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# A formal antimicrobial stewardship intervention programme targeting carbapenem-resistant Klebsiella pneumoniae (CRKP) bacteremia improved mortality, shortened lengths of stay, and reduced costs over a three-year period

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**Background:** Infections caused by carbapenem-resistant Klebsiella pneumoniae (CRKP) have limited antibiotic treatment options and poor clinical outcomes. Treatment algorithms for multi-drug resistant (MDR)-Gram negative infections at University of Pittsburgh Medical Center (UPMC) were created by collaboration between the Antibiotic Stewardship Program (ASP) and XDR Pathogen lab. Beginning June 2013, the ASP began a formal intervention program using decision support software to allow real-time recommendations for CRKP infections. We assessed clinical and economic parameters of CRKP bacteremia in the pre- and post-intervention periods.

**Material/methods:** Analyses compared pre (6/07-5/13) and post (6/13-4/16) time periods, and included patients treated with regimens that did not include the new agent ceftazidime-avibactam. Endpoints included 30-day mortality rate, hospital stay after positive blood culture, mean hospital length of stay (LOS), and 90-day readmission rate. Financials included mean and median total costs and charges. Antibiotic regimens did not include the new agent

**Results:** 83 patients with CRKP bacteremia were identified in the pre- intervention period, vs. 44 in the post- period (Table). Within 3 days of positive blood culture, 8 and 4 patients died in the pre vs. post periods, respectively, and were excluded from further analysis. In-hospital mortality rates comparing pre- to post- groups was 45% (34/75) vs. 19% (8/44), respectively (p=0.003); hospitalization after positive blood culture was 34 vs. 14.5 days, respectively (p=0.006). Median LOS was 60 vs. 25.5 days, and 90-day readmission rate was 39% vs. 36%, respectively( p=0.001 and NS). Estimated median total charges pre vs. post were $1,303,489 vs. $598,805, respectively, with an estimated average cost saved per CRKP bacteremic patient of $704,684. Cost savings in the post

period were observed across billing categories, including antibiotics and pharmacy (Figure). Results have been consistent across years in the post period.

**Conclusions:** The mortality rate in patients with CRKP was significantly reduced in the post intervention period, suggesting the benefit was due to the collaborative ASP and XDR lab intervention. Shorter LOS after onset of bacteremia was observed in the post-intervention period with a significant cost savings. Overall, the data suggest that a formal intervention program directed by ASP improved patient outcomes, shorten hospital stays, and reduce costs, even prior to the availability of new agents like ceftazidime-avibactam.

| | Pre-intervention | Post-intervention |
|---|---|---|
| **Date Range** | 6/2007 to 5/2013 | 6/2013 to 4/2016 |
| **Total Patients** | 83 | 44 |
| **Average length of stay** | 76 Days | 34.1 Days |
| **Median length of stay** | 60 Days | 25.5 Days |
| **90 day readmission rate** | 39% | 36% |
| **In hospital Mortality rate** | 45% | 19% |
| **Average Total Charges/patient** | $1,941,879 | $1,002,213 |
| **Median Total Charges/patient** | $1,303,489 | $598,805 |