Antimicrobial Susceptibility Summary:

Pediatric Patients

2023

Clinical Microbiology

Department of Pathology, Microbiology, and Immunology

Preface

This booklet contains up-to-date information to assist in decisions concerning antimicrobial therapy.

Tables summarize susceptibility data obtained for organisms isolated in the VUMC Clinical Microbiology Laboratory between January 1, 2023 – December 31, 2023.

Guidelines for Interpretation of Minimum Inhibitory Concentrations (MICs)

MICs are interpreted as susceptible, intermediate, resistant, non-susceptible, or susceptible dose dependent according to Clinical and Laboratory Standards Institute (CLSI) guidelines. When deciding whether the interpretation is meaningful, one should consider the antimicrobial pharmacokinetics, taking into account dosage and route of administration, the infecting organism and site of infection, and previous clinical experience.

For additional information, please call the microbiology laboratory or the Antimicrobial Stewardship team.

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Frequently Called Numbers

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Helpful Resources

VASP Website: https://www.vumc.org/antimicrobial-stewardship-program/welcome

Pediatric ASP Website: https://pediatrics.vumc.org/antimicrobial-stewardship-program

Table of Contents

General Antibiograms, 2023 Data

Table 1. Pediatrics—Most Common Gram-Negative Bacteria, Urine Cultures, % Susceptible

Data represent first isolate per patient

Organism	N	Amoxicillin-clavulanate	Ampicillin	Ampicillin-sulbactam	Aztreonam	Cephalexin	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Ertapenem	Gentamicin	Levofloxacin	Meropenem	Nitrofurantoin**	Piperacillin-tazobactam	Tetracycline	Tobramycin	Trimethoprim-sulfamethoxazole
Enterobacter cloacae	40	R	R	R	85	R	93	83	78	90	90	98	93	100	33	90	93	98	75
Escherichia coli	932	89	50	79	95	90	95	96	94	78	100	91	87	100	100	98	75	91	72
Outpatient	517	89	54	80	95	91	96	96	94	80	99	90	87	100	100	98	77	89	76
Inpatient (non-ICU)	377	88	45	77	94	89	94	97	93	77	100	93	87	100	100	97	71	92	67
ICU	41	88	51	78	95	93	95	95	95	73	100	93	83	100	100	98	88	90	76
Klebsiella oxytoca	23*	83	17	83	87	74	96	96	91	96	100	91	100	100	91	87	96	91	96
Klebsiella pneumoniae	104	96	R	82	93	90	93	92	92	87	99	95	89	100	30	92	80	93	85
Outpatient	44	98	R	84	98	96	98	96	98	93	100	100	98	100	32	98	80	98	82
Inpatient (non-ICU)	53	94	R	79	91	87	91	91	89	85	98	93	87	100	32	87	81	91	87
Pseudomonas aeruginosa	36	R	R	R	91	R	94	94	R	88	R	R	85	94	R	94	R	ND	R
Proteus mirabilis	47	96	85	98	98	92	98	98	94	94	100	77	94	ND	R	100	R	83	85

**fewer than 30 isolates, interpret with caution*

***Nitrofurantoin is restricted to uncomplicated cystitis only*

R, resistance; ND, no data.

Urinary Tract Clinical Practice Guidelines are available here.
For empiric treatment of uncomplicated UTI, first line therapy in children is oral cephalexin.

Table 2. Pediatrics—Most Common Gram-Negative Bacteria, Non-Urine Isolates, % Susceptible

Data represent first isolate per patient

Organism	N	Amoxicillin-clavulanate	Ampicillin	Ampicillin-sulbactam	Aztreonam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone	Ciprofloxacin	Ertapenem	Gentamicin	Levofloxacin	Meropenem	Piperacillin-tazobactam	Tetracycline	Tobramycin	Trimethoprim-sulfamethoxazole
Pseudomonas aeruginosa	192	R	R	R	88	R	98	94	R	84	R	R	85	95	91	R	ND	R
Outpatient	66	R	R	R	89	R	100	96	R	79	R	R	81	91	91	R	ND	R
Inpatient (non-ICU)	60	R	R	R	87	R	95	95	R	82	R	R	82	96	91	R	ND	R
ICU	66	R	R	R	88	R	99	92	R	91	R	R	91	97	92	R	ND	R
Escherichia coli	128	84	45	73	88	68	88	91	86	69	98	84	77	100	95	66	84	69
Outpatient	26	92	58	73	96	89	96	100	96	73	100	96	81	100	98	81	96	73
Inpatient (non-ICU)	69	81	44	77	90	65	87	91	86	71	99	84	75	100	92	61	84	65
ICU	33	85	36	67	79	60	82	85	79	61	97	73	79	100	98	64	73	73
Enterobacter cloacae	70	R	R	R	90	R	93	90**	81.4**	99	87	97	99	100	89	96	99	94
Inpatient (non-ICU)	26*	R	R	R	100	R	100	100**	96.2**	100	100	100	100	100	96	100	100	92
ICU	34	R	R	R	79	R	85	79.4**	64.7**	97	74	94	97	100	79	91	97	97
Stenotrophomonas maltophilia	54	R	R	R	R	R	R	R	R	ND	R	R	61	R	R	R	R	94
Serratia marcescens	48	R	R	R	100	R	100	100**	100**	92	100	100	94	100	100	ND	75	ND
Klebsiella oxytoca	41	90	R	88	93	30	98	100	90	95	95	100	98	100	86	95	100	95
Klebsiella pneumoniae	37	97	R	84	95	79	89	92	89	92	100	97	92	100	95	89	97	89

Minocycline susceptibility for S. maltophilia is 85%

**fewer than 30 isolates, interpret with caution*

*** Ceftriaxone and ceftazidime resistance may emerge quickly during therapy as a result of derepression of AmpC Beta-lactamase*

Table 3. Pediatrics—*Staphylococcus aureus,* % Susceptible

Data represent first isolate per patient

	N	Oxacillin	Ceftaroline	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Gentamicin	Linezolid	Nitrofurantoin*	Penicillin	Rifampin	Tetracycline	Trimethoprim-sulfamethoxazole	Vancomycin
Staphylococcus aureus	966	71	100	96	100	99	59	97	100	100	19	100	95	95	100
MRSA	277	R	99	90	100	98	30	96	100	100	R	99	95	94	100
MSSA	690	100	100	98	100	99	70	98	100	100	27	100	95	95	100

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Clindamycin susceptibility is high for MRSA and MSSA in all settings.

Table 4. Pediatrics—*Streptococcus pneumoniae,* % Susceptible

Data represent first isolate per patient, N = 63 patients

Antibiotic	Site of infection	%S
Penicillin G	Meningitis Non-meningitis Oral	65 96 65
Amoxicillin	Non-meningitis	97
Ceftriaxone	Meningitis Non-meningitis	96 99
Cefotaxime	Meningitis Non-meningitis	94 97
Cefepime	Meningitis Non-meningitis	81 90
Meropenem	All	82
Levofloxacin	All	97
Moxifloxacin	All	100
Trimethoprim/Sulfamethoxazole	All	80
Clindamycin	Non-meningitis	87
Erythromycin / Azithromycin	All	54
Vancomycin	All	100
Tetracycline	All	76

Meningitis and non-meningitis refer to breakpoint, not source of isolate

Macrolides are not preferred therapy for pneumococcal pneumonia due to reduced susceptibility.
Penicillin and amoxicillin susceptibility remains high and is preferred for infections outside the central nervous system.
Clinical Practice guidelines for community acquired pneumonia in children can be found here.

Table 5. Pediatrics—*Enterococcus* spp., % Susceptible

Data represent first isolate per patient

Organism	N	Ampicillin	Daptomycin	Doxycycline	Gentamicin Synergy*	Linezolid	Nitrofurantoin**	Penicillin	Vancomycin
Enterococcus faecalis	164	99	92	47	90	100	100	99	99

Among 9 E. faecium isolates, 100% were susceptible to ampicillin and 87.5% to vancomycin

**Gentamicin synergy indicate % susceptible to these aminoglycosides, if combined with a susceptible cell-wall active agent, such as penicillin, ampicillin or vancomycin, for endocarditis*

***Nitrofurantoin is restricted to uncomplicated cystitis only*

Table 6. Pediatrics—Coagulase-Negative Staphylococci, % Susceptible

Data represent first isolate per patient

Organism	N	Oxacillin	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Gentamicin	Linezolid	Nitrofurantoin	Penicillin	Vancomycin
Staphylococcus epidermidis	97	26	51	100	87	13	100	100	100	20	100
Staphylococcus lugdunensis	19*	95	79	100	100	68	100	100	100	53	100

**fewer than 30 isolates, interpret with caution*

Table 7. *Streptococcus* spp., % Susceptible

Data represent first isolate per patient

Organism	N	Cefepime	Cefotaxime	Ceftriaxone	Clindamycin	Erythromycin	Levofloxacin	Linezolid	Penicillin	Tetracycline	Vancomycin
Streptococcus agalactiae (GBS)	13*	100	100	100	46	23	100	100	100	8	100
Streptococcus pyogenes (GAS)	32	100	100	100	100	93	100	97	100	97	97
Streptococcus intermedius	27*	100	100	100	81	ND	100	100	100	ND	100
Streptococcus constellatus	24*	79	100	100	79	ND	96	100	96	ND	100
Streptococcus anginosus	33	100	100	100	79	ND	94	100	100	ND	97
Streptococcus mitis	14*	100	92	92	92	ND	77	100	64	ND	100

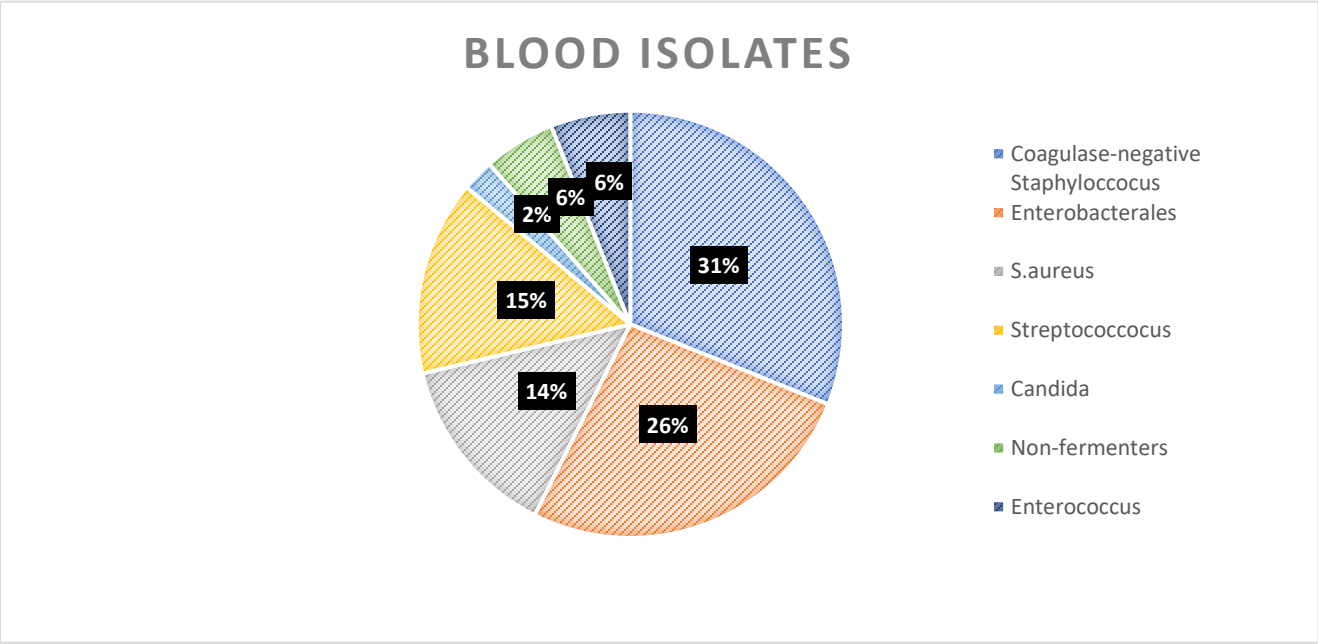
**fewer than 30 isolates, interpret with caution*

For GAS pharyngitis, penicillin remains preferred therapy. Macrolides are not preferred due to reduced susceptibility.

Table 8. Pediatrics—Blood Culture Isolates

Data represent first isolate per patient

Organism	N	Resistance profile
Staphylococcus epidermidis	71	81% oxacillin-resistant
Staphylococcus aureus	46	31% oxacillin-resistant
Escherichia coli	33	9% ESBL
Enterococcus faecalis	15	0% Ampicillin-resistant
Staphylococcus hominis	14	65% oxacillin-resistant
Enterobacter cloacae	13	0% cefepime resistant
Klebsiella pneumoniae	13	8% ESBL
Streptococcus mitis	13	0% ceftriaxone resistant
Pseudomonas aeruginosa	12	0% cefepime-resistant
Staphylococcus capitis	12	50% oxacillin-resistant
Klebsiella oxytoca	10	20% ESBL
Streptococcus pneumoniae	10	11% ceftriaxone resistant



Multidrug Resistant Organism (MDRO) Trends, Pediatric Patients

Table 9. Pediatrics—Trends in MDROs

	2017	2018	2019	2020	2021	2022	2023
ESBL E. coli	6	6	8	7	7	6.5	7
ESBL K. pneumoniae	10	3	4	5	2	6	9
MRSA	41	38	37	27	33	31	29
VRE	0	30	33	0	10	1	1.1
MRAB	0	0	10	0	0	0	0
CRPA	6	5	4	5	4.3	5.1	5