DISTRICT ANTIBIOGRAM

Alappuzha, Kottayam, Pathanamthitta, Thrissur and Thiruvananthapuram

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Foreword by Hon’ble Minister

Health & Family Welfare

Right from the release of KARSAP (Kerala Antimicrobial Resistance Strategic Action Plan) in 2018, Kerala has been at the forefront of the fight against antimicrobial resistance [AMR] by becoming the first state in India to draft and implement an AMR strategic action plan . In order to understand the magnitude of AMR in the State, Kerala Antimicrobial Resistance Surveillance Network (KARS-NET) was established in 2019. *In 2022 , Kerala became the first State in India to release its own antibiogram.* With the aim of capturing the susceptibility trends among priority pathogens at all tiers of health care system, for the first time in India,a hub and spoke model of AMR surveillance was initiated in all districts in Kerala . First District antibiogram in India was compiled and released by Ernakulam. Such stratified antibiograms at district level help in planning customized interventions at various levels of healthcare.

AMR surveillance is not merely a data exercise; it is the bedrock of evidence based policymaking. By systematically tracking resistance profiles of priority pathogens, this report highlights emerging trends, enabling us to anticipate and mitigate threats. District level stratified antibiograms reflecting granular level data is transformative for policy decision making.

This antibiogram report from five districts is a vital reflection of AMR surveillance trends at the grassroots level from our primary and secondary care institutions. As we stand at the forefront of India's AMR combat, this document underscores Kerala's unwavering commitment to evidence based stewardship.

This annual report reflects the dedication and hardwork of the district clinical microbiologists, AMR surveillance nodal officers, district medical officers and medical superintendents of the hub and spoke hospitals .I wholeheartedly congratulate the entire KARSAP team for their exemplary work and wish them all the success in their unending fight against AMR.

Smt. Veena George
Hon’ble Minister
Health & Family Welfare
Government of Kerala

Foreword by Additional Chief Secretary
Health & Family Welfare

The world over, we have been highlighting that there is a ‘silent pandemic’ of antimicrobial resistance being experienced. The next question should come to our minds: ‘What are we doing regarding the AMR?' What is the response of the health system by designing and implementing specific interventions? It is a matter of pride that the state of Kerala has taken this seriously, laid out a strategic action plan, and most importantly, put it in action by taking various foundational steps, such as establishing structures at the state, district, and block levels; formulating policy interventions; building partnerships with all the stakeholders; and involving health functionaries in the government and private sectors as well as people. These initiatives have been ably guided by a grassroots-level governance structure—local self-governments. There are various innovative approaches taken, such as making Kerala antibiotic literate and accrediting hospitals as antibiotic smart hospitals and local self-governments as antibiotic smart Panchayaths. Another initiative is establishing KARSNET.

The District Antibiogram Report is a vital tool in our ongoing battle against antimicrobial resistance (AMR), which is one of the most pressing public health threats of our time. This report encapsulates the tireless efforts of our hub-and-spoke model of AMR surveillance, which is a unique initiative in India. This district-level surveillance network, which is a part of the broader Kerala Antimicrobial Resistance Surveillance Network [KARSNET], helps in generating actionable data on antimicrobial susceptibility patterns to priority pathogens from secondary and primary care institutions across the state.

KARSNET data reflects susceptibility trends in tertiary care institutions only. Hence, with the aim of capturing the susceptibility trends among priority pathogens at all tiers of the health care system, for the first time in India, a hub-and-spoke model of AMR surveillance was initiated in all districts in Kerala, which captures data from 180 spokes across the state. The first District antibiogram in India was compiled and released by Ernakulam last year. Such stratified antibiograms at the district level help in planning customized interventions at various levels of healthcare. In this report antibiograms of five districts have been included. In an era where resistant infections claim countless lives and strain healthcare systems, robust AMR surveillance remains the cornerstone of effective stewardship, and granular-level data like what is depicted in this report is essential to formulate customized stewardship initiatives to tackle the scourge of AMR.

This annual report reflects the dedication and hard work of the district clinical microbiologists, AMR surveillance nodal officers, district medical officers, and medical superintendents of hub and spoke hospitals. It is an excellent example to demonstrate the efficiency of the Kerala health system.

I wholeheartedly congratulate Dr. Saritha, Dr. Aravind, and the entire KARSAP team for their exemplary work and wish them all the success in their unending fight against AMR. Let this report galvanize action: district-level stewardship committees must adopt these antibiograms for local protocols, while prescribers integrate them into daily practice. Together, we can reverse resistance trajectories, safeguard patient outcomes, and build a resilient health system. Let us commit to vigilance and collaboration. The fight against AMR is a shared mandate for today’s patients and tomorrow’s legacy.

Dr. Rajan N Khobragade, IAS
Additional Chief Secretary
Health & Family Welfare, Government of Kerala

Message by Director

Health Services

Antimicrobial Resistance (AMR) is a serious global public health threat which can be tackled only by a "One Health" approach. If mitigation measures are not adopted, AMR will impose a projected $100 trillion global economic burden by 2050 .Kerala was the first state in India to draft and implement an AMR strategic action plan , KARSAP (Kerala Antimicrobial Resistance Strategic Action Plan) which was launched on 25 October 2018. Lord Kelvin had stated that " If you cannot measure it, you cannot improve it". Hence inorder to understand the magnitude of AMR in the State, Kerala Antimicrobial Resistance Surveillance Network(KARS-NET) was established in 2019.In 2022 , Kerala became the first State in India to release its own antibiogram. KARSNET antibiograms released every year is reflective of susceptibility trends in tertiary care institutions only, and it showed that the resistance trends among priority pathogens varied from centre to centre. Hence with the aim of capturing the susceptibility trends among priority pathogens at all tiers of health care system, for the first time in India a hub and spoke model of AMR surveillance was initiated in all districts in Kerala . As a result, the first District antibiogram in India was compiled and released by Ernakulam in 2024.

District level stratified antibiograms which reflect cumulative antimicrobial susceptibility testing (AST) reports for WHO priority pathogens ,provide facility tiered granular resistance indices at secondary and primary care level which help in planning customized interventions at various tiers of healthcare. AMR surveillance data obtained through the vast hub and spoke network across Kerala clearly demonstrate that in the fight against AMR, local data is our strongest weapon.

This annual District antibiogram from five districts, reflect the dedication and hardwork of the district nodal officers and district clinical microbiologists .I wholeheartedly congratulate the nodal officers and the entire KARSAP team for their exemplary work and wish them all the success in their unending fight against AMR.

Dr. Reena K.J.

Director of Health Services Government of Kerala

Preface by Nodal Officer KARSAP

Antimicrobial Resistance (AMR) is one of the most pressing public health threats of our time. In alignment with the National Action Plan on AMR and the surveillance framework coordinated by the National Centre for Disease Control (NCDC), Kerala has consistently strengthened its laboratory-based AMR surveillance systems. We have already generated district level antibiogram of Ernakulam district . In this report, we have validated antimicrobial susceptibility data from five districts , systematically compiled and analysed using WHONET software. The participating laboratories function within a structured hub-and-spoke model, wherein district-level culture facilities serve as hubs, supporting peripheral healthcare institutions for culture and antimicrobial susceptibility testing. This model ensures timely sample processing, quality assurance, and comprehensive data capture across different tiers of healthcare delivery.

The data generated have been compiled following standard reporting formats compatible with national AMR surveillance requirements and are aligned with global reporting principles under the World Health Organization Global Antimicrobial Resistance Surveillance System (GLASS). This integration ensures that district-level data contribute meaningfully to state, national, and global AMR surveillance efforts.

The district antibiogram serves multiple critical purposes like guiding empirical antimicrobial therapy based on local resistance patterns, strengthening Antimicrobial Stewardship Programmes (AMSP), supporting Infection Prevention and Control (IPC) strategies and enhancing evidence-based policy decisions at district and state levels. I whole heartedly thank Dr Aravind.R, Chairman Working Committee KARSAP for his support and guidance, Dr Sivaprasad, State Nodal Officer Hub and Spoke model and Dr Arya RV, Nodal officer for laboratory surveillance for their efforsts in compiling and editing the data.This achievement has been possible only through the collective efforts of the entire District AMR team including the DMO, Microbiologist, Nodal Officers, Superintendents etc. Their dedication to quality-assured microbiology and timely data submission is deeply appreciated.

This report is not merely a statistical document; it is a strategic tool for rational antimicrobial use and a foundational step toward containing antimicrobial resistance in Kerala. We remain committed to expanding district-level surveillance to all districts and further strengthening the state's contribution to national AMR containment efforts.Let this initiative serve as a model for collaborative, data-driven action against antimicrobial resistance.

Dr. Saritha N
Nodal Officer KARSAP
Professor and Head,
Microbiology Department
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Thiruvanthapuram, Kerala

Executive Summary:

District Antibiogram Overview

In 2024, the Government of Kerala **(GOK)** achieved a national milestone with the release of the first District Antibiogram in Ernakulam.Launched by the Honorable Health Minister, this initiative transforms Antimicrobial Resistance **(AMR)** monitoring from a centralized, tertiary-hospital activity into a comprehensive 360-degree surveillance framework. By integrating data from all tiers of the healthcare system, the state is mapping the "slow pandemic" of AMR at a granular level to ensure precision in public health response. Now **5** districts generated report based on surveillance conducted on antimicrobial resistance priority pathogens through Hub & Spoke model AMR program in Alappuzha, Kottayam, Pathanamthitta,Thiruvananthapuram and Thrissur.

The Hub & Spoke Model: Decentralized Stewardship

The cornerstone of this initiative is a unique Hub & Spoke architecture designed to bridge the diagnostic and clinical gap between major centers and remote areas.

The Hub (District & General Hospitals, Public health labs): These secondary and tertiary-level facilities serve as the analytical and validation centers. They host the specialized microbiology labs that analyze cultures, identify resistance patterns, and compile the cumulative District Antibiogram.

The Spokes (FHCs, PHCs, & Taluk Hospitals): Peripheral health institutions act as critical data-capturing nodes. By routing information and samples to the Hub, this model extends diagnostic stewardship to the primary care level, ensuring that surveillance reflects the reality of rural and remote healthcare settings.

360-Degree Data Capturing &Surveillance:

The "360-degree" approach ensures that no level of the healthcare system is excluded from the resistance "weather map."

Community-to-Hospital Visibility: Data is captured from Family Health Centres (FHCs) through to General and District Hospitals. This provides a true representation of both community-acquired and hospital-acquired infections, moving beyond the skewed data often seen in ICU-only reports.

Evidence-Based Empirical Therapy: The District Antibiogram serves as a localized "report card" for clinicians. It empowers doctors-particularly in primary care-to initiate Empirical Therapy based on real-world local evidence, ensuring the most effective antibiotic is chosen from the first point of contact.

Mapping AMR Hot Spots: The system allows health departments to identify specific geographic "hot spots" within a district where resistance to particular drugs is surging. This enables hyper-local interventions, such as targeted prescription audits or community awareness campaigns.

Scientific Containment: By providing a 360-degree view, the state can monitor the effectiveness of "Access" category antibiotics and strictly regulate "Reserve" drugs, creating a data-driven barrier against the spread of resistant strains.

Alappuzha- District Antibiogram

Compiled by

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District Clinical Microbiologist
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MESSAGE

As antimicrobial medicines are corner stone of modern medicine, development of resistance against the same jeopardizes our capacity to provide treatment to both common ailments as well as life saving procedures. AMR exacts heavy financial burdens on healthcare system and entire national economics.

Antibiograms and antibiotic policies serve as foundational tools in antimicrobial stewardship, enabling evidence based prescribing to optimize therapy and curb resistance. Antibiograms combined with antibiotic policies encourages dynamic antibiotic stewardship program. This synergy shortens therapy duration and preserves antibiotic efficacy amid global resistance threats.

A hub and spoke transport model for collecting culture and sensitivity samples from peripheral spokes ensures comprehensive representation of antimicrobial susceptibility patterns across the entire district. This approach facilitates centralized laboratory processing while capturing diverse local resistance trends, enhancing the accuracy and utility of district – wide antibiograms.

Now Alappuzha District is ready with District Antibiogram 2024 including data from 25 spokes and 1 hub hospital. I extend my sincere and immense appreciation to all the staff members at every level who labored diligently behind the scene to make this antibiogram possible.

Dr.Jamuna Varghese
District Medical Officer (Health)
Alappuzha

GENERAL HOSPITAL, ALAPPUZHA

General Hospital Junction, Alappuzha — 688011

Office- 0477-2253324, **ghalappuzha@gmail.com**

Dr R Sandhya

Deputy director

Medical superintendent General Hospital Alappuzha

Message

Anti-microbial resistance is one of the most pressing global challenge because of the irrational use of antibiotics, over the counter prescriptions and use of antibiotics in animal and agriculture sector. This is where the importance of antibiogram comes in to the picture. This antibiogram can be used as a reference at district level and can be customised at institutional level. It helps in the judicial use of antibiotics gives deeper understanding of AMR and promote responsible antimicrobial stewardship.

I really appreciate the effort taken by the team in preparing the antibiogram. Hope this antibiogram will be extremely helpful to all the institutions.

GENERAL HOSPITAL ALAPPUZHA-688 011

Yours faithfully,

Sandhya R

Superintendent

SUPERINTENDENT
GENERAL HOSPITAL
ALAPPUZHA

Alappuzha- District Antibiogram

(Jan 2024- Dec 2024)

District AMR Lab of Alappuzha is functioning in District Public Health Lab Alappuzha. Lab started collecting samples from May 2023. From then own WHONET software is used to collate, analyse and share AMR data monthly to state government and NCDC. KARS-Net currently includes surveillance of AMR in 9 key priority pathogens responsible for high antibiotic resistance rates among bacteria that commonly cause human infections. The nine priority pathogens monitored for district antibiogram are:

1. *Staphylococcus aureus*

2. *Enterococcus* species

3. *Klebsiella* species

4. *Escherichia coli*

5. *Acinetobacter* species

6. *Pseudomonas aeroginosa*

7. *Salmonella enterica* serovar Typhi and Paratyphi

8. *Shigella* species

9. *Vibrio cholerae*

Till now there is no isolation of *Salmonella enterica* serovar Typhi and Paratyphi ,*Shigella* species and
Vibrio cholerae as blood and stool samples processing started in the last quarter of 2024.

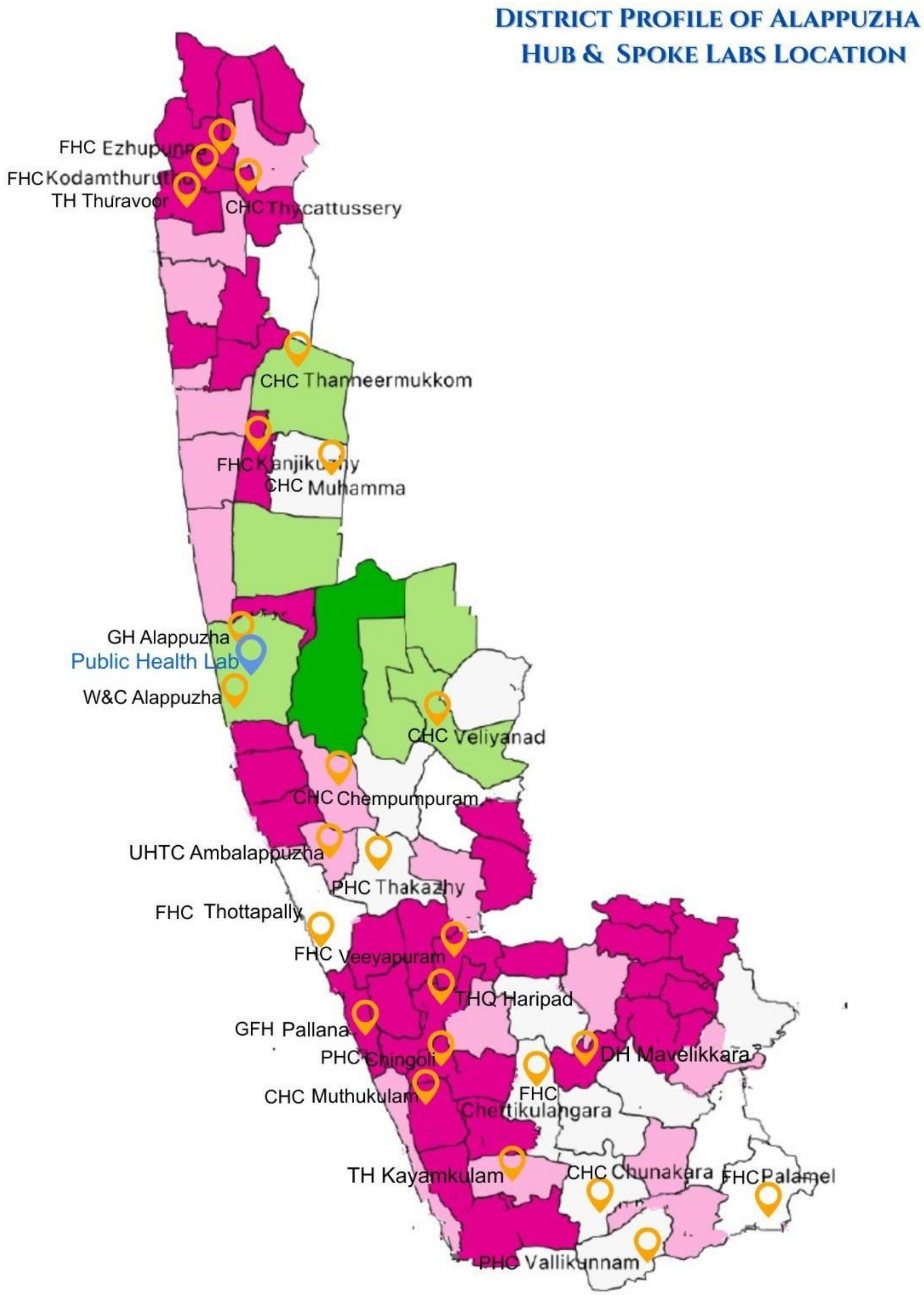

Fig 1 : Alappuzha district profile with hub lab and spoke labs marked

District Antibiogram of Alappuzha includes representation from 24 spoke institutions.

Hospital names:

1. CHC CHEMPUMPURAM
2. CHC CHUNAKKARA
3. CHC MUHAMMA
4. CHC MUTHUKULAM
5. CHC THANNEERMUKKAM
6. CHC THYCATTUSSERY
7. CHC VELIYANAD
8. DH MAVELIKKARA
9. FHC CHETTIKULANGARA
10. FHC EZHUPUNNA
11. FHC KANJIKUZY
12. FHC KODAMTHURUTH
13. FHC PALAMEL
14. FHC THOTTAPALLY
15. FHC VALLIKUNNAM
16. FHC VEEYAPURAM
17. GFH PALLANA
18. PHC CHINGOLI
19. PHC THAKAZHY
20. PHC VALLIKUNNAM
21. TH KAYAMKULAM
22. TH THURAVOOR
23. THQH HARIPAD
24. UHTC AMBALAPPUZHA

General hospital Alappuzha is considered as hub hospital.

AMR surveillance data was received for the period of one year from 1 January to 31 December 2024 from 24 spoke centres in Alappuzha.

The clinical specimens currently included under KARS-Net are:

• Blood

• Urine

• Pus aspirate (PA)

• Other sterile body fluids (OSBF)

• Stool (only for Salmonella Typhi and Paratyphi, Shigella spp and Vibrio cholerae)

Since processing of blood and stool samples started in the last quarter of 2024, pathogens were not isolated in 2024.

Table 1: Pathogens and specimens included under surveillance

	Staphylococcus aureus	Enterococcus spp.	Klebsiella spp.	*E. coli*	Acinetobacter spp.	Pseudomonas sp	*Salmonella Typhi/ Paratyphi*	*Shigella*	*Vibrio cholera*
Blood	✓	✓	✓	✓	✓	✓	✓	✗	✗
Urine	✗	✓	✓	✓	✓	✓	✗	✗	✗
Pus aspirate	✓	✓	✓	✓	✓	✓	✗	✗	✗
OSBF	✓	✓	✓	✓	✓	✓	✗	✗	✗
Stool	✗	✗	✗	✗	✗	✗	✓	✓	✓

✗ - specimen not relevant

Internal quality control is an essential component of quality assurance in antimicrobial susceptibility testing. Our lab follow a standardised approach for AMR data collection, analysis, and reporting using WHONET software. Trainings are received on regular intervals from GMC Trivandrum to strengthen bacteriology laboratory capacity by improving the quality of culture and AST practices. In addition, trainings and workshops on WHONET software to streamline AMR surveillance data are also regularly attended .

Data analysis

The analysis of cumulative data for the year 2024 has been performed by the Microbiology wing, District Public health Lab Alappuzha, based on which this annual report was prepared. The AST data is obtained by conventional disk diffusion method.

The WHONET software is used for the collection, collation and analysis of the antimicrobial susceptibility (AST) data generated by the manual testing methods.

The classification of the isolates as susceptible, intermediate or resistant is based on the Clinical & Laboratory Standards Institute (CLSI) guidelines 2024

a) Data collection

As a first step for data analysis, a single file was created by collating all the cumulative AMR data files. During this step, duplicate isolates (from the same patients) have been excluded from the database files. For analysis, only one result was considered for each patient per specimen type and per pathogen. The total number of isolates were 1118 and the number of patients were 946.

b) Demography and distribution of priority pathogens

Among the total of 946 unique patients, 33% pathogens were from males as compared to females (67%). Age data was available for 99.4% of unique patient isolates. The highest proportion of unique patients contributing to the AST data belong to mature working age group that is 55-64 years whereas the lowest number of pathogens were reported from age group of 85+ years as shown in Fig 2.

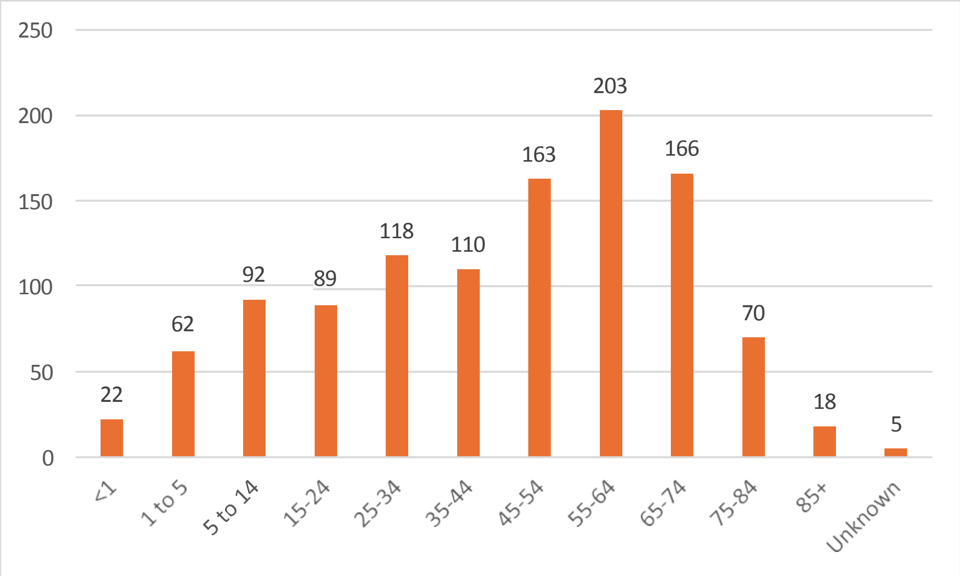

Figure 2: Distribution of isolates based on age

Of the total unique isolates the following was the specimen distribution:

- Urine – 762 (75.5%)
- Pus aspirate (PA) –247 (24.4%)

Of the samples received from different facilities(spokes) the maximum distribution was from GH Alappuzha, followed by W&C Alappuzha and then DH Mavelikkara as shown in Fig 3

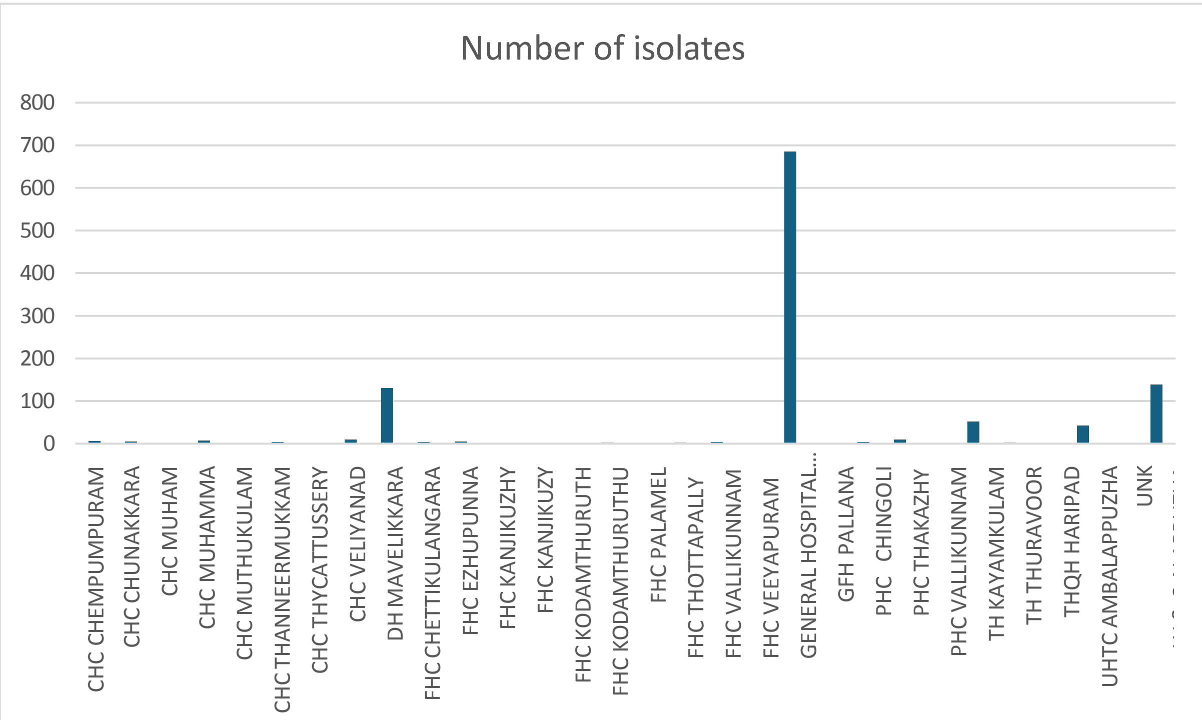

Figure 3: Distribution of isolates from different spokes.

Out of the 1118 isolates, 87% were from out-patients (OPD) 9% from in-patients (IPD), and 4% from patients in Intensive care units (ICU); (Figure 4).

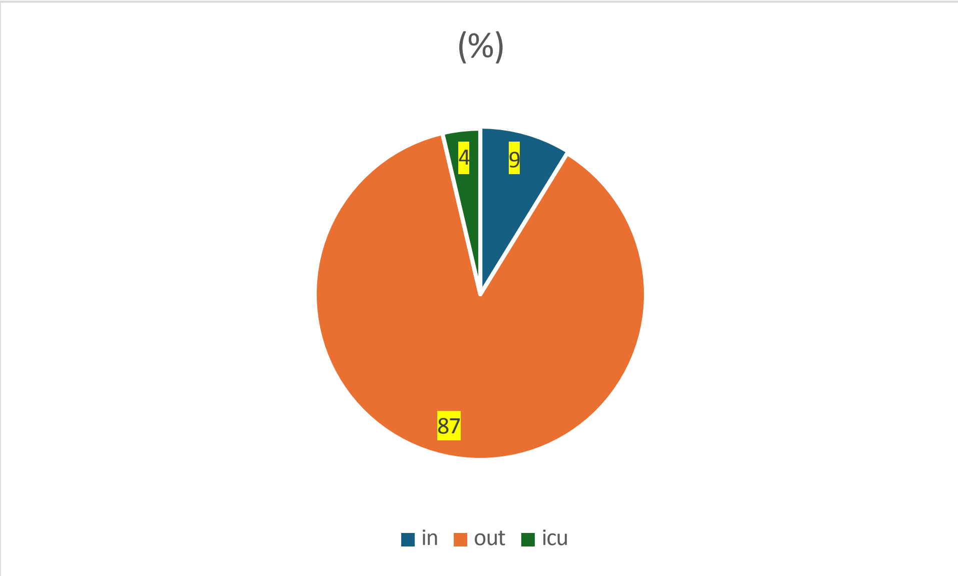

Figure 4: Location-wise distribution of isolates

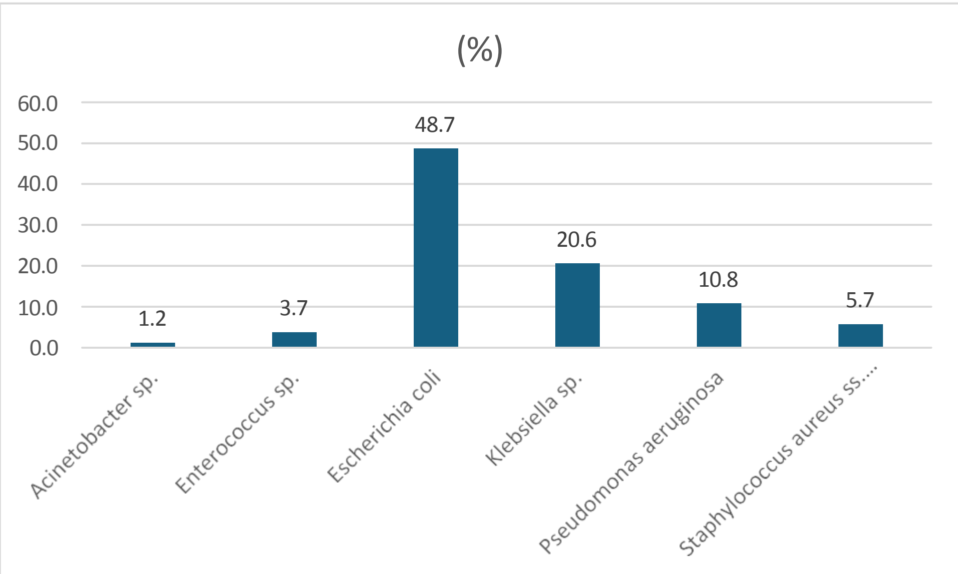

Figure 5: Distribution of AMR surveillance priority pathogens

In 2024 AMR surveillance data, the most commonly isolated priority pathogen was *E. coli* (48.7%), followed by Klebsiella species (20.6%), Pseudomonas species (10.8%) *Staphylococcus aureus* (5.7%), , Enterococcus species (3.7%) and Acinetobacter species (1.2%) (Figure 5).

Among all specimen types, highest number of *E. coli* (66.7%) were isolated from urine samples.and from pus aspirate the highest percentage of priority pathogen isolated was *Pseudomonas aeroginosa* (35.6%). Lowest percentage of pathogen isolated from pus aspirate was Acinetobacter spp. (4.5%) whereas from urine also was Acinetobacter spp (4.5) (Table 1, Figure 5).

1) *Staphylococcus aureus*

Table 1: Specimen-wise isolation of priority pathogens

Priority pathogens	**Urine(%)**	**Pus aspirate (%)**
Escherichia coli	508(66.7)	35(14.2)
Klebsiella spp.	182(23.9)	47(19)
Pseudomonas aeroginosa	31(4.1)	88(35.6)
Acinetobacter spp.	2(0.3)	11(4.5)
Enterococcus sp	24(3.1)	17(6.9)
Staphylococcus aureus	15(2)	49(19.8)

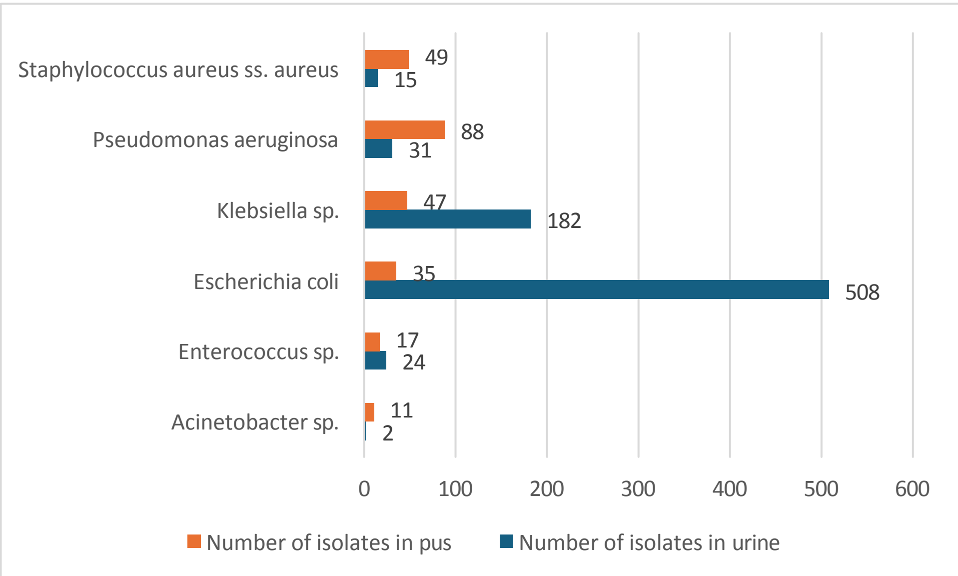

Figure 6: Specimen wise distribution of AMR surveillance priority pathogens

5. AMR profile of priority pathogens

The data collected under KARS-Net is for selected antibiotics only as per NCDC's AMR surveillance data management SOP. This AMR surveillance data is from patients visiting the OPD,IPD and ICU of the hospitals/laboratories.

a. Gram positive cocci

AMR surveillance under KARS-Net covers two important globally prevalent gram-positive bacterial pathogens i.e., *Staphylococcus aureus* and *Enterococcus* species.

1) *Staphylococcus aureus*

Ciprofloxacin was showing maximum resistance (60.5%) followed by Cefoxitin. So, MRSA prevalence was 39.6% in pus isolates.

Table 2: Resistance profile of *Staphylococcus aureus* in whole district

Antibiotic name	Pus (n=49)			Urine (*n=15)		
	Number tested	Number resistant	% Resistance	Number tested	Number resistant	% Resistance
Cefoxitin	48	19	39.6	14	5	
Gentamicin	43	2	4.7	13	1	
Ciprofloxacin	38	23	60.5	11	2	
Trimethoprim/Sulfamethoxazole	46	3	6.5	15	2	
Clindamycin	46	8	17.4	1	0	
Erythromycin	47	9	19.1	10	2	
-Doxycycline	48	1	2.1	13	0	

* Percentage not computed due to numbers being < 30

Table 3: Resistance profile of *Staphylococcus aureus* in spoke samples

Antibiotic name	Pus (* n=6)	
	Number tested	Number resistant
Cefoxitin	6	2
Gentamicin	6	2
Ciprofloxacin	6	0
Trimethoprim/Sulfamethoxazole	6	0
Clindamycin	6	1
Erythromycin	6	1
-Doxycycline	6	0

* Percentage not computed due to numbers being < 30

2) *Enterococcus* species

Only 17 pus isolates and 24 urine isolates yielded *Enterococcus* Spp and resistance profile is shown in Table 3.

Table 4: Resistance profile of *Enterococcus* species in whole district

Antibiotic name	Pus (* n=17)			Urine (*n=24)		
	Number tested	Number resistant	% Resistance	Number tested	Number resistant	% Resistance
Ampicillin	17	7		24	9	
Gentamicin	11	5		10	2	
Ciprofloxacin	7	3		23	13	
Erythromycin	17	11				
Nitrofurantoin				24	5	
Linezolid	17	0		20	0	
Vancomycin	11	0		21	0	
Doxycycline	16	7				

* Percentage not computed due to numbers being < 30

Table 5: Resistance profile of *Enterococcus* species in spoke samples

Antibiotic name	Urine (*n=8)	
	Number tested	Number resistant
Ampicillin	8	2
Gentamicin	8	2
Ciprofloxacin	8	1
Nitrofurantoin	8	0
Linezolid	8	0
Vancomycin	8	0

* Percentage not computed due to numbers being < 30

b. Gram negative bacilli

Under KARS-Net, seven commonly isolated gram-negative bacilli of public health importance are included for AMR surveillance. These are *E. coli, Klebsiella* species, *Pseudomonas aeroginosa*, *Acinetobacte*r species, Salmonella enterica serovar Typhi and Paratyphi, *Shigella* species and *Vibrio cholerae*.

AST data of 908 isolates of Gram-negative bacilli have been reported from during the reporting period. No Salmonella enterica serovar Typhi and Paratyphi, *Shigella species and Vibrio cholera*e cases were reported during this period.

1) Enterobacteriaceae

Escherichia coli

High level of resistance was observed in *Escherichia coli* compared to *Klebsiella* spp. Total of 543 *Escherichia coli* were isolated from urine and pus specimens. Ampicillin was showing maximum resistance (88.2% in urine) followed by cephalosporins (61.8%). Meropenem resistance was not reported as described in Table 6

Table 6: Resistance profile of *Escherichia coli* in whole district

Antibiotic name	Pus (n=35)			Urine (n=508)		
	Number tested	Number resistant	% Resistance	Number tested	Number resistant	% Resistance
Ampicillin	34	30	88.2	499	406	81.4
Piperacillin/Tazobactam	26	12	46.2	483	91	18.8
Cefuroxime(Parenteral)	31	19	61.3	212	116	54.7
Cefuroxime (Oral)	31	19	61.3	212	116	54.7
Cefotaxime	34	21	61.8	504	286	56.7
Cefixime	34	21	61.8	202	124	61.4
Meropenem	4	0	0.0	90	0	0.0
Amikacin	33	12	36.4	505	139	27.5
Gentamicin	34	16	47.1	506	165	32.6
Ciprofloxacin	34	23	67.6	505	263	52.1
Trimethoprim/Sulfamethoxazole	34	16	47.1	508	175	34.4
Nitrofurantoin				506	26	5.1

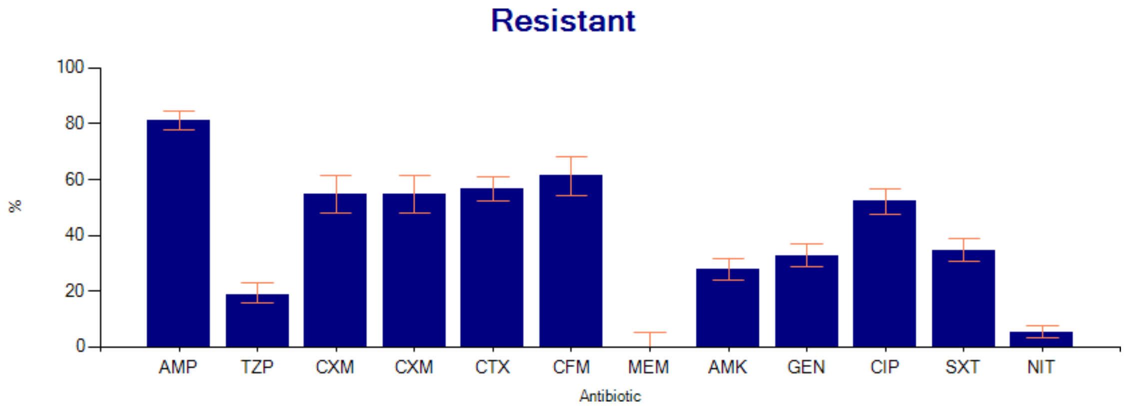

Fig 7 : Resistance profile of *Escherichia coli* in urine isolates

Fig 8 : Resistance profile of *Escherichia coli* in pus isolates

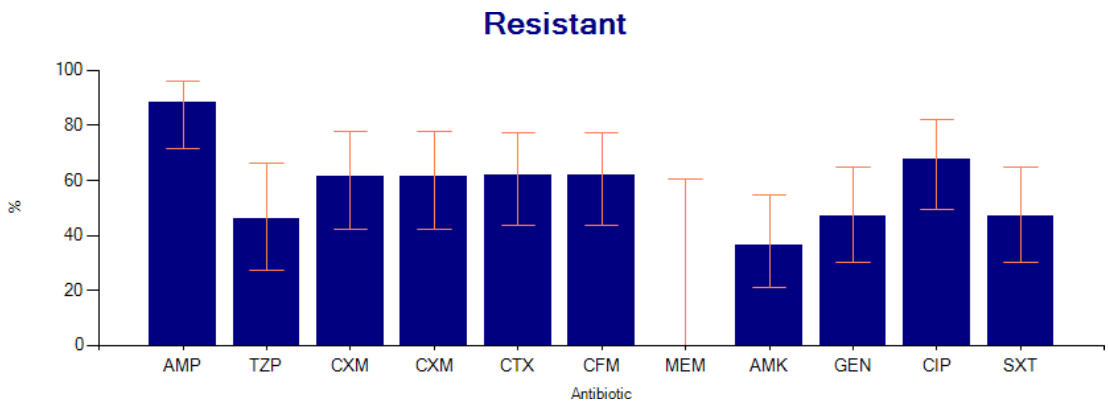

Table 7: Resistance profile of *Escherichia coli in* spoke samples

Antibiotic name	Urine (n=410)		
	Number tested	Number resistant	% Resistance
Ampicillin	410	333	81.2
Piperacillin/Tazobactam	395	74	18.7
Cefuroxime(Parenteral)	170	93	54.7
Cefuroxime (Oral)	170	93	54.7
Cefotaxime	352	199	56.5
Cefixime	170	104	61.1
Meropenem	170	0	0
Amikacin	410	112	27.3
Gentamicin	410	133	32.4
Ciprofloxacin	410	213	52
Trimethoprim/Sulfamethoxazole	410	139	33.9
Nitrofurantoin	410	20	4.8

Klebsiella species

Total of 230 *Klebsiella* species were isolated from urine and pus specimens. Ciprofloxacin resistance was maximum in pus isolates (47.8%) and urine isolates (35.4%). Carbapenem resistance was seen in 2 pus isolates.

Table 8: Resistance profile of *Klebsiella* species in whole district

Antibiotic name	Pus (n=47)			Urine (n=182)		
	Number tested	Number resistant	% Resistance	Number tested	Number resistant	% Resistance
Ampicillin	44	41	93.2	172	157	91.3
Piperacillin/Tazobactam	43	17	39.5	170	53	31.2
Cefuroxime(Parenteral)	46	16	34.8	74	17	23.0
Cefuroxime (Oral)	46	16	34.8	74	17	23.0
Cefotaxime	46	17	37.0	180	56	31.1
Cefixime	45	17	37.8	70	18	25.7
Meropenem	6	2	33.3	26	0	0.0
Amikacin	47	12	25.5	180	46	25.6
Gentamicin	47	14	29.8	180	42	23.3
Ciprofloxacin	46	22	47.8	181	64	35.4
Trimethoprim/Sulfamethoxazole	47	10	21.3	182	28	15.4
Nitrofurantoin				182	58	31.9

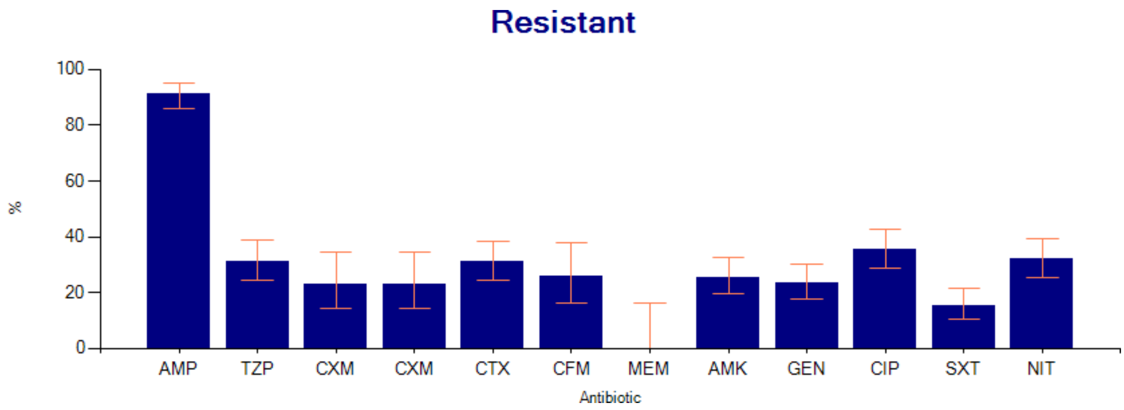

Fig 9 : Resistance profile of *Klebsiella* species in urine isolates

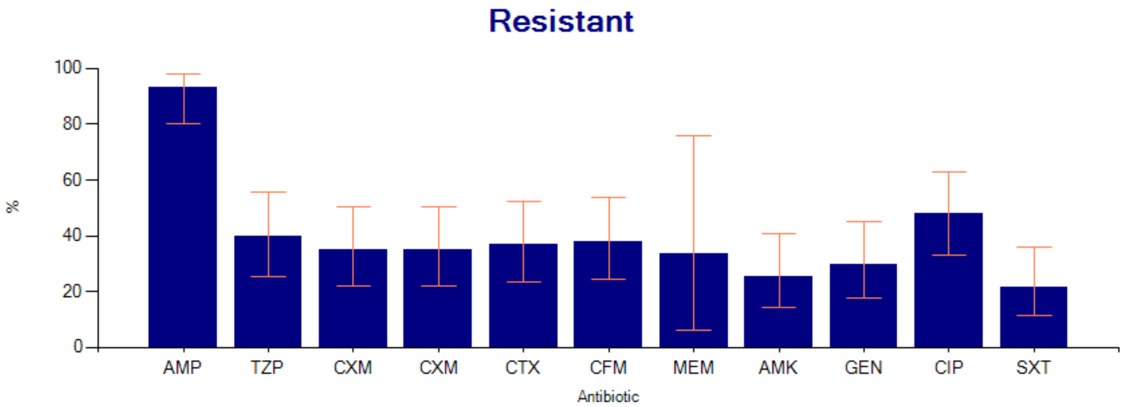

Fig 10 : Resistance profile of *Klebsiella* species in pus isolates

Table 9: Resistance profile of *Klebsiella* species *in* spoke samples

Antibiotic name	Urine (n=112)		
	Number tested	Number resistant	% Resistance
Ampicillin	110	100	90.9
Piperacillin/Tazobactam	98	30	30.6
Cefuroxime(Parenteral)	56	13	23.2
Cefuroxime (Oral)	56	14	25
Cefotaxime	145	45	31
Cefixime	56	14	25
Meropenem	18	0	0
Amikacin	110	27	24.5
Gentamicin	110	24	21.8
Ciprofloxacin	110	38	34.5
Trimethoprim/Sulfamethoxazole	112	16	14.2
Nitrofurantoin	112	35	31.2

2) Non-fermenting Gram-negative bacilli

Among the non-fermenting Gram-negative bacilli (NFGNB) collected during Jan-Dec 2024, *Pseudomonas* species (121) was the most common pathogen isolated followed by *Acinetobacter* species (13).

Pseudomonas aeroginosa

Two *Pseudomonas aeruginosa* isolated from pus showed resistance to meropenem , but meropenem was tested in 15 isolates only. 11% of isolates were resistant to Piperacillin/Tazobactam.

Table 10: Resistance profile of *Pseudomonas aeruginosa* in whole district

Antibiotic name	Pus (n=88)			Urine (n=31)		
	Number tested	Number resistant	% Resistance	Number tested	Number resistant	% Resistance
Piperacillin/Tazobactam	82	9	11.0	31	1	3.2
Ceftazidime	86	8	9.3	31	4	12.9
Cefepime	85	9	10.6	31	4	12.9
Aztreonam	87	9	10.3	829	2	
Imipenem	*22	0	0.0	*4	1	
Meropenem	*15	2	--	*6	0	
Amikacin				30	1	3.3
Ciprofloxacin	38	4	10.5	*10	1	

* Percentage not computed due to numbers being < 30

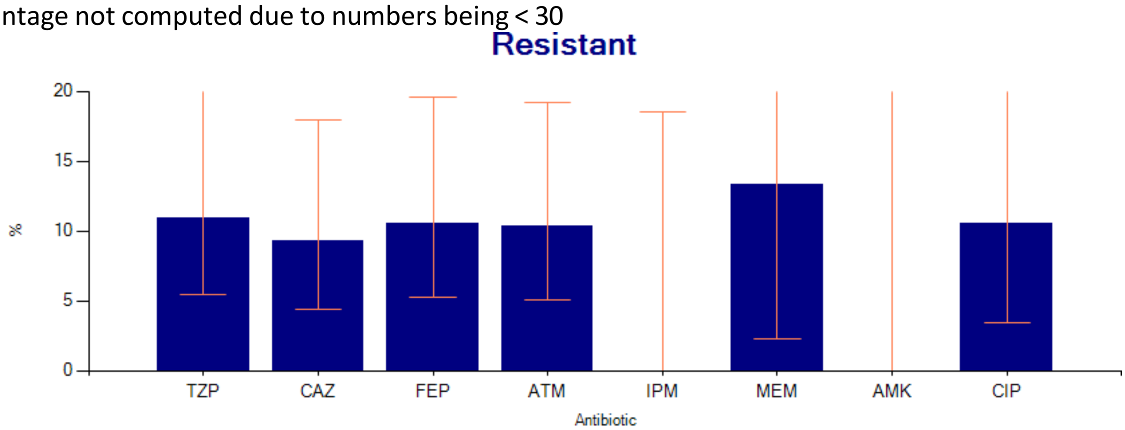

Fig 11 : Resistance profile of *Pseudomonas aeruginosa* in pus isolates

Acinetobacter species

Acinetobacter spp was isolated from 11 pus isolates. Maximum resistance was seen to Ciprofloxacin , Piperacillin/Tazobactam and Amikacin.

Table 11: Resistance profile of *Acinetobacter* species in whole district

Antibiotic name	*Pus (n=11)			Urine (n=0)		
	Number tested	Number resistant	% Resistance	Number tested	Number resistant	% Resistance
Piperacillin/Tazobactam	10	8				
Ceftazidime	8	6				
Imipenem	3	1				
Meropenem	3	2				
Amikacin	9	7				
Gentamicin	11	7				
Ciprofloxacin	6	6				
Trimethoprim/Sulfamethoxazole	4	2				

* Percentage not computed due to numbers being < 30

Resistance profile of nonfermenting Gram negative organisms of spokes is not assessed separately since nonfermenters where not isolated from there.

DISCUSSION :

Strengthening global, national and local AMR surveillance is critical for AMR containment as it is the basis for designing and implementing evidence-based strategies, monitoring the effectiveness of public health interventions and detecting new trends and threats. AMR poses a significant global health challenge threatening the attainment of Sustainable Development Goals (SDGs) related to health. WHO declared AMR as one of the ten global public health threats in 2019 and an emerging health challenge for the decade in 2020.

Majority of isolates in antibiogram belongs to female patients (67%) of 55-64 years age group, reason may be attributed to the more number of urine samples coming to our lab, almost 3/4th of total sample load.

General hospital is sharing the same compound of our lab, which explains the maximum number of samples received from there. It is followed by samples from Women & Child hospital which is situated 1 km away from the lab. District Hospital, Mavelikkara samples account for the third position. Rest of the spokes are having almost uniform distribution of samples.

Antibiogram of 2024 is the first antibiogram prepared by district AMR lab Alappuzha. It includes data from 24 spokes throughout the district. E. coli was the most common pathogen isolated (48.7%) in the AMR surveillance data of 2024 .

Amongst urinary isolates, *E. coli* was the most common pathogen isolated (66.7%) while *Pseudomonas aeroginosa* (35.6%) was the most common pathogen isolated from pus aspirates.

For *Staphylococcus aureus*, Ciprofloxacin was showing maximum resistance (60.5%) followed by Cefoxitin. MRSA prevalence was 39.6% in pus isolates.

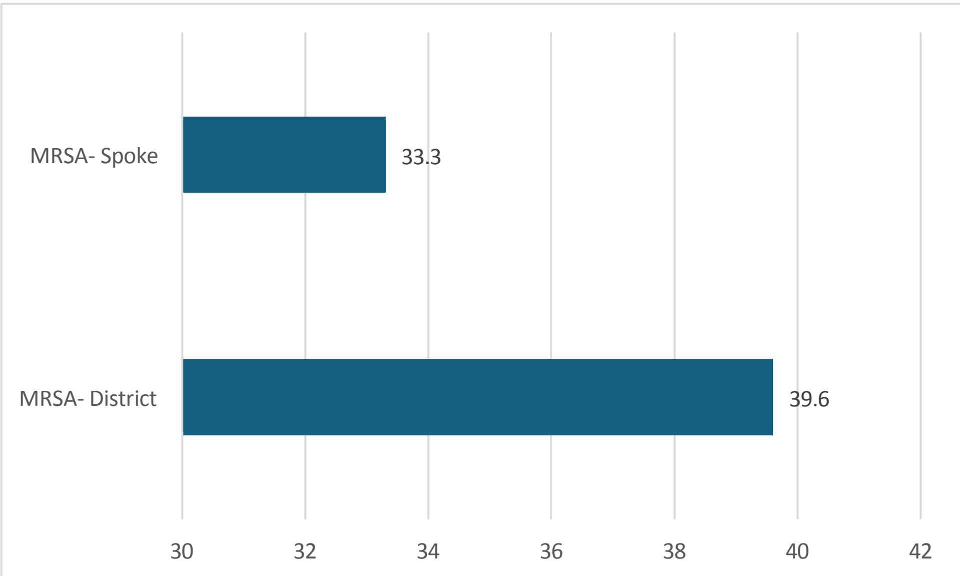

Fig 12: Trends of MRSA isolates in spoke and whole district

MRSA prevalence was higher in isolates from whole district compared to isolates from spokes as shown in figure 12.

13/23 Enterococcus species isolate from urine samples of whole district were resistant to ciprofloxacin, whereas 11/17 isolates were resistant to erythromycin from pus samples of whole district. Whereas for samples from spokes, 1 out of 8 samples were resistant to ciprofloxacin.

High level of resistance was observed in *Escherichia coli* compared to *Klebsiella*. ESBL producing *E coli* was 61.3% & 56.7% from pus and urine respectively whereas in *Klebsiella* sp ESBL rates were 37% & 31% from pus and urine respectively. District as well as spokes are showing almost similar ESBL – E.coli rates in urine as shown in Fig 13. Similar trend is shown by ESBL- Klebsiella species also.

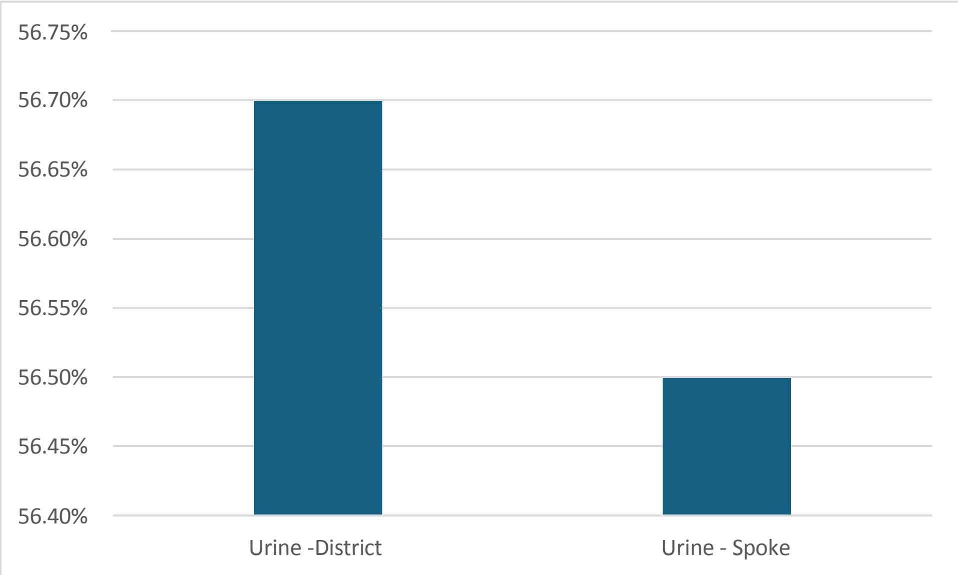

Fig 13 : Trends of ESBL – *E.coli* isolated from urine sample

Carbapenem resistance was seen in 2 pus aspirates yielding *Klebsiella* spp. Carbapenem resistance was seen in 2 isolates of *Pseudomonas aeruginosa* also obtained from pus aspirates. Carbapenem resistance was not seen in spoke samples.

2 out of 15 *Pseudomonas aeruginosa* isolates demonstrated carbapenem resistance.

AMR surveillance plays a pivotal role in determining the burden and trends of AMR in Alappuzha, providing valuable information for evidence-based policy making and implementation for containment of AMR. Integrating antibiograms and antibiotic policies promote evidence based prescribing to optimise therapy and curb resistance.

DISTRICT ANTIBIOGRAM KOTTAYAM

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MESSAGE

The emergence of AMR is one of the most serious public health challenges of our time. Rational and evidence based use of antibiotics is essential to ensure effective treatment and to safe guard the efficacy of available antimicrobials for further generations.

The District-Antibiogram of Kottayam has been prepared by compiling and analyzing laboratory data from health institutions across the district. This document provides valuable insights in to local antimicrobial sensitively patterns and serves as a practical guide for clinicians in selecting appropriate empirical therapy.

I appreciate the sincere efforts of the microbiologists clinicians, surveillance teams and health care institutions who contributed to the preparation of this antibiogram. I am confident that this publication will support rational antibiotic use, strengthen antimicrobial steward ship, and contribute to improved patient out comes in Kottayam district.

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Dr.Sushama PK
Superintendent
General Hospital, Kottayam

MESSAGE

Antimicrobial Resistance (AMR) is a multi-faceted global challenge known as a "silent pandemic." It is widely recognized as one of the top ten global public health threats to humanity in the 21st century.

Kerala has set a benchmark in addressing this crisis by becoming the first state to release an AMR action plan in 2018. A critical pillar of this strategy is the optimization of antibiotic usage through data-driven decision-making.

The formulation and release of the District Antibiogram is a pivotal step in this direction. By mapping the local patterns of resistance, this document will serve as an essential guide for clinicians in choosing appropriate empirical therapies. This, in turn, will help improve patient outcomes, reduce treatment costs, and preserve the efficacy of essential antibiotics for future generations.

I am proud that General Hospital Kottayam is playing a lead role in this initiative. I extend my heartfelt appreciation to the team behind this comprehensive report and wish the initiative every success.

Dr.Sushama
Superintendent
General Hospital,
Kottayam

Antibiogram 2023-2024

(1 January 2023 to 31 December 2024)

Abbreviations

AMR	Antimicrobial resistance
AST	Antimicrobial susceptibility testing
CLSI	Clinical and Laboratory Standards Institute
ESBL	Extended spectrum beta-lactamase
GLASS	Global Antimicrobial Resistance Surveillance System
ICU	Intensive care unit
ID	Identification
IPD	In-patient
KARSAP	Kerala Antimicrobial Resistance Strategic Action Plan
KARS-Net	Kerala Antimicrobial Resistance Surveillance Network
MRSA	Methicillin resistant Staphylococcus aureus
NCDC	National Centre for Disease Control
NFGNB	Non-fermenting Gram-negative bacilli
OPD	Outpatient
OSBF	Other sterile body fluids
R I S	Resistant Intermediate Sensitive
SOP	Standard operating procedure
WHO	World Health Organization

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I. Executive Summary

The Government of Kerala in collaboration with Ministry of Health and Family Welfare and WHO Country Office for India officially launched the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) on 25 October 2018. Antimicrobial resistance (AMR) has emerged as a significant public health threat that requires urgent attention. In order to strengthen and expand the AMR surveillance network in Kerala, Kerala Antimicrobial Resistance Surveillance Network (KARS-Net) was established in 2019. The objectives of the network were to foster standardization, to strengthen and expand AMR surveillance in Kerala, to analyze and report KARS-Net data to State Government and NCDC on regular basis, to contribute towards the estimation of extent, burden and monitoring of AMR in Kerala and to detect emerging resistance and it's spread in Kerala. Priority pathogens under surveillance currently include nine commonly isolated pathogens from identified specimens. The WHONET software is used for the collection and analysis of antimicrobial susceptibility data.

This report covers the AMR data from 1 January,2023 to 31 December, 2024 from Kottayam district. Data has been collected from a total of 27 government institutions in Kottayam district comprising of the hub at General Hospital, Kottayam and 26 spoke hospitals (Figure 1). After data deduplication, data from 1343 unique patient isolates were analysed; 33% (439) of reported isolates were males; 67% (904) were females.

Urine was the most commonly reported specimen 70% (936), followed by pus 30% (403), blood 0.2% (3) and stool 0.074% (1). The most frequently reported priority pathogen from all specimens was *E. coli* (47.91%), followed by *Klebsiella species* (17.91%), *S. aureus* (12.9%), *Pseudomonas species* (8.4%), *Enterococcus species* (6.7%), *Acinetobacter species* (6.04%) and *Salmonella species* (0.15%). No *Shigella species* and *Vibrio cholerae* cases were reported during this time period.

Among the reported *Staphylococcus aureus* isolates, 27.4% were Methicillin resistant *Staphylococcus aureus* (MRSA). In the Enterococcus isolate from blood, vancomycin and linezolid resistance was not reported. Potential Extended spectrum beta-lactamase (ESBL) production was observed in 46% of *E. coli* and 27% of *Klebsiella spp*. isolated from all specimens. Resistance to ciprofloxacin was observed in the single *Salmonella species* isolated from blood culture.

No isolates of *Acinetobacter spp*. and *Pseudomonas spp* were obtained from blood.

II. Kerala Antimicrobial Resistance Surveillance Network (KARS-Net)

Antimicrobial resistance (AMR) is a growing threat to public health which needs urgent attention. Government of India has already taken a series of initiatives to combat this burgeoning problem. One such initiative is the National Programme on Antimicrobial Resistance Containment, launched in 2013, during the Twelfth Five-Year Plan (2012-2017). This programme coordinated by National Centre for Disease Control (NCDC), New Delhi, aims to capture quality AMR surveillance data from sentinel surveillance sites to generate evidence of AMR prevalence in the country to guide the National Action Plan on AMR.

Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP) was the first subnational State action plan on AMR conceptualised in India. It was launched by the Honourable Chief Minister of Kerala Sri Pinarayi Vijayan on 25 October 2018. Kerala Antimicrobial Resistance Surveillance Network (KARS-Net) was established in 2018 to estimate the extent, burden and monitoring of AMR in Kerala with the Department of Microbiology, Government Medical College, Thiruvananthapuram as the State nodal centre. The network had 10 laboratories in the beginning. From 2019, with the technical support from World Health Organization (WHO) and National Centre for Disease Control (NCDC), the network has now expanded to 49 laboratories from both public and private sectors. The data generated by KARS-Net is shared with NCDC for submission to WHO's Global Antimicrobial Resistance Surveillance System (GLASS) from 2021 onwards.

The KARSAP identified AMR surveillance as a strategic priority in line with national and global AMR action plans. The WHO Country Office for India collaborated with KARS-Net, with oversight of the State Government and NCDC. The network utilizes WHONET to collate, analyse and share AMR data on a monthly basis. KARS-Net currently includes surveillance of AMR in nine key priority pathogens responsible for high antibiotic resistance rates among bacteria that commonly cause human infections.

The nine priority pathogens monitored by KARS-NET are:

1. *Staphylococcus aureus*
2. *Enterococcus species*
3. *Klebsiella species*
4. *Escherichia coli*
5. *Acinetobacter species*
6. *Pseudomonas species*
7. *Salmonella enterica* serovar Typhi and Paratyphi
8. *Shigella species*
9. *Vibrio cholerae*

Under the hub and spoke model for AMR surveillance, General Hospital Kottayam functions as the hub lab receiving samples from 26 spoke institutions. Samples from these 27 institutions collected over a period of 2 years from January 2023 to December 2024 were used for AMR surveillance data.

The clinical specimens currently included under surveillance are:

- Blood
- Urine
- Pus aspirate (PA)
- Other sterile body fluids (OSBF)
- Stool (only for Salmonella Typhi and Paratyphi, Shigella spp and *Vibrio cholerae*)

Table 1: Pathogens and specimens included under surveillance

	Staph. aureus	*Enterococcus spp.*	*Klebsiella spp.*	*E. coli*	*Acinetobacter spp.*	*Pseudomonas spp.*	*Salmonella Typhi/ Paratyphi*	*Shigella spp*	*Vibrio cholerae*
Blood	✓	✓	✓	✓	✓	✓	✓	X	X
Urine	X	✓	✓	✓	✓	✓	X	X	X
PA	✓	✓	✓	✓	✓	✓	X	X	X
OSBF	✓	✓	✓	✓	✓	✓	X	X	X
Stool	X	X	X	X	X	X	✓	✓	✓

X: specimen not relevant

The monthly AMR data of the nine priority pathogens from the above-mentioned specimen types is reported to the Department of Microbiology, Government Medical College, Thiruvananthapuram. The feedback regarding the quality and completeness of AMR data is being obtained.

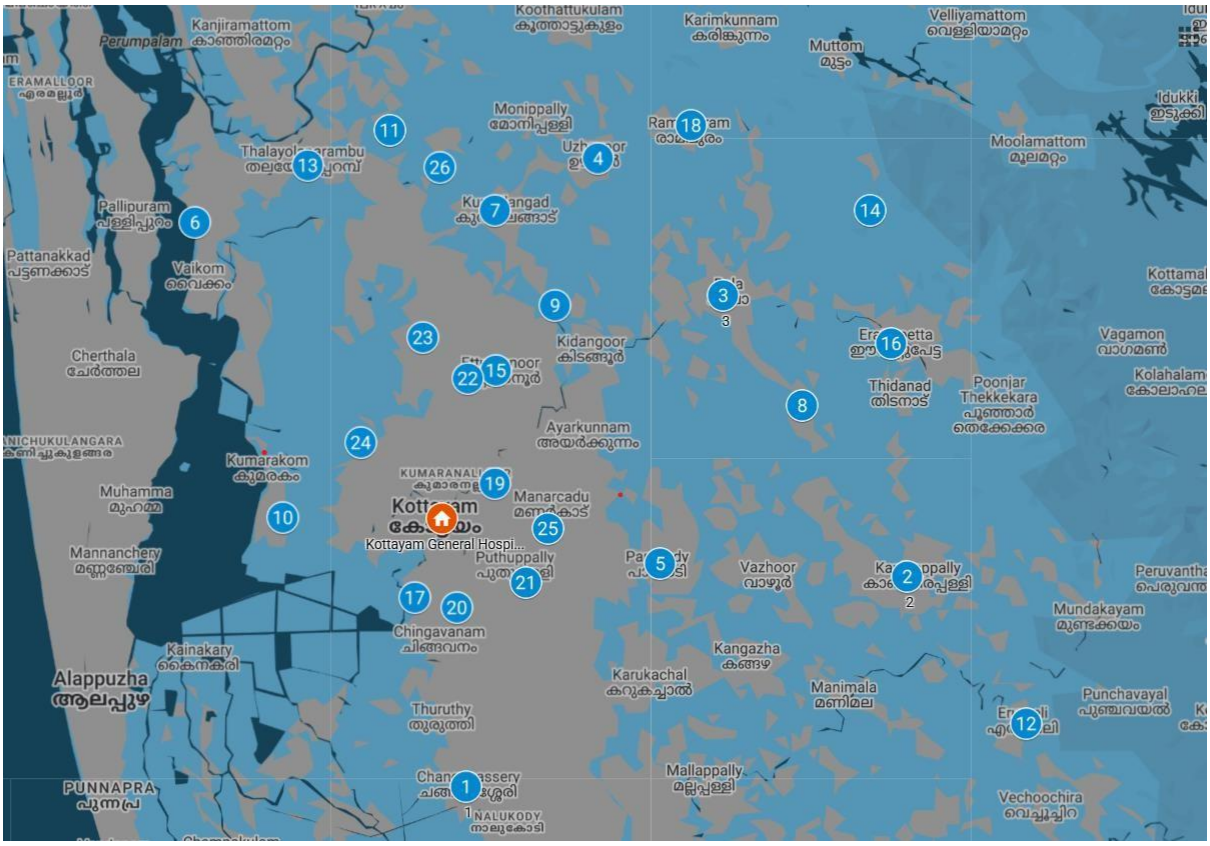

Figure 1: Spoke hospitals sending specimens to District AMR Lab, Kottayam

Spokes have been marked on the map according to serial number with hub shown at General hospital, Kottayam

- 1. GH Changanassery
- 2.GH Kanjirapally
- 3.KMMSGGH Pala
- 4.KRNMSH Uzhavoor
- 5.THQH Pampady
- 6.THQH Vaikom
- 7.THQH Kuravilangad
- 8. CHC Paika
- 9.CHC Koodalloor
- 10. CHC Kumarakom
- 11. CHC Arunootimangalam
- 12. CHC Erumely
- 13.CHC Thalayolaparambu

- 14. CHC Edamaruku
- 15.KMCHC Ettumaanoor
- 16. FHC Erattupetta
- 17. FHC Nattakom
- 18. FHC Ramapuram
- 19. FHC Parampuzha
- 20. FHC Panachikkad
- 21. FHC Puthupally
- 22. PHC Athirampuzha
- 23. PHC Onamthuruth
- 24. PHC Aymanam
- 25. PHC Manarcadu
- 26. PHC Kattampak

A standardised approach is followed for AMR data collection, analysis, and reporting using WHONET software.

III. Data Collection

The WHONET software is used for the collection, collation and analysis of the antimicrobial susceptibility (AST) data generated by the manual testing methods and the automated systems. WHONET is a free open-source Windows application for management of microbiology laboratory data on antimicrobial susceptibility testing, developed by WHO Collaborating Centre for Surveillance of AMR at the Brigham and Women's Hospital at Harvard University. WHONET is used for local, national, regional and global surveillance efforts worldwide.

The classification of the isolates as susceptible, intermediate or resistant is based on the Clinical & Laboratory Standards Institute (CLSI) guidelines. During 2023-2024, AST data of 1343 priority pathogens, along with the demographic information of the patients from whom these pathogens were isolated, was reported from 26 spoke sites and 1 hub site in Kottayam district.

The data is submitted monthly after validation by the AMR nodal officer at the hub lab. The monthly data submitted was screened and analysed by the nodal centre at medical college, Thiruvanathapuram and the detailed feedback was obtained for each month. Based on feedback the corrected WHONET files were sent.

IV. Data Analysis

The analysis of cumulative data for the years 2023-2024 has been performed by the Department of Microbiology, General Hospital Kottayam, based on which this antibiogram report was prepared. The AST data includes data of conventional disk diffusion method.

a. Data deduplication

As a first step for data analysis, a single file was created by collating all the cumulative AMR data files. During this step, duplicate isolates (from the same patients) have been excluded from the database files. Before starting the de-duplication process, variables containing information about the patient was checked and variables were generated if required, e.g., patient ID number, age, sex, location, department, AST in values (mm) etc. For analysis, only one result was considered for each patient per specimen type and per pathogen. For example, if two blood cultures from the same patient yielded growth of *E. coli*, only the first has been included in the data; if the growth of E. coli was detected in one culture and of *K. pneumoniae* in the other, both results have been considered. If there is the growth of *E. coli* in one blood culture and in one urinary culture from the same patient, both specimen types have been included. From each patient, only the first isolate of a given species recovered during the investigated time interval was included, regardless of its susceptibility profile. The total number of isolates from unique patients (after de-duplication) was 1343.

b. Demography and distribution of priority pathogens

Among the total of 1343 unique patients, 33% pathogens were from males and 67% from females. Age data was available for all of the unique patient isolates. The highest proportion of unique patients contributing to the AST data (23.4%) belong to age group of 55-64 years whereas the lowest number of pathogens (0.3%) were reported from age group of <1 year (Figure 2).

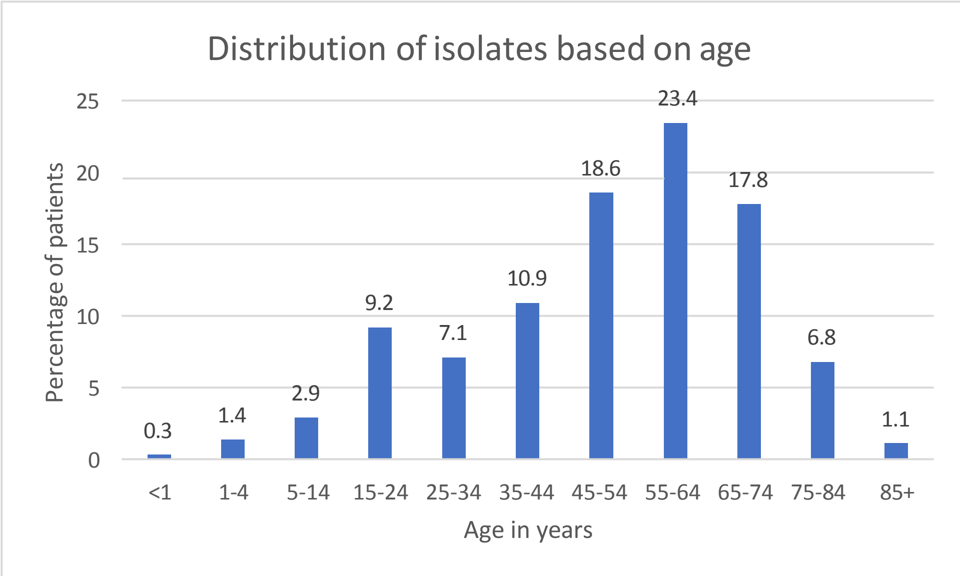

Figure 2: Distribution of isolates based on age

Of the total unique isolates, the following was the specimen distribution:

- Urine – 936 (69.7%)
- Blood – 3 (0.2%)
- Pus – 403 (30.01%)
- Stool – 1 (0.074%)

The total number of isolates reported in the year 2024 has increased over those reported in 2023. In 2023-2024 AMR surveillance data, the most commonly isolated priority pathogen was *E. coli* (47.91%), followed by *Klebsiella species* (17.91%), *S. aureus* (12.9%), *Pseudomonas species* (8.4%), *Enterococcus species* (6.7%), *Acinetobacter species* (6.04%), and *Salmonella spp* (0.15%) (Figure 3).

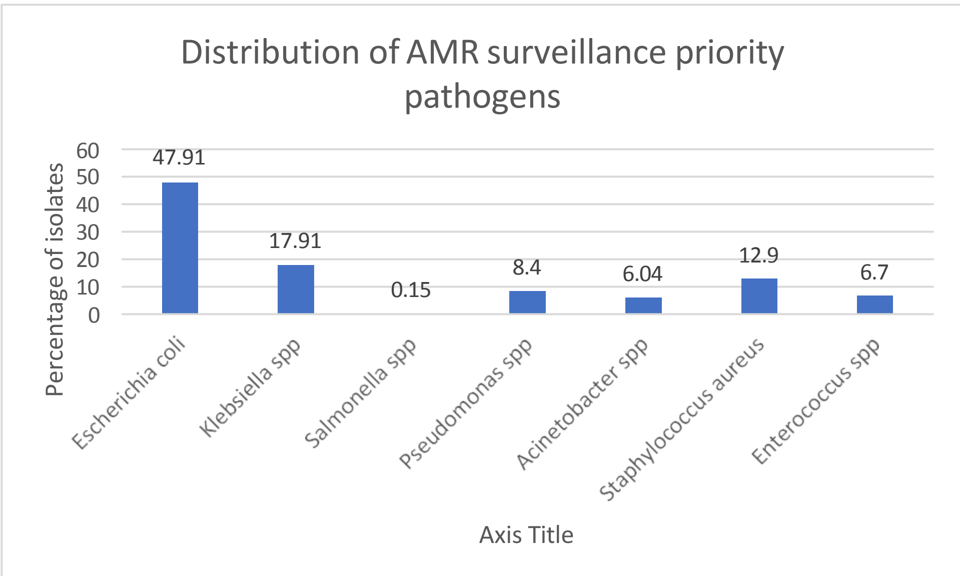

Figure 3: Distribution of AMR surveillance priority pathogens

Among all specimen types, highest number of *E. coli* (65.81%) were isolated from urine samples. There was one isolate each of *Staphylococcus aureus, Enterococcus species and Salmonella species* each from blood . The priority pathogen most frequently isolated from pus aspirates and swabs were *Staphylococcus aureus* (38.46%). Lowest percentage of pathogen isolated from pus was *Enterococcus species* (2.48%) .*Vibrio cholerae* and *Shigella species* was not isolated.

Table 2: Specimen-wise isolation of priority pathogens

	Blood (%)	**Urine (%)**	**Pus swabs and aspirates (%)**	**Stool (%)**	**Total**
Escherichia coli	0	616 (65.81%)	48 (11.91%)	0	664
Klebsiella spp	0	191 (20.4%)	54(13.39%)	0	245
Salmonella spp	1 (33.3%)	0	0	1 (100%)	2
Pseudomonas spp	0	39 (4.2)	78 (19.35%)	0	117
Acinetobacter spp	0	26 (2.77%)	58 (14.3%)	0	84
Staphylococcus aureus	1 (33.3%)	19 (2.02%)	155 (38.46%)	0	175
Enterococcus spp	1 (33.3%)	45 (4.80%)	10 (2.48%)	0	56
Total	3	936	403	1	1343

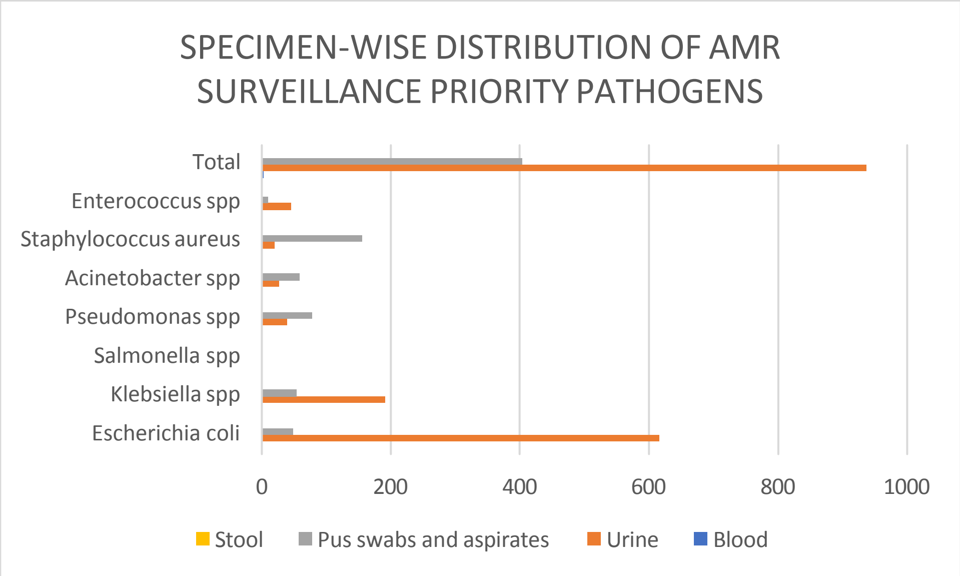

Figure 4: Specimen wise distribution of AMR surveillance of priority pathogens

Of the 1343 isolates, 21.03% were from patients in IPD, 78.27% were from patients in OPD and 0.70% were patients from ICUs (Figure 5). The most common pathogen isolated from OPD was *E. coli* (57.4%), followed by *Klebsiella spp* (19.3%), *Staphylococcus aureus* (10.8%), *Pseudomonas spp* (5.9%), *Acinetobacter spp* (3.5%) and *Enterococcus spp* (2.96%). In IPD patients, maximum isolates were *E. coli* (21.3%) and *Staphylococcus aureus* (21.3%), followed by *Pseudomonas* spp. (18.5%), *Acinetobacter* spp. (16.4%), *Klebsiella spp* (13.8%) and Enterococcus spp (8.4%). In ICU facilities, *Klebsiella* spp. (33.3%) was the most common isolate followed by *E. coli* (22.2%) and Pseudomonas (22.2%). *Staphylococcus aureus* and *Enterococcus spp* (Table 3, Figure 5). No *Vibrio cholerae* and *Shigella* cases were reported.

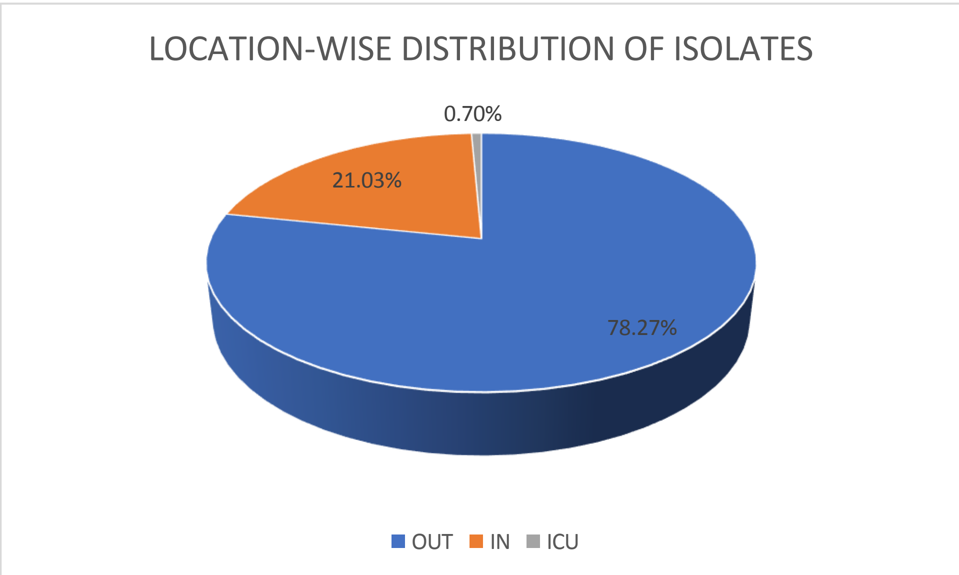

Figure 5: Location-wise distribution of isolates

Table 3: Location-wise distribution of priority pathogens

Priority Pathogens	ICU(%)	IPD (%)	OPD (%)
Escherichia coli	2(22.2%)	61(21.3%)	601(57.4%)
Klebsiella spp	3(33.3%)	40(13.8%)	202 (19.3%)
Salmonella spp	0	1(0.3%)	1(0.1%)
Pseudomonas spp	2(22.2%)	53(18.5%)	62(5.9%)
Acinetobacter spp	0	47(16.4%)	37(3.5%)
Staphylococcus aureus	1(11.1%)	61(21.3%)	113(10.8%)
Enterococcus spp	1 (11.1%)	24(8.4%)	31(2.96%)
TOTAL	9	287	1047

V. AMR profile of priority pathogens

The data collected under KARS-Net is for selected antibiotics only as per NCDC's AMR surveillance data management SOP. This AMR surveillance data is from patients visiting the OPD, IPD and ICU of the hospitals/laboratories.

a. Gram positive cocci

AMR surveillance under KARS-Net covers 2 important globally prevalent gram-positive bacterial pathogens i.e., *Staphylococcus aureus* and *Enterococcus species*. The AST data of 231 Gram positive cocci have been analysed.

Staphylococcus aureus

Staphylococcus aureus constituted 12.9% of all the isolates (Figure 3). Data of a total of 175 *S. aureus* isolates were analysed. Of the 175 isolates, 1(33.3%) was from blood and 38.46% from pus. Methicillin resistance was reported as 27.4% overall. Methicillin resistance was seen in the single blood isolate. 30% Methicillin resistance was seen in pus (Table 4). Erythromycin resistance was not observed in the *S. aureus* isolated from blood. Erythromycin resistance was 68% in pus (Table 4). Distribution of *S. aureus* isolates reported under the programme in 2023-24 is 11.1% from ICU patients, 21.3% from IPD patients and 10.8% from OPD patients (Table 3).

Table 4: Resistance profile of *Staphylococcus aureus* (Hub+Spoke)

Antibiotic tested	**Blood** (N = 1*)		**Pus** (N = 155)		
	Number tested	Number Resistant	Number tested	Number Resistant	Resistance (%)
Cefoxitin	1	1	155	37	24
Gentamicin	1	0	155	23	15
Ciprofloxacin	1	1	155	96	62
Trimethoprim/Sulfa methoxazole	1	0	155	9	6
Clindamycin	1	0	155	20	13
Erythromycin	1	0	155	107	69
Linezolid	1	0	155	0	0
Doxycycline	1	0	155	9	6

*Due to number tested being < 30, percentages were not computed

Table 5: Resistance profile of *Staphylococcus aureus* (Spoke)

Antibiotic tested	**Pus** (N = 17*)	
	Number tested	Number
Cefoxitin	17	5
Gentamicin	17	2
Ciprofloxacin	17	11
Trimethoprim/Sulfamethoxazole	17	1
Clindamycin	17	2
Erythromycin	17	10
Linezolid	17	0
Doxycycline	17	0

*Due to number tested being < 30, percentages were not computed

Enterococcus species

Enterococcus species constituted 6.7% of all isolates (Figure 3). The data of 56 isolates of *Enterococcus species* were analysed. 1 *Enterococcus species* was isolated from blood. 2% of Pus and 5% of urine isolates were *Enterococcus spp* (Table 2).

There was no Vancomycin or Linezolid resistance among urinary isolates, blood isolates and pus. Resistance profile of Enterococcus species is given in Table 6.

Table *6*: Resistance profile of Enterococcus species (Hub+Spoke)

Antibiotic tested	**Blood** (N=1*)		**Pus**(N=10*)		**Urine** (N=45)		
	Number tested	No. Resistant	Number tested	No. Resistant	Number tested	No. Resistant	Resistance %
Ampicillin	1	0	10	4	45	22	49
Gentamicin-HLAR	1	0	10	4	45	17	38
Ciprofloxacin					45	39	87%
Erythromycin	1	1	10	10			
Linezolid	1	0	10	0	45	0	0
Vancomycin	1	0	10	0	45	0	0
Doxycycline	1	0	10	3			
Tetracycline					45	41	91
Nitrofurantoin					45	21	47

*Due to number tested being < 30, percentages were not computed

Table 7: Resistance profile of Enterococcus species (Spoke) *Due to number tested being < 30, percentages were not computed

Antibiotic tested	Pus (N=2*)		Urine (N=5*)	
	Number tested	No. Resistant	Number tested	No. Resistant
Ampicillin	2	0	5	1
Gentamicin-HLAR	2	0	5	1
Ciprofloxacin			5	4
Erythromycin	2	2		
Linezolid	2	0	5	0
Vancomycin	2	0	5	0
Doxycycline	2	0		
Tetracycline			5	5
Nitrofurantoin			5	1

b. Gram negative bacilli

Under KARS-Net, seven commonly isolated gram-negative bacilli of public health importance are included for AMR surveillance. These are *E. coli*, *Klebsiella species, Pseudomonas species*, *Acinetobacter species*, *Salmonella enterica* serovar Typhi and Paratyphi, *Shigella* spp and *Vibrio cholerae*. No *Vibrio cholerae* cases were reported during this period. AST data of 1112 isolates of Gram-negative bacilli have been reported from 1112 unique patients during the reporting period.

i. Enterobacteriaceae

E. coli, *Klebsiella species* and *Salmonella spp* together accounted for 911 isolates constituting 68% of total isolates.

Escherichia coli

A total of 664 *E. coli* isolates. *E. coli* constituted 47.91% of data reported from unique patients for the year 2023-24. The highest number of *E. coli* was reported from urine samples, followed by pus (Table 2). Ampicillin resistance in *E. coli* was observed to be more than 80% in all specimen types. Cefotaxime resistance was observed in >40% from *E. coli* isolated from all specimen types. For non-beta-lactam antibiotics, 41% resistance was observed to ciprofloxacin and 32% to trimethoprim-sulfamethoxazole (TMP/SMX). Around 15% resistance to nitrofurantoin was seen in urinary isolates (Table 8).

Table 8: Resistance profile of *Escherichia coli (HUB+SPOKE)*

Antibiotic tested	**Pus** (N=48)			**Urine** (N=616)		
	Number tested	Number resistant	Resistance %	Number tested	Number resistant	Resistance %
Ampicillin	48	46	96	616	499	81
Amoxicillin/ Clavulanic acid	48	30	63	616	626	53
Piperacillin/ Tazobactam	48	11	23	616	142	23
Cefuroxime	48	25	53	616	626	53
Cefotaxime	48	28	58	616	345	56
Imipenem	48	2	5	616	62	10
Meropenem	48	1	2	616	49	8
Amikacin	48	13	28	616	216	35
Gentamicin	48	18	38	616	246	40
Ciprofloxacin	48	27	56			
Norfloxacin				616	234	38
Trimethoprim/ Sulfamethoxazole	48	14	30	616	253	41
Nitrofurantoin				616	92	15

Table 9: Resistance profile of *Escherichia coli (SPOKE)*

Antibiotic tested	Pus (N=8*)		Urine (N=208)		
	Number tested	Number resistant	Number tested	Number resistant	Resistance %
Ampicillin	8	7	208	172	83
Amoxicillin/ Clavulanic acid	8	5	208	112	54
Piperacillin/ Tazobactam	8	0	208	10	5
Cefuroxime	8	5	208	102	49
Cefotaxime	8	5	208	96	46
Imipenem	8	1	208	2	1
Meropenem	8	0	208	0	0
Amikacin	8	0	208	23	11
Gentamicin	8	1	208	30	14
Ciprofloxacin	8	5			
Norfloxacin			208	73	35
Trimethoprim/ Sulfamethoxazole	8	5	208	69	33
Nitrofurantoin			208	16	8

*Due to number tested being < 30, percentages were not computed

Klebsiella species

Total of 191 *Klebsiella species* were isolated from urine specimens. Cefotaxime resistance was 36% in pus isolates and 38% in urinary isolates.

Table 10: Resistance profile of *Klebsiella species* (Hub+Spoke)

Antibiotic tested	**Pus** (N=54)			**Urine** (N=191)		
	Number tested	Number resistant	Resistance %	Number tested	Number resistant	Resistance%
Amoxicillin/ Clavulanic acid	54	30	56	191	90	47
Piperacillin/ Tazobactam	54	16	30	191	50	26
Cefuroxime	54	18	34	191	53	28
Cefotaxime	54	19	36	191	73	38
Imipenem	54	8	14	191	10	5
Meropenem	54	5	10	191	6	3
Amikacin	54	15	28	191	53	28
Gentamicin	54	21	38	191	73	38
Ciprofloxacin	2710	32	59			
Norfloxacin				191	36	19
Trimethoprim/ Sulfamethoxazole	2309	15	27	191	52	27
Nitrofurantoin				191	53	28

Table 11: Resistance profile of *Klebsiella species* (Spoke)

Antibiotic tested	**Pus** (N=9*)		**Urine** (N=77)		
	Number tested	Number resistant	Number tested	Number resistant	Resistance%
Amoxicillin/ Clavulanic acid	9	3	77	28	37

Antibiotic tested	Pus (N=9*)		Urine (N=77)		
	Number tested	Number resistant	Number tested	Number resistant	Resistance%
Piperacillin/ Tazobactam	9	1	77	6	8
Cefuroxime	9	3	77	18	23
Cefotaxime	9	3	77	16	21
Imipenem	9	1	77	2	2
Meropenem	9	1	77	0	0
Amikacin	9	1	77	4	5
Gentamicin	9	3	77	6	8
Ciprofloxacin	9	32			
Norfloxacin			77	11	14
Trimethoprim/ Sulfamethoxazole	9	3	77	18	24
Nitrofurantoin			77	28	37

*Due to number tested being < 30, percentages were not computed

Salmonella enterica serovar Typhi and Paratyphi

AMR surveillance data of 1 *Salmonella spp* isolate was obtained from blood. Isolate was resistant to Ciprofloxacin.

Table 12: Resistance profile of *Salmonella species*

Antibiotic tested	Salmonella spp (N=1*)	
	Number tested	Number Resistant
Ampicillin	1	0
Ceftriaxone	1	0
Ciprofloxacin	1	1
Trimethoprim/Sulfamethoxazole	1	0

*Due to number tested being <30, percentages were not computed

ii. Non-fermenting Gram-negative bacilli

Among the non-fermenting Gram-negative bacilli (NFGNB) obtained during Jan2023-Dec 2024, *Pseudomonas species* (117) was the most common pathogen isolated followed by *Acinetobacter species* (84).

Pseudomonas species

Carbapenem-resistance was observed in 8% of *Pseudomonas spp*. isolated from urine. (Table 10)

Table 13: Resistance profile of *Pseudomonas species* (Hub+Spoke)

Antibiotic tested	**Pus** (N=78)			**Urine** (N=39)		
	Number tested	Number resistant	Resistance %	Number tested	Number resistant	Resistance %
Piperacillin/ Tazobactam	78	15	19	39	7	18
Ceftazidime	78	23	29	39	13	33
Aztreonam	78	6	8	39	7	17
Imipenem	78	12	16	39	4	11
Meropenem	78	6	8	39	4	11
Amikacin				39	9	23
Ciprofloxacin	78	32	41	39	12	31

Table 14: Resistance profile of *Pseudomonas species* (Spoke)

Antibiotic tested	**Pus** (N=23*)		**Urine** (N=39)		
	Number tested	Number resistant	Number tested	Number resistant	Resistance %
Piperacillin/ Tazobactam	23	1	39	7	18

Ceftazidime	23	2	39	13	33
Aztreonam	23	0	39	7	17
Imipenem	23	1	39	4	11
Meropenem	23	0	39	4	11
Amikacin			39	9	23
Ciprofloxacin	23	5	39	12	31

*Due to number tested being <30, percentages were not computed

Acinetobacter species

Data from a total of 84 *Acinetobacter species* isolates were obtained. Majority of *Acinetobacter spp*. reported were from pus (69%). *Acinetobacter spp*. isolated from all specimen types showed highest resistance to ceftazidime (Table 11).

Table 15: Resistance profile of *Acinetobacter species* (Hub+Spoke)

Antibiotic tested	**Pus** (N=58)			**Urine** (N=26*)	
	Number tested	Number resistant	Resistance %	Number tested	Number resistant
Piperacillin/ Tazobactam	58	29	50	26	3
Ceftazidime	58	38	66	26	11
Imipenem	58	10	17	26	2
Meropenem	58	5	9	26	2
Amikacin	58	19	32	26	3
Gentamicin	58	35	60	26	7
Ciprofloxacin	58	32	55	26	4
Trimethoprim/ Sulfamethoxazole	58	36	62	26	2
Tetracycline				26	5

*Due to number tested being <30, percentages were not computed

Table 16: Resistance profile of *Acinetobacter species* (Spoke)

Antibiotic tested	**Pus** (N=12*)		**Urine** (N=9*)	
	Number tested	Number resistant	Number tested	Number resistant
Piperacillin/ Tazobactam	12	4	9	0
Ceftazidime	12	5	9	1
Imipenem	12	1	9	0
Meropenem	12	1	9	0
Amikacin	12	5	9	0
Gentamicin	12	6	9	0
Ciprofloxacin	12	5	9	0
Trimethoprim/ Sulfamethoxazole	12	6	9	0
Tetracycline			9	2

*Due to number tested being <30, percentages were not computed

VI. AMR Analysis

It was observed that potential ESBL production in Escherichia coli isolated from pus samples was 37.5% and from urine was 47.5%. 26% of the Klebsiella species isolated from pus and 27% from urine were potential ESBL producers. 24% of pus had MRSA. One Staphylococcus aureus isolated from blood was MRSA.

E. coli was the most common pathogen isolated (47.91%) in the AMR surveillance data of 2023-24. Amongst urinary isolates, *E. coli* was the most common pathogen isolated (65.81%). *Staphylococcus aureus* was the predominant pathogen isolated from pus (38.46%). In terms of location type, *E coli* was the most common priority pathogen isolated from OPD (57.4%) and IPD (21.3%) settings. In the ICU setting, *Klebsiella spp*. was the common pathogen reported, amounting to 33.3%.

DISTRICT ANTIBIOGRAM PATHANAMTHITTA

Compiled by
Dr Lakshmi Balaraman
District Clinical Microbiologist
Regional Public Health Laboratory
Pathanamthitta

MESSAGE FROM DISTRICT MEDICAL OFFICER

Antimicrobial Resistance (AMR) is a growing public health concern that threatens effective treatment and patient outcomes. The Government of Kerala, through the Kerala Antimicrobial Resistance Strategic Action Plan (KARSAP), has strengthened AMR surveillance by establishing district-level AMR laboratories.

The District AMR Laboratory at the Regional Public Health Laboratory (RPHL), Pathanamthitta, generates valuable local resistance data that reflects both community-acquired and hospital-associated infections. This report will support evidence-based antibiotic use, formulation of institutional guidelines, and strengthening of antimicrobial stewardship in the district.

I commend the efforts of all staff involved and wish continued success in AMR containment activities in Pathanamthitta district

Dr. Anithakumari L

District Medical Officer, Pathanamthitta

District Antibiogram PATHANAMTHITTA

Abbreviations

AMR	Antimicrobial resistance
AST	Antimicrobial susceptibility testing
CLSI	Clinical and Laboratory Standards Institute
CRE	Carbapenem resistant Enterobacteriaceae
ESBL	Extended spectrum beta-lactamase
ICU	Intensive care unit
IPD	In-patient
MRSA	Methicillin resistant Staphylococcus aureus
NCDC	National Centre for Disease Control
NFGNB	Non-fermenting Gram-negative bacilli
OPD	Outpatient
OSBF	Other sterile body fluids
PA	Pus aspirate
TMP SMZ	Trimethoprim sulfamethoxazole
VRE	Vancomycin Resistant Enterococci
DHK	District hospital Kozhenchery
DTC	District TB centre

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ANTIBIOGRAM

REGIONAL PUBLIC HEALTH LABORATORY PATHANAMTHITTA

01/01/2023-31/12/2024(2 YEARS)

STARTED DOING MICROBIOLOGY SAMPLES FROM 2022 ONWARDS. SINCE WE ARE A STANDALONE LABORATORY LOCATED IN DISTRICT HOSPITAL COMPOUND, MAJORITY OF SAMPLES ARE FROM DISTRICT HOSPITAL KOZHENCHERY AND DISTRICT TB CENTRE. REST OF THE SAMPLES ARE FROM VARIOUS SPOKE HOSPITALS

9 pathogens of public health importance are tracked –testing of resistance

GRAM NEGATIVE

1. ***Acinetobacter spp***
2. ***Ecoli***
3. ***Klebsiella spp***
4. ***Pseudomonas aeruginosa***
5. ***Salmonella enterica serovar Typhi and Paratyphi***
6. ***Shigella species***
7. ***Vibrio cholerae***

GRAM POSITIVE

8. ***Staphylococcus aureus***
9. ***Enterococcus spp***

The clinical specimens currently included are:

- Blood
- Urine
- Pus aspirate (PA)
- Other sterile body fluids (OSBF)
- Stool (only for Salmonella Typhi and Paratyphi, Shigella spp and *Vibrio cholerae*

No isolates were obtained from stool and other sterile body fluids.

- For isolates , which are less than 30 in number, percentage resistance not calculated

Organism	Number of isolates	(%)
Escherichia coli	**250**	**41.3**
Klebsiella sp.	**136**	**20.5**
Pseudomonas sp	**90**	**13.2**
Staphylococcus aureus	**55**	**9.1**
Acinetobacter sp.	**34**	**5.6**
Enterococcus sp.	**24**	**4**

TABLE 1: NUMBER OF PRIORITY PATHOGENS

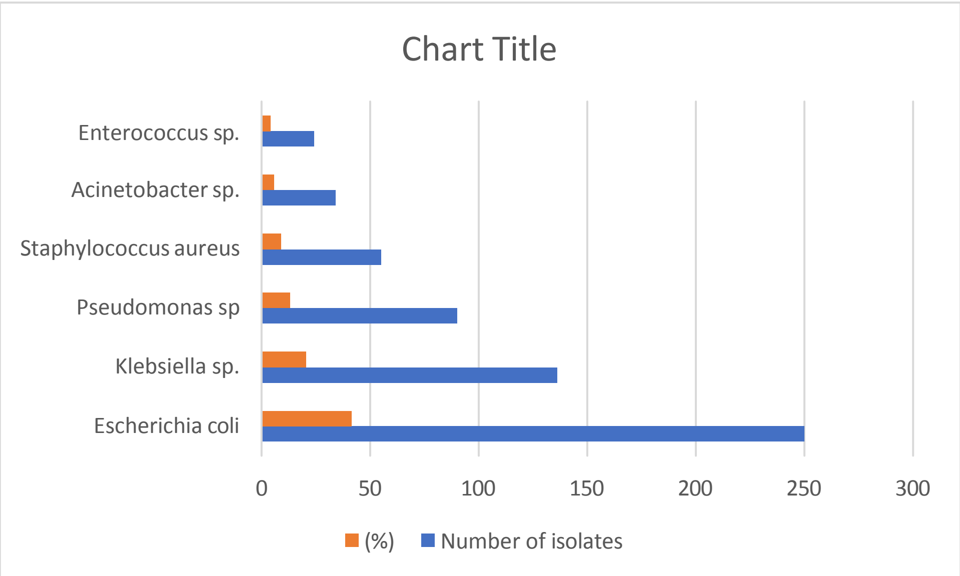


FIGURE 1: NUMBER AND PERCENTAGE OF PRIORITY PATHOGENS

PATIENT AND SAMPLE DETAILS

- Patient demographics
- Sex: Male - 39.7%, Female - 60.3%
- Median age group: Male = 55-64, Female = 45-54

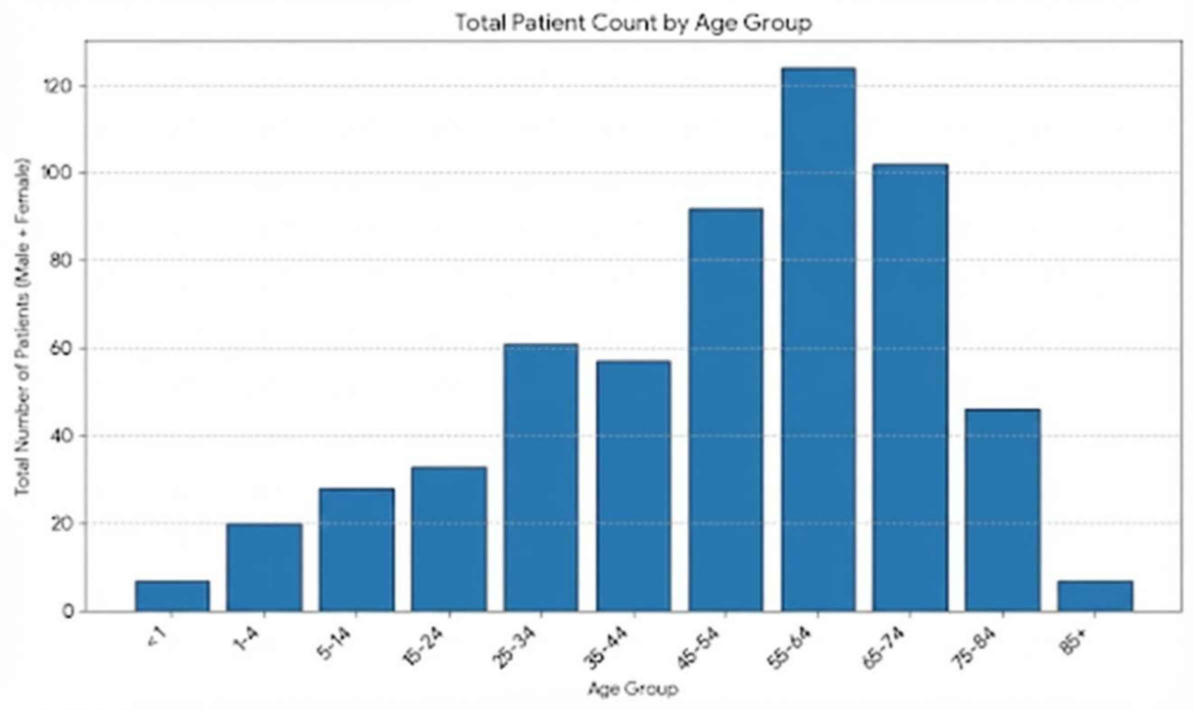


FIGURE 2: DISTRIBUTION OF ISOLATES BASED ON AGE

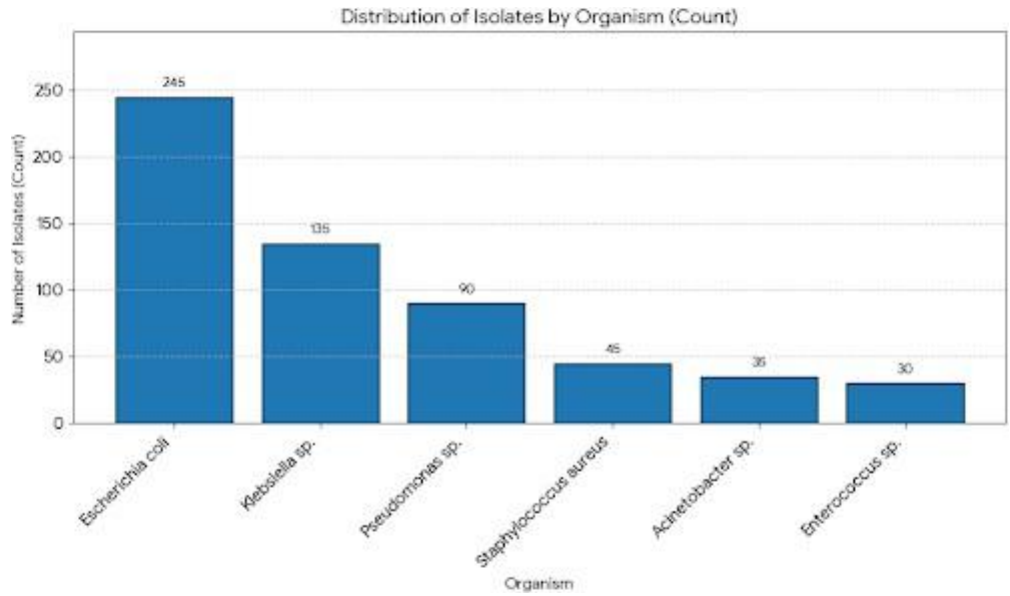


FIGURE 3: DISTRIBUTION OF AMR SURVEILLANCE PRIORITY PATHOGENS

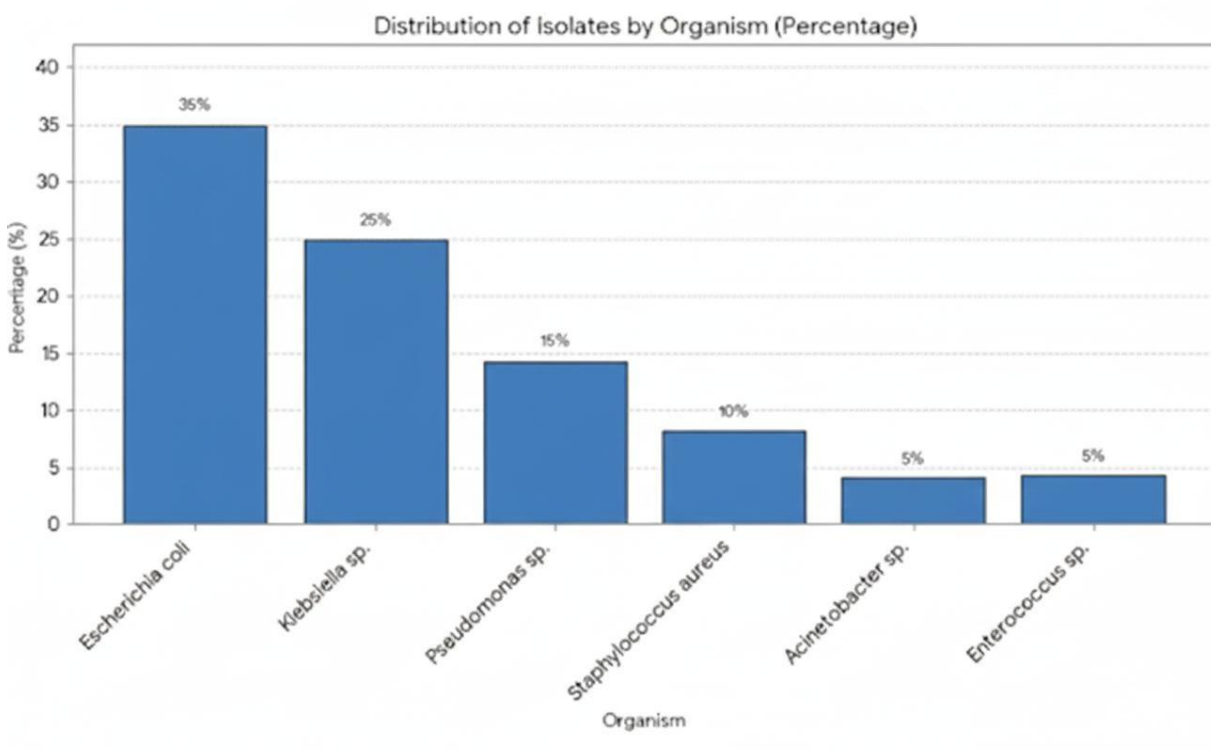
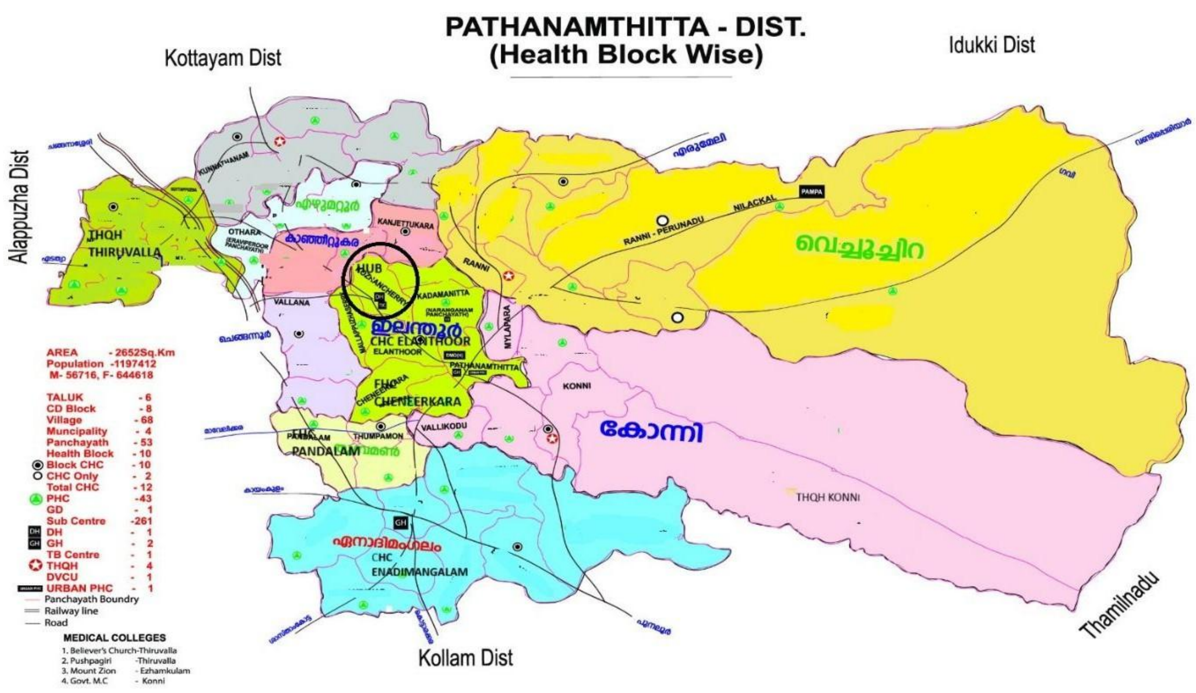


FIGURE 4: DISTRIBUTION OF ISOLATES BY ORGANISM (PERCENTAGE)

TABLE 2: LIST OF INSTITUTIONS CONTRIBUTING CULTURE SAMPLES

SL.NO	NAME OF INSTITUTION
1	DISTRICT HOSPITAL KOZHENCHERY
2	DISTRICT TB CENTRE
3	THQH THIRUVALLA
4	GH PATHANAMTHITTA
5	CHC ELANTHOOR
6	FHC KOIPURAM
7	FHC CHENEERKARA
8	THQH RANNI
9	CHC ENADIMANGALAM
10	FHC PANDALAM
11	FHC KADAMMANITTA

FIGURE 5 : DISTRICT MAP SHOWING CONTRIBUTING HOSPITALS



Location	Number of isolates	(%)
DHK+DISTRICT TB CENTRE	513	84.8
OTHERS	92	15.2

Priority pathogens	Blood (%)	PA (%)	OSBF (%)	Urine (%)	Stool (%)
Escherichia Coli	6	6	0	230 (69.3%)	0
Klebsiella spp.	2	9	0	71 (21.4%)	0
Salmonella Typhi and Paratyphi			0		0
Shigella			0		0
Pseudomonas spp.	3	22	0	21(6.3%)	0
Acinetobacter spp.			0		0
S. aureus	12	29	0		0
Enterococcus spp		14	0	10(3.0%)	0
Total	23	80	0	332	

TABLE 3: SPECIMEN-WISE ISOLATION OF PRIORITY PATHOGENS

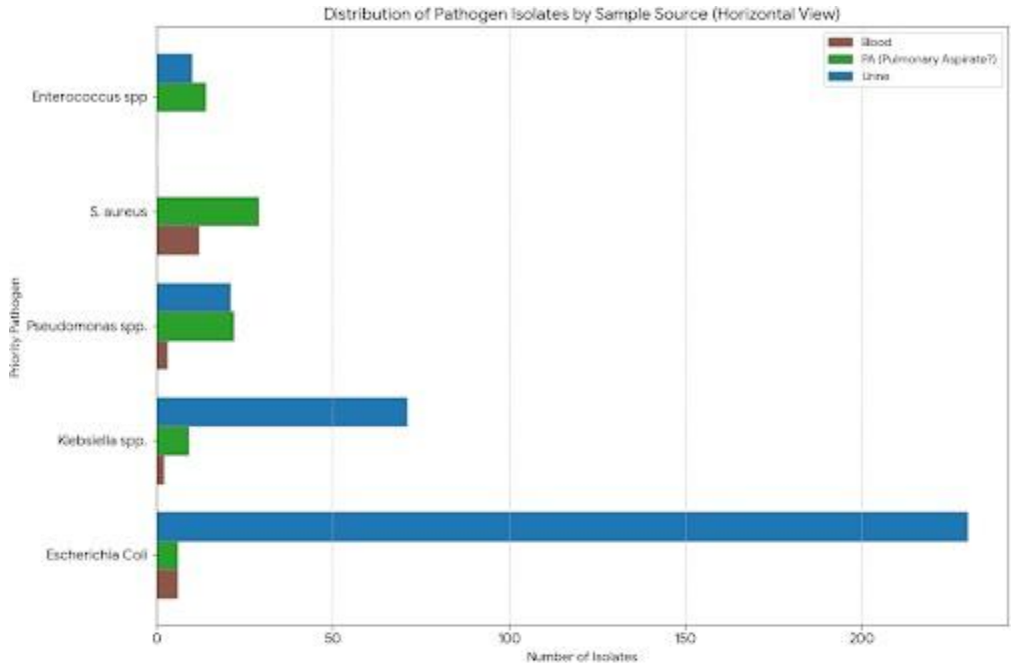


FIGURE 6: SPECIMEN-WISE ISOLATION OF PRIORITY PATHOGENS

Location type	Number of isolates	(%)
Out	381	62.98
In	211	34.88
Icu	13	2.14

TABLE 4 : DISTRIBUTION OF ISOLATES BY LOCATION TYPE

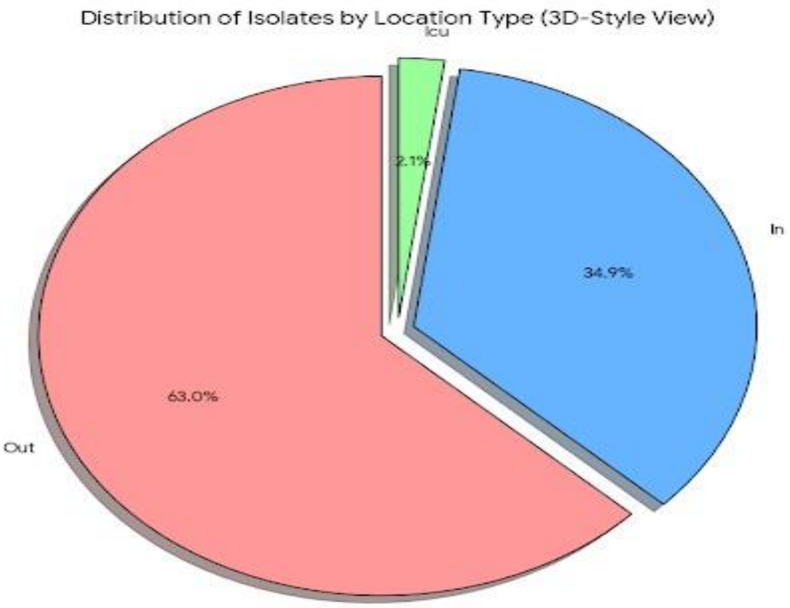


FIGURE 7: DISTRIBUTION OF ISOLATES BY LOCATION TYPE

GRAM POSITIVE COCCI

Staphycoccus aureus

Antibiotic tested	Blood (N = 12)			PA (N = 29)		
	Number tested	Number Resistan	Resistan	Number tested	Number Resistan	Resistan ce
Cefoxitin	12	2		29	4	
Gentamicin	12	0		29	0	
Ciprofloxacin	12	8		29	15	

Trimethoprim/Sulfamethoxazole	12	2		29	8	
Clindamycin	12	2		29	2	
Erythromycin	12	7		29	19	
Linezolid	12	0		29	0	
Teicoplanin						
Doxycycline	12	2		29	2	
Vancomycin	12	0		29	0	

Since number of isolates are less than 30 in number, percentage resistance not calculated

TABLE 5 :RESISTANCE PROFILE OF STAPHYLOCOCCUS AUREUS

Out of the 41 isolates, 12 were from blood, 29 from PA . Methicillin resistance was observed in 2 of blood isolates and 4 in PA . Erythromycin resistance was observed in 7 isolates of *S. aureus* isolated from blood; 19 isolates from PA .

Enterococcus species

TABLE 6 : RESISTANCE PROFILE OF ENTEROCOCCUS SPECIES

Resistance profile of Enterococcus species

Antibiotic tested	PA (N=14)			Urine (N=10)		
	Number tested	No. Resistant	Resistance %	Number tested	No. Resistant	Resistance %
Ampicillin	14	1		10	0	
Gentamicin-HLAR	14	0		10	0	
Ciprofloxacin				10	2	
Erythromycin	14	3				
Linezolid	14	0		10	0	
Vancomycin	14	0		10	0	
Teicoplanin					0	
Doxycycline	14	0				
Fosfomycin						
Tetracycline						
Nitrofurantoin				10	0	

Since number of isolates are less than 30 in number, percentage resistance not calculated

Out of the 24 isolates, 14 were from pus aspirates and 10 were from urine. No VRE and no linezolid resistance were reported from the enterococcus isolates

a. *Gram negative bacilli*

The most commonly isolated gram negative bacilli were E*. coli*, *Klebsiella species, Pseudomonas species*, *Acinetobacter species*. No *Salmonella* , *Shigella* or *Vibrio cholerae* cases were reported during this period

E coli

The highest number of *E. coli* was reported from urine samples, followed by PA and blood . Ampicillin resistance in *E. coli* was observed to be more than 95% in urine specimen. Cefotaxime resistance was observed in 46% of *E. coli* isolated from urine specimens Carbapenem resistance observed in *E. coli* isolates from urine was 1.67%. For non-beta-lactam antibiotics, 43.7% resistance was observed to ciprofloxacin and trimethoprim-sulfamethoxazole (TMP/SMX). Around 5.2% resistance to nitrofurantoin was seen in urinary isolates .

Antibiotic tested	Blood (N=6)			PA (N=6)			Urine (N=230)		
	Number tested	Number	Resistance %	Number tested	Number	Resistance %	Number tested	Number	Resistance %
Ampicillin	6	6		6	6		230	223	97
Amoxicillin/ Clavulanic acid	6	3		6	3		145	12	8.3
Piperacillin/ Tazobactam	6	3		6	5		230	4	1.8
Cefuroxime									
Ceftriaxone	6	0		6	1		230	105	46
Cefotaxime	6	0		6	1		230	105	46
Imipenem	6	4					180	3	1.67
Meropenem	6	4					180	3	1.67
Amikacin	6	3		6	6		230	6	2.8
Gentamicin	6	3		6	5		230	50	22
Ciprofloxacin	6	0		6	3		230	100	43.7
Trimethoprim/ Sulfamethoxazole	6	3		6	4		230	100	43.7
Colistin									

Doxycycline							150	31	20.6
Fosfomycin									
Nitrofurantoin							230	12	5.2

TABLE 7: RESISTANCE PROFILE OF *Ecoli*

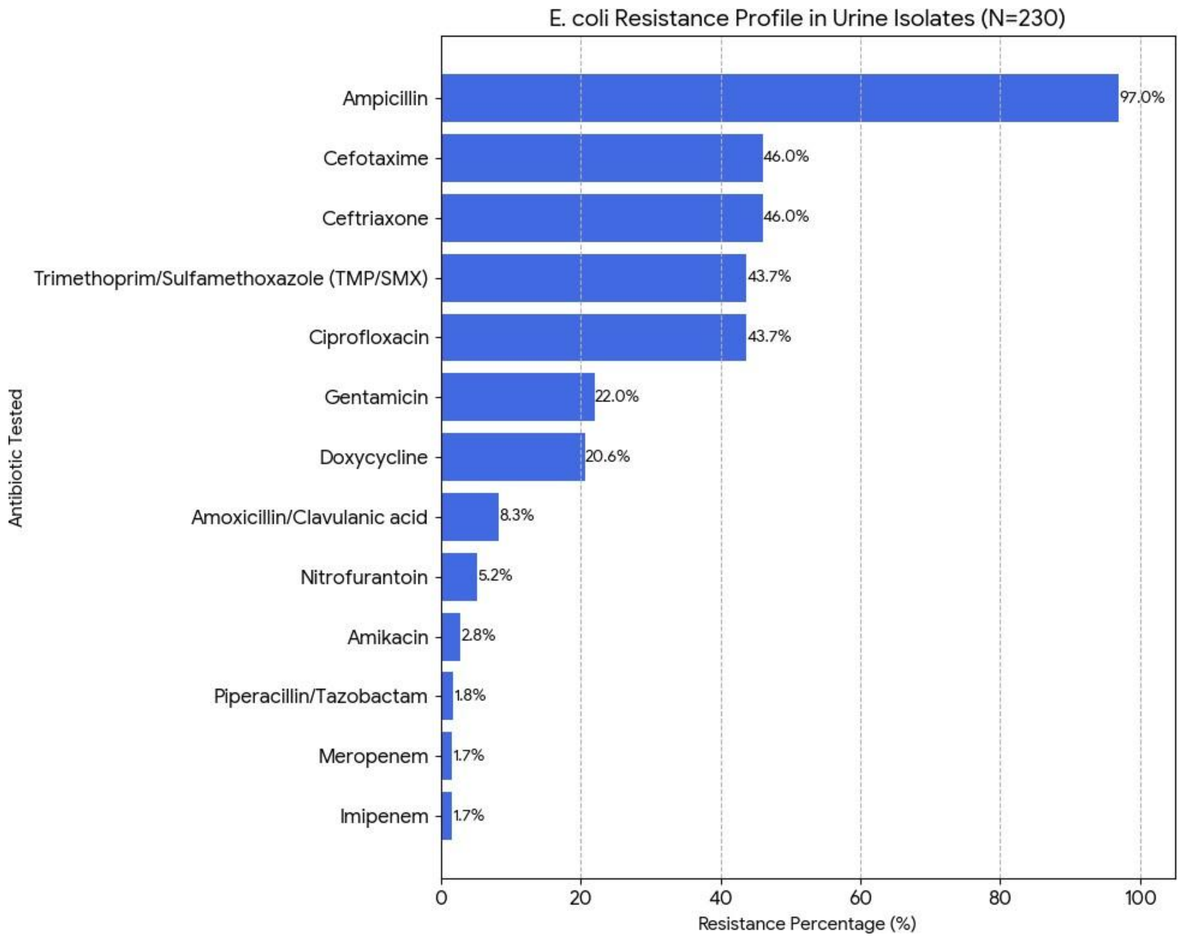


FIGURE 8: RESISTANCE PERCENTAGE OF *E coli* in urinary isolates

Resistance profile of *Klebsiella* species

Cefotaxime resistance in urinary isolates was found to be 38.1%. Carbapenem resistance was found to be 2.4%. For non-beta-lactam antibiotics, Ciprofloxacin resistance was found to be 26.2% and TMP-SMZ resistance was found to be 28.7%

Antibiotic tested	**Blood** (N=2)			**PA** (N=9)			**Urine** (N=71)		
	Number	Number	Resistanc	Number	Number	Resistanc	Number	Number	Resistanc
Amoxicillin/ Clavulanic acid	2	2		9	6		65	9	14. 3
Piperacillin/ Tazobactam	2	2		9	8		71	4	6.5
Cefuroxime									
Ceftriaxone	2	2		9	5		71	27	38. 1
Cefotaxime	2	2		9	5		71	27	38. 1
Cefepime									
Ertapenem									
Imipenem	2	2		9	8		65	2	2.4
Meropenem	2	2		9	8		65	2	2.4
Amikacin	2	2		9	9		71	4	5.4
Gentamicin	2	2		9	9		71	9	12. 5

Antibiotic tested	Blood (N=2)			PA (N=9)			Urine (N=71)		
	Number	Number	Resistanc	Number	Number	Resistanc	Number	Number	Resistanc
Ciprofloxacin	2	2		9	7		71	18	26.2
Trimethoprim/ Sulfamethoxazole	2	2		9	7		71	20	28.7
Colistin									
Doxycycline									
Nitrofurantoin							71	38	54.2

TABLE 8: RESISTANCE PROFILE OF *Klebsiella* species

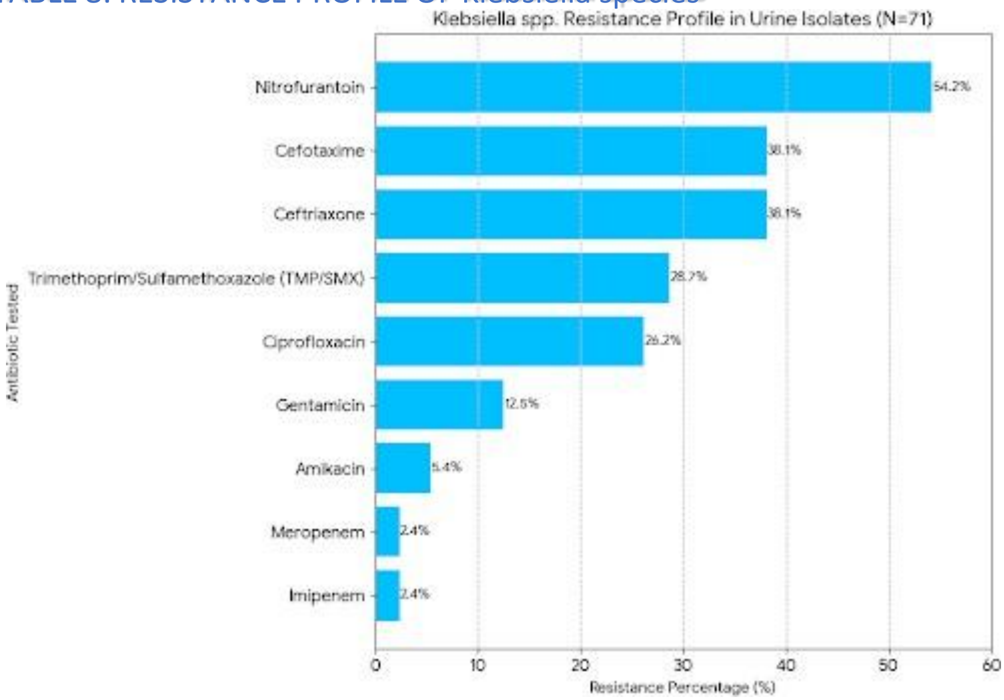


FIGURE 9: RESISTANCE PROFILE OF Klebsiella IN URINE

Non-fermenting Gram-negative bacilli

Among the non-fermenting Gram-negative bacilli (NFGNB) . *Pseudomonas species* was the most common pathogen isolated followed by *Acinetobacter species*

Pseudomonas species

Maximum number of samples were from pus aspirates followed by urine. Four out of 22 PA were resistant to Ceftazidime. Carbapenem resistance wasn't observed in any specimens

Resistance profile of Pseudomonas species

Antibiotic tested	**Blood** (N=3)			**PA** (N=22)			**Urine** (N=21)		
	Number	Number resistant		Number	Number	Resistance	Number	Number	Resistance
Piperacillin / Tazobactam	3	0		22	0		21	0	
Ceftazidime	3	1		22	4		21	1	
Aztreonam									
Imipenem	3	0		22	0		21	0	

Meropenem	3	0		22	0		21	0	
Amikacin	3	0		22	2		21	0	
Gentamicin	3	0					21	0	
Ciprofloxacin	3	1		22	3		21	3	
Colistin									
Netilmicin									

TABLE 10: Resistance profile of Pseudomonas species

Since number of isolates are less than 30 in number, percentage resistance not calculated

CONCLUSION

- The analysed antibiogram suggests that urinary tract infections(UTIs), respiratory, skin and soft tissue infections were the most common reasons for ordering culture and sensitivity tests in our setting.
- The predominant isolates were Gram-negatives as compared to the gram-positive ones.
- Gram-negative isolates of the study showed a lower sensitivity to Penicillin, Cephalosporins.
- Most of the second line antibiotics, still shows a higher sensitivity which necessitates a rational use of these antibiotics to prevent resistance in future.

DISTRICT ANTIBIOGRAM, THIRUVANANTHAPURAM

JANUARY 2023- DECEMBER 2024

AMR HUB LAB
General hospital Thiruvananthapuram

Spoke hospitals- 6

W& C hospital Thycaud GH Neyyattinkara Taluk hospital Fort Taluk hospital Varkkala Taluk hospital Attingal DMH Peroorkada.

Prepared by:

Dr Renuka. M, MO, AMR HUB LAB

Dr Ceena. V. Netto, Consultant, GH Thiruvananthapuram

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Phone : 0471-2471291 e-mail- dmohealthtvm@gmail.com

MESSAGE

Antimicrobial resistance (AMR) represents a growing and complex challenge to public health, with significant implications for the affective management of infectious diseases. Ensuring the rational, judicious, and evidence-based use of antibiotics is essential to optimize patient care and to preserve the effectiveness of antimicrobial agents for the future.

The District Antibiogram of Thiruvananthapuram has been developed through systematic compilation and analysis of microbiological data collected over a two-year period from January 2023 to December 2024. Data from the AMR Hub Laboratory, General Hospital Thiruvananthapuram, along with six major hospitals across the district, have been included. This document presents local antimicrobial resistance and sensitivity patterns of priority pathogens isolated from urine, pus, blood, and ICU specimens, following WHO-recommended methodologies and CLSI/EUCAST guidelines.

By capturing resistance trends across outpatient, inpatient, ICU, and secondary-care settings, this district antibiogram serves as a practical and evidence-based guide for clinicians in selecting appropriate empirical therapy based on local epidemiology. It also strengthens ongoing AMR surveillance and supports the implementation of antimicrobial stewardship activities across health care facilities in the district.

I acknowledge with appreciation the dedicated contributions of everyone involved in the preparation of this district antibiogram. I am confident that this document will support informed clinical decision-making, strengthen antimicrobial stewardship efforts, and contribute to improved patient care and safety in Thiruvananthapuram district.

Dr Bindu Mohan
District Medical Officer (Health)
Thiruvananthapuram

Dr Krishnaveni. V

Superintendent

General hospital,

Thiruvananthapuram

MESSAGE

Modern medicine conquered premature deaths to a limit by treating infections with antimicrobials and by giving vaccinations to vaccine preventable diseases to due candidates. AMR (Antimicrobial resistance) attained by common pathogenic organisms is a critical problem in public health interfering in our ability to treat infections effectively. Infections caused by drug resistant organisms compel doctors to treat with higher antimicrobials with many side effects. Infections caused by multi drug resistant organisms needs longer hospital stay, higher medical costs and high death rate.

Effective surveillance of antimicrobial resistance and antimicrobial stewardship are very important steps to prevent development of antimicrobial resistance among common pathogenic bacteria. Clinicians can develop an antibiotic policy to select antibiotic for empirical therapy of infection, if they get the data of resistance among the priority pathogens isolated from priority specimens collected from patients attending the important hospitals in a defined geographical area, like district.

AMR HUB Lab of General hospital, Thiruvananthapuram is receiving specimens for culture and sensitivity from patients attending General hospital, Thiruvananthapuram and the spoke hospitals attached to General hospital, Thiruvananthapuram. Using the data of sensitivity/resistance pattern of priority pathogens from priority specimens as per WHO is prepared. Both location wise and data of isolates from spoke hospital patients are prepared. Doctors working in the hospitals in Thiruvananthapuram district can refer to this Antibiogram and form the antibiotic policy to treat common bacterial infections.

I would like to congratulate the team of the health service department for publishing the district Antibiograms for various districts including Thiruvananthapuram district. I hope clinicians will use this data effectively.

Dr Krishnaveni. V

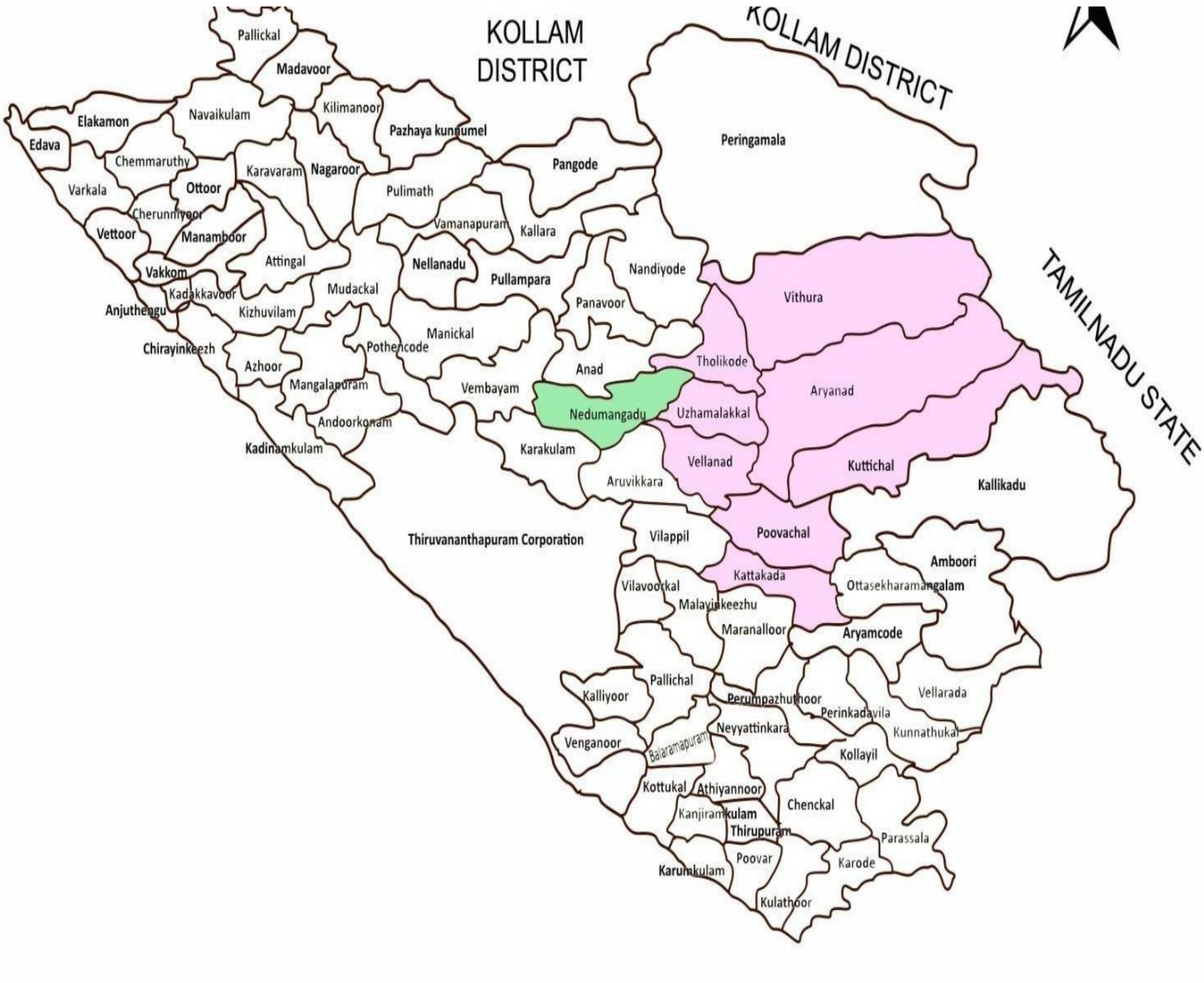
Superintendent

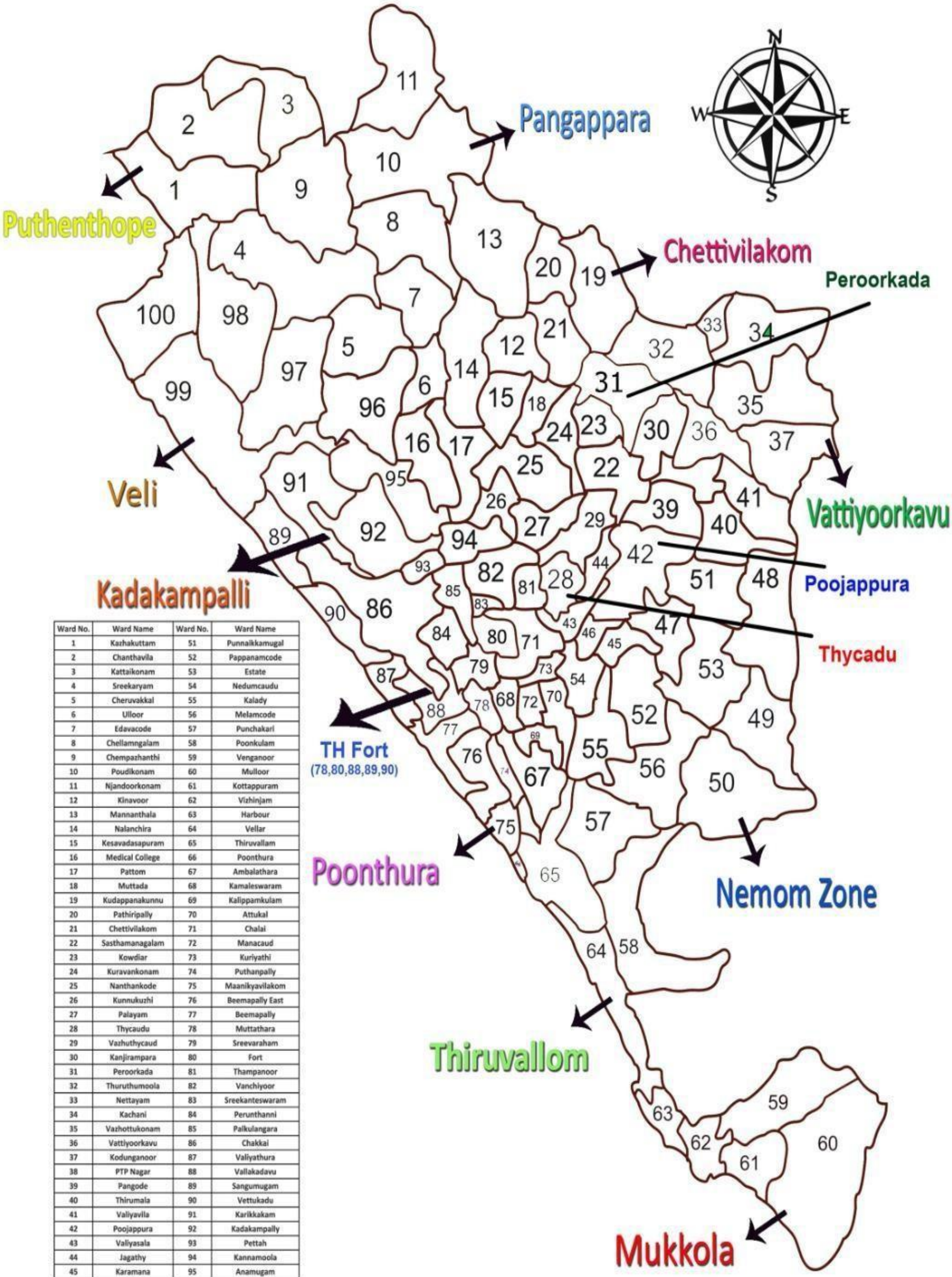
General hospital, Thiruvananthapuram

Superintendent
General Hospital
Thiruvananthapuram

GOVT. GENERAL HOSPITAL
THIRUVANANTHAPURAM-35.

Dr.V. KRISHNAVENI. MBBS MBA
DEPUTY DHS
SUPERINTENDENT
GENERAL HOSPITAL
THIRUVANANTHAPURAM


KOLLAM DISTRICT
KOLLAM DISTRICT
TAMILNADU STATE
Pallickal
Madavoor
Elakamon
Navaikulam
Kilimanoor
Pazhaya kunnumel
Edava
Chemmaruthy
Karavaram
Nagaroor
Pangode
Peringamala
Varkala
Ottoor
Pulimath
Cherunniyoor
Vamanapuram
Kallara
Vettoor
Manamboor
Attingal
Nellanadu
Nandiyode
Vakkom
Kadakkavoor
Mudackal
Pullampara
Vithura
Anjuthengu
Kizhuvilam
Panavoor
Chirayinkeezh
Manickal
Pothencode
Azhoor
Tholikode
Anad
Mangalapuram
Vembayam
Aryanad
Nedumangadu
Uzhamalakkal
Andoorkonam
Kadinamkulam
Karakulam
Vellanad
Kuttichal
Kallikadu
Aruvikkara
Poovachal
Thiruvananthapuram Corporation
Vilappil
Amboori
Kattakada
Vilavoorkal
Ottasekharamangalam
Malayinkeezhu
Maranalloor
Aryamcode
Pallichal
Vellarada
Kalliyoor
Perumpazhuthoor
Perinkadavila
Neyyattinkara
Kunnathukal
Venganoor
Balaramapuram
Kollayil
Kottukal
Athiyannoor
Chenckal
Kanjiramkulam
Thirupuram
Parassala
Karumkulam
Poovar
Karode
Kulathoor



Ward No.	Ward Name	Ward No.	Ward Name
1	Kazhakuttam	51	Punnaikkamugal
2	Chanthavila	52	Pappanamcode
3	Kattaikonam	53	Estate
4	Sreekaryam	54	Nedumcaudu
5	Cheruvakkal	55	Kalady
6	Ulloor	56	Melamcode
7	Edavacode	57	Punchakari
8	Chellamngalam	58	Poonkulam
9	Chempazhanthi	59	Venganoor
10	Poudikonam	60	Mulloor
11	Njandoorkonam	61	Kottappuram
12	Kinavoor	62	Vizhinjam
13	Mannanthala	63	Harbour
14	Nalanchira	64	Vellar
15	Kesavadasapuram	65	Thiruvallam
16	Medical College	66	Poonthura
17	Pattom	67	Ambalathara
18	Muttada	68	Kamaleswaram
19	Kudappanakunnu	69	Kalippamkulam
20	Pathiripally	70	Attukal
21	Chettivilakom	71	Chalai
22	Sasthamanagalam	72	Manacaud
23	Kowdiar	73	Kuriyathi
24	Kuravankonam	74	Puthanpally
25	Nanthankode	75	Maanikyavilakom
26	Kunnukuzhi	76	Beemapally East
27	Palayam	77	Beemapally
28	Thycaudu	78	Muttathara
29	Vazhuthycaud	79	Sreevaraham
30	Kanjirampara	80	Fort
31	Peroorkada	81	Thampanoor
32	Thuruthumoola	82	Vanchiyoor
33	Nettayam	83	Sreekanteswaram
34	Kachani	84	Perunthanni
35	Vazhottukonam	85	Palkulangara
36	Vattiyoorkavu	86	Chakkai
37	Kodunganoor	87	Valiyathura
38	PTP Nagar	88	Vallakadavu
39	Pangode	89	Sangumugam
40	Thirumala	90	Vettukadu
41	Valiyavila	91	Karikkakam
42	Poojappura	92	Kadakampally
43	Valiyasala	93	Pettah
44	Jagathy	94	Kannamoola
45	Karamana	95	Anamugam
46	Aranoor	96	Akkulam
47	Mudavanmugal	97	Kulathoor
48	Thrikannapuram	98	Attippra
49	Nemom	99	Poundukadavu
50	Ponnumangalam	100	Pallithura

Preface

We are hereby submitting the Antibiogram prepared from the data during the period 01-01-2023 to 31- 12-2024. The antibiotic resistance pattern of priority pathogens we could isolate from priority specimens according to WHO, are given here. The data of frequent isolates from samples for the period January 2023 to December 2024 are also shown here.

We need the data / sensitivity pattern of minimum 30 isolates to calculate the percentage of sensitivity/ resistance. Those isolates of < 30 in number charts are prepared from which we can make rough assessment of sensitivity/ resistance of the primary pathogens present in the area. Yet a bar diagram is also shown for those who are interested, without mentioning the percent of sensitivity. Whenever we could isolate only one pathogen during this 2 year, the data of sensitivity/ resistance is mentioned as statement, rather than as a table.

The pathogens can be divided into those isolated from in patients, out patients & ICU patients. For the pathogens which were many, separate antibiograms for the specimen collected from out patients and in patients are prepared. MICU isolates were very few. And those were isolated from the patients admitted in MICU, General hospital. Thiruvananthapuram. Since very little in number, only charts are prepared for relevant isolates.

The Antibiogram of spoke hospitals are given as separate because those are either primary / secondary care centers. Those who are interested in the resistance of priority pathogens isolated from patients attending primary & secondary care centers of Thiruvananthapuram district can refer that.

The antibiogram is prepared on the data collected for 2 years. Otherwise the number of isolates of each pathogen would be too small to make assessments.

DR Renuka. M

DR Ceena. V. Netto

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Table - 5	Resistance pattern of *Salmonella* typhi in Blood
Table - 6	Resistance pattern of *Shigella flexneri* in Stool
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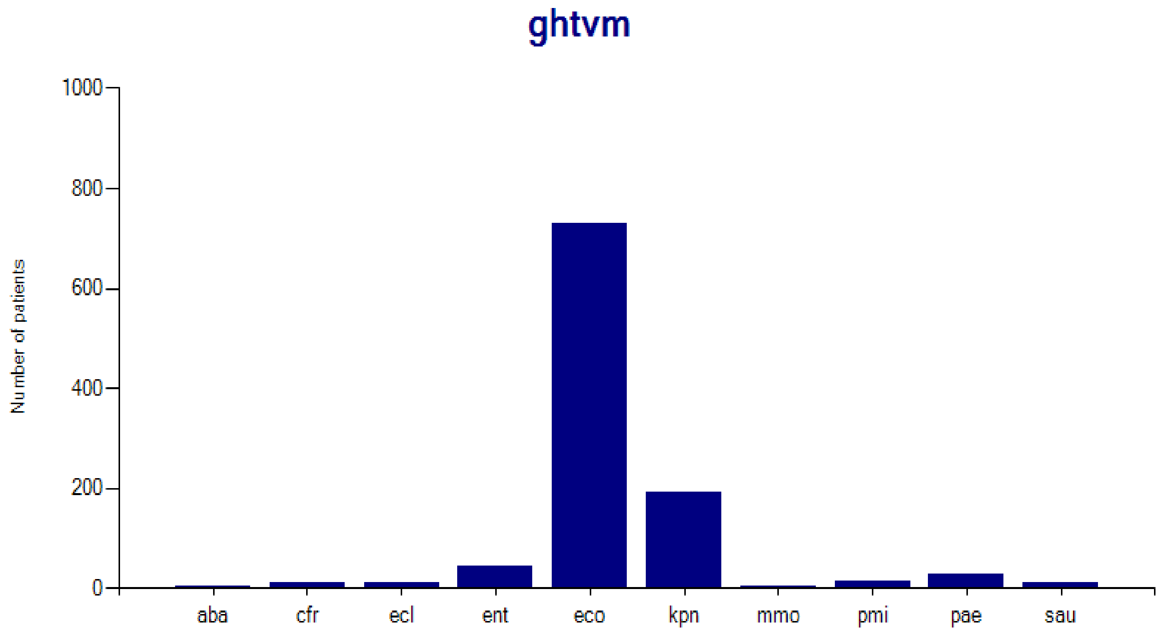
Chart -1

Data of Isolates from Urine/ total 1138 isolates January 2023- December 2024

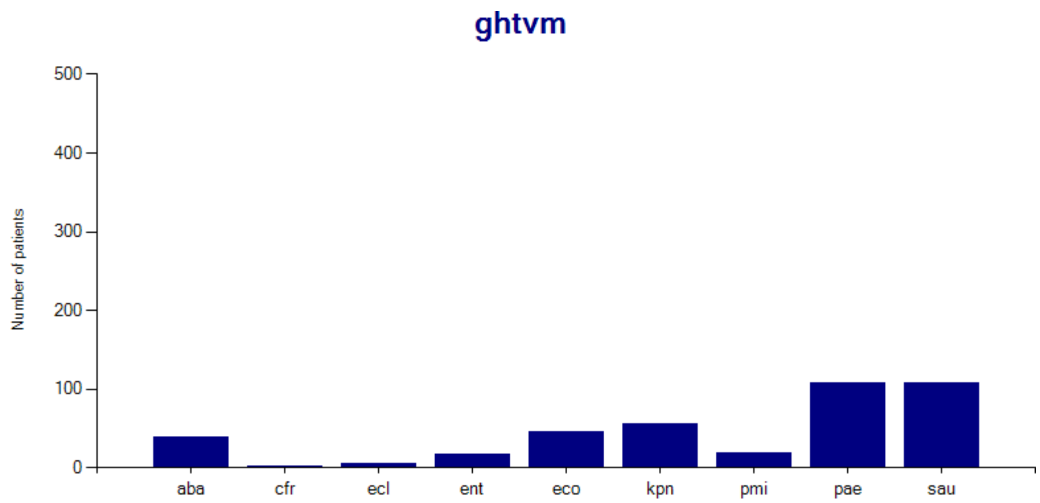


E.coli was the main isolate from urine specimens

Refer the list of Abbreviations of names of bacterial pathogens

Chart -2

Data of Isolates from PUS / total 404 isolates January 2023- December 2024



Both Staphylococcus aureus & Pseudomonas aeruginosa were isolated in almost same number from pus samples.

Chart - 3

Data of Isolates from Blood / total 38 isolates January 2023- December 2024

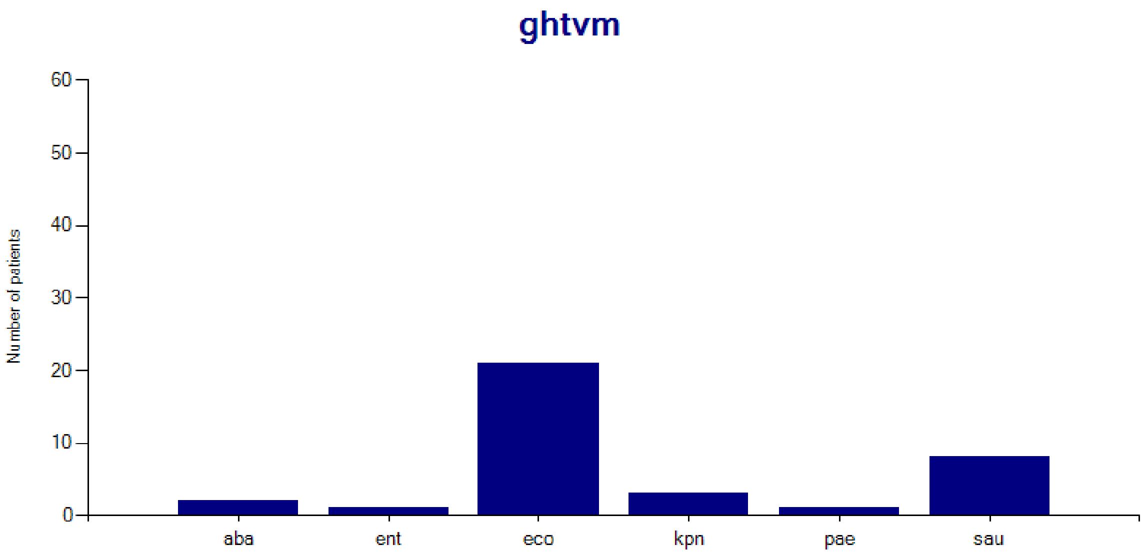
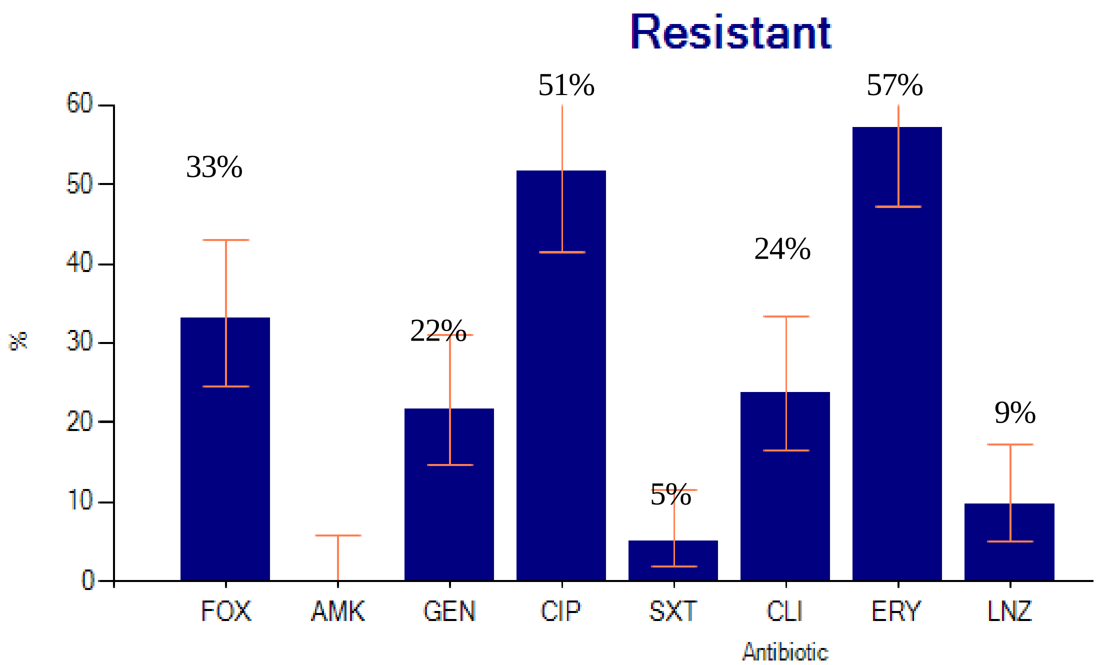


Chart 3 shows that mainly E.coli followed by Staphylococcus aureus cause blood stream infections

GRAM POSITIVE COCCI

Chart -4   Antibiotic resistance pattern of *Staphylococcus aureus* in Pus (N= 106)



Vancomycin MIC was not performed . So resistance /sensitivity pattern is not shown

Teicoplanin disc diffusion method is not accepted by CLSI. So it is not shown

Table – 1

Resistance pattern of *Staphylococcus aureus* in Blood

January 2023- December 2024 (N=9)

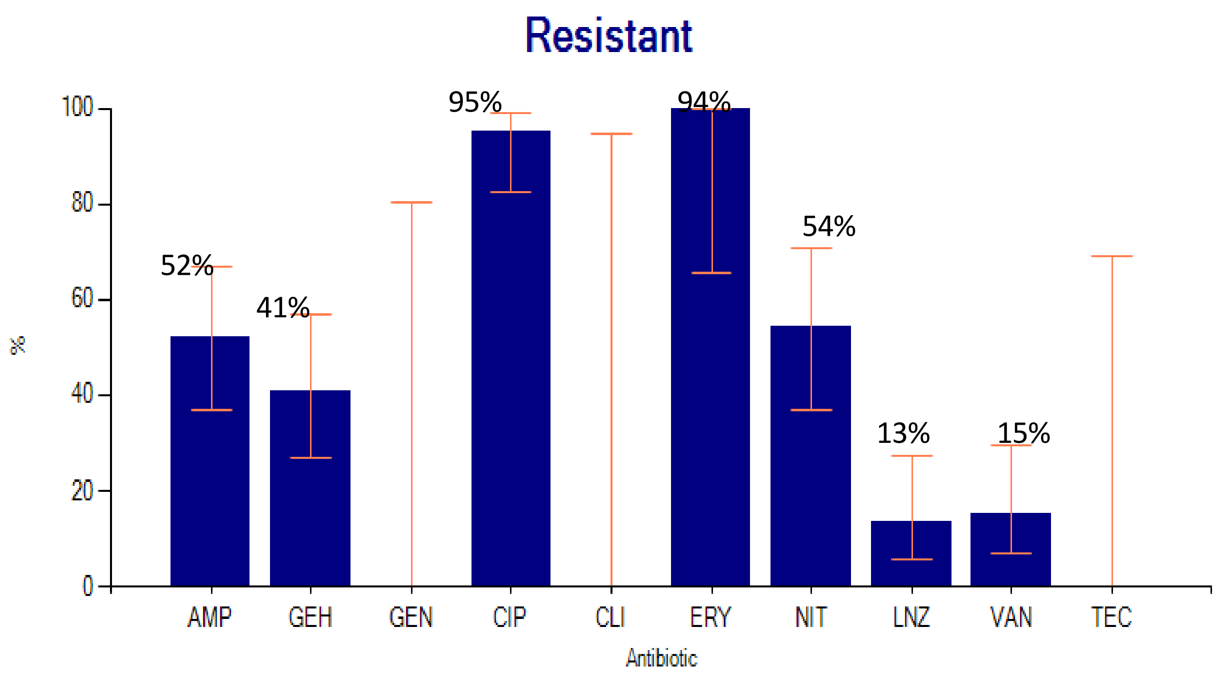
Antibiotics	No of resistant Isolates
Cloxacillin	2/9
Gentamicin	4/9
Ciprofloxacin	6/9
Trimethoprim/Sulfamethoxazole	0/9
Clindamycin	4/9
Erythromycin	8/9
Amikacin	0/9
Linezolid	1/9
Teicoplanin	0/9

Do not report susceptibility % bar charts if >30 isolates are not tested

Vancomycin MIC is not done

Chart -5

Antibiotic resistance pattern of *Enterococcus* sp. in Urine (N= 46)



TMP/SMX- Trimethoprim/sulfamethoxazole is not effective against Enterococcus.

Enterococcus spp is intrinsically resistant to Clindamycin

Only high level gentamicin is tested

Table - 2

Resistance of *Enterococcus* species isolated from Pus

January 2023 - December 2024 (N= 18)

Antibiotics	No of resistant Isolates
Ampicillin	4/18
Gentamicin-High	3/18
Erythromycin	17/18
Linezolid	2 /18
Vancomycin	5/18

Do not report susceptibility % bar charts if >30 isolates are not tested

^Sites using automated method may extrapolate results of Benzylpenicillin for ampicillin sensitivity

Gram- negative bacilli

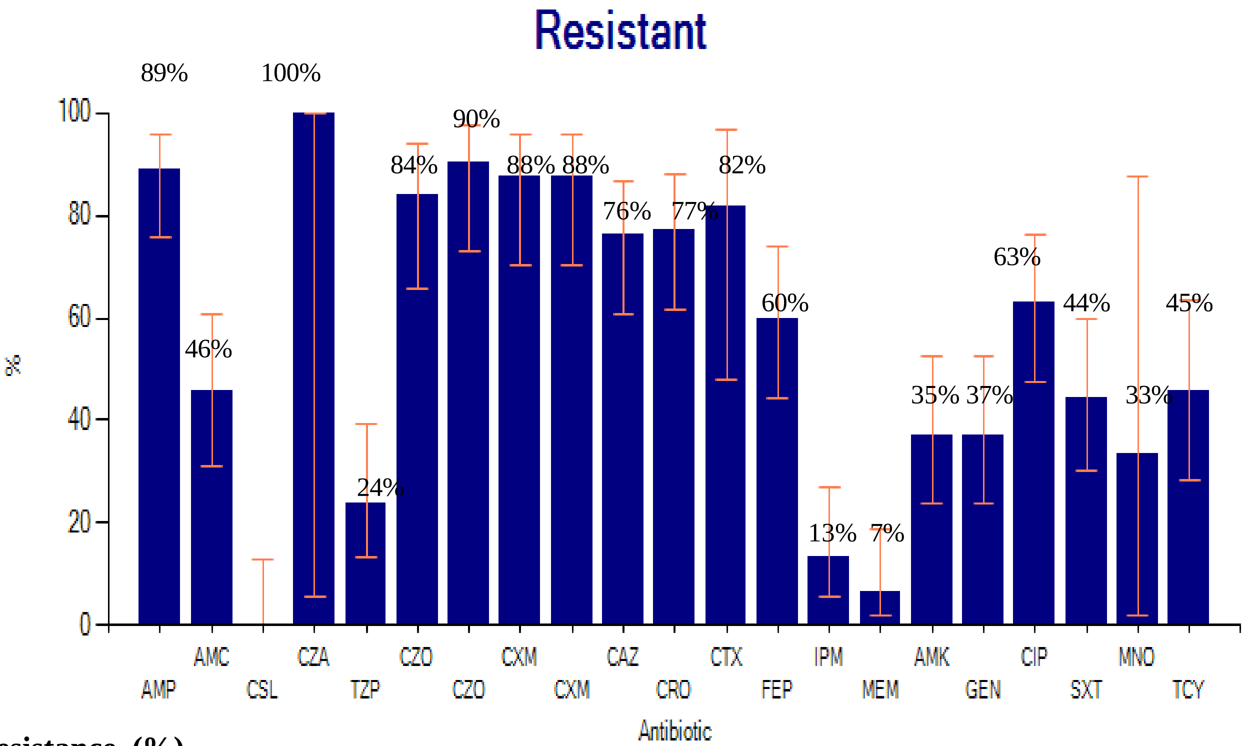
Enterobacterales

Table -3 Resistance pattern of *Escherichia coli* Isolated from Blood (N=21)*

Antibiotics	No. of resistant Isolates
Ampicillin	20/21
Amoxicillin/Clavulanic acid	14/21
Piperacillin/Tazobactam	9/21
Cefuroxime	19/21
Ceftriaxone	16/21
Cefotaxime	21/21
Cefepime	17/21
Imipenem	3/21
Meropenem	4/21
Amikacin	10/21
Gentamicin	9/21
Ciprofloxacin	**11/15**
Trimethoprim/Sulfamethoxazole	16/21

Chart - 6

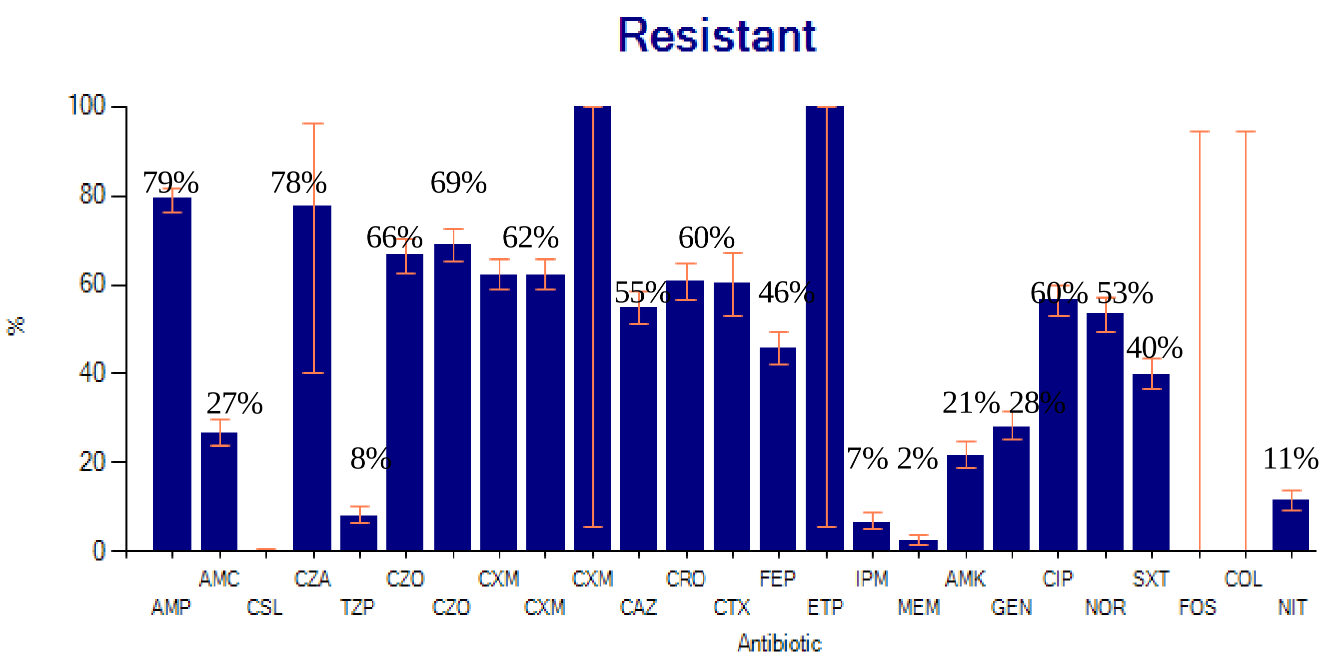
Antibiotic resistance pattern of *Escherichia coli* in Pus (N= 46)*



Resistance (%)

Chart – 7

Antibiotic resistance pattern of *Escherichia coli* in Urine (N= 813)*



Colistin MIC is not done. Cefoperazone/sulbactam sensitivity is tested as per EUCAST guidelines. WHO-NET software based on CLSI guidelines is used to make this chart

Table- 4

Resistance pattern of *Klebsiella* spp. Isolated from Blood (N=3)*

Antibiotics	stant *Klebsiella* Isolates/ No of isolates tested
Meropenem	0/3
Imipenem	1/3
PipTaz	2/3
TMP/SMX	0/3
Amox-clav	1/3
Cefuroxime	2/3
Cefotaxime	1/3
Cefepime	2/3
Amikacin	1/3
Gentamicin	1/3
Ciprofloxacin	2/3

Do not report susceptibility % bar charts if >30 isolates are not tested

TMP/SMX - Trimethoprim/sulfamethoxazole

PipTaz - Piperacillin/tazobactam

Chart - 8

Antibiotic resistance pattern of *Klebsiella* spp. in urine (N= 197)*

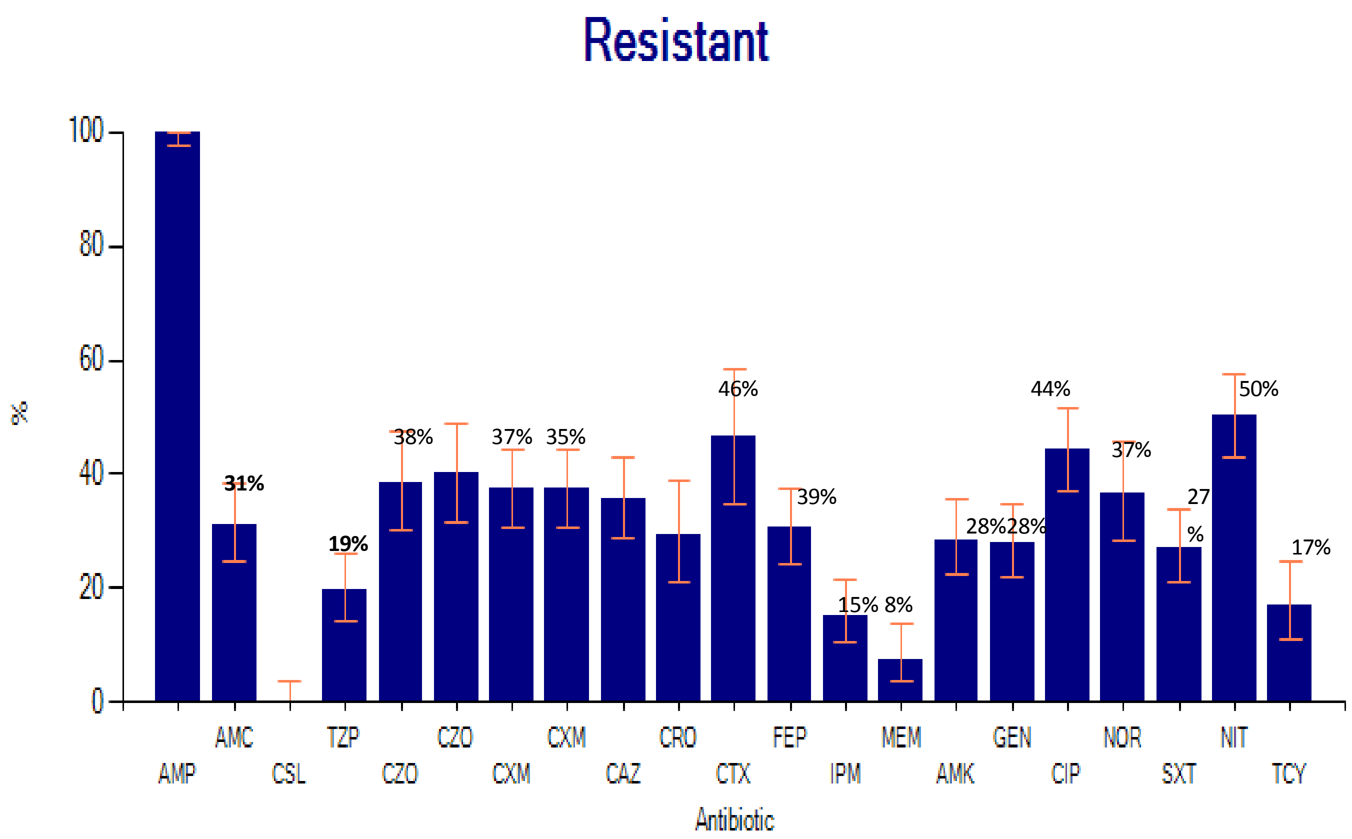


Chart – 9

Antibiotic resistance pattern of *Klebsiella* spp.from Pus (N= 53)*

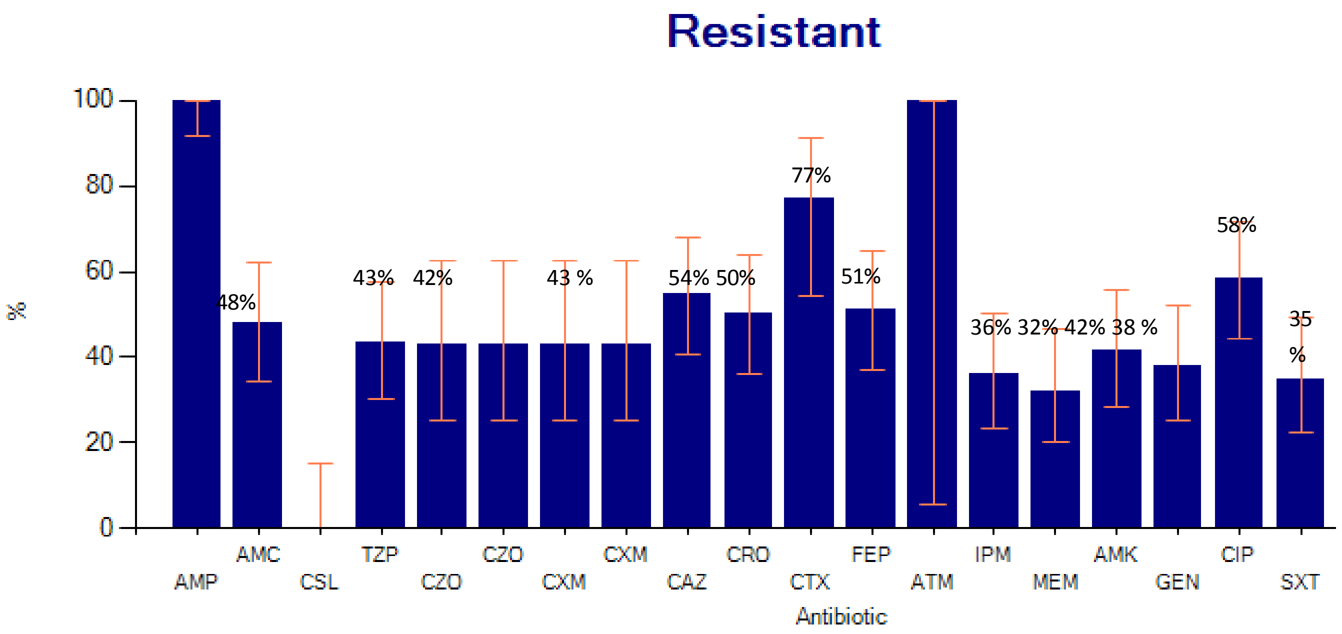


Table-5

Resistance pattern of *Salmonella* Typhi in Blood

January 2023- December 2024(N=4)*

Antibiotics	**No: of Resistant Isolates** ***Total Salmonella* Typhi**
Ampicillin	0/4
Ciprofloxacin	1/4
Chloramphenicol	0/4
Ceftriaxone	0/4
Imipenem	0/4
Azithromycin	0/4

*When isolates are < 30 in number, they are not statistically significant when expressed in proportions

Hence the usage of Numerator and Denominator is advisable

TMP/SMX - Trimethoprim/sulfamethoxazole

Table-6

Resistance pattern of *Shigella flexneri* isolated from Stool January 2023 - December 2024(N=3)*

Antibiotics	No: of Resistant Isolates *of Shigella flexneri*
Ampicillin	2/3
Ciprofloxacin	3/3
Chloramphenicol	0/3
Ceftriaxone	0/3
Co-trimoxazole	3/3
Azithromycin	0/3

*When isolates are < 30 in number, they are not statistically significant when expressed in proportions

Hence the usage of Numerator and Denominator is advisable

Non- fermenters

Table-7

Resistance pattern of *Acinetobacter spp.* Isolated from urine January 2023 – December 2024(N= 5)*

Antibiotics	tant *Acinetobacter* Isolates/ No of isolates tested
Meropenem	3/5
Imipenem	3/5
Piperacillin/Tazobactam	2/5
Trimethoprim/Sulfamethoxazole	0/5
Amoxicillin-clavulanate	5/5
Cefuroxime	5/5
Ceftazidime	5/5
Ceftriaxone	5/ 5
Minocycline	1/5
Tetracycline	1/ 5
Amikacin	1/5
Gentamicin	2/ 5
Ciprofloxacin	3/ 5

Do not report susceptibility % bar charts if >30 isolates are not tested

Chart – 10

Antibiotic resistance pattern of *Acinetobacter spp.* in pus (N= 38)*

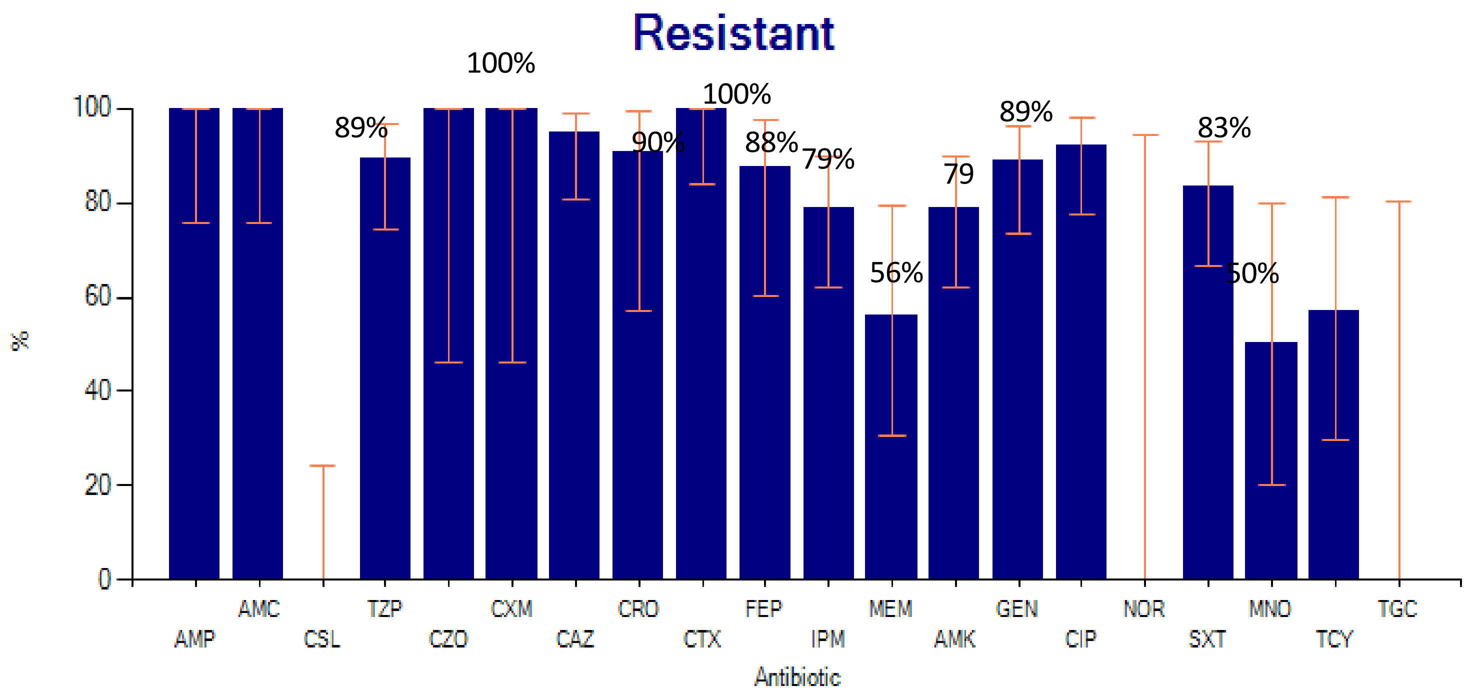


Table- 8

Resistance pattern of *Pseudomonas aeruginosa* isolated from Urine (N=27)*

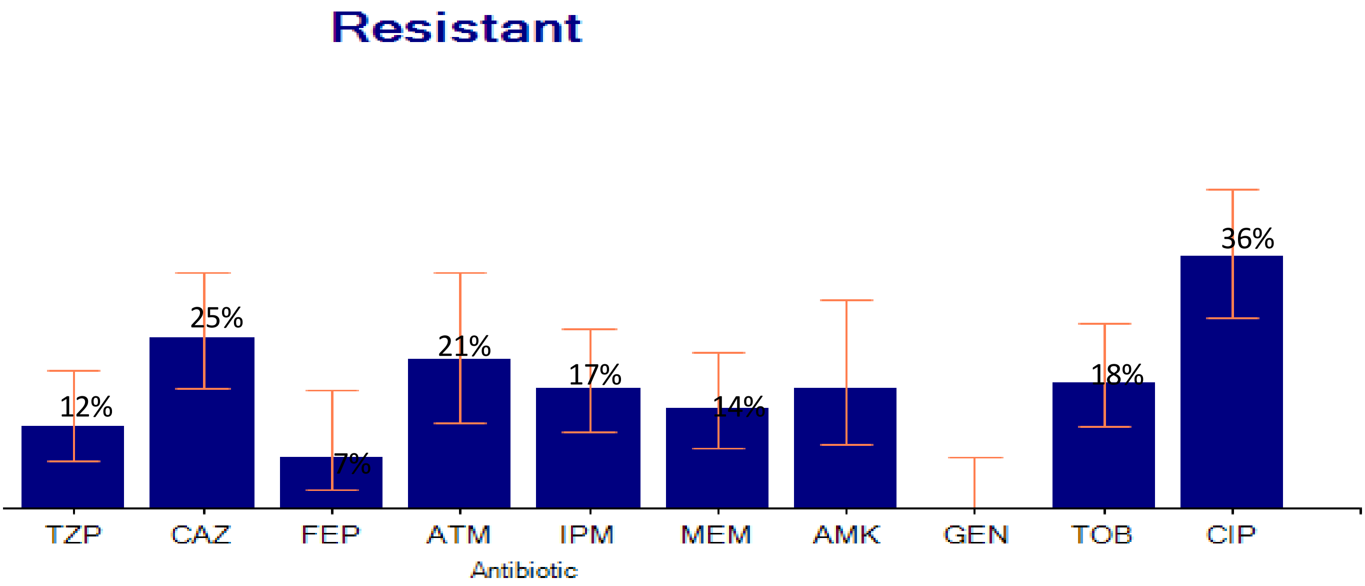
Antibiotics	No: of Resistant Isolates
Meropenem	4/27
Imipenem	4/27
Amikacin	4/27
Tobramycin	4/27
Ciprofloxacin	7/27
Piperacillin/Tazobactam	2/27
Ceftazidime	6/27
Cefepime	0/27

Do not report susceptibility % bar charts if >30 isolates are not tested

Amikacin can be used to treat UTI caused by *P.aeruginosa*

Chart - 11

Antibiotic resistance pattern of *Pseudomonas aeruginosa from pus* (N= 112)*



Antibiogram for the spoke hospitals Thiruvananthapuram

January 2023- December 2024

Spoke hospitals - 6

- General hospital Neyyattinkara
- Taluk hospital Fort
- W& C hospital Thycaud
- DMH Peroorkada
- Taluk hospital Attingal.
- Taluk hospital Varkala
- These hospitals are scattered in Thiruvananthapuram district. Common criteria for all these hospitals are that they are secondary care hospitals. So a multihospital Antibiogram is prepared.

General hospital Neyyattinkara , Taluk hospital Attingal & Taluk hospital Varkala are outside Thiruvananthapuram corporation. All other hospitals are situated in Thiruvananthapuram Corporation.

Gram positive cocci

Table -9

Antibiotic resistance pattern of *Staphylococcus aureus* in pus Spoke hospital specimens (N= 14)*

Antibiotics	No of Resistant Isolates/ Total
Cefoxitin	6/14
Gentamicin	3/14
Ciprofloxacin	8/14
TMP/SMX	1/14
Clindamycin	6/14
Erythromycin	11/14
Vancomycin	0/14
Linezolid	3/14
Teicoplanin	0/14

Table -10 Antibiotic resistance pattern of *Enterococcus* species in Urine Spoke hospital specimens (N=10)

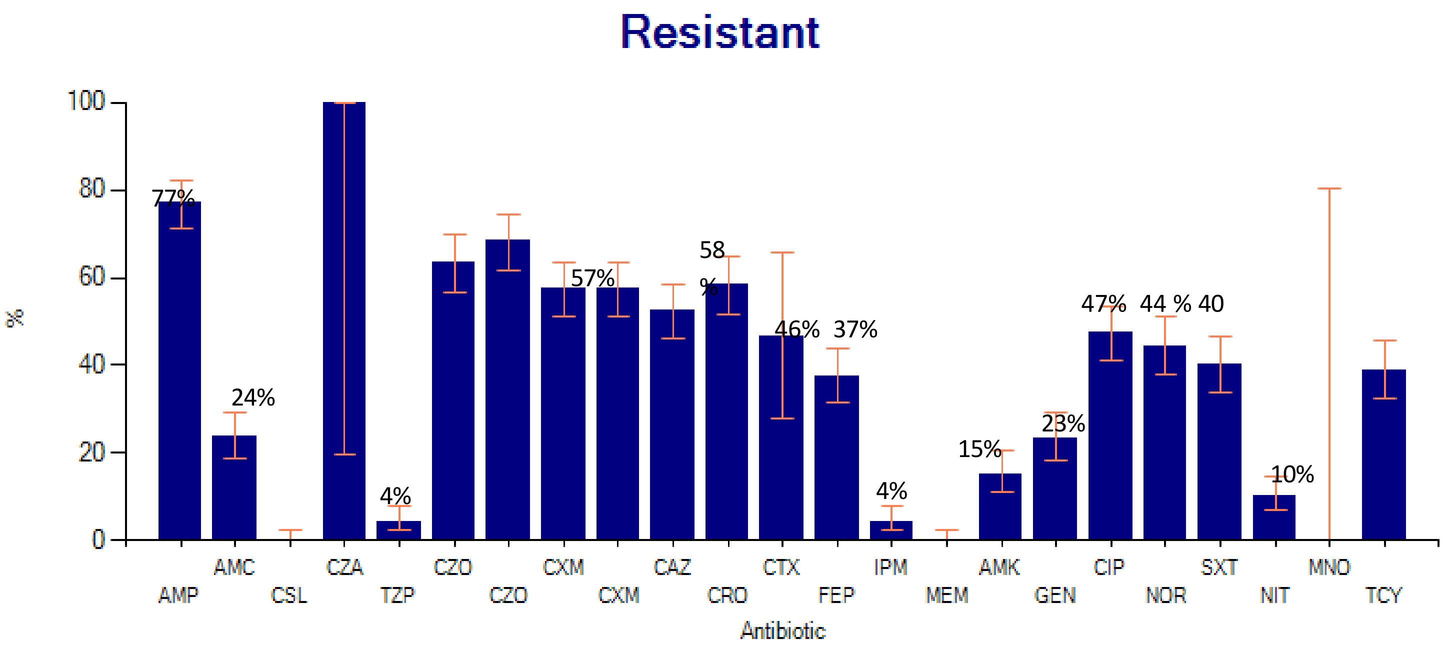
Antibiotics	No of resistant Isolates/ total
Linezolid	1/10
Ampicillin	2/10
Vancomycin*	1/10
Ciprofloxacin	10/10
Gentamicin (high level)	1/10
Nitrofurantoin	2/10
Erythromycin	10/10

Gram-negative bacilli

Enterobacterales

Chart - 12

Antibiotic resistance pattern of *Escherichia coli* in Urine Spoke hospital specimens (N=255)*



Antibiotic resistance pattern of *Escherichia coli* in Pus Spoke hospital specimens (N= 10)*

Antibiotics	No of resistant Isolates/total
Ampicillin	10/10
Amoxicillin/Clavulanic acid	4/10
Piperacillin/Tazobactam	0 /10
Cefuroxime	10/10
Ceftriaxone	9 /10
Cefotaxime	6/10
Cefepime	7/10
Imipenem	0/10
Meropenem	0/10
Amikacin	2/10
Gentamicin	3/10
Ciprofloxacin	5/10
imethoprim/Sulfamethoxa zole	4/10

Chart - 13

Antibiotic resistance pattern of *Klebsiella* spp. in Urine Spoke hospital specimens January 2023- December 2024 (N=51)*

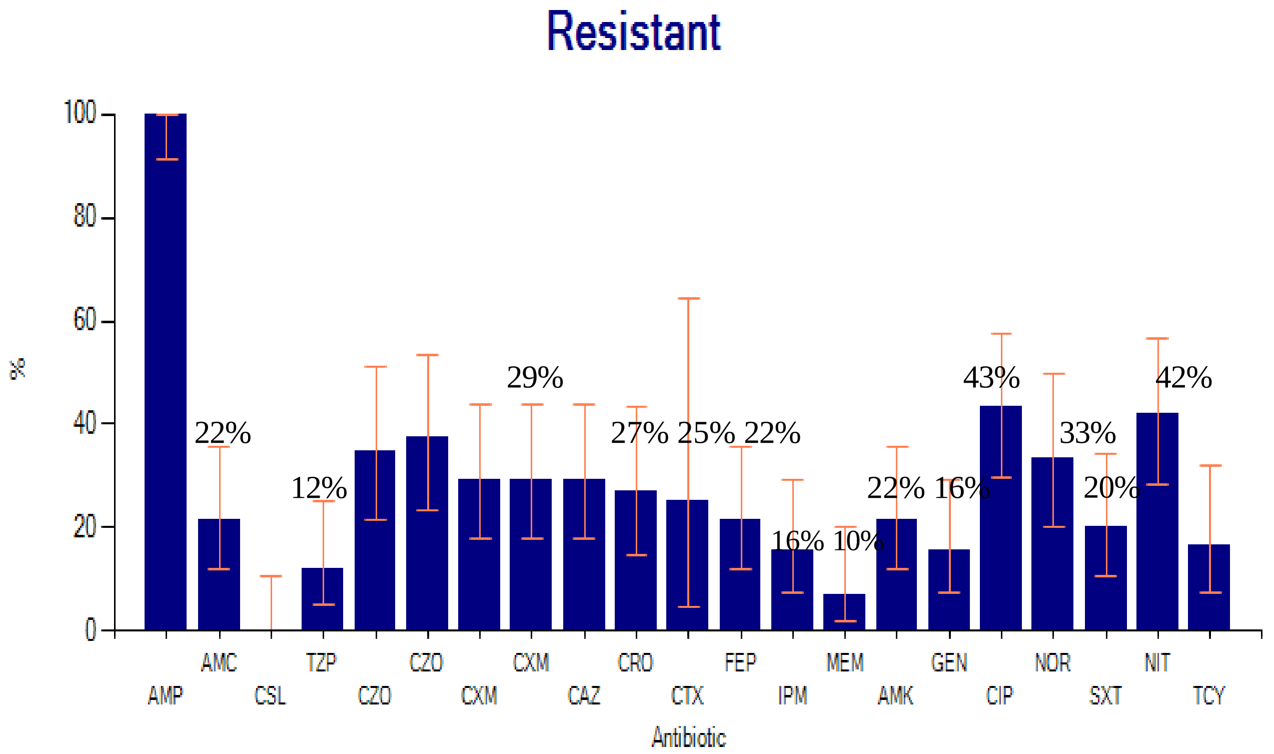


Table – 12

Antibiotic resistance pattern of *Pseudomonas* aeruginosa in Pus samples from spoke hospitals (N=9)*

Antibiotics	No of Resistant Isolates/ Total
Tobramicin	1/9
Meropenem	0/9
Imipenem	0/9
Ciprofloxacin	1/9
PipTaz	1/9
Ceftazidime	1/9

List of Abbreviations of names of bacterial pathogens

Code	Organism
aba	Acinetobacter baumannii
ac	Acinetobacter species
cfr	Citrobacter freundii
efa	Enterococcus faecalis
ent	Enterococcus species
eco	Escherichia coli
kpn	Klebsiella pneumoniae ss. pneumoniae
kl	Klebsiella species
mmo	Morganella morganii
nfr	Non-fermenting Gram negative rods
pae	Pseudomonas aeruginosa
pmi	Proteus mirabilis
sat	Salmonella Typhi
shb	Shigella flexneri
Sau	Staphylococcus aureus
SPP	

Listof Abbreviations/ Antibiotics

AMP	**Ampicillin**
AMC	**Amoxicillin/clavulanic acid**
AMK	**Amikacin**
AZM	**Azithromycin**
ATM	**Aztreonam**
FEP	**Cefepime**
FOX	**Cefoxitine**
CTX	**Cefotaxime**
CAZ	**Ceftazidime**
CIP	**Ciprofloxacin**
CLI	**Clindamycin**
DOX	**Doxycycline**
ERY	**Erythromycin**
ETP	**Ertapenem**
GEN	**Gentamicin**

GEH	Gentamicin high 120 µg
IMP	Imipenem
LNZ	Linezolid
MEM	Meropenem
MNO	Minocycline
NET	Netilmicin
NIT	Nitrofurantoin
TZP	Piperacillin/ Tazobactam
TCY	Tetracycline
TOB	Tobramycin
TEC	TAEICOPLANIN
SXT	Trimethoprim/ Sulfamethoxazole
VAN	Vancomycin
COL	Colistin

References for further reading

1. Standard Operating Procedure for Antimicrobial Resistance Surveillance, National AMR Surveillance Network (NARS-Net). January 2023
2. CLSI. Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data; 5th edition. CLSI document M39. Clinical and Laboratory Standards Institute; 2022.
3. CLSI M100-ED33:2023 Performance Standards for Antimicrobial Susceptibility Testing, 33rd Edition
4. CLSI M100-ED34:2024 Performance Standards for Antimicrobial Susceptibility Testing, 34th Edition

DISTRICT ANTIBIOGRAM THRISSUR

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MESSAGE

The emergence of AMR is one of the most serious public health challenges of our time. AMR is a multi-faceted global challenge known as "silent pandemic". Rational and evidence-based use of antibiotics is essential to ensure effective treatment and to safeguard the efficacy of available antimicrobials for further generations.

The District-Antibiogram of Thrissur, has been prepared by compiling and analyzing laboratory data from health institutions across the district. This document provides valuable insights into local antimicrobial sensitivity patterns and serves as a practical guide for clinicians in selecting appropriate empirical therapy.

I appreciate the sincere efforts of the microbiologists, clinicians, surveillance teams and health care institutions who contributed to the preparation of this antibiogram. I am confident that this publication will support rational antibiotic use, strengthen antimicrobial stewardship, and contribute to improve patient outcomes in Thrissur district.

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Dr Taj Paul Panakkal .

Superintendent

General Hospital, Thrissur

MESSAGE

Antimicrobial Resistance (AMR) is a multi-faceted global challenge known as a "silent pandemic." It is widely recognized as one of the top ten global public health threats to humanity in the 21st century.

Kerala has set a benchmark in addressing this crisis by becoming the first state to release an AMR action plan in 2018. A critical pillar of this strategy is the optimization of antibiotic usage through data-driven decision-making.

The formulation and release of the District Antibiogram is a pivotal step in this direction. By mapping the local patterns of resistance, this document will serve as an essential guide for clinicians in choosing appropriate empirical therapies. This, in turn, will help improve patient outcomes, reduce treatment costs, and preserve the efficacy of essential antibiotics for future generations.

I am proud that General Hospital Thrissur is playing a lead role in this initiative. I extend my heartfelt appreciation to the team behind this comprehensive report and wish the initiative every success.

Dr Taj Paul Panakkal

Superintendent

General Hospital, Thrissur .

ANTIBIOGRAM - DISTRICT AMR LAB, THRISSUR

Reporting Period: January 1, 2024 – December 31, 2024 (1 year data)

An antibiogram is a summary report that shows the results of antimicrobial susceptibility testing (AST) for bacterial isolates collected in a hospital, laboratory, or community over a specific period of time. It indicates how sensitive or resistant particular microorganisms are to a range of antibiotics and is usually presented as a table showing the percentage of isolates susceptible/resistant to each antibiotic.

USES

- Prepared annually or periodically by microbiology laboratories based on data from clinically significant isolates, not colonizers or contaminants.
- Helps clinicians choose the most effective empirical antibiotic therapy before culture results are available.
- Useful for monitoring antimicrobial resistance (AMR) trends and guiding hospital antibiotic policies (e.g., antibiotic stewardship programs).

GENERAL CONSIDERATIONS

- DISTRICT AMR lab, Thrissur has started functioning at Govt. general Hospital, Thrissur from May 2, 2023. The lab currently performs culture for urine, Sputum, exudates, blood, stool (surveillance) and environmental surveillance.
- The present antibiogram covers data from for isolates from: January 1, 2024 – December 31, 2024, urine, blood and exudates.
- The antibiogram includes only routinely tested antimicrobial agents, expressed as percentage susceptibility (%S).

  - Based on the National Policy for Containment of Antimicrobial Resistance (2011) and the National Action Plan on AMR (2017–2021), AMR surveillance focuses on the following infections of public health importance:
    a) Bloodstream infections (BSI)
    b) Skin and soft tissue infections (SSTI)
    c) Respiratory tract infections (RTI)d) Urinary tract infections (UTI)
- The following six priority pathogens were tracked

1. Acinetobacter spp.
2. E. coli

3. Klebsiella spp.

4.Pseudomonas aeruginosa

GRAM NEGATIVE

5. ***Staphylococcus aureus***

6.Enterococcus spp.

GRAM POSITIVE

The current antibiogram was generated using WHONET 2025, following CLSI 2025 guidelines. Since breakpoints for Cefoperazone–sulbactam are not included in CLSI guidelines, it was excluded from analysis

ABBREVIATIONS

CLSI – Clinical and Laboratory Standards Institute

AMP – Ampicillin

AMK – Amikacin

GEN – Gentamicin

CRO – Ceftriaxone

CIP – Ciprofloxacin

NIT – Nitrofurantoin

SXT – Trimethoprim–Sulfamethoxazole

MEM – Meropenem

TZP – Piperacillin–Tazobactam

CAZ – Ceftazidime

AMC – Amoxicillin–Clavulanic Acid

SPOKE HOSPITALS

- THQH Kodungallur
- THQH Chalakkudy
- THQH Chavakkad
- THQH Puthukkad
- THQH Kunnamkulam
- THQH Chelakkara
- GH Irinjalakkuda
- GH Wadakkancheri
- FHC Arthat
- FHC Manalur
- FHC Porathisseri
- FHC Vallachira
- FHC Nenmanikkara
- FHC Tholur
- FHC Deshamangalam
- CHC Kattur
- CHC Cherpu

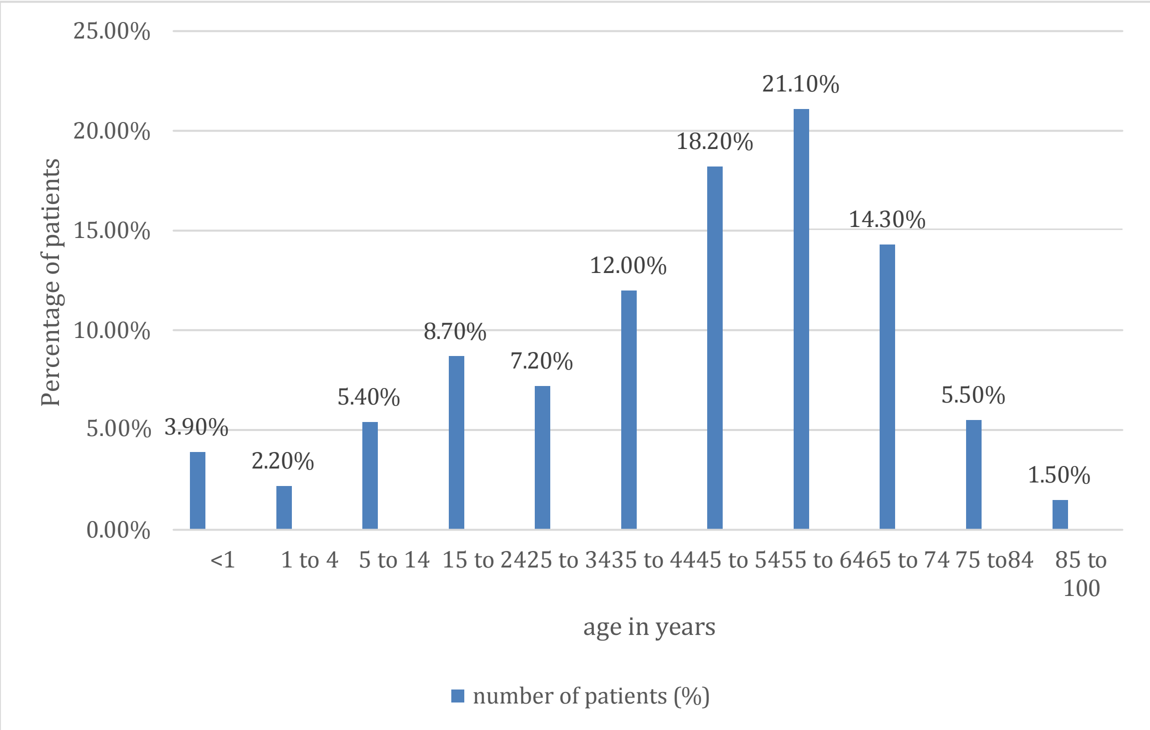
AMR HUB & SPOKE HEALTH FACILITIES IN THRISSUR DISTRICT

PATIENT DEMOGRAPHICS

Total number of patients: 3607

- Total number of isolates: 797
- Total number of isolates from hub: 699
- Total number of isolates from spoke: 98
- Commonest age group: 55-64 years

Distribution of isolates based on age



Distribution of isolates based on age

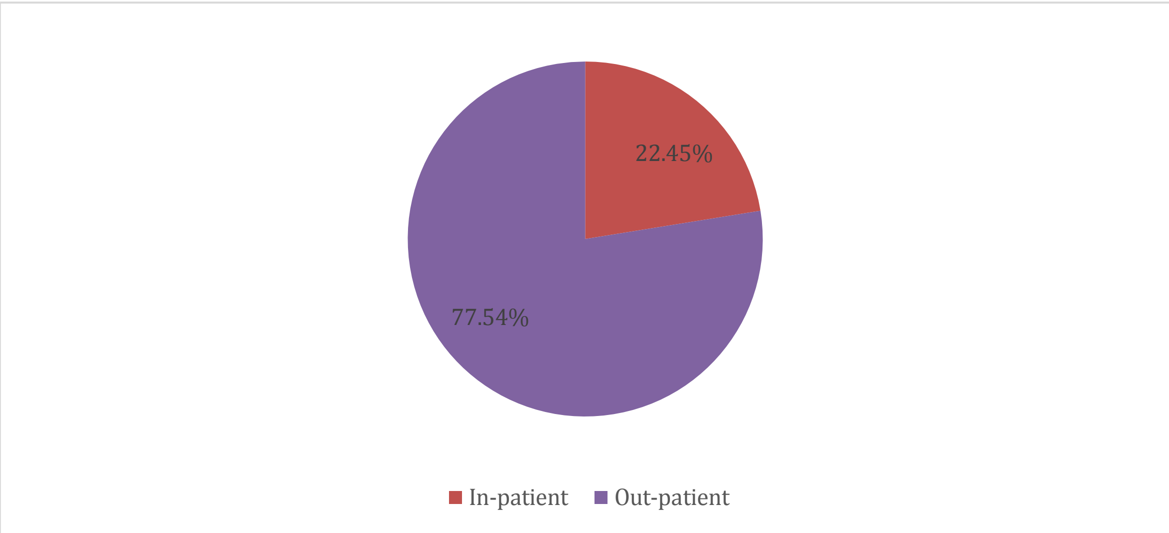
Among the total of 3607unique patients, 35.7% pathogens were isolated. Age data was available for 99.9% of unique patient isolates. The highest proportion of unique patients contributing to the AST data belong to mature working age group that is 55-64 years whereas the lowest number of pathogen (1.50%). were reported from age group of 85-100 years.

LOCATION DETAILS

Table 1: Distribution of patients by location type

SL.NO	LOCATION TYPE	NUMBER OF PATIENTS
1	Inpatient	**179**
2	Outpatient	**618**

Distribution of patients by location type



Location- wise distribution of isolates

Out of 1291 isolates 77.54% were from OP department and 22.45% from IP department.

Pathogens and specimens included under surveillance

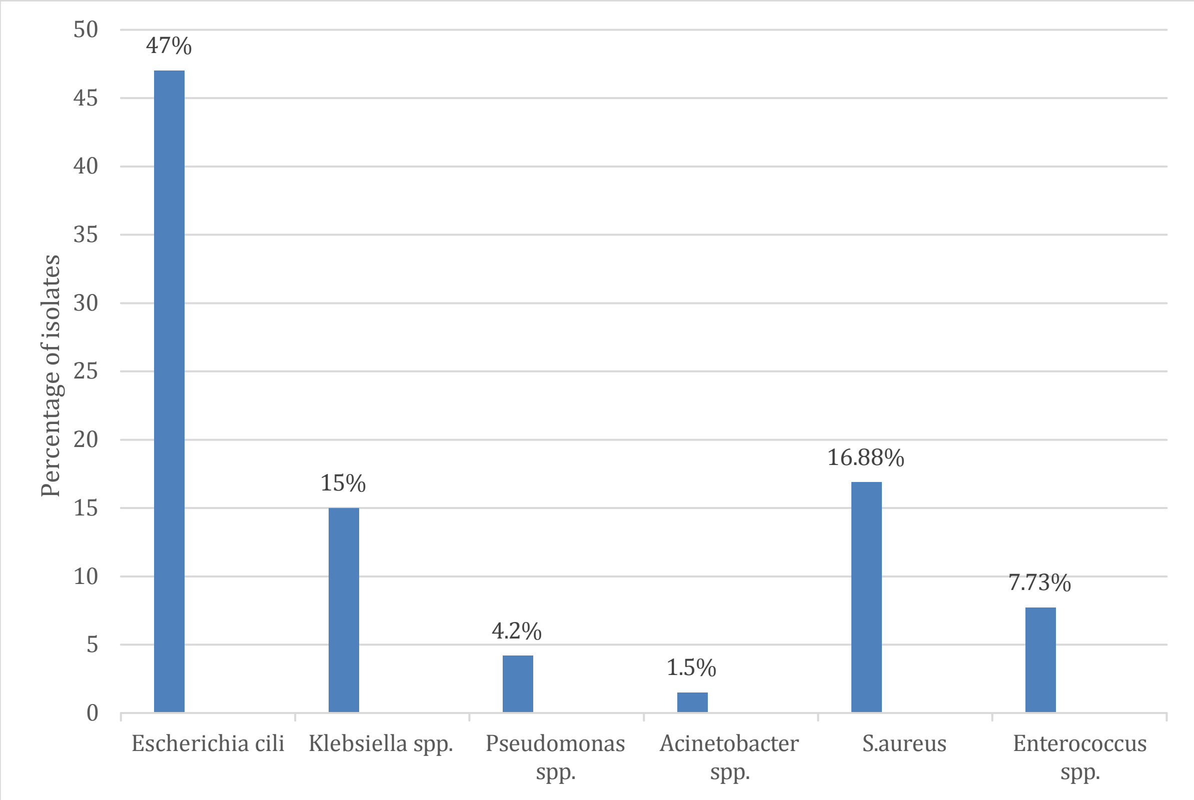
Table 2: Distribution of organisms isolated from different samples

	Staphylococcus aureus	**Enterococcus Spp.**	**Klebsiella Spp.**	**E. Coli**	**Acinetobacter Spp.**	**Pseudomonas Spp.**
Blood	✓	x	x	x	✓	x
Urine	✓	✓	✓	✓	✓	✓
PA	✓	✓	✓	✓	✓	✓
OSBF	✓	x	✓	x	x	✓

Specimen-wise isolation of priority pathogens

Table 3: Distribution of isolates by specimen category

Priority pathogens	**Blood**	**PA**	**OSBF**	**Urine**
Escherichia coli	0	13	0	389
Klebsiella spp.	0	29	1	97
Pseudomonas aeruginosa	0	22	1	13
Acinetobacter spp.	3	5	0	8
Staphylococcus aureus	6	90	1	53
Enterococcus spp.	0	8	0	58
Total	**9**	**167**	**3**	**618**



Distribution of AMR Surveillance priority pathogens

Out of the total unique isolates the following was the specimen distribution.

- Urine -618(47%)
- Pus aspirate -167 (12%)
- Other sterile body fluid- 3 (0.23%)
- Blood -9 (0.69%)

The total number of isolates reported in the year 2024 has increased over those reported last year, probably due to the increase in reporting sites. In 2024 AMR surveillance data. The most commonly isolated pathogen *was E. coli* (47%) followed by *Staphylococcus aureus* (16.88%), *klebsiella spp.* (15%), *Enterococcus spp.* (7.73%), *Pseudomonas spp.* (4.2%) and *Acinetobacter spp.* (1.5%).

ORGANISM STATISTICS

Table 4: Distribution of isolates by organism type

Organism type	Number of isolates	(%)
Gram-positive bacteria	216	27.10
Gram-negative bacteria	581	72.89
TOTAL	**797**	

Most of the isolates are Gram negative bacilli

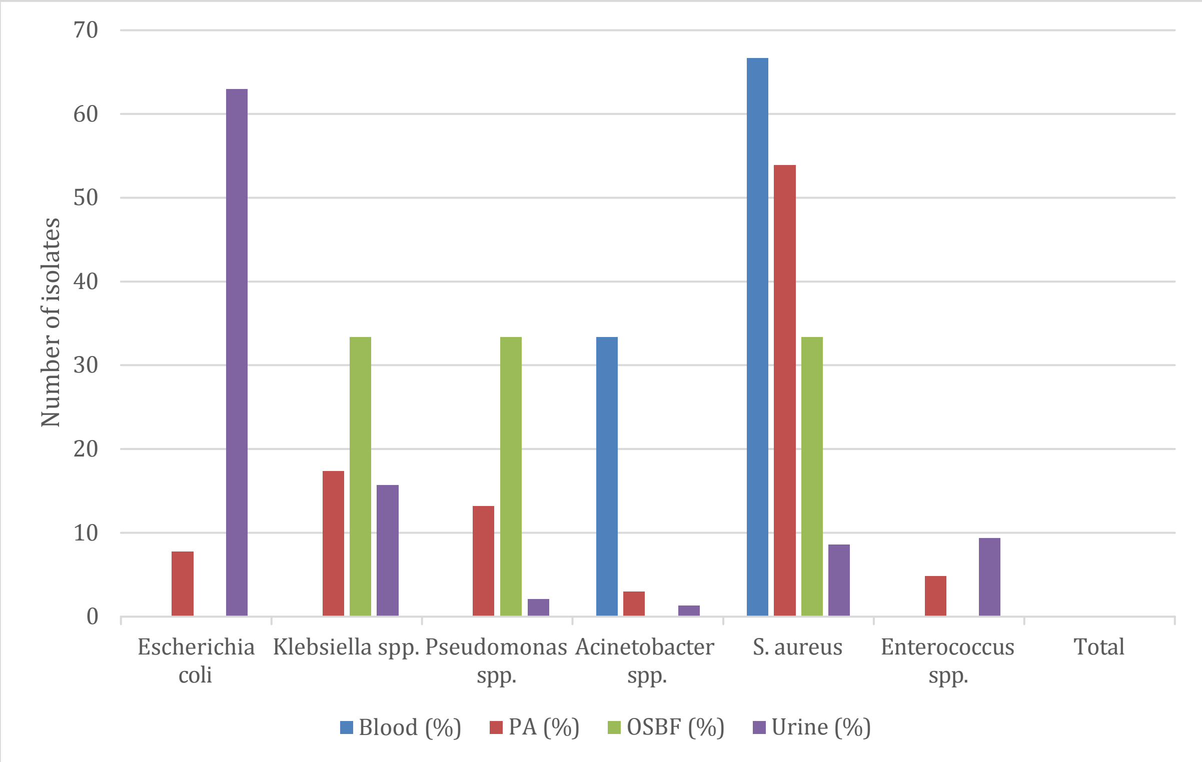
Table 5: Distribution of organisms from all specimens

Gram negative Organisms	Number of isolates	Percentage
E. coli	402	50.43
Klebsiella spp.	127	15.93
Acinetobacter spp.	16	2.00
Pseudomonas aeruginosa	36	4.51

Gram positive organisms	Number of isolates	percentage
Staphylococcus	150	18.80
Enterococcus	66	8.28

Commonest Gram-negative bacteria isolated are *E. coli* and Commonest Gram-positive bacteria are *Staphylococcus aureus*

<u>Specimen wise distribution of AMR surveillance priority pathogens</u>



Specimen wise distribution of AMR surveillance priority pathogens

Table 6: DISTRIBUTION OF MAJOR PATHOGENS IN SPECIMEN

Priority pathogens	Blood (%)	PA (%)	OSBF (%)	Urine (%)
Escherichia coli	0	13 (7.78)	0	389 (62.94)
Klebsiella spp.	0	29 (17.36)	1 (33.33)	97 (15.69)
Pseudomonas spp.	0	22 (13.17)	1 (33.33)	13 (2.1)
Acinetobacter spp.	3 (33.33)	5 (2.99)	0	8 (1.29)
Staphylococcus aureus	6 (66.66)	90 (53.89)	1 (33.33)	53 (8.57)
Enterococcus spp.	0	8 (4.79)	0	58 (9.38)
Total	**9**	**167**	**3**	**618**

Specimen-wise isolation of priority pathogens

Among the all specimen types, highest number of *E. coli* (62.94%) were isolated from urine samples. And in pus aspirate it was Staphylococcus *aureus* (53.89%) isolated in highest number. The most common pathogen isolated from blood was Staphylococcus aureus (66.66%). From OSBF *Staphylococcus aureus* (33.33%), *Pseudomonas aeruginosa* (33.33%) and *Klebsiella spp. (*33.33%).

TABLE 7: DISTRIBUTION AND ANTIBIOTIC RESISTANCE PATTERN OF GRAM-NEGATIVE ISOLATES FROM URINE

Organism	**No of isolates**	**AMK %R**	**AMP %R**	**CSL %R**	**CFM %R**	**CTX %R**	**CSL %R**	**CAZ %R**	**CIP %R**	**FEP %R**	**AMC %R**	**GEN %R**	**MEM %R**	**NIT %R**	**CRO %R**	**TZP %R**	**SXT %R**
Acinetobacter bauman Nii	1							0	100	0	0	0	0	100	5.5	0	0
Escherichia coli	389	25.3	100				100	100	67.1		40.7	24.6	11.1	11.1	55.2	28.5	37
Klebsiella sp	97	23.5	100				100		50.6		24.2	19.1	8.5	40.7	41.9	44.3	21.4
Pseudomonas aeruginosa	13							0	7.7	0			0			0	

TABLE 8: ANTIBIOTIC RESISTANCE PATTERN OF GRAM POSITIVE ORGANISMS URINE

Organism	Number of isolates	AMP %R	FOX %R	CIP %R	CLI %R	ERY %R	GEN %R	GEH %R	LNZ %R	NIT %R	SXT %R	VAN %
Enterococcus sp.	58	100	100	100	94.4	99.2	100	28.8	5.3	18.4	100	0

TABLE 9: ANTIBIOTIC RESISTANCE PATTERN OF GRAM POSITIVE ORGANISMS (ASPIRATE)

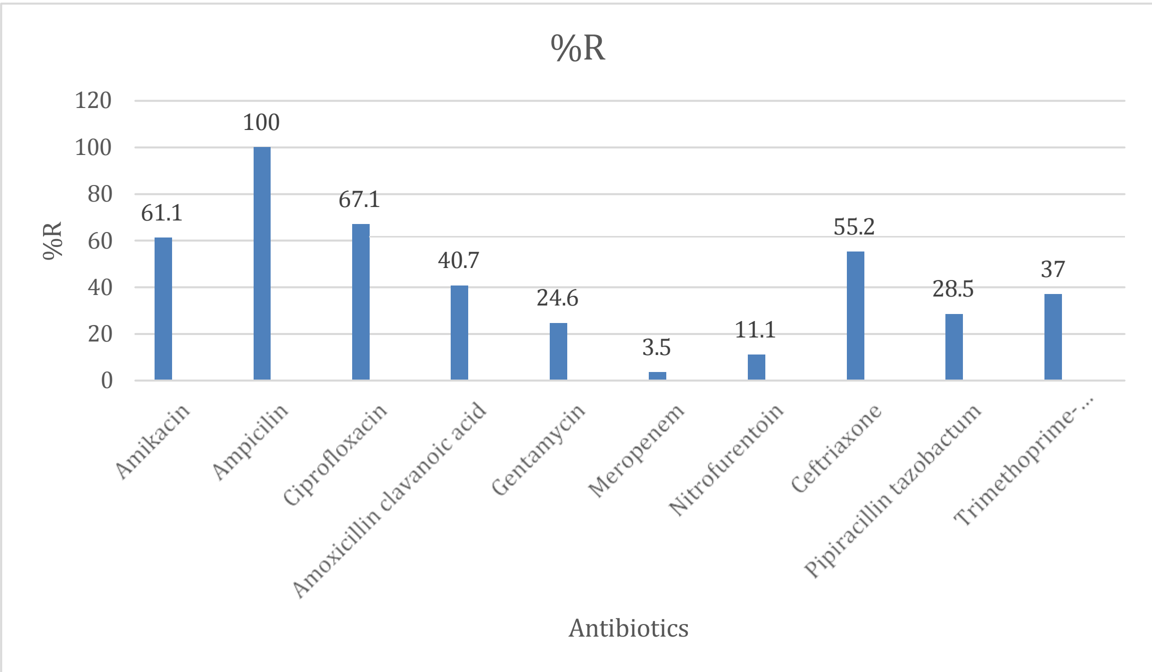
Organism	Number of isolates	AMP %R	FOX %R	CIP %R	CLI %R	ERY %R	GEN %R	GEH %R	LNZ %R	NIT %R	SXT %R	VAN %R
Enterococcus sp.	7	0			83.9	100		25				
Staphylococcus aureus ss. aureus	80		6.2		24.1	62.8	50				3.9	

TABLE 10: ANTIBIOTIC RESISTANCE PATTERN OF GRAM NEGATIVE ORGANISMS (Exudate)

Organism	No of isolates	AMK %R	AMP %R	FEP %R	CFM %R	CRO %R	CSL %R	CAZ %R	CIP %R	GEN %R	MEM %R	AMC %R	TZP %R	SXT %R
Acinetobacter baumannii	1		100	0					100	0	0		0	100
Escherichia coli	17	20	78.6	85.7		73.3			82.4	31.2	0	50	35.7	47.1
Klebsiella sp.	24	60	90	20		31.6			46	23	21.4	17	50	20
Pseudomonas aeruginosa	18			100			0	88.9	77.8		92.3		76.5	

TABLE 11: Antibiotic Resistance of *Escherichia coli (Urine, n=255)*

Antibiotic	% of Resistant isolates
Amikacin	61.1
ampicillin	100
Ciprofloxacin	67.1
Amoxicillin–Clavulanic Acid	40.7
Gentamicin	24.6
Meropenem	3.5
Nitrofurantoin	11.1
Ceftriaxone	55.2
Piperacillin tazobactam	28.5
Trimethoprim–Sulfamethoxazole	37



Nitrofurantoin is preferred as first choice for empirical treatment of uncomplicated UTI. Fluoroquinolones showed 68% resistance and 3rd generation cephalosporins showed around 56% resistance.

TABLE 12: Antibiotic Resistance of *Klebsiella spp*. (Urine n=97)

Antibiotic	% of Resistant isolates
Amikacin	23.5
ampicillin	100
Ciprofloxacin	24.3
Amoxicillin clavulanic acid	19.1
Gentamicin	8.5
Meropenem	40.7
Nitrofurantoin	49.9
Ceftriaxone	4.3
Piperacillin tazobactam	22

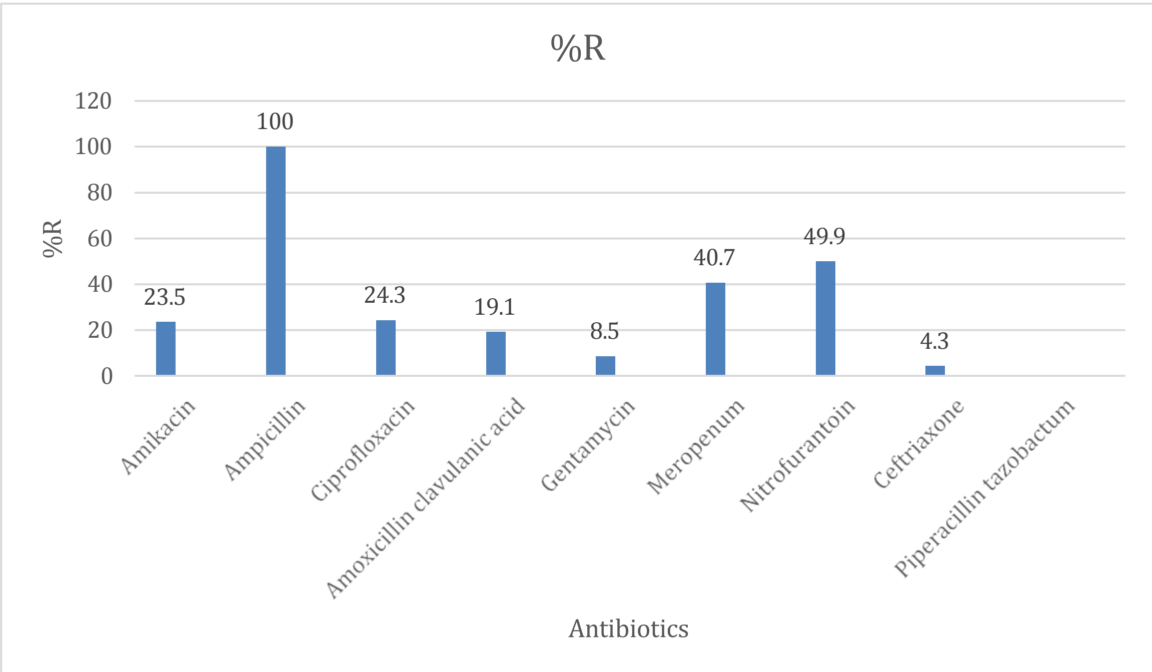


TABLE 13: Antibiotic Resistance of *Pseudomonas aeruginosa*. (Urine, n=13)

Antibiotic	No. of Resistant isolates
Ceftazidime	0/13
Ciprofloxacin	0/13
Cefepime	0/13
Meropenem	0/13
Piperacillin tazobactam	0/13

TABLE 14: Antibiotic Resistance of *Enterococcus spp*. (Urine, n=58)

Antibiotic	% of Resistant isolates
Ampicillin	100
Clindamycin	94.4
Erythromycin	95.2
Gentamicin	28.8
Linezolid	0
Nitrofurantoin	18.4
Vancomycin	0

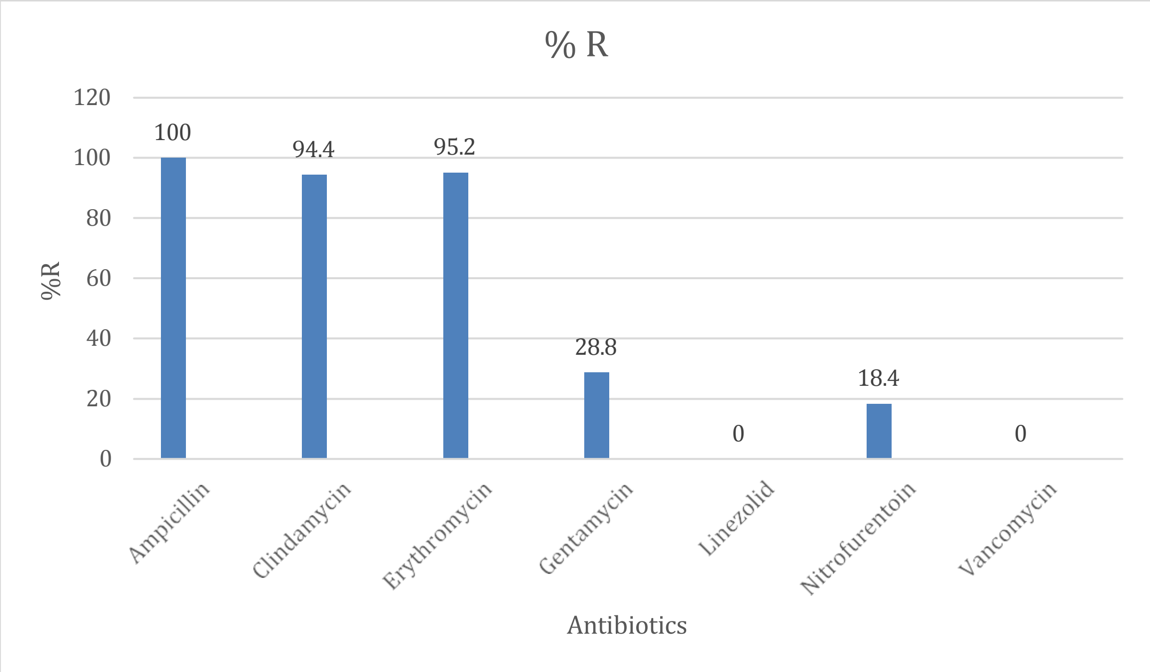
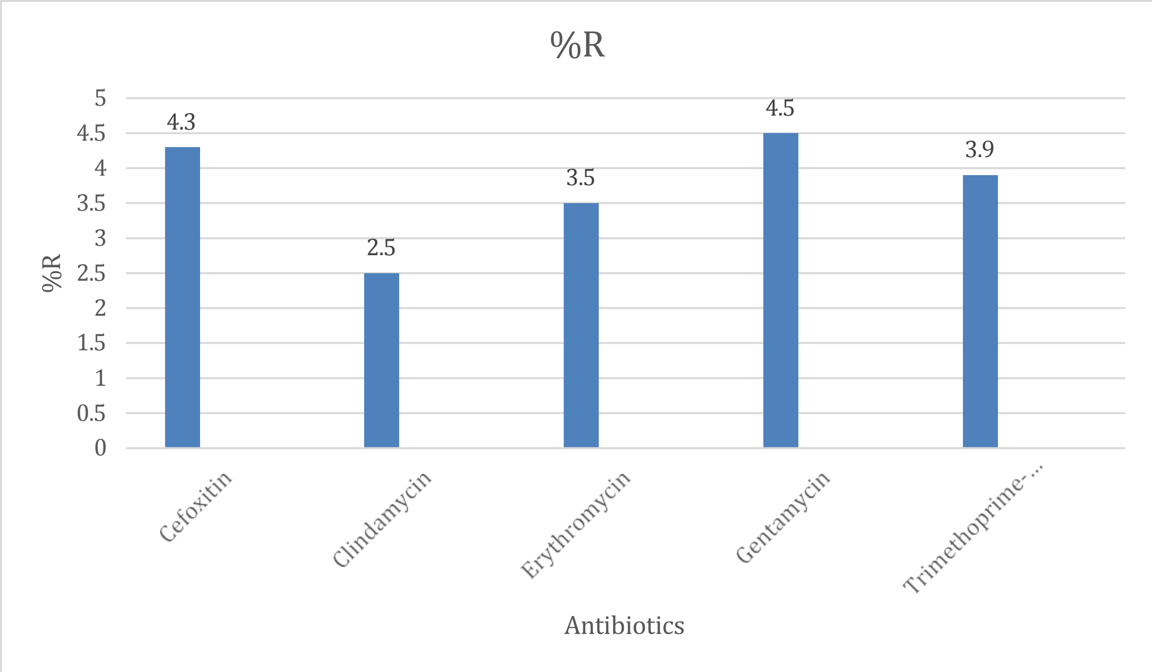


TABLE 15: Antibiotic Resistance *of Staphylococcus aureus* (Exudate, n=80)

Antibiotic	**% of Resistant isolates**
Cefoxitin	6.3
Clindamycin	24.1
Erythromycin	62.8
Gentamicin	50
Trimethoprim–Sulfamethoxazole	3.9



%R
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
%R
4.3
2.5
3.5
4.5
3.9
Cefoxitin
Clindamycin
Erythromycin
Gentamycin
Trimethoprime-...
Antibiotics

TABLE 16: Antibiotic Resistance of *Enterococcus spp*. (Exudate, n=7)

Antibiotics	**No. of Resistant isolates**
Ampicillin	0/7
Ciprofloxacin	7/7
Clindamycin	6/7
Erythromycin	7/7
High level gentamicin	2/7

TABLE 17: Antibiotic Resistance of *E. coli* (Exudate, n=17)

Antibiotic	**No. of Resistant isolates**
Amikacin	8/17
Ampicillin	14/17
Cefepime	15/17
Ceftriaxone	13/17
Ciprofloxacin	15/17
Gentamicin	6/17
Meropenem	0/17
Amoxicillin clavulanic acid	6/17
Piperacillin tazobactam	9/17
Trimethoprim–Sulfamethoxazole	6/17

TABLE 18: Antibiotic Resistance of *Klebsiella spp.* (Exudate, n=24)

Antibiotic	No. of Resistant isolates
Amikacin	15/24
Ampicillin	22/24
Cefepime	5/24
Ceftriaxone	8/24
Ciprofloxacin	11/24
Gentamycin	6/24
Meropenem	6/24
Amoxicillin clavulanic acid	4/24
Piperacillin tazobactam	12/24
Trimethoprim–Sulfamethoxazole	5/24

TABLE 19: Antibiotic Resistance of *Pseudomonas aeruginosa* (Exudate, n=18)

Antibiotic	No. of Resistant isolates
Cefepime	0/18
Ceftazidime	0/18
Ciprofloxacin	0/18
Meropenem	0/18
Piperacillin tazobactam	0/18

SPOKE HOSPITALS ANTIBIOTIC RESISTANCE PATTERN

Total number of positive isolates = 98

TABLE 20: Antibiotic Resistance of *Enterococcus spp.* In Exudates (n=1)

Antibiotic	**No of Resistant isolates**
Gentamycin	0
ampicillin	0
Clindamycin	1/1
Erythromycin	0

TABLE 21: Antibiotic Resistance of *Pseudomonas spp.* in exudates (n=3)

Antibiotics	**No. of Resistant isolates**
Cefaperazone/ sulbactum	0/3
Piperacillin tazobactam	2/3
Ceftazidime	1/3
Cefepime	0/3
Meropenem	1/3
Ciprofloxacin	1/3

TABLE 22: Antibiotic Resistance of *E. coli* in exudates (n=5)

Antibiotics	No. of Resistant isolates
Ampicillin	5/5
Piperacillin	0/5
Amoxicillin clavulanic acid	0/5
Ceftriaxone	4/5
Cefepime	1/5
Meropenem	0/5
Amikacin	0/5
Gentamycin	2/5
Ciprofloxacin	4/5
Cotrimoxazole	2/5

TABLE 23: Antibiotic Resistance of *Staphylococcus aureus* in exudates (n=5)

Antibiotics	No of Resistant isolates
Cefoxitin	0/5
Gentamycin	0/5
Cotrimoxazole	0/5
Clindamycin	0/5
Erythromycin	1/5
Vancomycin	0/5

TABLE 24: Antibiotic Resistance of *Klebsiella spp.* in exudates (n=4)

Antibiotics	No. of Resistant isolates
Ampicillin	0/4
Cefaperazone sulbactam	0/4
Piperacillin tazobactam	0/4
Ceftriaxone	¾
Meropenem	¼
Amikacin	4/4
Gentamycin	2/4
Ciprofloxacin	2/4
Cotrimoxazole	4/4

TABLE 25: Antibiotic Resistance of *Enterococcus spp.* in urine sample (n= 32)

Antibiotics	% of Resistant isolates
Ampicillin	50
High level gentamycin	23.3
Gentamycin	0
Ciprofloxacin	55.6
Clindamycin	85.7
Erythromycin	100
Nitrofurantoin	10
Linezolid	0
Vancomycin	0

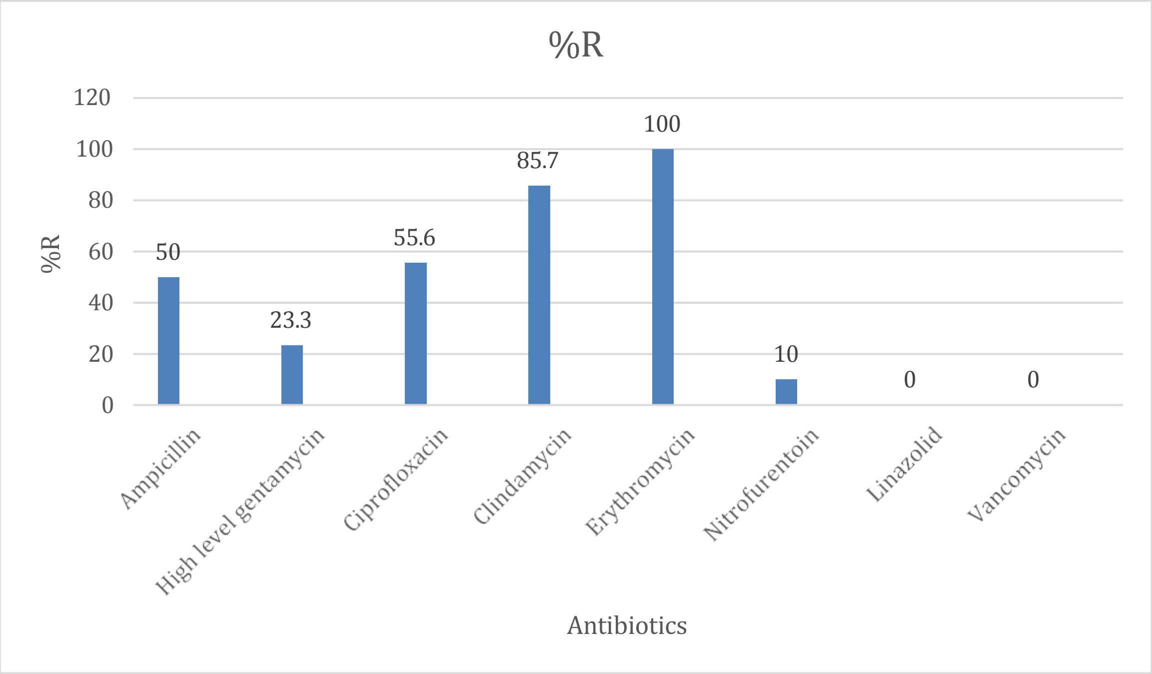
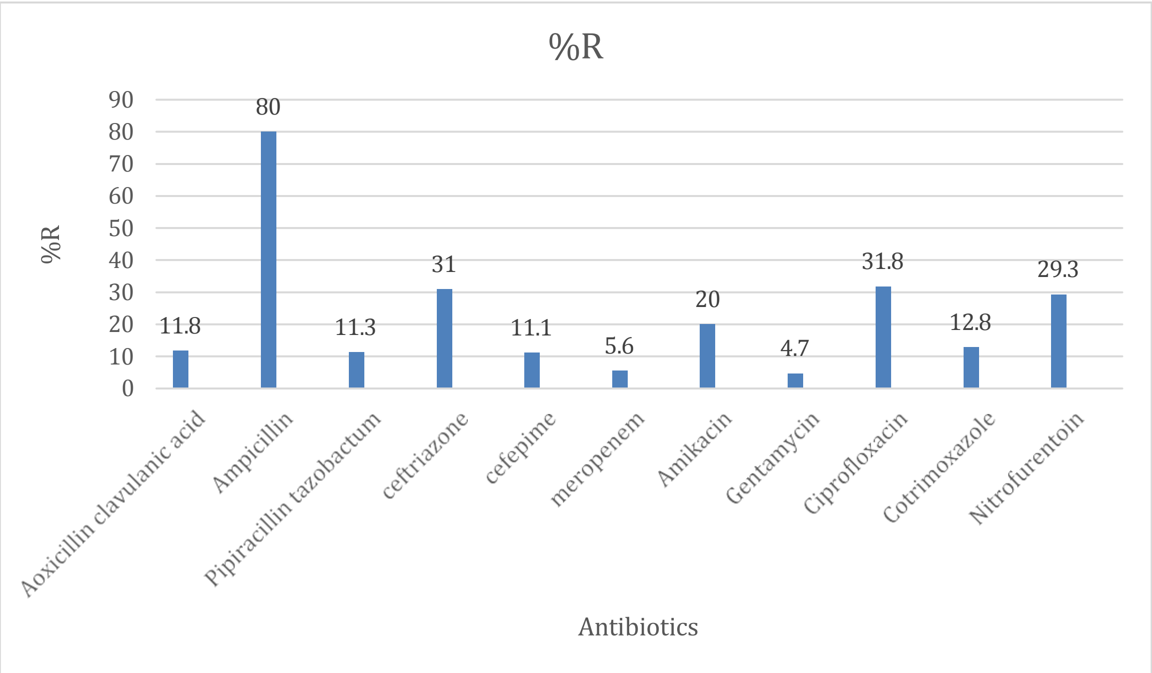


TABLE 26: Antibiotic Resistance of *Pseudomonas spp.* in urine samples (n= 2)

Antibiotics	**No. of Resistant isolates**
Piperacillin tazobactam	0/2
Ceftazidime	0/2
Meropenem	0/2
Amikacin	0/2
Ciprofloxacin	0/2

TABLE 27: Antibiotic Resistance of *Klebsiella spp*. in urine samples (n=46)

Antibiotics	**% of Resistant isolates**
Amoxicillin clavulanic acid	11.8
Ampicillin	80
Piperacillin tazobactam	11.3
Ceftriaxone	31
Cefepime	11.1
Meropenem	5.6
Amikacin	20
Gentamycin	4.7
Ciprofloxacin	31.8
Cotrimoxazole	12.8
Nitrofurantoin	29.3



CONCLUSION

Strengthening global, national and local AMR surveillance is critical for AMR containment as it is the basis for designing and implementing evidence-based strategies, monitoring the effectiveness of public health interventions and detecting new trends and threats. AMR poses a significant global health challenge threatening the attainment of Sustainable Development Goals (SDGs) related to health. WHO declared AMR as one of the ten global public health threats in 2019 and an emerging health challenge for the decade in 2020.

KARS-Net compiles the State AMR surveillance report annually. The activities under KARS- Net include capacity building of a network of government and private medical colleges and laboratories for AMR surveillance. KARS-Net has been expanded in a phased manner to all 14 districts establishing hub and spoke model in all districts across the state. AMR surveillance under KARS-Net includes standardised collection, collation, analysis and compilation of AMR data from all the network sites. The compiled data is used to generate the annual State AMR surveillance report which is shared with all the network sites under KARS-Net and to the stakeholders at the State level. This network data is also submitted annually to NCDC for submission to WHO's Global AMR Surveillance System (GLASS).

The compilation of the District Antibiogram across five districts represents an important operational achievement of KARSAP, translating surveillance into actionable, district-level intelligence. More than a summary of susceptibility data, this report serves as a practical tool for clinicians, hospital infection control teams, and policymakers to refine empirical therapy and strengthen antimicrobial stewardship practices based on local evidence.

The district-wise analysis highlights both shared resistance challenges and unique local trends, reinforcing the need for context-specific antibiotic policies rather than uniform approaches. The findings emphasize the continued burden of resistant priority pathogens and the urgency of optimizing diagnostic stewardship, improving culture yield, and ensuring timely reporting to guide patient care.

Importantly, this initiative demonstrates the growing maturity of district laboratory networks and the effectiveness of coordinated data compilation from hub and spoke centres. Sustaining data quality, periodic validation, and regular annual updates will be critical to maintaining the relevance and reliability of future antibiograms.

Going forward, the focus should extend beyond data generation to measurable impact — improved prescribing behaviour, strengthened infection prevention and control practices, and enhanced community awareness on antimicrobial use. The continued engagement of clinicians, microbiologists, administrators, and public health authorities will determine the long-term success of this effort.

This second consolidated district antibiogram under KARSAP is not an endpoint, but a foundation — paving the way for deeper surveillance coverage, stronger stewardship integration, and a more resilient response to antimicrobial resistance across Kerala.