

# THE EFFECTS ON PRESCRIBING RATES IN THE EMERGENCY DEPARTMENT AFTER THE IMPLEMENTATION OF AN ANTIBIOTIC STEWARDSHIP PROGRAM AT A SMALL COMMUNITY HOSPITAL IN RURAL MAINE

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## Abstract

Antibiotic overuse has been identified as the leading factor causing antibiotic resistance by The Centers for Disease Control and Prevention (CDC). Antibiotic overuse has also been identified as one of the top five health threats in the United States (CDC, 2014). The World Health Organization's (WHO) Global Action Plan on antibiotic resistance has identified antibiotic stewardship programs as an essential part of their plan to decrease antibiotic overuse and misuse (WHO, 2015). The purpose of this study is to assess the effectiveness of an antibiotic stewardship program in the Emergency Department at a small rural hospital in northern Maine. Effectiveness in this context is identified as decreasing prescribing rates of antibiotics post implementation of this program. Results show the percentage of antibiotic prescription decreases from 24% at its highest in 2013 to 20% at its lowest in 2016, which is the same year in which the Antibiotic Stewardship Program was implemented. Overall, these rates remain consistent between 20-21% the years following the intervention of the program despite increasing annual volume totals each year. Secondary findings indicate more appropriate prescribing by providers secondary to use of the algorithms provided. Limitations of this study include a small sample size of providers along with the lack of consistency of providers who have data represented throughout the duration of the time frame in which data was collected. Further research is needed to explore whether or not these findings can be generalized to other departments of the hospital or to the outpatient clinical setting.

## Introduction

The CDC estimates that as much as 50% of antibiotic prescriptions being prescribed are prescribed inappropriately (CDC, 2018). There have been efforts to reduce inappropriate antibiotic use through both provider and patient education (Fay et al., 2019). Although some improvement has been made, there still appears to be a gap between best practices for prescribing antibiotics and prescribing practices nationally among providers (Chua, Fischer, & Linder, 2019). Patient expectations and pressures to meet them were physician reported non-clinical reasons in antibiotic prescribing patterns (Munoz-Plaza et al., 2016). Additionally, the WHO has declared overuse of antibiotics leading to antibiotic resistance a global health issues (Kesselheim & Outterson, 2010). Antibiotic stewardship programs have been identified as an essential component in reducing the risk of antibiotic resistance (Chater, & Courtenay, 2019). A rural non-profit community hospital located in rural Maine, was one of the many organizations to recognize this and begin an antibiotic stewardship program to assess and regulate antibiotic prescribing. The National Action Plan for Combating Antibiotic-Resistant Bacteria was created by the White House with a call to have antibiotic stewardship programs implemented by 2020 in all acute-care hospitals (Manning, 2016). Latest progress reports show that hospitals in the United States meeting the CDC's recommended guidelines for Antibiotic Stewardship programs rose from 46% in 2015 to 64% in 2016 (AHC Media, 2020). However, hospitals still lacking implementation of an Antibiotic Stewardship Program are those with less resources from smaller, rural communities (New Rule Requires Antibiotic Stewardship Programs at All Hospitals, 2019). These programs have also been found to be effective in decreasing unnecessary antibiotic exposure, slow the development and spread of antibiotic resistance, improve patient outcomes, and decrease health care costs (Manning, 2016).

With these national guidelines set in place, Northern Maine Medical Center in Fort Kent, Maine identified an obvious gap in practice as there was no antibiotic stewardship program in place and it was identified that one must be created to keep with the recommended standard of care. The antibiotic stewardship program was implemented using the guidance of the CDC's recommendations regarding the core elements needed in such a program as well as specific recommendations for small, critical access hospitals.

## Methods

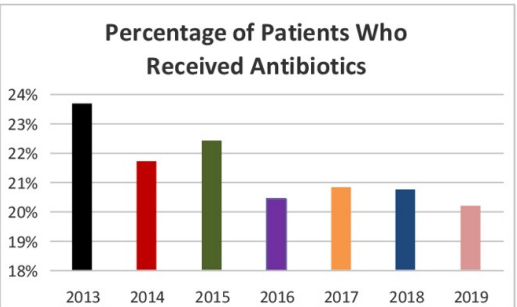
**Research Design** — A retrospective quantitative analysis. Outcomes identified were provider prescribing rate change pre and post antibiotic stewardship intervention. The dates of comparison were the amount of antibiotic prescriptions by provider beginning January 2013 through December 2019.

Data was collected from 2013-2019 on a total of fourteen emergency room providers consisting of seven Medical Doctors (MD), one Doctor of Osteopathic Medicine (DO), five Physician Assistants (PA) and one Nurse Practitioner (NP). Of these providers, 9 total providers were used for this study including four providers (2 MDs, 1 DO, 1 PA) all of which were full time (FT) status throughout the time data was collected from 2013-2019, three FT providers from the years 2015-2019 (2 MDs, 1 PA) and two FT providers (1 MD, 1 PA) from 2013-2018. The remaining provider mix consisted of per-diem or locums providers that were working after the time the Antibiotic Stewardship Program was implemented in 2016.

## Analysis

This project used a retrospective quantitative analysis to review overall prescribing rates of antibiotics by Emergency Department providers. Data was extracted from the Medhost EMR system on total amount of patients seen and total amounts of antibiotics prescribed each year for each provider. Prescriptions were further broken down by type of antibiotic prescribed by each provider as well as type of antibiotic prescribed by the entire emergency department for each year.

## Results



**Chart One**

*Total percentage of patients receiving antibiotic prescription at discharge*

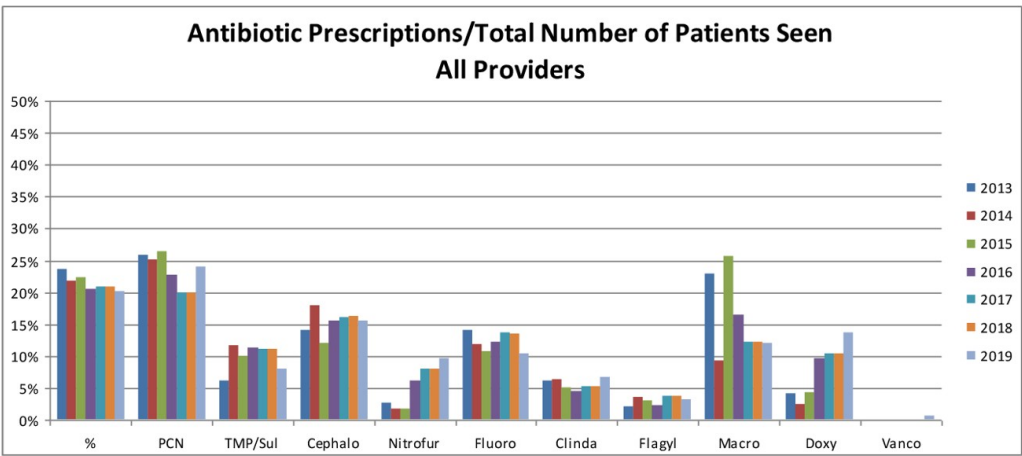
Chart one summarizes the total percentage of patients receiving an antibiotic prescription at discharge from the Emergency Department for the years 2013-2019. This is a combination of all prescribing providers in the Emergency Department within this time frame.

Year	Patients with an antibiotic prescribed at discharge	Total number of Patients Seen in the Emergency Department	Percentage of Patients who received and antibiotic
2013	828	3500	24%
2014	819	3772	22%
2015	1186	5294	22%
2016	1034	5058	20%
2017	1165	5598	21%
2018	1176	5665	21%
2019	1145	5668	20%

**Table One**

*Total emergency room patients per year and prescriptions per year*

Results of overall patient volume in the emergency department for each respective year as well as total number of antibiotic prescriptions for year each from all providers combined are summarized in table one.



**Chart Two**

*Percentage of all antibiotic prescriptions separated by each antibiotic type for the years 2013-2019*

Lastly, Chart Two breaks down all antibiotic types and shows total percentage of each prescribed by all providers between the years 2013-2019. The overall prescribing rate percentage is reflected in the first column on the left.

## Conclusion

Overall, this study has met its hypothesis and it was found that overall prescribing rates decreased in the Emergency Department after implementation of an antibiotic stewardship program. Greatest decreases in prescribing rates were seen in full time providers that have been employed for the longest duration of time within the organization regardless of provider type (PA vs MD) compared to part-time or per diem providers. As a whole, Physician Assistants percentage prescribing rates were lower than their physician counterparts.

When reviewing specific antibiotic prescribing trends, it appears that antibiotics are being prescribed more appropriately as seen with an increase in first line treatment prescribing for urinary tract infections. It also appears that in addition to decreases in antibiotic misuse, antibiotic overuse has also decreased secondary to following algorithm guidelines. It is not determined if these findings are able to be generalized to other hospital departments or outpatient clinical settings and future studies are needed to further evaluate the effectiveness of an antibiotic stewardship program in these settings.

## Discussion

Overall, the Emergency Department at this organization has seen a steady increase in volume of patients. It appears that this may have been a secondary effect of renovations to the facility and to this department in particular that were completed in early 2015. Not surprising too is that total amount of antibiotic prescriptions do appear to increase along with the increase in overall volume. However, the percentage of antibiotic prescription decreases from 24% at its highest in 2013 to 20% at its lowest in 2016, which is the same year in which the Antibiotic Stewardship Program was implemented (chart one). Overall, these rates remain consistent between 20-21% the years following the intervention of this program despite increasing annual volume totals each year.

Chart Two separates the percentage of individual antibiotic types that are prescribed for each year. It should be noted that although overall antibiotic prescribing rates decreased, there are certain trends that antibiotics appear being prescribed more appropriately. This can be seen by the increase in prescribing Nitrofurantoin (labeled "Nitrofur"), the first line antibiotic for a urinary tract infection. Seeing this being prescribed more along with a decrease use in Fluoroquinolone antibiotics (ex. Ciprofloxacin), which is second line and reserved for more severe infection, infers that provider are using algorithms provided by the Antibiotic Stewardship Program in their medical decision making.

Additionally, Macrolide antibiotics have also been prescribed less often including Azithromycin, often prescribed for an acute upper or lower respiratory infection. Within the antibiotic algorithm it suggests to refrain from antibiotic use for symptoms less than 10 days for diagnoses such as Bronchitis and Acute Sinusitis. Additionally, if there is no evidence of Pneumonia on chest x-ray then antibiotics are also not indicated according to the algorithms. Following guidelines such as these likely indicate a decrease in prescribing due to more appropriate prescribing (ex. not prescribing an antibiotic for symptoms for two days that is likely a viral infection).

## Limitations

The most significant limitation of this project include a small sample size of providers throughout the duration of the time frame in which data was collected. However there is a large enough sample size of total patient volume to assess antibiotic prescribing rates prior to implementation of an antibiotic stewardship program as well as enough time to collect adequate data post implementation for comparison. Additional limitations include bias of access to information, for example providers working on the Antibiotic Stewardship Committee, could unintentionally skew data.

Further limitations include collection of data and different electronic medical record (EMR) systems that did not allow for collection or interpretation of data in other clinic settings such as outpatient clinics. Although these practices are within the same organizational system, clinics are physically located outside of the hospital. It is undetermined if findings can be generalized to other areas within the organization due to potential lack of communication regarding the Antibiotic Stewardship Program and the enforcement or reinforcement of it.

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