ISSUE

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January-June 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, Rajsthan
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, Maharshtra
48. Pt. RMMC & Hospital, Baripada, Odisha
49. UCMS & Associated GTB Hospital, Delhi
50. Pt. DDUMC, Rajkot, Gujarat

National Antimicrobial Resistance Surveillance Data

National AMR Surveillance Network (NARS-Net)

Antimicrobial resistance (AMR) is a serious challenge placing an enormous burden on the country's healthcare system. As antibiotic resistance continues to escalate, the key contributor, namely overuse and often inappropriate use of antibiotics, continues unabated. High population density, inadequate water, sanitation and hygiene leading to poor infection control measures further exacerbate the problem of AMR. This not only complicates routine medical procedures, such as surgeries and chemotherapy, but also adds to the healthcare costs due to longer hospital stays and the need for more expensive treatments. The economic implications are substantial as well, with increased healthcare costs, prolonged hospital stays, and the need for more expensive treatment.

Antimicrobial resistance (AMR) surveillance is crucial for monitoring the threat posed by resistant pathogens. By systematically monitoring patterns of resistance across various pathogens, AMR surveillance enables health authorities to track trends, identify emerging threats, and evaluate the effectiveness of intervention strategies. This data-driven approach supports the development of targeted treatment guidelines by enabling timely responses to shifts in resistance profiles, informs policy decisions, and guides public health initiatives to reduce the spread of resistant infections.

This is the third semi-annual bulletin of National AMR Surveillance Network established under the “National Programme on Antimicrobial Resistance Containment" a Government of India initiative to combat AMR and coordinated by National Centre for Disease Control (NCDC), Delhi. NCDC has been designated as the National Coordinating Centre for AMR Surveillance in the country. As of June 2024, NARS-Net has been expanded to 60 state medical college laboratories in 27 states and 6 UTs (Fig. 1). These sentinel sites perform bacterial culture, identification & antimicrobial susceptibility testing (AST) by manual methods and/or automated systems using programme Standard operating Procedures (SoPs). The Sentinel sites submit the AST data for selected nine priority pathogens from 5 specimen types (blood, urine, pus & other sterile body fluids, stool) to NCDC on a monthly basis. To ensure data quality and reliability of test results, all the sites are mandated to implement internal quality control (IQC) measures and enroll in National External Quality Assessment Scheme (EQAS) programs. The AST data is compiled, analysed and semi-annual bulletins and annual reports are prepared by NCDC and uploaded on NCDC website. Since 2018, the data has also been collated for WHO-GLASS priority bacterial pathogens and priority specimen types and submitted to Global AMR and use Surveillance System (GLASS).

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

In addition, virtual data quality monitoring calls are done by the respective nodal NCDC officers to handhold on data management issues using WHONET and to improve the data quality at the sites. Moreover, the sites are mandated to submit all emerging AMR alert isolates, as defined under the programme, to NCDC for confirmation. In addition, NCDC organizes training workshops on AMR data management using WHONET to standardize AMR surveillance data collection and submission from network sites to NCDC.

This semi-annual bulletin covers the AMR data from January 2024 to June 2024 from 50 sentinel surveillance sites.

Data Collection and Analysis

The network sites used WHONET 2023 for AMR data management. The monthly data is validated through virtual data quality monitoring calls and thereafter the revised data is collated and analyzed with respect to the demographic and antimicrobial susceptibility testing results using WHONET. The classification of the isolates as susceptible, intermediate or resistant is based on the recent Clinical & Laboratory Standards Institute (CLSI) guidelines.

A single file is generated from all the cumulative AMR data files and data de-duplication is done before carrying out the analysis. For analysis, only the first antibiotic susceptibility result is considered for each patient per specimen type and pathogen.

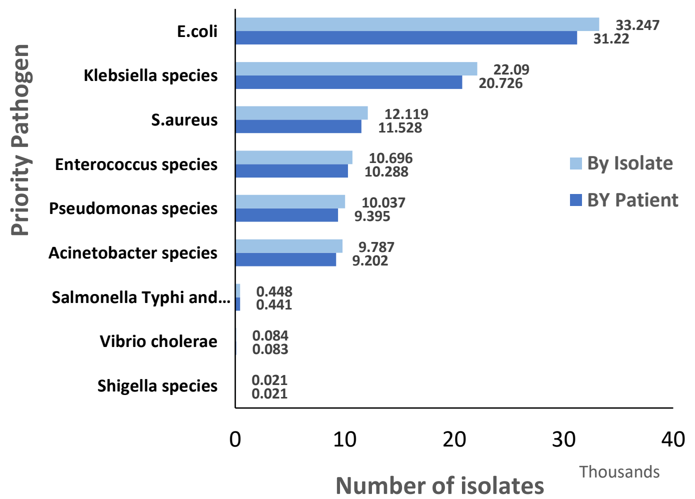


Fig. 1- Distribution of priority pathogen isolates and Unique patient isolates

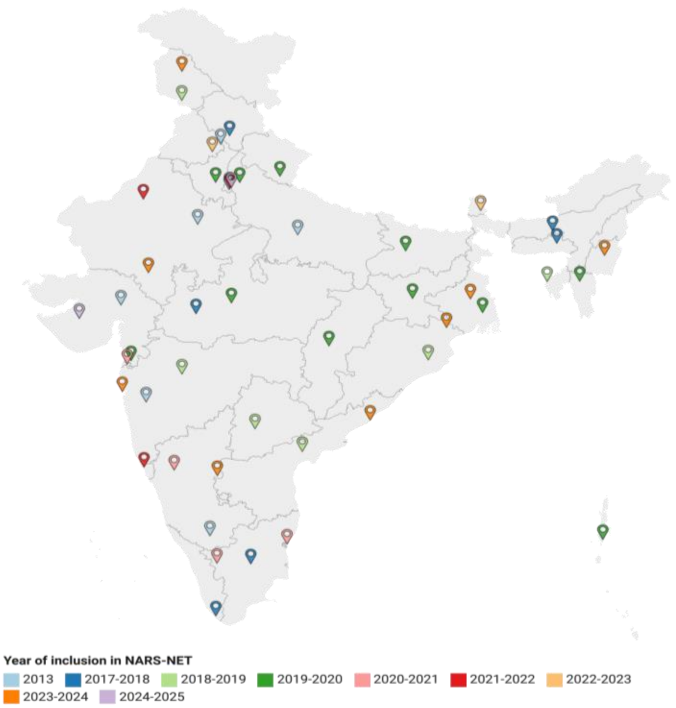


Fig. 2- Geographic location of NARS-Net laboratories submitting AMR data for Jan – June 2024

AMR Surveillance Findings

In this six-monthly bulletin, AMR data of 92,904 unique patients has been reported after de-duplication of the 98,529 isolate data. Of 92,904 unique patients, 52% are male and 47% female patients. As per the age category, almost half of the patients belong to age group 25-64, whereas lowest was reported from children in age group of 1-4 years of age.

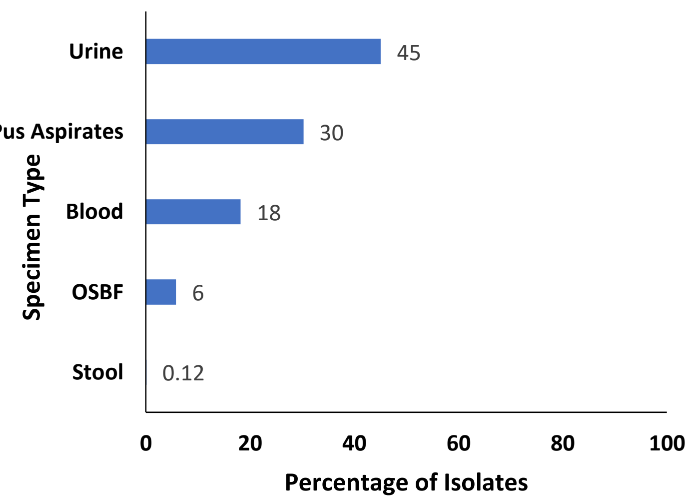
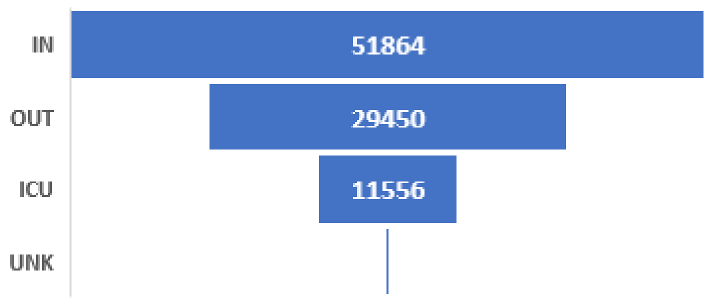


Fig. 3- Percentage Distribution of priority pathogen isolates based on specimen type, NARS-Net (Jan – June 2024)



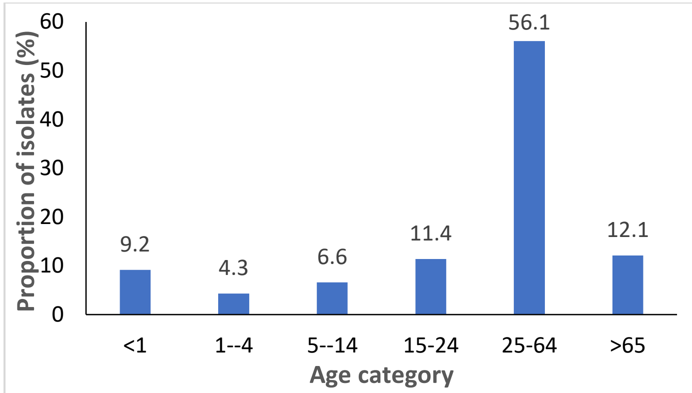


Fig. 4- Distribution of each priority pathogen by location-type (N=92,904), location-type of 34 isolates is unknown

Fig. 5 - Distribution of all priority pathogen isolates by age category (N=92,904)

Table 1- Isolation of priority pathogen by specimen type

Priority Specimen	Blood		OSBF		PA		Urine		Stool	
	Number Tested	%R	Number Tested	%R	Number Tested	%R	Number Tested	%R	Number Tested	%R
E.coli	1752	10.3	1203	22.3	6572	23.4	21693	51.2	x	x
Klebsiella species	3887	23.0	1267	23.5	6170	22.0	9402	22.2	x	x
Acinetobacter species	3744	22.1	1179	21.9	2671	9.5	1608	3.8	x	x
Pseudomonas species	1695	10.0	779	14.5	4120	14.7	2801	6.6	x	x
Salmonella Typhi	402	2.4	x	x	x	x	x	x	3	2.7
Salmonella Paratyphi	33	0.2	x	x	x	x	x	x	3	2.7
Shigella species	x	x	x	x	x	x	x	x	21	19
Vibrio cholerae	x	x	x	x	x	x	x	x	83	75.4
Staphylococcus aureus	3486	20.6	518	9.6	7524	26.8	x	x	x	x
Enterococcus species	1934	11.4	443	8.2	1042	3.7	6869	16.2	x	x
	16933		5389		28099		42373		110	

AMR Surveillance Priority pathogens

During Jan to June 2024 data reporting period, the most commonly isolated priority bacterial pathogen was *E. coli* (33%), which is similar to the previous years, followed by *Klebsiella* species (22%), *S. aureus* (12%), *Enterococcus* species (11%), *Pseudomonas* species (10%), *Acinetobacter* species (9.8%), *Salmonella enterica* serovar Typhi and Paratyphi (0.47 %), *Vibrio cholerae* (0.08%) and *Shigella* species (0.02%) (Table1). The majority of isolates were from patients admitted in hospital wards (IPD- 56%) whereas almost a third of the isolates (32%) were from patients visiting the outpatient clinics. Twelve percent of priority pathogens were isolated from Intensive care units (Fig. 4).

Amongst the inpatients and outpatients, the most commonly isolated priority pathogen was *Escherichia coli* (32%, 43%) followed by *Klebsiella* spp. (22.5%, 20%).

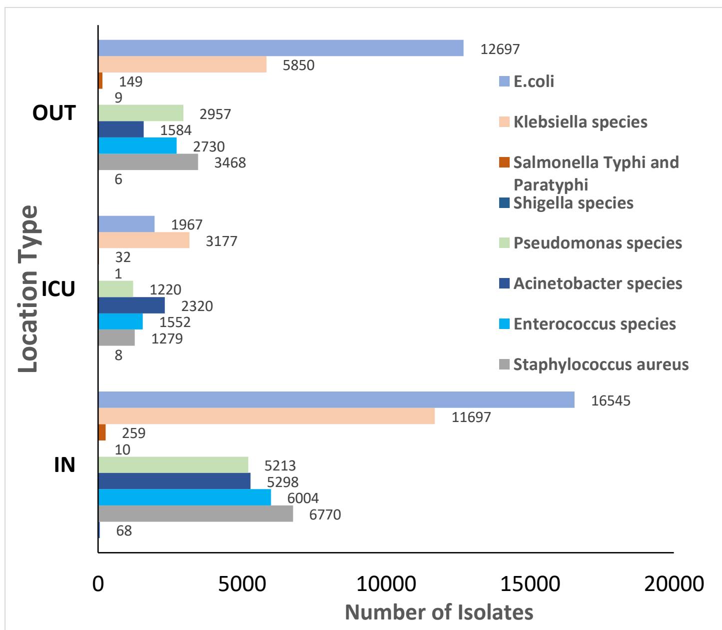


Fig. 6- Distribution of priority pathogen isolates by location-type

However in Intensive care units *Klebsiella* spp. (27.5%) was the most commonly isolated pathogen followed by *Acinetobacter* spp. (20%).

AMR Surveillance Resistance Profile

Gram-positive bacterial pathogens

In this six month reporting period, Gram-positive bacteria viz. *S.aureus* and *Enterococcus* species constituted 23.5% isolates data among all the priority pathogens isolates.

Staphylococcus aureus

Sixty percent of *S.aureus* isolates were found to be MRSA. Of 6468 isolates tested by vancomycin agar screen (VAS) test, none showed growth on VAS plate.

S.aureus isolates from blood showed notably higher resistance to linezolid (1.6%) as compared to the previous years (0-0.2%). This was attributed to the increased revised breakpoints of linezolid for *S.aureus* by CLSI.

Enterococcus species

Enterococcus species was most commonly isolated from urine (67%) followed by blood (19%), pus aspirates (10%) and other sterile body fluids (4%). Isolates from blood showed 21% resistance to vancomycin and 2% resistance to linezolid.

Table 2- Resistance profile of *Staphylococcus aureus* (N=11,528)

Antibiotic Tested	Blood (N=3,486)		OSBF (N=518)		PA (N=7,524)	
	Number tested	%R	Number tested	%R	Number tested	%R
Cefoxitin	2888	60	454	50	6323	53
Gentamicin	2106	21	332	23	5020	20
Ciprofloxacin	2828	56	431	61	6049	67
Trimethoprim/Sulfamethoxazole	2751	34	378	28	5415	19
Clindamycin	3241	42	425	37	6797	29
Erythromycin	3165	66	429	55	6640	53
Linezolid	3073	2	475	1	6676	1
Teicoplanin	635	8	115	2	1108	8
Doxycycline	2426	10	364	10	5104	6

Table 3- Resistance profile of *Enterococcus* species (N=10,288)

Antibiotic Tested	Blood (N=1,934)		OSBF (N=443)		PA (N=1,042)		Urine (N=6,869)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Ampicillin	1627	72	378	68	869	50	5773	60
Gentamicin-High	1553	50	345	51	691	41	4948	56
Erythromycin	1645	80	366	78	793	69	x	x
Linezolid	1854	2	419	1	949	1	6185	1
Vancomycin	1684	21	408	16	896	6	6240	8
Teicoplanin	1241	22	286	18	639	16	4256	16
Doxycycline	1267	33	313	40	653	30	1853	43
Ciprofloxacin	x	x	x	x	x	x	5370	82
Tetracycline	x	x	x	x	x	x	4134	75

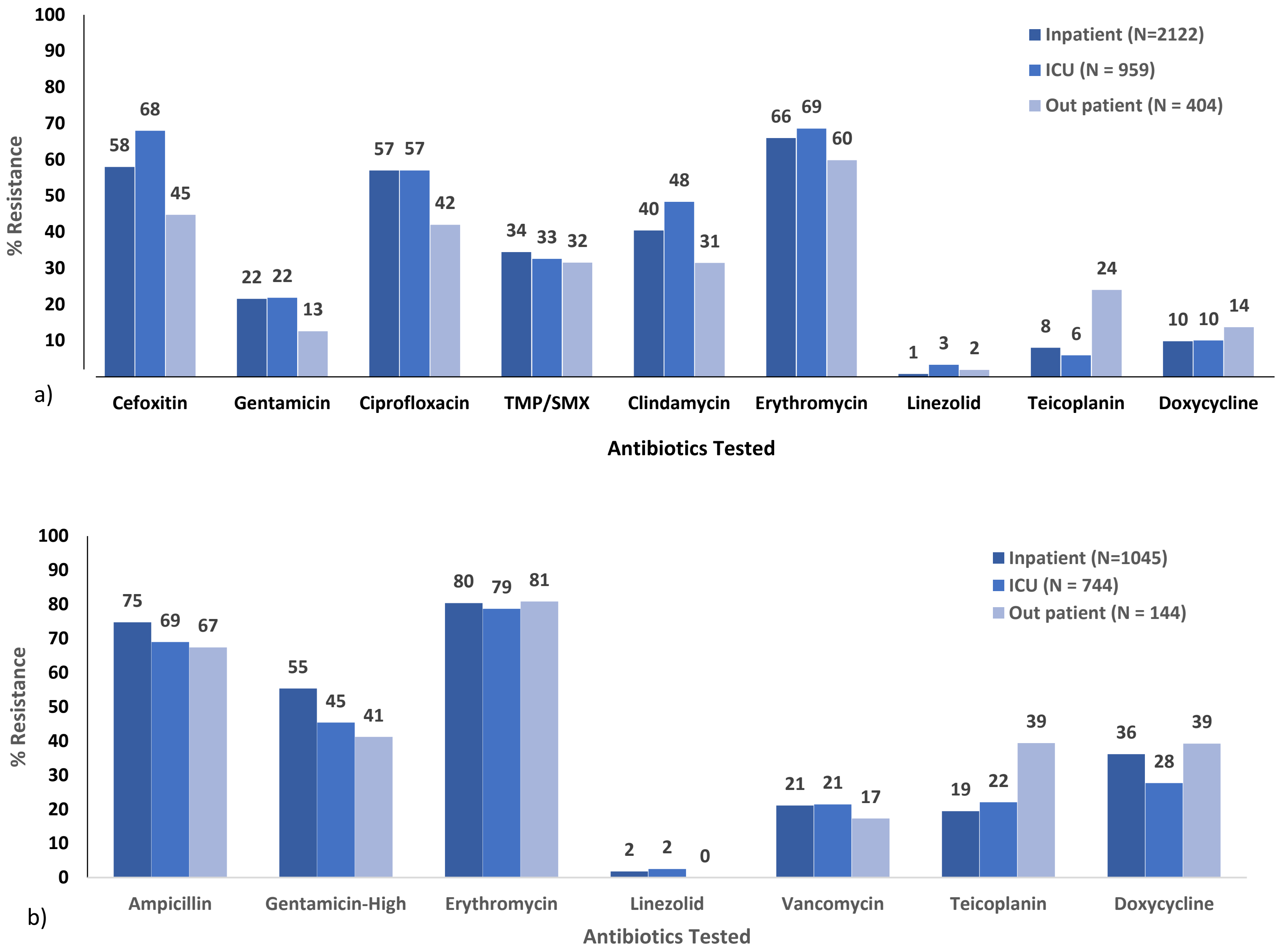


Fig. 9- Resistance profile of a) *S.aureus* (N=3,486) and b) *Enterococcus* spp. (N=1,934) in blood by location type

Gram-Negative Pathogens

AST data of 75,714 isolates of Gram-negative bacterial pathogens have been reported from 71,088 unique patients. Of the Gram-negative pathogens, Enterobacteriaceae accounted to 74% (52,408) of isolates. All the colistin resistant isolates are confirmed using broth microdilution at AMR-NRL at NCDC.

Escherichia coli

E.coli contributed to one-third of the unique patient AST data (Fig. 1). *E coli* was most commonly isolated from the urine samples followed by pus aspirate, blood and sterile body fluids (Table 1).

Klebsiella species

AST data of 75,714 isolates of Gram-negative bacterial pathogens have been reported from 71,088 unique patients.

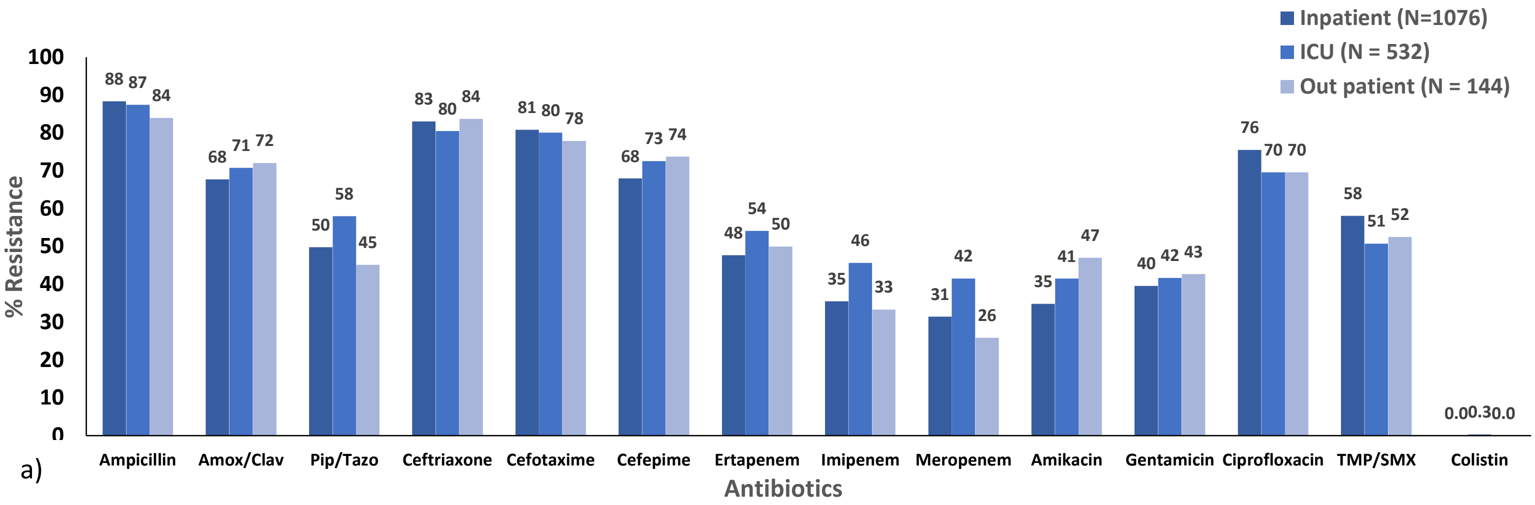
Isolates of *Klebsiella* species from all specimen types showed higher resistance to colistin and to carbapenems as compared to the *E.coli* isolates. Among blood and urine isolates of *E. coli and Klebsiella* species, resistance profile of *Klebsiella* spp. showed higher resistance to all the surveillance panel antibiotics.

Table 4- Resistance Profile of *E.coli* (N=31,220)

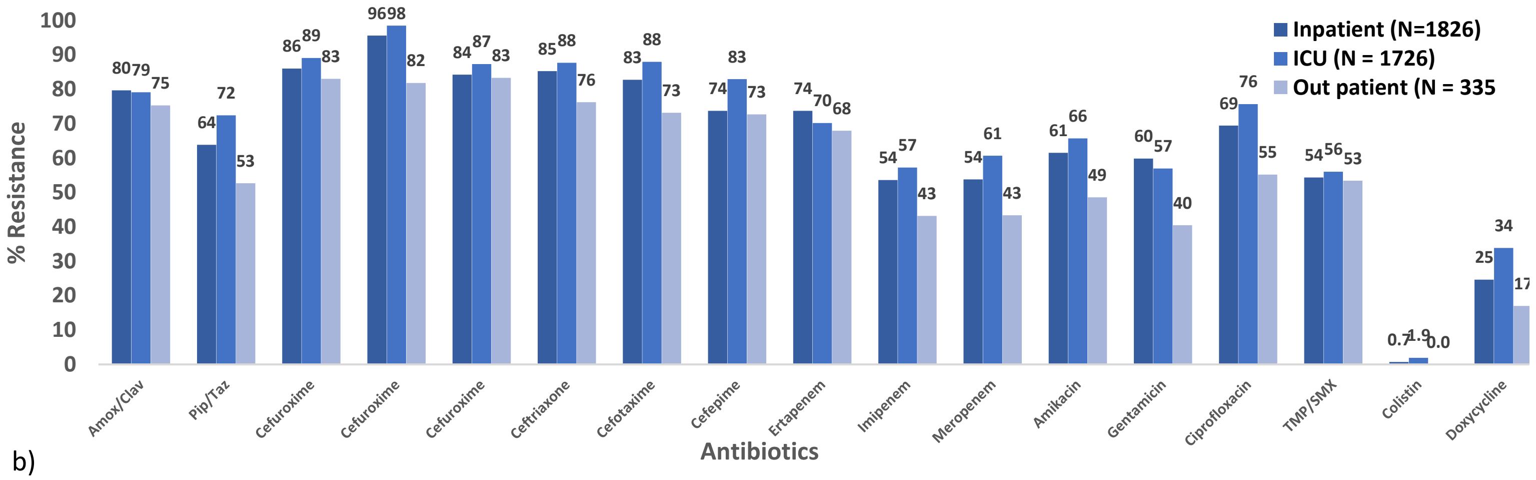
Antibiotic Tested	Blood (N=1,752)		OSBF (N=1,203)		PA (N=6,572)		Urine(21,693)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Ampicillin	1129	88	783	90	4262	90	15433	88
Amoxicillin/Clavulanic acid	1267	69	865	71	4631	64	15410	60
Piperacillin/Tazobactam	1510	52	1041	54	5242	50	15173	39
Ceftriaxone	1106	82	709	84	4335	81	10421	76
Cefotaxime	1023	80	839	84	4703	83	16824	76
Cefepime	1290	70	951	63	4794	63	13585	55
Ertapenem	747	50	558	43	2659	33	8239	23
Imipenem	1455	39	952	38	4833	31	15822	21
Meropenem	1302	34	949	31	4908	26	12524	19
Amikacin	1526	38	1082	26	5419	30	16873	26
Gentamicin	1268	40	804	35	4118	37	13581	34
Ciprofloxacin	1522	73	1019	80	5200	78	17810	74
Trimethoprim/Sulfamethoxazole	1348	55	979	62	5074	58	17756	55
Colistin	1140	0.088	733	0.13	3546	0	9667	0.04
Doxycycline	x	x	420	50	1891	37	x	x
Fosfomycin	x	x	x	x	x	x	10131	3.5
Nitrofurantoin	x	x	x	x	x	x	20199	16

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

Antibiotic Tested	Blood (N=3,887)		OSBF (N=1,267)		PA (N=6,170)		Urine (N=9,402)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Amoxicillin/Clavulanic acid	2779	79	4767	73	4767	73	6931	65
Piperacillin/Tazobactam	3163	67	5026	61	5026	61	6818	48
Ceftriaxone	2581	86	4191	79	4191	79	4849	70
Cefotaxime	2141	84	4442	80	4442	80	6984	72
Cefepime	2741	78	4697	68	4697	68	6067	56
Ertapenem	1521	72	2196	50	2196	50	3658	40
Imipenem	3095	55	4652	44	4652	44	7000	32
Meropenem	2783	56	4732	42	4732	42	5850	32
Amikacin	3290	62	5102	52	5102	52	7424	41
Gentamicin	2809	57	3938	54	3938	54	6278	42
Ciprofloxacin	3273	71	4869	72	4869	72	7894	63
Trimethoprim/Sulfamethoxazole	2852	55	4931	58	4931	58	7651	52
Colistin	2575	1.2	3674	0.4	3674	0.4	5198	0.3
Doxycycline	1015	27	1732	33	1732	33	x	x
Nitrofurantoin	x	x	x	x	x	x	8560	49



a)



b)

Fig. 10- Resistance profile of a) *E.coli* (N=1,752) and b) *Klebsiella* spp. (N=3,887) in blood by location type

including carbapenems and colistin in isolates from the intensive care units as compared to the isolates from inpatient and outpatient departments.

Salmonella Typhi and Paratyphi

A total of 441 isolates of *Salmonella enterica* sero. Typhi and Paratyphi isolates were received, of which 435 were from blood and six were from stool specimens. Four blood isolates of *Salmonella enterica* sero. Typhi were found to be resistant to ceftriaxone and one isolate was resistant to azithromycin.

Table 6- Resistance profile of S. Typhi and Paratyphi (N=435) in blood isolates

Antibiotic Tested	Salmonella Typhi (N=402)		Salmonella Paratyphi (N=33)	
	Number Tested	%R	Number Tested	%R
Ampicillin	357	5.3	28	0
Ceftriaxone	385	1.0	32	0
Cefixime	287	0	23	0
Imipenem	383	0	29	0
Ciprofloxacin	392	31	33	12
Pefloxacin	243	76	20	85
Azithromycin	351	0.3	30	0
Chloramphenicol	354	2.5	30	0

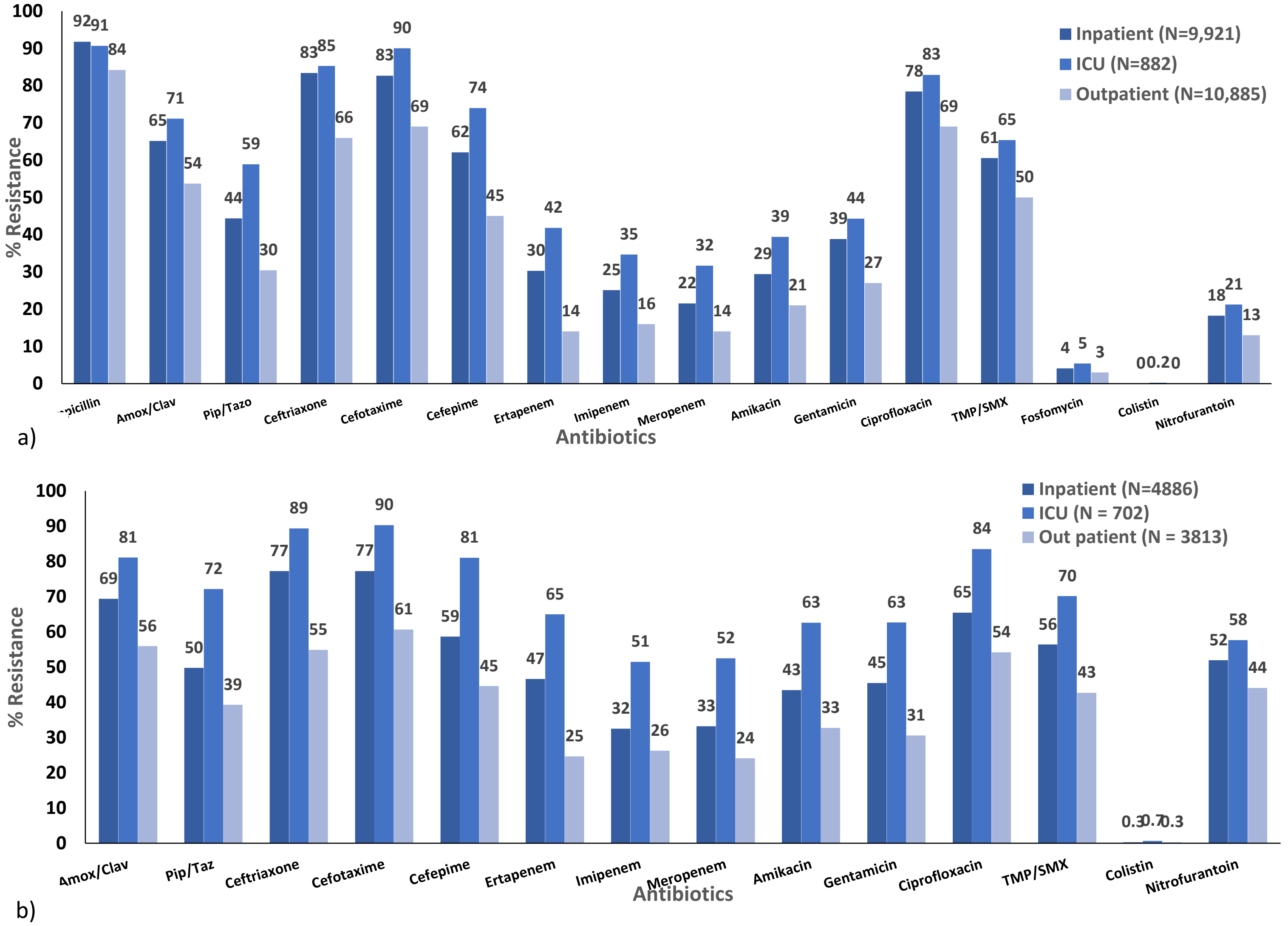


Fig. 11- Resistance profile of a) *E.coli* (N=21,688) and b) *Klebsiella spp*. (N=9,401) in urine by location type; *Location type of 5 *E.coli* isolates and one isolate of *Klebsiella* species is unknown

Shigella species

In the six month data reporting period from Jan to June 2024, 21 isolates of *Shigella* species from stool specimen were confirmed at AMR-NRL and were considered for analysis. Highest resistance is observed to ciprofloxacin and lowest resistance to chloramphenicol and azithromycin.

Table 7- Resistance profile of *Shigella* species (N=21)

Antibiotic Tested	Number Tested	Number Resistant
Ampicillin	19	15
Trimethoprim/Sulfamethoxazole	21	10
Azithromycin	16	5
Chloramphenicol	17	5
Ceftriaxone	20	8
Ciprofloxacin	21	20

Non- Fermenting Gram Negative Bacilli (NFGNB)

NFGNB accounted for 20% of the total unique patients isolates. Most of the *Pseudomonas* species isolates in current data are from pus aspirates (44%) and urine (30%) followed by blood (18%) and OSBF (8.2%). Wheras most of the *Acinetobacter* species isolates are from blood and OSBF.

Blood isolates of *Pseudomonas* species showed least resistance to piperacillin/tazobactam, amikacin, gentamicin and ciprofloxacin.

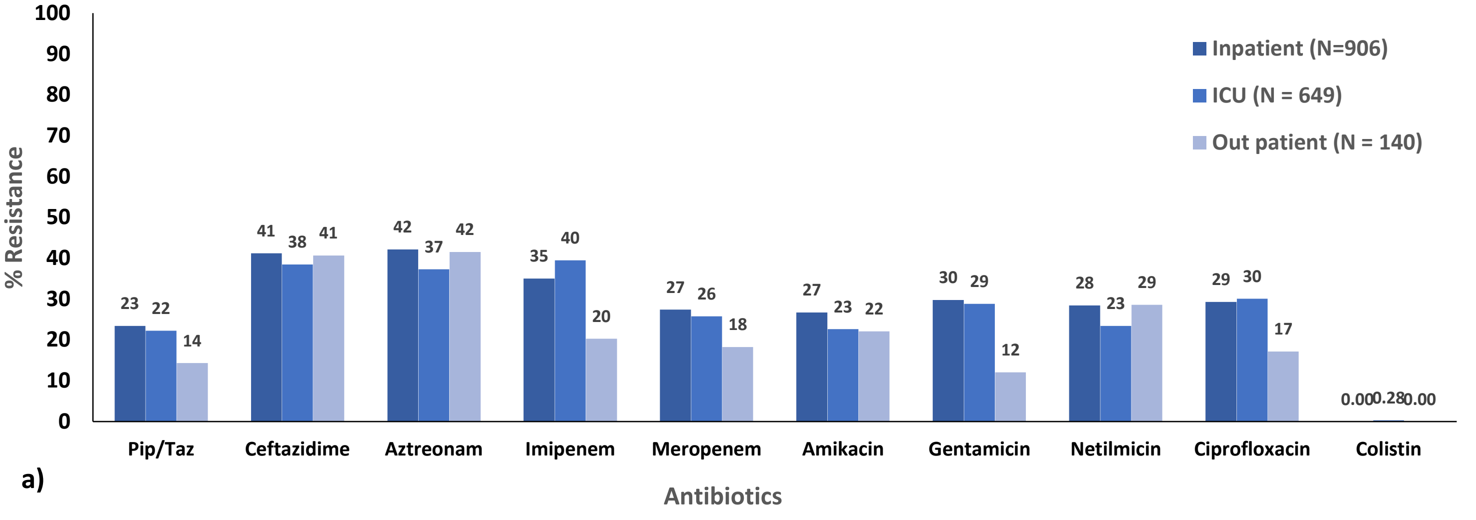
Most of the *Acinetobacter* species isolates in current data are from blood (41%) followed by pus aspirate (29%), urine (17%) and sterile body fluids (13%) (Table 1). Among the antibiotics tested, *Acinetobacter* species isolates showed least resistance to minocycline. Blood, OSBF and PA isolates showed high resistance to imipenem and meropenem. Four blood isolates, two each from urine and pus aspirates and one isolate from other sterile body fluids showed colistin resistance.

Table 8- Resistance profile of *Pseudomonas* species (N=9,395)

Antibiotic Tested	Blood (N=1,695)		OSBF (N=7,79)		PA (N=4,120)		Urine (N=2,801)	
	Number tested	%R	Number tested	%R	Number tested	%R	Number tested	%R
Piperacillin/Tazobactam	1359	22	646	24	3378	28	2124	32
Ceftazidime	1380	40	724	50	3505	52	2504	56
Aztreonam	889	40	503	36	2864	30	1673	37
Imipenem	1202	36	619	37	3126	28	2278	40
Meropenem	1180	26	599	29	3197	23	1808	36
Amikacin	1269	25	611	30	2883	35	2371	42
Gentamicin	784	28	346	28	1785	37	1403	41
Netilmicin	603	26	280	30	1195	34	1369	45
Ciprofloxacin	1301	29	660	35	3248	46	2317	59
Colistin	921	0.11	356	0.0	1873	0.00	1417	0.07

Table 9- Resistance profile of *Acinetobacter* species (N=9,202)

Antibiotic Tested	Blood (N=3,744)		OSBF (N=1,179)		PA (N=2,671)		Urine (N=1,608)	
	Number Tested	%R	Number Tested	%R	Number Tested	%R	Number Tested	%R
Ampicillin/Sulbactam	1248	54	495	53	1332	60	587	47
Piperacillin/Tazobactam	3003	66	907	64	2069	70	1165	44
Ceftazidime	2819	84	874	77	1746	84	1168	66
Imipenem	3023	73	801	68	1967	71	1251	45
Meropenem	2435	69	838	64	1914	67	997	39
Amikacin	3142	63	1030	59	2104	70	1293	48
Gentamicin	2723	65	884	59	1510	71	1039	46
Ciprofloxacin	3072	69	870	67	2021	80	1301	55
Trimethoprim/Sulfamethoxazole	2479	60	883	58	1834	70	1281	48
Colistin	2340	0.17	734	0.14	1390	0.14	698	0.29
Minocycline	2571	33	776	28	1351	27	1041	32
Tetracycline	x	x	x	x	x	x	692	52



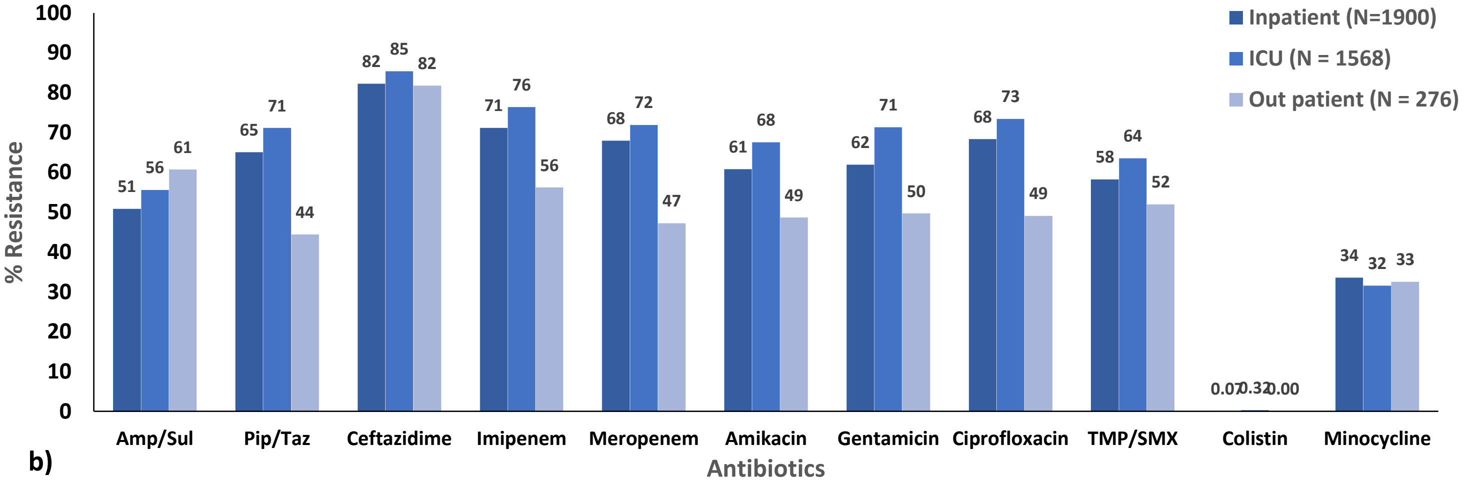


Fig. 8 - Resistance profile of a) *Pseudomonas* species (N=1,695) and b) *Acinetobacter* species (N=3,744) in blood

Vibrio cholerae

In the current data reporting period, data of 83 isolates of *Vibrio cholerae* confirmed at AMR-NRL has been analyzed. Doxycycline, azithromycin and tetracycline showed low resistance. None of the isolates showed resistance to chloramphenicol.

Table 10- Resistance profile of *V.cholerae* (N=83)

Antibiotic Tested	Number Tested	%R
Ampicillin	81	17
Trimethoprim/Sulfamethoxazole	81	70
Azithromycin	70	3
Chloramphenicol	72	0
Doxycycline	78	4
Tetracycline	80	2.5

Discussion and Conclusion

Under the National Programme on AMR Containment, this is the third semi-annual bulletin on AMR surveillance. The number of sites submitting AMR surveillance data has increased from 41 sites which contributed data till December 2023 to 50 sites. The number of sites submitting broth microdilution AST data for colistin testing against Enterobacteriaceae and NFGNB has increased due to number of hands on trainings conducted by NCDC for the programme sites. Similarly, 2/3rd of the sites have started performing vancomycin agar screen as a part of AST of *S.aureus* isolates. The data quality of sites has improved significantly which is attributed to the monthly virtual data monitoring calls done for all the sites. The proportion of MRSA has increased to 60% among blood isolates as compared to the previous year. Similarly there is 2% increase in resistance rates in VRE from the previous year data (19% in 2023 and 21% in Jan – June 2024). Notably, the rate of resistance to carbapenem has increased for *Acinetobacter* species from last 5 years.

In summary, robust AMR surveillance data is crucial for understanding the scope and dynamics of antimicrobial resistance. This data enables timely detection of resistance patterns, informs treatment guidelines, and drives targeted public health interventions. By leveraging comprehensive surveillance systems, one can make informed decisions, allocate resources effectively, and ultimately enhance the efforts in AMR containment. Investing in this data not only protects current therapeutic options but also safeguards public health for the future. The collective efforts are vital in turning the tide against AMR.

National Programme on AMR Containment
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