Summary:
Implementation of an electronic antibiotic decision support tool in the ED’s electronic medical record (EMR) and computerized physician order entry (CPOE) to guide empiric antibiotic selection for patients presenting with pneumonia.

Hospital: PENN Presbyterian Medical Center
Location: Philadelphia, PA
Contact: Amanda Binkley, PharmD amanda.binkley@uphs.upenn.edu

Category:
- C: Clinician Initial Evaluation & Throughput
- D: Disposition

Key Words:
- Continuity of Care
- Information Systems
- Patient Satisfaction

Hospital Metrics:
- Annual ED Volume: 39,000
- Hospital Beds: 300
- Ownership: Not-For-Profit
- Trauma Level: None
- Teaching Status: Yes

Tools Provided:
- Appendix 1: Appropriate Empiric Antibiotic Selection
- Appendix 2: Excess Antibiotic Days

Clinical Areas Affected:
- Emergency Department
- Infectious Diseases
- Inpatient Units
- Outpatient Units
- Pharmacy

Staff Involved:
- ED Staff
- IT Staff
- Pharmacists
Innovation

To improve risk factor identification and appropriate antibiotic selection at our institution, the pharmacy and emergency departments (ED) collaborated with infectious diseases and informatics representatives in the development and implementation of an electronic antibiotic decision support tool in the ED’s electronic medical record (EMR) and computerized physician order entry (CPOE) to guide empiric antibiotic selection for patients presenting with pneumonia.

The pharmacy and emergency departments collaborated in the development and implementation of an electronic antibiotic decision support tool in the ED CPOE/EMR to guide empiric antibiotic selection for patients presenting with pneumonia. The decision support systems (CDSS) listed risk factors and provided empiric antibiotic recommendations for healthcare-associated pneumonia (HCAP) and community-acquired pneumonia (CAP).

For patients admitted to the hospital, prescribers selected from the restricted list to antibiotics which included doses specific for the pneumonia indication. The CDSS also included a separate component consisting of pre-populated prescriptions to ensure the correct dose and duration of antibiotics for patients discharged from the ED. A pharmacy resident tailored educational material for prescribers in the ED based on the results of an anonymous survey. During the educational session, risk factors for multi-drug resistant organisms (MDRO) and appropriate antibiotic selection was discussed as well as the utility of the new CDSS tool.

The distinction between CAP and HCAP is important because it guides the collection of microbiologic samples, site of care decisions, empiric antibiotic selection, and duration of antibiotic therapy. The improper identification of risk factors for HCAP and multidrug-resistant pathogens may lead to inadequate or unnecessarily broad coverage which may lead to worse outcomes or promote antibiotic resistance.

Previous studies have demonstrated the utility of CDSS in improving medication safety. In addition, CDSS improved antibiotic selection both empirically and in confirmed infections. This has been associated with trends in improved patient outcomes including duration of hospitalization and mortality. To improve risk factor identification and appropriate antibiotic selection at our institution, the pharmacy and emergency departments collaborated with infectious diseases and informatics representatives in the development and implementation of an electronic antibiotic decision support tool in the EMR and CPOE to guide empiric antibiotic selection for patients presenting with pneumonia.

Innovation Implementation

The core team comprised: Christopher Edwards, MD, Physician lead- Emergency Department; Danielle Evans, PharmD, Pharmacy resident; Amanda Binkley, PharmD, Infectious Diseases Pharmacy Specialist; Richard Maniglia, MD, Infectious Diseases physician; and Christopher Boedec, MS, MBA, IT consultant.

Representatives from the pharmacy, emergency and infectious diseases departments developed an algorithm in collaboration with the IT department to determine the capabilities of the current EMR/CPOE program. The algorithm should be developed utilizing national guidelines, CMS regulations, and local susceptibility patterns. Because of the outpatient and inpatient components of this quality improvement project, consideration must be given to susceptibility in both settings in addition to hospital costs and patient out-of-pocket costs, including insurance plan coverage. Initial education and continued feedback by the pharmacy department to providers in the ED was essential in the success of this project.

Timeline

The entire process including planning, development and implementation of this project took approximately 5-6 months. The planning and development process was begun approximately 3-4 months prior to implementation of the innovation. During the planning process, the key representatives met to develop the algorithm and protocol to be implemented. The representative from the IT department then implemented the protocol into the Emergency Department CPOE/EMR system, which took approximately 3 weeks. Once the protocol was active in the Emergency Department CPOE/EMR system, education was conducted and providers were able to begin using the decision support tool.
Results
During the control period, 78 patients presented to the ED with a primary or secondary diagnosis of pneumonia. After excluding patients with an alternate source of infection, 68 patients were included in the analysis. Of these patients, 48 were admitted to the hospital and 20 patients were discharged with an antibiotic prescription.

Following the implementation of the CDSS, 80 patients presented with a primary or secondary diagnosis of pneumonia. After patients were excluded for an alternate source of infection, a total of 60 patients were included in the analysis, 43 patients were admitted and 17 were discharged from the ED.

- Following the implementation of the CDSS, the proportion of patients receiving appropriate empiric antibiotics significantly improved from 52.9% to 73.3% (p<0.01) (Appendix 1: Appropriate Empiric Antibiotic Selection)
- For patients admitted to the hospital, appropriate empiric antibiotic selection improved from 37.5% to 65.1%.
- For patients discharged from the ED, appropriate empiric antibiotic selection improved from 90.0% to 94.1% and mean excess antibiotic days decreased from 2.35 excess days/patient to 0.73 excess days/patient (Appendix 2: Excess Antibiotic Days)

Cost/Benefit Analysis
There were no costs for implementation of the innovation, as this was completed by employees of the health system as a quality improvement and patient safety project. Cost savings would be identified by the patients as this protocol decreased the number of antimicrobial days when a patient was discharged. Cost savings for the patient will vary depending on their insurance status and mandated co-pay

Advice and Lessons Learned
- Engage all key stakeholders including representatives from the following areas: Emergency Department, Infectious Diseases, Pharmacy and IT.
- Use national guidelines, as well as your local susceptibilities to develop an institution specific protocol.
- For patients discharged from the Emergency Department, include the cost of antimicrobials for patients without insurance in order to ensure medication will be readily available.

Sustainability
Resources required for implementation of this innovation included key representatives from several departments in order to develop and implement the process. In order to sustain the innovation, the protocol should be reviewed annually for necessary changes based on the institutions antimicrobial susceptibility patterns.

Tools to Download
- Appendix 1: Appropriate Empiric Antibiotic Selection
- Appendix 2: Excess Antibiotic Days
Appendix 1:

Appropriate Empiric Antibiotic Selection

% Appropriate

Pre (n=68)  Post (n=60)

52.9  73.3
Appendix 2:

Excess Antibiotic Days (ED Discharges)

Pre (n=20)  Post (n=15)

Mean (days)

2.35  0.73