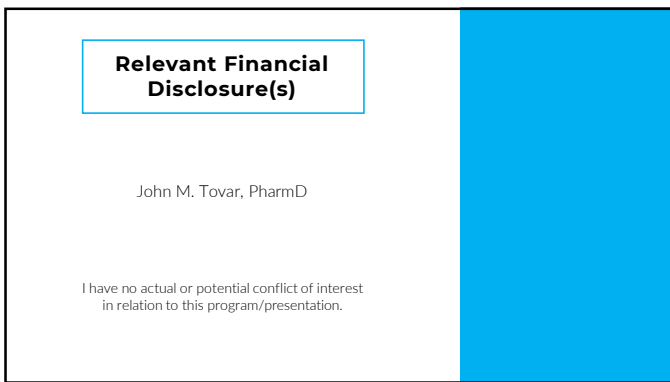
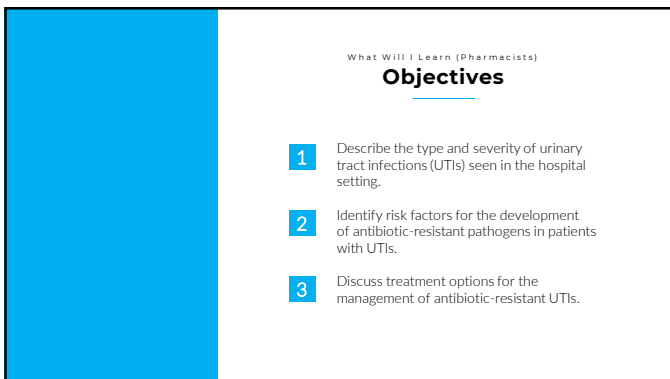




1



2



3

What Will I Learn (Pharmacy Technicians)

Objectives


- 1 State the types of urinary tract infections seen in the hospital.
- 2 List the main antibiotic-resistant pathogens found in patients with UTIs.
- 3 Identify the main antibiotics used in the management of antibiotic-resistant UTIs.

4

Epidemiology

Why Should I Care

- ▷ Second most common bacterial infection in the United States
- ▷ 7 million ambulatory care visits by females every year
- ▷ Fourth most common health-care associated infection
- ▷ Prevalence in the hospital is 12.9% (2/3 are catheter-associated)



1. Schappert SM, et al. Vital Health Stat. 2011;13(1):28. 2. Foxman B. Nat Rev Urol. 2010;7(5):653-660. 3. Magill SS, et al. N Engl J Med. 2014;370(11):98-105.

5

Question 1

An uncomplicated UTI is defined as acute cystitis occurring in a female who: (Select ALL that apply)

- A. is healthy
- B. is not pregnant
- C. is postmenopausal
- D. has no known structural urological abnormalities

6

Urinary Tract Infections

Classification

- Anatomical**
 - ▷ Lower
 - ▷ Upper
- Severity**
 - ▷ Uncomplicated
 - ▷ Complicated
- Location**
 - ▷ Community-Associated (CAUTI)
 - ▷ Health care-Associated (HAUTI)

Bader M, et al. Postgraduate Medicine. 2017;129(2):243-58.

7

Frequently Isolated

Usual Suspects

<p style="text-align: center;">Outpatient</p> <ul style="list-style-type: none"> <i>E. coli</i> – 65% <i>K. pneumoniae</i> – 10% <i>P. mirabilis</i> – 5% <i>E. faecalis</i> – 4% <i>P. aeruginosa</i> – 3% 	<p style="text-align: center;">Inpatient</p> <ul style="list-style-type: none"> <i>E. coli</i> – 49% <i>Enterococcus spp.</i> – 18% <i>K. pneumoniae</i> – 15% <i>P. aeruginosa</i> – 10% <i>P. mirabilis</i> – 6% <i>E. cloacae</i> – 5%
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Bader M, et al. Postgraduate Medicine. 2017;129(2):243-58.

8

Question 2

Which of the following enterobacteriales is more likely to harbor Extended-Spectrum Beta Lactamases (ESBLs) genes?

- A. *E. coli*
- B. *P. aeruginosa*
- C. *E. cloacae*
- D. *C. freundii*

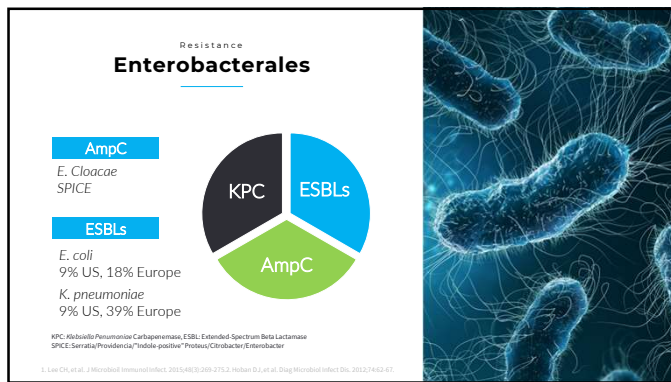
9

Question 3

Enterobacteriales that produce Extended-Spectrum Beta Lactamases (ESBLs) remain susceptible to _____.

- A. ceftaxitin
- B. cefepime
- C. ceftriaxone
- D. ceftazidime

10



11

Clinical Infectious Diseases
MAJOR ARTICLE

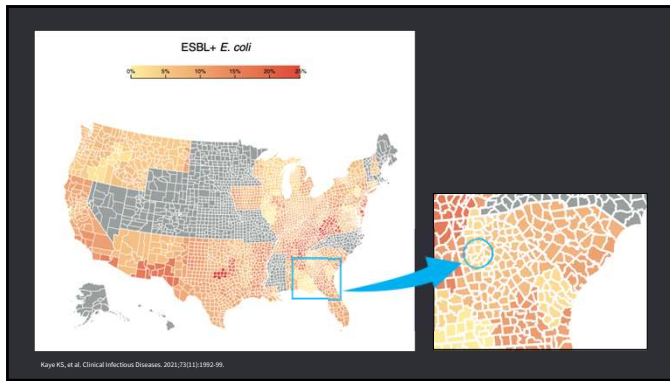
Antimicrobial Resistance Trends in Urine *Escherichia coli* Isolates From Adult and Adolescent Females in the United States From 2011 to 2019: Rising ESBL Strains and Impact on Patient Management

Keith S. Kaye,¹ Vikas Gupta,² Aruni Malgigama,³ Ashish V. Joshi,¹ Nicolo E. Scangarella-Oman,⁴ Kalvin Yu,⁵ Gang Ye,⁶ and Fanny S. Mitrani-Gold⁴

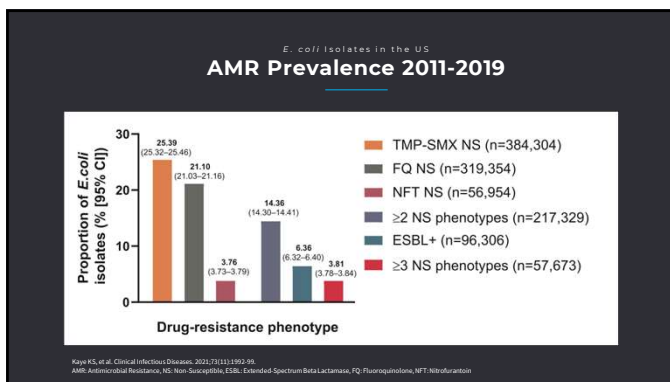
¹University of Michigan, Ann Arbor, Michigan, USA; ²Becton, Dickinson and Company (BD), Franklin Lakes, New Jersey, USA; ³GileadSmithKline plc., London, United Kingdom; and ⁴GileadSmithKline plc., Collegeville, Pennsylvania, USA

Kaye KS, et al. Clinical Infectious Diseases. 2022;73(11):1992-99.

12



13



14

Environmental Advances 8 (2022) 100191

Contents lists available at ScienceDirect

Environmental Advances

journal homepage: www.sciencedirect.com/journal/environmental-advances

Plasmid-mediated antimicrobial resistance in drinking water

Marwa Alawi^{a,c,*}, Trinidad Velasco Torrijos^{b,c}, Fiona Walsh^{b,c}

^a Department of Biology, Maynooth University, Maynooth, County Kildare, Ireland
^b Department of Chemistry, Maynooth University, Maynooth, County Kildare, Ireland
^c Kathleen Lonsdale Institute for Human Health Research, Maynooth University, Maynooth, County Kildare, Ireland

Alawi M, et al. Environmental Advances. 2022. <https://doi.org/10.1016/j.envadv.2022.100191>.

15

Question 4

All of the following are risk factors for the development of antibiotic-resistant gram-negative UTIs, EXCEPT:

- A. Age (older than 50)
- B. Prior UTIs
- C. Presence of a urinary catheter
- D. Recent hospitalization (30 days)

16

Resistance Risk Factors

- ▷ Age (>60 years)
- ▷ Prior UTIs
- ▷ cUTIs
- ▷ Presence of catheter
- ▷ Chronic medical conditions
- ▷ Recent hospitalization
- ▷ Recent antibiotic use
- ▷ Recent travel

Bader H, et al. Postgraduate Medicine. 2017;119(5):242-58.

17

PHARMACIST PATIENT CARE PROCESS (PPCP)

COLLECT

- SUBJECTIVE**
What problem(s) does the patient have?
- OBJECTIVE**
What information supports the patient problem(s)?
- What additional, if any, information is required to confirm the problem(s)?

ASSESS

- ASSESSMENT**
How bad is the problem(s)?
Is (are) the problem(s) being addressed?
 Yes No
- Is the therapy appropriate?
Is therapy not appropriate?
What are my options?

PLAN / IMPLEMENT

- PLAN**
How should the problem(s) be addressed?
- IMPLEMENT**
What should I tell my patient about the problem(s) and the medication(s) for it?

FOLLOW-UP

- EVALUATE**
How will I know that what was done is working?
How will I know that what was done is safe?
When should the patient see improvement?
When should I follow-up on the patient?


- | | | | |
|--|--|---|--|
| PATIENT FACTORS
Allergies
Pregnancy
Age
Organ dysfunction | PATIENT FACTORS
Adherence
Comorbidities
Previous episodes
Social issues | DISEASE FACTORS
Severity
Goals of therapy
Prognosis | DRUG FACTORS
Indication
Drug efficacy/safety
Drug interactions
Cost / Simplicity of use |
|--|--|---|--|

What references are you using to answer the questions?

18

It's All About ...
Your Approach

- 1 Work-up
- 2 Diagnosis
- 3 Empiric Treatment
- 4 Targeted Therapy

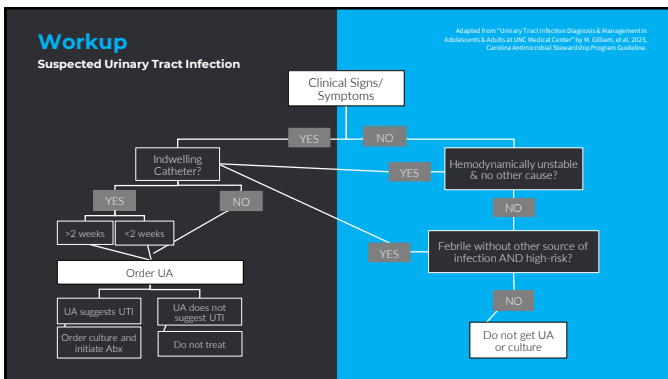


19

Be careful. You will always find what you are looking for.

Olianna Portnoy
 (Author and Motivational Speaker)

20



21

To Workup or Not
Diagnosis

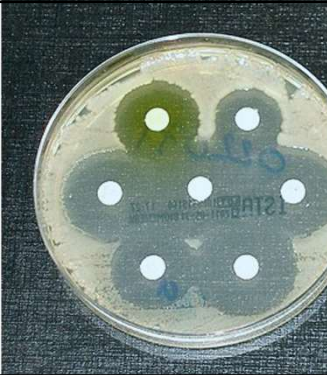
- 1 Signs and/or symptoms
 - ▷ Dysuria, new or worsening frequency or urgency
 - ▷ Back or flank (CVA) pain or tenderness
 - ▷ Fever
- 2 Indwelling Catheter
- 3 Laboratory
 - ▷ Urinalysis (UA)
 - ▷ Urine culture (colonization vs infection)

Civ. Costoverbal Angle
1. Bader M, et al. Postgraduate Medicine. 2017;29(2):240-58. 2. Dwivedi DM, et al. Prim Care Clin Office Pract. 2008;35:534-67.

22

Approach
Empiric Treatment

- 1 "Most" likely pathogen
- 2 Previous organisms identified
- 3 Prior antibiotic exposure
- 4 Antibiogram



23

AAC
Journal.ASMB.org

Two Simple Rules for Improving the Accuracy of Empiric Treatment of Multidrug-Resistant Urinary Tract Infections

Katherine Linsenmeyer,^{a,b} Judith Strymish,^{a,c} Kalpana Gupta^{a,b,d}

VA Boston Healthcare System, Boston, Massachusetts, USA^a; Boston University School of Medicine, Boston, Massachusetts, USA^b; Harvard Medical School, Boston, Massachusetts, USA^c; VA National Center for Occupational Health and Infection Control, Gainesville, Florida, USA^d

“... when empiric therapy was concordant with the prior microbiologic data, the rate of accuracy of the treatment against the uropathogen improved from 32% to 76%”

Linsenmeyer K, et al. Antimicrob Agents Chemother. 2015;59:7593-7596.

24

The screenshot shows the IDSA website header with navigation links for COVID-19, IDSA Academy, MyIDSA, Journals, News, Science Sparks, Multimedia, and Events. Below the header, the main title is "IDSA 2023 Guidance on the Treatment of Antimicrobial Resistant Gram-Negative Infections". There are "Download" and "Cite" buttons. The text below the title states: "Published by IDSA, 6/7/2023". A focus area is highlighted: "A Focus on Extended-spectrum β -lactamase-Producing Enterobacteriales, AmpC β -Lactamase-Producing Enterobacteriales, Carbapenem-Resistant Enterobacteriales, *Pseudomonas aeruginosa* with Difficult-to-Treat Resistance, Carbapenem-Resistant *Acinetobacter baumannii* and *Stenotrophomonas maltophilia*". At the bottom, a small text block reads: "Tamma PD, et al. Infectious Diseases Society of America Antimicrobial-Resistant Treatment Guidance: Gram-Negative Bacterial Infections, IDSA 2023, Version 3.0. Available at <https://www.idsociety.org/practice-guideline/amr-guidance/>. Accessed 09/12/2023."

25

The infographic is titled "Targeted Therapy ESBL Enterobacteriales". It is divided into two sections: "Uncomplicated Cystitis" and "Complicated UTIs & Pyelonephritis". Under "Uncomplicated Cystitis", the list is: 1 Nitrofurantoin, TMP-SMX; 2 Ciprofloxacin, levofloxacin, carbapenems. Under "Complicated UTIs & Pyelonephritis", the list is: 1 Ciprofloxacin, levofloxacin, TMP-SMX; 2 Carbapenems, aminoglycosides. At the bottom left, a small text block reads: "Tamma PD, et al. Infectious Diseases Society of America Antimicrobial-Resistant Treatment Guidance: Gram-Negative Bacterial Infections, IDSA 2023, Version 3.0. Available at <https://www.idsociety.org/practice-guideline/amr-guidance/>. Accessed 09/12/2023."

26

The infographic is titled "ESBL Enterobacteriales What is their Role?". It lists five items: 1 Piperacillin tazobactam; 2 Cefepime; 3 Cephamycins; 4 Other B-lactam-B-lactamase inhibitor combinations; 5 Cefiderocol. At the bottom left, a small text block reads: "Tamma PD, et al. Infectious Diseases Society of America Antimicrobial-Resistant Treatment Guidance: Gram-Negative Bacterial Infections, IDSA 2023, Version 3.0. Available at <https://www.idsociety.org/practice-guideline/amr-guidance/>. Accessed 09/12/2023."

27

Research

JAMA | Original Investigation

Effect of Piperacillin-Tazobactam vs Meropenem on 30-Day Mortality for Patients With *E coli* or *Klebsiella pneumoniae* Bloodstream Infection and Ceftriaxone Resistance A Randomized Clinical Trial

Patrick N. A. Harris, MBBS, Paul A. Tambyah, MD, David C. Lye, MBBS, Yin Mo, MBBS, Tau H. Lee, MBBS, Mesut Yilmaz, MD, Thamer H. Alenazi, MD, Yaseen Arabi, MD, Marco Falcone, MD, Matteo Bassetti, MD, PhD, Edda Righi, MD, PhD, Benjamin A. Rogers, MBBS, PhD, Souha Karj, MD, Hasan Ghaffly, MBBS, Jon Iredell, MBBS, PhD, Marc Mendelson, MBBS, PhD, Tom H. Boyles, MD, David Lookie, MBBS, Spiros Myakis, MD, PhD, Genevieve Wallis, MS, CNB, Mohammed Al-Khramis, MD, Ahmed Zaki, PharmD, Amy Crowe, MBBS, Paul Ingram, MBBS, Nick Daneman, MD, Paul Griffin, MBBS, Eugene Athan, MBBS, MPH, PhD, Penelope Lorenc, RN, Peter Baker, PhD, Leah Roberts, BSc, Scott A. Beatson, PhD, Anton Y. Peleg, MBBS, PhD, Tiffany Harris-Brown, RN, MPH, David L. Paterson, MBBS, PhD, for the MERINO Trial Investigators and the Australasian Society for Infectious Disease Clinical Research Network (ASID-CRN)

Harris PN, et al. JAMA. 2018;320(10):984-994.

28

Research

JAMA | Original Investigation

Effect of Piperacillin-Tazobactam vs Meropenem on 30-Day

RESULTS Among 379 patients (mean age, 66.5 years; 47.8% women) who were randomized appropriately, received at least 1 dose of study drug, and were included in the primary analysis population, 378 (99.7%) completed the trial and were assessed for the primary outcome. A total of 23 of 187 patients (12.3%) randomized to piperacillin-tazobactam met the primary outcome of mortality at 30 days compared with 7 of 191 (3.7%) randomized to meropenem (risk difference, 8.6% [1-sided 97.5% CI, -∞ to 14.5%]; $P = .90$ for noninferiority). Effects were consistent in an analysis of the per-protocol population. Nonfatal serious adverse events occurred in 5 of 188 patients (2.7%) in the piperacillin-tazobactam group and 3 of 191 (1.6%) in the meropenem group.

Harris PN, et al. JAMA. 2018;320(10):984-994.

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Targeted Therapy

E. cloacae

Uncomplicated Cystitis

- 1 Nitrofurantoin, TMP-SMX
- 2 Ciprofloxacin, levofloxacin, aminoglycosides

Complicated UTIs & Pyelonephritis

- 1 Aminoglycosides, Ciprofloxacin, levofloxacin, TMP-SMX
- 2 Carbapenems, aminoglycosides

Tamma PD, et al. Infectious Diseases Society of America Antimicrobial Resistance Treatment Guidelines: Gram-Negative Bacterial Infections. IDSA 2022. Version 1.0. Available at <https://www.idsociety.org/practice-guideline/amr-guidelines/>. Accessed 09/02/2023.

30

E. cloacae
Antibiotic I Should Avoid

Table 1. ampC Induction Profile of Various Antibacterials

	Inducible (Wild-Type)	
	Strong Inducers of ampC	Weak Inducers of ampC
Good substrates of ampC	Ampicillin first-generation cephalosporins, ceftaxitin, cefotetan	Ceftazidime, ceftriaxone, cefotaxime, piperacillin, ticarcillin, aztreonam
Phenotype	Resistant	Susceptible
Poor substrates of ampC	Imipenem	Cefepime
Phenotype	Susceptible	Susceptible

MacDougall C. J Pediatr Pharmacol Ther. 2011;36(1):23-30.

31

Question 5

Which of the following would be the best choice for a hospitalized patient with a Carbapenem-Resistant Enterobacteriales (CRE) pyelonephritis?

- A. ceftazidime-avibactam
- B. meropenem
- C. piperacillin-tazobactam
- D. ciprofloxacin

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Others
Targeted Therapy

CRE

- 1** Nitrofurantoin, TMP-SMX, ciprofloxacin, levofloxacin (E susceptible)
- 2** Aminoglycosides, ceftazidime-avibactam, meropenem-varbactam, imipenem-cilastatin-relebactam, ceftiderocol

DTR-P. aeruginosa

- 1** Ceftazidime-avibactam, meropenem-varbactam, imipenem-cilastatin-relebactam
- 2** Ceftiderocol, aminoglycosides (uncomplicated cystitis)

Tamma PD, et al. Infectious Diseases Society of America Antimicrobial Resistance Treatment Guidance. Carbapenem-Resistant Enterobacteriales (CRE) 2022, Version 1.5. Available at <https://www.idsociety.org/practice-guideline/amr-guidance/>. Accessed 06/10/2023.
CRE: Carbapenem-Resistant Enterobacteriales
DTR: Difficult-to-Treat Resistance

33



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