

Extended-Spectrum Beta-Lactamase (ESBL) Enterobacterales



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- Conflicts of interest

Learning Objectives

- What is a ESBL
- Epidemiology of ESBL's
- ESBL Identification and Testing
- Identify ESBL risk factors
- ESBL Transmission
- ESBL Mitigation

What is a ESBL?

- Some Enterobacterales can produce enzymes called extended-spectrum beta-lactamases (ESBLs). ESBL enzymes break down and destroy some commonly used antibiotics, including penicillins and cephalosporins, and make these drugs ineffective for treating infections



EXTENDED-SPECTRUM BETA-LACTAMASE (ESBL) PRODUCING **ENTEROBACTERIACEAE**

THREAT LEVEL **SERIOUS**



197,400

Estimated cases
in hospitalized
patients in 2017



9,100

Estimated
deaths in 2017



\$1.2B

Estimated attributable
healthcare costs in 2017

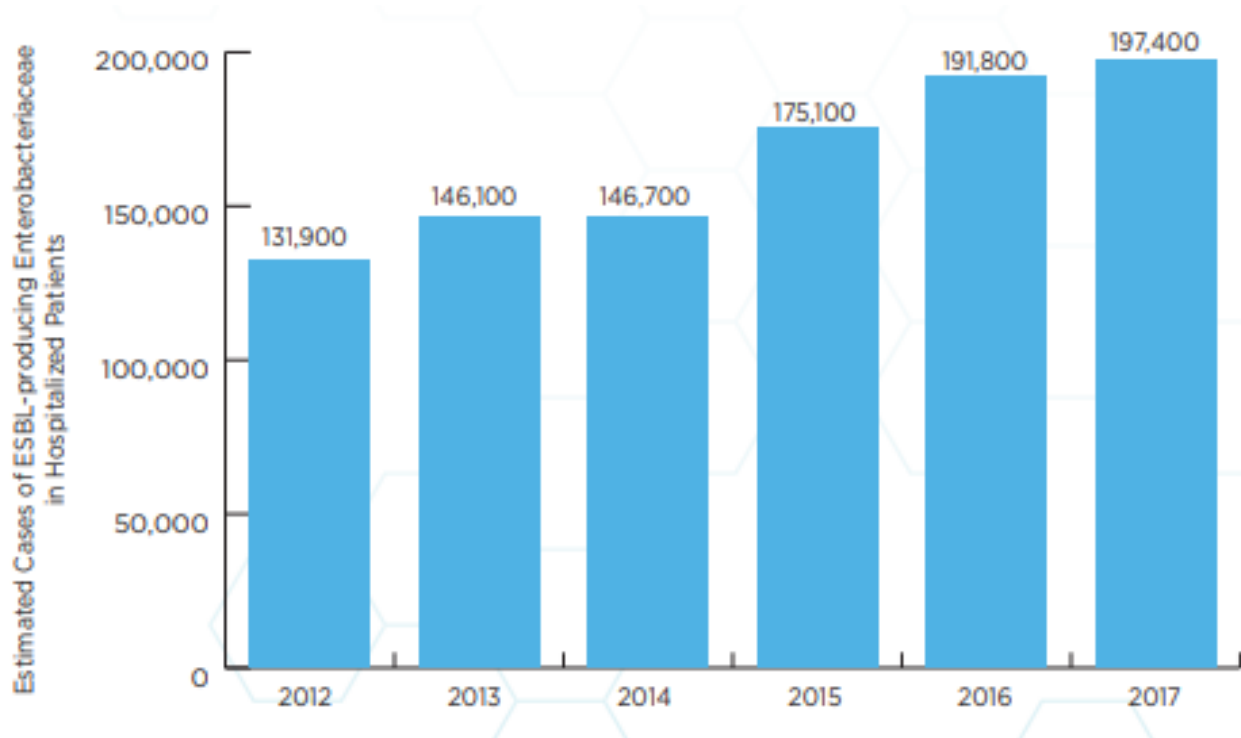
ESBL-producing Enterobacteriaceae (a family of different types of bacteria) are a concern in healthcare settings and the community. They can spread rapidly and cause or complicate infections in healthy people.

Why are ESBL Bacteria Considered Epidemiologically Important?

- ESBL-producing Enterobacteriaceae often cause infections in otherwise healthy people. About one-quarter of patients with these infection had no known underlying health conditions.
- Antibiotic options to treat ESBL-producing Enterobacteriaceae infections are limited. Healthcare providers often have to use intravenous (IV) carbapenem antibiotics to treat infections that used to be treated with oral antibiotics.

Current CDC ESBL Statistics

- CDC and partners are working to assess and address why cases of ESBL-producing Enterobacteriaceae have increased since 2012.



ESBL Identification

- Standard microbiology testing, for organisms with susceptibilities
- ESBL will show resistance to 1st, 2nd and 3rd generation cephalosporin's

Enterobacterales (*E. coli*, *K. pneumoniae*, *K. oxytoca*, or *P. mirabilis* only):

	Ceftriaxone, Cefotaxime, or Ceftazidime	Cefoxitin	Cefepime	Presumed Beta-lactamase	Beta-lactam treatment options
Susceptibility	I or R	I or R	S	AmpC	Cefepime or carbapenems
Susceptibility	I or R	I or R	I or R	AmpC and ESBL	Carbapenems
Susceptibility	I or R	S	S	ESBL	Carbapenems



How to Test for ESBL

The Microbiology lab is your new best friend!

- Platforms your lab might have for susceptibilities
 - Automated susceptibilities testing (AST)
 - Kirby-Bauer disk diffusion
 - E-tests
 - Molecular testing, looking for CTX-M gene

ESBL Example

Escherichia coli

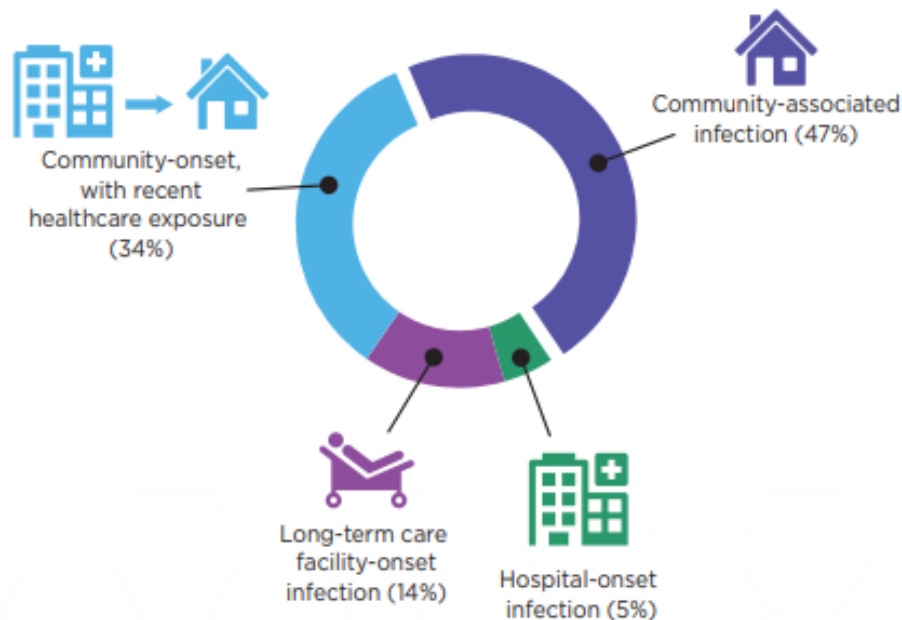
AUTOMATED SUSCEPTIBILITY	Breakpoint	S.I.R.
Amikacin	<=4 ug/mL	Susceptible
Amoxicillin/Clavulanic	4/2 ug/mL	Susceptible
Ampicillin	<=2 ug/mL	Susceptible
Ampicillin/Sulbactam	2/1 ug/mL	Susceptible
Aztreonam	<=1 ug/mL	Susceptible
Cefazolin	<=1 ug/mL	Susceptible
Cefepime	<=0.5 ug/mL	Susceptible
Ceftazidime	<=0.5 ug/mL	Susceptible
Ceftriaxone	<=0.5 ug/mL	Susceptible
Cefuroxime	<=4 ug/mL	Susceptible
Ciprofloxacin	<=0.5 ug/mL	Susceptible
Ertapenem	<=0.125 ug/mL	Susceptible
Gentamicin	<=1 ug/mL	Susceptible
Imipenem	<=0.25 ug/mL	Susceptible
Levofloxacin	<=1 ug/mL	Susceptible
Meropenem	<=0.125 ug/mL	Susceptible
Moxifloxacin	<=1 ug/mL	Susceptible
Piperacillin/Tazobactam	<=2/4 ug/mL	Susceptible
Tetracycline	<=1 ug/mL	Susceptible
Tobramycin	1 ug/mL	Susceptible
Trimethoprim/Sulfamethoxazole	1/19 ug/mL	Susceptible

Escherichia coli (ESBL)

AUTOMATED SUSCEPTIBILITY	Breakpoint	S.I.R.
Amikacin	<=4 ug/mL	Susceptible
Amoxicillin/Clavulanic	4/2 ug/mL	Susceptible
Ampicillin	>16 ug/mL	Resistant
Ampicillin/Sulbactam	16/8 ug/mL	Intermediate
Aztreonam	>16 ug/mL	Resistant
Cefazolin	>32 ug/mL	Resistant
Cefepime	>16 ug/mL	Resistant
Ceftazidime	16 ug/mL	Resistant
Ceftriaxone	>32 ug/mL	Resistant
Cefuroxime	>16 ug/mL	Resistant
Ciprofloxacin	>2 ug/mL	Resistant
Ertapenem	<=0.125 ug/mL	Susceptible
Gentamicin	<=1 ug/mL	Susceptible
Imipenem	<=0.25 ug/mL	Susceptible
Levofloxacin	>4 ug/mL	Resistant
Meropenem	<=0.125 ug/mL	Susceptible
Moxifloxacin	>4 ug/mL	Resistant
Piperacillin/Tazobactam	<=2/4 ug/mL	Susceptible
Tetracycline	>8 ug/mL	Resistant
Tobramycin	1 ug/mL	Susceptible
Trimethoprim/Sulfamethoxazole	<=0.5/9.5 ug/ml	Susceptible

How Common are ESBL Infections?

- Almost half of ESBL-producing Enterobacteriaceae infections occur in people who have not had recent inpatient healthcare exposure or an invasive medical procedure. These infections are called community-associated infections



Data shows infections by epidemiological classification (the setting where patients most likely got the infection based on clinical information).

Who is Most Likely to get a ESBL Infection?

- These infections most commonly occur in people with exposure to healthcare, including those in hospitals and nursing homes. However, unlike many other resistant germs, ESBL-producing Enterobacterales can also cause infections in otherwise healthy people who have not been recently been in healthcare settings. In healthy people, this often means urinary tract infections.
- ESBL germs have also been identified in people returning to the United States after traveling abroad, especially to places where these germs are more commonly found.

How are ESBL Germs Spread or Transmitted?

- In the United States, they can be spread from one person to another in healthcare settings through contaminated hands and surfaces.
- Outside the United States, they can be spread to people through contaminated food or water. The role of food and water in the spread of these germs in the United States is not clear.

What Can Clinicians do to Prevent ESBL Transmission?

- Keeping your hands clean is one of the most important steps you can take to avoid getting sick and spreading germs that can cause infections. Use soap and water or alcohol-based hand sanitizer.
- ESBL-producing germs live in the gastrointestinal (GI) tract, so it is especially important to clean your hands after using the bathroom and before eating or preparing food. You should remind healthcare providers and other caregivers to clean their hands before they care for you and before they handle any medical devices. When traveling abroad, follow recommended practices for [food and water safety](#).

Public Health Departments and ESBL's

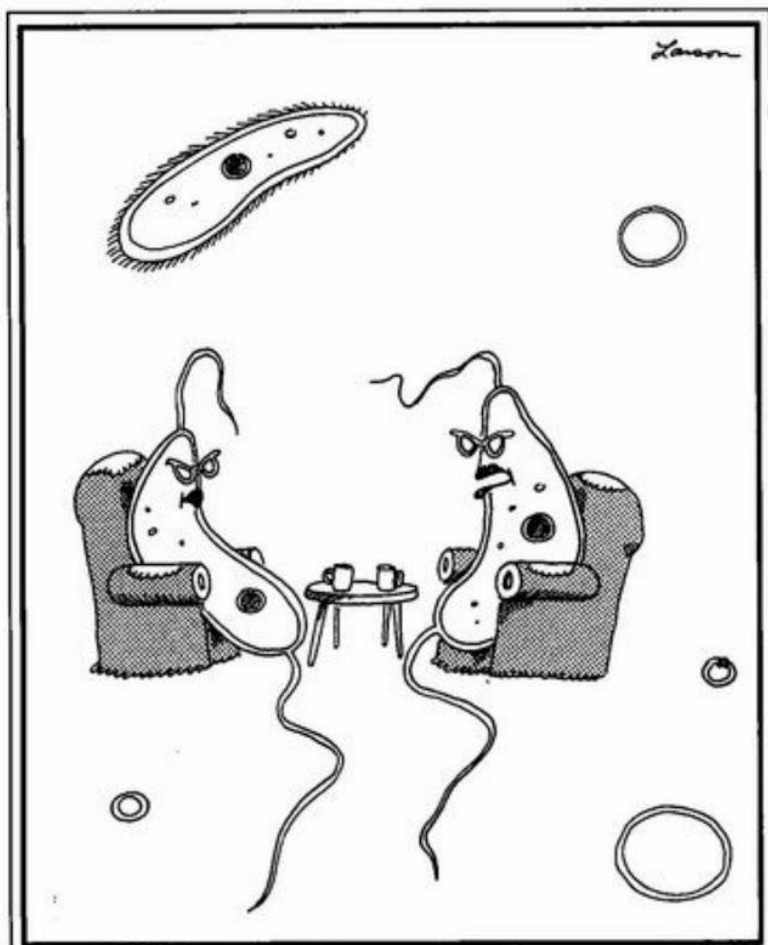
Take Steps Now! Public health departments should lead coordination.



- Identify the health care facilities in the area and how they are connected.
- Dedicate staff to improve connections and coordination with health care facilities in the area.
- Work with CDC to use data for action to better prevent infections and improve antibiotic use in health care settings.
- Know the antibiotic resistance threats in the area and state.

SOURCE: CDC Vital Signs, August 2015.

Questions?



"He told you that? Well, he's pulling your flagellum, Nancy."

Resources

- <https://www.cdc.gov/drugresistance/pdf/threats-report/esbl-508.pdf>
- <https://www.cdc.gov/hai/organisms/ESBL.html>