

# Prevalence of Extended Spectrum Beta-Lactamase Producing and Quinolone Non-susceptible Enterobacteriaceae in Inpatient and Outpatient Settings in the USA from 2011-2017

Sailaja Puttagunta, MD<sup>1</sup>, Vikas Gupta, PharmD, BCPS<sup>2</sup>, John Murray, MPH<sup>2</sup>, and Michael Dunne, MD<sup>1</sup>

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<sup>1</sup>Iterum Therapeutics, Old Saybrook, CT 06475; <sup>2</sup>Becton, Dickinson and Company, Franklin Lakes, NJ. [sputtagunta@iterumtx.com](mailto:sputtagunta@iterumtx.com); [vikas.Gupta@bd.com](mailto:vikas.Gupta@bd.com)

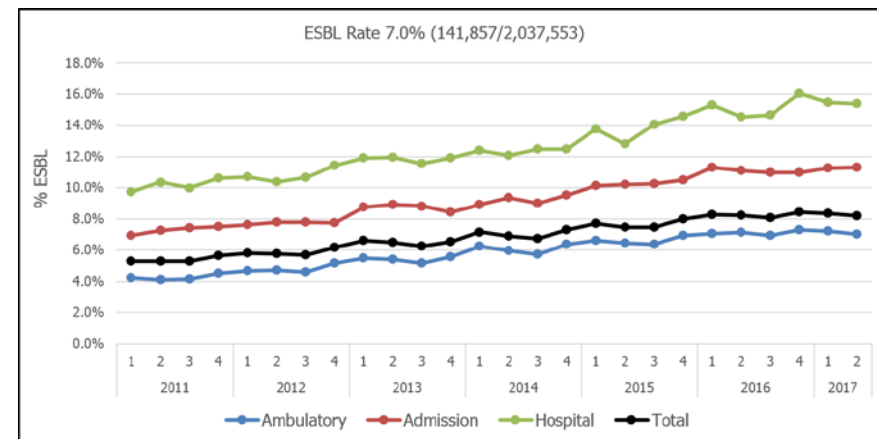
## ABSTRACT (revised)

**Background:** Rising rates of resistance to quinolones and cephalosporins have been reported recently amongst *E.coli* and other gram-negative pathogens that cause urinary tract infections (UTI). We sought to define the regional prevalence of quinolone-non-susceptible (QNS) and extended spectrum β-lactamase (ESBL) producing gram-negative pathogens in the United States (US).

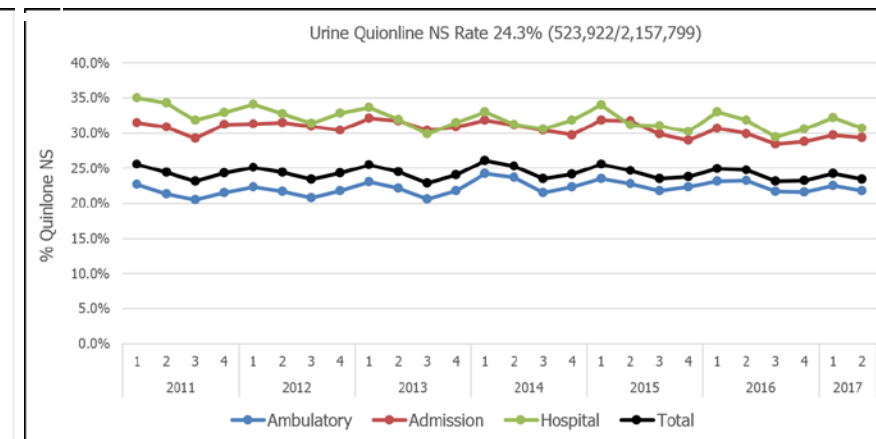
**Methods:** An electronic research dataset from 192 US hospitals (BD Insights Research Database; Becton, Dickinson and Company) was analyzed to study trends in prevalence of QNS and ESBL organisms from 2011 to Q2 2017. All non-duplicate *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca* and *Proteus mirabilis* isolates were characterized as ESBL if confirmed as ESBL-positive per commercial panels or intermediate/resistant to either ceftriaxone, cefotaxime, ceftazidime or cefepime and categorized as QNS if identified as intermediate or resistant to either ciprofloxacin, levofloxacin or moxifloxacin. Isolates were categorized by specimen collection location as follows: (a) Inpatient if collected in hospitalized patients and (b) Ambulatory: isolates not collected during hospital admission.

**Results:**

**Figure 1. Trends in prevalence of ESBL-positive Enterobacteriaceae.**



**Figure 2. Trends in prevalence of QNS Enterobacteriaceae.**



**Conclusion:** ESBL producing organisms at these sentinel hospitals have been rising since 2011. Quinolone resistance remains persistently elevated.

## INTRODUCTION

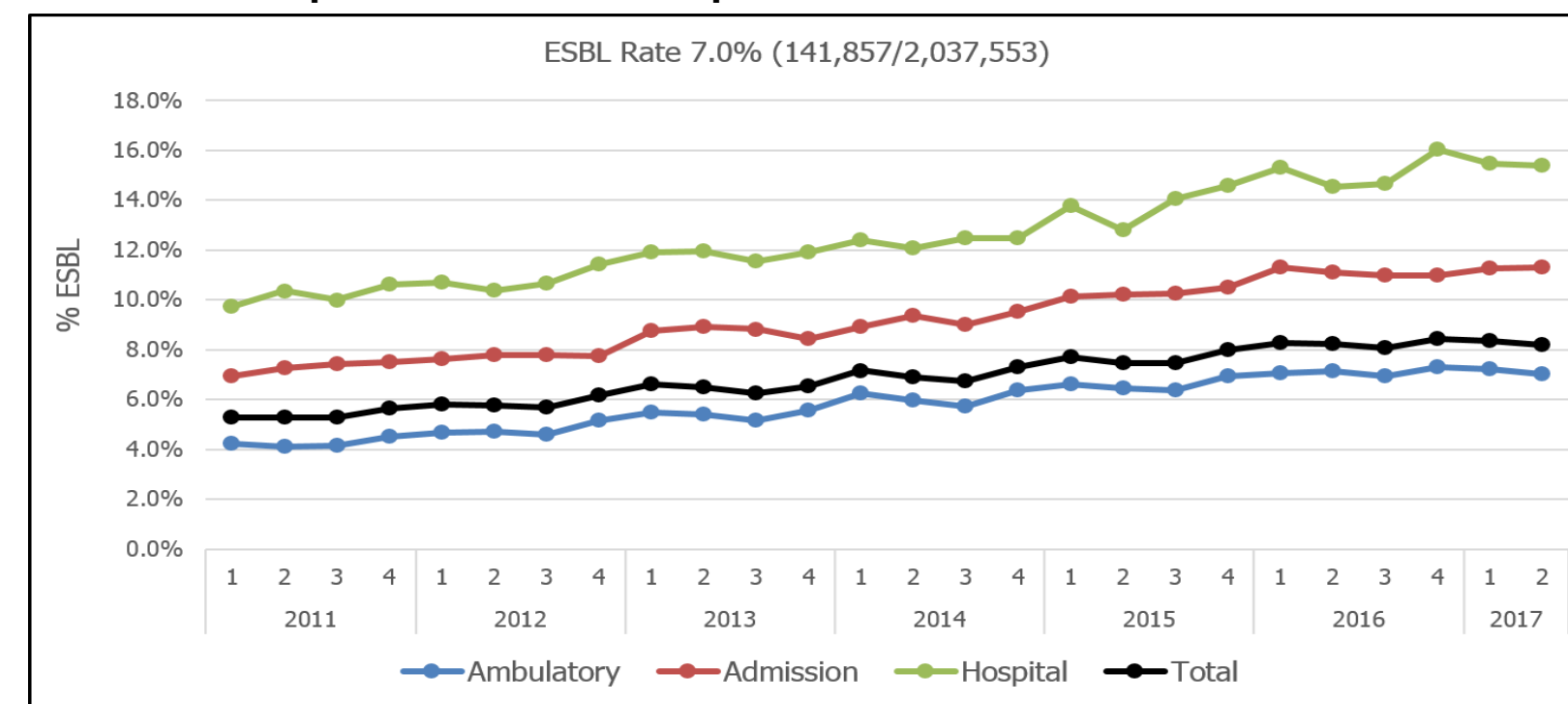
- Based on CDC surveillance data, the prevalence of infections caused by ESBL producing or quinolone non-susceptible Enterobacteriaceae has been increasing worldwide and includes both hospital acquired and community onset infections (ICHE 2016;37:1288–1301).
  - In hospitals, 13.4% ESBL resistance nationally, with rates as high as 24% reported in some Northeastern, Southern and Western states.
  - Over a third of *E.coli* isolates in 2014 were resistant to quinolones.
- Oral antibiotic treatment options are extremely limited for patients with these infections
  - Resulting in lengthy hospital stays to facilitate administration of intravenous antibiotics, even for those with uncomplicated infections.
- Sulopenem is a thiopenem antibiotic being developed for the treatment of infections caused by multi-drug resistant bacteria
  - Exerts bactericidal activity through inhibition of bacterial cell wall synthesis by binding to penicillin-binding proteins
  - Has potent activity against Enterobacteriaceae, including those with ESBLs or AmpC-type β-lactamases
  - Is available as intravenous and oral formulations.

## METHODS

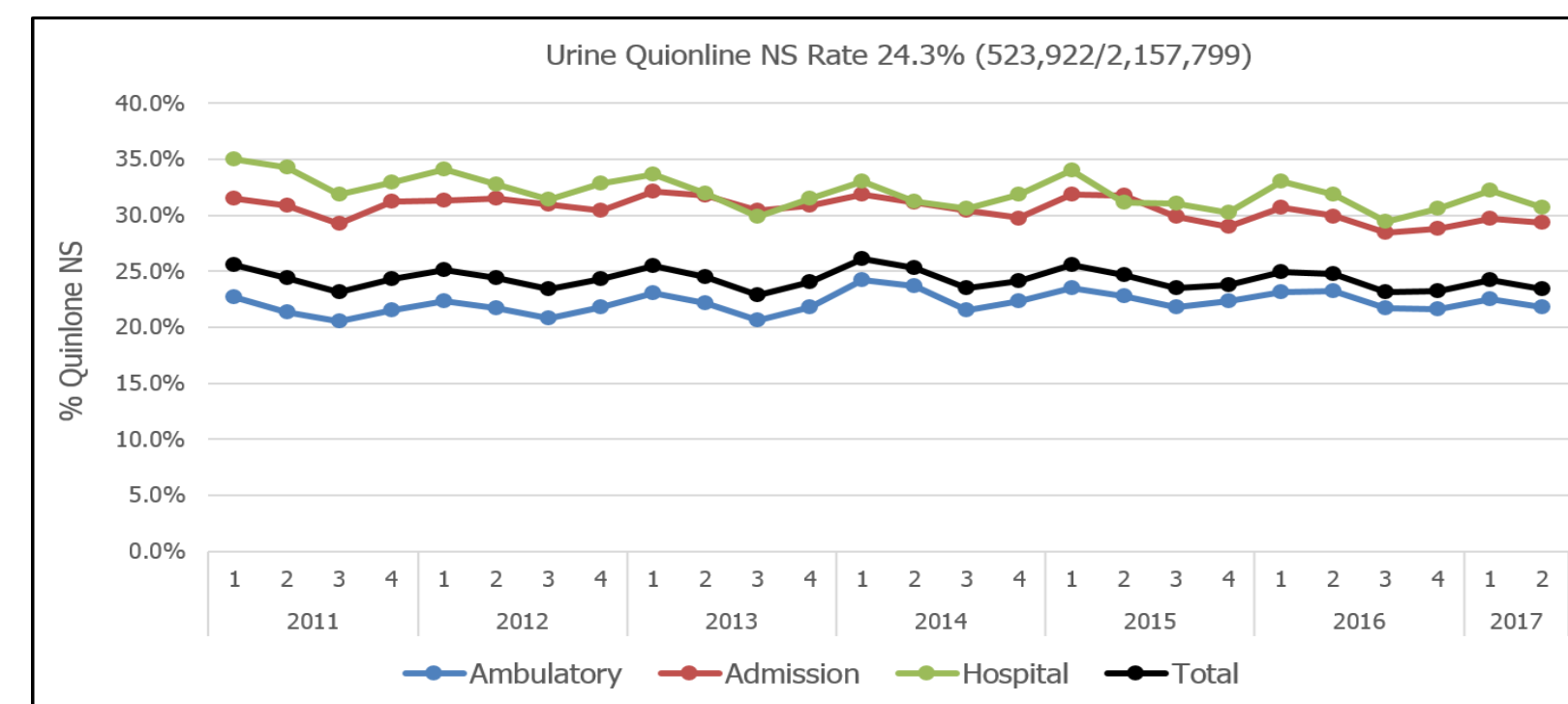
- The data source was the BD Insights Research Database (Becton, Dickinson & Company) from 192 US hospitals (2011 – June 2017) and 379 facilities in Q2 2017.
- All non-duplicate *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca* and *Proteus mirabilis* isolates were characterized as:
  - ESBL if confirmed as ESBL-positive per commercial panels or intermediate/resistant to either ceftriaxone, cefotaxime, ceftazidime or cefepime and
  - Quinolone non-susceptible (QNS) if identified as intermediate or resistant to either ciprofloxacin, levofloxacin or moxifloxacin
- Isolates were categorized by specimen collection location as follows:
  - Admission period (AD): ≤ 3 days after inpatient admission with no previous admission within 14 days
  - Hospital-onset period (HO): > 3 days after inpatient admission or within 14 days of previous discharge
  - Ambulatory: isolates not collected during hospital admission.
- Ambulatory ESBL and QNS rates are displayed by zip code territory area (ZCTA) for 379 acute care facilities in Q2 2017 ([https://www.census.gov/geo/maps-data/data/cbf/cbf\\_zcta.html](https://www.census.gov/geo/maps-data/data/cbf/cbf_zcta.html)).

## RESULTS

**Figure 1. Trends in prevalence of ESBL-positive Enterobacteriaceae in urine.**

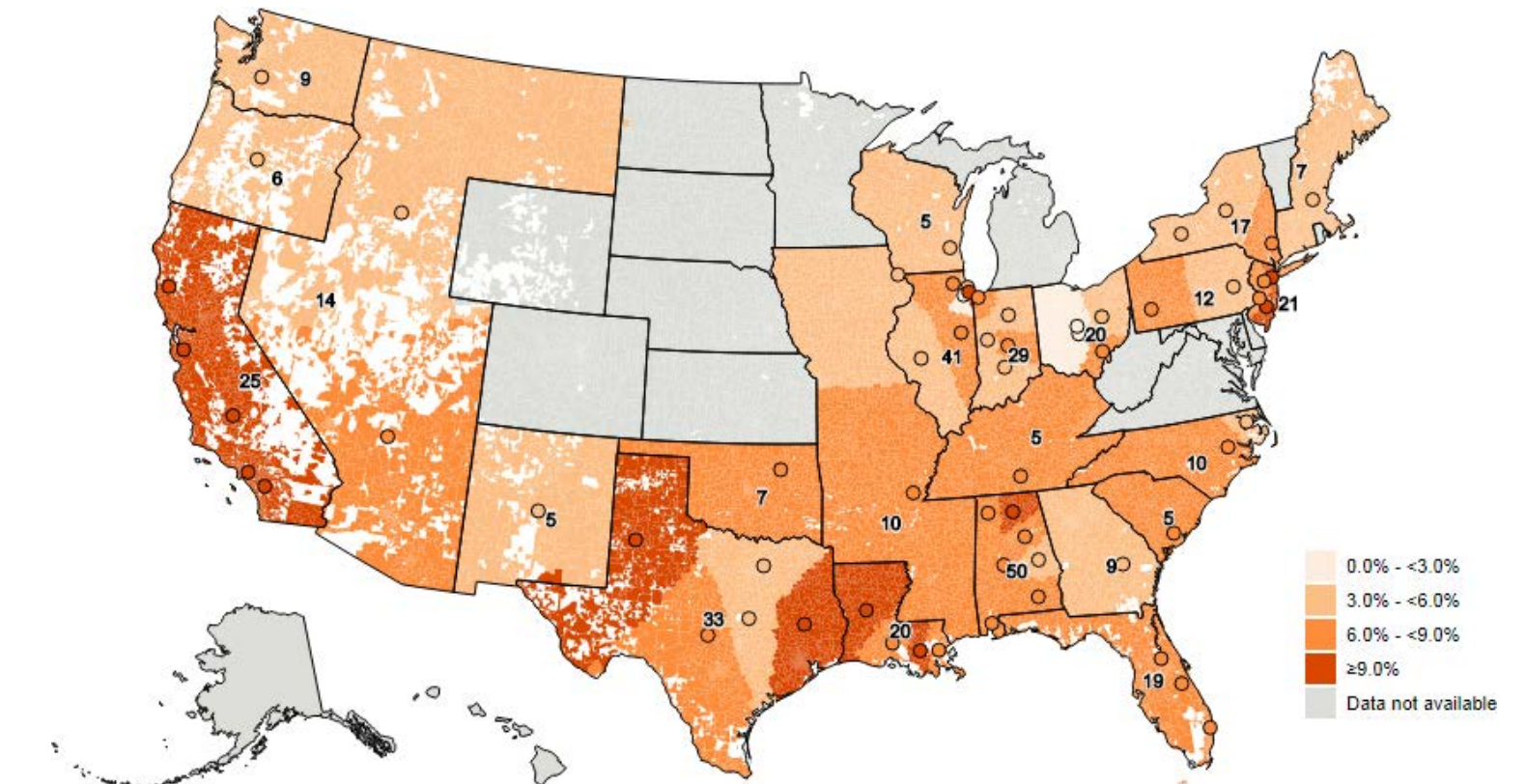


**Figure 2. Trends in prevalence of QNS Enterobacteriaceae in urine.**

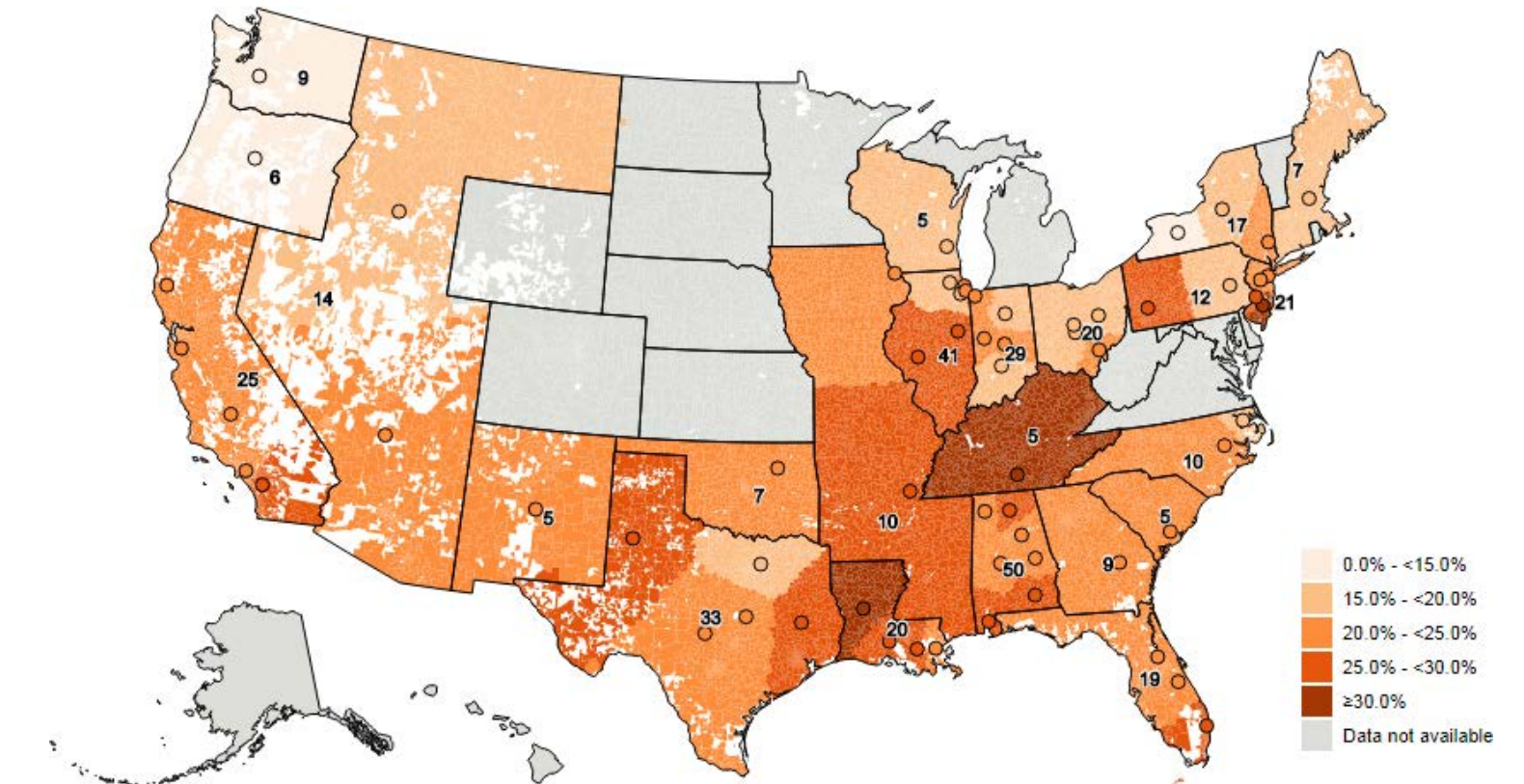


## RESULTS

**Figure 3. Geographic prevalence of ESBL-positive Enterobacteriaceae.**



**Figure 4. Geographic prevalence of QNS Enterobacteriaceae.**



## CONCLUSIONS

- ESBL-producing organisms at these sentinel hospitals have been rising since 2011.
- Quinolone resistance remains persistently elevated in both inpatient and outpatient settings
- Oral antibiotics with good activity against ESBL-producing and quinolone non-susceptible pathogens are needed

