

## Is ESBL a Hospital or Community Problem?

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### **What is an ESBL producer?**

Extended-Spectrum  $\beta$ -Lactamase (ESBLs) are enzymes that inactivate and confer resistance to most beta-lactam antibiotics, including penicillins, cephalosporins, and the monobactam aztreonam, and which are inhibited by Clavulanic acid. They are found exclusively in gram-negative organisms, primarily *Klebsiella Pneumoniae*, *Klebsiella oxytoca*, and *Escherichia coli*.

### **How does ESBL spread?**

The ways that ESBL can spread include:

1. Someone who colonized or infected with ESBL touches you with unwashed hands.
2. You touch objects or surfaces that have the germs.
3. Healthcare workers touch you without washing their hands properly after contact with an infected patient, object, or surface.

ESBL can enter your body in the following ways:

1. Through the mouth. This happens if you have the germs on your hands and then touch your mouth, such as when you eat. The germs are then swallowed and live in your intestine.
2. Through the urinary tract. This occurs if you already have ESBL in your bowel and do not cleanse properly after a bowel movement. ESBL can also enter the urinary tract through a urinary catheter, if you have one.
3. Through a wound.

### **Hospital-acquired ESBL producers**

Hospital-acquired infections are caused by viral, bacterial, and fungal pathogens; the most common types are bloodstream infection (BSI), pneumonia (e.g., ventilator-associated pneumonia [VAP], urinary tract infection [UTI], and surgical site infection [SSI])

Extended-spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae* have been reported worldwide. More than 50 hospital outbreak with ESBL producers (affecting 3000 patients) has been published worldwide in which methods were used to ascertain the genotypic relatedness of strains. In every reported outbreak, the common strain was isolated from more than two patients.

Prevalence rates vary from hospital to hospital and from country to country following:

1. A study in Japan reported that among ESBL-positive clinical *E. coli* strains, 94% of the isolates carried  $bla_{CTX-M}$ , but none carried  $bla_{TEM}$  and  $bla_{SHV}$ , indicating that  $bla_{CTX-M}$  in clinical settings might have originated from animal foods<sup>1</sup>. However, demonstrated that among ESBL gene-positive *E. coli*,  $bla_{CTX-M-9}$  (67%) was most prevalent followed by  $bla_{CTX-M-1}$  (19%) and  $bla_{CTX-M-2}$  (5.8%) genes in outpatients<sup>11</sup>.
2. In a sample of 5739 isolates from 72 US hospitals collected in 2012, the overall frequency of ESBLs was 16 percent in *K. pneumoniae*, 11.9 percent in *E. coli*, 10 percent in *K. oxytoca*, and 4.8 percent in *P. mirabilis*<sup>9</sup>. CTX-M-15 was the most common ESBL identified, followed by SHV- and TEM-type enzymes. Two or more  $\beta$ -lactamase genes were identified in 63 percent of the isolates, including non-ESBLs and carbapenemases.

3. Rates of ESBLs have also been increasing in the US, as reflected by a study that reported an increase in the incidence of ESBL-producing infections in southeastern US hospitals from 11.1 to 22.1 infections per 100,000 patient days between 2009 and 2014<sup>9</sup>.
4. ESBL prevalence is even higher in isolates from Asia, Latin America, and the Middle East<sup>3</sup>, reaching 60 percent in *K. pneumoniae* isolates from Argentina, and 48 percent in *E. coli* isolates from Mexico<sup>4,2</sup>.
5. Increasing community-acquired ESBL infections led to the discovery of concomitant high and increasing rates of fecal colonization by ESBL-producing bacteria worldwide<sup>5,10</sup>.
6. A total of 34 isolates from 27 patients (6.1%) admitted to Dutch hospitals were ESBL/pAmpC positive and 29 ESBL-*E. coli*, three pAmpC-*E. coli*, one ESBL-*Enterobacter cloacae*, and one pAmpC-*Proteus mirabilis* were found. In the German hospital, 18 isolates (16 *E. coli* and 2 *Klebsiella pneumoniae*) from 17 patients (7.7%) were ESBL positive. In isolates from the hospitalized patients, CTX-M-15 was the most frequently detected ESBL-gene. In the Dutch community, 11 individuals (2.75%) were ESBL/pAmpC positive: 10 ESBL-*E. coli* (CTX-M-1 being the most prevalent gene) and one pAmpC *E. coli*. Six Dutch (1.3%) and four German (3.9%) hospitalized patients were colonized with VRE. Genetic relatedness by core genome multi-locus sequence typing (cgMLST) was found between two ESBL-*E. coli* isolates from Dutch and German cross-border hospitals and between VRE isolates from different hospitals within the same region<sup>11</sup>.
7. In the study period, 49 patients needed hospitalization for upper UTI. Overall, in 25 patients (51%), cultures were negative. In the remaining, seven patients (14.3%) presented positive blood and urine-culture for ESBL + *E. coli*. Of these, four were female, and three were male. Their median age was 73 years (range 66-84). The median hospital stay of these patients was 23 days (range 13 to 45 days)<sup>7</sup>.

### How can hospital control spread?

Many hospitals and long-term care facilities take steps to help prevent ESBL:

1. **Handwashing.** This is the most critical way to help prevent the spread of germs. Healthcare workers wash their hands with soap and water or use an alcohol-based hand cleanser before and after treating each patient. They also clean their hands after touching any surface that may be contaminated with germs.
2. **Protective clothing.** Healthcare workers and visitors will likely wear gloves and a gown when entering the room of a patient with ESBL. Before leaving the room, they remove these items and clean their hands.
3. **Private rooms.** Patients with ESBL are put in private rooms or in a room with another patient who also has ESBL.
4. **Personal care items.** Patients with ESBL may have their patient care items, such as thermometers and stethoscopes. If these items are shared, they are thoroughly cleaned and disinfected before reuse.
5. **Monitoring.** Hospitals and long-term facilities monitor the presence and spread of ESBL. They teach caregivers the best ways to prevent it.

## Reference:

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