ANTIMICROBIAL STEWARDSHIP PROGRAM (AMSP)

What Why and How?

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What does stewardship mean?

Stewardship refers to:

'The careful and responsible management of something entrusted to one's care'.

What is Antimicrobial Stewardship?

Careful & responsible management of Antibiotic use

"Antimicrobial stewardship:

- is an **inter-professional effort**, across the continuum of care
- involves timely and optimal selection, dose and duration of an antimicrobial
- for the best clinical outcome for the treatment or prevention of infection
- with minimal toxicity to the patient
- and minimal impact on resistance and other ecological adverse events such as *C. difficile*"

[Nathwani et al., 2012]

CDC defined AMS as : Use of

- The right antibiotic
- For the right patient
- At the right time
- With the right dose
- Right route and frequency
- Causing the least harm to the patient and future patients.

Does Antimicrobial Stewardship needed?

We have all learned about right drug, dose, route, frequency and duration of treatment in our MBBS or PG Courses and don't need any Stewardship Program in other disciplines of Medical Practices But why we need for Antimicrobials?

Answer- It is needed

Wrong use of antibiotics leads to antimicrobial Resistance causing Rx failure and harm to that patient and Future patients and that resistance spreads from one Hospital to Other Hospitals of same country or different country. And from Hospital to Locality. May cause 10 million (1crore) deaths/ year by 2050.

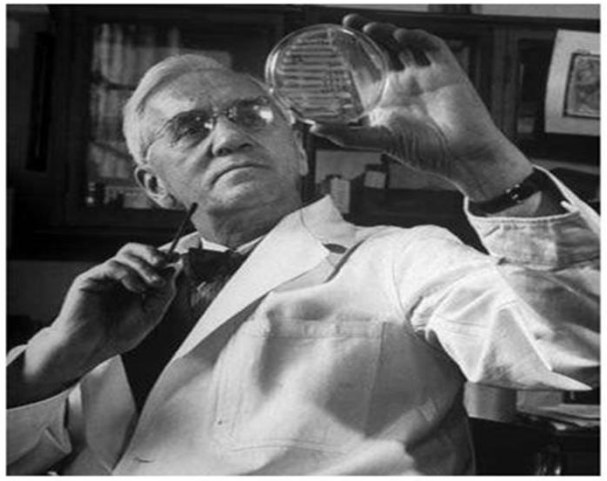
ANOTHER WAY OF EXPRESSION!

Antimicrobial Stewardship isn't about "not using antimicrobials" but rather "identify that small group of patients who really need antibiotic treatment and then explain, reassure and educate the large group of patients who don't".

Brief History

Sir Alexander Fleming on June 26, 1945

"The microbes are **educated to resist penicillin** and a host of penicillin-fast organisms is bred out…in such cases the thoughtless person playing with penicillin is morally responsible for the death of the man who finally succumbs to infection with the penicillin-resistant organism. I hope this evil can be averted."



Penicillin finder assays its future. New York Times 26 June 1945: 21.

BRIEF HISTORY-2

1996 - McGowan and Gerding in the USA first published a paper on this.

- "There is an association **between the use of antimicrobial agents and resistance** that is likely causal.
- "The best methods to prevent and control this problem and ensure our optimal antimicrobial-use "stewardship."
- "Consideration of the long-term effects of antimicrobial selection, dosage, and duration of treatment on resistance development should be a part of every antimicrobial treatment decision.

BRIEF HISTORY-3

- 1997- Society for Healthcare Epidemiology of America (SHEA) and Infectious Diseases Society of America (IDSA) published guidelines to prevent antimicrobial resistance.
- In 1998- Ian Gould and Jos van der Meer founded ESGAP (the European Society of Clinical Microbiology and Infectious Diseases Study Group for Antimicrobial stewardship), which helped to amplify the use of 'antimicrobial stewardship' worldwide.
- In 2007- CDC rang the alarm, IDSA and SHEA published guidelines for developing an AMS program
- In 2012, the SHEA, IDSA and PIDS published a joint policy statement on AMS.
- **In 2014, the CDC recommended, that all US hospitals** have an antibiotic stewardship program
- **2017: Joint Commission** regulations: Hospitals should have an Antimicrobial Stewardship team consisting of
  - Infection preventionist, Pharmacist(s), Practitioner

Is it logical to use Stewardship only with Antimicrobials but not with other Medicine?

This is logical, because Antimicrobials are not like other drugs.

Antibiotics are unique, inappropriate use leads to development of resistance by Microbes leading treatment failure and has consequences on individual patient and the broader society.

Resistant bacteria from a wrong prescription spreads from one patient to another patient of same hospital, from one hospital to another hospital, from hospital to community.

Why AMS is needed ?

Antimicrobial resistance (AMR) and spread of MDRO

Misuse and over use of Antimicrobials

Widespread of Antimicrobial in other sectors

Poor Antimicrobial research for New Antibiotics

ANTIMICROBIAL RESISTANCE

AMR causes an estimated **700,000** deaths annually, the number could grow to **10 million** per year by 2050.

In some high-income countries, about 35% of infections are due to MDRO, in low to middle income countries, resistance rates are as high as **80 to 90%.**

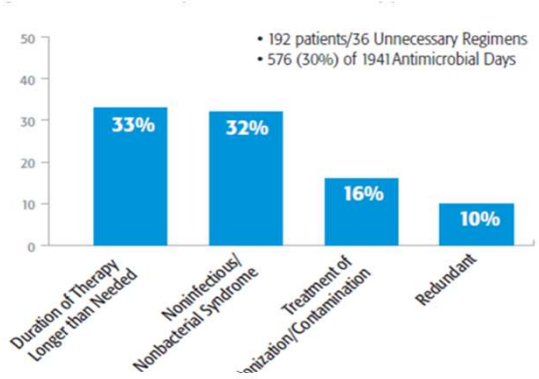
AMR causes an estimated 700,000 deaths annually, the number could grow to 10 million per year with a cumulative cost of $100 trillion by 2050.
In 2019, AMR cost 389,000 lives in South Asia, 84,000 of which were children under 5

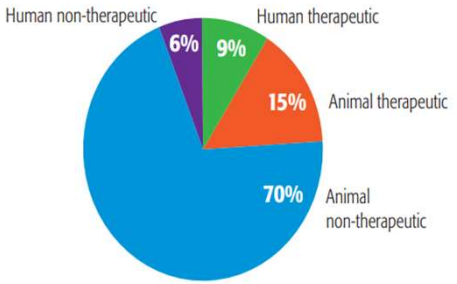
Misuse and over use of Antimicrobials

Antimicrobial Prescribing Facts: The 30% Rule

- ~ **30%** of all hospitalised inpatients at any given time receive antibiotics
- Over **30%** of antibiotics are prescribed inappropriately in the community
- Up to **30%** of all surgical prophylaxis is inappropriate
- ~ **30%** of hospital pharmacy costs are due to antimicrobial use
- **10-30%** of pharmacy costs can be saved by antimicrobial stewardship programs

[Hoffman et al., 2007; Wise et al., 1999; John et al., 1997]

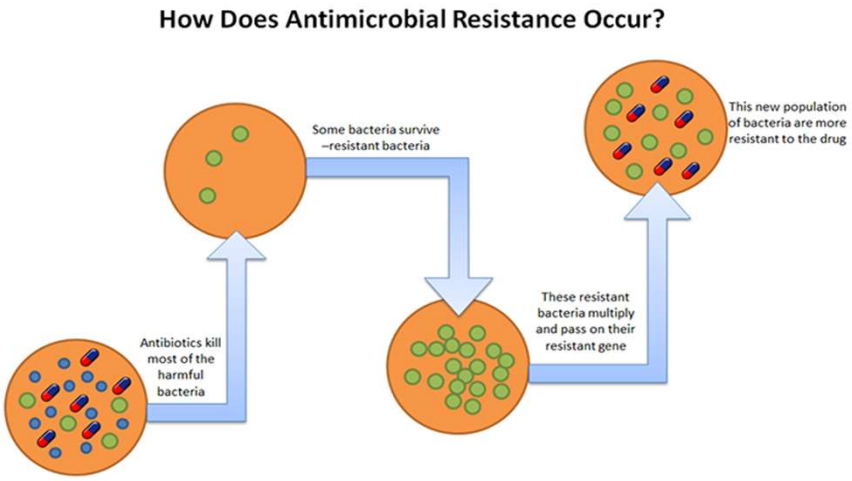


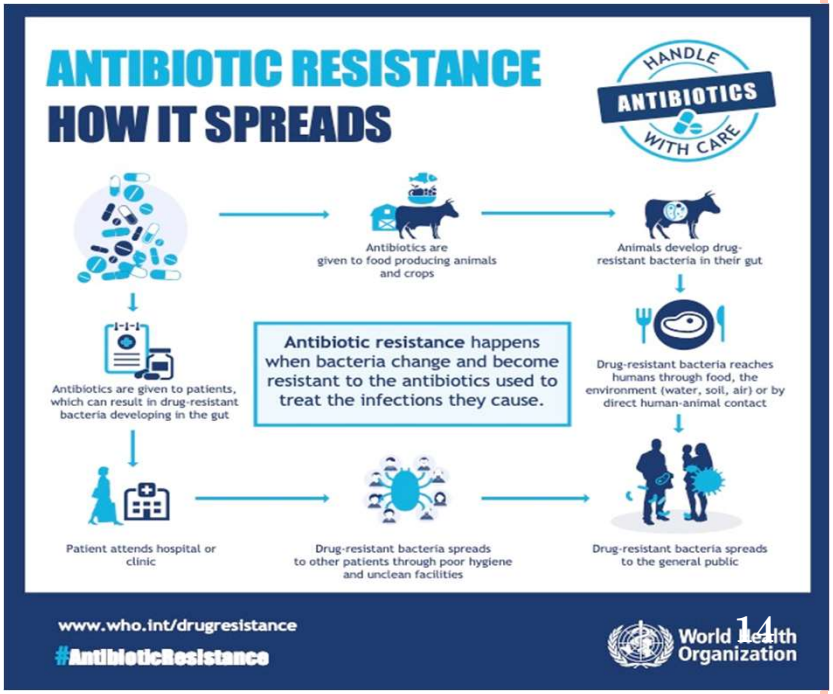


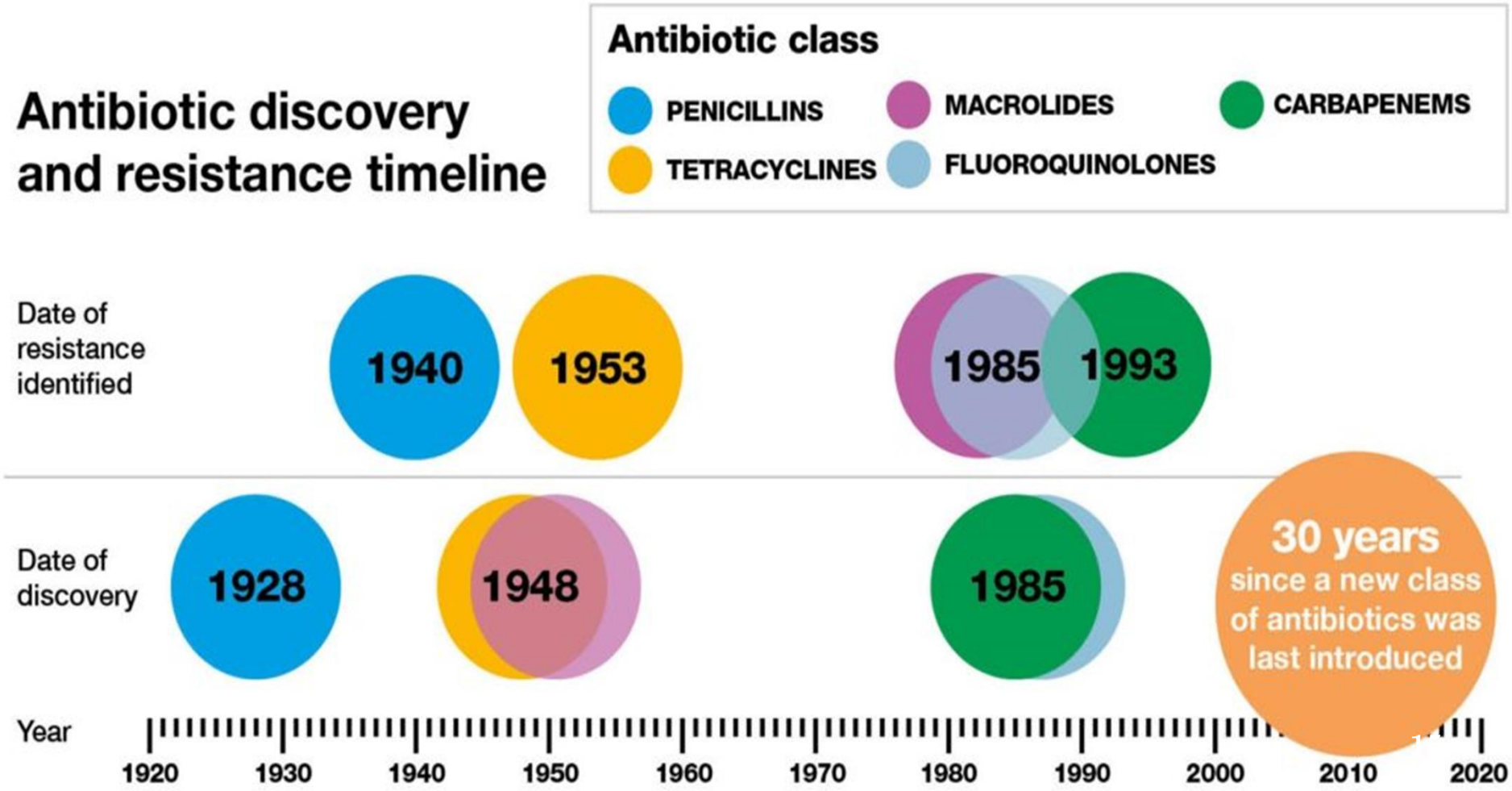
ce: www.pewhealth.org

How Does Antibiotic resistance occur and spreads

Antimicrobial use is a main driver for the emergence of drug-resistant organisms






Antibiotic discovery and resistance timeline
Antibiotic class
PENICILLINS
MACROLIDES
CARBAPENEMS
TETRACYCLINES
FLUOROQUINOLONES
Date of resistance identified
1940
1953
1985
1993
Date of discovery
1928
1948
1985
30 years
since a new class of antibiotics was last introduced
Year
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020

AMR Situation In Bangladesh

E. coli resistance

~ **60%** to Ciprofloxacin, Ceftazidime, Ceftriaxone

~ **10%** to Amikacin and imipenem.

Klebsiella resistance

~ **40%** to ceftriaxone, ciprofloxacin and

~ **20%** to Amikacin and Imipenem

S. aureus resistance

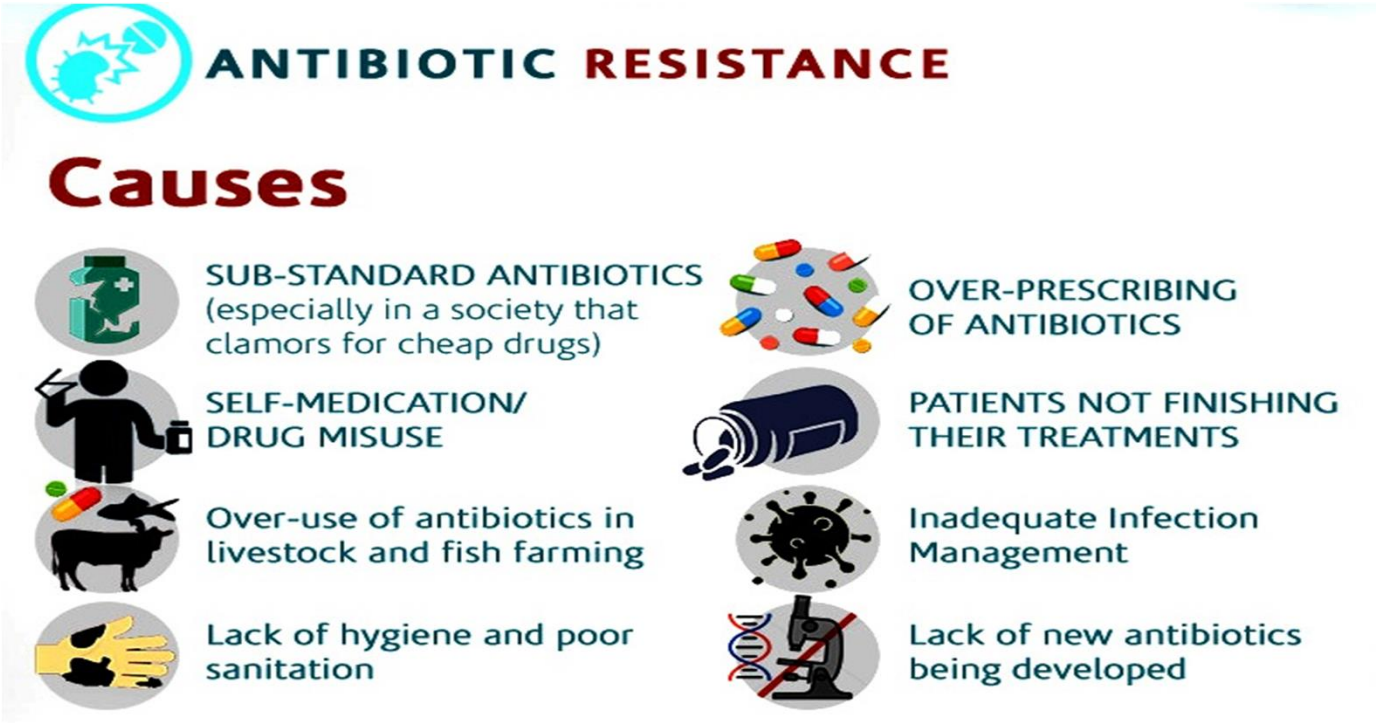
~60-70% to cloxacillin, ceftriaxone, ceftazidime

Pseudomonas

~ 50% netilmicin, ciprofloxacin,

~ 30% to ceftazidime and ceftriaxone.

CAUSES OF ANTIMICROBIAL RESISTANCE



How to Combat AMR?

To overcome the threat of antimicrobial resistance, a three-pillar approach has been advocated:

1. Optimize the use of existing antimicrobial agents
2. Prevent the transmission of drug-resistant organisms through infection control
3. Improve environmental decontamination

3 Objectives & 4 Goals of AMSP

Objectives

1. To achieve best clinical outcomes while minimizing toxicity and other adverse events
2. To limit the selective pressure on bacterial populations
3. To reduce excessive costs attributable to suboptimal antimicrobial use.

Goals-

1: Improve patient outcomes

2: Improve patient safety (by minimizing Adverse reactions of antimicrobials)

3: Reduce resistance and Prolong life of existing antibiotic

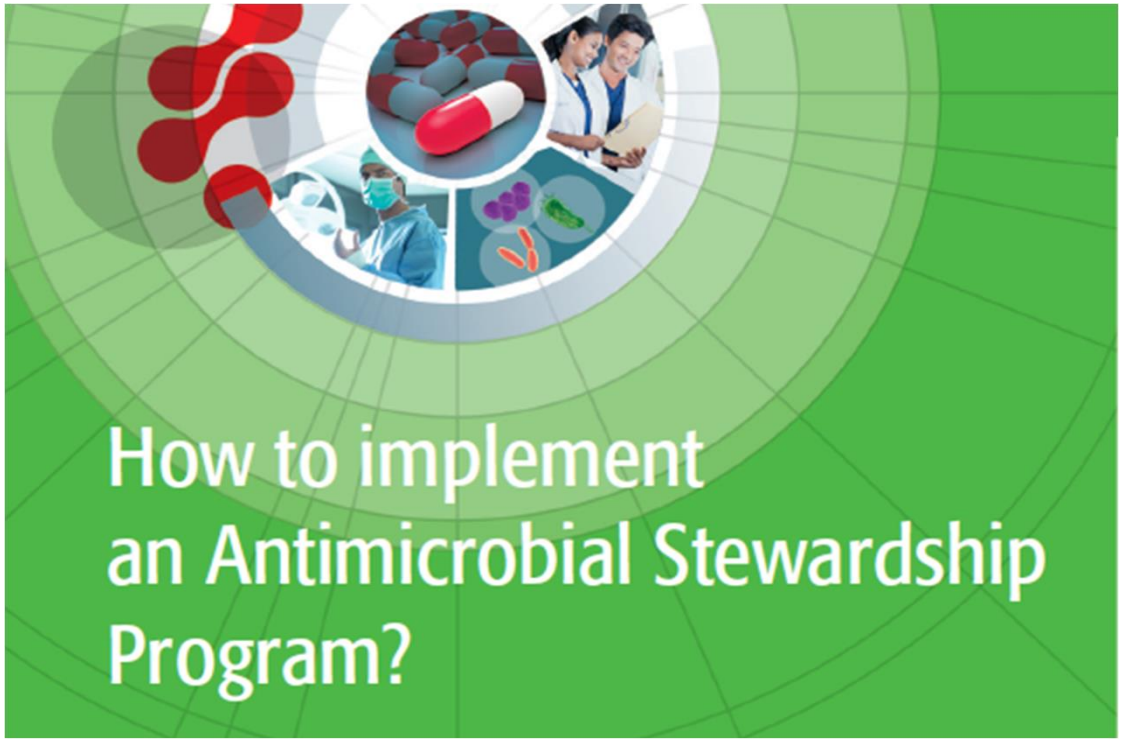
4: Reduce healthcare costs

1: IMPROVE PATIENT OUTCOME → Improve infection cure rates
Reduce surgical infection rates
Reduce mortality and morbidity

2: IMPROVE PATIENT SAFETY → Reduce antimicrobial consumption, by 22%-36% without infection related morbidity or readmission (Dellit et al., 2007).
Reduce C. difficile infection by controlling the use of "high-risk" antibiotics Valiquette et al,. 2007)

3: REDUCE RESISTANCE → Restricting broad spectrum Abx agents

4: REDUCE HEALTH CARE COST → Savings achieved by reducing antibiotic costs


How to implement
an Antimicrobial Stewardship
Program?

8 KEY STEPS

1. Assess the motivations
2. Ensure accountability and leadership
3. Set up structure and organization
4. Define priorities and how to measure progress and success
5. Identify effective interventions for your setting
6. Identify key measurements for improvement
7. Educate and Train
8. Communicate

1. Assess Motivations

- Prescribing Guideline
- surgical prophylaxis
- IV to oral conversion
- Restricting availability of certain antibiotics
- Promoting Education

Situation Analysis
Implemented will depend on

- local needs/issues
- geography
- available skills/expertise other resources

2. Ensure Accountability and Leadership

Head of Institute

3. Set up structure and organization

AMSP committee
Lead Physician
Microbiologist
Clinical Pharmacist
Any interested Clinician,
Specialist Nurse

4. Define priorities and how to measure progress and success

The objectives of the AMSP and how they are going to be achieved and measured need to be agreed by all the key stakeholders and communicated clearly.

Can be achieved by Driver diagram developed by CDC

Primary Driver

Timely and appropriate administration of antibiotics

Secondary Drivers

1. Promptly identify pts who requires antibiotics
2. Obtain culture prior to starting antibiotics
3. Don't give antibiotics with overlapping spectra or combination not supported by guideline
4. Consider local susceptibility pattern in selecting therapy
5. Start treatment promptly
6. Specify specific duration as per guideline

4. Define priorities and how to measure progress and success (Contd)

Primary Driver

Appropriate administration & De-escalation

Secondary Drivers

1. Start date of Abx be written clearly in treatment sheet
2. Give antibiotics at right dose and interval
3. Stop or De-escalate promptly based C/S report
4. Reconcile or adjust Abx at all transitions and changes in pts condition
5. Monitor for toxicity reliably and adjust agent and dose properly

TWO CORE STRATEGIES

- **"Front–end strategies"** where antimicrobials are made available through an approval process (formulary restrictions and preauthorization).

- **"Back-end" strategies** are where antimicrobials are reviewed after antimicrobial therapy has been initiated (prospective audit with intervention and feedback)

FRONT END STRATEGIES

Classifies drugs into

Restricted- Colistin, Tigecycline, Carbapenem

Pharmacy require prior approval from AMS for > 1 day supply

Semi-restricted- Teicoplanin, Linezolid, Vancomycin, Daptomycin-
Pharmacy require prior approval from AMS for > 3 day supply

Non-restricted – 1st, 2nd Cephalosporin, Cotrim, Azithromycin, Flruroqunolone etc

Pharmacy does not require prior approval from AMS team

More attractive, impact is immediate and appears to be most ideal but **practically implementation is challenging.** Creates a **lots of confusion** as it directly compromises clinicians freedom to choose antibiotics. AMSP team to remain available for approval

BACK END STRATEGIES

Antimicrobial review methods are employed post-prescription
Though difficult to perform, **but it is most effective strategy to implement AMSP**.

- It has several advantages
  - More **widely practiced**
  - More **easily accepted by the clinicians**
  - Provides **higher opportunity** for education and training
  - Impact is delayed but sustained

BACK END STRATEGIES- ANTIMICROBIAL REVIEW METHODS

Commonly used checklists

- ✓ Review of indication for Abx and compliance with guideline;
- ✓ Review of appropriate Abx choice, dose, route and planned duration
- ✓ Review of drug allergy and duplicative therapy
- ✓ Review targeted therapy based on C/S report
- ✓ Potential conversion from IV to oral route
- ✓ Review of antibiotic related adverse events
- ✓ Review of empiric or directed therapy based on biomarkers

AUDIT AND DIRECT FEEDBACK TO PRESCRIBERS

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Questionnaire for AMSP Prescription Audit

Record No		Date Audited		Daily No:		MRN	
Location			Age			Sex	
Prescribers name							
Antibiotics Prescription							
SI	Name of Antibiotics	Dose	Route	Interval	Start date		

Indication for Antibiotic Treatment (Multiple response)			
SI	Indication		Please write
Initial review of Antibiotic Treatment			
SI	Description/Question		Answer
	Is indication for Antibiotic treatment documented?	Yes/ No	
	Is Antibiotic treatment prescribed according to the guideline?	Yes/ No	
	If no, please describe why not?	Yes/ No	
	Correct dose?	Yes/ No	
	Appropriate route?	Yes/ No	
	Treatment duration or review dated started?	Yes/ No	
48/72 hours review of Antibiotic treatment			
	Is Antibiotic treatment reviewed? If "Yes' what action?	Yes/ No	
	Escalate/ Continue/ De-escalate/ Stop/ IV-oral switch		
	Why Antibiotic treatment being continued?		
F. Microbiology			
1.	Microbiology specimens collected before start of antibiotic? If Yes please mention date.	Yes/ No	
2.	Microbiology results received? If yes please mention date.	Yes/ No	
3.	Microbiology results acted upon?	Yes/ No	

Name of Data collector	Signature	Date of data collection
Review of AMSP team		
Feedback given		Yes/ No

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Antimicrobial Stewardship Program (AMSP) Feedback form

Dear…… (Prescriber's Name)

Following is missing in your Antibiotic prescription of audit date ……

Patient …… Age…. Sex…..MRN……

Sl. No	Checklist point	
1.	Indication not documented	
2.	AIH Guideline not followed	
3.	HO of Drug Allergy not documented	
4.	Dose not written/mentioned	
5.	Route not written/mentioned	
6.	Duration of empirical therapy till review date 48/72 hrs not documented/mentioned)	
7.	Sample for Culture and Sensitivity (C/S) not advised / collected	
8.	Review of Antibiotics after getting C/S report not done (Escalation/De-escalation/Addition/ Stop)	
9.	If continued for longer duration reason not mentioned	
Comment:		

Signature of Chairman

AMSP

ANTIMICROBIAL PRESCRIBING POLICY/ GUIDELINE

Antibiotic Guideline should include

- **Definition** of infections: UTI, RTI, BSI etc
- In which situation antibiotic is **indicated** and **not indicated**
- Which antibiotic should be given **empirically** before getting C/S report - with doses and duration (based on local antibiogram)
- **Escalation/ De-escalation:**
  - Changing the Antibiotic after getting C/S report
  - Shifting from parenteral to oral
  - When to discontinue (duration)

How is antimicrobial use data collected and analysed?

- Antimicrobial use at individual patient level, using an electronic prescribing system through the Hospital Information System.
- Data from hospital pharmacy computer systems
- Two types of **antimicrobial usage process indicators**
  - **Days of Therapy (DOT/ 100 patient days)** – it is the number of days that patient receives at least one dose of antibiotic summed for each antibiotic. It is the most preferred indicator of antibiotic consumption recommended by IDSA, CDC, and WHO.
  - **Daily Defined Dose- Complex**

WHAT IS DOT & HOW TO CALCULATE?

- It is the number of days patient receives an Antibiotic

- Examples
  1. One patient received meropenem 1g twice daily for 3 days – DOT is 3
  2. One patient received meropenem 0.5 thrice daily for 3 days – DOT is 3
  3. One patient received meropenem 1g twice daily and Vancomycin 1g thrice daily for 3 days DOT is 3+3= 6 days

Days of Therapy (DOT/ 100 patient days) is calculated as

$$\frac{\textbf{Total DOT on Abx in a location for a given period of time}}{\textbf{Total patient days of the location for the same period}} \times 100$$

How is antimicrobial resistance data collected and analyzed?

- Resistance data is obtained from the Microbiology laboratory through computer systems

- An **Antibiogram** is an overall profile **antimicrobial susceptibility results of a specific** organism to set of Antibiotics.

- Types of **Antibiogram**
  - Routine cumulative
  - Enhanced antibiograms-
    - Patient location (ICU vs Non ICU)
    - Department (medical vs Surgical)
    - Population age
    - Infection site
    - Community Vs Hospital acquired
    - Type of organism

EDUCATE AND TRAIN

- ✓ Education is a **key component** of any Antimicrobial Stewardship Program.
- ✓ It should include healthcare professionals from all care settings, as well as patients and the public.

Passive Educational Measure

- Developing /updating guideline
- Educational sessions, workshops

Active Interventions

- Clinical round discussing cases
- Prospective audit with intervention and feedback
- Reassessment of antibiotic prescriptions, with streamlining and de-escalation

An **evaluation process** should be included in the education program to measure attendance, understanding and assimilation, using regular training assessment tools such as attendance forms, completion certificates, questionnaires, tests etc

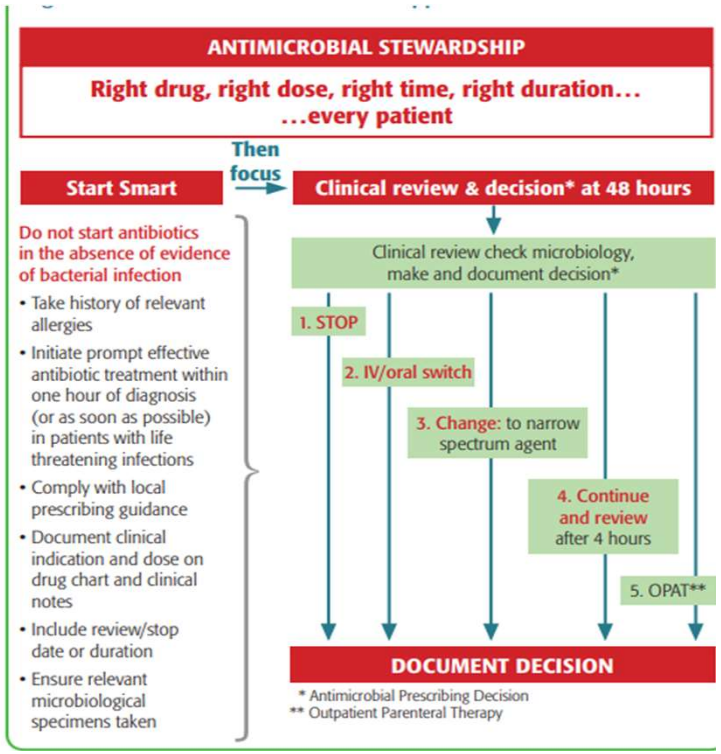
COMMUNICATE

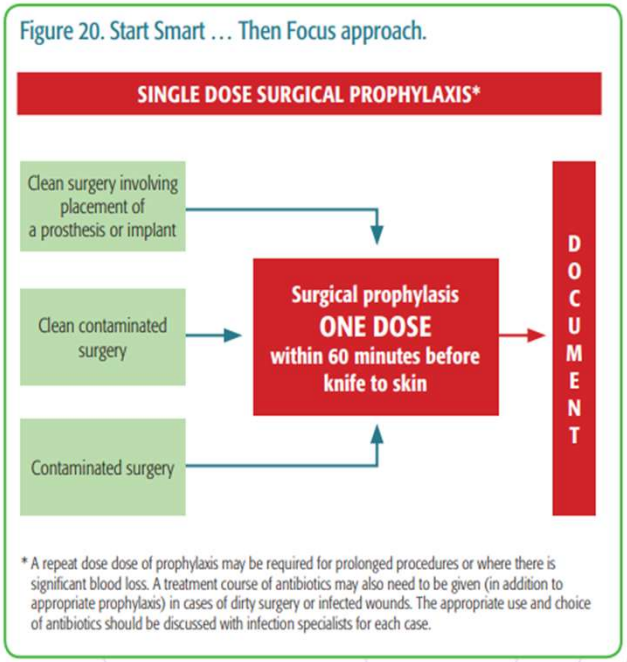
Communication is a key component of the success of an AMSP.

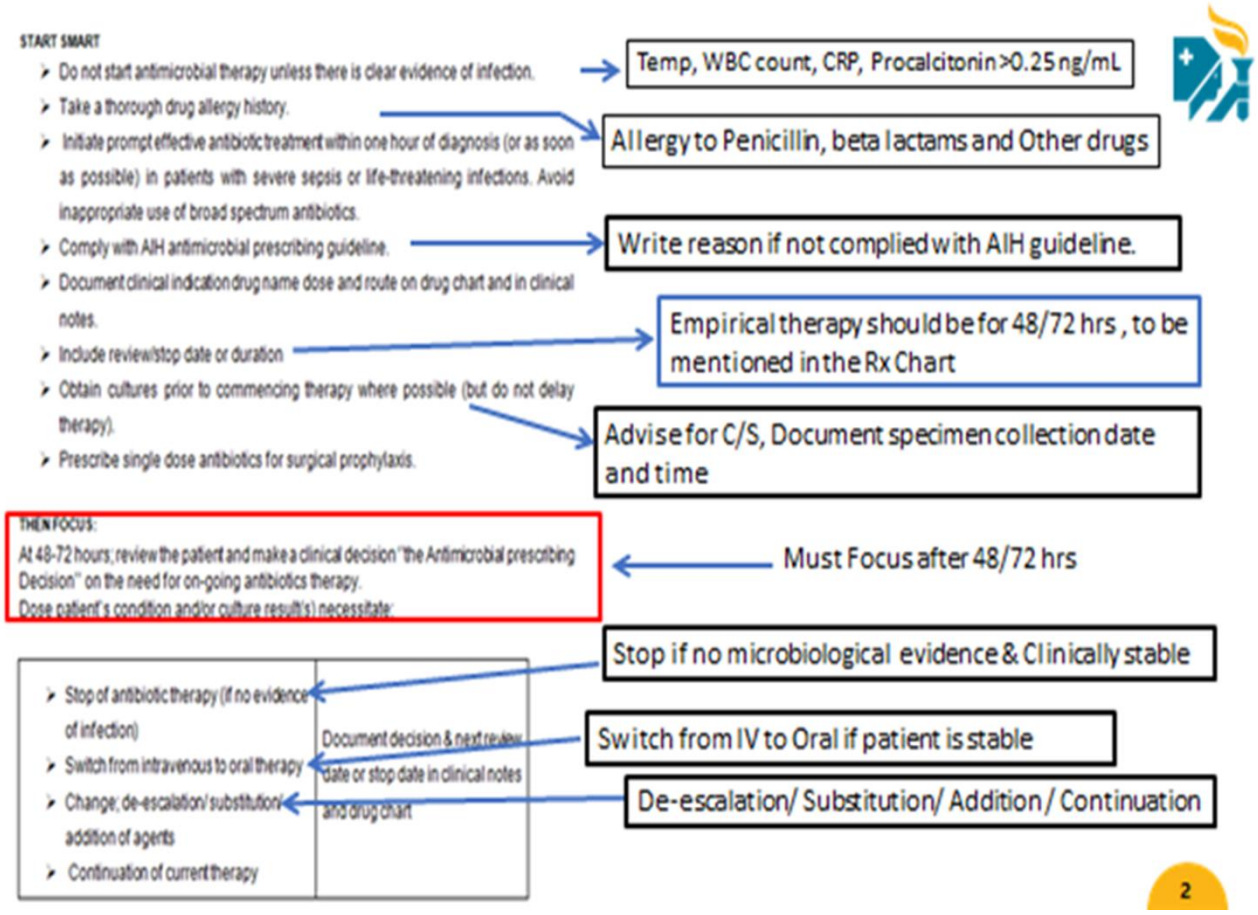
Clear, simple communication should show the vision and the benefits of the program, with core clinical messages.

The “Start Smart - Then Focus” approach in the UK is a good example of such an approach

"START SMART - THEN FOCUS UK MODEL






START SMART
Do not start antimicrobial therapy unless there is clear evidence of infection.
Take a thorough drug allergy history.
Initiate prompt effective antibiotic treatment within one hour of diagnosis (or as soon as possible) in patients with severe sepsis or life-threatening infections. Avoid inappropriate use of broad spectrum antibiotics.
Comply with AIH antimicrobial prescribing guideline.
Document clinical indication drug name dose and route on drug chart and in clinical notes.
Include review/stop date or duration
Obtain cultures prior to commencing therapy where possible (but do not delay therapy).
Prescribe single dose antibiotics for surgical prophylaxis.
Temp, WBC count, CRP, Procalcitonin >0.25 ng/mL
Allergy to Penicillin, beta lactams and Other drugs
Write reason if not complied with AIH guideline.
Empirical therapy should be for 48/72 hrs , to be mentioned in the Rx Chart
Advise for C/S, Document specimen collection date and time
THEN FOCUS:
At 48-72 hours, review the patient and make a clinical decision "the Antimicrobial prescribing Decision" on the need for on-going antibiotics therapy.
Dose patient's condition and/or culture result(s) necessitate:
Must Focus after 48/72 hrs
Stop of antibiotic therapy (if no evidence of infection)
Switch from intravenous to oral therapy
Change; de-escalation/ substitution/ addition of agents
Continuation of current therapy
Document decision & next review date or stop date in clinical notes and drug chart
Stop if no microbiological evidence & Clinically stable
Switch from IV to Oral if patient is stable
De-escalation/ Substitution/ Addition / Continuation
2

MINIMUM REQUIREMENTS FOR THE PROGRAM

1. A multidisciplinary **AMS team**

   Comprising 1. physician 2. pharmacist 3. clinical microbiologist. 4. infection prevention and control officer
2. Institutional guidelines for common infection syndromes.
3. Additional interventions **to improve the use of antimicrobials,**
4. **Processes to measure and monitor antimicrobial use**
5. Periodic distribution of a facility-specific **Antibiogram**

MONITORING COMPLIANCE OF AMSP

"If you can not measure it, you can not improve it"

Two types –

1. **Policy adherence indicator / Process Indicators**
   - **Prescription compliance**
   - **Administrative compliance**
2. Outcome indicators
   - Antimicrobial usage
   - AMR pattern
   - Clinical outcome
   - Financial

OUTCOME INDICATORS

1. **Antimicrobial usage outcome indicators-** DDD, DOT
2. **AMR outcome indicator:** Change of AMR pattern through surveillance
3. **Clinical outcome indicator:** such as morbidity and mortality
4. **Financial outcome indicators** antimicrobial cost per patient day or per year or per admission.

PRESCRIPTION COMPLIANCE INDICATORS

1. Percentage of time **empirical antibiotics** given according to policy
2. Percentage of time empirical antibiotics **is modified** as per a **sensitivity report.**
3. Percentage of time **cultures were taken** before antibiotics started
4. Percentage of time **choice of surgical prophylaxis** given as per policy

THE KEYS TO SUCCESS

Establish a **Clear aim/ vision** and share to all stake holders. Stewardship should be a patient safety priority

Seek **Management support** accountability and secure funding

Form a **Multidisciplinary AMS Team**

Establish **Effective communication structures**

Start with Core **Evidenced based AMS interventions** depending on local needs

Ensure All HCW are aware of importance **Stewardship.** Empower them to act and support with **Education**

Ensure **Early or short term win** and then consolidate success while progressing with more change innovation

3 Main Steps in Stewardship

- **Guidelines for Antibiotic**
  - To prepare guidelines for Common type of infection
- **Surveillance**
  - To observe whether patients are being treated as per guideline
- **Feedback**
  - To discuss with respective physician in case of non compliance
  - Training

WORK DISTRIBUTION OF AMSP

Develop Antibiogram — **Microbiology**

Guidelines- Clinical team — **Clinical Departments**

Auditing — **Surveillance team**

Feedback and interventions — **Stewardship Committee**

Annual antibiotic consumption

Rationale use of Antibiotics

RATIONAL USE OF ANTIBIOTICS

Abx use Checklist

1. Decide whether bacterial infection by CBC, CRP, PROCAL >0.5ng/ml
2. Make a reasonable statistical guess as the possible pathogen
3. Empirical therapy based on local statistics and antibiogram
4. Be aware about previous use Abx or hospital admission
5. Reestablishment of normal flora can take weeks, pts in hospital recolonize with resistant flora
6. Host factors- Age, CBC, Hepatic and renal function, Duration of hospitalization, Co-morbidity, severity of illness must take into account
7. De-escalation within 3 days

Last but not the least: Growth of bacteria or fungi from any specimen does not mean Infection. Will have to differentiate between **Infection, Colonization** and **Contamination** by Gram stained smear as well as Clinical feature. Should have a good interaction between Microbiologist and Clinician.

RATIONAL USE OF ANTIMICROBIAL AGENTS

1. **Prescribe only when indicated**
2. **Culture of cultures**
3. **Empirical vs Targeted therapy**
4. Escalation vs De-escalation approach
   - Escalation- from narrow to broad spectrum-
   - De-escalation- **from Broad to narrow spectrum**
5. **Site specific antimicrobials**
6. **Avoidance of administrative error**
7. **MIC guided therapy- Therapeutic index**
8. **Therapeutic drug monitoring**
9. **Timely stoppage of antimicrobials**
10. **Biomarkers guided therapy**

INTERPRETATION OF C/S REPORT BY MIC

MIC helps to select the most appropriate antibiotic:

- Lower - MIC, better - therapeutic efficacy.
- If >1 antimicrobial agents – susceptible - antibiotic having lowest MIC (when compared with the susceptibility breakpoint) - chosen for therapy.
- Better guided by calculating the **therapeutic index / Therapeutic efficacy**

Please Note

In CLSI, No **"S"** category is available for certain organisms- agent combination **Colistin for** *Enterobacteriaceae, Pseudomonas, Acinetobacter* only **"I"** and **"R"** categories are available

If you get any AST report with *Enterobacteriaceae, Pseudomonas, Acinetobacter* sensitive to Colistin then may ask your Microbiologist colleague

INTERPRETATION OF C/S REPORT BY MIC…

Blood culture report

Susceptibility report *of E.coli* with therapeutic efficacy

Antibiotic	MIC (µg/ml)	Susceptible break point	Interpretation	Therapeutic efficacy
Amikacin	2.0	16.0	S	16/2= 8
Piperacillin tazobactam	4.0	16.0	S	16/4=4
Cefoperazone sulbactam	16.0	16.0	S	16/16=1
Ciprofloxacin	>=4.0	0.25	R	Not applicable
Ceftriaxone	>=64.0	1.0	R	Not applicable
Cefepime	4.0	4.0-8.0 (Int. break point)	SDD	Not applicable

Site specific antimicrobials

Following antibiotics are not active at the respective sites

CSF: macrolide, clindamycin, quinolones, tetracyclines, 1st and 2nd generation cephalosporins.

Blood: Tigecycline.

Urine: Cholamphenicol, macrolide, clindamycin

Colistin and Polymixin B have poor concentration in lung, pleura and CNS

MISUSE OF ANTIMICROBIALS

1. Avoid overlapping spectra-
2. Redundant antibiotics –
3. Ineffective antibiotics-
4. Inferior antibiotics -

Examples of inappropriate use of Abx

Avoid overlapping spectra: Meropenem and piperacillin-tazobactam combination therapy for double Gram-negative coverage

Redundant Antibiotic: Meropenem and metronidazole combination therapy for suspected Gram-negative/anaerobic sepsis

- **Ineffective antibiotic:** Cloxacillin for MRSA.
- **Inferior antibiotic :** Vancomycin for MSSA.

COMMON EXAMPLES OF AVOIDABLE ANTIBIOTIC MISUSE

1) Inadequate dosing
2) Unnecessary wide spectrum
3) Unnecessary double anaerobic coverage
4) Limited intravenous-to-oral shift
5) Unnecessary long antibiotic therapy duration
6) Limited access to outpatient parenteral antibiotic therapy (OPAT)
7) Limited exploitation of the PK/PD potential of a certain antibiotic
8) Limited clinical use of biomarkers
9) Limited knowledge of old (but effective) antibiotics

GOLDEN RULES OF ANTIMICROBIAL PRESCRIBING

M	Microbiology guides therapy wherever possible
I	Indications should be evidence based
N	Narrowest spectrum required
D	Dosage appropriate to the site and type of infection
M	Minimise duration of therapy
E	Ensure monotherapy in most cases

Adapted from Antibiotic Expert Group. Therapeutic guidelines: antibiotic. Version 14. Melbourne: Therapeutic Guidelines Limited; 2010.

SOME IMPORTANT POINTS ABOUT USE OF ANTIBIOTICS

Empirical broad spectrum therapy is continued for long time even after getting AST report with a previous wrong idea that once an antibiotic is started course of that antibiotic should be completed.

Duration of exposure to Abx: is an important contributing factor for development of resistance. Number of resistance bacteria remains low early in course of antibiotics. The longer the exposure more chance of resistant. **5-7 days duration is ideal**.

In normal host **Neutrophils;** work in concert with Abx to kill microbes. When the conc of organisms drops to 100-1000/g of tissue, neutrophils alone can eradicate infection.

Repeat AST after 3-4 days is required because some bacteria develops resistance **during the course of treatment**. *Ps aeruginosa*- develops, *S.aureus*, *Klebsiella*, *Enterobacter.*

SOME IMPORTANT POINTS REGARDING INTRINSIC RESISTANCE

- **Intrinsic resistance:** Both Clinicians and Microbiologists must know about IR of common bacteria. This IR varies with species of same bacteria
- *Proteus mirabilis*- has **Intrinsic resistance to** Tetra, Tigecycline, Nitrofurantoin and Colistin *B*
- *Proteus mirabilis*- has **Intrinsic resistance to** Tetra, Tigecycline, Nitrofurantoin Colistin *B* plus ampicillin, cefuroxime, cefazolin, cephalexin, cefadroxil
- *Burkholderia cepacia, serratia* resistance to Colistin
- *Stenotrophomonas* resistant to Meropenem

6 Great Antimicrobial Stewardship Resources

1. This is a fantastic introductory course on antimicrobial use and prescribing for clinicians with a focus on stewardship: Antimicrobial Stewardship: A Competency-Based Approach (WHO)

2. Global Action Plan on Antimicrobial Resistance (WHO)

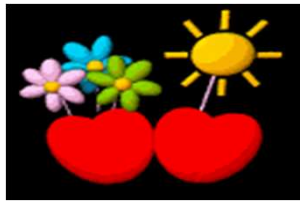
3. Link of a check list to make an impact on AMS from Antimicrobial Stewardship: A competency-based approach

6 Great Antimicrobial Stewardship Resources…

4. IDSA & SHEA have assembled detailed and incredibly well-written guidelines for implementing an Antimicrobial Stewardship Program

5. **Dr. Brad Spellberg** is an Infectious Diseases Physician who publishes the Shorter Is Better list of resources in a fantastic repository of information to help optimize antimicrobial duration backed with evidence-based data

6. **Dr. Timothy Gauthier** is a Pharmacist and Editor-In-Chief of IDStewardship, which is another great resource where experts in Antimicrobial Stewardship & Infectious Diseases share educational material in a fun and easy to read manner.



Wish You All the best