Predicting carbapenem resistance among gram-negative pathogens in complicated urinary tract infections

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Disclosures

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Consulting & Advisory Boards

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Background

- In the US, UTI hospitalizations rose by 50% over the 2000s
  - over 3 million UTI admissions in 2009[1]
- Pathogens[2]
  - Enterobacteriaceae -- common
  - *P. aeruginosa* -- common
  - *A. baumannii* – rare, but often resistant
- Carbapenem resistance (CR) has grown rapidly
  - over 3% of Enterobacteriaceae carbapenem non-susceptible[2-4]
  - CR among PA and AB substantially higher[1]
- Resistance associated with inappropriate empiric therapy (IET)[5-6]
- IET associated with worsened outcomes

Study aim

- To develop and validate a predictive score to be used at the bedside to identify hospitalized patients with complicated UTI (cUTI) who are at risk for a CR pathogen

Methods

- Design: multi-center retrospective cohort
- Population: adult patients admitted to a US hospital with cUTI
- Data source: Premier Research database, years 2009-2016
- Modeling: Split cohort method
  - 60% training
  - 40% validation
  - Limited to $\leq$10 predictors
  - Score weighted to each predictor's regression coefficient

Definitions

- cUTI defined through an algorithm using ICD-9-CM codes
  - CAUTI analyzed as a subgroup of cUTI
- Appropriate empiric treatment: patient received coverage that
  - Included corresponding organism
  - Within two days of the culture being obtained
- IET: All other regimens
- Predictors: baseline factors, hospital characteristics, processes prior to infection onset

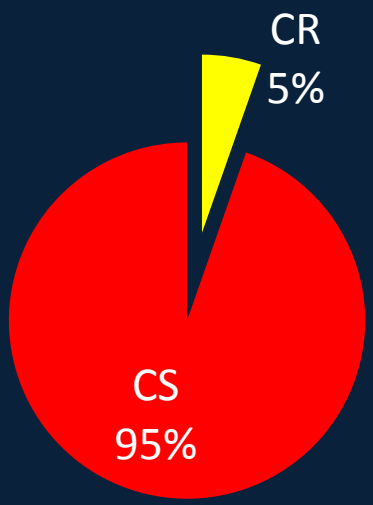
Organisms of interest

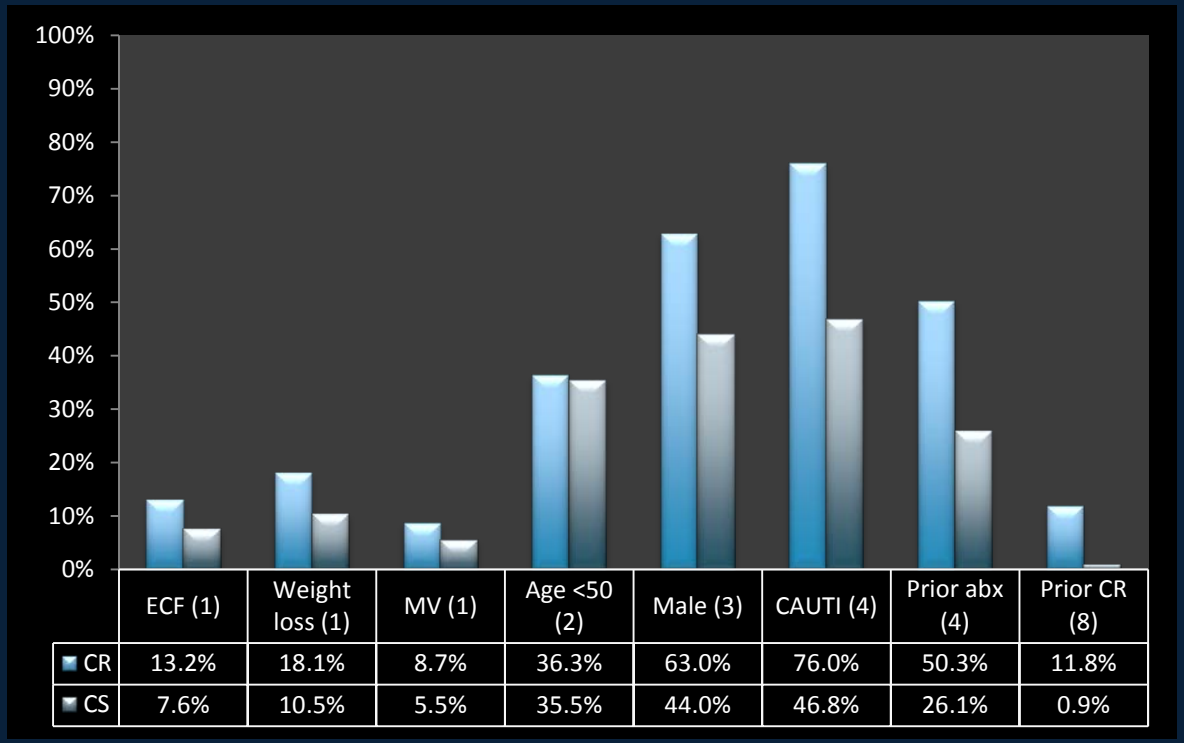
- *Pseudomonas aeruginosa*
- *Acinetobacter baumannii*
- *Stenotrophomonas maltophilia*
- *Escherishia coli*
- *Klebsiella pneumoniae*
- *Klebsiella oxytoca*
- *Enterobacter cloacae*
- *Enterobacter aerogenes*
- *Proteus mirabilis*
- *Proteus spp.*
- *Serratia marcescens*
- *Citrobacter freundii*
- *Morganella morganii*
- *Providencia spp.*

Results

cUTI N=25,285, 92% CO

	CR	CS	P-value
Mean age	64.1 (17.9)	64.0 (18.7)	0.86
Mean Charlson	2.9 (2.2)	2.3 (2.2)	<0.001

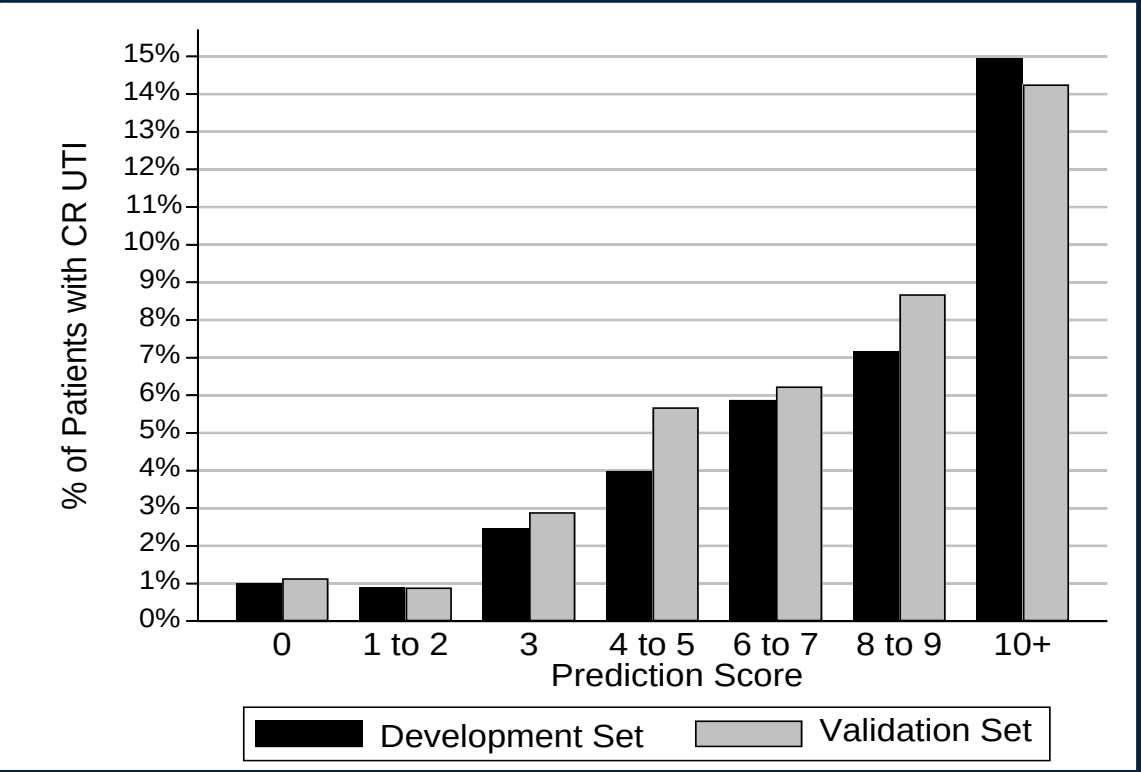




	ECF (1)	Weight loss (1)	MV (1)	Age <50 (2)	Male (3)	CAUTI (4)	Prior abx (4)	Prior CR (8)
CR	13.2%	18.1%	8.7%	36.3%	63.0%	76.0%	50.3%	11.8%
CS	7.6%	10.5%	5.5%	35.5%	44.0%	46.8%	26.1%	0.9%

Model and prediction score

- C-statistic
  - Training 0.746
  - Validation 0.721
- Performed better among hospitals with lower prevalence of CR
  - tertile 1 – 0.752 [CR prevalence 2.1%]
  - tertile 2 – 0.725 [CR prevalence 4.7%]
  - tertile 3 – 0.703 [CR prevalence 9.2%]



NPV is high (99%) for score ≤3

Conclusions

- CR is prevalent in 5% of hospitalized patients with cUTI
- Our simple bedside score was able to identify cUTI patients at low risk for CR
- Using our score may help reduce overuse of broad-spectrum antibiotics in patients with cUTI

Research Team

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