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Title:
Impact of order-set modifications and provider education on broad-spectrum antibiotic use in patients admitted with community acquired pneumonia

Authors:
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Objective:
Following updates to the Infectious Diseases Society of America guidelines in 2019, Hartford HealthCare implemented changes to the community acquired pneumonia order-set in August 2020 to reflect criteria for prescribing of broad-spectrum antimicrobial therapy. The objective of the study was to evaluate changes in broad-spectrum antibiotic days of therapy (DOT) following these order-set updates with accompanying provider education.

Methods:
This was a multi-center, quasi-experimental, retrospective, study of patients admitted to five Hartford HealthCare hospitals with a diagnosis of community acquired pneumonia (CAP) from September 1, 2019 to November 30, 2019 (pre-intervention period) and September 1, 2020 to November 30, 2020 (post-intervention period). Informed consent was waived by the IRB. Patients were included if ≥ 18 years old and had qualifying ICD-10 codes indicating lower respiratory tract infection. Patients were excluded if they were admitted from a non-community setting, received active treatment for another infection before or during admission, had a diagnosis of hospital-acquired or ventilator-associated pneumonia, had a history of cystic fibrosis, or had a positive SARS-COV-2 PCR during hospital admission. Data collected included baseline demographics, pre-specified labs and vitals on admission, radiographic and microbiological data, and antibiotic data. The primary outcome was broad-spectrum antibiotic DOT, specifically anti-pseudomonal β-lactams, anti-MRSA antibiotics or both. Secondary outcomes included guideline-concordance of initial antibiotics for the treatment of CAP, utilization of an order-set to prescribe antibiotics, incidence of *Clostridioides difficile* infection (CDI), length of stay (LOS), and in-hospital mortality. Normally distributed continuous data were analyzed using a Student's t-test while continuous data that were not normally distributed were analyzed using a Mann-Whitney U test. For categorical data, a Pearson chi-square test was utilized and results reported as percentages with p-values.

Results:
A total of 331 and 352 patients met inclusion/exclusion criteria in the pre- and post-intervention groups, respectively. Patients were primarily male (53.7%) and Caucasian (74.8%) with a median age of 70 years old. Common comorbidities included heart failure (39.1%), COPD (38.9%), and diabetes (34.1%). Patients were admitted to the ICU initially in 11.6% of cases and 36.4% had documented sepsis on admission. The overall duration of broad-spectrum therapy was a median of 2 days (IQR 0-8 days) in the pre-intervention period and 0 days (IQR 0-4 days) in the post-intervention period (p = <0.001). Fewer patients received anti-MRSA therapy (30.1% vs 44.7%; p <0.001) and anti-pseudomonal β-lactam therapy (27% vs 46.2%; p <0.001) in the post-intervention group compared with the pre-intervention group, respectively. Antibiotics were ordered in concordance with IDSA guidelines in 144 (43.5%) patients in the pre-intervention group and 226 (64.2%) patients in the post-intervention group, p = <0.001. Patients in whom the order-set was used were more likely to have guideline-concordant regimens ([66/73] 90.4% vs. [304/610] 49%; p <0.001). Hospital LOS was significantly lower in the

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intervention cohort (4.8 days [IQR 2.9-7.2 days] vs 5.3 days [IQR 3.5-8.5 days], p = 0.002). There were no differences in order set usage (33 [10%] vs. 40 [11.3%], p = 0.642), CDI (5 [1.5%] vs. 1 [0.3%], p = 0.191), or in-hospital mortality (19 [5.7%] vs. 19 [5.3%], p = 0.191) between the pre- and post-intervention groups, respectively.

Conclusions:
Provider education surrounding order-set implementation following IDSA CAP guideline updates improved broad-spectrum antibiotic usage, guideline-directed therapy, and overall hospital length of stay across the Harford HealthCare system. Order-set usage was low across pre- and post-intervention groups, however the education surrounding the order-set updates impacted prescribing practices in a positive manner. Although guideline concordant prescribing improved to 64.2%, there continues to be opportunities for improved compliance. These data will be used locally to justify future stewardship efforts aimed at providing education surrounding updates to national guidelines.