

## Creating Healthy Work Environments 2019

### Implementation and Evaluation of an Antimicrobial Stewardship Program in the Outpatient Setting

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**Background and Purpose:** Antibiotics have transformed the delivery of healthcare and become an indispensable constituent of medicine. The rapidly emerging crisis of antibiotic resistance threatens the efficacy of antibiotics and has created a prodigious global health threat. Paradoxically, as the need for new antibiotics grows, healthcare has witnessed sharp declines in antimicrobial research and innovation. Protecting antibiotics has become an absolute imperative. Antimicrobial stewardship programs (ASPs) have been introduced in a variety of healthcare settings with the goal of optimizing the prescription of antibiotic agents.

**Methods:** A multidisciplinary group was formed to design and implement the ASP. The group included Antimicrobial Stewardship Pharmacists, an Infectious Disease Physician, and a Doctor of Nursing Practice Candidate. The study was conducted in a community hospital in the Northwestern United States. Components of the ASP included clinical decision support, a viral prescription built into the electronic health record, and education for providers, nurses, and patients. The study took place over a period of two years, allowing for seasonally comparative group pre- and post-ASP implementation data sets. Descriptive statistics were used to characterize the pre- and post-implementation cohorts. Categorical variables were compared between cohorts using Pearson's chi-square test or the Fisher exact test. In all tests, a P-value of  $< 0.05$  was considered statistically significant.

**Results:** In the pre- and post-intervention study, 5,504 and 4,510 patients were included, respectively. The institution witnessed a decrease in 994 patient presentations (18% reduction) in the post-implementation phase for the typically viral complaints of sinusitis, bronchitis, pharyngitis, and non-specific upper respiratory infection. Overall, antibiotic prescribing rates for these conditions decreased significantly. The proportion of patients who received an antimicrobial prescription decreased from 67.0% to 54.2% (12.8% decrease;  $P = 0.001$ ).

The average duration of antibiotic therapy was shortened by 1.01 days from pre- to post-implementation. The average pre-implementation duration was 9.98 days which was cut to 8.97 days ( $P = 0.001$ ) in the post-implementation phase. This equated to over 2,469 fewer days of antibiotics prescribed to patients.

In terms of selection of antimicrobials, providers wrote for less broad-spectrum and more targeted therapies on the whole after the implementation of the ASP. Macrolides were the most commonly prescribed non-first line antibiotic in the pre-implementation data ( $P = 0.001$ ). In the post-implementation phase, antibiotics such as doxycycline and the penicillins replaced many of the macrolide scripts ( $P = <0.0001$ ). These changes were congruent with the treatment algorithms provided.

The viral prescription was utilized 101 times in the post-implementation phase, indicating that 2.24% of the patients who presented to the clinics received it in lieu of an antibiotic. The cases of community acquired *C. Diff* decreased in the post-implementation phase, from 55 to 44. However, this is not statistically significant due to the decreased cohort size in the post-implementation.

**Discussion:** In this Northwestern Community Hospital system, the ASP led to a substantial and sustained improvement in the prescribing antimicrobials. Antibiotic prescribing was improved in every month after the implementation of the ASP. Education and resources for providers was shown to be effective. The overall decrease of 12.8% ( $P = 0.001$ ) in prescriptions indicated a higher level of scrutiny prior to ordering a drug. It is likely to be a combination of the interventions imposed in the ASP that improved prescribing patterns.

Contrary to prevailing thought, ASPs are not meant to only deter the use of antimicrobials. Instead they are intended to optimize the use of antibiotics and prescribe them judiciously when indicated. This study suggests that because of the ASP, antibiotics were optimized. When an antibiotic was suitable, clinicians chose more appropriate classes and precise durations of therapy. Prescribing patterns followed the treatment algorithms in terms of increased scrutiny to prescribe, precise class of medication selection, evidence-based durations of therapy, and adjunctive treatments. Clinicians made a concerted effort to optimize the use of antibiotics as a result of the ASP.

The community outreach and education was shown to be effective. As a result of the community education, 18% ( $P = 0.0001$ ) fewer patients presented to the clinics for predominately viral illnesses. This is critically important as it decreases some of the pressure to prescribe that providers experience. Patients appreciating that antibiotics do not decrease viral symptoms is crucially significant to the functionality of an ASP. Moreover, providers also dispensed 101 Viral Prescriptions, indicating that the tool is an effective means to avoid prescribing antimicrobials.

**Implications for Practice:** The profound need to protect antibiotics necessitates changes in the healthcare field. Antimicrobial Stewardship Programs optimize the appropriate and safe use of antibiotics, enhance clinical outcomes, decrease unintended consequences, and support providers in clinical practice. As demonstrated in this study, multidisciplinary stewardship teams offer expanded expertise and provide merit to the programs. Nurse Practitioners have the unique skillset to design and lead these taskforces in a meaningful way.

Much more research is needed on the topic of stewardship. Particularly in the outpatient arena, the lack of publications and validated interventions have hindered institutions from implementing such programs. The dearth of research highlights the challenges that researchers and clinicians face. The catastrophic threats that antimicrobial-resistant pathogens pose necessitate profound changes in healthcare at every level and cannot be deferred any longer.

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**Title:**

Implementation and Evaluation of an Antimicrobial Stewardship Program in the Outpatient Setting

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### **Abstract Summary:**

The rapidly emerging crisis of antibiotic resistance has created a prodigious global health threat. To address this crisis, an Antimicrobial Stewardship Program was designed and implemented. Through various interventions, the DNP lead program optimized the prescription of antibiotics, enhanced clinical outcomes, supported providers, and decreased adverse events.

### **Content Outline:**

#### **I. Introduction**

1. Antibiotic resistance is one of the major health threats facing the global health system. In the United States more than two million individuals acquire serious bacterial infections resistant to at least one antibiotic each year
2. At least 23,000 individuals die every year as a direct result of antibiotic-resistant infections and considerably more die from medical conditions that were complicated by antibiotic-resistant bacteria. Antimicrobial use is the primary driver of antibiotic resistance

#### **II. Body**

A. Beyond the impact of antibiotic-resistant organisms, the use and misuse of antibiotics has far reaching repercussions.

1. Antibiotics are implicated in nearly 20% of all Emergency Department visits for drug-related adverse events in the United States.
2. Up to 39% of all patients prescribed antibiotics will develop antibiotic-associated diarrhea.
3. *Clostridium difficile* is the causative pathogen in 15% to 20% of all cases of antibiotic-associated diarrhea.

- There are a reported 500,000 cases of *difficile* in the United States each year.

B. While concerns related to antibiotic use span the continuum of care, the majority of antimicrobials prescribed originate from the outpatient setting.

1. Over 262 million ambulatory care antibiotic prescriptions were dispensed in 2011.
2. Family practitioners prescribed 24% of these courses, the most of any specialty.
  - 50% of all ambulatory antibiotic courses are inappropriate, either from unnecessary use, inappropriate selection, improper dose, or erroneous duration.
  - Specifically, 30% of all antibiotics prescribed in the outpatient setting are unnecessary, indicating that no antibiotic should have been prescribed at all.

C. Prescription and over-prescription of antimicrobials in the ambulatory care setting is multifaceted.

1. Primary care providers (PCPs) are confronted with patient expectations of care, a lack of understanding surrounding the seriousness of the antimicrobial resistance problem, unfamiliarity with the medication's associated corollaries, prescription of empiric treatments, and uncertainty concerning the origin of disease.
  - The totality of these health issues places significant burden on public health, facilities, and patients.

D. The importance of protecting and optimizing antibiotics cannot be overstated. Antimicrobial stewardship programs (ASPs) implemented in healthcare facilities are designed to address many of the pitfalls associated with prescribing antibiotic agents.

1. The overarching goals of ASPs are to decrease adverse drug reactions, mitigate associated superinfections (*C. difficile*), lessen or halt antimicrobial resistance, improve patient outcomes, route antibiotic therapy to those that need it, and deliver cost-effective care.
2. Coordinated multidisciplinary ASPs have been shown to optimize the prescription of antibiotics in a variety of healthcare settings.
3. The challenge lies in the fact that there is no single ASP template that institutions can implement for the ambulatory care setting.
4. The complexity of medical decision making necessitates that individual ASPs be tailored to the specific facility.
5. Although institutions are tasked to individualize programs, the core elements of successful ASPs are leadership commitment, accountability, drug expertise, action, tracking, reporting, and education.

### **III. Methods**

A. A multidisciplinary group was formed to design and implement an ASP in the outpatient setting. The group was led by a DNP student.

1. Interventions included: clinical decision support, education for providers, nurses, and patients, and a viral prescription built into the electronic medical record.

B. In this pre- to post-implementation study, retrospective prescribing data were extracted from the EHRs of patients who presented to the outpatient facilities

1. The pre-implementation study dates were between 9/11/2016-4/1/2017 and post-implementation dates were 9/11/2017 - 4/1/2018.
  - These time periods were used to serve as a seasonally comparative group pre- and post-ASP implementation data sets.

2. Patients with an ICD-10-code indicative of sinusitis, non-specific upper respiratory infection, bronchitis, and pharyngitis were included.
3. Descriptive statistics were used to characterize the pre- and post-implementation cohorts.
  - o Categorical variables were compared between cohorts using Pearson's chi-square test or the Fisher exact test.
  - o In all tests, a P-value of < 0.05 was considered statistically significant.

#### **IV. Results**

A. Results indicated a significant improvement in the prescribing of antibiotics.

1. In the pre- and post-intervention study, 5,504 and 4,510 patients were included, respectively
  - o The institution witnessed a decrease in 994 patient presentations (18% reduction) in the post-implementation phase for the typically viral complaints of sinusitis, bronchitis, pharyngitis, and non-specific upper respiratory infection.
  - o Overall, antibiotic prescribing rates for these conditions decreased significantly. The proportion of patients who received an antimicrobial prescription decreased from 67.0% to 54.2% (12.8% decrease; P = 0.001).
2. The average duration of antibiotic therapy was shortened by 1.01 days from pre- to post-implementation.
  - o The average pre-implementation duration was 9.98 days which was cut to 8.97 days (P = 0.001) in the post-implementation phase. This equated to over 2,469 fewer days of antibiotics prescribed to patients.
3. In terms of selection of antimicrobials, providers wrote for less broad-spectrum and more targeted therapies on the whole after the implementation of the ASP.
  - o Macrolides were the most commonly prescribed non-first line antibiotic in the pre-implementation data (P = 0.001).
  - o In the post-implementation phase, antibiotics such as doxycycline and the penicillins replaced many of the macrolide scripts (P = <0.0001).
  - o These changes were congruent with the treatment algorithms provided.
4. The viral prescription was utilized 101 times in the post-implementation phase, indicating that 2.24% of the patients who presented to the clinics received it in lieu of an antibiotic.
5. The cases of community acquired *C. Diff* decreased in the post-implementation phase, from 55 to 44. However, this is not statistically significant due to the decreased cohort size in the post-implementation.

#### **V. Discussion**

A. In this Northwestern Community Hospital system, the ASP led to a substantial and sustained improvement in the prescribing antimicrobials. Antibiotic prescribing was improved in every month after the implementation of the ASP.

1. Education and resources for providers was shown to be effective. The overall decrease of 12.8% (P = 0.001) in prescriptions indicated a higher level of scrutiny prior to ordering a drug.
  - o It is likely to be a combination of the interventions imposed in the ASP that improved prescribing patterns.

B. Contrary to prevailing thought, ASPs are not meant to only deter the use of antimicrobials.

1. Instead they are intended to optimize the use of antibiotics and prescribe them judiciously when indicated. This study suggests that because of the ASP, antibiotics were optimized.
2. When an antibiotic was suitable, clinicians chose more appropriate classes and precise durations of therapy.

- Prescribing patterns followed the treatment algorithms in terms of increased scrutiny to prescribe, precise class of medication selection, evidence-based durations of therapy, and adjunctive treatments.
- Clinicians made a concerted effort to optimize the use of antibiotics as a result of the ASP.

C. The community outreach and education was shown to be effective.

1. As a result of the community education, 18% ( $P = 0.0001$ ) fewer patients presented to the clinics for predominately viral illnesses.
  - This is critically important as it decreases some of the pressure to prescribe that providers experience.
  - Patients appreciating that antibiotics do not decrease viral symptoms is crucially significant to the functionality of an ASP.

## **VI. Conclusions**

A. The profound need to protect antibiotics necessitates changes in the healthcare field.

B. Antimicrobial Stewardship Programs optimize the appropriate and safe use of antibiotics, enhance clinical outcomes, decrease unintended consequences, and support providers in clinical practice.

1. As demonstrated in this study, multidisciplinary stewardship teams offer expanded expertise and provide merit to the programs.
2. Nurse Practitioners have the unique skillset to design and lead these taskforces in a meaningful way.

C. Much more research is needed on the topic of stewardship.

1. Particularly in the outpatient arena, the lack of publications and validated interventions have hindered institutions from implementing such programs.
2. The dearth of research highlights the challenges that researchers and clinicians face.

D. The catastrophic threats that antimicrobial-resistant pathogens pose necessitate profound changes in healthcare at every level and cannot be deferred any longer.

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**Author Summary:** Carey Phelan attended Carroll College in Helena, MT in 2011 and earned a BA in psychology and a BS in nursing. She authored a thesis focused on the health of nurses and was able to

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