Epidemiology of Carbapenem-Resistant Enterobacteriaceae—Connecticut, January 2014–December 2015

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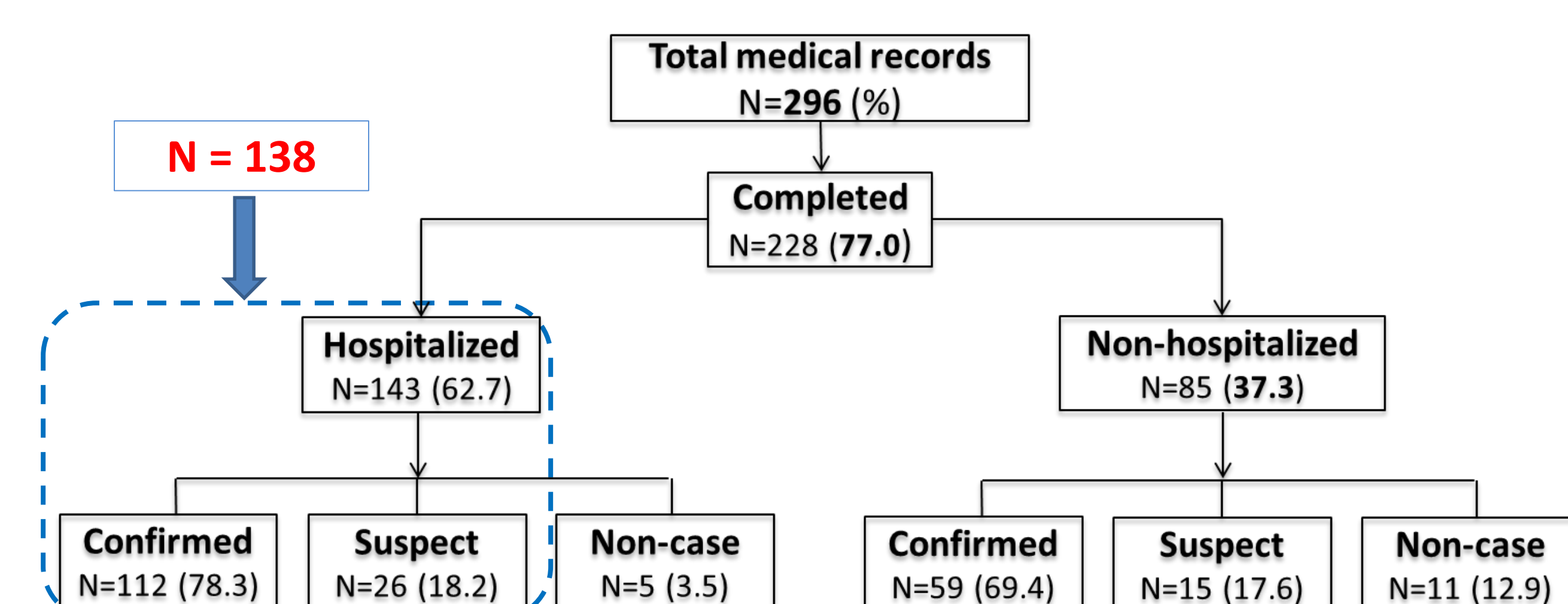
BACKGROUND

- CRE are a family of bacteria that cause infections which are difficult to treat due to their high levels of resistance to the carbapenem class of antibiotics.
- In the United States, the reported percentage of carbapenem-nonsuceptible Enterobacteriaceae causing common healthcare–associated infections (HAI) increased from 1.2% in 2001 to 4.2% in 2011[1].
- The Connecticut Department of Public Health (CT DPH) initiated laboratory reporting of CRE effective January 1, 2014.

OBJECTIVES

- Characterize CRE incident cases, pathogens and isolates reported to the HAI Program by the clinical laboratories
- Assess risk factors of CRE cases during the data collection period and during their exposures in the previous year
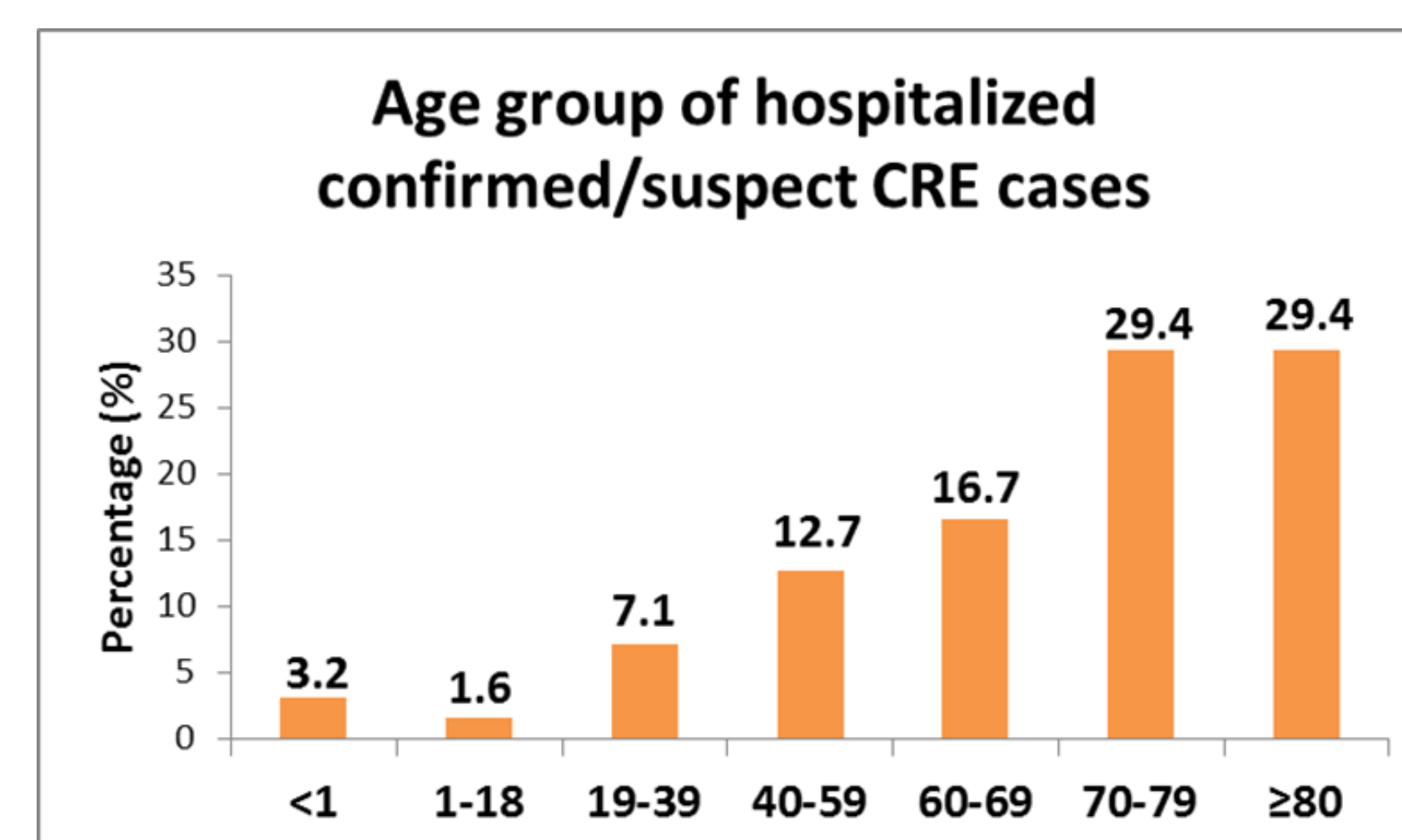- Evaluate infection control practices

METHODS

- In 2014, CRE was defined as clinical isolates of Enterobacteriaceae obtained from any sterile site, sputum, or urine which was non-susceptible to at least 2 carbapenems: doripenem, imipenem, meropenem, or ertapenem (resistant isolates only). In 2016, the CRE case definition was changed to include clinical isolates that were non-susceptible to any carbapenem.
- In 2014, in those cases where isolates had demonstrated non-susceptibility to only one carbapenem, the isolate was reportable if it was also resistant to all 3rd generation cephalosporins tested. In 2016, this criterion was removed.
- Multiple isolates of the same genus/species and antibiotic susceptibility pattern from a single patient were reportable as incident cases once every 30 days.
- Cases were classified as confirmed if they met the genus, clinical source, and antibiogram components of the case definition, and as suspect if they had insufficient antibiogram data.
- Chart review was performed for suspect and confirmed cases reported from January 1, 2014–December 31, 2015.
- Reports were assessed with the 2014 and the simplified 2016 case definitions to quantify any variance of case classification.
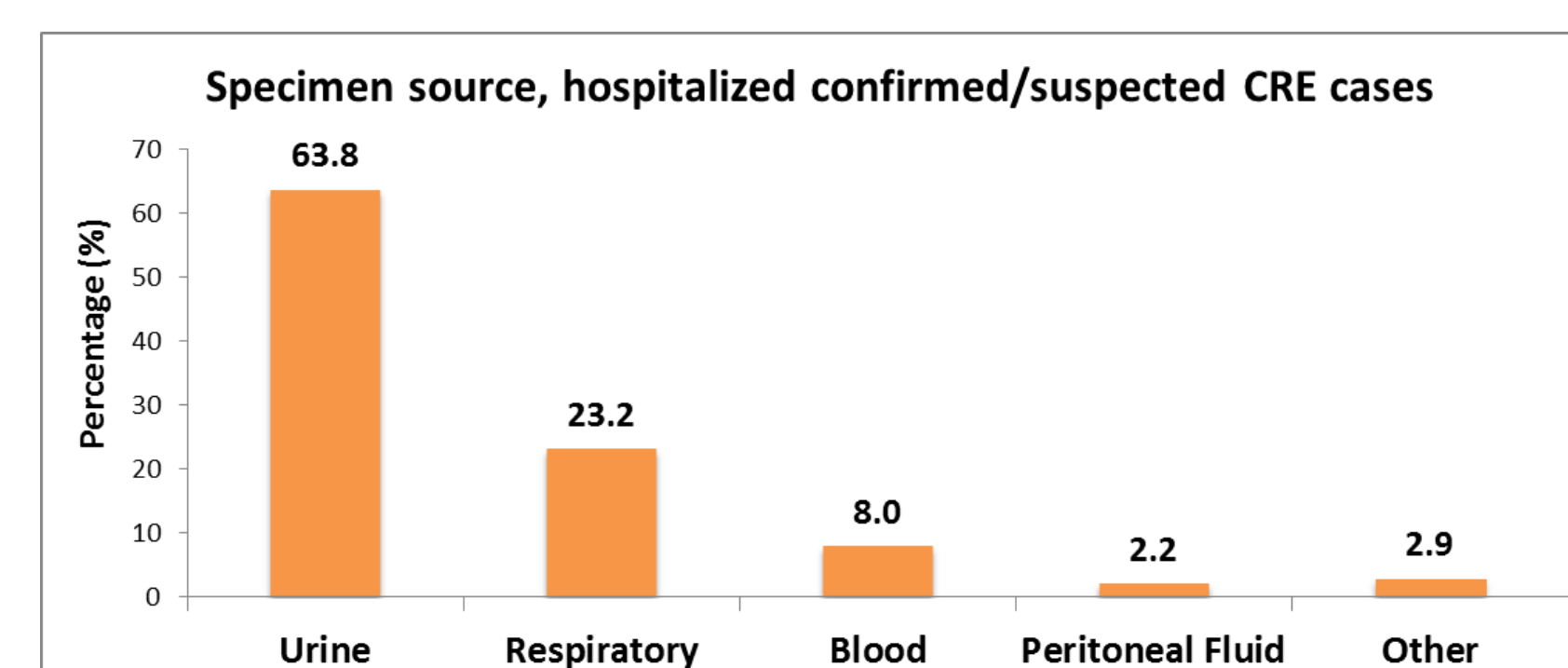
N = 138

Total medical records N=**296** (%)
- Completed N=228 (**77.0**)
  - Hospitalized N=143 (**62.7**)
    - Confirmed N=112 (78.3)
    - Suspect N=26 (18.2)
    - Non-case N=5 (3.5)
  - Non-hospitalized N=85 (**37.3**)
    - Confirmed N=59 (69.4)
    - Suspect N=15 (17.6)
    - Non-case N=11 (12.9)

RESULTS

1. Characteristics of CRE Cases

- For the demographic analysis, twelve duplicate forms were excluded to ensure unique individuals.
- Females and males were nearly equally distributed (50.8% and 49.2%, respectively).
- For females, most isolates were from urine (79.7%, 51/64).
- The distribution of race and ethnicity was representative of the population in Connecticut.
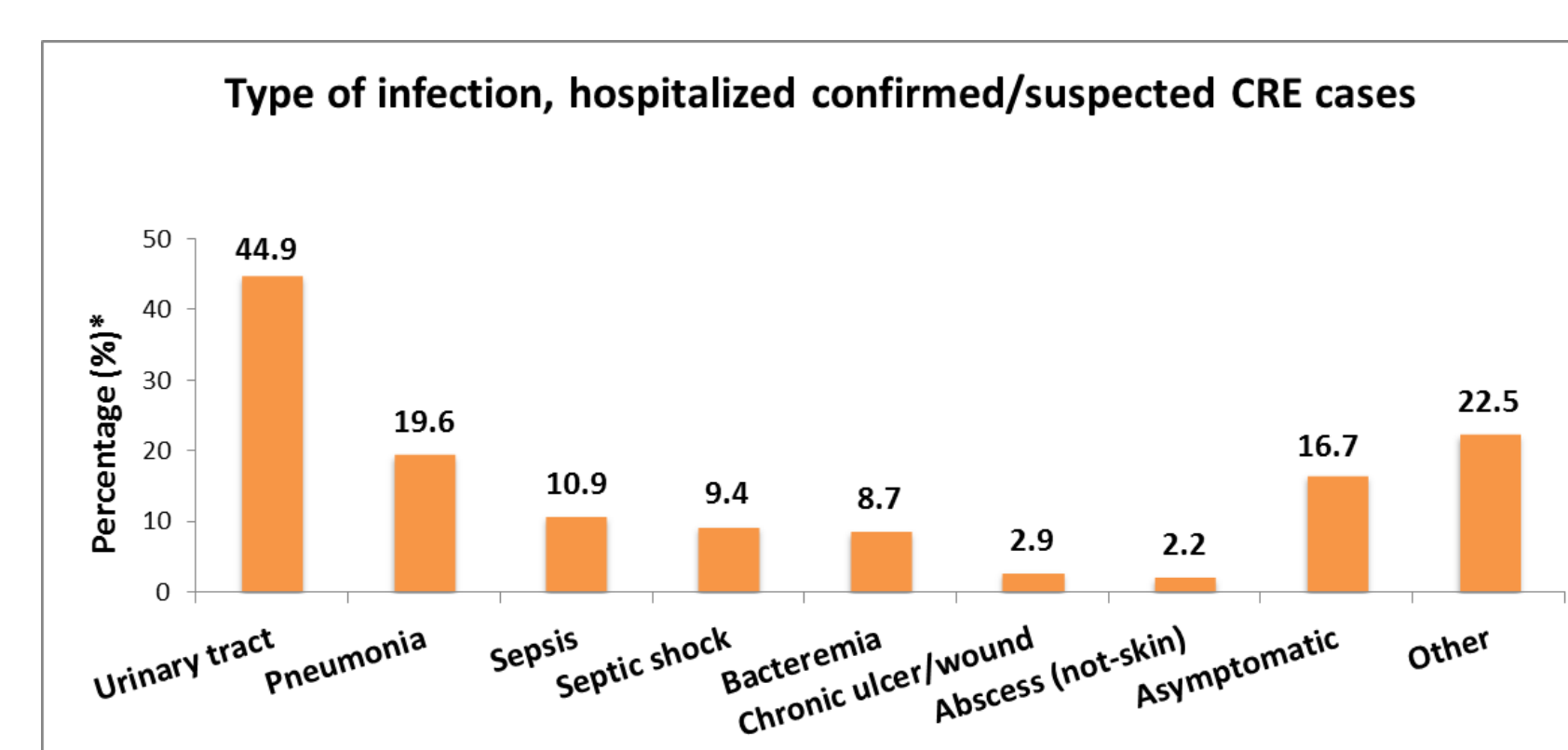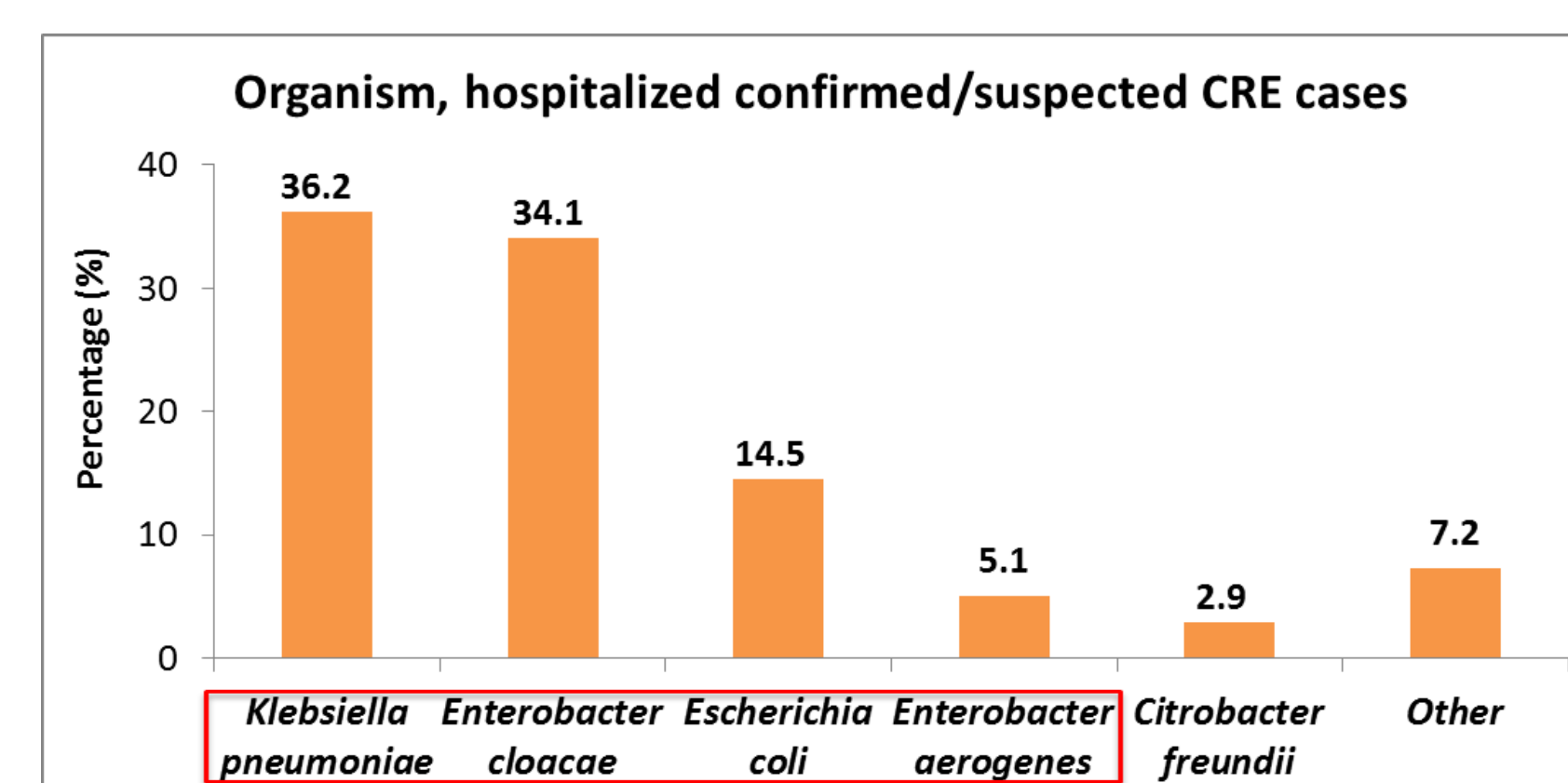

Age group of hospitalized confirmed/suspect CRE cases
- <1: 3.2
- 1-18: 1.6
- 19-39: 7.1
- 40-59: 12.7
- 60-69: 16.7
- 70-79: 29.4
- ≥80: 29.4

2. Specimen Source

Specimen source, hospitalized confirmed/suspected CRE cases
- Urine: 63.8
- Respiratory: 23.2
- Blood: 8.0
- Peritoneal Fluid: 2.2
- Other: 2.9

Respiratory includes: sputum (20), endotracheal aspirate (10), and Bronchoalveolar lavage (BAL) (2).
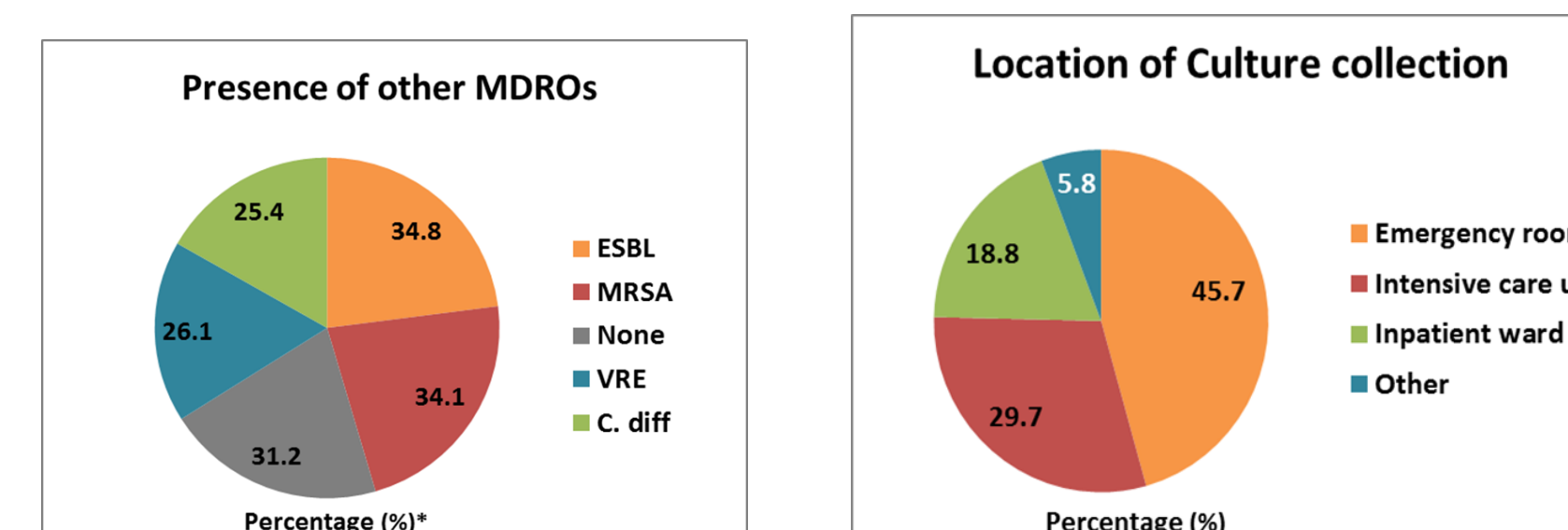
3. Type of Infection

Type of infection, hospitalized confirmed/suspected CRE cases
- Urinary tract: 44.9
- Pneumonia: 19.6
- Sepsis: 10.9
- Septic shock: 9.4
- Bacteremia: 8.7
- Chronic ulcer/wound: 2.9
- Abscess (not-skin): 2.2
- Asymptomatic: 16.7
- Other: 22.5

Sepsis and septic shock are conditions that indicate severity of infections.

4. Type of Organism

Organism, hospitalized confirmed/suspected CRE cases
- Klebsiella pneumoniae: 36.2
- Enterobacter cloacae: 34.1
- Escherichia coli: 14.5
- Enterobacter aerogenes: 5.1
- Citrobacter freundii: 2.9
- Other: 7.2

5. Exposures During Collection Period

Presence of other MDROs
- ESBL: 34.8
- MRSA: 31.2
- None: 26.1
- VRE: 25.4
- C. diff

Location of Culture collection
- Emergency room: 45.7
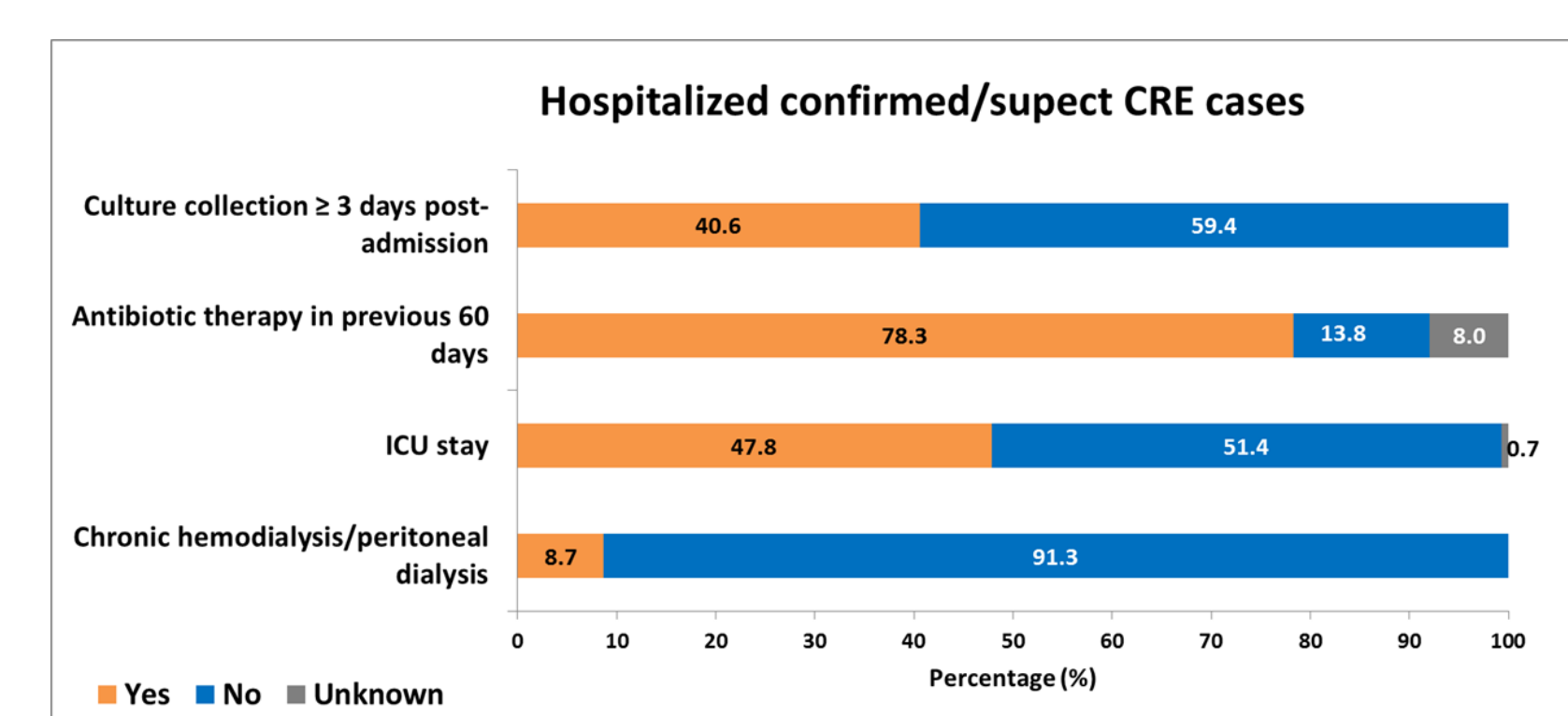- Intensive care unit: 29.7
- Inpatient ward: 18.8
- Other: 5.8

*Total percentage per year may exceed 100, categories are not mutually exclusive.
MDRO = multidrug-resistant organism; ESBL = Extended-spectrum β-lactamases; MRSA = Methicillin-resistant Staphylococcus aureus; VRE = Vancomycin-resistant Enterococci; C. diff = Clostridium difficile
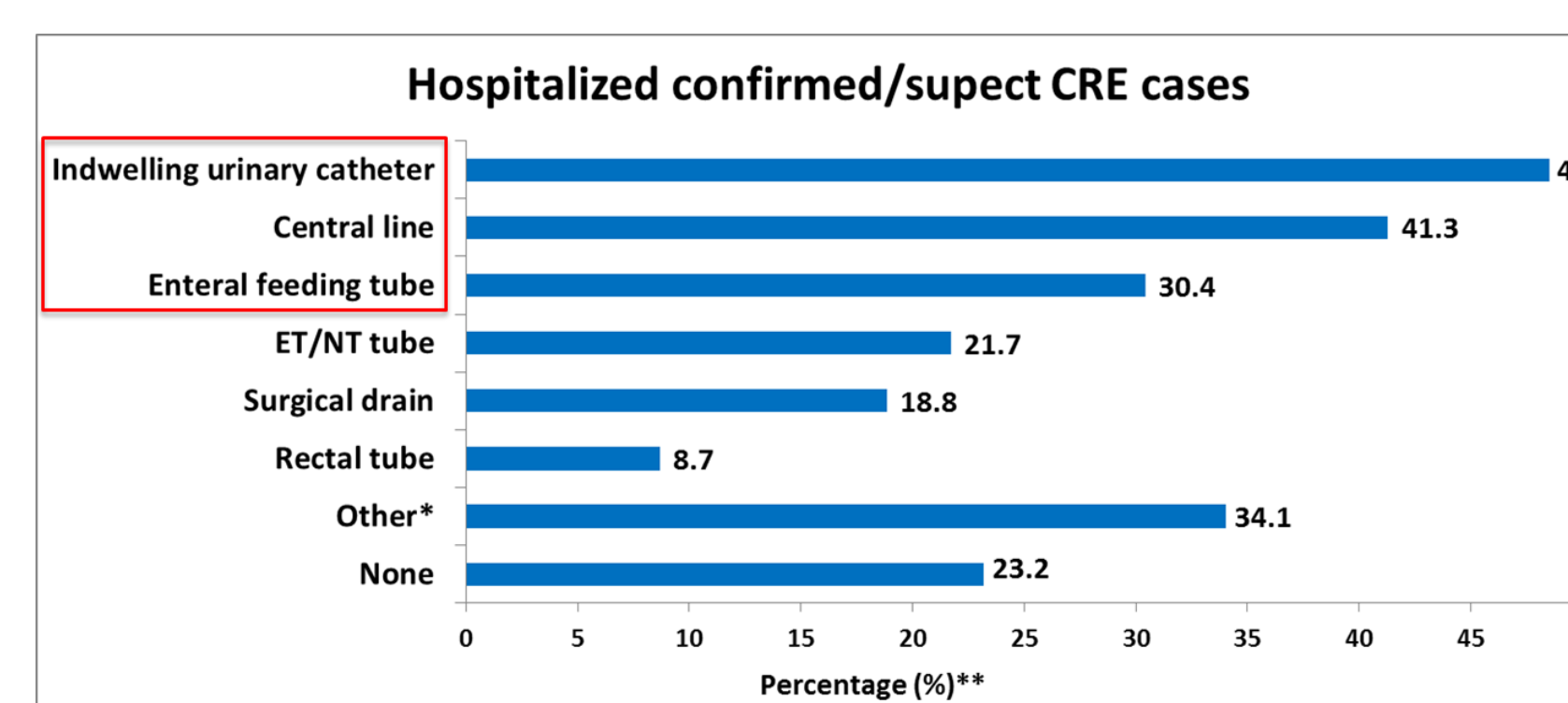
Hospitalized confirmed/suspect cases	N=138	%
Hospital stay, median days (range)	14 (2–177)	
Antimicrobial therapy, median days (range)	17 (0–563)	
Other positive cultures ≤ 30 days*		
Yes	44	31.9
No	90	65.2
Mortality in hospital (%)		
Yes**	21	15.2
No	117	84.8

*Unknown: 2.9% (4/138)
** Specimen source for those who died during hospitalization: urine (42.9%, 9/21), any sterile site (33.3%, 7/21), and sputum (23.8%, 5/21)
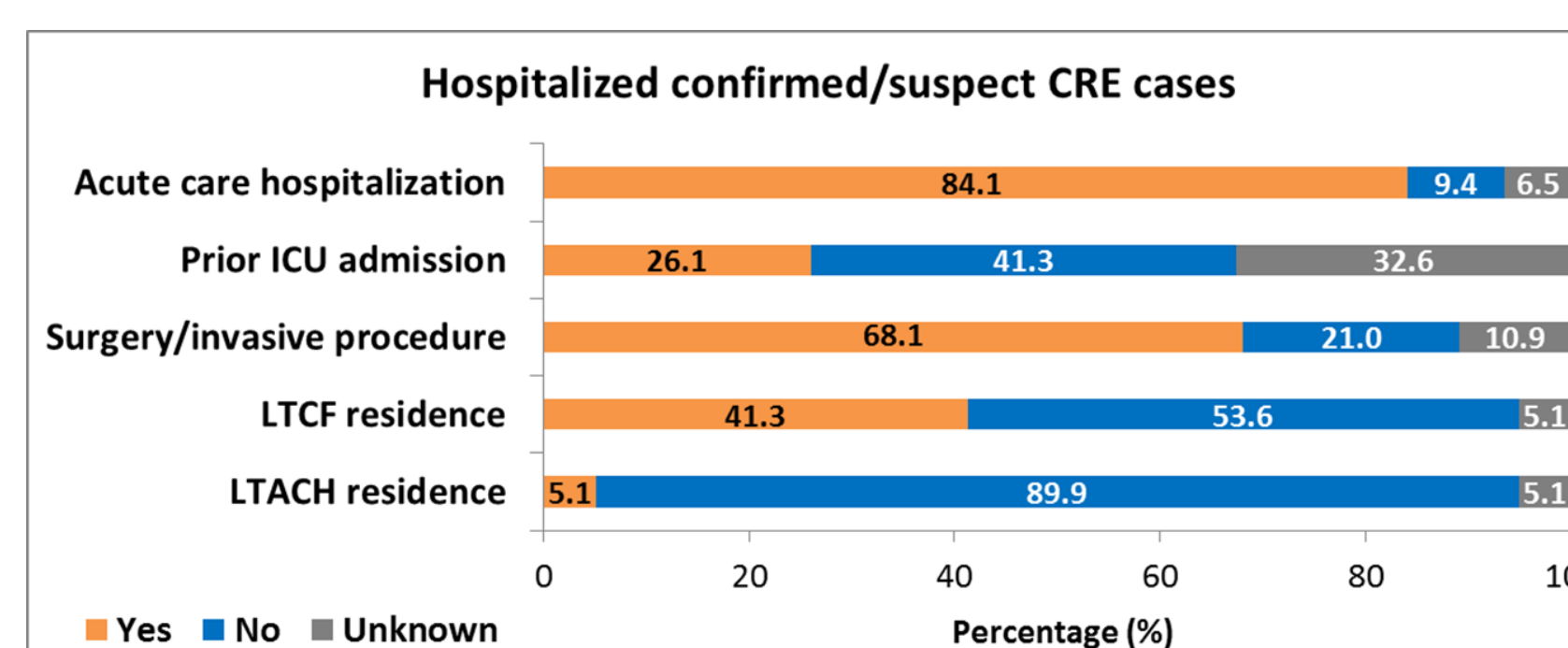

Hospitalized confirmed/suspect CRE cases
- Culture collection ≥ 3 days post-admission: Yes 40.6, No 59.4
- Antibiotic therapy in previous 60 days: Yes 78.3, No 13.8, Unknown 8.0
- ICU stay: Yes 47.8, No 51.4, Unknown 0.7
- Chronic hemodialysis/peritoneal dialysis: Yes 8.7, No 91.3

Invasive Devices

Hospitalized confirmed/suspect CRE cases
- Indwelling urinary catheter: 48.6
- Central line: 41.3
- Enteral feeding tube: 30.4
- ET/NT tube: 21.7
- Surgical drain: 18.8
- Rectal tube: 8.7
- Other*: 34.1
- None: 23.2

*Other includes categories with ≤7 and ≤3 responses in 2014 and 2015, respectively.
**Total percentage per year may exceed 100, categories are not mutually exclusive.

6. Exposures in the Past Year

Hospitalized confirmed/suspect CRE cases
- Acute care hospitalization: Yes 84.1, No 9.4, Unknown 6.5
- Prior ICU admission: Yes 26.1, No 41.3, Unknown 37.6
- Surgery/invasive procedure: Yes 68.1, No 21.0, Unknown 10.9
- LTCF residence: Yes 41.3, No 53.6, Unknown 5.1
- LTACH residence: Yes 5.1, No 89.9, Unknown 5.1

7. Infection Prevention Considerations

- More than half of cases were incontinent of urine (58%), incontinent of stool (52.9%), and had an open/draining wound (63.8%).

CONCLUSIONS

- Most CRE cases were of older age (75.5%, ≥60 years old).
- *Klebsiella pneumoniae, Enterobacter cloacae, Enterobacter aerogenes,* and *Escherichia coli* represented 90% of the organisms reported.
- Urinary tract infection and pneumonia were the most common type of infection reported (64.5%).
- Most hospitalized cases had at least one known risk factor for CRE including ≥1 additional MDROs or ≥1 invasive devices.
- Most cultures were collected in the ED or ICU highlighting the significance of proper communication of CRE status within and between facilities upon patient transfer.
- There was no difference in the case classification between the two definitions, 2014 and 2016, (p<0.05), allowing for consistent characterization of cases over time.

LIMITATIONS

- CRE case report is dependent on lab reports only.
- Limited outpatient information available.
- CRE cases reported with no antibiogram were classified as "suspect" pending antibiogram information collection.
- Medical record review strategies changed according to the facilities' medical record storage systems.

NEXT STEPS

- Beginning 2017, the state Public Health Laboratory (SPHL) will perform genetic characterization of isolates.
- SPHL will collaborate with the Antibiotic Resistance Laboratory Network regional lab in New York and the CDC to look for molecular genetic markers.
- Develop a multidrug-resistant organism patient registry accessible to Infection Preventionists in acute care hospitals
- Develop a data collection protocol for outpatients

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CONTACT INFORMATION

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REFERENCES

1. Chea N, Bulens SN, Kongphet-Than T, Lynfield R et al., Emerging Infectious Diseases. Improved Phenotype-Based Definition for Identifying Carbapenemase Producers among Carbapenem-Resistant Enterobacteriaceae. Emerg Infect Dis; 2015;21(9):1611–1616.