

# Carbapenem-resistant *Enterobacteriaceae* (CRE)

The *Enterobacteriaceae* are a large family of Gram-negative bacilli found in the human gastrointestinal tract. Commonly encountered species include *Escherichia coli*, *Klebsiella* spp. and *Enterobacter* spp. Carbapenem-resistant *Enterobacteriaceae* (CRE) are not susceptible to carbapenem antibiotics. They are broadly categorized based on the mechanism of their resistance as carbapenemase producers (CP-CRE) and non-carbapenemase producers.

Carbapenems are broad-spectrum antibiotics typically used to treat severe health care-associated infections (HAIs) caused by highly drug-resistant bacteria. Currently available carbapenems include imipenem, meropenem, ertapenem and doripenem. Although related to the  $\beta$ -lactam antibiotics, carbapenems retain antibacterial activity in the presence of most  $\beta$ -lactamases, including extended-spectrum  $\beta$ -lactamases (ESBLs) and extended-spectrum cephalosporinases (e.g., AmpC-type  $\beta$ -lactamases). Loss of susceptibility to carbapenems is a serious problem because few safe treatment alternatives remain against such resistant bacteria.

Infections caused by CRE occur most commonly among people with chronic medical conditions through use of invasive medical devices such as central venous and urinary catheters, frequent or prolonged stays in health care settings or extended courses of antibiotics. CP-CRE are most concerning and have spread rapidly across the nation and around the globe, perhaps because carbapenemases can be encoded on plasmids that are easily transferred within and among bacterial species.

In December 2011, CRE bacterial isolates became reportable statewide. The CRE case definition has gone through major changes over the years, which is reflected in the big changes in case numbers from year to year. In 2013, the definition was non-susceptible (intermediate or resistant) to all carbapenems tested and resistant to any third generation cephalosporins tested. This definition was considered to be too non-specific. The definition was then revised in 2014 to non-susceptible to any carbapenem, excluding ertapenem, and resistant to all third generation cephalosporins tested. A study conducted by the CDC found this definition to be too insensitive in picking up carbapenemase producers. The current definition, which was changed July 1, 2015, is resistant to any carbapenem antibiotic. This definition is simpler and is aligned with the CDC's.

The Oregon State Public Health Laboratory offers specialized testing to determine whether reported CRE are carbapenemase producers, and the Oregon Public Health Division's HAI program performs detailed investigation of any reported cases.

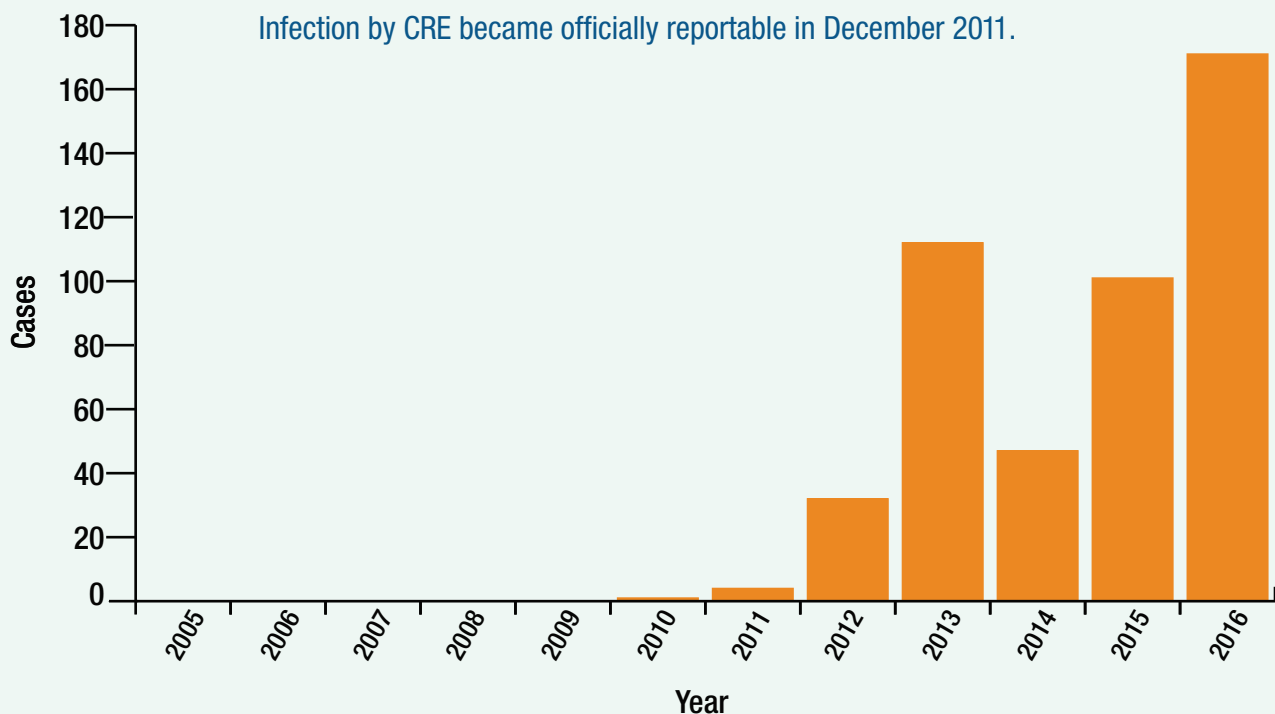
Four hundred sixty-seven cases of CRE infection or colonization were reported among Oregon residents from 2010 to 2016. The median case age was 71 (range 0–97) years; 293 (63%) were female — 217 (47%) were hospitalized at the time of, or within 30 days of specimen collection. Urine was the most common source (72%) and *Enterobacter* spp. accounted for 63% of all isolates.

By the end of 2016, Oregon had 15 CP-CRE; 10 *Klebsiella pneumoniae* carbapenemase (KPC), three New Delhi metallo- $\beta$ -lactamase (NDM) and two Oxacillinase-48 (OXA-48). Eleven of the CP-CRE were from patients with histories of health care exposure in other states or out of the United States.

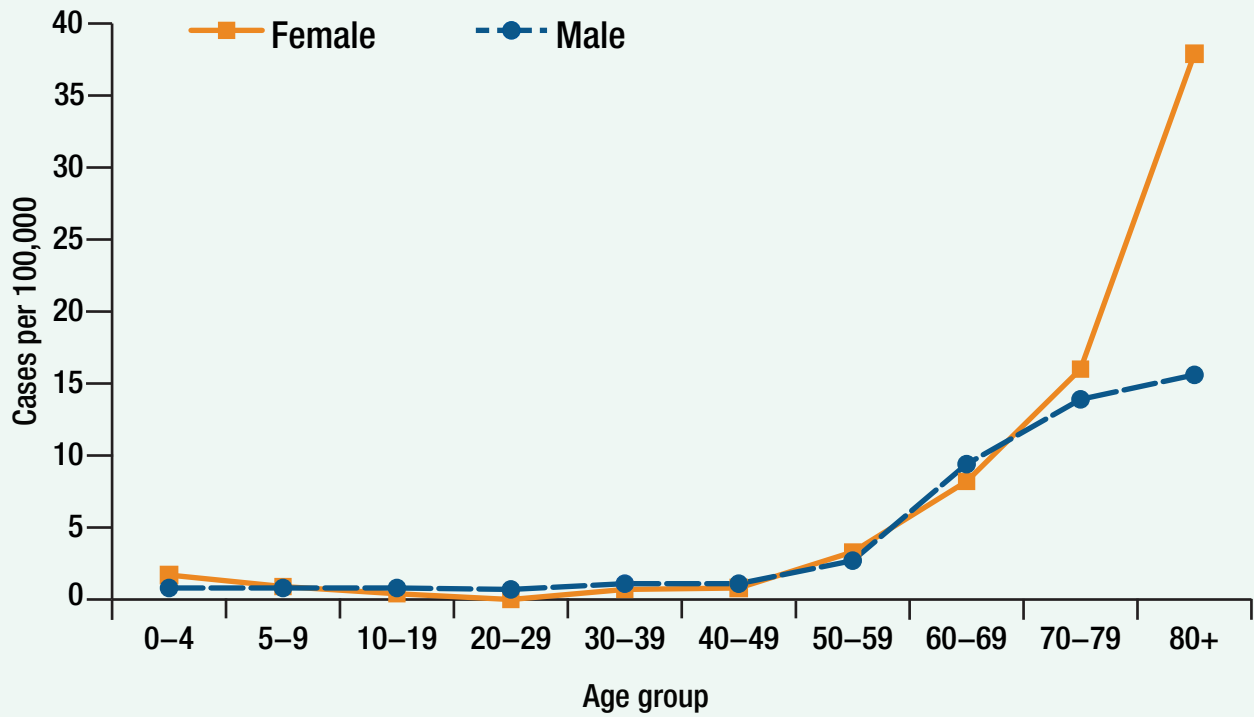
Unlike much of the rest of the country, we have no indication CP-CRE are spreading in Oregon. We have instituted enhanced surveillance and prevention efforts and established the Drug-Resistant Organism Prevention and Coordinated Regional Epidemiology Network (DROPCRE), a statewide network to rapidly detect, respond to and prevent CRE.

For more information, including our [CRE toolkit](#), please see [Carbapenem-resistant \*Enterobacteriaceae\*](#).

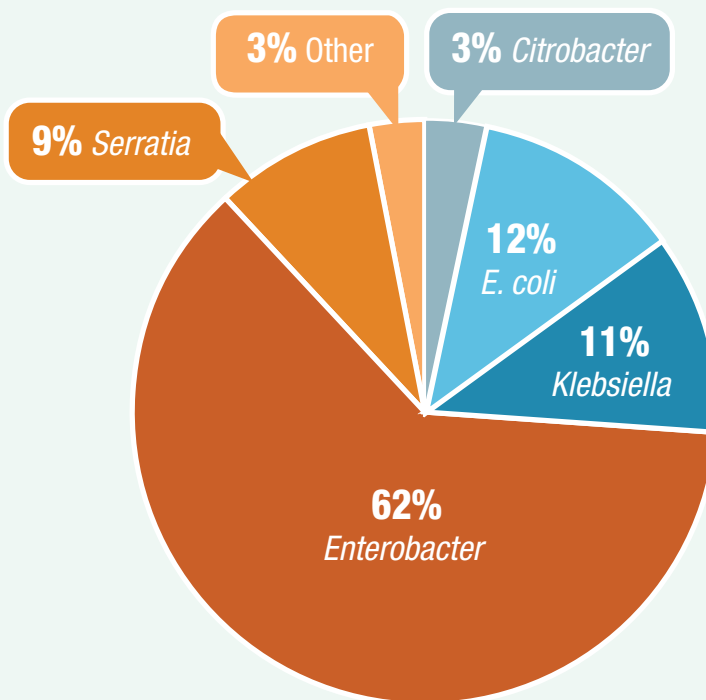
### Carbapenem-resistant *Enterobacteriaceae* by year: Oregon, 2005–2016



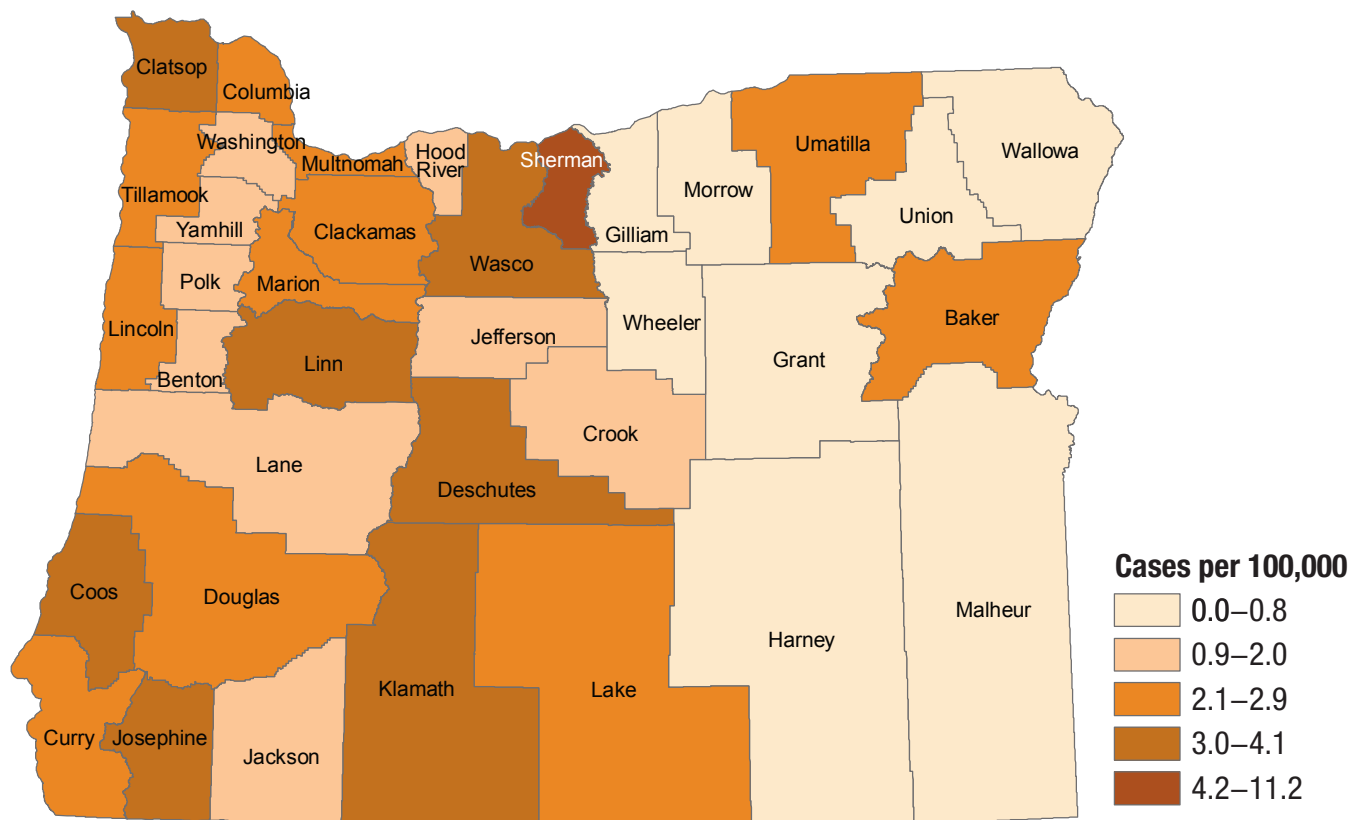
## Incidence of carbapenem-resistant *Enterobacteriaceae* by age and sex: Oregon, 2016



## Carbapenem-resistant *Enterobacteriaceae* by species: Oregon, 2016



## Incidence of carbapenem-resistant *Enterobacteriaceae* by county of residence: Oregon, 2012–2016



### Prevention

Think “NICE” if you encounter CRE:

**Notify** the county health department, pertinent clinical groups and your antibiotic stewardship program that CRE has been spotted.

**Intervene** in all cases with core infection control activities: hand hygiene, contact precautions, private rooms and optimized environmental cleaning. Reduce unnecessary antibiotics and use of invasive devices. Additionally, for CP-CRE, screen patient contacts, and cohort staff and patients.

**Communicate** CRE infection or colonization status to the receiving facility upon patient transfer.

**Educate** patients, staff and visitors about CRE.