Antibiotic Usage And Antimicrobial Resistance In Tertiary Care Hospitals Of Bangladesh

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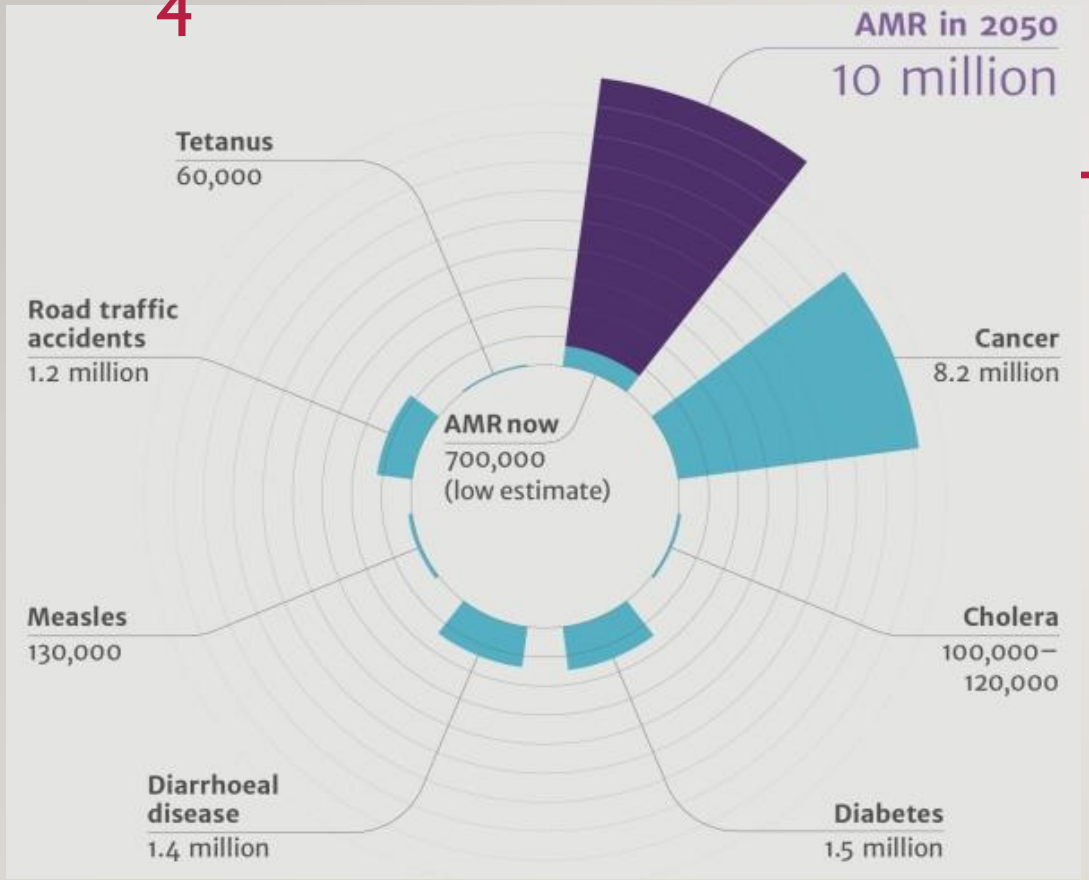
Antimicrobials are probably one of the most successful forms of treatment in the history of medicine

Introduction

- Like access to clean water and air, we have taken antibiotics for granted for too long.
- Since the discovery of penicillin in 1928, antibiotics have significantly improved global health.
- Decades of overuse and misuse of antibiotics have accelerated the emergence and spread of resistant bacteria



Deaths attributable to AMR every year compared to other major causes of death

- As things stand, AMR is projected to cause more deaths than cancer by 2050.

Image courtesy of Jim O'Neill, Chairman of the Review on Antimicrobial Resistance.

Global Action Plan On AMR

In May 2015 World Health Assembly adopted a global action plan on antimicrobial resistance (AMR)

The Global Action Plan on AMR sets out five strategic objectives as a blueprint for countries in developing national action plans (NAPs) on AMR:

- Objective 1: Improve awareness and understanding of AMR through effective communication, education and training.

- **Objective 2: Strengthen the knowledge and evidence base through surveillance and research**

Global Action Plan On AMR

- Objective 3: Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures.

Objective 4: Optimize the use of antimicrobial medicines in human and animal health.

Objective 5: Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

Ministry of Health & Family Welfare

National Action Plan

Antimicrobial Resistance Containment in Bangladesh

2017-2022

Disease Control Unit

Communicable Disease Control Program (CDC)

Directorate General of Health Services

Strategic Objectives Of National Action Plan (NAP)

1. Establish multi-sectoral approach

2. Ensure Rational Use of Antimicrobial agents (AMs)

3. Promote and strengthen infection prevention and control (IPC) measures in both human and animal health sectors.

4. Surveillance

5. Promote basic, experimental and operational research in the area of AMR

6. Establish advocacy, communication and social mobilization (ACSM)





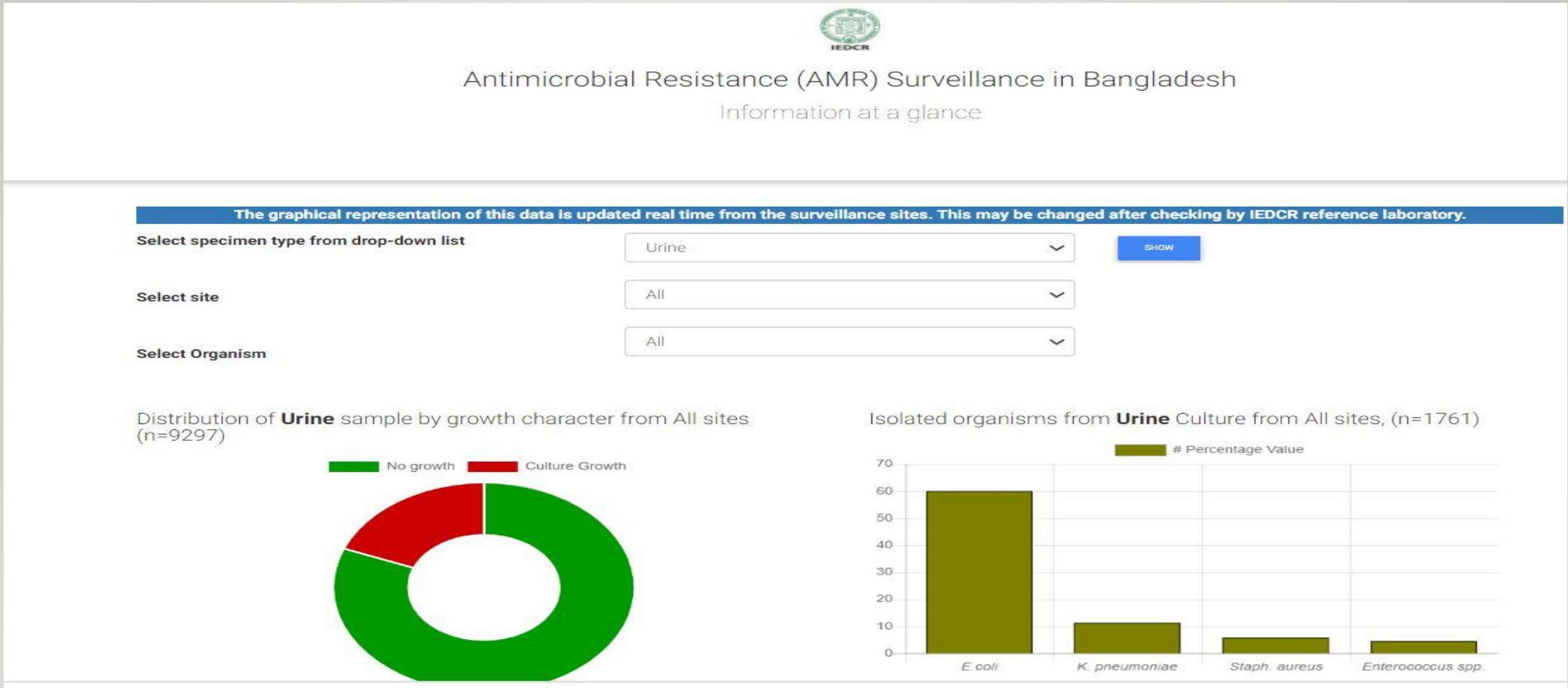
Antimicrobial Resistance Surveillance in Bangladesh (2016-2021)




10 SURVEILLANCE SITES:

1. Mymensingh Medical College
2. Uttara Adhunik Medical College
3. Rajshahi Medical College
4. Rangpur Medical College
5. Bangladesh Institute of Tropical and Infectious Disease(BITID)
6. Dhaka Medical College
7. Sylhet MAG Osmani Medical College
8. Khulna Medical College
9. Cox’s Bazar Medical College

AMR Surveillance data visualization dashboard in IEDCR website (http://119.148.17.100:8080/amr/summary_graph.php



Importance of rational use of antimicrobials

- Antimicrobial use is one of the main drivers of AMR
- In a recently published Cochrane review and meta-analysis, the authors showed that interventions to reduce excessive antibiotic prescribing to patients in hospitals can reduce antimicrobial resistance or hospital acquired infections and
- Interventions to increase effective prescribing can improve clinical outcome.

(*Ref: Davey P, Brown E, Charani E, Fenelon L, Gould IM, Holmes A, et al. Interventions to improve antibiotic prescribing practices for hospital inpatients. Cochrane Database Syst Rev. 2013;4:CD003543.)*

Study on Antibiotic Usage And Antimicrobial Resistance In Tertiary Care Hospitals Of Bangladesh

14 Use Of Antibiotics In Health-care Facilities

Three main types of antibiotic data are used to provide baseline information and evaluate Antimicrobial Stewardship (AMS) interventions.

-antibiotic consumption

-antibiotic use

- antibiotic audit data

Each type of data — has advantages and disadvantages

QUANTITY – AMC DATA

The term "consumption" refers to estimates that are derived from aggregated data sources, mainly procurement and dispensing data, and serves as a proxy for actual antibiotic use.

These data sources do not contain any patient information or treatment indications

Antibiotic Use

It refers to estimates derived from individual patient data and may include information on patient characteristics and indications for treatment.

Collection of use data is more resource demanding than consumption data,

but the additional information provided is important for e.g. AMS programmes and to identify areas for improving antibiotic use.

Antibiotic Audit Data

Auditing" refers to the **prospective (real-time) or retrospective** collection of antibiotic prescription data on hospitalized patients.

The data are analysed and then fed back to the prescribers.

This method can begin with weekly or bimonthly quick audits during ward rounds, with real-time feedback to the prescribers,

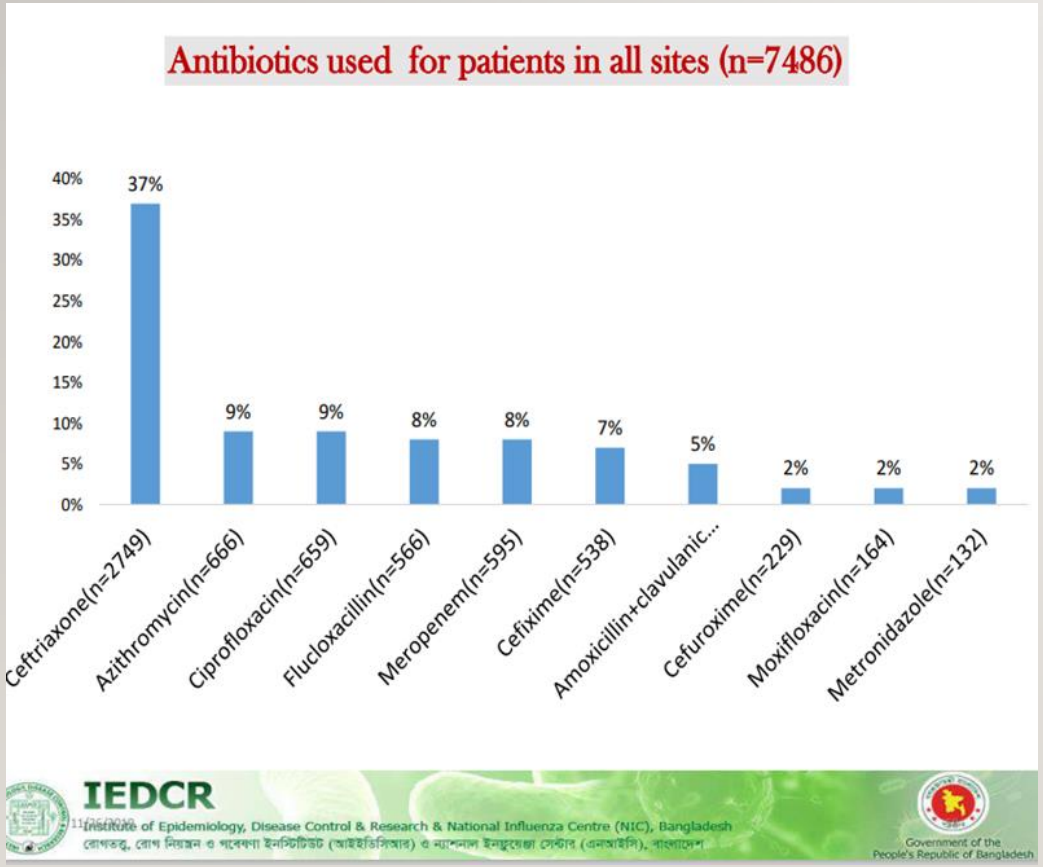

Result

Sentinel Sites

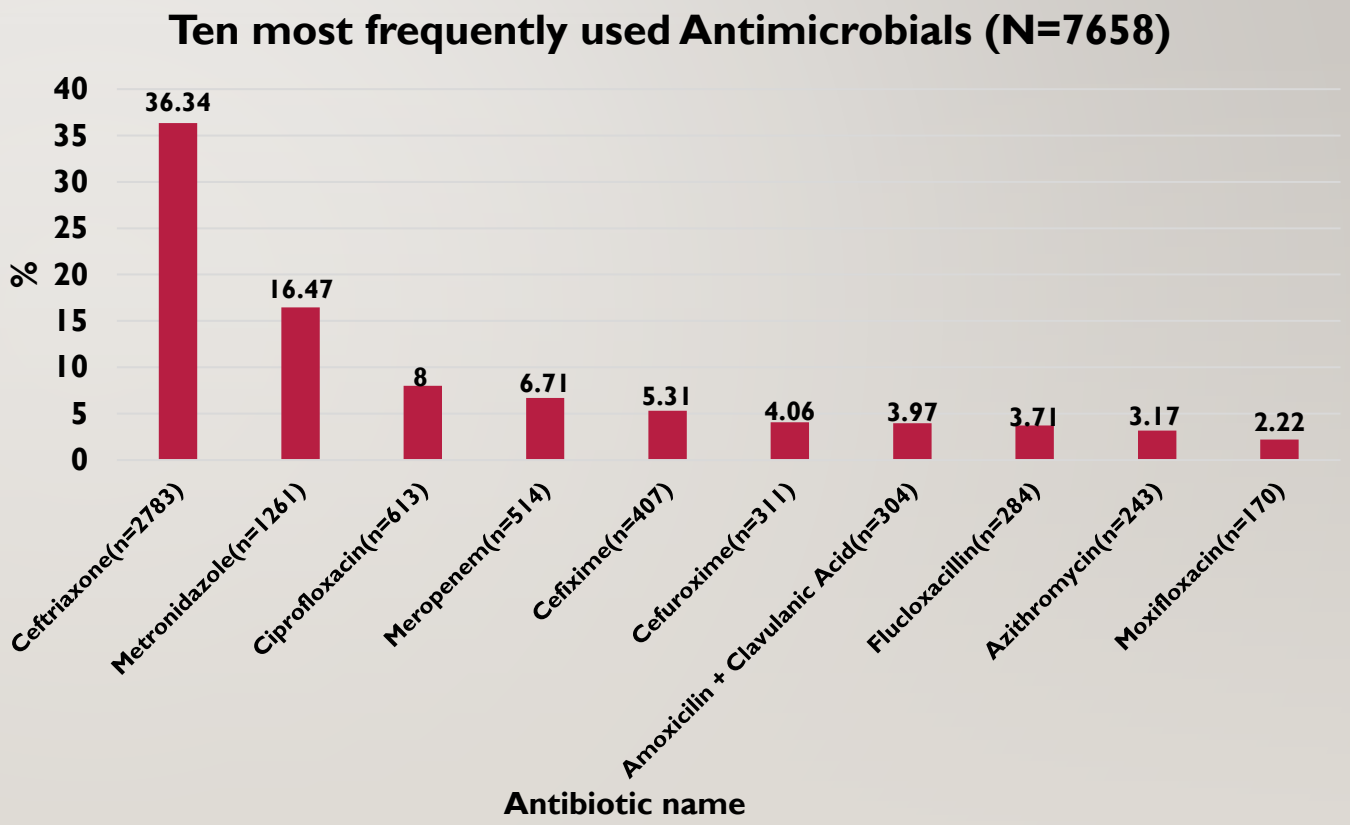
Division	Hospital
Dhaka	1. Sir Salimullah Medical College Mitford hospital (JRRMCH) 2. Uttara Adhunik Medical College Hospital (UAMCH)
Chattogram	1. Chattogram Medical College Hospital (CMCH) 2. Chattogram International Medical College (CIMCH) 3. Bangladesh Institute of Tropical and Infectious Diseases (BITID)
Rajshahi	1. Rajshahi Medical College Hospital (RMCH) 2. Islami Bank Medical College Hospital (IBMCH)
Sylhet	1. Sylhet MAG Osmani Medical College hospital (SOMCH) 2. Jalalabad Ragib Rabeya Medical College Hospital (JRRMCH) 3. Shaheed Shamsuddin Ahmed Hospital, Sylhet (SSAMCH)

Ten Most Used Antibiotics

Ten most frequently used antibiotics in sentinel sites during AMR Surveillance (2017-2019)



Findings of this AMU study (June-July,2021)



Department Wise Ten mostly Used Antibiotics

	Medicine (N=1993)		Surgery Ward (N=2057)		Gynaecology Ward(N=1962)	
Sl. no	Name of antibiotic	(%)	Name of antibiotic	(%)	Name of antibiotic	(%)
1	Ceftriaxone	37	Ceftriaxone	30	Ceftriaxone	40
2	Ciprofloxacin	21	Metronidazole	28	Metronidazole	24
3	Azithromycin	11	Cefuroxime	11	Cefixime	12
4	Metronidazole	8	Flucloxacillin	6	Ciprofloxacin	6
5	Amoxicilin + CA	4	Cefixime	6	Flucloxacillin	6
6	Meropenem	3	Amikacin	4	Cefradine	5
7	Cefuroxime	3	Amoxicilin + CA	4	Ceftazidime	2
8	Clarithromycin	3	Ciprofloxacin	4	Cefuroxime	2
9	Moxifloxacin	2	Meropenem	2	Azithromycin	1
10	Flucloxacillin	2	Cefuroxime+CA	2	Amoxicilin + CA	1

Department Wise Top Ten Used Antimicrobials

	COVID Ward (N=1168)		ICU(N=321)		COVID ICU(N=157)	
Sl. no	Name of antibiotic	(%)	Name of antibiotic	(%)	Name of antibiotic	(%)
1	Ceftriaxone	47	Meropenem	30	Meropenem	70
2	Meropenem	17	Ceftriaxone	25	Tigecycline	10
3	Amoxicilin + CA	12	Metronidazole	17	Ceftriaxone	6
4	Moxifloxacin	9	Linezolid	4	Piperacillin+Tazobactum	6
5	Ramdisivir	4	Amikacin	3	Moxifloxacin	6
6	Clarithromycin	2	Moxifloxacin	3	Clarithromycin	11
7	Ciprofloxacin	1	Cefuroxime	2	Doripenem	11
8	Cefixime	1	Flucloxacillin	2		
9	Piperacillin+Tazobactum	1	Acyclovir	1		
10	Metronidazole	1	Vancomycin	1		

Ten most frequently used antimicrobial in Public and Private hospital and the most sensitive antibiotics found in laboratory

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Sl no	Public hospital(4416)				Private hospital (3242)			
	Antibiotic used	%	Antibiotic sensitivity in culture	%	Antibiotic	%	Antibiotic in culture	%
1	Ceftriaxone	39	24%		Ceftriaxone	33	43%	
2	Metronidazole	18	Not Tested		Metronidazole	14	Not Tested	
3	Ciprofloxacin	10	46%		Cefixime	10	25%	
4	Meropenem	9	57%	180(5.97)	Cefuroxime	7	21%	79(3.44)
5	Amoxicilin + CA	5	11%		Ciprofloxacin	6	48%	
6	Flucloxacillin	3	38%		Flucloxacillin	5	85%	
7	Azithromycin	2	30%		Azithromycin	4	33%	
8	Cefuroxime	2	13%		Meropenem	4	90%	
9	Cefixime	2	6%		Moxifloxacin	4	7%	
10	Amikacin	1	74%		Amoxicilin + CA	2	52%	

Sitewise most commonly used Antimicrobial in ICU

SSMC-MH (n=74)		CMCH(n=123)		SOMCH (n=71)		JRRMCH (n=53)		RMCH (n=157)	
Antibiotic	%	Antibiotic	%	Antibiotic	%	Antibiotic	%	Antibiotic	%
Meropenem	28	Ceftriaxone	31	Meropenem	24	Meropenem	51	Meropenem	70
Metronidazole	19	Metronidazole	25	Ceftriaxone	21	Ceftriaxone	25	Tigecycline	10
Ceftriaxone	18	Meropenem	24	Moxifloxacin	11	Metronidazole	6	Ceftriaxone	6
Linezolid	8	Amikacin	4	Metronidazole	10	Ramdisivir	6	Piperacillin+Tazobactum	6
Cefuroxime	4	Flucloxacillin	4	Acyclovir	4	Amikacin	4	Moxifloxacin	6
Amikacin	3	Cefuroxime	2	Imipenem+Cilastin	4	Cefuroxime	4	Clarithromycin	1
Flucloxacillin	3	Amoxicilin +CA	2	Linezolid	4	Linezolid	4	Doripenem	1
Rifampacin	3	Amoxicillin	2	Nystatin	3	Amoxicillin+CA	2		
Vancomycin	3	CEFEPIME	2	Vancomycin	3				
Acyclovir	1	Gentamicin	2	Anti TB	1				

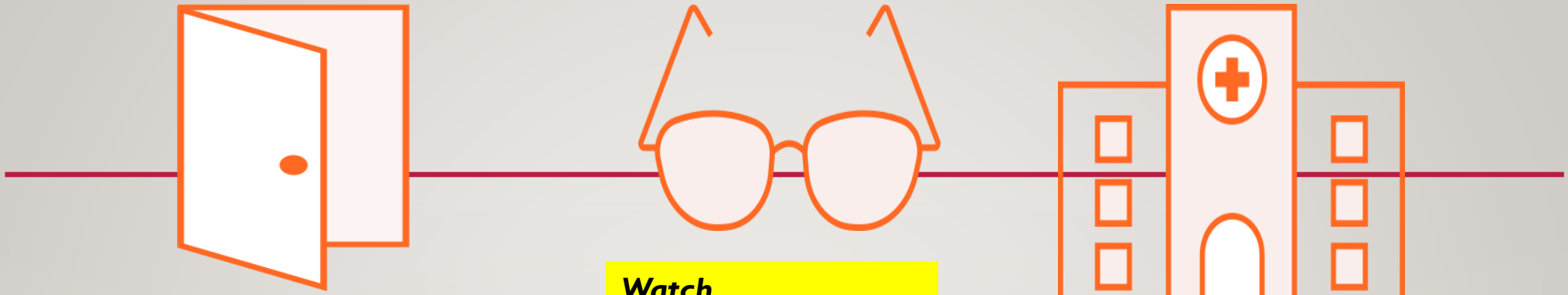
Sitewise most commonly used Antimicrobials In Covid Ward

UAMC(N=219)		CMCH (N=205)		RMCH (N=396)		Shahid Sam Suddin (N=97)		BITID (N=250)	
Antibiotic	%	Antibiotic	%	Antibiotic	%	Antibiotic	%	Antibiotic	%
Moxifloxacin	39.3	Ceftriaxone	30.7	Ceftriaxone	55.8	Ceftriaxone	52.6	Ceftriaxone	62.8
Ceftriaxone	27.9	Amoxicillin+CA	28.3	Meropenem	31.1	Ramdisivir	22.7	Amoxicilin + CA	24.8
Meropenem	23.7	Clarithromycin	11.7	Moxifloxacin	4.8	Meropenem	6.2	Ciprofloxacin	4.8
Linezolid	2.3	Ramdisivir	11.7	Amoxicilin + CA	2.8	Cefixime	4.1	Azithromycin	2.0
Piperacillin+TZ	2.3	Meropenem	8.8	Cefixime	1.3	Moxifloxacin	3.1	Cefixime	1.6
Amoxicilin +CA	1.4	Metronidazole	2.0	Piperacillin+TZ	1.3	Clarithromycin	2.1	Meropenem	1.6
Cefuroxime	0.9	Amikacin	0.5	Azithromycin	0.8	Levofloxacin	2.1	Cefuroxime Axetil	0.4
Ceftibuten	0.5	Amoxicillin	0.5	Metronidazole	0.8	Amoxicilin +CA	1.0	Clarithromycin	0.4
Clindamycin	0.5	Cefuroxime	0.5	Cefuroxime	0.3	Azithromycin	1.0	Levofloxacin	0.4
Levofloxacin	0.5			Ciprofloxacin	0.3	Flucloxacillin	1.0	Mrtronidazole	0.4

TOTAL Antimicrobial Use During Hospital Stay

Number of antimicrobials used	Medicine (n=1995)	Surgery (n=984)	Gynae (n=1160)	COVID ward (n=871)	COVID ICU (n=121)	ICU (n=178)
0	22	5	17	3	-	1
1	59	25	22	65	74	41
2	16	41	42	27	23	38
3	2	13	14	3	3	16
4	1	16	5	1	-	4


Adopt AWaRe:
Handle antibiotics
with care.



Access

Which indicates the antibiotic of choice for each of the 25 most common infections. These antibiotics should be available at all times, affordable and quality-assured.

Watch

Which includes most of the "highest-priority critically important antimicrobials" for human medicine and veterinary use.

These antibiotics are recommended only for specific, limited indications

Reserve

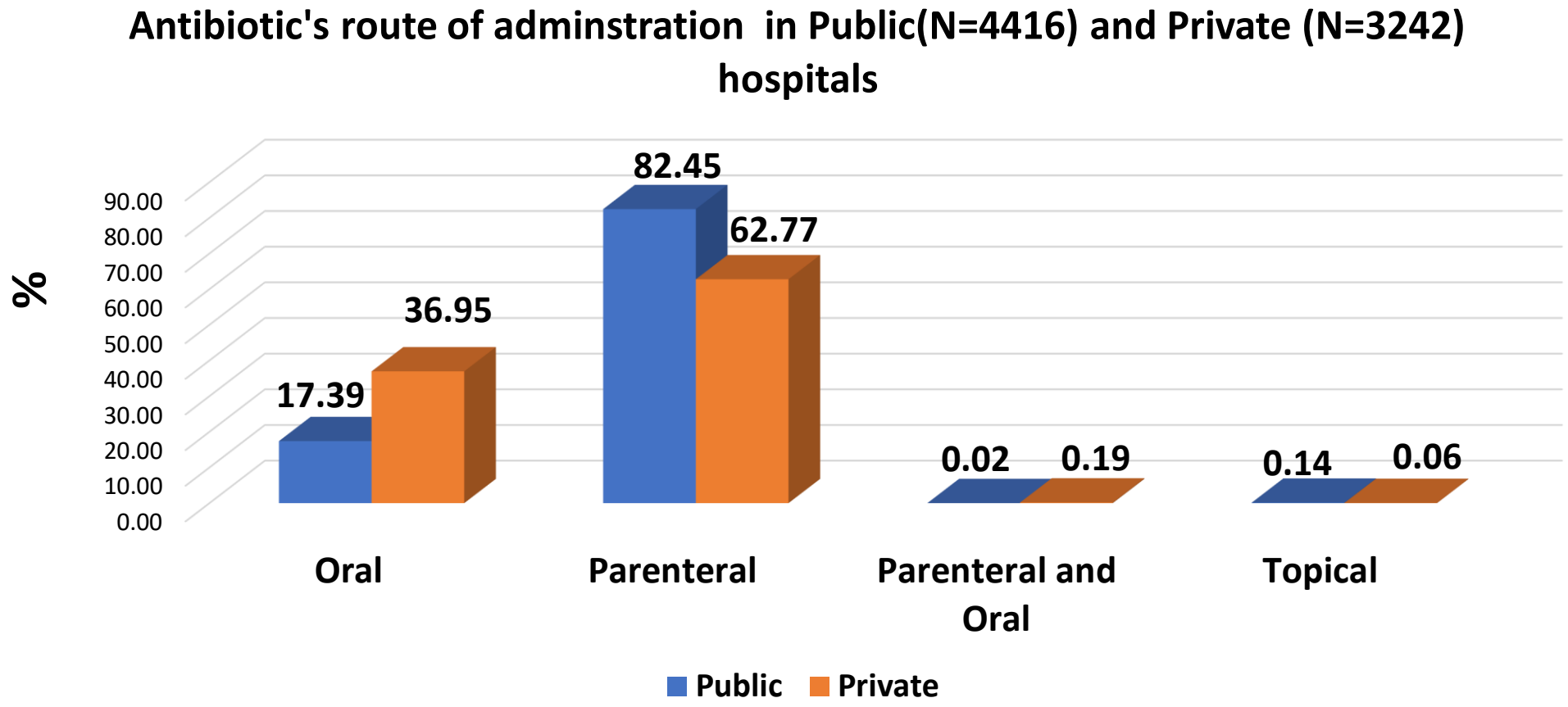
Antibiotics that should only be used as a last resort when all other antibiotics have failed.

Overall Antibiotic Use of Antimicrobial According To AWaRe Classification

Overall AWaRe classification (n=7658)	%
Access	28.0
Watch	69.4
Reserve	0.8
Not recommanded	0.4
Not included in AWaRe classification	1.4

Distribution Of Reserve Drug and not recommended antimicrobials Used In Different Hospitals

Reserve			Not Recommended (N=26)		
Antibiotic	(n=66)	%	Antibiotic	(n=26)	%
Linezolid	45	68.1	Cefuroxime +Clavulanic Acid	26	100
Tedizolid Phosphete	1	1.5			
Tigecycline	20	30.3			


Antibiotic's route of adminstration in Public(N=4416) and Private (N=3242) hospitals
%
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
17.39
36.95
82.45
62.77
0.02
0.19
0.14
0.06
Oral
Parenteral
Parenteral and Oral
Topical
Public
Private

Department wise Distribution Of Route Of Administration Of Drug In Public And Private Hospital

Route of administration	Medicine		Surgical		Gynae& Obs		COVID		ICU	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
	%	%	%	%	%	%	%	%	%	%
Oral	28.42	35.89	15.6	35.77	13.01	45.55	15.93	5.90	2.82	-
Parenteral	**71.58**	**63.87**	**84.23**	**63.67**	**86.99**	**54.45**	**84.07**	**93.63**	**96**	**100**
Parenteral & Oral	-	-	0.09	0.56	-	-	-	0.45	-	-
Topical	-	0.24	0.09	-					1.18	-

Number and duration of Antibiotic used before Surgical intervention In Public & Private Hospital

		Public Hospital	Private Hospital
Number of antimicrobial used simultaneously	1	36%	41%
	2	55%	53%
	3	8%	6%
	4	1%	-
Antibiotic started before intervention	Same day	72%	77%
	1 day before	23%	12%
	2 days before	6%	11%

34 Antibiotic used mostly before Surgical intervention In Public & Private Hospital

Public hospital (n= 212)367			Private hospital (n=212)349		
Name of antibiotic	n	%	Name of antibiotic	n	%
Ceftriaxone	168	45.8	Ceftriaxone	108	30.9
Metronidazole	109	29.7	Metronidazole	98	28.1
Flucloxacillin	35	9.5	Cefuroxime	52	14.9
Amoxicillin+CA	18	4.9	Flucloxacillin	23	6.6
Cefuroxime	16	4.4	Ciprofloxacin	20	5.7

Number and duration of Antibiotic used before LUCS In Public & Private Hospital

		Public Hospital	Private Hospital
Number of antimicrobial used simultaneously	1	13%	86.6%
	2	87%	12.7%
	3	0	0.7%
Antibiotic started before intervention	Same day	92%	96%
	1 day before	8%	4%
	2 days before	0%	

Antibiotic used before LUCS in Public & Private Hospital 36

Public hospital (n=263)			Private Hospital (n=284)		
	N	%		N	%
Ceftriaxone	244	49.7	Ceftriaxone	264	81.5
Metronidazole	228	46.4	Metronidazole	34	10.5
Ceftazidime	14	2.6	Cefazolin-	7	2.2
Cefradin	4	0.8	Cefixime	5	1.5
Azithromycin	1	0.2	Fucloxacillin	4	1.2
			Cefuroxime	3	0.9

SUMMARY

- Ceftriaxaone- A Third generation cephalosporin is the most commonly used drug in every department of every hospital both public and private including COVID ward but excluding the Intensive care units (ICUs).
- Ceftriaxone is also the most preferred drug before intervention in surgery units and before lower uterine segment Caesarean section (LUCS)
- The combination of Ceftriaxone and Metronidazole is most preferred before both surgical intervention in surgical units as well as in LUCS in Gynae & Obstetrics department.
- Meropenem is the most preferred drug in ICU both public and private medical college and in case of COVID ICU except CMCH

SUMMARY

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- Both public and private hospital among the ten most used antibiotics nine are same
- Both in public and private hospital top 2 used antibiotics are the same- Ceftriaxone and Metronidazole
- Reserve drugs have only used in ICUs
- Linezolide and other oxazolidine group antibiotics and Tigecycline are the reserved drugs used in ICU
- Before LUCS more single antibiotic and less double antibiotic used than public hospital

SUMMARY

- The only non-recommended drug from AWaRe classification used is the combination drug of Cefuroxime and Clavulanic acid
- Reserved drugs are only used in ICU
- Over all more parenteral drugs are used in hospital than oral or topical drug and in this regard public hospital is ahead of private hospital
- Most of the pre surgical intervention in surgery department and LUCS in Gynae and Obstetrics department antibiotics are used at the same day of surgery in both public and private hospital and two drugs combination is mostly chosen in combination are ceftriaxone and metronidazole

RECOMMENDATION

- More culture and sensitivity testing should be advised before prescribing antibiotic andAntibiotic should be prescribed according to culture sensitivity testing
- Laboratories should provide antibiogram regularly so that clinicians can choice appropriate antibiotic
- Ceftriaxone should be used judiciously, and clinicians may replace it with other antibiotic according to the local antibiogram
- Study can be carried out to see the effectiveness o single prophylactic antibiotics before LUCS


Thank You !