ISSUE
04/2024
July-December 2024

SEMI-ANNUAL BULLETIN

NARSNET Sites

1. LHMC and Associated Hospitals, Delhi
2. VMMC and SJ Hospital, Delhi
3. SMS Medical College, Jaipur, Rajasthan
4. BJ Medical College, Ahmedabad, Gujarat
5. BJ Medical college, Pune, Maharashtra
6. Government Medical college, Chandigarh
7. MMCRI, Mysuru, Karnataka
8. GSVM Medical College, Kanpur, Uttar Pradesh
9. Gauhati Medical College & Hospital, Guwahati, Assam
10. KAP V. GMC, Tiruchirappalli, Tamil Nadu
11. NEIGRIHMS, Shillong, Meghalaya
12. Govt. Medical College, Thiruvananthapuram, Kerala
13. MGM College and Hospital, Indore, Madhya Pradesh
14. IGMC, Shimla, Himachal Pradesh
15. GMC & Hospital, Aurangabad, Maharashtra
16. Osmania Medical College, Hyderabad, Telangana
17. Govt. Medical College & Hospital, Jammu, J&K
18. Agartala Govt. Medical College, Agartala, Tripura
19. Guntur Medical College, Guntur, Andhra Pradesh
20. SCB Medical College & Hospital, Cuttack, Odisha
21. Pt. JLNM Medical College, Raipur, Chhattisgarh
22. RIMS, Ranchi, Jharkhand
23. Pt. BDS PGIMS Rohtak, Haryana
24. IGIMS, Sheikpura, Patna, Bihar
25. Government Medical College, Haldwani, Uttarakhand
26. Gandhi Medical College, Bhopal, Madhya Pradesh
27. Calcutta STM, Kolkata, West Bengal
28. LLRM Medical College, Meerut, Uttar Pradesh
29. GMERS Medical College & Civil Hospital, Valsad, Gujarat
30. Coimbatore Medical College & Hospital, Coimbatore, Tamil Nadu
31. KIMS, Hubli, Karnataka
32. IGMCRI, Puducherry
33. NAMO MERI, Silvassa, Dadra & Nagar Haveli
34. MAMC & Associated Hospitals, Delhi
35. SPMC & Associated Hospital, Bikaner, Rajasthan
36. Goa Medical College & Hospital, Bambolim, Goa
37. STNM Medical College & Hospital, Gangtok, Sikkim
38. Government Medical College, Patiala, Punjab
39. Zoram Medical College, Falkawn, Mizoram
40. Andaman & Nicobar Islands Institute of Medical Sciences (ANIIMS), Andaman & Nicobar Islands
41. RNT Medical College, Udaipur, Rajasthan
42. JNIMS, Manipur
43. GMC, Srinagar, Jammu & Kashmir
44. AMC, Vishakhapatnam, Andhra Pradesh
45. VIMS, Ballari, Karnataka
46. BMC & Hospital, Burdwan, West Bengal
47. GGMC & JJ Grp of Hospitals, Mumbai, Maharashtra
48. Pt. RMMC & Hospital, Baripada, Odisha
49. UCMS & Associated GTB Hospital, Delhi
50. Pt. DDUMC, Rajkot, Gujarat
51. GMC Thrissur, Kerala
52. SVMC Tirupati, Andhra Pradesh
53. Jorhat Med College & Hospital, Jorhat, Assam
54. NSCBMC, Jabalpur, Madhya Pradesh

National Antimicrobial Resistance Surveillance Data

National AMR Surveillance Network (NARS-Net)

The emergence of antimicrobial resistance (AMR) has become one of the leading global health problems having far reaching effects on mankind. Though AMR occurs due to natural genetic changes in the micro-organisms, however its emergence and spread is mainly accelerated by the overuse and misuse of antimicrobials and poor infection prevention and control practices in healthcare facilities and in the community. To overcome this challenge, the process of development of novel drugs and therapeutics is ongoing but fails to match the pace with which microbes are developing resistance to existing antimicrobials. This makes treatment of common infections difficult, prolonging hospital stays and increasing financial implications for patients and healthcare settings. The Government of India launched "National Programme on Antimicrobial Resistance Containment" to combat AMR in human health sector, which is coordinated by the National Centre for Disease Control (NCDC), New Delhi. National AMR Surveillance Network (NARS-NET) has been established under this programme to systematically monitor resistance patterns across various priority pathogens and detect emerging AMR threats.

The resistance profile of priority pathogens tracked under NARS-Net further guide appropriate interventions to contain the emergence and spread of resistant microbes including development of the National treatment guidelines.

The Sentinel sites submit the antimicrobial susceptibility testing (AST) data to NCDC monthly adhering to the programme data management SoP. This includes implementing internal quality control (IQC) measures and participation in External Quality Assessment Scheme (EQAS).

The network sites use WHONET 2024, an open-source, offline microbiology data management desktop application, to collect, collate and analyze routine antimicrobial susceptibility testing data generated at their laboratories. The classification of the isolates as susceptible, intermediate or resistant is based on the recent Clinical & Laboratory Standards Institute (CLSI) guidelines. The monthly data is validated through virtual data quality monitoring calls by the respective nodal officers at NCDC. Data analysis is conducted after de-duplication, only the first isolate of a given species isolated from a priority specimen type is considered for each patient.

National Programme on AMR Containment,
National Centre for Disease Control (NCDC), Directorate General of Health Services,
Ministry of Health & Family Welfare, Government of India

NCDC prepares annual reports and semi-annual bulletins after collating data for priority bacterial pathogens isolated from defined specimen types. This compiled data is also submitted to Global AMR and use Surveillance System (GLASS).

In this fourth semi-annual bulletin, AMR data from June 2024 to December 2024 from 54 state medical college laboratories in 27 states and 6 UTs enrolled under NARS-NET has been presented (Fig. 1).

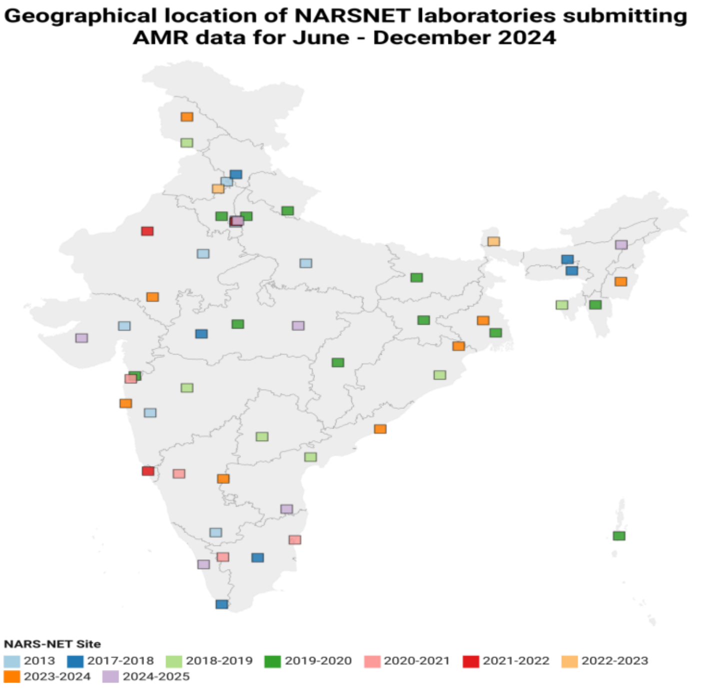


Fig. 1- Geographic location of NARS-Net laboratories submitting AMR data for June – December 2024

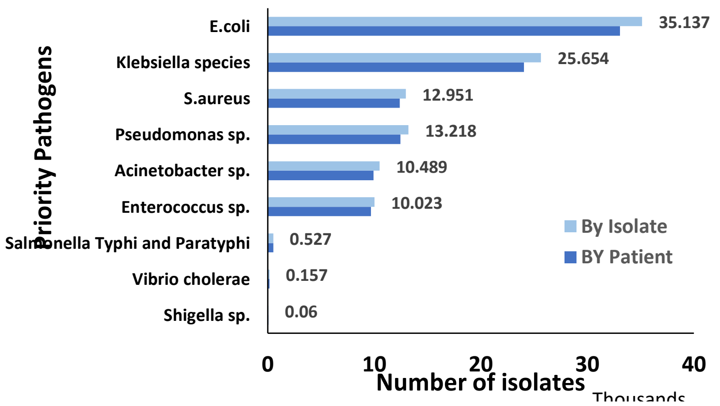


Fig. 2- Distribution of priority pathogen isolates and unique patient isolates

AMR Surveillance Findings

In this six-monthly bulletin, AMR data of 1,02,312 unique patients has been reported after de-duplication of the 1,08,216 isolates data (Fig. 2).

Of 1,02,312 unique patients, 52% were males and 48% were females). Majority of patients from whom the data of priority pathogens has been reported belonged to the age group 25-44 (30%), followed by 45-64 (26%) and least number of isolates have been reported from children in age group of 1-4 years (Fig. 4).

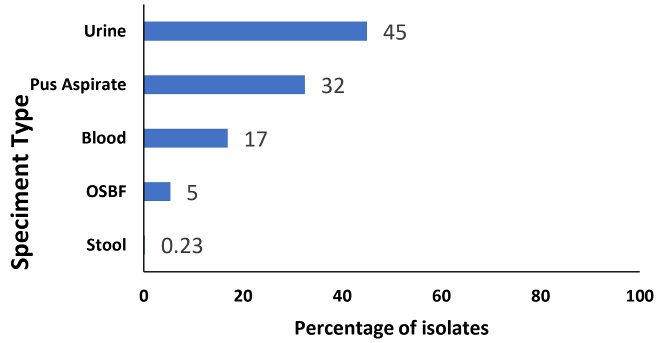


Fig. 3- Percentage distribution of priority pathogen isolates based on specimen type

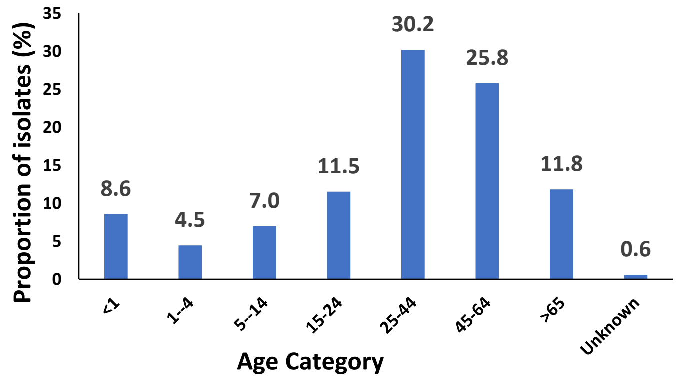


Fig. 4- Distribution of all priority pathogen isolates by age category (N=1,02,312)

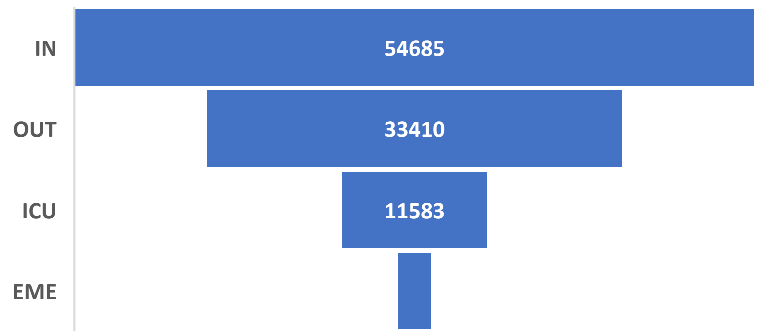


Fig. 5- Distribution of priority pathogen isolates by location type (N=1,02,312)

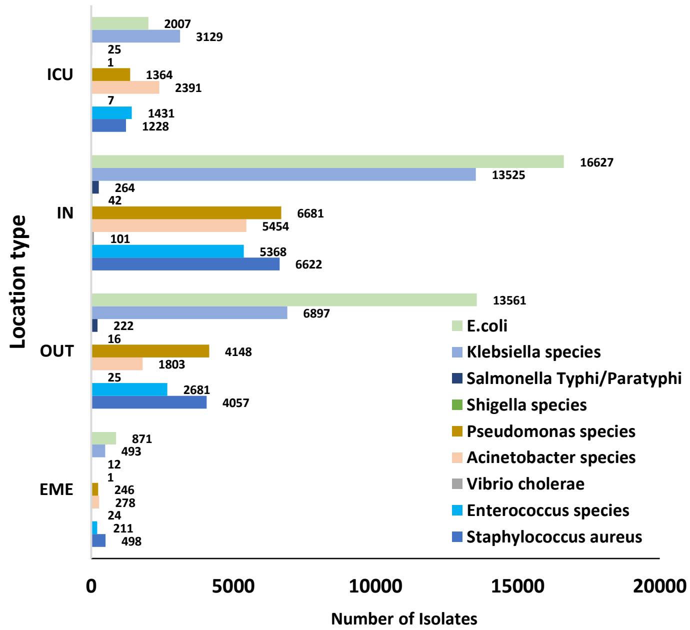


Fig. 6- Distribution of priority pathogen isolates by location-type

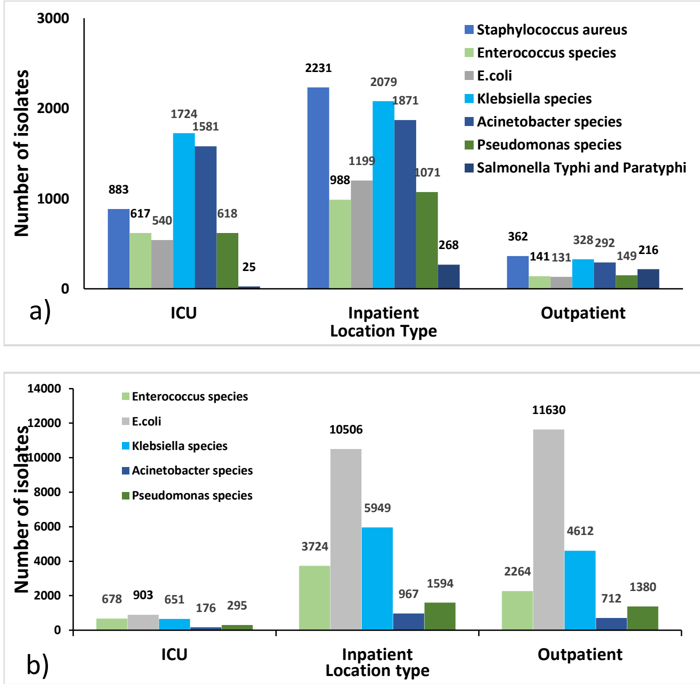


Fig. 7- Isolation of priority pathogen isolates from a) Blood and b) Urine specimens from patients in different location types

Table 1- Isolation of priority pathogen by specimen type

Priority Specimen	Blood (N=17,314)		OSBF (N=5,490)		Pus Aspirate (N=33,236)		Urine (N=46,041)		Stool (N=231)		Total	
	Number Tested	%	Number Tested	%	Number Tested	%	Number Tested	%	Number Tested	%		%
E.coli	1870	10.8	1142	20.8	7015	21.1	23039	50.0	x	x	33066	32
Klebsiella species	4131	23.9	1273	23.2	7429	22.4	11212	24.4	x	x	24045	23
Acinetobacter species	3744	21.6	1192	21.7	3135	9.4	1855	4.0	x	x	9926	10
Pseudomonas species	1838	10.6	917	16.7	6415	19.3	3269	7.1	x	x	12439	12
Salmonella Typhi	434	2.5	X	X	X	X	X	X	5	3.5	439	0.4
Salmonella Paratyphi	75	0.4	X	X	X	X	X	X	9	3.9	84	0.1
Shigella species	X	X	X	X	X	X	X	X	157	68.0	157	0.15
Vibrio cholerae	X	X	X	X	X	X	X	X	60	26.0	60	0.06
Staphylococcus aureus	3476	20.1	587	10.7	8342	25.1	X	X	x	x	12405	12
Enterococcus species	1746	10.1	379	6.9	900	2.7	6666	14.5	x	x	9691	9

AMR Surveillance Priority pathogens

During June to December 2024 data reporting period, the most commonly isolated priority bacterial pathogen was *E. coli* (32%), which is similar to the previous years, followed by *Klebsiella* species (23%), *S. aureus* (12%), *Pseudomonas* species (12%), *Acinetobacter* species (10%), *Enterococcus* species (9%), *Salmonella enterica* serovar Typhi and Paratyphi (0.51%), *Vibrio cholerae* (0.06%) and *Shigella* species (0.15%) (Table1).

Majority of these isolates were from patients admitted in hospital wards (IPD- 53%), whereas almost a third of the isolates (33%) were from patients visiting the outpatient clinics. Eleven percent of priority pathogens were isolated from ICU (Fig. 5).

Amongst the IPD and OPD, the most commonly isolated priority pathogen was *E. coli* followed by *Klebsiella* spp. However, in ICU patients *Klebsiella* spp. was the most common isolated pathogen followed by *Acinetobacter* spp. (Fig. 6)

AMR Surveillance Resistance Profile

Gram-positive bacterial pathogens
In this six-month reporting period, amongst the priority pathogens, Gram-positive bacteria namely *S. aureus* and *Enterococcus* species contributed to 22% of data.

Staphylococcus aureus
Fifty four percent of *S. aureus* isolates were found to be MRSA. Of 7,746 isolates tested on vancomycin agar screen (VAS) test, none showed growth on VAS plate.

S. aureus isolates from blood showed slightly lower resistance to linezolid (0.12%) as compared to the previous six months (1.6%).

***Enterococcus* species**
Enterococcus species was most commonly isolated from urine (69%) followed by blood (18%), pus aspirates (9%) and other sterile body fluids (4%). Isolates from blood showed 20% resistance to vancomycin and 1.5% resistance to linezolid.

Table 2- Resistance profile of *Staphylococcus aureus* (N=12,405)

Antibiotic Tested	Blood (N=3,476)		OSBF (N=587)		PA (N=8,342)	
	Number tested	%R	Number tested	%R	Number tested	%R
Cefoxitin	3082	53	508	48	7391	55
Gentamicin	2952	16	483	16	6674	17
Ciprofloxacin	2976	52	486	54	7239	70
Trimethoprim/Sulfamethoxazole	2653	31	457	27	6608	21
Clindamycin	3130	39	498	37	7819	29
Erythromycin	3087	62	508	57	7734	54
Linezolid	3213	0.12	515	0	7453	0.12
Teicoplanin	615	10	116	8	1142	8
Doxycycline	2531	12	397	10	5566	7

Table 3- Resistance profile of *Enterococcus* species (N=9,691)

Antibiotic Tested	Blood (N=1,746)		OSBF (N=379)		PA (N=900)		Urine (N=6,666)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Ampicillin	1434	70	314	57	764	44	5577	56
Gentamicin-High	1437	53	359	43	784	37	5685	51
Erythromycin	1520	78	320	73	749	69	x	x
Linezolid	1658	1.5	359	0.84	819	1.1	6078	0.36
Vancomycin	1590	20	362	13	807	7	6057	8
Teicoplanin	1247	31	256	14	619	20	4147	15
Doxycycline	1082	29	285	28	618	22	2066	39
Ciprofloxacin	x	x	x	x	x	x	4896	81
Tetracycline	x	x	x	x	x	x	4143	73

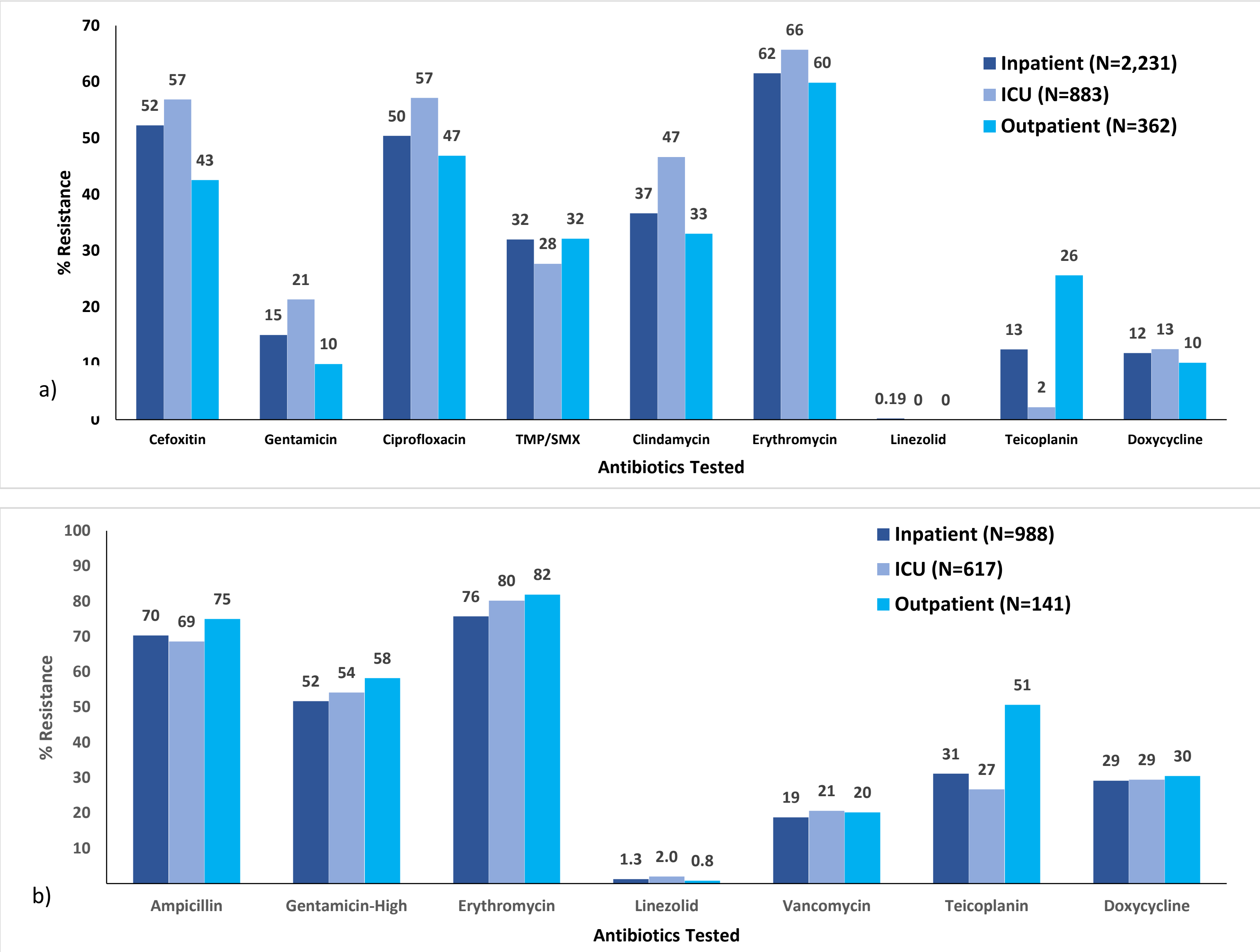


Fig. 8- Resistance profile of a) *S. aureus* (N=3,476) and b) *Enterococcus* spp. (N=1,746) in blood by location type

Gram-Negative Pathogens

AST data of 85,242 isolates of Gram-negative bacterial pathogens has been reported from 80,216 unique patients. Of the Gram-negative pathogens, Enterobacteriaceae accounted for 72% (57,694) of isolates. All the colistin resistant isolates reported have been confirmed using broth microdilution at AMR-NRL at NCDC.

Escherichia coli

E. coli contributed to one-third of the unique patient AST data (Fig. 2 wrong fig no). *E coli* was most commonly isolated from urine samples (70%) followed by pus aspirate (21%), blood (6%) and sterile body fluids (3.4%) (Table 1).

Klebsiella species

Isolates of *Klebsiella* species from all specimen types showed 0.3% – 1% resistance to colistin. Blood isolates of *Klebsiella* species showed 38% - 48% resistance to carbapenems. Except for carbapenems and aminoglycosides, *Klebsiella* species showed more than 50% resistance to all other tested antibiotics.

Table 4- Resistance Profile of *E. coli* (N=33,066)

Antibiotic Tested	Blood (N=1,870)		OSBF (N=1,142)		PA (N=7,015)		Urine (23,039)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Ampicillin	1150	85	707	88	4236	87	15349	87
Amoxicillin/Clavulanic acid	1493	67	773	71	5121	62	16018	58
Piperacillin/Tazobactam	1730	52	978	56	5987	49	18843	41
Ceftriaxone	1314	78	674	82	4361	78	11701	73
Cefotaxime	1056	81	798	81	4939	79	17674	75
Cefepime	1425	69	867	64	5159	58	15013	52
Ertapenem	888	48	592	47	3572	34	8957	26
Imipenem	1608	41	901	38	5490	32	16230	24
Meropenem	1366	38	847	37	5396	29	14122	20
Amikacin	1729	37	982	28	5996	28	17762	25
Gentamicin	1530	41	933	31	5735	33	17325	31
Ciprofloxacin	1608	75	969	76	5957	75	18372	73
Trimethoprim/Sulfamethoxazole	1400	57	941	62	5400	57	19826	55
Colistin	1212	0.08	648	0.00	4063	0.07	10517	0.03
Doxycycline	x	x	393	47	1906	38	x	x
Fosfomycin	x	x	x	x	x	x	11476	5
Nitrofurantoin	x	x	x	x	x	x	21282	21

Table 5- Resistance profile of *Klebsiella* species (N=20,726)

Antibiotic Tested	Blood (N=4,131)		OSBF (N=1,273)		PA (N=7,429)		Urine (N=11,212)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Amoxicillin/Clavulanic acid	3247	81	937	74	5732	71	8459	64
Piperacillin/Tazobactam	3662	66	1135	56	6447	56	9339	49
Ceftriaxone	2822	83	762	77	4669	76	5967	68
Cefotaxime	2032	85	832	76	5104	76	8486	69
Cefepime	3105	75	1010	67	5694	65	7725	55
Ertapenem	1778	72	662	58	3626	48	4465	41
Imipenem	3479	56	1006	47	5904	43	8219	31
Meropenem	2883	58	968	48	5802	43	7359	31
Amikacin	3647	58	1112	47	6398	48	8969	39
Gentamicin	3423	53	1038	46	5981	47	8830	38
Ciprofloxacin	3436	67	1034	67	6150	68	9363	60
Trimethoprim/Sulfamethoxazole	3133	59	1003	59	5743	57	9475	52
Colistin	2579	1.1	777	1.03	4161	0.5	5794	0.3
Doxycycline	1129	38	398	45	2050	37	x	x
Nitrofurantoin	x	x	x	x	x	x	10269	50

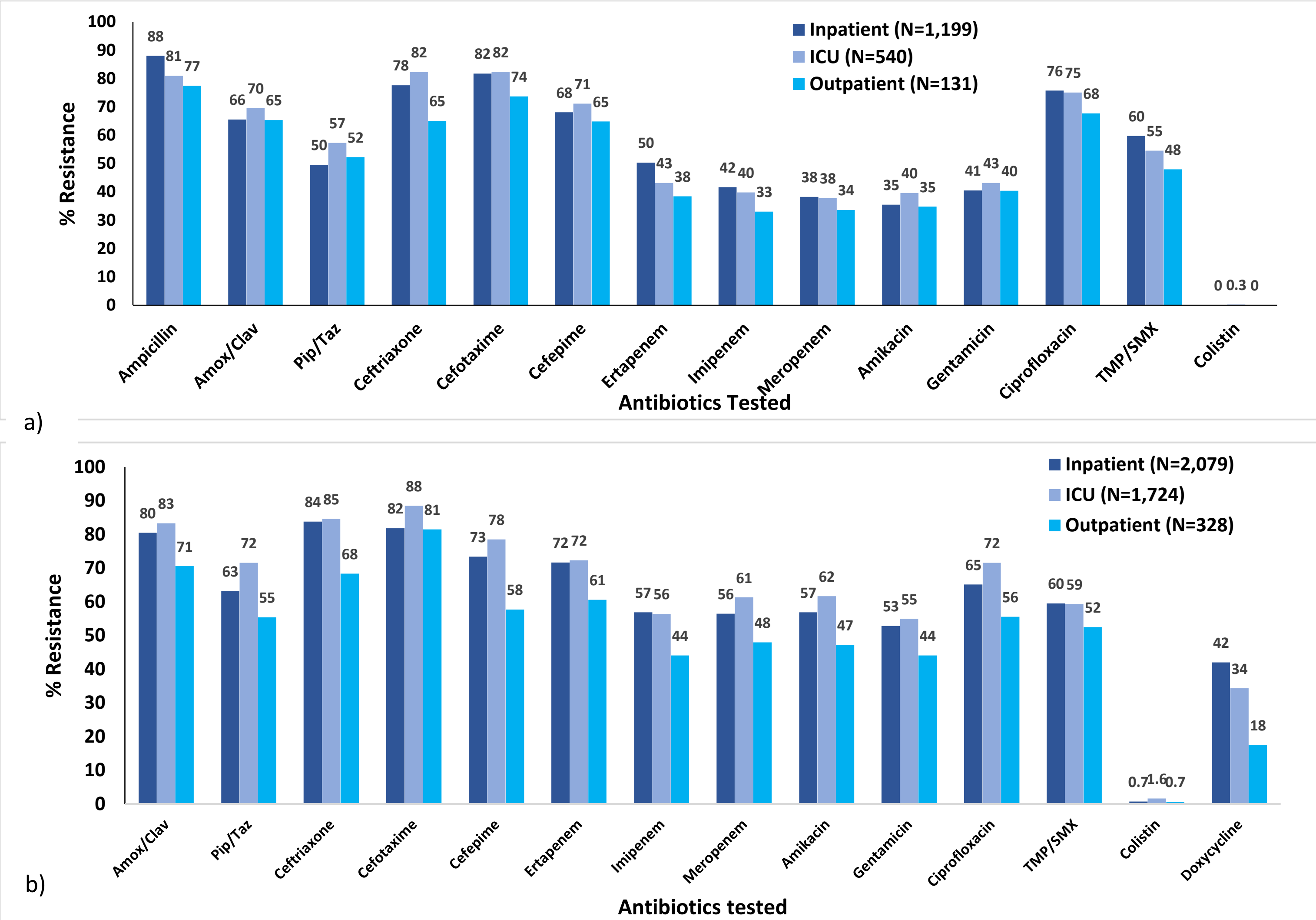


Fig. 9- Resistance profile of a) *E. coli* (N=1,870) and b) *Klebsiella* spp. (N=4,131) in blood by location type

Amongst the tested antibiotics, blood and urine isolates of *Klebsiella* species showed higher resistance in comparison to *E. coli* isolates from the same specimens.

Salmonella Typhi and Paratyphi

A total of 523 isolates of *Salmonella enterica* serotype Typhi and Paratyphi isolates were received, of which 509 were from blood and 14 were from stool specimens. Of 509 blood isolates, 434 were *Salmonella* Typhi and 75 were *Salmonella* Paratyphi. Six blood isolates of *Salmonella* Typhi and four of *Salmonella* Paratyphi were confirmed to be resistant to ceftriaxone and one isolate of *Salmonella* Typhi was resistant to azithromycin. (Table 6)

Table 6- Resistance profile of *S.* Typhi and *S.* Paratyphi (N=509) in blood isolates

Antibiotic Tested	Salmonella Typhi (N=434)		Salmonella Paratyphi (N=75)	
	Number Tested	%R	Number Tested	%R
Ampicillin	356	6	58	7
Ceftriaxone	410	1.5	73	5
Cefixime	327	0	45	0
Imipenem	423	0	74	0
Ciprofloxacin	417	39	68	26
Pefloxacin	296	91	45	96
Azithromycin	368	0.3	66	0
Chloramphenicol	353	1.7	55	0

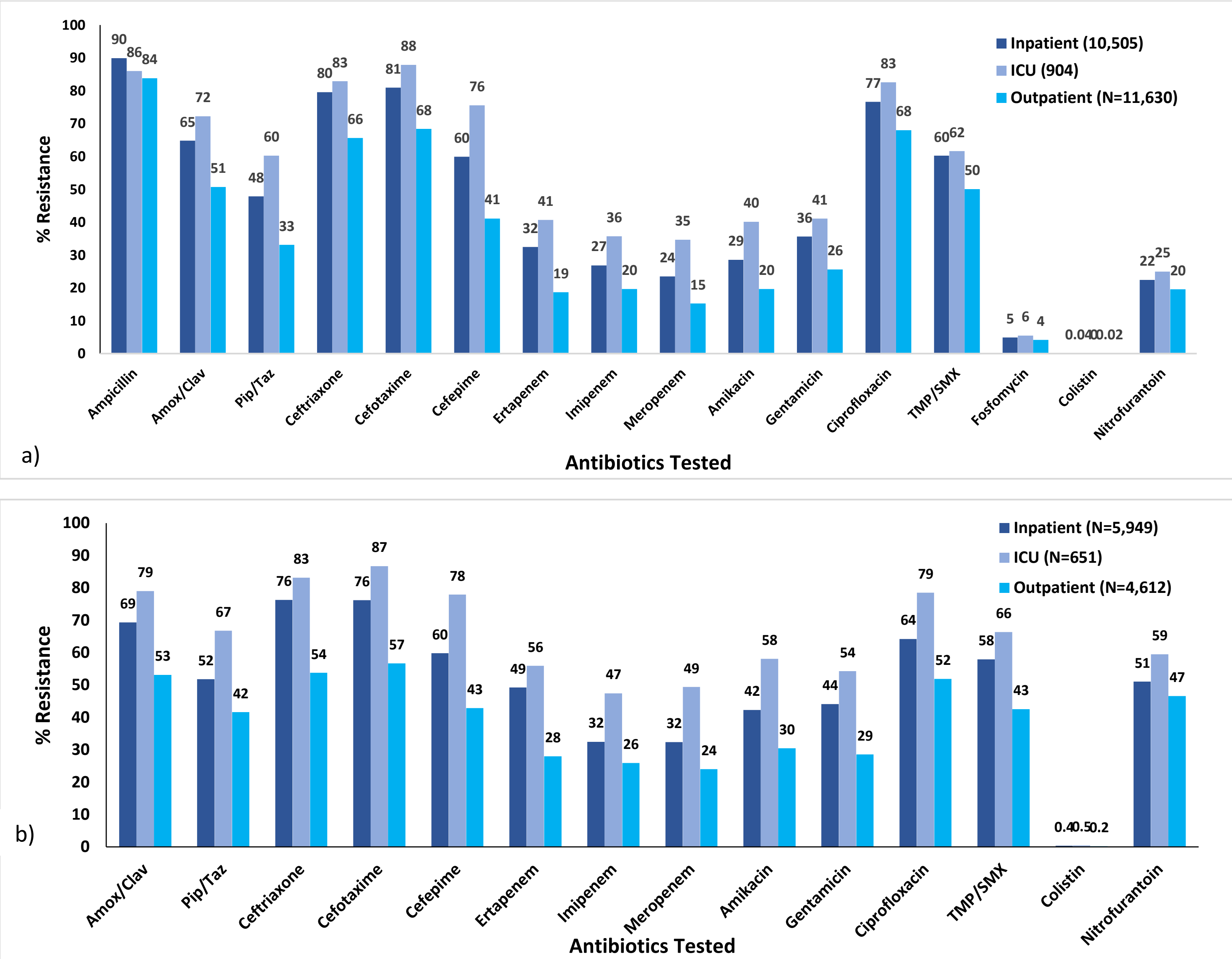


Fig. 10- Resistance profile of a) *E. coli* (N=23,039) and b) *Klebsiella spp*. (N=11,212) in urine by location type

Shigella species

In this data reporting period, 60 isolates of *Shigella* species from stool specimen were confirmed at AMR-NRL. Amongst these isolates, maximum resistance was reported against ciprofloxacin and minimum resistance against chloramphenicol. (Table 7)

Table 7- Resistance profile of *Shigella* species (N=60)

Antibiotic Tested	Number Tested	% R
Ampicillin	54	72
Trimethoprim/ Sulfamethoxazole	57	49
Azithromycin	51	33
Chloramphenicol	53	4
Ceftriaxone	57	40
Ciprofloxacin	57	81

Non- Fermenting Gram Negative Bacilli (NFGNB)

NFGNB accounted for 22% of the total unique patient isolates. Most of the *Pseudomonas* species isolates in current data were isolated from pus aspirates (52%) followed by urine (26%) in comparison to *Acinetobacter* species isolates which were majorly reported from blood (38%) and pus aspirates (32%).

Blood isolates of *Pseudomonas* species showed least resistance to piperacillin/tazobactam, amikacin, gentamicin and ciprofloxacin. Four blood isolates showed resistance to colistin. (Table 8)

Amongst the antibiotics tested, *Acinetobacter* species isolates showed least resistance to minocycline. Blood, OSBF and PA isolates showed high resistance to imipenem and meropenem. Eleven blood isolates of *Acinetobacter* species, three each from urine and pus aspirates showed colistin resistance. (Table 9)

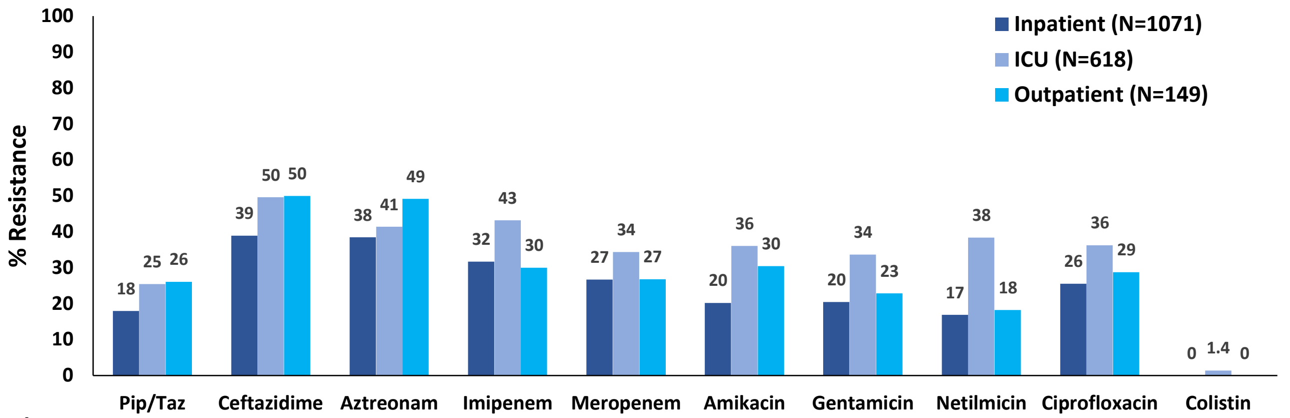
Amongst blood isolates, *Acinetobacter* species showed higher resistance to all antibiotics compared to *Pseudomonas* species isolated from patients in different location types.

Table 8- Resistance profile of *Pseudomonas* species (N=12,439)

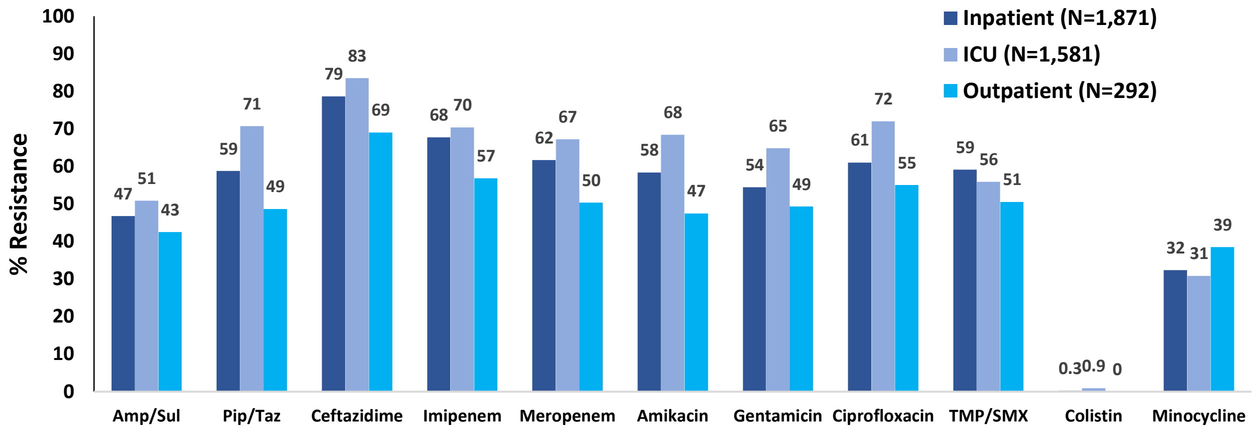
Antibiotic Tested	Blood (N=1,838)		OSBF (N=917)		PA (N=6,415)		Urine (N=3,269)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Piperacillin/Tazobactam	1628	21	861	21	5759	26	2944	33
Ceftazidime	1507	43	854	40	5578	44	2800	54
Aztreonam	1149	40	630	32	3952	28	2274	39
Imipenem	1507	35	791	30	5469	29	2671	41
Meropenem	1326	29	674	26	5193	26	2131	40
Amikacin	1494	26	766	25	5117	31	2813	41
Gentamicin	1177	25	546	18	3946	34	2008	41
Netilmicin	779	23	449	19	2866	33	1688	44
Ciprofloxacin	1502	29	807	31	5377	43	2628	56
Colistin	1039	0.4	508	0	3430	0.06	1732	0.2

Table 9- Resistance profile of *Acinetobacter* species (N=9,926)

Antibiotic Tested	Blood (N=3,744)		OSBF (N=1,192)		PA (N=3,135)		Urine (N=1,855)	
	Number Tested	%R	Number Tested	%R	Number Tested	%R	Number Tested	%R
Ampicillin/Sulbactam	1367	48	591	41	1496	53	740	44
Piperacillin/Tazobactam	3142	63	1079	58	2666	66	1469	43
Ceftazidime	2706	80	935	74	2278	80	1199	64
Imipenem	3157	68	858	68	2483	68	1373	42
Meropenem	2501	64	840	64	2474	66	1151	39
Amikacin	3117	62	1042	57	2595	67	1387	43
Gentamicin	3028	59	981	57	2589	66	1310	41
Ciprofloxacin	3117	65	887	67	2574	75	1447	53
Trimethoprim/Sulfamethoxazole	2659	57	882	60	2156	67	1451	47
Colistin	2046	0.54	691	0	1617	0.19	756	0.40
Minocycline	2206	32	804	25	1637	28	1003	30
Tetracycline	X	X	x	x	x	x	678	48



a)



b)

Fig. 11 - Resistance profile of a) *Pseudomonas* species (N=1,838) and b) *Acinetobacter* species (N=3,744) in blood in different location types

Vibrio cholerae

In the current data reporting period, data of 157 isolates of *Vibrio cholerae* confirmed at AMR-NRL has been analyzed. The isolates showed low resistance to Chloramphenicol, azithromycin and tetracycline respectively. (Table 10).

Table 10- Resistance profile of *V. cholerae* (N=157)

Antibiotic Tested	Number Tested	%R
Ampicillin	156	23
Trimethoprim/Sulfamethoxazole	148	74
Azithromycin	151	3.3
Chloramphenicol	157	1.3
Doxycycline	132	3
Tetracycline	155	1.9

Discussion and Conclusion

Under the National Programme on AMR Containment, this is the fourth semi-annual bulletin on AMR surveillance. AMR surveillance data of 54 sites being supported under the National Programme on AMR Containment is included in the current bulletin. The quality of data submitted by the sites showed significant improvement in last one year which is due to the support provided in terms of onsite visits, wet lab trainings on broth microdilution and data management along with the virtual data quality monitoring calls done monthly with each site.

The proportion of MRSA isolates has decreased from 60% (last 6-month reporting period) to 54% (this reporting period) among blood isolates. The percentage of VRE strains isolated from blood specimen remains almost same in this data reporting period (20%) as compared to that of the previous semi-annual bulletin with data from Jan – June 2024 (21%).

The resistance profile of *E. coli* and *Klebsiella* species isolates from blood reported in this bulletin is comparable to the last one. Blood isolates of Salmonella Typhi and S. Paratyphi showed no resistance to cefixime and very less resistance to Azithromycin (0.3% in S. Typhi, no resistance in S. Paratyphi) comparable to the last bulletin.

High resistance to carbapenem among A*cinetobacter* species is of concern. Resistance to Carbapenems amongst *Pseudomonas* species isolates reported in this bulletin is almost similar to the previous bulletin, 29% and 26% respectively in blood isolates (Meropenem).

Almost double isolates of Vibrio cholerae (157) are reported in this bulletin in comparison to the last one(83), probably because of seasonal variation. However, their susceptibility profiles are similar with maximum isolates showing resistance to cotrimoxazole, 74% and 70% respectively.

In conclusion, AMR surveillance data plays a pivotal role in understanding the scope and progression of resistance patterns, guiding timely interventions, and shaping national and local health strategies. This data helps identify high-risk areas, track trends, and inform policies, allowing for a more targeted and effective response to AMR. The impact of this surveillance is significant, as it supports informed decision-making in healthcare, ultimately reducing the burden of resistant infections. Effective AMR Surveillance coupled with the rational use of antimicrobials, enhanced infection control, public awareness, and investment in research, will play a significant role in containing AMR and protecting future generations from the threat of untreatable infectious diseases. The collective commitment of all relevant stakeholders is essential to reverse the impact of antimicrobial resistance. The dynamic nature of AMR necessitates continuous surveillance and data monitoring and requires a comprehensive and a well-coordinated multi-sectoral approach for early containment.

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