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Background: The survival of patients with hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) is largely determined by the timely administration of effective antibiotic therapy. Guidelines for the treatment HAP and VAP recommend empiric treatment with broad-spectrum antibiotics and tailoring of antibiotic therapy once results of microbiological testing are available. **Objective:** We examined the influence of bacterial identification and antibiotic susceptibility testing on antibiotic therapy for patients with HAP or VAP. **Methods:** We used the US Veterans' Health Administration (VHA) database to identify a retrospective cohort of patients diagnosed with HAP or VAP between fiscal year 2015 and 2018. We further analyzed patients who were started on empiric antibiotic therapy, for whom microbiological test results from a respiratory sample were available within 7 days and who were alive within 48 hours of sample collection. We used the antibiotic spectrum index (ASI) to compare antibiotics prescribed the day before and the day after availability of bacterial identification and antibiotic susceptibility testing results. **Results**: We identified 4,669 cases of HAP and VAP in 4,555 VHA patients. The median time from respiratory sample receipt in the laboratory to final result of bacterial identification and antibiotic susceptibility testing was 2.22 days (IQR, 1.31–3.38 days). The most common pathogen was *Staphylococcus aureus* (n = 994), with methicillin resistance in 58% of those isolates tested. The next most common pathogen was *Pseudomonas* spp (n = 946 isolates). The susceptibility of antipseudomonal antibiotics, when tested, was as follows: 64% to carbapenems, 74% to cephalosporins, 75% to β-lactam/β-lactamase inhibitors, 69% to fluoroquinolones, and 95% to amikacin. Lactose-fermenting gram-negative bacteria (296 *Escherichia coli* and 360 *Klebsiella pneumoniae*) were also common. Among the 3,094 cases who received empiric antibiotic therapy, 607 (20%) had antibiotics stopped the day after antibiotic susceptibility results became available, 920 (30%) had a decrease in ASI, 1,075 (35%) had no change in ASI, and 492 (16%) had an increase in ASI (Fig. 1). Among the 1,098 patients who were not started on empiric antibiotic therapy, only 154 (14%) were started on antibiotic therapy the day after antibiotic susceptibility results became available. **Conclusions:** Changes in antibiotic therapy occurred in at least two-thirds of cases the day after bacterial identification and antibiotic susceptibility results became available. These results highlight how respiratory cultures can inform the treatment and improve antibiotic stewardship for patients with HAP/VAP.
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Presentation Type:
Poster Presentation

Patient-Specific Predictive Antibiogram in Decision Support for Empiric Antibiotic Treatment

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Background: The rising trend of antibiotic resistance imposes a heavy burden on healthcare both clinically and economically (US$55 billion), with 23,000 estimated annual deaths in the United States as well as increased length of stay and morbidity. Machine-learning–based methods have, of late, been used for leveraging patient's clinical history and demographic information to predict antimicrobial resistance. We developed a machine-learning model ensemble that maximizes the accuracy of such a drug-sensitivity versus resistivity classification system compared to the existing best-practice methods. **Methods:** We first performed a comprehensive analysis of the association between infecting bacterial species and patient factors, including patient demographics, comorbidities, and certain healthcare-specific features. We

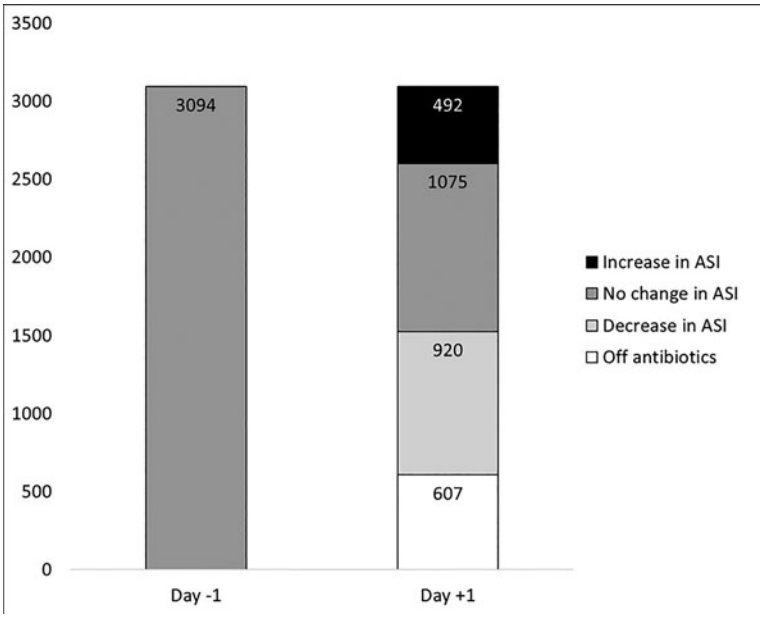

Fig. 1

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leveraged the predictable nature of these complex associations to infer patient-specific antibiotic sensitivities. Various base-learners, including k-NN (k-nearest neighbors) and gradient boosting machine (GBM), were used to train an ensemble model for confident prediction of antimicrobial susceptibilities. Base learner selection and model performance evaluation was performed carefully using a variety of standard metrics, namely accuracy, precision, recall, F1 score, and Cohen κ. **Results:** For validating the performance on MIMIC-III database harboring deidentified clinical data of 53,423 distinct patient admissions between 2001 and 2012, in the intensive care units (ICUs) of the Beth Israel Deaconess Medical Center in Boston, Massachusetts. From ~11,000 positive cultures, we used 4 major specimen types namely urine, sputum, blood, and pus swab for evaluation of the model performance. Figure 1 shows the receiver operating characteristic (ROC) curves obtained for bloodstream infection cases upon model building and prediction on 70:30 split of the data. We received area under the curve (AUC) values of 0.88, 0.92, 0.92, and 0.94 for urine, sputum, blood, and pus swab samples, respectively. Figure 2 shows the comparative performance of our proposed method as well as some off-the-shelf classification algorithms. **Conclusions:** Highly accurate, patient-specific predictive antibiogram (PSPA) data can aid clinicians significantly in antibiotic recommendation in ICU, thereby accelerating patient recovery and curbing antimicrobial resistance.
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Patterns of Oral Antibiotic Use and Excess Duration at Hospital Discharge

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Background: Antimicrobial stewardship (AMS) interventions have predominantly involved inpatient antimicrobial therapy. However, for many hospitalized patients, most antibiotic use occurs after discharge, and unnecessarily prolonged courses of therapy are common. Patient transition from hospitalization to discharge represents an important opportunity for AMS intervention. We describe patterns of antibiotic use selection and duration of therapy (DOT) for common infections including discharge antibiotics. **Methods:** This retrospective cross-sectional analysis was derived from an IRB-approved, multihospital, quasi-experiment at a 5-hospital health system in southeastern Michigan. The study population included patients discharged from an inpatient general and specialty practice ward on oral antibiotics from November 2018 through April 2019. Patients were included with the following diagnoses: skin and soft-tissue infections (SSTIs), community-acquired pneumonia (CAP), hospital-acquired pneumonia (HAP), respiratory viral infections, acute exacerbation of chronic obstructive pulmonary disease (AECOPD), intra-abdominal infections (IAIs), and urinary tract infections (UTIs). Other diagnoses were excluded. Data were extracted from medical records including antibiotic indication, selection, and duration, as well as patient characteristics. **Results:** In total, 1,574 patients were screened and 800 patients were eligible for inclusion. The most common antibiotic indications were respiratory tract infections, with 487 (60.9%) patients. These included 165 AECOPD cases (20.6%) and 200 CAP cases (25%) with no multidrug resistant organism (MDRO) risk factors; 57 patients (7.1%) with MDRO risk factors; HAP in 7 patients (0.9%); and influenza in 58 patients (7.2%). Also, 205

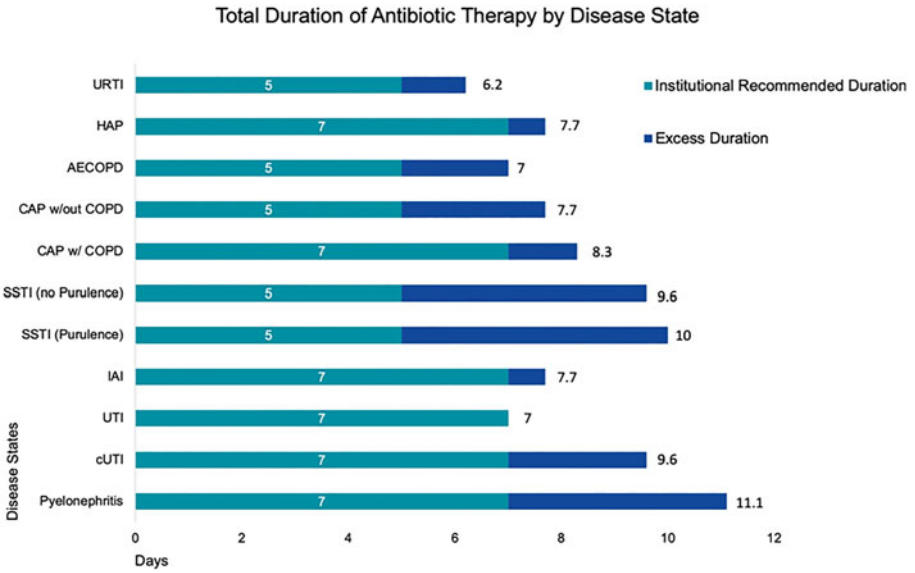

Fig. 1