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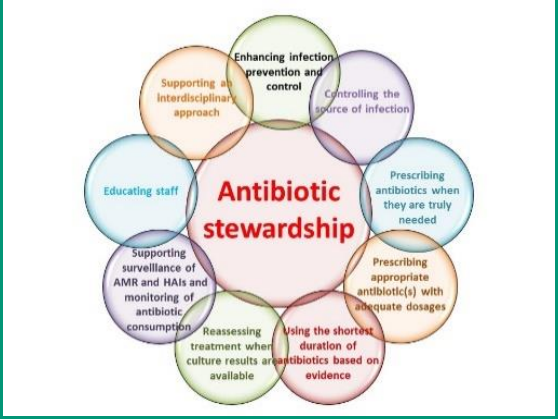
Bingham Memorial Hospital
Antimicrobial Stewardship Program



by Wade H. Flowers, Pharm.D., BCPS, BCGP

December 3rd, 2024

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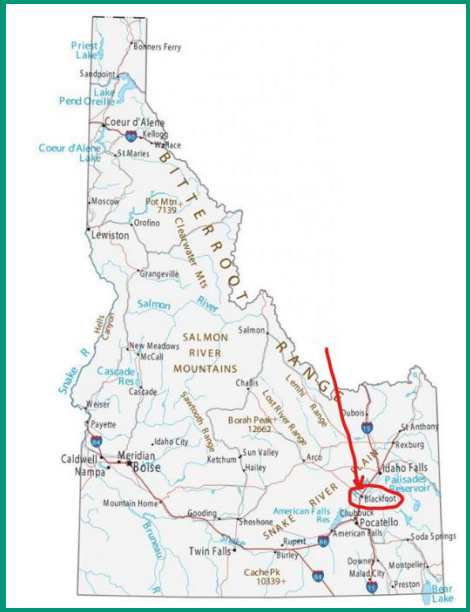
Background

- 25-bed CAH in Blackfoot, Idaho
- 2nd largest CAH in U.S.
- 32 clinics and 7 Urgent Care Clinics covering > 3,000 mi² of Eastern Idaho
- ~ 350,000 Population



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Background

- Nestled between 2 Regional Hospitals
- > 1,100 employees
- > 150 providers
- > 12,000 surgeries per year
- East Idaho Population ~ 350,000

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Antimicrobial Stewardship Goals

- Provide Tender Guidance to Enhance Appropriate Abx Utilization within Bingham Healthcare
- Monitor Abx Utilization and Pathogenic Resistance Patterns
- Collaborative Education

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Quick AMS Timeline

2000 – Developed 1st Antibiogram

			Gram-Pos				Gram-Negative					
		Patient Cost per Day	Enterococcus	S. pneumoniae	S. aureus	Coag Neg. Staphylococcus	E. coli	Enterobacter cloacae	K. pneumoniae	Proteus	S. Marcescens	P. aeruginosa
6	# Organisms Tested		46	1	55	46	170	3	24	8	2	23
7												
8	Ampicillin - 2gm IV q6h	$ 76.00	98	100	11	9	61	0	8	100	0	
9	Augmentin - 875mg po q12h	$ 32.00			95	54	98	0	92	100	0	
10	Bactrim/Septra - DS po bid	$ 3.50			100	80	81	100	92	100	0	
11	Cefazolin - 1gm IV q8h	$ 38.00			95	54	95	0	88	100	0	
12	Cefotaxime - 1gm IV q8h	$ 130.00			95	52						
13	Ceftazidime - 2gm IV q8h	$ 260.00					98	100	100	100	100	87
14	Ceftriaxone - 1gm IV q24h	$ 147.00					98	100	100	100	0	26
15	Cefuroxime - 250mg po q12h	$ 26.00					99	67	92	100	0	
16	Clindamycin - 900mg IV q8h	$ 123.00		100	100	91						
17	Erythromycin - 500mg IV q6h	$ 153.00	9	100	76	54						
18	Gentamicin - 500mg IV q24h	$ 99.00			96	91	99	100	100	88	0	61
19	Levofloxacin - 500mg IV q24h	$ 119.00	50	100	100	70	100	100	100	100	100	57
20	Nafcillin - 2gm IV q6h	$ 57.00			95	54						
21	Penicillin G - 5 mU q4h	$ 41.00	100	100	11	9						
22	Primaxin - 500mg IV q6h	$ 370.00			95	54	99	100	100	100	100	87
23	Tobramycin - 500mg IV q24h	$ 224.00					99	100	100	88	50	96
24	Unasyn - 3gm IV q6h	$ 175.00					64	0	88	100	0	
25	Zosyn - 3.375gm IV q6h	$ 195.00					99	100	100	100	100	87
26												

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Quick AMS Timeline

- 2001 – 1st Infectious Disease Newsletter
- 2003 – Developed Pneumonia Pathway
- 2004 – Sepsis Pathway
- 2006 – Developed Gentamicin and Vancomycin (pre-historic) PK Program

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Quick AMS Timeline

- 2013 – Formal Antimicrobial Stewardship Kickoff
- 2014 – Developed Various Protocols
  - Updated CAP/HAP
  - Pneumococcal Vaccine Protocol
  - Sepsis

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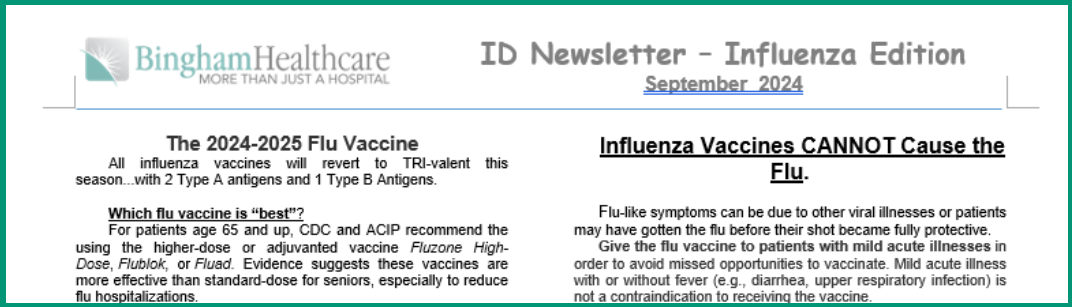
Quick AMS Timeline

- **2015 – Started Quarterly Infectious Disease Newsletter**
  - **Annual Influenza Edition**



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ID Newsletter – Influenza Edition
September 2024

The 2024-2025 Flu Vaccine

All influenza vaccines will revert to TRI-valent this season...with 2 Type A antigens and 1 Type B Antigens.

Which flu vaccine is "best"?

For patients age 65 and up, CDC and ACIP recommend the using the higher-dose or adjuvanted vaccine *Fluzone High-Dose*, *Flublok*, or *Fluad*. Evidence suggests these vaccines are more effective than standard-dose for seniors, especially to reduce flu hospitalizations.

Influenza Vaccines CANNOT Cause the Flu.

Flu-like symptoms can be due to other viral illnesses or patients may have gotten the flu before their shot became fully protective.

Give the flu vaccine to patients with mild acute illnesses in order to avoid missed opportunities to vaccinate. Mild acute illness with or without fever (e.g., diarrhea, upper respiratory infection) is not a contraindication to receiving the vaccine.

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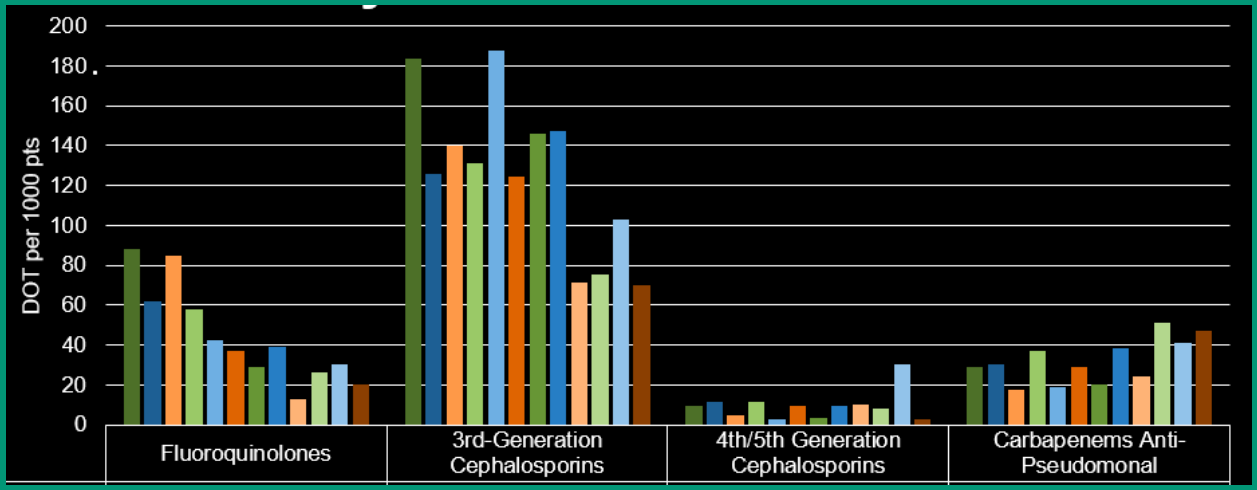
Quick AMS Timeline

Annual Antimicrobial Utilization Review



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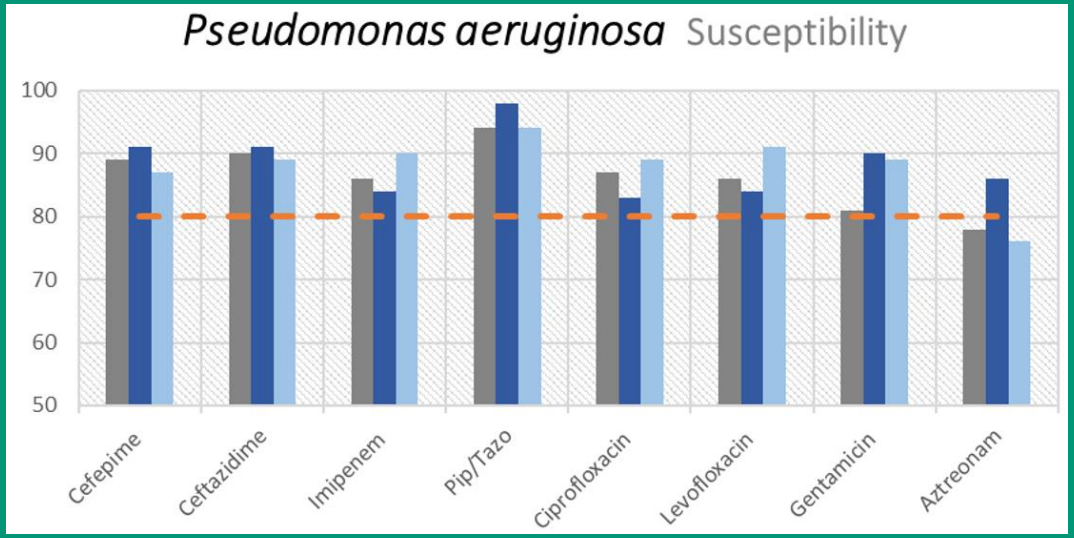
Quick AMS Timeline

Annual Pathogenic Susceptibility Review



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Quick AMS Timeline

- 2020 – Joined UW-TASP
- 2020 – Joined ECHO Idaho - COVID
- 2022 – IQIC 101
- 2023 – IQIC 201
- 2024 – IQIC 301

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Antimicrobial Stewardship - Today

Antibiogram - Rolling 12-month published q 6 months

Antimicrobial Susceptiblity Report
01/01/2023 thru 12/31/2023

Gram Negative Organisms - All Sources

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	Beta-Lactams							Carbapenems		BLICs			Fluoro-quinolones		Amino-glycosides		Miscellaneous			
	Ampicillin	Cefazolin (Ancef™)	Cefuroxime (Zinacef™/Ceftin™)	Cefotaxime (Claforan™)	Ceftazidime (Fortaz™)	Ceftriaxone (Rocephin™)	Cefepime (Maxipime™)	Imipenem (Primaxin™)	Ertapenem (Invanz™)	Amoxicillin/Clav (Augmentin™)	Ampicillin/Sulbactam (Unasyn®)	Piperacillin/Tazobactam (Zosyn®)	Ciprofloxacin (Cipro™)	Levofloxacin (Levaquin™)	Gentamicin	Tobramycin	Aztreonam (Azactam™)	TMP-SMX (Bactrim™/Septra™)	Tetracycline	Nitrofurantoin (Macrobid™)
** NOTE: Data for < 30 isolates insufficiently powered to detect trends*																				
Organism (# of isolates)	AM	CFZ	CRM	CFT	CAZ	CAX	CPE	IMP	ETP	AUG	A/S	P/T	CP	LVX	GM	TO	AZT	T/S	TE	FD
Citrobacter freundii (30)	3	0	20	90	87	83	93	87	100	0	17	100	97	100	93	93	87	83	70	96
Enterobacter cloacae (54)	2	0	9	79	85	72	96	94	89	0	7	93	94	96	96	96	80	91	85	34
Escherichia coli (1,452)	61	95	93	95	95	94	95	99	99	90	67	99	90	91	94	95	95	81	80	98
Klebsiella aerogenes (31)	0	0	3	87	77	74	100	77	97	0	3	90	97	100	100	100	90	97	90	46
Klebsiella oxytoca (64)	6	89	89	95	95	92	95	95	95	89	73	97	97	98	97	97	91	89	89	93
Klebsiella pneumoniae (187)	2	100	95	98	99	98	99	99	98	96	92	98	99	99	99	98	98	95	90	73
Proteus mirabilis (82)	82	95	93	93	93	91	95	-	94	90	85	99	87	89	89	88	90	83	0	0
Pseudomonas aeruginosa (84)	0	0	0	0	98	0	94	92	0	0	0	98	94	95	86	99	92	0	0	-

Susceptibility Pattern Comparison - 2022 vs 2023 - Gram-Negative Pathogens

E. coli - Susceptibilities remained relatively stable compared to 2022

E. coli-ESBL - Susceptibilities remained relatively stable compared to 2022

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Antimicrobial Stewardship - Today

- Empiric Guidelines
  - Sepsis, Pneumonia, UTI
  - Reviewed Annually
  - Updated PRN

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Antimicrobial Stewardship - Acute

Quarterly Reports to Medical Therapeutics and Med Staff

Antimicrobial 48-hour Time-Out
a) July – Sept 2024

Parameter	#	%	Comments
Abx Regimen appropriate for Indication	23	100%	
Post-Op Abx < 24 hrs (unless indicated)	23	100%	
Culture and Sensitivity Results Abx De-escalation appropriate	12 8	- 100%	Appropriate De-escalation includes NO de-escalation, C&S results inconclusive, etc.
Abx Dose Appropriate for Clinical Status	23	100%	
Abx Drug Levels Appropriately Monitored	6	100%	Vancomycin, Gentamicin

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Antimicrobial Stewardship - Acute

Quarterly Reports – ABX Utilization Review

MDRO Antimicrobial	Pts	Met	Findings / Discussion
Daptomycin (Cubicin™)	14	13	1. 73 YOM with Septic arthritis and bacteremia placed on Daptomycin. C&S revealed MSSA amenable to Cefazolin (pt was NKDA)
Linezolid (Zyvox™)	2	2	No aberrant findings
Tigecycline (Tygacil™)	0	0	No Patients
Aztreonam (Azactam™)	1	1	No aberrant findings
Ceftaroline (Teflaro™)	0	0	No patients
Ertapenem (Invanz™)	13	12	73 YOF admitted for hypoglycemia with acute cystitis placed on Ceftriaxone 1gm IV q24hrs. Day 2, Abx changed to Meropenem due to failure of Abx to improve mental status. Day 3 C&S urine revealed E. coli, pan-sensitive. Meropenem changed to Ertapenem. Day 5, Ertapenem changed to Ceftriaxone. Day 6, pt discharged on Cefdinir. Improvement of mental status not a reliable marker of Abx efficacy.

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Antimicrobial Stewardship - Acute

Quarterly Reports – ABX Utilization Review

a) 4th/5th Generation Cephalosporin Reviews

Antimicrobials	Pts	Met	%	Findings / Discussion
Cefepime (Maxipime™)	4	4	100%	
Ceftaroline (Teflaro™)	0	0	N/A	No patients

i) NET Results: 4 total patients
   (1) 4 patients had appropriate utilization
ii) Discussion
   (1) 4th / 5th-Generation Cephalosporin utilization was in-line with benchmarks
   (2) 4th / 5th-Generation Cephalosporin dosing

a) Oct – December 2024: MRSA Antimicrobials
b) Jan – March 2025: Fluoroquinolones
c) Apr – June 2025: Beta-lactam/Beta-Lactamase Inhibitor Combinations
d) July – Sept 2025: 4th / 5th-Generation Cephalosporins and Carbapenems

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Antimicrobial Stewardship - Acute

Quarterly Reports – Targeted ABX Utilization

ABSSSI (Acute Bacterial Skin/Skin-Structure Infections)

Parameter	Pts	% Met	Discussion
Empiric Tx (n = 14)			
Appropriate Abx	13	93 %	Daptomycin monotherapy for empiric lower extremity cellulitis. Dapto lacks substantial Gm(-) coverage (e.g. Enterobacteriaceae)
Appropriate Duration	14	100 %	
Culture/Sensitivity (n = 5)			
De-Escalation Indicated	3	100 %	

i) Conclusions and Discussion
(1) Will continue to monitor de-escalation strategies and provide feedback.

Oct – Dec 2024: UTI/Pyelonephritis
Jan – March 2025: Pneumonia (CAP,HAP, VAP)
Apr – June 2025: Sepsis
July – Sept 2025: ABSSI

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Antimicrobial Stewardship - Acute

Quarterly Reports – Peri-Operative Abx Review

Parameter	Pts	% Met	Discussion
Pre-OP (n = 24)			
Appropriate Abx	24	100 %	
Timing of Administration	24	100 %	
POST-OP (n = 24)			
Appropriate Abx and Dosing	24	100 %	
Duration < 24 hrs (unless clinical conditions dictate otherwise)	24	100 %	

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Antimicrobial Stewardship - Acute

Quarterly Reports – Pharmacist Interventions

Intervention	n	Comments
Antibiotic Dose Adjustment	21	All Renal
Antibiotic Dose Changed due to indication (empiric)	14	
C&S Guided Abx Change	11	De-escalation (n = 14)
Unnecessary Abx Discontinued	3	
Drug Level Monitoring	23	Vancomycin (n = 21), Gent (n = 2)
Pharmacist Consult on Empiric Tx	13	

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Antimicrobial Stewardship - Acute

Annual Reports – ABX Utilization

MRSA Agents (Formulary: Vancomycin, Daptomycin, Linezolid, Dalbavancin, Oritavancin)

(1) MRSA Abx Utilization – **2022 to 2023 → 5.7% DECREASE overall**
- (a) Vancomycin
  - (i) **2022 to 2023 → 24.8% DECREASE**
- (b) Daptomycin
  - (i) **2022 to 2023 → ~ 54.2% INCREASE**
- (c) Linezolid
  - (i) **2022 to 2023 → ~ 22.1% DECREASE**

Beta-lactam/Beta-lactamase Inhibitors (Formulary: Pip/Tazo, Amp/Sulbactam, Amox/Clav)

(1) **2022 to 2023 → ~ 12 % DECREASE in utilization**

Carbapenems (formulary agents: Ertapenem, Imipenem, Meropenem)

(1) Carbapenem Utilization – **2022 to 2023 → 5.8% INCREASE**

4th / 5th-Generation Cephalosporins (Formulary: Cefepime, Ceftaroline)
- (a) **2022 to 2023 → ~ 18 % INCREASE**

Fluoroquinolones (Formulary: Ciprofloxacin, Levofloxacin)

(1) **2022 to 2023 → ~ 19.6% DECREASE**

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Antimicrobial Stewardship - Acute

Annual Reports – Pathogen Susceptibility

Enterobacter cloacae	2021	2022	2023
Ertapenem	75%	89%	89%
Escherichia coli			
All susceptibilities relatively stable			
Escherichia coli – ESBL			
Amox/Clav	70%	84%	84%
E. coli – ESBL Rate	***4.6 %***	***3.7%***	***3.7%***

Pseudomonas aeruginosa	2021	2022	2023
Aztreonam	76%	79%	92%
Fluoroquinolones	90%	93%	94%
Gentamicin	89%	90%	86%

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Antimicrobial Stewardship - Acute

Annual Reports – Pathogen Susceptibility

Staphylococcus aureus (MSSA)	**2021**	**2022**	**2023**
Clindamycin	84%	80%	87%
Fluoroquinolones	88%	94%	87%
SMX/TMP	100%	100%	100%
Tetracycline	95%	95%	98%
Staphylococcus aureus (MRSA)			
Clindamycin	84%	75%	86%
Daptomycin	100%	100%	100%
SMX/TMP	97%	96%	93%
Vancomycin	100%	100%	100%
MRSA Rate	***37%***	***36%***	***32%***
Streptococcus agalactae (Group B Strep)			
Azithromycin	47%	34%	43%
Clindamycin	68%	53%	63%

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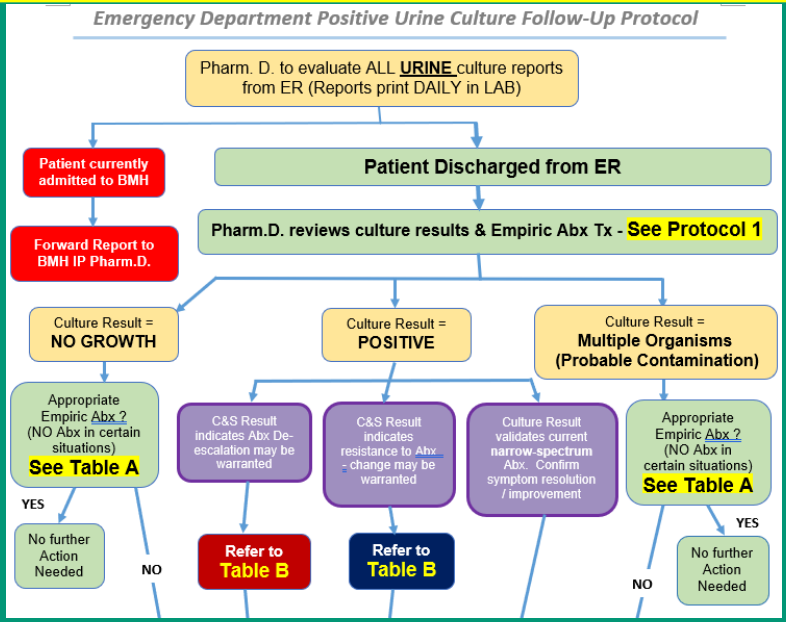
Antimicrobial Stewardship - ER



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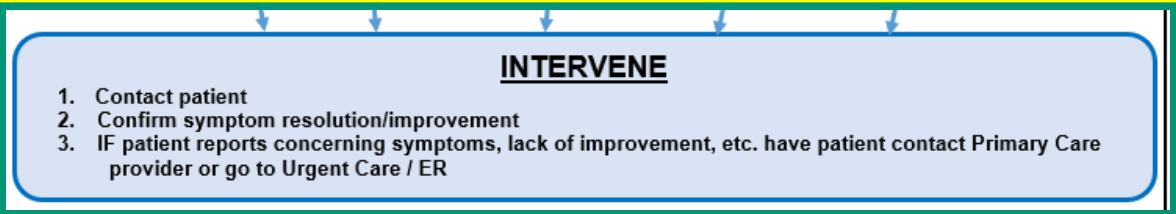
Antimicrobial Stewardship - ER



- Pharm.D. develops primary and contingency plans
- Presents info to ER Provider
- Contacts patient – implements appropriate plan based upon patient feedback

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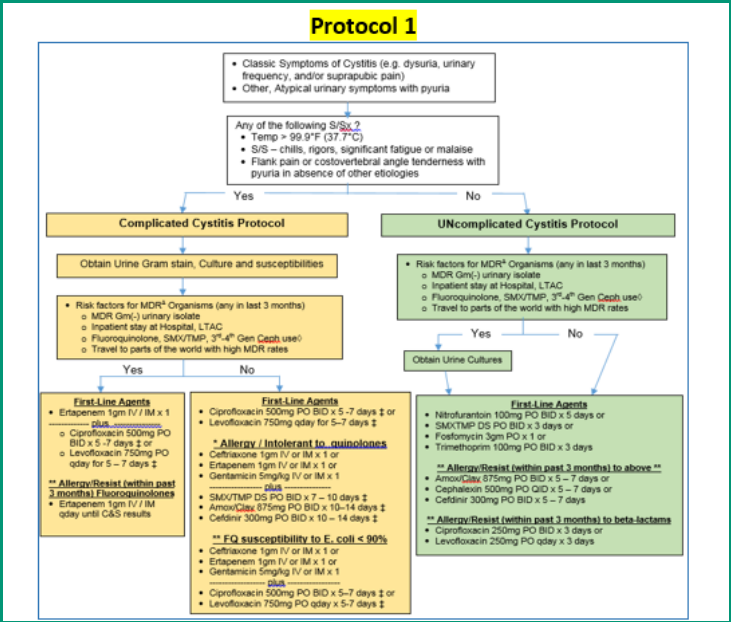
Antimicrobial Stewardship - ER



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Antimicrobial Stewardship - ER

Table A – Empiric Abx

Cystitis, Uncomplicated	
Preferred	Alternatives
TMP-SMX DS bid x 3 days	Ciprofloxacin 250mg BID x 3 days
Nitrofurantoin 100mg PO BID x 5 days	Levofloxacin 250mg PO qday x 3
Fosfomycin 3gm PO x 1	Amox/Clav 875mg PO bid x 5 – 7 days
	Cephalexin 500mg PO BID x 5 – 7 days
	Cefdinir 300mg PO BID x 3 – 7 days
	Cefixime 400mg PO qday x 3 – 7 days
Cystitis, Complicated including CAUTI	
Ciprofloxacin 500mg PO BID x 7 – 14 days	SMX-TMP DS BID x 7 – 14 days
Levofloxacin 500mg PO qday x 7 – 14 days	
Pyelonephritis	
Ciprofloxacin 500mg PO BID x 5 - 7 days	SMX-TMP DS BID
Ceftriaxone 1gm IV q24hrs x 10 days	Amox/Clav 875mg PO BID
Ertapenem 1gm IV q 24hrs	Cefixime 400mg PO qday

Table B – Pathogen-directed

Cystitis, Uncomplicated	
Pathogen	Preferred Abx
E. coli	1st line – NF, SMX/TMP
	2nd line – FQ, Amox/Clav, Amox
Staphylococcus saprophyticus	1st line – Amox/Clav, Amox
	2nd line – FQ, SMX/TMP, TMP, Cephalexin
Cystitis, Complicated, including caUTI	
Acinetobacter	1st – NO PO options, 2nd FQ, Amp/Sulb
Enterobacteriaceae	1st – FQ, 2nd – SMX/TMP
MRSA	1st – SMX/TMP, Linezolid
Pseudomonas	FQ only PO options
VRE	1st – NF (lower UTI), 2nd – Linezolid
Candida albicans	1st – Fluconazole
Pyelonephritis	
E. coli, incl. Enterobacteriaceae	1st – FQ, 2nd – SMX/TMP, Cephalexin, Cefixime
Staph saprophyticus	1st – FQ, 2nd – Amox/Clav
UTI in Pregnancy	
E. coli, incl. Enterobacteriaceae	**Cystitis** – Cephalexin, Cefuroxime, NF **Pyelonephritis** – Ceftriaxone, Cefuroxime
Staph saprophyticus *Group B Streptococcus*	Cystitis - Amox/Clav, Amox, Cephalexin, NF Pyelonephritis - Amp/Sulb, Cefoxitin

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Antimicrobial Stewardship - AMBU

'Antibiogram' – Urgent Care / Clinic

Antimicrobial Susceptibility for selected pathogens for 2023

	Cephalexin	Clindamycin	Fluoroquinolones	Doxycycline	TMP/SMX	Penicillin
MSSA	100%	84%	87%	95%	100%	14%
MRSA	0%	75% **	34%	93%	97%	0%
Streptococcus pyogenes	92%	79%	99%	52%	0%	93%

** Clindamycin exhibits inducible resistance to MRSA

	Cephalexin	Fluoroquinolones	Nitrofurantoin	TMP/SMX
E. coli	100%	90%	98%	83%

	Cefepime	Ceftazidime	Gentamicin	Fluoroquinolones	Pip-Tazo	Meropenem
Pseudomonas	87%	89%	90%	90%	94%	92%

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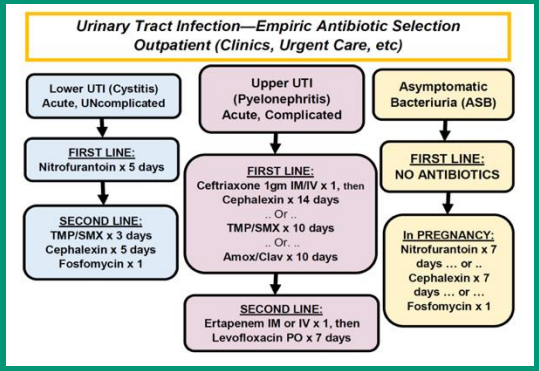
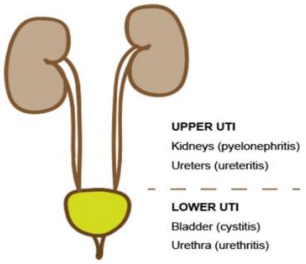
Antimicrobial Stewardship - AMBU

Flyers Deployed to Urgent Cares / Clinics





UTI PEARLS

- **Asymptomatic Bacteriuria—NO Antibiotics unless pregnant.** Tx for 7 days recommended.
  - Avoid SMX/TMP near term due to risk of kernicterus
  - Avoid Nitrofurantoin in last trimester or during labor due to risk of hemolytic anemia
- ***E. coli* resistance** to TMP/SMX and Fluoroquinolones increasing. ESBL producers often susceptible to Fosfomycin and ertapenem
- IF tx failure on 3-day course, perform cultures and treat for 2 wks

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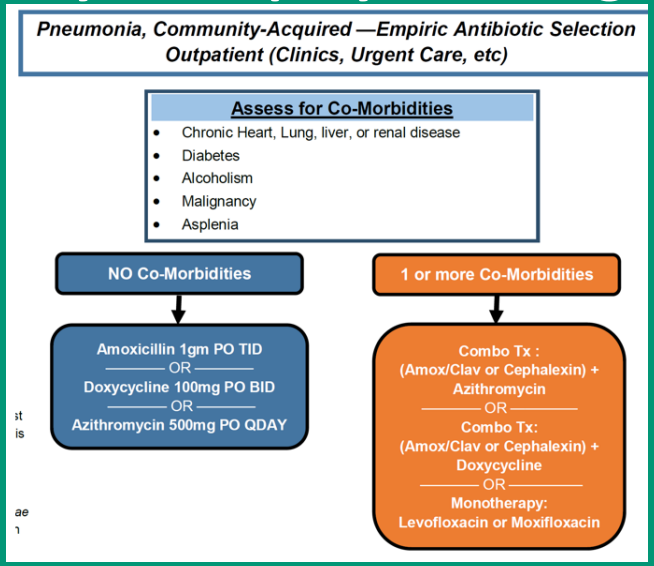
Flyers Deployed to Urgent Cares / Clinics



Pneumonia (CAP) - PEARLS

- Assess for Co-morbidities to guide empiric therapy
- Outpatient Treatment Strategies are for adults with NO risk factors for *MRSA* or *Pseudomonas*
- 5-days of therapy is sufficient for most patients (Azith 500mg daily x 3 days is equiv to at least 5 days Tx)
- Pts should be afebrile ≥ 48 hrs and clinically stable before stopping Tx
- Macrolide resistance to *S. pneumoniae* is increasing— macrolide exposure in past 6 months is a risk factor

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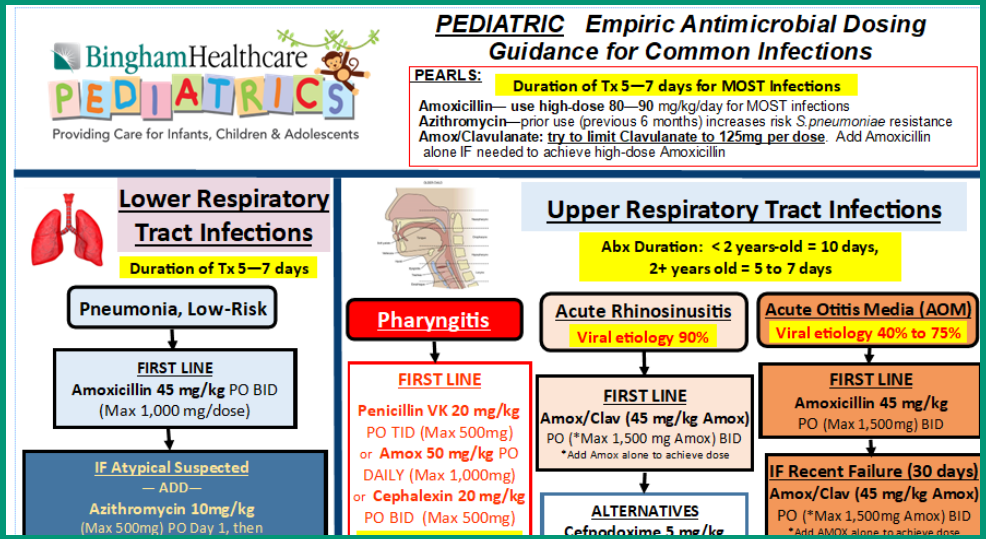
Antimicrobial Stewardship - AMBU

Flyers Deployed to Urgent Cares / Clinics



BinghamHealthcare PEDIATRICS
Providing Care for Infants, Children & Adolescents

PEDIATRIC Empiric Antimicrobial Dosing Guidance for Common Infections

PEARLS: Duration of Tx 5—7 days for MOST Infections

Amoxicillin— use high-dose 80—90 mg/kg/day for MOST infections
Azithromycin—prior use (previous 6 months) increases risk *S.pneumoniae* resistance
Amox/Clavulanate: try to limit Clavulanate to 125mg per dose. Add Amoxicillin alone IF needed to achieve high-dose Amoxicillin

Lower Respiratory Tract Infections

Duration of Tx 5—7 days

Pneumonia, Low-Risk

FIRST LINE
Amoxicillin 45 mg/kg PO BID (Max 1,000 mg/dose)

IF Atypical Suspected
— ADD—
Azithromycin 10mg/kg (Max 500mg) PO Day 1, then

Upper Respiratory Tract Infections

Abx Duration: < 2 years-old = 10 days, 2+ years old = 5 to 7 days

Pharyngitis

FIRST LINE
Penicillin VK 20 mg/kg PO TID (Max 500mg) or **Amox 50 mg/kg** PO DAILY (Max 1,000mg) or **Cephalexin 20 mg/kg** PO BID (Max 500mg)

Acute Rhinosinusitis
Viral etiology 90%

FIRST LINE
Amox/Clav (45 mg/kg Amox) PO (*Max 1,500 mg Amox) BID
*Add Amox alone to achieve dose

ALTERNATIVES
Cefpodoxime 5 mg/kg

Acute Otitis Media (AOM)
Viral etiology 40% to 75%

FIRST LINE
Amoxicillin 45 mg/kg PO (Max 1,500mg) BID

IF Recent Failure (30 days)
Amox/Clav (45 mg/kg Amox) PO (*Max 1,500mg Amox) BID
*Add AMOX alone to achieve dose

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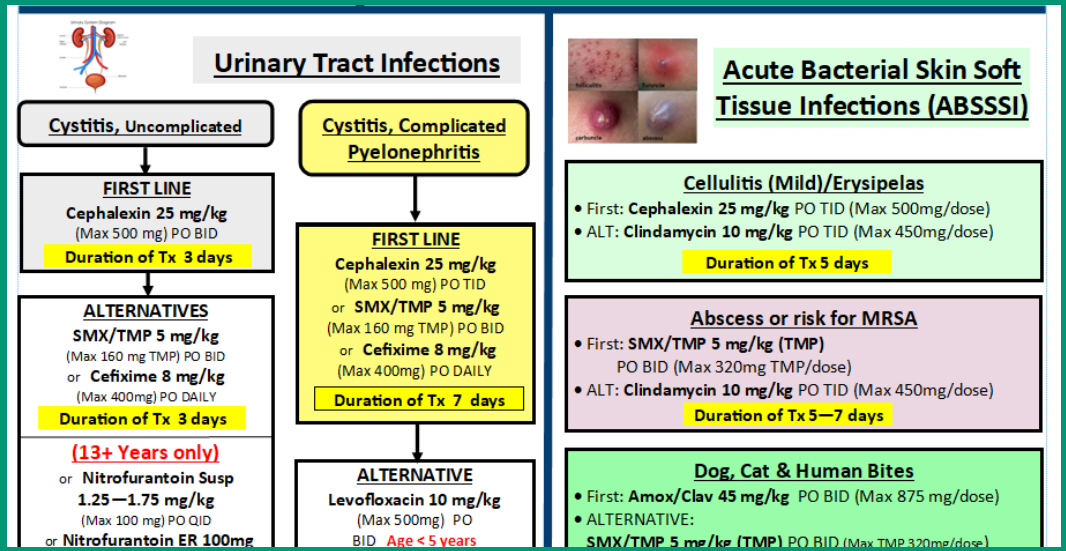
Antimicrobial Stewardship - AMBU

Flyers Deployed to Urgent Cares / Clinics



Urinary Tract Infections

Cystitis, Uncomplicated

FIRST LINE
Cephalexin 25 mg/kg
(Max 500 mg) PO BID
Duration of Tx 3 days

ALTERNATIVES
SMX/TMP 5 mg/kg
(Max 160 mg TMP) PO BID
or **Cefixime 8 mg/kg**
(Max 400mg) PO DAILY
Duration of Tx 3 days

(13+ Years only)
or **Nitrofurantoin Susp**
1.25—1.75 mg/kg
(Max 100 mg) PO QID
or **Nitrofurantoin ER 100mg**

Cystitis, Complicated
Pyelonephritis

FIRST LINE
Cephalexin 25 mg/kg
(Max 500 mg) PO TID
or **SMX/TMP 5 mg/kg**
(Max 160 mg TMP) PO BID
or **Cefixime 8 mg/kg**
(Max 400mg) PO DAILY
Duration of Tx 7 days

ALTERNATIVE
Levofloxacin 10 mg/kg
(Max 500mg) PO
BID **Age < 5 years**

Acute Bacterial Skin Soft Tissue Infections (ABSSSI)

Cellulitis (Mild)/Erysipelas
- First: **Cephalexin 25 mg/kg** PO TID (Max 500mg/dose)
- ALT: **Clindamycin 10 mg/kg** PO TID (Max 450mg/dose)

Duration of Tx 5 days

Abscess or risk for MRSA
- First: **SMX/TMP 5 mg/kg (TMP)**
  PO BID (Max 320mg TMP/dose)
- ALT: **Clindamycin 10 mg/kg** PO TID (Max 450mg/dose)

Duration of Tx 5—7 days

Dog, Cat & Human Bites
- First: **Amox/Clav 45 mg/kg** PO BID (Max 875 mg/dose)
- ALTERNATIVE:
  SMX/TMP 5 mg/kg (TMP) PO BID (Max TMP 320mg/dose)

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Antimicrobial Stewardship - Future

ER Post-Discharge Culture/Abx Review

- Continue to review UTI
- Expand to LRTI / URTI
- Expand services to Blood Culture / ABSSSI

Ambulatory Care Stewardship

- Pediatric Dosing Review
- UTI
- LRTI / URTI

New Undiscovered Territories !!!

- H5N1 ??

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