Spring 2020

Antimicrobial Stewardship in an Urgent-Primary Care Clinic

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Antimicrobial Stewardship in an Urgent-Primary Care Clinic

A DNP Project

Presented to the Faculty of the

Department of Nursing

West Chester University

West Chester, Pennsylvania

In Partial Fulfillment of the Requirements for

the Degree of

Doctor of Nursing Practice

By

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May 2020

Dedication

This DNP project is dedicated to people who suffered or died from antimicrobial resistance. May public be educated to have the knowledge and understanding of the risks of overusing antibiotics. May more healthcare providers keep the consequences in mind when they prescribe antibiotics.

Acknowledgements

The completion of my Doctor of Nursing Practice degree would not be possible without the great support, encouragement, and knowledge of my beloved husband, Brian Connell, my friend Manasi Sheth, my external mentor Kala Shahi, my advisor Dr. Cheryl Monturo, and my advisor and mentor Dr. Jacquelyn Owens. I am very grateful to have all of your support during my doctoral study. It would not be possible to have it done without you.

Abstract

Antimicrobial resistance is a significant risk that threatens life, increases health complications, decreases antibiotic effectiveness, and increases healthcare cost. Overprescribing of antibiotics in outpatient settings is a key factor that has led to increased antibiotic resistance. There are more than 150 million antibiotics prescribed in outpatients annually; 30 percent of these antibiotic prescriptions are either unnecessary or inappropriately prescribed, with acute respiratory infections holding the position of the highest unnecessary use of antibiotics at 50 percent. Antibiotic stewardship is the effort to improve and measure antibiotic prescribing so that antibiotics are only prescribed when it is appropriate and necessary. This DNP project is based on the first core element of "commitment to optimizing antibiotic prescribing and patient safety", which is one of the four core elements of outpatient antibiotic stewardship published by CDC in 2016. The Antimicrobial Stewardship Program (ASP) was implemented in a suburb clinic, which provides combined urgent and primary care. The focus of this ASP project was on acute respiratory infections. The quality project used a pre and post implementation design to collect data retrospectively three months pre and post project through review of electronic health records. The post intervention results showed unnecessary antibiotic prescriptions decreased by 17.27% (p-value is <0.0001), and all antibiotic classes prescriptions per 1,000 populations of respiratory visits decreased from 792 prescriptions to 654 prescriptions post-intervention.

Keywords: antibiotic overprescribing, antibiotic overuse, antimicrobial stewardship, antibiotic resistance, acute respiratory infection, outpatient and urgent care.

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Chapter 1

Introduction and Background

Antibiotics, antivirals, and other antimicrobials have saved millions of lives worldwide, but their effectiveness is decreasing due to antimicrobial resistance. The Infectious Diseases Society of America (IDSA, 2019) defines antimicrobial resistance as a microbe's natural ability to evolve genetically to resist the drugs. Antimicrobial over-prescribing and inappropriate use of antimicrobials play major roles in antimicrobial resistance. More than half of prescribed antibiotics are unnecessary or inappropriate (IDSA, 2019). Antimicrobial Stewardship has been defined from the IDSA, the Society for Healthcare Epidemiology of America (SHEA), and the Pediatric Infectious Diseases Society (PIDS) as "coordinated interventions designed to improve and measure the appropriate use of antibiotic agents by promoting the selection of the optimal antibiotic drug regimen including dosing, duration of therapy, and route of administration" (Barlarm et al., 2016, p.51).

The Centers for Disease Control and Prevention (CDC, 2019) estimates over two million people are infected with antibiotic resistant bacteria, and about 35,000 die from these infections annually in the United States. The U.S. health care system spends an estimated $21 billion to $34 billion annually due to antibiotic resistance (IDSA, 2019).

Although the reasons for increased antibiotic resistance are multifactorial, a major factor is antibiotic overprescribing in outpatient settings (CDC, 2013). Overuse of antibiotics in outpatient settings can lead to antibiotic resistance, increased healthcare cost, and increased incidence of adverse events, including anaphylaxis and Clostridium difficile

infection (Zoorob, Sidani and Fremont, 2012). Complications from antibiotics include common side effects of rashes and diarrhea and less frequent adverse effects such as anaphylaxis. These adverse events lead to an estimated 143,000 emergency department visits annually, which attributed to excessive use of healthcare resources (Sanchez, Roberts, Albert, Johnson and Hicks, 2016).

Importance of Outpatient Antibiotic Stewardship

It is critical to improve antibiotic prescribing and combat antibiotic resistance in all health care settings. Antibiotic stewardship is the effort to improve and measure antibiotic prescribing so that antibiotics are only prescribed when it is appropriate (CDC, 2016).

The CDC published the core elements of outpatient antibiotic stewardship in 2016. There was four core elements included in outpatient antibiotic stewardship: commitment to optimizing antibiotic prescribing and patient safety, action for policy and practice, tracking and reporting, and education and expertise (CDC, 2016). This DNP project will focus on the first core element of commitment to optimizing antibiotic prescribing and patient safety.

Known Issues

The CDC has campaigned to reduce unnecessary antibiotic prescribing for over 20 years, however, antibiotic prescriptions for acute respiratory infections have only shown only a limited reduction in rate (Wellbery, 2016). Providers are aware of the problem of antibiotic resistance, but state that patient pressure and satisfaction are reasons for prescribing antibiotics when they are unnecessary (Sanchez, et al., 2014).

According to the CDC (2019), 47 million antibiotics that are prescribed in the outpatient setting annually are unnecessary. From 2011 to 2016 there was a 5% decrease in antibiotic prescriptions in outpatient care settings. However, continued efforts are necessary.

Antibiotic community prescribing rates vary state by state and there is about a 2½ times difference between the lowest and the highest state prescribing rates. The Maryland community antibiotic prescription rate in 2016 was 751-852 prescriptions per 1000 visits, compared to the lowest state prescribing rate with 511-640 prescription per 1000 visit, suggesting there are opportunities for improvement (CDC, 2019b).

Gaps in Application

The challenge with antibiotic stewardship programs (ASP) is that each facility's needs and resources vary in different healthcare settings (CDC, 2019). In outpatient care settings, a selection of strategies, such as audit and feedback on providers' antibiotic prescription rates compared with peer rates or practice guidelines, clinical decision support with decision tools, provider commitment posters, and communication skills with patients, all are applicable methods to prevent antibiotic overprescribing. Healthcare facilities must investigate the effectiveness of each stewardship intervention before determining which intervention works the best in their healthcare settings (Sanchez et al., 2016). These assessments should take into account the impact of these efforts on appropriate prescribing as well as their impact on the healthcare cost and clinical outcomes.

Purpose Statement

The purpose of this study was to determine the effects of antibiotic stewardship program initiatives on antibiotic prescription rates for acute respiratory infections patients in a suburb urgent and primary care clinic.

PICOT Question

In primary and urgent care clinic patients, how does an antimicrobial stewardship program compared to no program affect the antibiotic prescribing rate for acute respiratory infections of primary care providers within a 3 month time period?

Methodology

The Antimicrobial Stewardship Program (ASP) was implemented in a suburban clinic, which provides combined urgent and primary care. The focus of this ASP project was on acute respiratory infections. The ASP project was a quality improvement (QI) project with a retrospective pre implementation and post implementation design.

The participant of the program was a healthcare provider prescribing antibiotics at the primary and urgent care practice setting. Patient diagnoses included were acute respiratory infections. The participating provider committed to practicing antibiotic stewardship publicly by posting the provider's picture and signature on a poster. The posters were displayed in the waiting rooms, high patient traffic areas, and exam rooms to give patients a visual reminder that this provider only prescribe antibiotic when necessary and appropriate.

Research Questions:

1. What facilitates providers to reduce their antibiotic prescribing rate for acute respiratory tract infection in patients?
2. Has commitment to optimizing antibiotic prescribing and increasing patient safety led to lower antibiotic prescribing rates for acute respiratory infection patients?
3. What are the most commonly prescribed antibiotics and for what type of diagnoses?

Objectives

1. To implement an antibiotic stewardship project through provider commitment to prescribe antibiotics appropriately.
2. To measure total antibiotic prescriptions of upper respiratory visits.
3. To measure unnecessary antibiotic prescription rates in acute respiratory infection patients.
4. To identify the most prescribed antibiotics by drug class.
5. To measure antibiotic rates of commonly prescribed diagnoses.

Chapter 2

Literature Review

This literature review includes a review of the literature on antimicrobial stewardship program (ASP) in general and in outpatient setting specifically. This review was divided into the antibiotic prescribing epidemiology, respiratory infection clinical guideline, ASP Intervention, and CDC recommendation on Antibiotic Stewardship.

Definition of Variables and Concepts

For the purpose of this study, acute respiratory infections (ARIs) is defined as acute bronchitis, acute otitis media (AOM), pharyngitis/tonsillitis, rhinitis, sinusitis, and other viral syndromes and excludes community-acquired pneumonia, acute exacerbations of chronic obstructive pulmonary disease, bronchiectasis, or other chronic underlying lung diseases (National Institute for Health and Clinical Excellence, 2008; PEW Research Center, 2016). Antimicrobial Stewardship Program is defined as "coordinated interventions designed to improve and measure the appropriate use of antibiotic agents by promoting the selection of the optimal antibiotic drug regimen including dosing, duration of therapy, and route of administration" (Barlarm et al., 2016, p.51).

Theoretical Framework

The theoretical framework to support the antimicrobial stewardship project is Diffusion of Innovation developed by Martha Rogers. The theory refers to the pattern of adoption of a new practice over a period of time by a group of participants in a social system (Rogers, 2003). The theory includes four main concepts: innovation, communication channels, time and social system (Rogers, 2003).

An innovation is a practice or idea that is considered novel by an individual or the department/unit deciding to embrace it. In this project, the innovation is the antimicrobial stewardship program (see Table 1). The practice is considered new to the individual or unit regardless of the time passed since the practice was first used or discovered (Rogers, 2003). Newness of an innovation can be described as knowledge, persuasion, or a decision to practice.

Communication is the process where participants share information with each other to reach a goal of mutual understanding. A communication channel is the way by which information is passed from one person to another. Communication channels allow the transfer of information among people or organizations. For this reason, an antibiotic stewardship champion at the study clinic was chosen for this project to facilitate the communication and implementation of the antimicrobial stewardship project.

Time is the third element in the diffusion process. Time is critical for any innovation to be considered and eventually adopted. The time dimension is demonstrated with an innovation's rate of adoption in a system measured by the number of people who implement the novel practice in a given time period (Rogers, 2003). For this project, a three-month time period was set to measure the outcome of the antimicrobial stewardship effect.

The decision process of innovation is the process through which an individual from first contact of the information to the decision of whether or not to adopt the information. The process includes five steps: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003). Interpersonal communications among peers are likely to relay such evaluation on the innovation. The antimicrobial stewardship champion, who was the only full time practitioner at the clinic, was a good candidate to communicate the benefits of

the antimicrobial stewardship program with other clinic staff and facilitate their adoption of the innovation as the practice to improve patients' clinical outcomes.

The fourth element in the diffusion process is social system. A social system is a set of interconnected units that are bound together to fulfill a common goal (Rogers, 2003). The structure of the social system affects the innovation's diffusion. There are two types of social structure: the formal structure and informal structure. The formal structure has a hierarchical system that higher-ranked individuals give orders to lower rank individuals with an expectation that their orders will be carried out. At the antimicrobial stewardship project site, the administrator of the clinic was the higher ranked individual and expected healthcare provider at the clinic to participate in the antimicrobial stewardship program. As for the informal structure, it happens among the interpersonal actions of the members in the social system. Such communication structure has influences on a potential adopter. A healthcare provider who works in a clinic where other providers have already committed to the antimicrobial stewardship program is more likely to adopt the practice because of the system effects.

Review of the Literature

A detailed review of literature was conducted using CINAHL, MEDLINE, PubMed, and the Cochrane Library. The search terms or keywords used included: *antibiotic overprescribing, antibiotic overuse, antimicrobial stewardship, antibiotic resistance, and acute respiratory infection, and outpatient and urgent care*. The time period included was from 2010 through early 2020 using a peer-reviewed strategy that aimed at antimicrobial stewardship program (ASP) and/or improving antibiotic prescribing for acute respiratory infections (ARIs) in the outpatient setting. The language is limited to English. There is no

limit in study design. Additionally, guidelines and information from the IDSA, SHEA, PIDS, and the CDC were reviewed and applied to the project.

Antimicrobial prescribing epidemiology. Overuse of antibiotics can lead to antibiotic resistance, increased healthcare cost and incidence of adverse events. Antimicrobial resistance (AMR) can cause extended illness, higher risk of infection, increased morbidity and mortality. AMR resulted in increased cost to the people, healthcare facilities, and government (Mohiuddin, 2019). Antibiotic prescribing in outpatient settings has exceeded the prescribing in inpatient. Annually, there are more than 150 million antibiotics prescribed in outpatients; 30 percent of these antibiotic prescriptions are either unnecessary or inappropriately prescribed, with acute respiratory infections holding the position of the highest unnecessary use of antibiotics at 50 percent (CDC, 2019b; Coker et al., 2010; Fleming-Dutra, Mangione-Smith, & Hicks 2016; Habboush & Guzman, 2018; Suda et al., 2018). In a study of a large, outpatient ambulatory network, among 52,000 cases of upper respiratory infectionss, antibiotics were prescribed at 65 percent of the time (Coker et al., 2010). Of the total consumption of antibiotics, oral antimicrobials accounted for approximately 90 percent. Commonly prescribed antibiotics include oral third generation cephalosporins, macrolides, and fluoroquinolones, which accounted for approximately 77% of oral antimicrobials (Mohiuddin, 2019).

Furthermore, according to CDC (2013), approximately 269 million antibiotic prescriptions were prescribed and dispensed from outpatient clinics and pharmacies in the United States in 2013. Approximately 20% of pediatric visits and 10% of adult visits in outpatient settings resulted in an antibiotic prescription (Hersh, Jackson, & Hicks, 2013; Shapiro, Hicks, Pavia, & Hersh, 2014). Adverse effects from antibiotics include common

side effects such as rashes and diarrhea, and more serious complications such as severe allergic reactions. These drug adverse effects lead to an estimated annual emergency department visits of 143,000 times and other expenditure of health care resources (Sanchez et al., 2016). These numbers and cost revealed the importance of antibiotic stewardship efforts across the healthcare system (Suda et al., 2018). In a study for pediatric acute respiratory infections, only 27.4% of U.S. children were estimated to have an ARI from a bacterial origin which requiring antimicrobials, however, antimicrobials were prescribed for approximately two times higher than expected. The study identified an important target for persistent interventions of antimicrobial stewardship (Kronman, Zhou, & Mangione-Smith, 2014).

In most acute respiratory infections, it is not beneficial to prescribe antibiotics, which expose the patients to undesirable adverse events, drug-drug interactions and increased health care cost; moreover, contributed to antimicrobial resistance (Prasetyoputri, Jarrad, Cooper, & Blaskovich, 2018). Antibiotic treatment is the major contributing risk factor to Clostridium difficile infection. There was an estimated 453,000 cases of C. difficile infection occurred in the United States in 2011; approximately one third of these infections occurred in community settings (Lessa et al., 2015). Of these community-associated C. difficile infections, approximately 35% of them were adult and 70% of them were pediatric (Lessa et al., 2015; Wendt et al., 2014). In a study by Dantes et al. (2015), it is estimated that 10% overall reduction of outpatient antibiotic prescribing could reduce C. difficile infections by 17%.

Clinicians are aware of the antibiotic resistance issue, but state that patient pressure and satisfaction are their reasons for prescribing antibiotics that are not unnecessary

(Ashworth, White, Jongsma, Schofield, & Armstrong, 2016; Fleming -Dutra et al., 2016; Sanchez, Roberts, Albert, Johnson, & Hicks, 2014). Clinicians are more likely to prescribe antibiotics when they think that the patient expects them, or fear of losing patients to other providers if antibiotics are not prescribed (Sanchez et al., 2014). The provider's perception of patients' expectations was found to be the strongest determinant of prescribing (CDC, 2016).

Clinicians must balance the risks of not treating or inadequately treating illness against the risk of antibiotic use regarding adverse effects, drug interactions, cost, and antibiotic resistance (Habboush & Guzman, 2018). Lawrence (2017) voiced similar concerns that fear is a factor related to the overuse of antibiotics. Clinicians are concerned that what if their patients are the 5% of bacterial infection and they did not treat them with an antibiotic? Despite these concerns, research suggested infectious complications associated with common outpatient infections are rare (Lawrence, 2017).

Age, gender, race and ethnicity difference. Age, gender and ethnicities influence antibiotic prescription rates. In a study by the CDC, about 67 million antibiotics were prescribed to children in 2013 (CDC, 2019b). The misuse of antibiotics contributes to antibiotic resistance and adverse effects (Lovegrove et al., 2019). Studies show young adults 20-34 years old visited emergency department twice as often as older adults above 65 years old for antibiotic related adverse events from 2011-2015 (CDC, 2019b; Geller et al., 2018). Similarly, in a study by Gahbauer, Gonzales, and Guglielmo (2014), significant variations in antibiotic prescription rates were identified between different age groups and ethnicities. Patients age below 18 years old and age between 19 and 64 years old were associated with

higher antibiotic prescription rates compare to patient age above 65 years old (Gahbauer, et al., 2014).

Gender difference is another factor influencing antibiotic prescription. In a systemic review and meta-analysis, antibiotics were found to be 27% more likely to be prescribed to women than men in the 16 to 54 years old age group in primary care settings (Schröder et al., 2016). For race and ethnicity groups, Alaskan Native or American Indian had the highest antibiotic rate, followed by Caucasians, then Asians. African-Americans have been found to be less likely than other ethnicities to receive antibiotic treatment (Gahbauer, et al, 2014). In the same way among pediatric patients, black race was found to receive the least antibiotic prescriptions when diagnosed with acute respiratory infections (Goyal et al., 2017; Kornblith et al., 2018;).

Clinical guidelines. Acute respiratory infections include a wide variety of common conditions and other syndromes treated in outpatient facilities, including bronchitis and bronchiolitis, influenza, middle ear infections, pharyngitis, sinus infections and viral upper respiratory infections. Antibiotics are not recommended for many of these conditions (PEW Research Center, 2016). Sinus infections are the number one diagnosis that antibiotics are prescribed in outpatient settings in the United States, accounting for more than 17 million prescriptions annually (CDC, 2019b; PEW Research Center, 2016). Most of these antibiotics are prescribed for the patient age group of 20-64 (PEW, 2016). The cause of sinus infection can be bacterial or viral, but treatment guidelines recommend an antibiotic only being prescribed when the infection is suspected to be a bacteria origin (CDC, 2017a; Chow et al., 2012; Rosenfeld et al., 2015; Wald et al., 2013). Antibiotics are indicated if at least one criteria for acute bacterial sinusitis is present: (1) severe symptoms (defined as

temperature >38°C or 101°F and purulent discharge, or facial pain for ≥3 days); (2) persistent symptoms not improving for ≥10 days; or (3) initial improvement of symptoms followed by worsening symptoms (CDC, 2017a).

Similarly, for patients with uncomplicated acute pharyngitis, viruses are the most common causes, and antibiotics are not indicated in most cases except group A streptococcal pharyngitis (CDC, 2019d). Only about 20%-30% of children and 5%-18% of adults with pharyngitis are streptococcal pharyngitis (Fine, Nizet, & Mandi, 2012; Kronman et al., 2014; Shulman et al., 2012). The IDSA 2012 guidelines recommend using a rapid antigen detection test (RADT) to diagnose streptococcal pharyngitis. The IDSA guidelines recommend clinicians only test patients who meet the criteria including patients 3 years and older, fever, sudden onset of sore throat, and pain with swallowing. Patients with viral symptoms such as runny nose, hoarseness, cough, oral ulcer, or conjunctivitis, should not be tested. In children with negative RADT results, throat culture should be ordered to confirm the results. Clinician should contact the family to initiate antibiotic treatment in the case throat culture is positive. In adult negative RADT cases, they do not need to be confirmed by throat culture because the incidence of streptococcal pharyngitis is low (Fine et al., 2012; Kronman et al., 2014; Shulman et al., 2012). However, the IDSA guideline is not followed in many clinical practices. In a national study, about 56% of children and 72% of adults with pharyngitis were treated with antibiotics, which equates to an estimated seven million unnecessary antibiotic prescriptions for pharyngitis each year (Fleming-Dutra et al., 2016). Establishing the accurate diagnosis of streptococcal pharyngitis is critical to use antibiotic appropriately.

Acute otitis media (AOM) is the most common childhood infection for which antibiotics are prescribed (CDC, 2017b). The AOM incidence peaks in children between six months and one year of age then decline with increasing of age. About 60% of children have had AOM by age three, on the other hand, AOM is uncommon in adults, only 14% of the adult patients are diagnosed with AOM (CDC, 2017b). AOM can be caused by bacteria, virus, or co-infections with bacteria and virus. Mixed bacterial and viral infections are the most common cause of AOM. Vaccinations, such as pneumococcal conjugate vaccine (PCV) and influenza vaccine have been shown to be effective in preventing AOM (CDC, 2017b). It is critical to differentiate AOM from otitis media with effusion (OME), which should not be treated with antibiotics per American Academy of Pediatrics (AAP) guidelines (Lieberthal et al., 2013). AOM by definition must have signs of middle ear effusion and other signs of acute infection, such as acute pain, fever, or purulent fluid (Lieberthal et al., 2013). Once an AOM diagnosis is established, treatment options include initial observation without antibiotics and immediate antibiotic treatment based on patient symptoms and patient and caregiver preferences. All children with AOM need treatment for pain. Even though most AOM is due to bacterial infection, many children will recover without antibiotic treatment. Children less than two years old, children with tympanic perforation, and children with severe AOM (fever, symptoms more than 48 hours, severe ear pain) would benefit the most from antibiotic treatment (Lieberthal et al., 2013). For patients under observation without antibiotics, strategies like watchful waiting and delayed antibiotic prescription are recommended. Patients or parents will call or return to the clinic, or have prescription filled if symptoms do not improve within 48 to 72 hours or worsens (CDC, 2017b).

Common cold or upper respiratory infection is the third most frequent diagnosis among outpatient visits. Adults can experience two to four episodes of colds each year (CDC, 2017a). Zoorob et al. (2012) stated in the guidelines and indications for common upper respiratory infections that antibiotics should not be prescribed for the common cold or laryngitis patients. Antibiotic treatment may be indicated if patients have acute otitis media, streptococcal pharyngitis, epiglottitis, or pertussis. Also, recurrent rhinosinusitis can be treated with antibiotics if symptoms continued beyond observation time (Fashner, Ericson, & Werner, 2012; Zoorob et al., 2012).

For acute uncomplicated bronchitis, an antibiotic is not recommended regardless of cough duration. Acute uncomplicated bronchitis is defined as absence of abnormal vital signs including heart rate ≥ 100 beats/min, respiratory rate ≥ 24 breaths/min, or oral temperature≥ 38°C, or abnormal lung examination findings including focal consolidation, egophony, and fremitus (CDC, 2017a). Symptomatic therapy is recommended, which includes cough suppressants, antihistamine, and decongestants (CDC, 2017a).

Antibiotic stewardship programs. Antibiotic stewardship has been defined by SHEA as a group of action plans to improve the appropriate use of antibiotic agents and patient clinical outcomes as well as reduce healthcare costs (SHEA, 2019). Antibiotic stewardship was established to combat inappropriate use of antibiotics. The history of antimicrobial stewardship can be traced as far back as 1977. At that time, experts of infectious disease and prevention searched for a multidisciplinary program to reduce antibiotic prescribing and improve clinical outcomes (Counts, 1977). Antimicrobial stewardship was recognized in 1996 due to the rising incidents of mortality and morbidity related to inappropriate use of antibiotics (Habboush & Guzman, 2018). However, it was not

until 2007 that the first ASP guidelines were published by the IDSA and the SHEA with focus on hospital antimicrobial stewardship (Dellit et al., 2007).

The focus of the stewardship programs is to improve patient outcomes, decrease antibiotic resistance, and reduce healthcare costs. In a cluster of randomized controlled trials, peer-based feedback groups were identified as having a statistically meaningful reduction of antibiotic prescribing (Meeker et al., 2016). The authors concluded that the reason of success in these interventions was attributed to the exposure of the providers' prescribing habits and involvement of their accountability and commitment (Meeker et al., 2016). Another effective recommendation to reduce antibiotic prescribing is to make a public commitment to prescribe antibiotics appropriately by having the committed providers' posters with their photograph and signature displayed in examination rooms (Fleming-Dutra et al., 2016; Meeker et al., 2014). There was a 20% reduction in the public commitment by poster group compared with the control group in unnecessary antibiotic prescribing for acute respiratory infections (Meeker et al., 2014). Additionally, the poster intervention is a simple, low-cost intervention compared to other more intensive quality improvement efforts.

Similarly, in a systemic review of randomized, controlled trials investigating the impact of antibiotic stewardship interventions in upper respiratory infections (URIs), the authors concluded interventions of clinical guidelines, peer leader training and regular feedback on antibiotic as well as public commitment posters and brochures were effective in successfully decreasing the antibiotic prescription rate in the intervention group compared to control group (Gerber et al., 2013; Wei & Zhang, 2018). In the study by McDonagh et al. (2018), 95 fair-quality studies were evaluated. There were four ASP interventions identified

in the evaluation as moderate-strength evidence of improving antibiotic prescribing. These four interventions are as following: (1) parent education demonstrated a 21% reduction in antibiotic prescribing with no increased return visits; (2) combined patient/clinician education exhibited a 7% reduction in antibiotic prescribing with no change in complications or patient satisfaction; (3) procalcitonin testing for adults with RTIs of the lower respiratory tract provided a 12%–72% reduction in antibiotic prescribing with no increased adverse consequences; (4) electronic decision support systems elicited a 24%–47% improvement in appropriate prescribing, 5%–9% reduction in antibiotic prescribing, and no increased complications (McDonagh et al., 2018). Finally, in a study by Ouldali et al. (2017), there was a significant reduction of antibiotic prescriptions for ARIs through implementing national guidelines. There were notable decreases in both the antibiotic prescription rate and broad-spectrum antibiotic usage for ARIs patients (Ouldali et al., 2017).

Center for Disease Control and Prevention recommendation. In 2014, the CDC published the "Core Elements of Hospital Antibiotic Stewardship Programs" and called on all hospitals to implement ASPs. The core elements provided further guidance for hospitals on how to structuring their ASP activities. In 2015, the CDC published the "Core Elements of Antibiotic Stewardship for Nursing Homes", which adapts hospital ASP core elements into practical ways to initiate and expand ASP activities in nursing homes. Finally, in 2016, CDC published the "Core Elements of Outpatient Antibiotic Stewardship Programs", which provides a framework of ASP for outpatient clinicians and facilities that routinely provide antibiotic treatments.

The CDC has developed core elements of antibiotic stewardship in outpatient settings to address the specific needs to improve use of antimicrobials in outpatients (Sanchez et al., 2016). According to CDC (2016), the four core elements of outpatient antibiotic stewardship are provider commitment, action for policy and practice, tracking and reporting, and education and expertise. The Core Elements of Outpatient Antibiotic Stewardship provides a framework of antibiotic stewardship for clinicians and facilities that routinely prescribe antibiotics in outpatient settings. It is essential to implement ASP strategies align with evidence-based practices for diagnosis and treatment (Sanchez et al., 2016). Outpatient providers and facilities' leaders can initiate actions by committing to at least one core element or practice targeting at improving and tracking antibiotic prescribing and providing consistent feedbacks of data to providers (CDC, 2016).

Barriers of ASP implementation. Outpatient antibiotic stewardship implementation is complicated by a number of reasons. First, the IDSA guidelines on antimicrobial stewardship recommend that the key members of the multidisciplinary stewardship team include an infectious diseases (ID) provider and a clinical pharmacist with ID training (Bessesen et al., 2015). However, most of the outpatient facilities may not be equipped with experts in critical areas such as infectious diseases, pharmacology, and information technology; Second, outpatient facilities often lack of adequate data systems that provide access for quick data collection and dissemination on antibiotic prescription. Timely data collection and analysis can support implementation of ASP by focusing on bad prescribing habits that require improvement (PEW Research Center, 2016). Finally, time constraints limit the time a provider has to communicate with a patient regarding effective treatment

options, as well as a facility's capability to implement ASP in general (PEW Research Center, 2016).

There are a few possible solutions to overcome the above barriers such as joining a healthcare system network to utilize their resources or pooling resources from nearby hospitals, and facilitating the use of resources from CDC and SHEA, and state health department. Stewardship is a function of a healthcare system, which is usually controlled and managed by the government to oversee and regulate healthcare (Habboush, & Guzman, 2018) Antimicrobial stewardship programs require a systematic measurement and coordinated interventions between clinicians, infection control specialists, pharmacists, and informational technology. ASP is designed to promote the best use of antibiotics in terms of drug choice, dosing, route, and duration of administration (Aslam et al., 2018; Steffens et al., 2018).

Research Gaps

Many of the ASP studies were done in the acute care hospital setting with few studies done in the outpatient care settings and a limited few in urgent care settings. The challenge with ASP programs is there is no comprehensive stewardship program that satisfies all facilities' unique needs and resources across health care settings (CDC, 2019). Healthcare facilities need to research into the effectiveness of the types of antibiotic stewardship interventions and evaluate their practice settings before determining which stewardship interventions would work best in their settings (Sanchez et al., 2016). These assessments should take into account not only the impact these efforts will bring on inappropriate antibiotic prescribing, but also their effects on clinical outcomes and healthcare cost. The purpose of this study was to determine the effects of antibiotic

stewardship program initiatives on antibiotic prescription rates for acute respiratory infections patients in a suburb urgent and primary care clinic.

Chapter 3

Methods

Study Design

This quality improvement project used a pre and post study design to compare changes in antibiotic prescription rates three months after the implementation of the antimicrobial stewardship project at a primary and urgent care practice. A pre and post design was appropriate for this study because this design measures the degree of changes occurring as a result of the interventions (Bell, 2010). It is effective in demonstrating the immediate impacts of a short-term program (Trochim, 2006). The project had the participating provider commit to practicing antibiotic stewardship publicly by posting the provider's picture and signature on a poster. The posters were displayed in the waiting rooms, high patient traffic areas, and exam rooms to give patients a visual reminder that this provider will only prescribe antibiotics when necessary and appropriate per evidence based guidelines (CDC, 2016). The project data was collected retrospectively pre-project (November 1, 2018 through January 31, 2019) and three months post project (November 1, 2019 through January 31, 2020) through review of electronic health records.

Study Setting

The setting of the study was at an urgent and primary care clinic in a suburb of Washington D.C. The population of the study area was 45,882 people. The demographics of the area mainly consisted of Caucasians 75.8%, followed by Asians 15.9%, African Americans 4.6%, and other races 3.7%. The overall median age is 47.3 years, 45.8 years for males, and 48.7 years for females. The gender ratio is female 52%, and male 48%. For education attained, 50.7% people have a graduate degree, 30.1% people have a bachelor's

degree, and 10% people have some college education or associate degree. The median income for household is $188.104 (U.S. Census, 2018).

In terms of general demographics of patients visiting this study clinic, 89% of patients were Caucasians, 7.5% were Asians, 58% of patients were women, and the average patient age was 42.7 years old. The clinic was a full-service walk-in clinic that provides both primary care and urgent care to adult patients as well as pediatric patients. The clinic was staffed with one full time healthcare provider and two as-need providers. All of the providers were family nurse practitioners. The clinic was open seven days a week, ten hours per day during weekdays and five hours per day on weekends. The clinic was closed on Christmas and New Year's days.

Sample Access and Recruitment

This quality improvement project was based on a CDC recommended initiative to improve antibiotic overprescribing in the outpatient setting for acute respiratory infections (Sanchez et al., 2016). The author met with the director of the clinic and the clinic decided to participate in the initiative due to CMS' final rule on facilities establishing antibiotic stewardship programs to improve the infection control efforts (CMS, 2019). The full-time healthcare provider agreed to participate in the project, but the two as-need providers did not want to participate in the project due to limited time working at this clinic. The participating provider committed to practicing antibiotic stewardship publicly by having her picture taken and signing the poster. The poster was displayed in the waiting rooms, high traffic patient areas, and exam rooms to give patients a visual reminder that this provider only prescribes antibiotics when necessary and appropriate. The full-time participating provider was made the champion of the clinic for the antimicrobial stewardship project per CDC

recommendation to promote adherence to clinical practice guidelines for antimicrobial prescribing. As champion, she relayed information to the other providers and nurse practitioner students who practiced in the clinic.

The project inclusion criteria were:

- Healthcare provider who committed to practicing antibiotic stewardship publicly.
- Patient diagnoses: acute respiratory infections including acute uncomplicated bronchitis, acute laryngitis, acute sinusitis, acute viral pharyngitis, asthmatic bronchitis, common cold, nasal congestion, cough, rhinitis, sore throat, upper respiratory infection, and viral infection.

The project exclusion criteria were:

- Patient diagnoses: acute exacerbation of chronic obstructive airway disease, bronchiectasis, community acquired pneumonia, chronic otitis media and other chronic underlying lung diseases.

Resources

Resources used for the project included CDC clinical guidelines for adult treatment and pediatric treatment in outpatient settings, and patient education material and handouts. All information was available on the CDC's website in multiple languages. Additionally, the CDC (2019d) provides online training for antibiotic stewardship.

Ethical Approvals and Consent

This is a quality improvement project. There was no consent process, since the clinic itself recruited providers to the ASP program. A waiver of consent to access patient information was requested due to (1) the quality improvement project involved no more than minimal risk to the subjects; (2) the project did not adversely affect the rights and welfare of

the subjects; (3) the project could not practicably be carried out without the waiver; and (4) whenever appropriate, the subjects were provided with additional pertinent information after participation (45 CFR). Additionally, the patient information was de-identified in the datasheet. The project was submitted to the West Chester University Institutional Review Board and was approved for study (Appendix A).

Data Collection

The project data was collected retrospectively pre project intervention (November 1, 2018 through January 31, 2019) and three months post project intervention (November 1, 2019 through January 31, 2020) through review of electronic health records. Since the project was implemented during the peak winter flu and cold season, the pre-project data was collected from the same season of the previous year. Data collection was strictly followed using the inclusion and exclusion criteria to avoid potential bias.

The following data was extracted from the electronic health records: date of visit, diagnosis, treatment (including whether antibiotic was prescribed, and which antibiotic in the case of prescribing), age, gender, ethnicity, comorbidities, and provider name. A master list was created. The provider's name was de-identified, while patients' names were assigned random Arabic numbers to protect confidentiality. The collected data was entered into a password-protected data collection sheet locked in a cabinet at the investigator's home. Data was then analyzed to measure the numbers of acute respiratory infections and the number of prescriptions written. A data collection tool was created to gather and organize extracted data from the clinic electronic health records (See Table 5). Based on the Healthcare Effectiveness Data and Information Set (HEDIS) and CDC outpatient antibiotic prescription measurement, the clinic utilization of antibiotic prescriptions during the

measurement period was measured, stratified by age, gender and antibiotic class (CDC, 2019a; NCQA, 2019). The measurements helped understand the clinic's prescription rates and facilitate antibiotic stewardship efforts.

The author retrospectively reviewed the electronic health records for data collection three months pre project (November 1, 2018 through January 31, 2019) and three months post project (November 1, 2019 through January 31, 2020). The review process included identification with international codes of diagnosis (ICD-10 code) for acute respiratory infection (ICD-10 codes include J00 acute nasopharyngitis (common cold); J01 acute sinusitis, J02 acute pharyngitis; J03 acute tonsillitis; J04 acute laryngitis; J06 acute upper respiratory infection; J10 influenza due to other identified influenza virus; J11 influenza due to unidentified influenza virus; J20 acute bronchitis; J30.9 allergic rhinitis; H66 suppurative and unspecified otitis media; R05 cough, R07.0 pain in throat; R09.81 nasal congestion) (Choez, Acurio & Sotomayor, 2018; Havers, et al., 2018) and other inclusion/exclusion criteria. The health records were reviewed to ensure patients did not have underlying comorbidities that would affect treatment, such as COPD. In patients meeting the inclusion criteria, the chart was reviewed to see whether an antibiotic was written.

Data Analysis

After data was collected, it was analyzed to calculate the antibiotic prescription rate. The post project antibiotic prescription rate was then measured against pre project antibiotic prescription rate.

The outcomes of antibiotic prescribing were analyzed in the following ways:

- Total antibiotics prescribed per1000 visits: total antibiotic prescriptions of all antibiotic classes in respiratory visits divided by total respiratory visits, then times 1000;
- Unnecessary antibiotic prescription rate: number of unnecessary antibiotic prescriptions divided by total antibiotic prescriptions;
- Total antibiotic prescription rate by age: total number of each age group antibiotic prescriptions divided by age group of respiratory infection visits. The patients are divided into three age groups: patients <20 years old, 20-64 years old, and patients ≥ 65 years old;
- Total antibiotic prescription rate by gender (male and female): total number of gender group antibiotic prescriptions divided by each gender respiratory infection visits;
- Top two ethnicity group antibiotic prescription rate: total number of each ethnicity antibiotic prescriptions divided by each ethnicity respiratory infection visits;
- Top two antibiotics by drug class: for selected antibiotics of concern including penicillins, macrolides, cephalosporins, fluoroquinolones, and beta-lactams, the number of top two antibiotic prescriptions is counted.

The data was also analyzed for antibiotic appropriateness. The appropriate antibiotic prescription rate was calculated by the number of appropriate antibiotic prescriptions divided by all antibiotics prescribed (CDC, 2019c; Choez et al., 2018; Havers et al., 2018). The appropriateness of antibiotic prescribing was decided based on the CDC's clinical guidelines and IDSA guidelines as well as patients' clinical information and testing results.

The author analyzed the data with minor assistance of a statistician. Pre intervention and post intervention data was compared using two-tailed z-test, and an alpha value of 0.05 is used for all statistical tests in this study. Statistical Analysis Systems (SAS), a statistical software program, was used to analyze data.

Preliminary analysis included data cleaning for coding error, missing values, and outliers. The total numbers may not add to all prescriptions due to missing data. The prescriptions numbers included prescriptions sent to retail pharmacies and written prescriptions, which is rare. There was a chance that some prescriptions were not picked up by patients due to payment or other reasons, leading to prescriptions not dispensed and likely overstated prescriptions.

Timeline and Budget

The projected timeline of the project was from November 2019 through January 2020, beginning data collection in December 2019, followed by data analysis starting from the end of January 2020, and with study results presented in April 2020.

The budget of the project included poster of the participating provider from the primary and urgent care practice and materials of the project. The poster budget was covered by the clinic and the administrative staff of the clinic was responsible to assemble and hang the poster. Materials of the project included patient handouts (See Appendix C) and tips for provider communication with patients (See Appendix D), which were free order from CDC's website. Additionally, there was antimicrobial stewardship online training and implementation strategies/clinical guidelines, all are available from CDC's website.

Chapter 4

Results

Rates of antibiotic prescribing and the proportion of antibiotic use were measured over the study period and among age, gender, racial-ethnic and drug classes as well as the appropriateness of prescribing antibiotics. Of the total acute respiratory infections visits during the study period, pre-intervention three months accounted for 404 visits, and post-intervention three-month accounted for 465 visits, average 135 visits per month and 155 visits per months for pre and post intervention respectively.

Patient Characteristic

Among the pre-intervention and post-intervention patients, the gender and ethnicity consistency were similar: 54% were women; 84% were Caucasian, 8% were Asian, 2% were African, and 6% were other ethnicities. Patient age ranged from 1 year to 98 years old, average age is similar in pre and post intervention groups of 39.5 years and 39.8 years respectively. For the different patient age groups, 20-64 years old was the highest number of patients visits accounts for 52.1% and 56% pre and post respectively, followed by <20 years old group of patients of 30% and 26.7% pre and post respectively; and patients ≥ 65 years old group of 17.8% and 17.2% pre and post interventions respectively.

Antibiotic Prescription Rates

Among the total respiratory condition visits, 55% to 64% (average 59.38 %) were associated with unnecessary antibiotic prescriptions during the three months pre-intervention period, and 34% to 47% (average 42.11%) were associated with unnecessary antibiotic prescription during the three months post-intervention period. The average absolute difference between pre and post intervention was 17.27% (p <0.0001, 95% CI

[0.107, 0.238]). The appropriateness of antibiotic prescription was 40.63% in pre-intervention, and 57.89% in post-intervention with an absolute difference 17.26% (p <0.0001).

Two drug classes accounted for 96% of total antibiotic prescriptions in this project: penicillins and macrolides. The two most commonly prescribed diagnoses were acute pharyngitis and sinus infection. 46.7% of antibiotics were prescribed for acute pharyngitis including streptococcus pharyngitis, and 39.1% of antibiotics were prescribed for sinus infection. For pre-intervention period, macrolides (azithromycin) were most frequently prescribed at 57.8% of the time, followed by penicillins (amoxicillin or amoxicillin/clavulanate) 37.5% of the time. Compared to pre-intervention period, penicillins was prescribed the most at 49.3% of the time during the post-intervention period, macrolides prescription decreased from 58% to 47% post-intervention.

For all antibiotic prescriptions per 1,000 populations of respiratory visits, the pre-intervention was 792 prescriptions; while the post-intervention decreased to 654 prescriptions. The first two-month post-intervention the total prescriptions per 1,000 populations were similar at 702 and 707 respectively, however, the trend changed in the third month post-intervention, with the total prescriptions per 1,000 populations only at 538. The pre-intervention period had a similar trend pattern, with the first two-month total prescriptions per 1,000 populations at 813 and 808 respectively, and the third month total prescriptions per 1,000 populations at 754.

For different patient age groups, age 20-64 accounts for the most antibiotic prescriptions at 50.31% and 51.32% pre and post intervention respectively; followed by <20 years old, 34.06% and 33.22% pre and post respectively; and ≥65 years old 14.38% and

15.46% pre and post respectively. Female gender accounts for 51% and 52% antibiotic prescriptions pre and post respectively. Regarding ethnicities, Caucasian accounts for 87.5% of all prescriptions, followed by Asian 7.5%, African 2.5%, and others 2.5%.

Chapter 5

Discussion

The problem that was addressed in this project was the overprescribing of antibiotics for acute respiratory infections in the primary and urgent care setting. In a study of antibiotic prescriptions for common respiratory conditions in the outpatients settings, urgent care centers accounted for the highest percentage of unnecessary antibiotic prescriptions at 46%, compared to other outpatient settings including emergency department at 25%, medical offices at 17%, and retail health clinics at 14% (Palms et al., 2018).

Key Findings

The pre-intervention antibiotic prescribing rate for the urgent care clinic involved in this project was similar but higher than described in the Palms' study and ranged from 55% to 64%, average 59.38 % (see Figure1). A quality improvement program was initiated to reduce the antibiotic prescribing rate within three months, which includes provider commitment poster displayed in the exam rooms and patient waiting room as well as patient education materials distributed in the exam rooms and waiting room (see Appendix B and C). In the study by Meeker et al. (2014), there was a 20% reduction in the public commitment by poster group compared with the control group in unnecessary antibiotic prescribing for acute respiratory infections. Similarly, in this study, the post-intervention unnecessary antibiotic prescribing rates ranged from 34% to 47% (average 42.11%), and decreased 17.27% comparing to the pre-intervention unnecessary antibiotic prescription rate (see Figure1).

In Maryland the community antibiotic prescription rate in 2016 was 751-852 prescriptions per 1000 visits (CDC, 2019b). The study clinic pre-intervention total antibiotic prescription rate of respiratory visits was similar as the state prescription rate at 792

prescriptions per 1000 visits; in contrast, the post-intervention total antibiotic prescription rate of respiratory visits decreased to 654 prescriptions per 1000 visits. The measurement of total antibiotic prescriptions also can identify if providers shift diagnosis codes away from antibiotic-inappropriate diagnosis codes. In this study, the total antibiotic prescriptions decreased 138 prescriptions per 1000 visits post intervention, which indicates none to mild diagnosis code shift.

The first two-month post-intervention the total prescriptions per 1,000 populations were similar at 702 and 707 respectively, however, the trend changed in the third month post-intervention with the total prescriptions per 1,000 populations only 538. The pre-intervention period had a similar trend pattern, with the first two-month total prescriptions per 1,000 populations at 813 and 808 respectively, and the third month total prescriptions per 1,000 populations at 754 (See Figure 2). One possible reason why the third month prescriptions of the cold and flu season were lower than the first two months in both pre and post interventions was probably due to more people have been flu vaccinated by the time of January each year, which was the third month. A study by Robert Wood Johnson Foundation (2009) showed increased flu vaccination had the effect of fewer doctor visits and decreased antibiotic prescriptions.

According to CDC (2019b), antibiotics were prescribed most common for sinus infection than any other diagnoses in outpatient settings in the United States. In this project, antibiotics were prescribed the most for acute pharyngitis including streptococcus pharyngitis at 46.7%, and followed by sinus infections at 39.1% of the time. CDC's treatment guideline does not recommend macrolides for treatment of sinus infection due to the high rates of antibiotic resistance in this drug class (CDC, 2019b). However, more than

half (59.7%) of the sinus infections at the study clinic were treated with macrolides. The CDC's treatment guideline recommends amoxicillin or amoxicillin/clavulanate as the first-line therapy. For penicillin-allergic patients, the guideline recommends doxycycline as alternative antibiotics (CDC, 2017a).

Studies show young adults 20-34 years old visited emergency department twice as often as older adults above 65 years old for antibiotic related adverse events (CDC, 2019b; Geller et al., 2018). This is also the case in the is study, patient age 20-64 accounts for the most antibiotic prescriptions at 50.31% and 51.32% pre and post intervention respectively; and patients age 65 years and older accounts for only 14.38% and 15.46% pre and post respectively (See Table2). Gender difference was not dramatic in this study, with female accounts for 51% and 52% antibiotic prescriptions pre and post respectively (see Table3). For race and ethnicity groups, study shows Caucasians had higher antibiotic prescription rate compared to Asians or African-Americans; and black ethnicity have been found to be less likely than other ethnicities in receiving antibiotic treatment (Gahbauer, et al, 2014; Goyal et al., 2017; Kornblith et al., 2018). This is also the case in this study, Caucasian accounts for the most prescriptions at 87.5%, followed by Asian 7.5%, and African only accounts for 2.5% (See Table4). However, it must be taken into consideration that Caucasian is also the highest population in the study clinic area.

Limitations

This project was in a suburban urgent and primary care clinic, which may not be representative of other practice settings. The demographic of the clinic patients was mainly Caucasians, which have higher prescription rate compare to African Americans or Asians (Gahbauer, et al, 2014). The study participation was small due to there was only one full

time provider working at this clinic and committed to the study, therefore, the study results only reflect the sole provider's practice and clinical judgment. The study time is relatively short with three-month pre-intervention and three-month post-intervention. An extended study period with multiple providers' participation will provide more comparison data to reflect the antibiotic prescriptions at an urgent care clinic and during different seasons of the year. Additionally, the clinic used a lower level electronic health record system, which lacks the function of advanced data systems to allow for large data export, therefore was time consuming in data collection and analysis. Future study should take into consideration of the level of the electronic health record system.

Implication for Practice, Education, and Policy

Practice and Education

After the data analysis, a meeting was held with the clinic provider to discuss the prescription rates and strategies of managing acute respiratory infection in health patient population. The clinic did the best in the first month post intervention, and the worst in the middle month, which was the busiest month of the year for respiratory infection visits. The improved antibiotic prescription rate post intervention proved the effectiveness of antibiotic stewardship program, and indicated the potential of the clinic to continue improving the antibiotic prescription rates.

As more and more urgent care clinics and retail health clinics emerging, urgent care clinic has become a high-priority target in antibiotic prescriptions (Stenehjem et al., 2019). Study shows urgent care clinics accounted for the highest percentage of unnecessary antibiotic prescriptions at 46% for common respiratory conditions in the outpatient settings, compared to other outpatient settings including emergency department at 25%, medical

offices at 17%, and retail health clinics at 14% (Palms et al., 2018). Additionally, Maryland, among many other states, allows advanced nurse practitioners to independently practice. This project will serve as a valuable antibiotic stewardship example for other urgent care clinics, especially those operated by advanced nurse practitioners to initiate their antibiotic stewardship programs and use the findings in this project to support or modify their own projects.

In terms of education, this project used educational materials from CDC (2019) to provide guided communication skills to provider and nurse practitioner students on how to discuss with their patients about appropriate antibiotic prescriptions. In the same way, patient handouts and posters displayed in the clinic introduced the topics of antibiotic improvement to the patients. It is essential for providers and patients to reach shared decision of a treatment plan, especially for pediatric patients and their parents, which brings the optical clinical outcomes of patients (Johnson, 2019). Shared decision-making will increase patient engagement, which not only increases patient's satisfaction and also improves clinical outcomes.

Policy

The antimicrobial stewardship requires initiation and sustainability - the continued monitoring and measuring of the quality practice. The Joint Commission (2016) announced their antimicrobial stewardship standard to the hospitals, critical access hospitals, and nursing care centers, which is inclusive in accreditation requirements effective January 2017. Similarly, the Centers for Medicare and Medicaid Services (CMS, 2019) also require acute care hospitals participating in CMS to implement antibiotic stewardship by March 2020. The acute care hospitals are required to demonstrate and document evidence-based

antibiotic use and control antibiotic resistance (CMS, 2019). As a result, there was 76.4% of hospitals met the requirements of antibiotic stewardship program per national hospitals survey in 2018, which was likely driven by the accreditation and CMS requirements (CDC, 2019b).

In the same way, the Joint Commission (2019) introduced their newly revised antimicrobial stewardship requirements to ambulatory healthcare facilities, which requires accredited ambulatory healthcare facility to meet the requirements of appropriate antibiotic prescriptions effective January 2020. Additionally, the Urgent Care Association (UCA), which is the largest urgent care professional organization, also has incorporated the antibiotic stewardship program as one of the accreditation standards for the applying UCA accredited facilities (CDC, 2019b). As the requirements of policy on antimicrobial stewardship become more completed, more outpatient healthcare facilities will initiate their ASP implementation and continue the quality monitoring.

Future Research

The period of study should be extended to evaluate an urgent care clinic's full year performance, especially during the non-flu seasons. Antibiotic choice, dosage, and duration of treatment are not the focus of this project, however, they are listed among CDC's core elements to improve antibiotic prescriptions (CDC, 2016). Future study can focus on these areas to continue refining and improving patient treatment plans. The Infectious Diseases Society of America guidelines on antimicrobial stewardship recommend that the core multidisciplinary stewardship team include an infectious diseases (ID) physician and a clinical pharmacist with ID training (Bessesen et al., 2015).

Since there are more and more urgent care clinics and retail health clinics emerging, the Urgent Care Association may consider providing access to personnel with expertise in areas of infectious diseases, pharmacology, and information technology to facilitate ASP implementation, data collection and result dissemination. ASP has yet to have the best models to incorporate the most effective interventions. A model of combined ASP approaches should be developed for better success (Barlam et al., 2016).

The provider participating in this study was a nurse practitioner. However, there is no other ASP study solely focusing on advanced practice nurse. As the healthcare policy evolves allowing advanced practice nurses to practice without barriers, more advanced nurse practitioners will be practicing different healthcare settings especially in urgent care and other outpatient settings. More study of ASP with focus on advanced nurse practitioners as well as other providers in the outpatient settings will reflect the prescriber attitude and add an important value of ASP implementation in outpatient setting.

Conclusion

The antimicrobial stewardship program is an evidence-based program with a purpose of improving antibiotic prescription rates. The project was done in a combined urgent and primary care clinic in a suburb area that serves primarily Caucasian population. The antimicrobial stewardship program for this DNP project had a statistically significant outcome that effectively decreased 17.27% of the unnecessary antibiotic prescription rate post intervention for acute respiratory infection patients at urgent care setting. The implementation of the antimicrobial stewardship program is recommended as a practice change and quality improvement to other urgent care or primary care clinics. This project will serve as a valuable antibiotic stewardship example for other urgent care clinics,

especially those operated by advanced nurse practitioners to initiate their antibiotic stewardship programs and use the findings in this project to support or modify their own projects.

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Table 1

Highlight of Rogers Diffusion of Innovation Theory applied in Antimicrobial Stewardship Project

Diffusion of Innovation Theory	**Antimicrobial Stewardship Project**
Innovation	Antimicrobial stewardship
Communication Channel	Antibiotic stewardship champion
Time	Three-month period
Social System: the formal structure and informal structure	Clinic administrator, provider, other staff and NP students working in the clinic

Note: Roger's Diffusion of Innovation theory is applied in the ASP study. The left column of table 1 is the four concepts of the theory, and the right column of the table depicts key elements of the ASP study that corresponding to each concept of the theory.

Table 2

Age Groups of the Population with Antibiotics Prescribed

Percentage of Antibiotic Prescribed	Pre-Intervention	Post-Intervention
<20 years	34.06%	33.22%
20-64 years	50.31%	51.32%
≥65 years	14.38%	15.46%

Note: Patients included in the study are divided into three age groups. Table 2 provides antibiotic prescription rates in pre and post intervention of each age group.

Table 3

Gender of the Population with Antibiotics Prescribed

Percentage of Antibiotics Prescribed	Pre-Intervention	Post-Intervention
Male	49%	48%
Female	51%	52%

Note: Gender information of the study is provided in table 3. The table provides antibiotic prescription rates in pre and post intervention of each gender group.

Table 4

Ethnicities of the Population with Antibiotics Prescribed

Ethnicities	Percentage of Antibiotics Prescribed
Caucasian	87.50%
Asian	7.50%
African	2.50%
Other	2.50%

Note: Table 4 provides antibiotic prescription rate in each ethnic group.

Table 5

Antimicrobial Stewardship Data Collection Tool

Patient Random Number	**Date of Visit**	**Age**	**Gender**	**Diagnosis (ICD Code)**	**Antibiotic**	**Ethnicity**	**Ethnicity**

Note: Patient information was collected for the study using the data collection tool described in Table 5.

Figure 1

Comparison of Pre and Post Intervention Unnecessary Antibiotic Prescription Rates

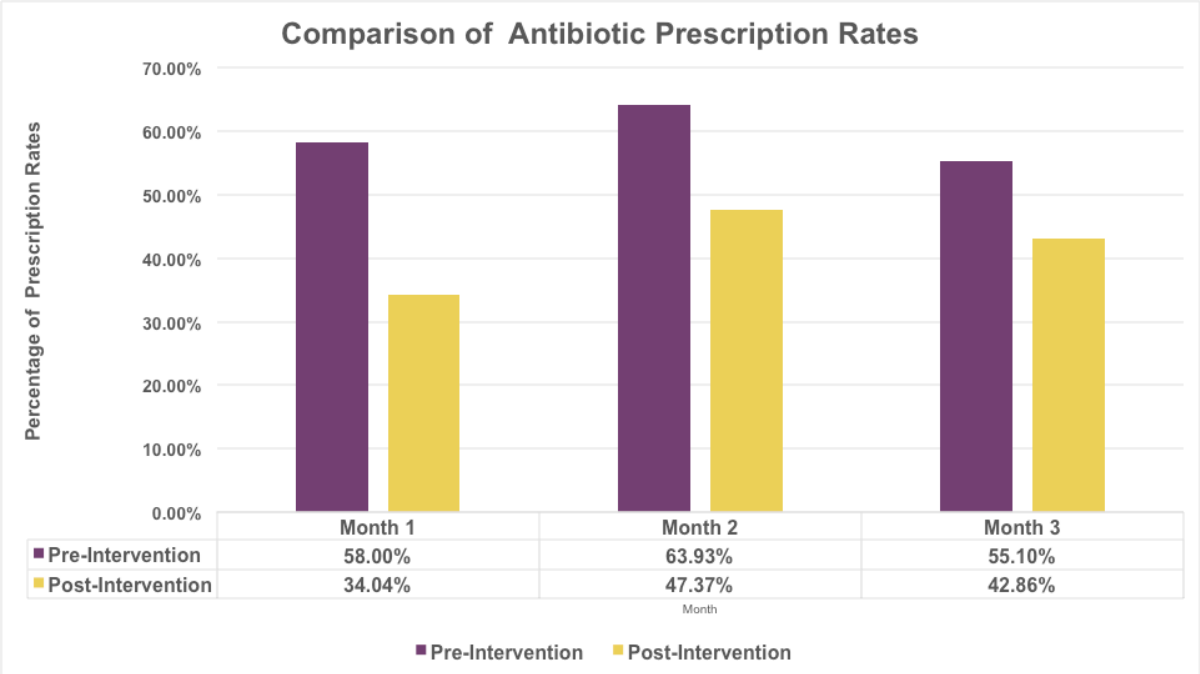

Figure 1. The purpose of the study is to examine the impact of ASP implementation on antibiotic prescription rate. Figure 1 provides month-to-month comparison of the differences in unnecessary antibiotic prescription rate between pre and post intervention.

Figure 2

Trend of Total Antibiotics Prescribed per1000 Visits

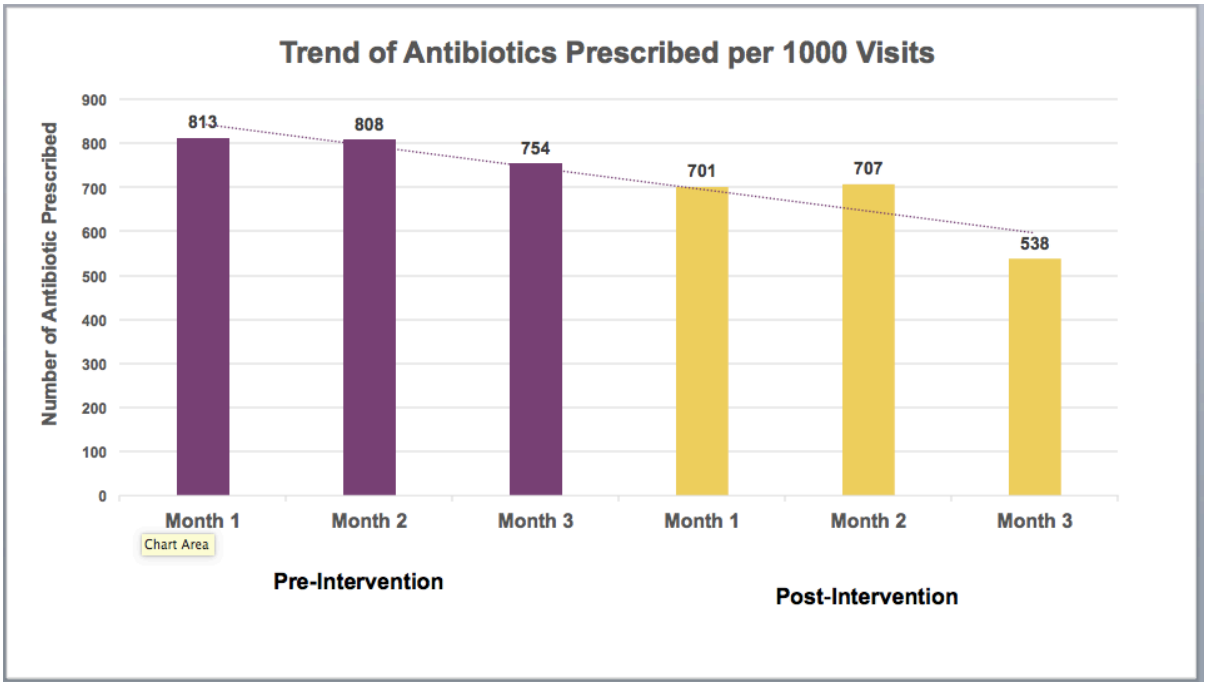

Figure 2. Total antibiotic prescribed per 1000 respiratory visits is another objective measured in this study. Figure 2 depicts the trend of total antibiotic prescriptions from pre-intervention to post-intervention.

Appendix A IRB Approval

Office of Research and Sponsored Programs | West Chester University | Ehinger Annex
West Chester, PA 19383 | 610-436-3557 | www.wcupa.edu

Protocol ID # 20191206A
This Protocol ID number must be used in all communications about this project with the IRB.

TO: Jian Connell

FROM: Nicole M. Cattano, Ph.D.
Co-Chair, WCU Institutional Review Board (IRB)
DATE: 12/5/2019

Project Title: Antimicrobial Stewardship Program

Notification of Initial Study Exemption Determination

☒**Exempt From Further Review**

This Initial Study submission meets the criteria for exemption per the regulations found at 45 CFR 46.104 (1)(i). As such, additional IRB review is not required.

The determination that your research is exempt does not expire, therefore, annual review is not required and no expiration date will be listed on your approval letter. If changes to the research are proposed that would alter the IRB's original exemption determination, they should be submitted to the WCU IRB for approval, using the IRB application form (check off I.G. Revision).

Your research study will be archived 3 years after initial determination. If your Exempt study is archived, you can continue conducting research activities as the IRB has made the determination that your project met one of required exempt categories. The only caveat is that no changes can be made to the application. If a change is needed, you will need to submit a NEW Exempt application. Please see www.wcupa.edu/research/irb.aspx for more information.

However, it is very important that you *close-out your project when completed or if you leave the university*. Faculty mentors are responsible for oversight of student projects and should ensure exempt studies are completed and closed-out before the student leaves the university.

The Principal Investigator and/or faculty mentor is responsible for ensuring compliance with any applicable local government or institutional laws, legislation, regulations, and/or policies, whether conducting research internationally or nationally. Please contact the WCU Office of Sponsored Research and Programs at irb@wcupa.edu with any questions.

Sincerely,

Co-Chair of WCU IRB

WCU Institutional Review Board (IRB)
IORG#: IORG0004242
IRB#: IRB00005030
FWA#: FWA00014155

West Chester University is a member of the State System of Higher Education

Appendix B Provider Commitment Poster

Dear Patient,

We promise to treat your illness in the best way possible.

This commitment includes not prescribing antibiotics if they are likely to cause more harm than good.

Sincerely,

_____

Quality Improvement Organizations
Sharing Knowledge. Improving Health Care.
CENTERS FOR MEDICARE & MEDICAID SERVICES

Quality Insights

This material was prepared by Quality Insights, the Medicare Quality Innovation Network-Quality Improvement Organization for West Virginia, Pennsylvania, Delaware, New Jersey and Louisiana under contract with the Centers for Medicare & Medicaid Services (CMS), an agency of the U.S. Department of Health and Human Services. The contents presented do not necessarily reflect CMS policy. Publication number QI-C310-020217

Appendix C Patient Handout

Viruses or Bacteria
What's got you sick?

Antibiotics are only needed for treating certain infections caused by bacteria. Viral illnesses cannot be treated with antibiotics. When an antibiotic is not prescribed, ask your healthcare professional for tips on how to relieve symptoms and feel better.

Common Condition	Common Cause			Are Antibiotics Needed?
	Bacteria	Bacteria or Virus	Virus	
Strep throat	✓			Yes
Whooping cough	✓			Yes
Urinary tract infection	✓			Yes
Sinus infection		✓		Maybe
Middle ear infection		✓		Maybe
Bronchitis/chest cold (in otherwise healthy children and adults)*		✓		No*
Common cold/runny nose			✓	No
Sore throat (except strep)			✓	No
Flu			✓	No

* Studies show that in otherwise healthy children and adults, antibiotics for bronchitis won't help you feel better.

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

To learn more about antibiotic prescribing and use, visit www.cdc.gov/antibiotic-use.

IMPROVING ANTIBIOTIC USE

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

Do I really need antibiotics?

SAY YES TO ANTIBIOTICS
when needed for certain infections caused by **bacteria**.

SAY NO TO ANTIBIOTICS
for **viruses**, such as colds and flu, or runny noses, even if the mucus is thick, yellow or green. Antibiotics also won't help for some common bacterial infections including most cases of bronchitis, many sinus infections, and some ear infections.

Antibiotics are only needed for treating certain infections caused by bacteria.

Antibiotics do NOT work on viruses.

Do antibiotics have side effects?

Anytime antibiotics are used, they can cause side effects. When antibiotics aren't needed, they won't help you, and the side effects could still hurt you. Common side effects of antibiotics can include:

Rash

Dizziness

Nausea

Yeast Infections

Diarrhea

More serious side effects include *Clostridium difficile* infection (also called *C. difficile* or *C. diff*), which causes diarrhea that can lead to severe colon damage and death. People can also have severe and life-threatening allergic reactions.

Antibiotics save lives. When a patient needs antibiotics, the benefits outweigh the risks of side effects.

1 out of 5
medication-related visits to the ED are from reactions to antibiotics.

Appendix D Tips of Provider Communication with Patients

What Is Delayed Prescribing?

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

WAIT. DO NOT FILL YOUR PRESCRIPTION JUST YET.

Your healthcare professional believes your illness may resolve on its own.

First, follow your healthcare professional's recommendations to help you feel better without antibiotics. Continue to monitor your own symptoms over the next few days.

- ○ Rest.
- ○ Drink extra water and fluids.
- ○ Use a cool mist vaporizer or saline nasal spray to relieve congestion.
- ○ For sore throats in adults and older children, try ice chips, sore throat spray, or lozenges.
- ○ Use honey to relieve cough. Do not give honey to an infant younger than 1.

If you **do not feel better in ____ days/hours or feel worse,** go ahead and fill your prescription.

If you **feel better, you do not need the antibiotic,** and do not have to risk the side effects.

Waiting to see if you really need an antibiotic can help you take antibiotics only when needed. When antibiotics aren't needed, they won't help you, and the side effects could still hurt you. Common side effects of antibiotics can include rash, dizziness, nausea, diarrhea, and yeast infections.

Antibiotics save lives, and when a patient needs antibiotics, the benefits outweigh the risks of side effects. You can protect yourself and others by learning when antibiotics are and are not needed.

To learn more about antibiotic prescribing and use, visit **www.cdc.gov/antibiotic-use.**

CDC

What Is Watchful Waiting?

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

WAIT. DO NOT FILL YOUR PRESCRIPTION JUST YET.

Your healthcare professional believes your illness may go away on its own.

You should watch and wait for **____ days/hours** before deciding whether to take an antibiotic.

In the meantime, follow your healthcare professional's recommendations to help you feel better and continue to **monitor your own symptoms** over the next few days.

- ○ Rest.
- ○ Drink extra water and fluids.
- ○ Use a cool mist vaporizer or saline nasal spray to relieve congestion.
- ○ For sore throats in adults and older children, try ice chips, sore throat spray, or lozenges.
- ○ Use honey to relieve cough. Do not give honey to an infant younger than 1.

If you **feel better, no further action is necessary. You don't need antibiotics.**

If you **do not** feel better, experience **new symptoms**, or have **other concerns**, call your healthcare professional _____. **Discuss whether you need a recheck or antibiotics.**

It may not be convenient to visit your healthcare professional multiple times, but it is critical to take antibiotics only when needed. When antibiotics aren't needed, they won't help you and the side effects could still hurt you. Common side effects of antibiotics can include rash, dizziness, nausea, diarrhea, and yeast infections.

Antibiotics save lives, and when a patient needs antibiotics, the benefits outweigh the risks of side effects. You can protect yourself and others by learning when antibiotics are and are not needed.

To learn more about antibiotic prescribing and use, visit **www.cdc.gov/antibiotic-use.**

CDC