Spring 5-2020

Implementation of an Evidence-Based Guideline to Improve Knowledge and Prescribing for Rhinosinusitis

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Antibiotic Misuse

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Abstract

This study measured the effectiveness of an evidence-based guideline intervention regarding provider's and antibiotic use in a rural health clinic. Sixty percent of providers in the clinic participated in the study. The Antibiotic Knowledge Survey (AKS) was used to measure provider's knowledge of antibiotic overuse at baseline and 10 weeks post-intervention. Antibiotics prescribed with the diagnosis of sinusitis was measured 6 months pre-intervention and 6 months post-intervention. There was not a significant change in provider's knowledge from pre-intervention to post-intervention (77.2, SD 9.4), $t(16) = 0.63$, $p = 0.53$. However, antibiotic prescribing did decrease from pre- to post-intervention, though this decrease was not statistically significant (583.3, SD 684.8), $t(0.84) = 2$, $p = 0.49$. Further analysis of each question on the AKS was assessed and showed statistical significance related to providers being more likely to prescribe antibiotics pre-intervention due to patient preference (M 1.17, SD 0.77), $t(16) = 2.05$, $p = 0.05$ and more likely to use education courses post-intervention (M 4.59, SD 0.50), $t(16) = 2.07$, $p = 0.05$. These results can be used in future studies to assess the best interventions related to educating providers on antibiotic overuse. This study also forms the basis for studies to assess patient's perception of antibiotics.

Keywords: Advance Practice Providers, educational interventions, antibiotic resistance, and antibiotic overuse.

Introduction

Antibiotic resistance is a growing epidemic in the United States as well as globally. Healthcare professionals are initiating protocols and policies to combat this problem. The Center for Disease Control and Prevention (CDC) has launched the Get Smart campaign to educate clinicians and the public on the overuse of antibiotics (CDC, 2019). This campaign provides awareness using pamphlets, brochures, and games. Guidelines are in place to help clinicians improve their practice regarding treatment for viral and bacterial infections. Use of the Get Smart campaign, along with evidence-based practice guidelines, can empower providers to improve patient outcomes and decrease the misuse of antibiotics.

Problem Statement

Evaluating the causes of, and measures to decrease, antibiotic resistance is of utmost importance. Healthcare professionals are recognizing increasing antibiotic resistance as a factor when treating patients for bacterial infections. One main contributing factor to antibiotic resistance is the overuse of antibiotics, especially in the treatment of upper respiratory infections (URIs). According to the CDC (2017), more than 47 million antibiotics are prescribed each year unnecessarily. The overuse of antibiotics can cause adverse reactions such as unwarranted allergic reactions and Clostridium *difficile* (CDC, 2016). Utilizing an evidence-based guideline can increase providers' knowledge of appropriate antibiotic prescribing and decrease the number of antibiotics prescribed.

Purpose

The purpose of this project is to initiate an evidence-based practice guideline to improve physicians’ and advance practice providers' (APPs) knowledge of antibiotic prescribing and decrease the number of antibiotics prescribed for sinusitis in a rural urgent care clinic located in

Tifton, Georgia. An initial literature review was conducted to assess provider's knowledge of antibiotic use educational interventions used to educate on antibiotic overuse for sinusitis. The review of literature led to guidelines being an effective intervention of education providers on antibiotic misuse and overprescribing (Urrusuno et al., 2014). The antibiotic stewardship committee where the study will take place understands the lack of knowledge related evidence-based guidelines for treating sinusitis can lead to antibiotic misuse.

Specific Aims and Clinical Questions

Due to the lack of knowledge related to antibiotic resistance, the CDC has developed educational tools for the public to gain understanding regarding the treatment of infections. Evidence supports the use of educational interventions to increase awareness of health needs (O'Doherty et al., 2019; Lee et al., 2016; Urrusuno et al., 2014 & Alweis et al., 2013). One area where providers can increase understanding is the use of evidence-based practice guidelines in the treatment of viral and bacterial infections. This descriptive study addresses the following specific aims and clinic questions:

Specific Aim: 1

This project aims to determine if an antibiotic guideline educational intervention will increase providers' knowledge regarding prescribing antibiotics for viral and bacterial sinusitis.

Specific Aim: 2

This project aims to determine the effect of a provider-focused antibiotic guideline educational intervention will have on the number of antibiotics prescribed in a rural health clinic.

Clinical Question 1:

How does implementing an evidence-based guide affect a provider's knowledge of antibiotic prescribing for rhinosinusitis from baseline to two months?

Clinical Question 2:

What effect does the implementation of evidence-based guidelines have on the number of antibiotics prescribed for rhinosinusitis?

Background

In 1928, Alexander Fleming introduced the world to Penicillin (Tan & Tatsumura, 2015). This antibiotic changed medicine for the better. People who were dying from diseases such as tuberculosis were no longer suffering or dying from long term illnesses. Ninety years later, this great discovery is at the center of a public health epidemic. The general public has become accustomed to receiving an antibiotic even for viral upper respiratory symptoms. People suffering from viral upper respiratory symptoms often call their primary physician two or three days after the onset of symptoms and request an antibiotic. Prescribers have given in to patients in order to achieve patient satisfaction. However, providers now understand that unnecessary antibiotics are not helpful and, in fact, can be harmful. The dilemma has led to antibiotic resistance resulting in the requirement of newer and stronger antibiotics to fight common infections. The development of antibiotic resistance has led to longer, more costly treatment (The Society for Healthcare Epidemiology of America [SHEA], 2016). The CDC (2018), has initiated a Get Smart campaign to bring awareness to the antibiotic resistance epidemic to providers as well as the general public.

A typical scenario occurs in urgent care clinics of a patient presenting with complaints of cough, cold, and congestion for three days. The patient requests an antibiotic. The provider wants to satisfy the patient but knows that antibiotics are not warranted in this situation. Providers must comply with patient satisfaction guidelines while providing appropriate,

evidence-based practice. CMS has recommended healthcare facilities make their communities aware of the overuse of antibiotics (American Society for Microbiology (AMS), 2019)

Providers who follow evidence-based practice guidelines can decrease the misuse of antibiotics. There are credible guidelines in place to help providers improve their practice. While prescribers are hesitant to prescribe antibiotics, they also want to achieve high patient satisfaction scores. Educating providers to use evidence-based practice guidelines can decrease antibiotic resistance, improve patient outcomes, and improve reimbursement for the organization.

Need and Feasibility

In the community of Tifton, Georgia, there is a need to educate providers and the adult population on antibiotic resistance. Tift Regional Medical Center (TRMC) is a facility in Tifton, Georgia, that services five counties and can address this need. This hospital is a 181-bed non-profit facility providing healthcare to the four surrounding counties of Berrien, Cook, Lanier, and Turner. TRMC also has a center located in Adel, Georgia, approximately 20 miles south of Tifton. Currently, the TRMC is meeting the quality measure of having an established antibiotic stewardship committee. The committee has recognized an increase in the number of antibiotics being prescribed in inpatient and outpatient settings that may not be warranted. Currently, there are measures in place to decrease the amount of antibiotics prescribed in the inpatient setting, but no standards exist to combat this problem in the outpatient setting.

The antibiotic stewardship committee at TRMC has addressed resistance and overuse in the inpatient setting by incorporating the use of procalcitonin levels to assess when an antibiotic is needed and penicillin allergy testing to decrease the use of expensive intravenous antibiotics. The chair of the committee believes that education regarding side effects of antibiotic overuse, effects of antibiotic resistance, and appropriate use of antibiotics when treating the infection is

needed. Currently, Leapfrog, a quality improvement organization, has not mandated any criteria for the outpatient community to address the overuse of antibiotics. The antibiotic stewardship committee anticipates future mandates regarding antibiotic overuse in the outpatient setting and aims to be at the forefront of any future changes.

Causes

The antibiotic stewardship committee at a rural health organization has identified multiple factors influencing the overuse of antibiotics. One primary reason is the belief of many patients' that cold symptoms are bacterial. This belief leads to patients' expectation of receiving antibiotic treatment regardless if the infection is viral or bacterial. Another cause of antibiotic misuse is the common misconception of patients' that a fever indicates a bacterial infection. Patients must be educated regarding symptoms of both bacterial and viral infections. Also contributing to the antibiotic overuse problem, patients and providers often do not understand the consequences of antibiotic overuse. Educating both patients and providers can lead to improvement. Finally, one of the most significant causes of antibiotic overuse is patient satisfaction. The Center for Medicare and Medicaid (CMS) has implemented a guideline requiring patients to report satisfaction of treatment via surveys. These patient satisfaction ratings are directly linked to reimbursement. If a patient is dissatisfied because they did not receive an antibiotic when they feel they should have they are likely to reflect this dissatisfaction in the survey thus decreasing the providers' satisfaction scores and decreasing their reimbursement from CMS. Appropriate, evidence-based, antibiotic prescribing education can improve both satisfaction scores and antibiotic overuse in this rural community.

In 2017, the CDC reviewed the number of antibiotics prescribed unnecessarily for all diseases versus acute respiratory diseases. In the age group of zero to nineteen years for all

conditions, 29% of antibiotics were prescribed unnecessarily (CDC, 2017). For the same age group, 34% of antibiotics prescribed for acute respiratory infections were unnecessary (CDC, 2017). When looking at the age range of 20 to 64 years, 35% of antibiotics for all conditions were prescribed unnecessarily, while 70% of antibiotics were unnecessary in the diagnosis of acute URI (CDC, 2017). Lastly, the CDC concluded that for all ages, 50% of antibiotics prescribed for URIs were unnecessary (CDC, 2017). Tifton, Georgia has a population of 16,733 people (United States Census Bureau, 2016). If half of this population is treated with antibiotics unnecessarily, the risk for antibiotic resistance increases in this community. Educating providers to use evidence-based guidelines for acute sinusitis and providing credible educational resources to patients explaining why they are not receiving an antibiotic can improve outcomes for this community.

Theoretical Framework

Leininger's Theory of Culture Care Diversity and Universality provides the basis for this translational project. This theory was developed by Madeleine Leininger in 1950 and was published in 1991 (Gonzalo, 2019). Leininger's' Theory recognizes culture and religion as social dimensions that should be identified when caring for a community (Chesnay & Anderson, 2016). The three aspects of focus for Leininger's theory are cultural care preservation and maintenance, repatterning and restricting, and accommodation and negotiation. Cultural care preservation and maintenance can be preserved by educating providers on conservative treatment such as rest and the use of nonsteroidal anti-inflammatory drugs (NSAIDs) to improve viral symptoms of URIs. Cultural care repatterning/restructuring is another concept of Leininger's Theory that focuses on providing activities to promote actions to help change a community's behavior (Chesnay & Anderson, 2016). Encouraging clinicians to utilize evidence-based guidelines and provide

educational material to patients regarding viral symptoms and treatment will address this concept. Cultural care accommodation and negotiation will be maintained by allowing providers to participate in the educational intervention and encouraging providers to spend time educating patients regarding the appropriate treatment of viral symptoms. Understanding why habits form is the driving force for this translational project. Utilizing this theory can help providers understand the culture that has caused antibiotic misuse and provide the foundation to change the current culture of antibiotic overuse.

Chapter II

Review of Literature

An initial search of the literature regarding antibiotic use was conducted with the database ProQuest. Search terms included antibiotic overuse, nurse practitioner, and antibiotic perception. The search was limited to articles from the years 2015 to 2019. Articles with a focus on parents', patients', and children's' perceptions were excluded. Articles referring to physicians, nurse practitioners' (NPs), and physician assistants' (PA) knowledge or comprehension were included. Articles assessing pharmacists' or pharmacy students were excluded. Articles with a focus on providers from countries other than the United States were included. Finally, articles focusing on knowledge and perception of antibiotic misuse were included. This search provided a total of 1,291 results with 1,286 articles being excluded due to not matching inclusion criteria, yielding a total of five studies. A similar search was done through the CINAHL database using the limitation of articles published from 2015 to 2019 and keywords of providers, antibiotics, and perception. A total of 172 articles were found. One article was a duplicate, and 166 articles did not meet the purpose of the project; therefore, only five articles were utilized. The total articles reviewed for this translational project, using both searches, was ten.

Results

The literature search provided evidence of the importance of assessing providers' knowledge of appropriate antibiotic prescribing and awareness of antibiotic resistance. Literature findings focusing on the common reasons for overprescribing of antibiotics as well as educational interventions directed toward providers applying evidence-based practice guidelines when prescribing antibiotics will be discussed.

Antibiotic resistance is a real-world threat that has already led to Methicillin and Vancomycin-resistant infections and, if not addressed, may lead to many other diseases unable to be treated with antibiotic therapy (Cong, Yang, and Rao, 2019). Educating providers to use appropriate, evidence-based practice guidelines would help decrease this threat and improve health outcomes (Fletcher-Lartey, Yee, Gaarsley, Khan, 2016).

Provider's Knowledge and Perception

Determining clinicians' awareness of the emergence of antibiotic resistance must be assessed before initiating education on guidelines. Evidence shows that providers in acute and primary care settings have a good understanding of antibiotic resistance and the danger it poses to society (Francesco et al., 2018 & Ryves et al., 2016). However, clinicians continue to overprescribe antibiotics. One study suggests that the overprescribing of antibiotics is due to patient request. Fletcher-Lartey, Yee, Gaarslev, and Khan (2016), conducted a study to assess for causes of overprescribing of antibiotics and found 56.6% of providers overprescribe due to patient perception. Equipping providers with evidence-based practice guidelines and encouraging the education of patients when antibiotics are needed can lead to better patient outcomes.

Education Interventions

Assessing clinicians' knowledge and understanding of antibiotic use can help improve outcomes. O'Doherty et al., (2019) recognized the need for different intervention techniques to engage the provider. Face-to-face or one-on-one interventions yield better provider knowledge and acceptance than online modules (Lee et al., 2016). A study conducted by O'Doherty et al. (2019) found that providers are aware of guidelines for acute URIs but recognized challenges with understanding and implementing the guidelines as well as fear of patient dissatisfaction.

Providing face-to-face or one-on-one educational intervention regarding current guidelines can help ease this fear.

Urrasano et al., (2014) evaluated the appropriateness of antibiotic use with an antimicrobial therapeutic guide. This guide was developed based on evidence-based guidelines and reviewing antibiotic resistance patterns. The study revealed a 21% improvement in the appropriate use of antibiotics in primary care. Alewis et al., (2013) utilized practice interventions to improve adherence to guidelines for upper respiratory tract infections. These interventions included: email of CDC guidelines, providing CDC posters in the clinical setting in English and Spanish on when antibiotics are appropriate for bacterial infections, and providing an educational intervention with providers regarding CDC guidelines. With the use of these interventions, adherence to practice guidelines improved significantly from 79.28% to 88.58% ($p = 0.004$).

Patient Perception

Understanding how patient perception or satisfaction impacts antibiotic misuse is an important factor. Broniatowski, Klein, and May (2018) evaluated providers and patient's perception of antibiotics prescribing. In this study, providers showed an increase in knowledge and understanding of when antibiotics needed to be prescribed, however, they continued to prescribed unnecessarily. The study found providers and patients would prefer to take the risk of increasing antibiotic resistance in hopes of improved symptoms in a timely manner (Broniatowski, Klein, and May (2018). Understanding patient perception can help organizations understand why provider's prescribe antibiotics unnecessarily.

Limitations

There is a lack of evidence focusing on educating APPs regarding antibiotic guidelines. Many studies focus on physicians, with only a few assessing APPs as well. Another limitation is

the lack of studies on providers' knowledge of antibiotic prescribing in the United States. A vast majority of the studies were conducted in European countries. Lastly, another limitation to the literature review is the lack of studies that focused on patients' perception of antibiotic use.

Chapter III

Methodology

Evidence is needed to improve the practice of providers and ensure safe patient care regarding the use of antibiotics to treat URIs. Not only is evidence needed but guidelines must show credibility and reliability before being instituted into clinic practice. Once credibility and reliability are proven, these guidelines can be utilized. This translational project focuses on using an evidence-based practice guideline to improve the knowledge of physicians and advance practice providers in the rural clinic setting.

The unnecessary prescribing of antibiotics is a topic that has recently been placed on the world agenda. The Centers for Disease Control and Prevention (CDC), states that one in three antibiotics is prescribed unnecessarily (CDC, 2016). One area where antibiotics are being overprescribed is for URIs, more specifically, sinusitis. Using an evidence-based practice guideline can help decrease the number of unnecessary antibiotics prescribed.

Methods

Doctor of Nursing Practice (DNP) projects utilize many approaches such as program and policy evaluation, quality improvement, and evidence-based guidelines (Moran, Burson, and Conrad, 2017). These different methods are used to improve clinical practice. The use of evidence-based practice guidelines improves providers' care and increases their knowledge. This translational project will be an evidence-based guideline project. The Infectious Disease Society of America (IDSA) has published guidelines for the treatment and management of rhinosinusitis to decrease the number of antibiotics used for this disease. This project aims to improve providers' knowledge of antibiotic misuse by implementing the use of the IDSA published guidelines.

Guideline

IDSA developed its guidelines for rhinosinusitis in 2017. An interdisciplinary team approach was utilized. The team consisted of internal medicine physicians, infectious disease physicians, pediatricians, and nurse practitioners (IDSA, 2017). This team approach increased the credibility of the guidelines. The developers of the IDSA rhinosinusitis guidelines used the Grading of Recommendation, Assessment, Development, and Evaluation (GRADE) tool to assess the strength of the evidence (IDSA, 2017). Utilizing the GRADE tool improved the credibility of the guidelines.

Credibility

The rhinosinusitis guidelines were developed by the IDSA in 2017. The IDSA group was formed in 1963 by two physicians and now has over 11,000 infectious disease clinicians and epidemiologists who help formulate guidelines for specific diseases (Clinical Infectious Disease, 2012). When developing guidelines for rhinosinusitis, an interdisciplinary team approach was utilized. Developers used representatives from multiple disciplines, including internal medicine, pediatrics, emergency medicine, otolaryngology, public health, adult, and pediatric infectious disease (Clinical Infectious Disease, 2012)). Use of an interdisciplinary approach increases the credibility of this guideline by decreasing biases. When more than one health specialist offers their expertise on a topic, the threat to credibility and validity are decreased.

Funding

Knowing who funds a project improves the credibility of the project and its guidelines. For the development of rhinosinusitis guidelines, the IDSA funded the developers. There is some bias with this organization funding research on an infectious disease topic. To weaken the threat to validity, the interdisciplinary team developing the guideline needed to disclose any conflict of

interest regarding this project. The guidelines noted that all developers disclosed any conflict of interest prior to the development of the guideline. Disclosing this information is what makes this guideline more credible.

Strategy

The first step to the development of the rhinosinusitis guideline was a literature review. Cochrane and Medline were databases used in the literature review. The review limited articles from 1980-2011 (Clinical Infectious Disease, 2012). The years used to find the evidence was greater than five years. If evidence was used from the 1980s, it can be seen as outdated and weaken the credibility of the guidelines. The guideline did not state if the most relevant articles were used. Evidence was graded on quality and was given a score of strong or weak (Clinical Infectious Disease, 2012). Each criterion included in the guidelines were graded on their strength of recommendation and given a level of high, moderate, low, or very low (Clinical Infectious Disease, 2012). The GRADE system was utilized to determine the level of strength of the recommendation (Clinical Infectious Disease, 2012). Eighteen recommendations were approved from this guideline after using this system.

Recommendations

The guideline produced eighteen recommendations for clinician's management of rhinosinusitis. Each recommendation was followed with a level of strength of evidence based on the GRADE system. This helps clinicians understand the strength of evidence supporting each recommendation. Not every recommendation is supported with substantial evidence. For example, the first recommendation of the guideline discusses clinical presentation and how to best identify if a patient is presenting with acute bacterial rhinosinusitis verses viral rhinosinusitis (Clinical Infectious Disease, 2012). The level of strength applied to this

recommendation was strong/moderate. According to the GRADE system, the desired effects outweigh the undesirable effects, and this implies that the recommendation can be used for most patients (Clinical Infectious Disease, 2012). On the contrary, the fourth recommendation was given a low/weak level of strength (Clinical Infectious Disease, 2012). This recommendation discusses the use of Augmentin rather than amoxicillin as empiric antibiotic therapy. Base on the GRADE level of weak, this recommendation is not supported by substantial evidence. Knowing the level of strength for each recommendation allows clinicians to know how strong the evidence is and helps guide their decision-making process.

Setting

The project will take place in a primary care clinic in Tifton, Georgia. The clinic is staffed by a total of 30 primary care providers who treat adult and pediatric patients. For this study, pediatric patients are not included because the organization does not monitor the number of antibiotics prescribed to the pediatric population. The clinic has the capacity to see up to one-hundred adult patients with three providers working simultaneously. This organization does not have an Institutional Review Board; however, permission was granted to carry out the study after the primary investigator presented the methodology. The organization provided a letter of approval to conduct the study.

Recruitment

The participants for this project were a convenience sample of physicians, nurse practitioners, and physician assistants who currently work in the primary care or walk-in clinic. The participants were asked in person if they would like to participate in the study. Participants were notified participation is not mandatory and they could leave the study at any time. The sample size included 19 providers. Inclusion criteria were physicians and APPs who work in the

walk-clinic and primary care clinic. Exclusion criteria included physicians and APPs who work in specialty areas due to the limited number of patients presenting with URIs. Licensed practical nurses and registered nurses were also excluded from participating in the study since they do not prescribe medication. Each provider received a 10-dollar gift card for participating in the study. The gift cards are not compensation participating and every participant received a gift card even if they decided to leave the study. Once the sample was recruited, they were educated on their human rights regarding the study.

Protection of Human Subjects

This translational project had no foreseen physical or psychological harm that could result from the project. Subjects' rights are protected by the ethical principles presented in the Belmont Report (1979) set forth by the United States Department of Health and Human Services. Respect for person, beneficence, and justice was utilized to protect subjects during data collection. Participants were allowed to enter the study voluntarily and were able to decline further participation at any time during the 10-week period. Regarding beneficence, subjects were protected from physical harm throughout the study. Also, beneficence was upheld by the protection of the subject's information. Participation was confidential. Lastly, justice was upheld by treating all participants equally. These three principles were the basis for protecting the subject's rights during this projection.

Even though there was no foreseen physical harm to the participants, some may experience distress in relation to lack of knowledge of guidelines. Some participants may also experience confusion on the topic. Participants were reassured that the interventions are for educational purposes and that no past experiences in relation to antibiotics will be discussed. The researcher offered a question and answer session for participants to provide answers to any

questions the participants had regarding the study. Participants were also provided with the researcher's contact number if they have questions in relation to antibiotic resistance upon completion of the study.

Data

Data were collected from multiple sources for this translational project. There was a combination of primary and secondary data. The physicians and advance practice providers provided primary data using pre-test and post-test surveys. This data was collected by an evidence-based tool. The number of antibiotics prescribed was secondary data. The healthcare organization where the data was collected provided secondary data with the use of their electronic health record (EHR) system, Cerner. The quality department provided the principal investigator the monthly total of antibiotics prescribed for URIs and sinusitis.

To ensure confidentiality remained with all patients, the data was stored on the investigators' personal laptop. The laptop was password protected and placed in a safe only accessible by the primary investigator. The data will be stored for three years and then will be discarded per Georgia College and State University policy.

Measurement Tools

Two measurement tools were utilized for this translational project. The first tool measured patient demographics. The demographic section was a self-made tool by the primary investigator. For confidentiality, subjects only acknowledged their gender and provided the number of years they had practiced as a physician or an APP.

The second tool used for this study was a psychometric tool that was developed by A. Rodrigues et al., (See Appendix 1). The tool was developed in Portugal and did not have a specific name but for this study has been given the name Antibiotic Knowledge Survey (AKS).

The instrument measures the providers' knowledge and understanding of antibiotics. The tool was developed in 2015 and has only been used once to test hospital providers versus outpatient providers' perception of antibiotic use. The tool has a Cronbach alpha of 0.77 and an intra-correlation coefficient (ICC) of greater than 0.4 in the outpatient setting. The tool is reliable but needs further testing to show validity. Participants answered 26 questions on a 5-point Likert scale that evaluated their understanding of prescribing antibiotics for upper respiratory infections and sinusitis. There was no right or wrong answer for this survey. Each item had a score with values ranging from 1 to 5, with the total possible score being 135. Results were interpreted as a lower average score resulting in a better understanding of antibiotic prescribing and a higher average score resulting in a lack of antibiotic prescribing knowledge. The publishers have granted utilization of the tool provided credit is given to the authors.

Implementation

The primary investigator met with the physicians and APPs in July 2019 to administer the pre-test. After the pre-test, subjects were educated on the IDSA guidelines for rhinosinusitis. Explain the type of education, how long did the session last? The individuals were able to ask questions at any time during the training session and after. The principal investigator provided a contact number for the subjects to call if needed. The providers were given a laminated copy of the IDSA guideline to have as a reference while seeing patients. After using the guideline algorithm for ten weeks, the primary investigator met with the providers to administer the post-test to assess if knowledge of antibiotics improved after utilizing the algorithm. The primary investigator then reviewed organizational data to assess the number of antibiotics prescribed 6 months prior to intervention and 6 months post-intervention for the diagnosis of sinusitis.

Chapter IV

Results

The results of this descriptive study are reported in this section. The report includes demographic characteristics as well as pre-and post-test outcomes of antibiotic prescribing knowledge for rhinosinusitis. Reliability testing for the instrument was conducted and is reported here.

Data analysis began with an assessment for missing data using IBM's statistical package for social sciences (SPSS) version 24. Mean substitution was used for missing descriptive characteristics such as….. Once standard data cleaning was complete, all scale level variables were assessed for normality with the appropriate parametric test, and all were found to be normally distributed.

Sample Description

A total of nineteen providers participated in the study. Two participants had a response rate of less than 50%. These two participants were excluded from the study, leaving seventeen participants. Further discussion will only include the seventeen participants who completed the pre- and post-survey. Providers were grouped as either physicians or advanced practice providers (APPs). Nurse Practitioners and Physician Assistants were placed in the APP category.

Of the 17 providers, there were three physicians (17.6%) and 14 advance practice providers (82.4%). Eight participants were male (47.1%), and nine were female (52.9%). The years of practice range from three months to 30 years, with the average years of practice being 5.9 (see Table 1).

Table 1.

Sample Characteristics

Characteristics	N	%
Gender		
Male	8	47.1
Female	9	52.9
Provider Type		
Physician	3	17.6
Advanced Practice Provider	14	82.4
Characteristic	$\bar{X}$(SD)	Range
Years of Practice	5.9(7.5)	0.3-30

Instrument

Prior to the study the AKS tool had a reliability score of 0.77 with outpatient provider use. Reliability for this tool pre-intervention produced a Cronbach alpha score of 0.75 and a post-intervention score of 0.70. Combined pre-test and post-test reliability produced a Cronbach alpha score of 0.82, therefore indicating instrument reliability throughout the project.

Clinical Question 1: How does implementing an evidence-based guide affect a provider's knowledge of antibiotic prescribing for rhinosinusitis from baseline to two months?

A paired-samples *t*-test was used to test the hypothesis that a provider's knowledge of antibiotic prescribing for rhinosinusitis would increase from pre-intervention to 10 weeks post-

intervention. This hypothesis was not supported. Providers showed a slight improvement in knowledge of antibiotic prescribing for rhinosinusitis (M 76.2, SD 8.6), although not significantly different from pre-test knowledge (77.2, SD 9.4), $t(16) = 0.63$, $p = 0.53$.

Table 2.

Antibiotic Survey Results (Pretest/Posttest)

Variable	Pre-intervention $\bar{X}$(SD)	Post-intervention $\bar{X}$(SD)	*P*
Antibiotic Knowledge Survey	77.2(9.4)	76.2(8.6)	0.53

Clinical Question 2: What effect does implementing evidence-based guidelines have on the number of antibiotics prescribed for rhinosinusitis?

A paired-samples *t*-test was used to test the hypothesis that the number of antibiotics prescribed will decrease significantly with the use of evidence-based guidelines. This hypothesis was not supported. The number of antibiotics decreased (M 569, SD 711.8), although not statistically significant from pre-intervention (583.3, SD 684.8), $t(0.84) = 2$, $p = 0.49$

Table 3.

Total Antibiotics prescribed results (Pre-intervention/post-intervention)

Variable	Pre-intervention $\bar{X}$(SD)	Post-intervention $\bar{X}$(SD)	*P*
Number of antibiotics prescribed	583.33(684.8)	569(711.8)	0.49

Miscellaneous Findings that are not related to Clinical Question

Further data analysis revealed statistically significant findings. Each question from the survey was analyzed using the paired samples *t*-test. Results revealed that providers prescribed antibiotics significantly more to gain patient trust before the initiation of the evidence-based guideline (M 2.18, SD 1.2), than 10-weeks post guideline (M 1.17, SD 0.77), $t(16) = 2.05$, $p = 0.05$. Further evaluation into why prescribers prescribed antibiotics to gain patient's trust will need to be addressed. Also, the healthcare organization will be able to use this information to provide an education intervention with the community on the overuse of antibiotics. A paired samples *t*-test also revealed significantly higher use of educational courses 10-weeks post guideline intervention (M 4.24, SD 0.56) than prior to guideline intervention (M 4.59, SD 0.50), $t(16) = 2.07$, $p = 0.05$. These findings indicate that providers were more likely to use educational courses after the initiation of the evidence-base guideline for rhinosinusitis. Indicating continued education interventions with evidence-based guidelines is warranted in this prescriber population.

Table 4.

Antibiotic Knowledge Items

Variable	Pre- Intervention $\bar{X}$(SD)	Post-Intervention $\bar{X}$(SD)	*P*
1.Antibiotic resistance is an important Public Health Problem in outpatient setting?	4.88(0.33)	4.76(0.56)	0.49
2. In a primary-care context, one should wait for microbiology results before treating an infectious disease?	2.94(0.89)	2.94(1.08)	1.0
3. Rapid and effective diagnostic techniques are required for diagnosis of infectious diseases?	3.53(0.94)	3.53(1.23)	1.0
4. The prescription of an antibiotic to a patient does not influence the possible appearance of resistance?	1.71(0.58)	1.71(0.68)	1.0
5. I am convinced that new antibiotics will be developed to	2.24(0.83)	2.24(0.75)	1.0

solve the problem of resistance?			
6. The use of antibiotics on animals is an important cause of the appearance of new resistance to pathogenic agents in humans?	2.88(0.85)	3.18(0.95)	0.13
7. In case of doubt, it is preferable to use a wide spectrum antibiotic to ensure that the patient is cured of infection?	2.24(0.97)	2.24(1.09)	1.0
8. I frequently prescribe an antibiotic in situations in which it is impossible for me to conduct a systematic follow-up of the patient?	2.41(1.12)	2.18(1.01)	0.33
9. In situations of doubt as to whether a disease might be of bacterial etiology, it is preferable to prescribe an antibiotic?	2.24(0.83)	2.12(0.85)	0.57
10. I frequently prescribe antibiotics	2.18(1.28)	1.71(0.77)	0.05

because patients insist on it?			
11. I sometimes prescribe antibiotics so that patients continue to trust me?	1.76(0.97)	1.65(0.78)	0.65
12. I sometimes prescribe antibiotics, even when I know they are not indicated because I do not have the time to explain to the patient the reason why they are not called for?	1.65(0.99)	1.47(0.51)	0.48
13. If a patient feels that he/she needs antibiotics he/she will manage to obtain them at the pharmacy without a prescription, even when they have not been prescribed?	1.71(0.77)	1.88(1.05)	0.33
14. Two of the main causes of the appearance of antibiotic resistance are patient self-medication and antibiotic misuse?	4.41(0.79)	4.59(0.50)	0.48
15. Dispensing antibiotics without a	4.47(0.62)	4.41(0.61)	0.66

prescription should be more closely controlled?			
16. In a primary-care context, amoxicillin is useful for treating most respiratory infections?	2.94(1.24)	3(1.17)	0.85
17. The phenomenon of resistance to antibiotics is mainly a problem in hospital settings?	1.47(0.51)	1.82(0.95)	0.16
18. How do you rate your usefulness of clinical practice guidelines?	4.82(0.52)	4.82(0.39)	1.0
19. How do you rate your usefulness of documentation furnished by the pharmaceutical industry?	2.24(1.39)	2.47(1.58)	0.45
20. How do you rate your usefulness of courses held by the pharmaceutical industry?	2.29(1.26)	2.29(1.31)	1.0
21. How do you rate your usefulness of information furnished	3.29(1.10)	3.35(1.16)	0.85

by medical information officers?			
22. How do you rate your usefulness of previous clinical experience?	4.12(0.92)	3.76(0.90)	0.11
23. How do you rate your usefulness of educational courses?	4.59(0.50)	4.24(0.56)	0.05
24. How do you rate usefulness from contribution of specialists?	4.12(0.20)	4.12(0.18)	1.0
25. How do you rate usefulness of peer contribution?	3.82(0.88)	3.71(0.77)	0.57
26. How do you rate usefulness of data collected via internet?	2.29(1.68)	2.06(1.63)	0.50

Chapter V

The findings and conclusion from this descriptive study will be discussed in this chapter. Demographics will be compared with the overall demographics of the providers in the primary care clinic of the rural health organization. Study limitations, strengths, and implications for primary care providers in the future will also be discussed in this chapter.

Clinical Question 1: Knowledge

Previous research has shown that providers have a good understanding of when to prescribe antibiotics for sinusitis. Previous study findings from Fransciesco et al., (2018) and Ryves et al., (2016) showed providers understand when antibiotics are appropriate. This finding did not show a change in knowledge of when antibiotics are prescribed, but this could be due to providers understanding when antibiotics are warranted. A study by Flecther-Larty, Yee, Gaardy, and Khan (2016), found that providers were 56% more likely to prescribe antibiotics based on patient preference. This study adds to previous research where providers prescribed antibiotics due to patient perception and not related to a lack of knowledge.

Clinical Question 2: Education intervention

There have been previous studies that used educational interventions with the implementation of guidelines. These studies have produced a decrease in the number of antibiotics. Urrasano et al., (2014) used guidelines to decrease the number of antibiotics prescribed by 21%. In this study, there was a clinical decrease in the amount of antibiotics prescribed with the use of ISDA guidelines. This study can be added to previous research regarding guidelines and the reduction of antibiotic use for sinusitis.

Strengths and Limitations

A unique aspect of this study is that it added to the reliability of the antibiotic knowledge tool. Rodriguez et al., (2016) previously developed the tool to be used in the primary care and acute care setting. For the primary care setting, the Cronbach alpha score was above 0.70, making it a reliable instrument (Rodriguez et al., 2016). The Cronbach alpha score for this study was 0.82 for the pre-test and post-test. This adds to the reliability of the tool, making this a vital strength of the study. This tool can be used in future studies to assess primary care provider's knowledge of antibiotic use.

The study included a total of seventeen participants, with fourteen participants being advanced practice providers and three participants being physicians. Two participants were removed due to not completing 50% of the survey. There is a total of thirty providers in the clinic where the study was held, with seven physicians and one advance practice provider choosing not to participate. More participation aspects, such as the number of years of practice, and knowledge of antibiotic prescribing, could have been assessed. Future studies could also evaluate the amount of antibiotics prescribed by each group of providers such as physicians, physicians assistants and nurse practitioners. Lack of participation was the main limitation of this study. Another limitation included the time frame of the study. The six months immediately prior to the study was during months when sinusitis symptoms are traditionally low (put those months here), and the months immediately following the intervention (put those months here) are months that antibiotic use is naturally higher due to increased cases of rhinosinusitis. If the study was repeated, a more extended comparison between years could be made to assess the number of antibiotics prescribed per month from year to year.

Implications for Practice

Through this study, the amount of antibiotics prescribed for the treatment of rhinosinusitis did decrease with the use of evidence-based guidelines, although the decrease was not statistically significant. While the study focused on reducing antibiotic use and improving providers' knowledge of antibiotic prescribing, other implications for further research were identified. The finding that providers often prescribe antibiotics due to patient preference adds to previous research. According to Ojo (2018), providers who prescribed antibiotics due to patients' perceptions and knowledge of when antibiotics were necessary improved with educational interventions. This study can be used as the basis for future studies regarding provider knowledge and the need for more patient education. Healthcare organizations can utilize educational courses to help clinicians better understand the guidelines that are available for their use. Clinicians using these tools can better address patient questions on when antibiotics are appropriate for rhinosinusitis and help change their perception.

Conclusion

In conclusion, this study found that the use of evidence-based guidelines did show a decrease in the number of antibiotics prescribed, even though it was not statistically significant. Furthermore, the study found that prescribers are knowledgeable of clinical guidelines but still prescribe antibiotics based on the patient's perception. Future research should focus on educating patients on when antibiotics are necessary for the treatment of rhinosinusitis. Continued education on the misuse and overprescribing of antibiotics is needed to reduce resistance in the future.

Appendix 1

Section 1 – Antibiotics and resistance tool

S 1: Antibiotic resistance is an important Public Health problem in our setting.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 2: In a primary-care context, one should wait for the microbiology results before treating an infectious disease.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 3: Rapid and effective diagnostic techniques are required for diagnosis of infectious diseases.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 4: The prescription of an antibiotic to a patient does not influence the possible appearance of resistance.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 5: I am convinced that new antibiotics will be developed to solve the problem of resistance.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 6: The use of antibiotics on animals is	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree

an important cause of the appearance of new resistance to pathogenic agents in humans.					
S 7: In case of doubt, it is preferable to use a wide-spectrum antibiotic to ensure that the patient is cured of an infection.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 8: I frequently prescribe an antibiotic in situations in which it is impossible for me to conduct a systematic follow-up of the patient.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 9: In situations of doubt as to whether a disease might be of bacterial aetiology, it is preferable to prescribe an antibiotic.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 10: I frequently prescribe antibiotics because patients insist on it.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree

S 11: I sometimes prescribe antibiotics so that patients continue to trust me.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 12: I sometimes prescribe antibiotics, even when I know that they are not indicated because I do not have the time to explain to the patient the reason why they are not called for.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 13: If a patient feels that he/she needs antibiotics, he/she will manage to obtain them at the pharmacy without a prescription, even when they have not been prescribed.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 14: Two of the main causes of the appearance of antibiotic resistance are	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree

patient self-medication and antibiotic misuse.					
S 15: Dispensing antibiotics without a prescription should be more closely controlled.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 16: In a primary-care context, amoxicillin is useful for treating most respiratory Infections.	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree
S 17: The phenomenon of resistance to antibiotics is mainly a problem in hospital settings	Strongly Agree	Agree	Unsure	Strongly Disagree	Disagree

Section 2 – In the treatment of respiratory tract infections, how would you rate the usefulness of each of these sources of knowledge? Rate on a scale of 0-10. 0 being the lowest and 10 being the highest

S 1': Clinical practice guidelines.

S 2': Documentation furnished by the Pharmaceutical Industry.

S 3': Courses held by the Pharmaceutical Industry.

S 4': Information furnished by Medical Information Officers.

S 5': Previous clinical experience.

S 6’: Continuing Education Courses.

S 7’: Others, e.g., contribution of specialists

S 8’: Contribution of peers (of the same specialization).

S 9’: Data collected via the Internet.

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