

Review prescriptions, provide feedback, and track metrics (DOT, DDD, CDI rates) through AMS rounds.

IV-to-Oral Switch

Identify candidates for transition to oral therapy, reducing IV days by 33% while maintaining efficacy.

Education

Train staff on AMS principles, AWaRe categories, and infection control through ward-round teachings.

Pharmacist-Led Stewardship Activities cont'd...

Guideline Implementation

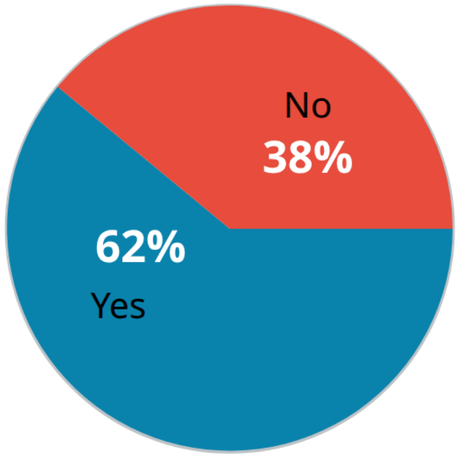
Develop and embed facility-specific protocols into electronic systems based on local antibiograms.

Leadership

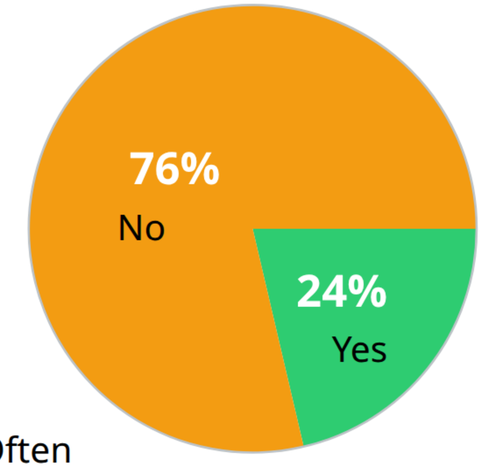
Serve as AMS champions, drive policy changes, and foster interprofessional stewardship culture.

Result from my survey (questionnaire)

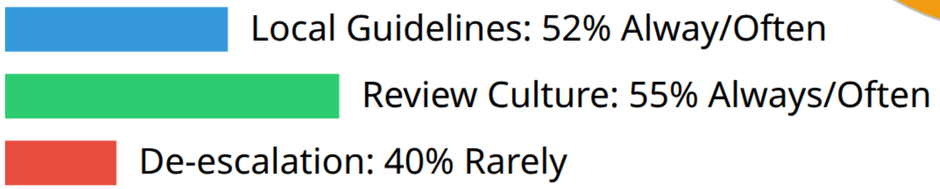
AMS Awareness



Formal Training



Prescribing Practices:



Top Barriers:



Nigerian Hospitals with Active/Pilot AMS Programs

S/n	Hospital Name	Location	Institution Type	AMS Status
1	Univ. Nigeria Teaching Hosp. (UNTH)	Ituku-Ozalla, Enugu	Fed. Teaching	Active
2	Univ. College Hosp. Ibadan (UCH)	Ibadan, Oyo	Fed. Teaching	Active
3	Lagos Univ. Teaching Hosp. (LUTH)	Ikeja, Lagos	Fed. Teaching	Active
4	Univ. Calabar Teaching Hosp. (UCTH)	Calabar, CR	Fed. Teaching	Active
5	Univ. Benin Teaching Hosp. (UBTH)	Benin City, Edo	Fed. Teaching	Active
6	Univ. Ilorin Teaching Hosp. (UITH)	Ilorin, Kwara	Fed. Teaching	Planned
7	ATB Univ. Teaching Hosp.	Bauchi, Bauchi	Fed. Teaching	Active
8	Usman Danfodiyo Univ. Teaching Hosp.	Sokoto, Sokoto	Fed. Teaching	Active
9	Enugu State Univ. Teaching Hosp.	Enugu, Enugu	State Teaching	Active
10	Benue State Univ. Teaching Hosp.	Makurdi, Benue	State Teaching	Active
11	National Orthopaedic Hosp. Igbobi	Lagos, Lagos	Fed. Specialist	Pilot
12	Fed. Med. Centre, Jalingo	Jalingo, Taraba	Fed. Med. Centre	Active
13	Fed. Med. Centre, Makurdi	Makurdi, Benue	Fed. Med. Centre	Active
14	Taraba State Specialist Hosp.	Jalingo, Taraba	State Specialist	Active
15	State Specialist Hosp. Yola	Yola, Adamawa	State Specialist	Active
16	Dalhatu Araf Specialist Hosp.	Lafia, Nasarawa	State Specialist	Active
17	Plateau State Specialist Hosp.	Jos, Plateau	State Specialist	Active
18	Khalifa Rabiu Paediatric Hosp.	Kano, Kano	State Specialist	Active
19	General Hosp. Gembu	Gembu, Taraba	State General	Active
20	General Hosp. Takum	Takum, Taraba	State General	Active
21	Babcock Univ. Teaching Hosp.	Ilishan-Remo, Ogun	Private Teaching	Active
22	Limi Children’s Hosp.	Abuja, FCT	Private Hosp.	Active

Total Hospitals:	Federal: 11	State: 9	Private: 2	Nigeria Hospitals:	% Practicing AMS:
22	**(50.0%)**	**(40.91%)**	**(9.09%)**	**(~3,950)**	**(0.56%)**

Conclusion

Antimicrobial Stewardship (AMS) is vital for **safe and effective patient care. Pharmacists** are central to its success, helping improve patient outcomes and combat **resistance.** FMC Keffi has much to gain from AMS, and with strong leadership can become a model for stewardship excellence and example to other hospitals in Nigeria.

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Thanks For Listening!

Questions and Discussions