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Assessment of Appropriate Antibiotic Usage After Intervention to Increase Antibiotic Stewardship in a Rural Health Care Setting

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ASSESSMENT OF APPROPRIATE ANTIBIOTIC USAGE AFTER INTERVENTION TO INCREASE ANTIBIOTIC STEWARDSHIP IN A RURAL HEALTH CARE SETTING

by

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ABSTRACT

Antibiotics are a powerful and useful tool prescribed by healthcare providers to treat bacterial infections in patients. However, when antibiotics are unnecessarily prescribed or improperly consumed or not consumed by patients, antimicrobial resistance (AMR) can ensue. Antibiotic resistance (ABR) is an urgent public health threat and is, unfortunately, the root cause of many deaths in the United States every year. According to the Centers for Disease Control (CDC), in the United States, more than 2.8 million antimicrobial-resistant infections occur each year, and more than 35,000 people die as a result (Centers for Disease Control [CDC], 2022a). Even further, when infections by *Clostridioides difficile* (C. diff) are combined with the results, the infection rate by antimicrobial resistant infections rises to three million infections with 48,000 deaths. The statistics are staggering, and without proper intervention and education to the general public, along to providers, the numbers will steadily increase. Not only will the issue be a public health threat, but instead, it will become a public health emergency.

The DNP project is aimed at utilizing patient education to combat antibiotic resistance in the rural community. Adult patients ages 18-65 will be assessed by the healthcare provider and doctoral student for the need of an antibiotic prescription during the clinic visit. After the appropriate antibiotic is chosen, a pre-questionnaire will be administered to determine the patient's baseline knowledge on antibiotics. Then, the doctoral student will provide the patient with verbal education and two handouts he or she can take home from the clinic. Questions will be appropriately answered by the doctoral student, and then, a post-questionnaire will be conducted to determine if the education provided was successful and beneficial. The identity of the participants will be

kept confidential, and the questionnaires will be conducted anonymously. The over-arching goal of the DNP project is to examine at least a 50% increase in post-education questionnaire scores, along with 50% of participants stating the education provided was both effective and beneficial.

ACKNOWLEDGMENTS

To Dr. Lisa Morgan, thank you for being such a wonderful instructor, leader, and friend. Ms. Jeanne Stewart, I do not think anyone replies to emails faster or is more eager to help than you. The guidance you provided helped make the DNP project a success. Southern Miss is fortunate to have the two of you.

To The University of Southern Mississippi, thank you for shaping me into a registered nurse as an undergraduate student and future nurse practitioner as a graduate student. Southern memories I shall always cherish. I am forever and always a Golden Eagle.

DEDICATION

I dedicate the totality of this project to my precious son, Henry Callaway Speights, who was born during the spring semester of our final year. Numerous pages of this DNP project were written with him sleeping peacefully on my chest. May he always be proud to call me his mother and know I love him till my last breath, and even after that.

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LIST OF ABBREVIATIONS

AACN	American Association of Colleges of Nursing
ABR	Antibiotic Resistance
AMR	Antimicrobial Resistance
CDC	Centers for Disease Control
CLABSI	Central Line Associated Blood Stream Infection
DNP	Doctor of Nursing Practice
ESBL	Extended-Spectrum Beta-Lactamases
FDA	Food and Drug Administration
HIPAA	Health Insurance Portability and Accountability Act
IRB	Institutional Review Board
MRSA	Methicillin-Resistant Staphylococcus-Aureus
USM	The University of Southern Mississippi
WHO	World Health Organization

CHAPTER I – INTRODUCTION

Background

Antimicrobial resistance is an increasing local and global health threat, and without proper intervention and education, more lives will continue to be lost. Resistant infections can be difficult, and sometimes impossible, to treat (CDC, 2022b). Measures can be taken prior to such morbidity and mortality associated with resistance, such as appropriate antibiotic selection by the provider and correct usage of prescribed antibiotic by the patient. The most important ways to prevent antibiotic resistance by the patient are to complete the full course of antibiotics as prescribed, not share antibiotics, and not store the medication for future use. If antibiotics and antifungals lose effectiveness, then we lose the ability to treat infections and control public health threats (CDC, 2022a). There are many misconceptions surrounding antibiotic use and education given by the healthcare provider at time of prescription is the cornerstone of preventing the misuse of them. Patients, especially those who live in rural areas, may be unfamiliar with terms such as antibiotic resistance and stewardship, and it is up to healthcare professionals to provide the crucial instructions and education to aid in the fight of the crisis and to improve overall patient outcomes.

Significance

Worldwide, at least 1.27 million people die every year due to antibiotic resistant infections, and in 2019, the number soared to five million deaths. Not only does the issue occur globally, but also presently in the United States. In the United States, more than 2.8 million antimicrobial-resistant infections occur each year, and more than 35,000 people die as a result (CDC, 2022a). The unfortunate occurrence is significant not only due to

the lives lost, but antibiotic resistance also contributes to increased hospital admissions, readmissions, and overall healthcare costs. For people who are at highest risk, a number of antibiotic resistant infections have a disproportionately larger negative impact. Social determinants of health are closely tied with the risk of contracting antibiotic-resistant infections. The disparities are most obvious among women who are pregnant, people of color, the elderly, those with weakened immune systems, and with certain pre-existing conditions, such as diabetes mellitus. Resistant infections superfluously impact younger children, men who have sex with men, and racial or ethnic groups who, historically, have faced great health disparities. Other health-related social determinants which increase the risk of contracting a resistant infection are structural inequities and socioeconomic factors, such as access to health care, level of education, lack or type of health insurance, type of housing, and overall household income.

Problem Statement

Antibiotic resistance is a steadily growing public health issue in Mississippi, the United States, and athwart the globe. Numerous studies have shown an insufficiency of knowledge which exists among the general population on antibiotics and the appropriate usage of them. The deficiency of knowledge leads to increasing amounts of antimicrobial resistant infections, which may have been prevented with appropriate education by the healthcare provider. Providing patients with education will vastly increase knowledge on the antibiotics, which are being prescribed to the patients and, in turn, will aid in decreasing the amount of documented antimicrobial resistant infections in Mississippi. The DNP project will utilize verbal education, as well as two educational handouts, which will be provided to take home by the participants of the study. The researcher's

goal is to demonstrate education is vitally important by the healthcare provider when prescribing an antibiotic. The goal will be accomplished by seeing an increase in scores between the pre-questionnaire and post-questionnaire, as well as patient verbalization education was both beneficial and useful.

PICOT

In adult patients ages 18-65 in a primary rural health care clinic, will an educational intervention increase knowledge of antibiotics during a clinic visit?

Available Knowledge

An abundance of information is readily available via the Internet regarding antibiotic resistance and antibiotic stewardship for the general population to access. The information includes extensive scientific research on the issue and methods to avoid it. The Centers for Disease Control and Prevention (CDC) has one of the largest sources of information readily available and also leads the U.S. public health response to combat antimicrobial resistance, a threat that can continuously emerge and spread across the world (CDC, 2023).

The World Health Organization (WHO) lists antibiotic resistance as a high priority and initiated a global action plan on antimicrobial resistance in May of 2015. The global action plan has five strategic objectives: to improve awareness and understanding of antimicrobial resistance, to strengthen surveillance and research, to reduce the incidence of infection, to optimize the use of antimicrobial medicines, and to ensure sustainable investment in countering antimicrobial resistance (World Health Organization [WHO], 2023).

The Food and Drug Administration (FDA), in cooperation with other government agencies, has launched many initiatives to address the giant of antibiotic resistance. Drug labeling regulations, encouraging providers to prescribe antibiotics only when deemed necessary and to instruct patients about the veracious use of antibiotics and the vitality of taking the medication as directed, help emphasize the sensible use of antibiotics. In all, the problem of antibiotic resistance is recognized as one of the largest public health threats facing humanity today, and numerous organizations are working diligently to help reduce the occurrence of resistant infections.

Needs Assessment

Antibiotic resistance is one of the most immense public health threats in Mississippi, America, and across the globe. Although a plethora of information is available on the web, it is not common knowledge to know, especially in rural communities, about correct antibiotic usage and antibiotic resistance. While obtaining clinical practice hours as a family nurse practitioner student in the clinical setting, the student observed a dire need for education on antibiotics for patients in the community during routine primary health care visits. Not completing the course of antibiotics and sharing antibiotics among family members and friends are quite common, and both contribute to the growing issue of antibiotic resistance.

In 2021, Mississippi's central line-associated bloodstream infection (CLABSI) rate was 20% higher compared to the national baseline. Methicillin-resistant *Staphylococcus aureus* (MRSA) rates in Mississippi in 2021 were 53% higher compared to the national average. The rates are astonishing to examine, and without proper

education and intervention, Mississippi will continue to see exorbitant numbers and the other unstated infection rates increase.

Synthesis of Evidence

Evidence-Based Search

Since antibiotic resistance is a substantial public health threat, a copious amount of information has been published and made readily available for educational purposes. The University of Southern Mississippi's (USM) library website was utilized by the doctoral student to access the Google Scholar and CINAHL databases. Multiple searches were conducted within the database to include keywords such as *antibiotics, resistance*, and *prevention.* The initial search of antibiotic resistance produced over 4 million results. The researcher then narrowed the date range from 2018-2023, a five-year span, which yielded 21,200 results. The articles were refined by adding more key words such as *rural health care, Mississippi,* and *education.* The library website for USM was further utilized to access the CINAHL database. The initial search produced 16,998 results for *antibiotic resistance.* Then, the date range was changed to include only articles from the years 2018-2023, a five-year span, which showed 5,251 articles. A more advanced search was conducted to include only full-text articles and those which were generated in the United States, which offered 1,577 articles.

Focused Topics and Evidence-Based Findings

Prevalence

Antibiotics were created to treat bacterial infections, which have been a major cause of disease and mortality since the beginning of human history. However, the continued success of antibiotics is threatened by the rise of antimicrobial resistance.

Many pathogenic bacteria have evolved resistance to the main classes of antibiotics, and multi-drug resistant bacteria have caused untreatable infections (Maclean & Millan, 2019). Research has consistently shown around 30% of antibiotics prescribed in the health care setting are unnecessary, further contributing to the drug resistance. Annually, four out of five people get prescribed an antibiotic in the United States. Antibiotic resistance comes with major economic burdens, also. The global annual cost of ABR could increase to 10 million deaths and US $100 trillion by 2050 (Maclean & Millan, 2019). The numbers are astronomical and encapsulate the ever-consuming presence of antibiotic resistance in the United States.

Each year in the United States, 2.8 million infections contributed to resistant pathogens occur, with 35,900 attributing deaths. It would be impossible to include all of the bacteria-specific data in the DNP project paper, but some statistics are difficult to ignore. Presently, nearly 200,000 extended-spectrum β-lactamase (ESBL) *Enterobacteriaceae* infections occur among patients in the United States, which represent an alarming 50% increase over the last half decade (Kadri, 2020). Once easily treatable bacterial infections have become extremely difficult to treat due to antibiotic resistance.

The World Health Organization created a list of six pathogens which were deemed the greatest threats to human health due to the resistance mechanisms the pathogens have developed. The pathogens the WHO lists include *Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa,* and *Enterobacter species.* It is deemed necessary for researchers to study the mechanisms of resistance these bacteria possess to aid in the development of new antibiotic medications to fight off the drug-resistant bacterium.

Education

Inappropriate use and overuse of antibiotics seem to be some of the main drivers of antimicrobial resistance, and both can be prevented by thorough education at the time of prescription in the healthcare setting. One study conducted by Lee, et. al., found on average, the number of inappropriate antibiotic prescriptions was reduced by more than 41% after proper education (2014). The results indicate clinician education can significantly improve antibiotic prescribing (Lee et. al., 2014). Healthcare providers can also benefit from education on proper prescription of antibiotics and can be intimidating to do. Unfortunately, there have been instances where patients can persuade the provider into prescribing an antibiotic against the provider's professional judgement.

Rationale

Theoretical Framework

The theory which aligns the most with the DNP project is Peplau's Interpersonal Model by Hildegard Peplau. Peplau used qualitative methods to examine something of interest and then used quantitative methods to test an intervention targeted at the problem (Zaccagnini & Pechacek, 2021). The model consists of four different phases in the interpersonal relationship, which are orientation, identification, exploitation, and resolution. The orientation phase identifies the problem and starts when the researcher and the patient meet. The identification phases encompass the selection of the appropriate intervention for the problem, such as education on antibiotic resistance, for example. The exploitation phase would reflect the education provided for the patient on proper antibiotic usage. Finally, the resolution phase is the termination of the interaction between the researcher and the participant, where the researcher can determine if

educational needs were met by the patient completing the post-education questionnaire. The intervention, proper patient education in the healthcare setting, is assumed by the doctoral student to be successful due to the lack of knowledge about antibiotics that exists among those to whom have prescribed them.

Specific Aims

The purpose of the DNP project was to provide education to patients in a rural health care setting being prescribed an antibiotic to increase antibiotic stewardship and help decrease antibiotic resistance rates in Mississippi. An existing lack of knowledge exists among those who have not been educated on the proper usage of antibiotics and education is the cornerstone of fixing a simple, yet complex, problem. Previous reports indicate more than one-third of patients do not fully adhere to antibiotic treatment regimens, around 50% cease the antibiotic treatment upon improvement, and one-third store antibiotic leftovers for future use (Mallah et al., 2022). The doctoral project addresses the issue of antibiotic resistance, and efforts were made to help reduce and prevent it in the surrounding community.

DNP Essentials

The first DNP Essential aligning with the doctoral project is Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking. Organizational and systems leadership are critical for DNP graduates to improve patient and healthcare outcomes (AACN, 2006). The Essential aims to eliminate disparities in healthcare and to promote patient safety and practice excellence. The second DNP Essential addressed in the doctoral project is Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice. Nursing practice is improved by

solving problems and improving health outcomes through research. The doctoral project will exemplify the Essential through research on antibiotic resistance and improving patient outcomes through assessment and education. The third DNP Essential which will be incorporated into the project is Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes. To combat an overwhelming issue, which is antimicrobial resistance, different team members should be involved. For the project, it will be the doctoral student, the family nurse practitioner, and the patients involved. Arguably, the most important DNP Essential utilized is Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health. The implementation of clinical prevention and population health activities is central to achieving the national goal of improving the health status of the population of the United States (AACN, 2006). The overall aim of the project most closely resembles the DNP Essential by providing patient education to promote patient health and prevent the spread of antibiotic resistance.

Summary

Education provided to patients receiving antibiotics is essential to prevent the ever-growing issue of antibiotic resistance. The doctoral project is a gateway to assess educational needs in a rural health care setting and equip patients with knowledge which will hopefully last the lifetime and spread to those around them. As healthcare professionals, it is easy to assume the general population shares the same comprehension as we on appropriate antibiotic usage and antibiotic stewardship. However, thinking along swayed lines can be detrimental in the aid to combat antimicrobial resistance in our communities, state, and country. With proper education in the clinical setting, the goal is

to see at least a 50% increase in post-questionnaire scores completed by the participants, and at least 50% state the education provided on antibiotics was both beneficial and useful.

CHAPTER II – METHODOLOGY

Context

The DNP project was conducted at a local rural family health clinic located in Columbia, Mississippi. The clinic is one of few in the community and treats patients of all ages, with many different types of health conditions. The clinic consists of one doctor and two nurse practitioners, along with nurses and other ancillary staff. To begin the DNP project process, patients were assessed by the nurse practitioner and nurse practitioner student during the routine health visits for the need of an antibiotic prescription. Verbal education, along with two handouts from the CDC, were provided by the doctoral student to increase patient knowledge on antibiotics. Patients in the community lack proper education on antibiotic resistance, and the DNP project was designed to assess and educate patients to increase antibiotic stewardship in a rural health care setting.

Intervention

Education in the primary health care setting is vital to improve antibiotic stewardship among the general population. The DNP project was designed as a stepwise process which begins upon meeting and greeting the patient. The idea began when the researcher examined patients in the clinical setting stating misuse of antibiotics and/or requested a prescription for an illness which did meet antibiotic prescription requirements. Quality improvement will be exemplified since there is an abounding need for education regarding proper education use. Once the patient portion of the intervention was complete and results are analyzed, the doctoral student presented to the clinic providers during a clinic meeting regarding the findings. The objective was to educate the providers on the importance of taking the time to properly educate the patients on

antibiotics during the clinic visit, and after statistical analysis, the numbers were expected to reflect the success of doing so. The doctoral student also assembled an educational handout the providers can supply to the patients to take home, to further instate the education. Not only will patients and families benefit from an educational intervention, but also the entire health system by combatting antimicrobial resistance through education.

Step I- Assessment and Pre-Questionnaire

To begin the DNP project, the doctoral student discussed the need of education for patients receiving antibiotic prescriptions in the clinic setting. The idea was brought forth to the rural health care clinic providers, and all were in agreement the intervention would be both useful and beneficial for patients under care. Patients were seen, as usual, by the health care provider, and along with the doctoral student. The provider and doctoral student determined if the adult patients, ages 18-65, met the need for an antibiotic prescription. Then, the patients who were given a prescription for an antibiotic were provided with a five-question knowledge assessment designed by the doctoral student in the form of a pre-education questionnaire. The patients' identities were kept confidential, and answers were provided anonymously. The doctoral student then gave the patients a score for the pre-education questionnaire. The data from the questionnaires was kept safe in a locked cabinet and data stored on the computer was password protected.

Step II- Education

The researcher then provided each patient with at least five to ten minutes of verbal education on proper antibiotic use, antibiotic resistance, and the importance of

antibiotic stewardship. Two different handouts by the CDC were chosen and printed out by the researcher. The CDC offers multiple tools, materials, and handouts to educate the general population on antimicrobial resistance and appropriate prescription use of antibiotics for infections. Permission is not needed to print, copy, or distribute any materials (CDC, 2021). The first handout labeled "*Antibiotics Aren't Always the Answer*" was given to each patient who participated in the activity. The handout highlights the importance of taking antibiotics exactly as prescribed, not saving antibiotics for later use, and the side effects the patient may experience from antibiotics. The second handout titled "*Viruses or Bacteria: What's Got You Sick?*" is set up as a table with nine different infections labeled, along with the common causes, and if antibiotics are needed for the specific infection or not. The two handouts were later taken home by the patients.

Step III- Evaluation and Post-Questionnaire

For the final step of the DNP project, the researcher supplied the patient participants with the post-questionnaire, which consisted of the same five questions as the pre-questionnaire, along with one extra question about effectiveness of the intervention. The same questions were used to assess the credibility and efficacy of the education provided. The overall goal of the intervention was to see an increase in scores of the questionnaires by 50% and to see at least 50% of research participants to check the education provided was useful, which was question six. All verbal questions were answered by the researcher, and patients were thanked for participating in the DNP project.

Step IV- Provider Education

The data was analyzed and prepared for presentation to the clinic providers, which consist of one medical doctor and two-family nurse practitioners, in a meeting held by the doctoral student. Research has shown that educating providers on appropriate prescribing of antibiotics and on the importance of educating patients during each interaction increases overall positive patient health outcomes and helps decrease antibiotic resistant infection rates. This educational change in practice can make a monumental difference in the way patients view antibiotics and seek the use of them in the future. The information was presented to the clinic providers, and all questions were appropriately answered about the study and findings. The providers were encouraged to take the time during each visit, when prescribing an antibiotic, to educate the patient on appropriate use, antibiotic resistance, and how to practice antibiotic stewardship. To further the education, the doctoral student printed out educational handouts from the Centers for Disease and Control Prevention website, which are made free for public use. The providers were also encouraged to disperse the handouts among patients at the end of the visits.

Study of the Intervention

The study of the intervention for the particular DNP project involved examining the pre-questionnaires and post-questionnaires. Scores were given for each patient's pre-questionnaire before education was provided to obtain a base level of understanding and knowledge on antibiotics. After education was provided and handouts were given, the patient completed the post-questionnaire, and scores were tallied for it, also. The only question not taken into account was question number six, which inquired about the

usefulness of the intervention. Question six was another way to study the intervention's effectiveness, apart from the questionnaire scores. If the education was successfully completed, the patients' scores would improve when comparing the pre-questionnaire to the post-questionnaire, and at least 50% of participants, when answering question six, would state the intervention was beneficial and useful to them.

Population of Interest

The population of interest for the DNP project was adults ages 18-65. The priority for the population was to improve knowledge about antibiotics and improve antibiotic stewardship within the age group. Although antimicrobial resistance does not discriminate when it comes to age, the age group comprises the largest population in the rural community in which the DNP project was carried out. According to a study by the CDC, antibiotics were prescribed in 11% of 42 million visits, and outpatient settings, adult patient age mix, and state location in the South were identified as top drivers of inappropriate prescribing (CDC, 2022a). In a study published by the CDC in 2021, in Mississippi 1,083 antibiotic prescriptions were given per 1,000 persons population. The numbers are astronomical in comparison to other parts of the United States. Adults in the population are also most likely to inappropriately use prescription antibiotics, whether it be stopping use before completing the entire course, or taking antibiotics with no appropriate indication, such as with a viral infection.

Setting

The Marion General Rural Health Clinic in Columbia, Mississippi, was the setting for the DNP project. The clinic offers a wide variety of services to patients of all ages and backgrounds. Some of the services include administrative healthcare examinations,

diagnostic and therapeutic services, medical emergency procedures, pap smears, minor surgical procedures, primary medical care, and routine healthcare maintenance. The clinic serves multiple surrounding areas and is located on the second story of Marion General Hospital. It is one of the few family health care clinics in the city of Columbia. The clinic has one medical doctor and two-family nurse practitioners and is open Monday through Friday.

Measures

The need for education to the general population in the community was examined by the doctoral student during clinical rotations and approval to carry out the DNP project was obtained by the researcher from administration and clinic staff. Antibiotic resistance is a major public health threat and can be combatted one step at a time through proper education and best health care practices. The measures chosen to collect data for the DNP project were pre and post education questionnaires which were completed by the patients participating. The rationale for choosing the questionnaires was to gain a sense of understanding of patient knowledge with a baseline assessment, and then again after the intervention, or education on antibiotics, was completed. The method is both valid and reliable and patients were encouraged to answer each question carefully and thoughtfully. Only adults ages 18-65 were allowed to participate.

The process included assessment of patient antibiotic prescription need, then introduction to the study and what the study entailed. Consent was obtained from patients for participation in the student's DNP project. Then, patients completed the pre-education questionnaire, and answers were given a percentage score. The researcher then completed verbal education on appropriate antibiotic use, improper antibiotic use, antibiotic

resistance, and emphasized the importance of antibiotic stewardship. The participants were also given two printed handouts on antibiotics obtained from the CDC website, which he or she could take home to further utilize. Patients were then asked if they had any questions, and the questions patients possessed were thoughtfully answered by the researcher before moving on to the final questionnaire. The patients were then asked to complete the post-education questionnaire, including questions which could be answered by using the verbal education provided by the doctoral student. Scores were analyzed for the post-education questionnaire and imputed into the researcher's data collection tool.

To further emphasize a need for change in practice, the doctoral student presented the findings at a provider meeting held at the health care clinic. It was exemplified education on antibiotics at time of prescription helps to increase the knowledge held by patients and decreases the chances of developing antibiotic resistant infections. All questions from the providers were appropriately answered. The providers were given printed information in the form of a pamphlet from the CDC on antibiotic resistance to disperse in hopes to additionally educate patients. The doctoral student expects the information presented to the providers will aid in a change in practice to improve patient outcomes.

Statistical Analysis

To draw inferences from the data collected, both quantitative and qualitative methods were used. The largest method used was quantitative data through the number of participants in the study, the number of days the study was carried out, and the scores from the participants' pre and post education questionnaires. Scores were evaluated by tallying the number of correct responses on the post-education questionnaire to the

number of correct responses on the pre-education questionnaire. The goal of the researcher was to examine at least 50% of participants' scores increase and state the education was useful and beneficial, which comprised question six on the post-education questionnaire. Data was compared individually in the way each patient's individual scores were compared to the pre and post education questionnaire scores.

Ethical Considerations

During the DNP project, patients' privacy and confidentiality were upheld to the highest extent in accordance with the Health Insurance Portability and Accountability Act (HIPAA). The participation of patients in the project was limited to patients examined only at the clinic, ages 18-65, and were prescribed an antibiotic during the visit. The information collected during the visit with the healthcare provider included no identifying information, and participation was on a voluntary basis after the researcher carefully described the study. Each participant was also asked to sign a consent form after all questions were answered about the project and interest was obtained to participate. A letter of support from the administrator of the facility was acquired, along with approval from The University of Southern Mississippi's Institutional Review Board (IRB) (Protocol #23-0448).

Project Timeline

The DNP project was proposed on Wednesday, May 3, 2023. Approval by the Institutional Review Board (IRB) was granted on Friday, June 16, 2023. The project began at Marion General Rural Health Clinic on Monday, July 31, 2023, and concluded on Friday, August 4, 2023, after five consecutive clinical days.

Summary

Education is crucial to confront many pressing issues in the world today, and antibiotic resistance is no exception. When a person is infected with an antibiotic-resistant bacterium, not only is treatment of the patient more difficult, but the antibiotic-resistant bacterium may spread to other people (Food and Drug Administration [FDA], 2019). The rise of antibiotic resistance rates is on the forefront of a global public health crisis. Education must be integrated into every health care visit between provider and patient, especially when the patient is receiving a prescription for an antibiotic. Proper use by the consumers can help decrease the rate of antibiotic resistant infections. Proper use includes completing the full course of antibiotic prescription, not sharing antibiotics with friends and family, and not storing antibiotics for future use. Complications of antibiotic resistance include increased risk of severe, extended illness, death, severe medication side effects, longer hospital stays, more medical appointments, and increased medical costs (Cleveland Clinic, 2021). Many patients believe antibiotics are useful for viral infections, but education provided by the healthcare professional can help clarify the false belief among the general population.

Through the doctoral project, the researcher was able to examine a baseline knowledge among patients about antibiotics. Indispensable education was provided, educational handouts were presented to the patients, and questions were thoughtfully answered. The lasting effects of the education provided were examined through the post-education questionnaire, and the researcher was able to conclude if efforts were successful or not. The purpose of the study is to exemplify the need for basic education in

a rural health care setting to improve patients' overall health and help defeat the giant of antibiotic resistance.

CHAPTER III – RESULTS

The DNP project was conceptualized to determine if high quality patient education on appropriate use of antibiotics increased knowledge on prescription usage, with hopes to practice and increase antibiotic stewardship in a rural health care setting. The DNP project took place over the span of five clinical days and was carried out at Marion General Rural Health Clinic. After identification of antibiotic prescription need was verified by the doctoral student and the primary care provider, the study was intricately explained by the student, and all questions from the patients were answered appropriately. In total, 11 patients participated in the research study. After consent was obtained, each individual patient completed a pre-education questionnaire consisting of five questions. If the patient had any questions regarding the questionnaire content, the researcher answered accordingly. After the pre-education questionnaire was complete, the doctoral student then proceeded to verbally educate each patient for a minimum of five minutes on antibiotic resistance, appropriate antibiotic use, the reason behind the antibiotic prescription, and side effects of antibiotics. All questions the patients had regarding antibiotics were considerately answered by the researcher. Finally, each patient completed a post-education questionnaire containing the same questions as the pre-questionnaire to assess education effectiveness. The last question, question number six, inquired if the patient believed the intervention proved to be effective and beneficial. Overall, patient questionnaire scores increased significantly after quality education was provided. A future change in practice was examined by the researcher to benefit patient outcomes and improve community awareness regarding antibiotics. After preparing a presentation, the clinic providers were educated on the results and need for interactive

patient education at time of antibiotic prescription to increase medication adherence and decrease negative patient outcomes. Antibiotic stewardship was exemplified by measuring and improving how antibiotics are used by patients and prescribed by providers.

Overview

Of all patients examined by the doctoral student and nurse practitioner in the clinic setting, 11 chose to participate in the DNP study. No identifying information was obtained from the patients, except their signature on the consent forms, which was shredded and disposed of properly. After all data from the intervention was obtained, a data analysis was performed to determine if the goal of at least a 50% increase of post-education questionnaire scores could be examined, along with at least 50% of participants who stated the education provided was both effective and beneficial. Of all 11 participants, there was one outlier, patient two, who scored 100% on both the pre and post education questionnaires. All of the participants, except patient number seven, scored 100% on the questionnaires after quality education.

Patients 1, 4, 5, 6, and 8 scored 60% on the pre-education questionnaires and 100% on the post-education questionnaires, signifying a 66.6% increase in survey scores. Patient 2, as previously stated, scored 100% on both the pre-education and post-education questionnaires. Patients 3 and 9 both scored 40% on the pre-education questionnaire and 100% on the post-education questionnaire, signifying a 150% increase in survey scores. Patient 7 scored a 40% on the pre-education questionnaire and an 80% on the post education questionnaire, exemplifying a 100% increase in their questionnaire scores.

Patients 10 and 11 both obtained 80% before quality education was provided, and both scored 100% on the post-education questionnaires, indicating a 25% increase in scores.

The average questionnaire score before education was provided on antibiotics was 62%, compared with the average score of 98% after quality education was given by the DNP student. In total, there was a 58% increase in post-education questionnaire scores, which surpasses the original goal of examining a 50% increase by the researcher.

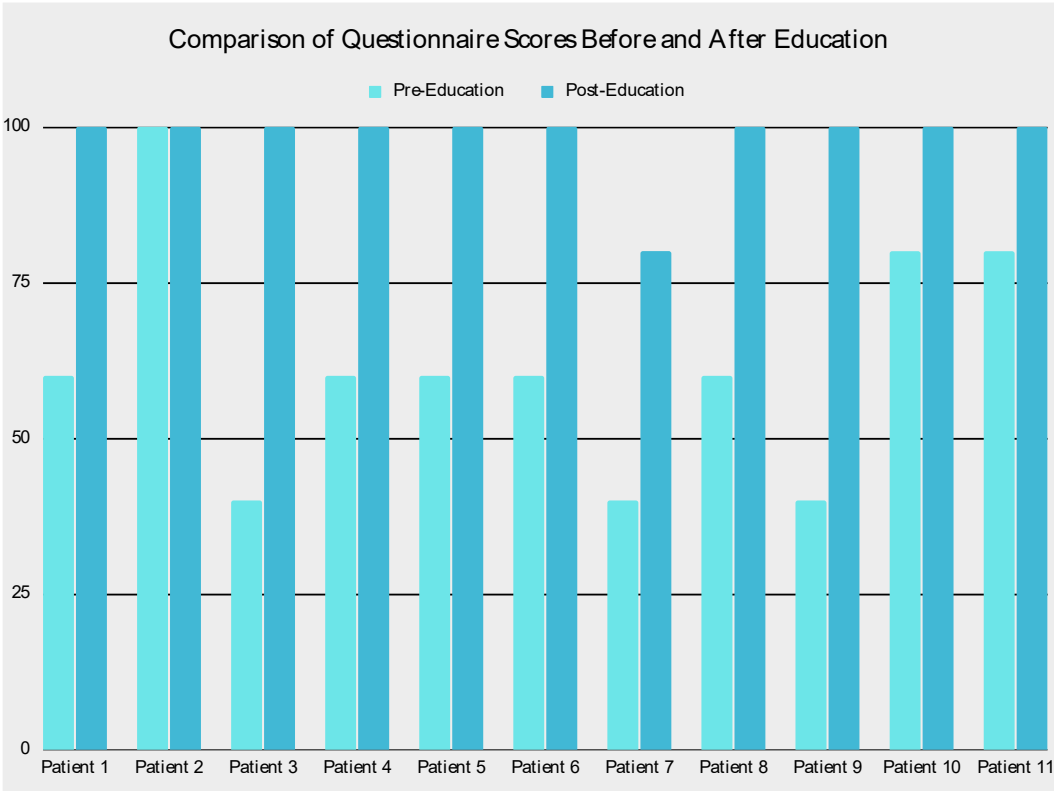

Figure 1. Comparison of Questionnaire Scores Before and After Education.

The final question on the post-education questionnaire was a true or false question which read: *The education provided was both beneficial and useful.* All eleven patients chose answer choice A, which was true, meaning 100% of the participants thought the education provided to be both beneficial and useful. This finding well surpasses the

original goal of examining 50% of patients answering the final question on the post-education questionnaires as true.

Summary

In conclusion, an increase in knowledge about antibiotics was examined after quality education was provided in the clinic setting by the doctoral student. There was a 58% increase in post-education questionnaire scores in comparison to pre-education scores. One hundred percent of the patients reported the educational intervention was both beneficial and useful. These findings correspond with the notion which is the significance of healthcare providers completely and thoughtfully taking time to explain the importance of taking antibiotics correctly at the time of antibiotic prescription to assist in decreasing antibiotic resistance rates within patients and the community in which he or she practices.

CHAPTER IV – DISCUSSION

The goals set before beginning the DNP project were surpassed after data analysis was complete. The doctoral student aimed to see at least a 50% increase in post-education questionnaire scores in comparison to pre-education questionnaire scores. After quality education on antibiotics was presented to participating patients, a 58% increase in scores was observed after analysis. The doctoral student also wished to see at least 50% of patients choose education that was both beneficial and useful. After data analysis, all 11 patients chose the answer *true* for question six on the post-education questionnaire, meaning 100% of participants found the education to be valuable.

Limitations

One limitation to the doctoral study was the small sample size of eleven participants. However, the student provided education only to patients receiving an antibiotic prescription during the five clinical days. It would be interesting to perform an analysis on a larger group of patients, potentially those who are receiving antibiotics and those who are not. Only patients aged 18-65 were considered for the study, which could be considered another limitation to the study.

Lessons Learned

Education is essential in all segments of life, and as future healthcare providers, we should make it an objective to incorporate education into our daily practice and notably, with every patient interaction. A conglomeration of issues can be avoided for patients with something as fundamental as education by his or her primary healthcare provider. The doctoral student observed a staggering amount of misinformation held by patients about antibiotics and how to properly take them. The largest lesson learned was

to take the time to educate patients to prevent complications and improve overall health outcomes.

Conclusion

In conclusion, the doctoral study highlighted the importance of quality education given by the primary care provider at the time of antibiotic prescription during a routine health care visit. Patients are often misinformed, and misinformation leads to overall negative health outcomes. By personable conversation and creating an environment for learning and the ability to ask questions, the healthcare provider can play a pivotal role in educating patients on antibiotics and helping decrease the rates of antibiotic resistance in his or her community.

APPENDIX A – Letter of Consent

Consent Form for Participation

Today's Date: _____

Project Title: Evaluation of Appropriate Antibiotic Usage After Intervention to Increase Antibiotic Stewardship in a Rural Health Care Setting

IRB Protocol Number: 23-0448

Principal Investigator: Mayci McCloud Speights

Phone: 601-320-1646 (Cell)

Email: Mayci.mccloud@usm.edu

College: The University of Southern Mississippi

School and Program: School of Leadership and Advanced Nursing Practice, Doctor of Nursing Practice (DNP) program

Purpose of Study:

The purpose of the investigation is to analyze data to determine if education provided during clinic visits increases patients' knowledge on antibiotics, antibiotic resistance, and antibiotic stewardship. The results from the investigation will be further utilized to educate providers on the importance of educating patients who receive an antibiotic prescription. In turn, the information given to patients will help combat antibiotic resistance through proper usage of antibiotics.

Description of Study:

Each patient seen by the provider and PI will be assessed for the need of an antibiotic prescription. After informed consent is obtained, the participant will take a pre-education questionnaire. Then, the PI will provide the patient with verbal education, along with handouts from the CDC. Finally, the participant will take a post-education questionnaire. The scores from the two questionnaires will be compared and included in data analysis. The amount of time for the intervention for each patient is estimated to be 15-20 minutes. There are no restrictions to normal activities and there are no invasive techniques involved.

Benefits:

The participants are expected to benefit from the education provided by the PI. There will be no compensation for participation or penalty for nonparticipation in the study.

Risks:

There are no known or expected physical, psychological, social, or financial research related risks, inconveniences, or side effects.

Confidentiality:

The questionnaires provided will not ask for any identifying information of the patient. Participation is voluntary and responses are kept anonymous. All questionnaires and consent forms will be locked in the main office of the clinic until all data is collected, and then questionnaires and consent forms will be shredded accordingly. Data will be reported as group data and no individual responses will be reported. Completing the consent form will confirm the participant is at least 18 years of age.

Alternative Procedures:

There will be no alternatives to participation offered to participants in the study.

Participant's Assurance:

This project and this consent form have been approved by USM's Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participants should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5125, Hattiesburg, MS 39406-0001, 601-266-5997.

Any questions about this research project should be directed to the Principal Investigator using the contact information provided above.

Participant's Name (Printed): _____

I hereby consent to participate in this research project. All research procedures and their purpose were explained to me, and I had the opportunity to ask questions about both the procedures and their purpose. I received information about all the expected benefits, risks, inconveniences, or discomforts, and I had the opportunity to ask questions about them. I understand my participation in the project is completely voluntary and that I may withdraw from the project at any time without penalty, prejudice, or loss of benefits. I understand the extent to which my personal information will be kept confidential. As the research proceeds, I understand that any new information that emerges and that might be relevant to my willingness to continue my participation will be provided to me.

Research Participant (Signature): _____

Date: _____

Principal Investigator (Signature): _____

Date: _____

APPENDIX B – IRB Approval Letter

Office *of*
Research Integrity

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

118 COLLEGE DRIVE #5116 • HATTIESBURG, MS | 601.266.6756 | WWW.USM.EDU/ORI

NOTICE OF INSTITUTIONAL REVIEW BOARD ACTION

The project below has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services regulations (45 CFR Part 46), and University Policy to ensure:

- The risks to subjects are minimized and reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered involving risks to subjects must be reported immediately. Problems should be reported to ORI using the Incident form available in InfoEd.
- The period of approval is twelve months. If a project will exceed twelve months, a request should be submitted to ORI using the Renewal form available in InfoEd prior to the expiration date.

PROTOCOL NUMBER:	23-0448
PROJECT TITLE:	Evaluation of Appropriate Antibiotic Usage After Intervention to Increase Antibiotic Stewardship in a Rural Health Care Setting
SCHOOL/PROGRAM	School of Leadership & Advance Nursing Practice
RESEARCHERS:	PI: Mayci McCloud Speights Investigators: McCloud Speights, Mayci~Morgan, Lisa~
IRB COMMITTEE ACTION:	Approved
CATEGORY:	Expedited Category
PERIOD OF APPROVAL:	16-Jun-2023 to 15-Jun-2024

Lisa Wright

Lisa Wright, Ph.D., MPH
Senior Institutional Review Board Analyst

APPENDIX C – Standardized Statement

Standardized Statement

My name is Mayci McCloud Speights and I am a doctoral student in The University of Southern Mississippi's Family Nurse Practitioner Doctor of Nursing Practice program. I am conducting a practice project entitled "Evaluation of Appropriate Antibiotic Usage after Intervention to Increase Antibiotic Stewardship in a Rural Health Care Setting." To collect data, surveys will be provided before and after education to evaluate the effectiveness of the intervention.

1. Participation is voluntary and survey responses are anonymous.
2. All surveys will be locked in the main office of the clinic until all data is collected, then will be shredded and properly disposed of.
3. You must be between the ages of 18-65 to participate.
4. Participation in the project can be withdrawn at any time of the process.
5. There will be no compensation for participation in the study.
6. There will be no penalty for nonparticipation in the study.

Antibiotic resistance is a major public health threat and accounts for many cases of severe illness and even death. This main objective of this project is to provide education to patients receiving an antibiotic prescription on how to properly take the medication and other important factors to combat antibiotic resistance. The goal is to see an increase in post-education questionnaire scores to showcase the importance on quality education in the healthcare setting.

The principal investigator of this study is Mayci McCloud Speights, and she can be contacted by email at Mayci.mccloud@usm.edu. The project advisor is Dr. Lisa Morgan, who can be reached at lisa.d.morgan@usm.edu. IRB Protocol Number: 23-0448.

This project has been reviewed by The University of Southern Mississippi's Institutional Review Board Human Subjects Protection Review Committee. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, 601-266-5997.

Why does taking antibiotics lead to antibiotic resistance?

Any time you take antibiotics, they can cause side effects and contribute to the development of antibiotic resistance. Antibiotic resistance is one of the most urgent threats to the public's health.

Always remember:

1. Antibiotic resistance does not mean the body is becoming resistant to antibiotics; it means bacteria are developing the ability to defeat the antibiotics designed to kill them.
2. When bacteria become resistant, antibiotics cannot fight them, and the bacteria multiply.
3. Some resistant bacteria can be harder to treat and can spread to other people.

More than 2.8 million antibiotic-resistant infections occur in the United States each year, and more than 35,000 people die as a result.

What is the right way to take antibiotics?

If you need antibiotics, take them exactly as prescribed. Never save your antibiotics for later use or share them with family or friends.

Taking antibiotics only when needed helps keep us healthy now, helps fight antibiotic resistance, and ensures that these life-saving drugs will be available for future generations.

Talk with your healthcare professional if you have any questions about your antibiotics, including how they could interact with other medications you are taking, or if you develop any side effects.

What are the side effects?

Common side effects range from minor to very severe health problems and can include:

- Rash
- Diarrhea
- Dizziness
- Yeast infections
- Nausea

Get immediate medical help if you experience:

- **Severe diarrhea**—it could be a symptom of a *C. diff* infection, which can lead to severe colon damage and death.
- **Severe and life-threatening allergic reactions**, such as wheezing, hives, shortness of breath, and anaphylaxis (which also includes feeling that your throat is closing or choking, or your voice is changing).

To learn more about antibiotic prescribing and use, visit **www.cdc.gov/antibiotic-use** or call 1-800-CDC-INFO.

CDC

Accessible content:

Antibiotics Aren't Always the Answer.

BE ANTIBIOTICS AWARE

SMART USE, BEST CARE

Viruses or Bacteria
What's got you sick?

Antibiotics are often prescribed when they are not needed for respiratory infections. 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 Respiratory Infections	Common Cause			Are Antibiotics Needed?
	Virus	Virus or Bacteria	Bacteria	
Common cold/runny nose	✓			No
Sore throat (except strep)	✓			No
COVID-19	✓			No
Flu	✓			No
Bronchitis/chest cold (in otherwise healthy children and adults)*		✓		No*
Middle ear infection		✓		Maybe
Sinus infection		✓		Maybe
Strep throat			✓	Yes
Whooping cough			✓	Yes

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

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

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

CDC

CS328461-A

APPENDIX E – Questionnaires

Pre-Education Survey

Question 1: It is acceptable to save antibiotics to take at a later date, especially if they have not expired yet.

A. True
B. False

Question 2: Antibiotic resistance occurs when bacteria change and can fight off the antibiotic medication that typically kills them.

A. True
B. False

Question 3: After taking two to three doses of an antibiotic, a person should not continue taking them if they feel better and symptoms are relieved.

A. True
B. False

Question 4: Which of the following can happen after taking antibiotics?

A. Yeast infection
B. Severe diarrhea infection (*C. diff* infection)
C. Allergic reaction
D. All of the above

Question 5: Antibiotics can help treat a bad cold and help the person feel better faster.

A. True
B. False

Score: _____

Post-Education Survey

Question 1: It is acceptable to save antibiotics to take at a later date, especially if they have not expired yet.

A. True
B. False

Question 2: Antibiotic resistance occurs when bacteria change and can fight off the antibiotic medication that typically kills them.

A. True
B. False

Question 3: After taking two to three doses of an antibiotic, a person should not continue taking them if they feel better and symptoms are relieved.

A. True
B. False

Question 4: Which of the following can happen after taking antibiotics?

A. Yeast infection
B. Severe diarrhea infection (*C. diff* infection)
C. Allergic reaction
D. All of the above

Question 5: Antibiotics can help treat a bad cold and help the person feel better faster.

A. True
B. False

Question 6: The education provided was both beneficial and useful.

A. True
B. False

Score: _____

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