2019

Nurse Practitioner Attitudes, Perceptions and Knowledge About Antimicrobial Stewardship

Evelyn C. Fabian
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral study by

Evelyn Fabian

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Diane Whitehead, Committee Chairperson, Nursing Faculty
Dr. Mark Wells, Committee Member, Nursing Faculty
Dr. Barbara Gross, University Reviewer, Nursing Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2019

Abstract

Nurse Practitioner Attitudes, Perceptions and Knowledge

About Antimicrobial Stewardship

by

Evelyn Fabian

MS, SUNY Downstate, 2015

BS, Hunter College, 2012

Project Submitted in Partial Proposal

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

August 2019

Abstract

Resistance to antibiotics has increased dramatically in the United States, with serious associated medical, social, and economic consequences. The purpose of this project was to assess nurse practitioners' attitudes, perceptions, and knowledge about antimicrobial stewardship and knowledge in the management of anaerobic infections as well as resistant gram-negative bacteremia. Data were collected using a web-based survey in a hospital facility. The practice question explored whether nurse practitioners' attitudes, perceptions, and knowledge about antimicrobial stewardship significantly increased after an education program on antimicrobial stewardship. The project was framed by Knowles's adult learning theory. A 16-item survey was administered before and after an education program to 11 advance practice nurses to assess their knowledge, attitudes, and perceptions about antimicrobial stewardship. Seventy-seven percent of the respondents agreed that antibiotics are overused nationally, and 33% agreed that antibiotics are overused within the institution; 88.9% of respondents agreed that inappropriate use of antibiotics can harm patients and that inappropriate use of antibiotics causes antimicrobial resistance (87.5%). Overall, 55.5% of respondents agreed or strongly agreed they were concerned about antimicrobial resistance in the community when prescribing antibiotics. Awareness of antimicrobial stewardship might contribute to social change by increasing the proper identification of organisms and the appropriate use of antibiotics, with the assistance of the antimicrobial stewardship programs, to help reduce the development and spread of antimicrobial resistance.

Nurse Practitioner Attitudes, Perceptions, and Knowledge About Antimicrobial Stewardship

by

Evelyn Fabian

MS, SUNY Downstate 2015

BS, Hunter College, 2012

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

August 2019

Dedication

I dedicate this paper to my kids (Jayden and Michaela). Thank you for your understanding, support and encouragement that you both provided throughout this long journey and hours at the library with me.

Acknowledgments

I would like to acknowledge, Dr. Diane Whitehead, for her knowledge, patience, guidance, support and expertise in this journey that allowed and help me gain the new degree and role of a Doctor of Nursing Practice. I would also like to acknowledge my family, friends and coworkers who helped me reach this point in my academic career.

Table of Contents

List of Tables

Section 1: Nature of the Project

Introduction

Antibiotic-resistant infections are associated with two million illnesses, 23,000 deaths, and more than $20 billion in direct excess healthcare costs in the United States each year (Centers for Disease Control and Prevention [CDC], 2018). In 2004, President Barack Obama issued the National Action Plan for Combating Antibiotic Resistant Bacteria, which outlined steps to reduce inappropriate antibiotic use and decrease antibiotic resistance (CDC, 2014). Antibiotic resistance is an ever-worsening issue that creates challenges for advanced practice nurse (APN) when caring for patients with infections. Antibiotic-resistant infections are associated with a higher mortality rate than infections caused by the same organism that are not resistant to multiple antibiotics (Patel et al., 2008), and prolonged hospital lengths of stay impose a considerable burden on health care system networks worldwide (de Kraker et al., 2011). To minimize the spread of antimicrobial resistance, providers and patients must become sufficiently aware of the public health implications of antimicrobial use and engage in appropriate antimicrobial use behaviors (Edgar et al., 2009).

Problem Statement

The project question was: Do nurse practitioners' attitudes, perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship? Antimicrobial resistance is one of today's most urgent public health problems, threatening to undermine the effectiveness of infectious disease treatment in every country (Spellburg et al., 2008). The persistent use of

antimicrobial agents is among the most important contributor of antimicrobial resistance: studies have estimated that 30-50% of all antimicrobial use is inappropriate (Owens et al., 2009). Antimicrobial stewardship programs (ASPs) use a systematic approach to optimize antimicrobial therapy through a variety of interventions that have been proven to be cost effective. (Dellit et al., 2007). Nurse practitioners provide a significant amount of medical care that is likely to increase with health care reform (Running et al., 2006); therefore, it is imperative that nurses exhibit sensible antimicrobial-prescribing practices. ASPs usually promote behavior changes by addressing the beliefs and motivations of target groups. (Giblin et al., 2004).

Purpose Statement

Antibiotic resistance is one of today's most urgent public health problems with 30-50% of antimicrobial use being inappropriate. Antibiotic-resistant infections are associated with prolonged hospital stays and higher mortality rates than infections caused by the same organisms that are not resistant to multiple antibiotics (Owens et al., 2009; Patel et al., 2008). Abbo and colleagues (2012) explored APN knowledge and perception of antibiotic stewardship. The results suggested that there are opportunities to improve baseline and continuous knowledge about antibiotic use and resistance among NPs. Therefore, the purpose of this study/project was to assess the knowledge of the Nurse Practitioner's using an educational in-service regarding antibiotic stewardship to assist APNs and other health care providers decrease inappropriate antibiotic use and limit the risk of antibiotic resistant organisms from developing.

Nature of the Doctoral Project

The setting for this doctoral project was an acute inpatient hospital in the tristate New York area. The goal was to provide an education program using pre- and post-surveys to assess their knowledge, attitudes, and perceptions regarding an antimicrobial stewardship program and appropriate antibiotic usage. The reason for choosing a survey was for both ease of its use as well as the time needed to complete making more attractive for the APN to participate. The feasibility of the project was high, since the gap in knowledge had been demonstrated through literature reviews (Manning, 2016) and assessments of the acute hospital setting. Some of the key variables were APN, attitudes, knowledge as well as the timing and length of the 16-question survey. The survey will be processed using RedCap an internal hospital survey application which will analyze the results in percentages once recorded.

Significance

Addressing antibiotic resistance and raising awareness is vital to protecting the public health and the environment. While addressing this goal required time and resources, it was necessary to prevent the more costly possibilities of widespread diseases, more infections, and lack of effective medicines (Sanford, 2016). Using this staff educational project, the newly gained knowledge supported the mission of Walden University to promote positive social change through the decrease of antibiotic resistance and unnecessary prescriptions for infections that do not require them, such as with viral etiology. By decreasing the sequelae of inappropriate antimicrobial use, antibiotic

stewardships can improve the quality of life and decrease the financial burden for patients, families, and the community.

Summary

Given the increasing social and economic burden of antimicrobial resistance and healthcare-associated infections, it was critical that healthcare professionals work together across disciplines to maximally benefit patients. (Edwards et al., 2011). ASP should target APNs and physicians, to assist in decreasing the rise in ARI. This project assisted in assessing barriers and facilitate ways to implement ASP targeting APN's to increase infection control and decrease antimicrobial resistance through inappropriate or overuse of antibiotics. The project question was: Do nurse practitioners' attitudes, perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship?

In Section 2, I describe the theory framing the project, how this project in collaboration with this theory has relevance to nursing practice, and my role in project development, implementation, and evaluation.

Section 2: Background and Context

Introduction

Antimicrobial resistance is among the most important emerging threats to effective clinical care and public health. (WHO, 2011). The World Health Organization (WHO) has declared antibiotic resistance one of the greatest threats the world is facing (WHO, 2011). Clinicians have been using antibiotics for over 60 years but increasing resistance has created multi-resistant organism, such as methicillin-resistant Staphylococcus aureus (MRSA) and extended spectrum B-lactamases (ESBLs). (CDC, 2018). While data demonstrating a clear casual effect between inappropriate use and resistance are limited, misuse of antibiotics may provide optimal conditions for organism resistance (CDC, 2018).

Antibiotic resistant infections are costly in terms of morbidity, mortality and financial burden (CDC, 2018). Antibiotic stewardship can be used as an important strategy to contain rising rates of antibiotic resistance, adverse drug events, and healthcare costs. One stewardship program demonstrated that systematic interventions, including intravenous-to-oral substitution, brand-name to generic drug substitutions, batching of intravenous antimicrobials, and formulary restrictions resulted in an annual cost saving of $832,590 (Goff et al., 2012). This project focused on assessing the attitudes, perceptions and knowledge of APNs about ASPs. The project question was: Do nurse practitioners' attitudes, perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship? In this

section, I discuss the models, relevance to nursing practice, background of the project, and my role as Doctor of Nursing Practice student.

Concepts, Models and Theories

Knowles's theory of adult learning was the conceptual framework that guided this project. In 1984, Knowles developed the term *andragogy*, defined as the art and science of assisting adult learners. Knowles identified that adults need to know the reason for learning something; adult learners bring life experiences to the classroom that are different from young learners; adults need to be responsible for their decisions about education; adults need to be involved in the planning and evaluation of their instruction; adults are interested in learning subjects having immediate relevance to their work and/or personal lives; adults need learning that is problem-centered rather than content-oriented; and adult learners respond better to internal versus external motivators. (Smith, 2002; Taylor & Hamdy, 2013).

Following are descriptions of the five assumptions of Knowles's theory (Smith, 2002) and how they were applied to this doctoral project:

- The concept of learning: Adults are more independent than children. Adults are self-directed and show responsibility toward learning. The idea of learning applied to this project was that (a) by providing healthcare workers with minimal instructions and maximum guidance and support and (b) by providing them with ample resources regarding the CDC's evidence-based practice guidelines helped the learners translate theory into practice within their learning requirement.

- The role of learner's experience: Adults have plenty of experience that can play an important part in the learning process. Because adults are goal oriented, unlike children, using case scenarios and active discussion related to antimicrobial stewardships helped nurses identify how the ASP was relevant to their learning and how it could affect patient outcomes.
- Readiness to learn: Adults are more goal oriented and willing to determine if any activity is related to their development socially and or professionally. This behavior is essential because adults need to recognize the importance of learning before becoming involved in any activity (Ortoleva, 2010). It is critical to create a healthy environment where staff feels supported by the management. When the staff sees the benefits of applying ASP guidelines into practice, they will be willing and openly participate.
- Orientation to learning: Adult learners are more focused and problem oriented. It was imperative to ensure that the learners were clear about the objective of the project and how will it apply to them. Adults are more willing to learn activities, which can help them solve and deal with their problems (Clapper, 2010).
- Motivation to learn: Adults, for the most part, are self-motivated. If staff are aware of the objectives and the outcome of the project, they will be able to apply the learned information, and eventually, their internal motivation will be engaged.

Relevance to Nursing Practice

A review of the literature was conducted using the following databases: CINAHL Plus with Full Text, ProQuest Nursing & Allied Health Services, Medline with Full Text, Health and Medical Complete, Ovid Nursing Journals Full Text and PubMed with Full Text. The following search terms were used: *advanced practice nurse, nurse practitioner, antimicrobial/antibiotic stewardship, antibiotic use, antimicrobial resistance, attitudes,* and *perception*. The scope of the literature search included studies with primary focus on NPs and antimicrobial stewardships published in English between 2004 and 2018. The search yielded 61 articles. After final review for appropriate evidence, 19 articles were included in the literature review. In addition to the CDC, National Association of Healthcare Quality (NAHQ) documents were the primary sources used to develop the educational module. A literature review matrix was constructed to present the selected articles including the level of evidence suggested by Fineout-Overholt et al. (2010). Table 1 summarizes the levels of evidence in the literature review.

Table 1

Levels of Evidence

Levels of Evidence	Number of Articles
Level1 1. Systematic review or meta-analysis	3
Level II: 2. Randomized controlled trial	0
Level III. 3. Control trial without randomization	1
Level IV: 3. Case-control or cohort study	1
Level V: Systematic review of qualitative or descriptive studies	3
Level VI: Qualitative or descriptive study (includes evidence implementation projects)	3
Level VII: 4. Expert Opinion or consensus	8

Adapted from Fineout-Overholt et al., 2010.

Nineteen articles were deemed appropriate for the literature review. The strength of evidence varied with three level one or systematic/meta-analysis review, three being of systematic review of qualitative or descriptive studies, three of qualitative or descriptive studies and 8 where expert opinion or consensus.

Federal Initiatives

The CDC released a report in September 2013, *Antimicrobial resistance threats in the U.S.*, sounding the alarm to drug-resistant bacteria. The report, was the first to look at burden and threats posed by antimicrobial resistance on human health, which showed that more than 2 million people are sickened every year with antibiotic-resistant infections, with at least 23,000 dying as a result; antibiotic-resistant bacteria are prioritized by threat level: concerning, serious, or urgent; core initiatives taken by CDC to fight the spread of antibiotic resistance and summaries of resistant bacteria, including key actions that public health professionals, health providers, and patients can take to combat antibiotic

resistance. In October 2016, the CDC was awarded more than $14 million to fund new approaches to combat antibiotic resistance, including research on how microorganisms naturally present in the human body (referred to as a person's micro biome) can be used to predict and prevent infections caused by drug-resistant organisms. The awards, made through CDC's Broad Agency Announcement, support activities in the CDC's Antibiotic Resistance Solutions Initiative. The initiative, which also provides funding for state health departments and other partners, implements the tracking, prevention, and antibiotic stewardship activities outlined in the National Action Plan for the Combating Antibiotic-Resistant Bacteria. (CDC, 2018). Despite these awards, and the wealth of knowledge provided by the CDC, 30–50% of all antimicrobial use is inappropriate. (Owens et al., 2009).

Quality Initiative Related to ASP

Be Antibiotics Aware (formerly Get Smart about Antibiotics) is a national effort to help fight antibiotic resistance and improve antibiotic prescribing and use. (CDC, 2018). Antibiotics save lives, but any time antibiotics are used, they can cause side effects and lead to antibiotic resistance. At least 80 million antibiotic prescriptions each year are unnecessary, which makes improving antibiotic prescribing and use a national priority. (CDC, 2018). Armitage et al. (2005) discussed some of the adverse consequences of antimicrobial resistance such as: more frequent treatment failures, increased pathogen resistance, increased cost due to more expensive second- or third-line antibiotic and lack of effective drugs to treat some of these infections.

To minimize the spread of antimicrobial resistance, both providers and patients must become sufficiently aware of the public health implications and engage in appropriate antimicrobial use behavior. (Edgar et al., 2009). Patient education materials are available on the CDC website, but in addition to this education, patients often need their clinician to acknowledge their discomfort and validate their decision to seek medical attention. Providers themselves need to be educated and provide alternative options such as rest, diet, or OTC analgesics with instructions to return if their symptom does not resolve in the next 7–10 days for cases such as those with viral etiology.

ASPs use a systematic approach to optimize antimicrobial therapy through a variety of interventions and have been proven to be cost effective. (Dellit et al., 2007). Bekkers et al. (2010) described the quality of antibiotic prescribing in Primary Care after a blended learning intervention using the Stemming the Tide of Antibiotic Resistance () educational program. This program consisted of a seven-part, theory-based learning program that included online reflection on clinicians' own practice with presentation of research evidence and guidelines, a practice-based seminar focusing on participants' own antibiotic prescribing and resistance rates from their practice, communication skills training using videos of stimulated patients in routine surgeries and participation in a web forum. The conclusion of this study reported a wide range of positive changes in attitudes and clinical practice from its participants.

The CDC's role in preventing antibiotic resistance, first, is going back to basics. Preventing infection through immunization, safe food preparation, hand washing and using antibiotics as directed and only when necessary. Second, tracking and gathering

data on antibiotic-resistant infections such as the causes of infections and whether there are reasons (risk factors) that caused some people to get a resistant infection. Third, and perhaps the most important action that can slow down the development and spread of antibiotic-resistant infections is, changing the way antibiotics are used. Committing to always use antibiotics appropriately and safely--only when needed, with the right antibiotic, route, and duration, and with appropriate de-escalation as recommended—or just the use of an Antimicrobial Steward Program can assist in decrease resistance development. Lastly, keeping up with the development of new diagnostic test and new drugs to keep up with the resistant bacteria as well as track the development of additional resistance. (CDC, 2018).

CDC's National Healthcare Safety Network (NHSN) is a system that collects and provides data on infections and drug-resistance in healthcare settings. Since NHSN collects data directly from healthcare facilities, it can provide facility-level information on healthcare-associated infections and antibiotic resistance (and in the future, on antibiotic use). NHSN gives healthcare facilities the ability to see their data in real-time and share that information with clinicians and facility leadership, as well as with other facilities (e.g., a multihospital system) and partners such as health departments or quality improvement organizations. CDC provides the standard national measures for hospital acquired infections. In addition, NHSN is the conduit for facilities to comply with Centers for Medicare and Medicaid Services (CMS) infection reporting requirements. (CDC, 2015).

Educational Programs

ASPs are coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administration, that results in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance. (Gerding, 2001.) According to Giusti and Cerutti (2016), the ASP has three main goals: (a) working with healthcare practitioners to help each patient receive the most appropriate antimicrobial with the correct dose and duration, (b) prevent antimicrobial overuse, misuse and abuse and (c) help minimize the development of resistance. Joseph and Rodvold (2008) described the 4 D's of optima antimicrobial therapy: right Drug, right Dose, and De-escalation to pathogen-directed therapy and right Duration. Using ASP and these guidelines, comprehensive programs have demonstrated annual savings of $200,000 to $900,000.

Giusti and Cerutti (2016) described two approaches to ASP: pre-prescription or restrictive prescriptive authority and post-prescription where providers can order antibiotics and focus on de-escalation, a critical aspect of appropriate antimicrobial use. Using the pre-approach method, which has restrictions on certain antimicrobials requiring prior authorization from an infectious disease specialist, data has shown that this approach significantly reduces targeted drugs but overuse of antimicrobials, which may not be restricted, is increased. Optimizing antimicrobial dosing based on an individual patient characteristic, causative organism, site of infection, and pharmacokinetic and

pharmacodynamics characteristics of the drug is an important part of an antimicrobial stewardship.

Abbo et al. (2012) conducted a 68-item web-based survey to assess clinical APN's attitudes, perceptions and knowledge towards antibiotic use, antimicrobial resistance and antimicrobial stewardship programs based on the knowledge that APN's provide a significant amount of medical care making it imperative that APN exhibit sensible antimicrobial prescribing practices. This study revealed 93% of its respondents felt that antibiotics were overused nationally and 54% agreed to local overuse. Ninety-six percent of the respondents agreed with inappropriate antibiotic use being harmful to patients, were 98% stated inappropriate antibiotic use could lead to antibiotic resistance.

Through research and reviewing the literature, previous surveys have been completed assessing the knowledge of physician's and attitudes about antimicrobial programs, but few addressed the APN knowledge or role in prescribing antimicrobials. (Giblin et al., 2004). This demonstration in gap of antimicrobial education for APN's, calls for implications of nurse practitioner programs and board certification maintenance to collaborate and incorporate more antimicrobial stewardship education into their curricula. Education modules and clinical scenarios can be used to reinforce awareness and presented to APN during rounds or scheduled meetings to encourage the use of antimicrobial stewardship assistance when prescribing antibiotics, thereby decreasing inappropriate use or overuse of antibiotics.

Local Background and Context

Resistance to antibiotic has increased dramatically in the United States, with serious associated medical, social and economic consequences. The CDC estimates that approximately 2 million people annually are affected by antibiotic resistant infections. (CDC, 2018). The most promising approach to this national crisis was a new understanding of the need for the careful and responsible use of antibiotics, both for the benefit of society and for optimal care of each patient. This approach, antimicrobial stewardship, typically involved specialist who perform numerous antibiotic-related activities daily to optimize clinical outcomes by taking a systematic approach to reducing antimicrobial inefficiency, treatment failures and resistance.

Bacterial resistance to antibiotics is not a new phenomenon. Sir Alexander Fleming, Scottish physician and researcher who discovered penicillin, warned the public in his 1945 Nobel Prize in Medicine speech: “playing with penicillin treatment is morally responsible for the death of the man who finally succumbs to infection with the penicillin resistant organism.” (1945). Over the past decade, strains of common microbes have developed resistance to drugs that once were effective against them. Prudent antimicrobial prescribing deserves emergent attention as resistance increases, given the paucity of new antimicrobials in the development pipeline. (CDC, 2018). The behaviors of APNs on antimicrobial prescribing require further assessment if the battle against antibiotic resistance is to be controlled and stopped. There is need for more research in the influencing factors on nurse prescribing behavior as only currently five studies have explored the antimicrobial behaviors of APNs.

With very little consideration afforded to the contribution APN can make to antimicrobial management, and the increase of APN medical care only likely to increase with health care reform (Guerra et al., 2007), health care professionals should work together across disciplines to maximally benefit patients, and this can be done through antimicrobial stewardship programs. ASPs usually promote behavior changes by addressing the beliefs and motivation of target groups. (Running et al., 2006). For antimicrobial stewardship programs to achieve optimal success they must include nursing perspective and the active participation of nurses and the nursing profession.

The practice-focused question was: Do nurse practitioners' attitudes, perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship? As demonstrated by the CDC (2018) and WHO (2018), antibiotic stewardship is the cost-effective use of antimicrobials which maximizes clinical therapeutic effect while minimizing both drug related toxicity and the development of antimicrobial resistance. Assessing the knowledge and attitudes of APN about ASP can allow for not only increase in awareness of the available resources for antibiotic administration but incorporate APN in improving EBP and antimicrobial use thereby decrease inappropriate, overuse and possible creation of resistant organisms.

Role of the DNP Student

The professional context for this project was antimicrobial overuse, with a specific focus on APN and ASP. I have been an APN for 4 years working in an urgent care and inpatient acute care hospital interventional radiology department. I was unaware of the increase in antibiotic overuse within the hospital setting. As a APN in an urgent

care setting, patients frequently would come in with complaints of runny nose and cough looking for antibiotics but after a thorough assessment and rapid testing with no bacterial source, I would always educate my patients, the differences between viral and bacterial infections/organisms, and that for their condition and diagnosis no antibiotic was warranted with recommendations for either rest, over-the-counter pain/fever relief with follow-up required if symptoms persisted longer than 7-10 days.

Within my acute inpatient setting planning was different. Many of these patients had various co-morbidities requiring antibiotics. My job as an APN for Interventional Radiology, was as a consultant that reviewed and assessed patient charts prior to a procedure. Part of the assessment was verifying if patients were on antibiotics to prevent additional unnecessary administration by my department for our pre-op cases. A situation occurred with a patient with newly diagnosed Candida Auris (C. Auris) infection, which according to the CDC (2018), is an emerging fungus represents a pending threat for the following three reasons: (a) it is often multidrug-resistant, meaning that it is resistant to multiple antifungal drugs commonly used to treat Candida infections; (b) it is difficult to identify with standard laboratory methods, and (c) it can be misidentified in labs without specific technology. Misidentification may lead to inappropriate management and it has caused outbreaks in healthcare settings. For this reason, it is important to quickly identify C. Auris in a hospitalized patient so that healthcare facilities can take special precautions to stop its spread, occurred within my department. Such patient was seen by an infectious disease specialist with recommendations for specific antibiotic coverage to be given pre-op along with the patient's daily continuous antibiotic regimen. My department failed to

see this recommendation and the patient received additional inappropriate and unnecessary antibiotics on two separate occasions. From this incident and the increase in inappropriate and overuse of antimicrobial use, I decided to meet with an infectious disease specialist and a pharmacology ASP specialist to assess the knowledge and perceptions of another APN regarding ASP.

My role for this project first was setting up a meeting with the Infectious Disease and Pharmacology ASP personnel to discuss the frequency in overuse or inappropriate antimicrobial prescribing within my acute care hospital. Within my own department after review of charts from April 2018 through June 2018, out of 292 patients' only 12 patients, not even 1% of the population was affected. A small number compared too approximately over 30-50% of overall hospital patients receiving at least one antibiotic, which were unnecessary or inappropriate. The necessity to assess the knowledge of the APN regarding ASP and how optimization in patient care and outcomes can be improved is my target.

For this project, I reached out to Dr. Abbo (2012) and requested permission to use her web-based survey for APN to assess their knowledge, attitudes and perceptions of ASP. An introduction regarding my doctoral project was announced at my monthly APN meeting with broad details at first regarding the anonymous online survey that would be conducted over a six-week period with weekly reminders within my acute care hospital setting.

My personal experience with antibiotic inappropriate and overuse could be a potential area of bias. Pratt (2008) reported on issues that affect qualitative research bias;

however, the issues described could be related to this DNP project. Pratt (2008) suggested that studies should be strongly embedded in theory, provide enough data for readers to draw their own conclusions, and researchers should try to be objective and transparent with their methods. My project is based on Knowles theory of Adult Learning and the most current evidence was used in development of the staff education program (Taylor and Hamdy, 2013). It was important to try and remain objective throughout this project, and through this anonymous web-based survey, I believe I remained objective.

APNs are registered nursing professionals who have either a doctoral or master's level training, practice autonomously in both primary and acute care settings. Since the 1970's, studies have shown that APN's consistently provide primary care that is similar in quality to physicians and that APN's have the ability to appropriately prescribe drugs independently. (Mundinger et al., 2000). APN's antimicrobial prescribing patterns (both inappropriate and appropriate) for viral infection have been shown to be like those of physicians according to some authors. (Running et al., 2006). The lack in literature related to APN prescribing methods and antimicrobial stewardship knowledge, makes this study even more relevant. The increase in antimicrobial resistance, along with the noted increase in APN's according to a 2010 assessment by the American Academy of Nurse Practitioners of approximately 140,000 APN's in the United States, makes it imperative that nurses engage and collaborate with an antimicrobial specialist to decrease resistance, overuse and inappropriate antibiotics prescribing. The following section will provide a thorough description of both collection and analysis of the evidence along with methods use for this project.

Summary

Section 2 introduced the adult learning theory framing this project. The purpose of the project and the practice question were described. The evidence-based literature supporting the need for antibiotic stewardship was summarized. The significance of this project to improving patient outcomes is supported in the literature. My role in the project was developing and implementing this education project was introduced.

Section 3 describes the planning, implementation, and evaluation of this education program and the use of the DNP *Staff Education Manual* in supporting the project.

Section 3: Collection and Analysis of Evidence

Introduction

Antimicrobial resistance is an ever-worsening issue that creates challenges for APN's when caring for patients with infections. A recent CDC report estimated that ARI incidences exceed 2 million cases in the United States annually (2018). Antibiotics were first discovered in the early 1900s by Sir Alexander Fleming, with a warning that if not used correctly it would eventually lead to the demise of all mankind (Olans, 2017). Even though initiatives have been implemented within acute and long-term care settings to promote evidence-based, antimicrobial prescribing, most studies have primarily targeted the practices of physicians and pharmacists. Very little examination into the benefits that APN's contribution could make to antimicrobial management have been researched and documented. This project will explore the knowledge and perceptions of NPs towards an antimicrobial stewardship program in a small, acute care, urban hospital.

Practice-Focused Question

In the United States, over 23 million people die annually due to antibiotic overuse or inappropriate prescribing leading to antibiotic resistance. It is estimated that over 2 million infections in the United States have risen since 2013 (CDC, 2018). APNs, as a prescribing group, continue to rise in numbers due to health care reform. APNs' gap in knowledge regarding antimicrobial prescribing methods has been demonstrated through the literature. (Abbo et al., 2002). The purpose of this project was to develop an educational program that focused on APNs, especially APNs and antimicrobial stewardships. The practice focus question was: Do nurse practitioners' attitudes,

perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship?

Sources of Evidence

The project was implemented in a small, urban, acute care hospital in a large metropolitan area the eastern United States. The hospital accommodates 400 patients between the emergency room, medical floors, ICU, PACU, pediatrics, and Labor & Delivery and is run by 50 APNs. Permission to use the web-based survey (Appendix A) developed by Abbo and colleagues (Abbo et al., 2012) was obtained (Appendix B). A behavioral scientist, infectious disease physicians, and a clinical pharmacist developed the instrument. The developers completed face validity of the instrument. The instrument was modified to reflect only the activities of the APN. The hospital infectious disease specialist reviewed the revised survey for content validity. The de-identified results were used to assess APNs' perception of ASPs. The survey was administered before and after an education program for ASPs. Demographic information, including number of years as APN, specialty, and practice setting, were included in the survey.

Planning

The education program was developed using current evidence and guidelines from the CDC and IDSA. The infectious disease specialist served as content expert. After facility and Walden University IRB approval, the content expert reviewed the proposed education program and survey. Upon review, additional information was? Was not? included in the presentation (Appendix C).

Protections

All participants electronically consented to participate using the consent for anonymous questionnaires in the DNP *Staff Education Manual*. The facility signed the site approval participation form in the DNP *Staff Education Manual*. Walden University Approval (#11-28-18-0761596) prior to implementation.

Implementation

The nurse practitioner manager sent me a link with all the APN e-mail addresses. I e-mailed an invitation (Appendix D) to all APNs inviting them to participate in the project with a link to Redcap. An announcement was made during the monthly APN meeting. All APNs received an e-mail regarding the purpose of this project and the importance of their participation to improve patient outcomes. The anonymous survey was available for six weeks, with participants receiving weekly reminders to submit their survey if not yet completed. After 6 weeks access to the pre-survey was closed. The education program was scheduled for the next APN meeting after pre-survey closure. The meeting was held from 12-1:30 pm on a weekday with all APN of various shifts encouraged to attend. A recording/ WebEx of the presentation was available for those who cannot make the presentation. Participants had six weeks to complete the post-education program survey and/or review the WebEx presentation and complete the survey.

Evaluation

Participants completed the web-based survey on perceptions of ASP before and after the education program. Participants also completed an evaluation of the program (Appendix E).

Analysis and Synthesis

Descriptive statistics were completed on the pre and post surveys assessing knowledge and attitudes, and on the program evaluation survey.

Summary

The purpose of this project was to assess the perception and knowledge of APN's regarding antibiotic use, overuse and inappropriate use in relation to antimicrobial stewardship programs using a web based online survey. The practice-focused question was: Do nurse practitioners' attitudes, perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship? Providers participating in this educational program will complete and evaluation regarding the program at the end of the presentation.

Section 3 described the planning, implementation and evaluation of this project. Protections of human subjects were reviewed.

Section 4 discusses the findings, implications, and recommendations related to the project question. Although there are only 50 APNs in this urban 350-bedd acute care hospital, the increase in antimicrobial resistance related to inappropriate and overuse of antibiotics made this educational program important to decrease resistance, improve patient care and APNs' knowledge related to prescribing practices.

Section 4: Findings and Recommendations

Introduction

APNs practice at an advanced level with multiple roles both for primary and acute care patients. Antibiotics are one of the class of drugs that are frequently used to treat various conditions and ailments. This project assessed the APNs' knowledge, attitudes and perceptions about antimicrobial use, perceptions about antibiotic use and resistance, perceptions about continuing education and knowledge regarding ASPs.

Findings and Implications

Demographics

Sixty APNs were invited to participate in the project. Eleven (18%) completed the survey. Of the APNs who responded, 27.3% have worked as APN's over 7 years but less than 9, with 45.5% having worked 1–3 years. Respondents' specialty area varied: critical care and internal medicine (27.3%, pediatrics and other (18.2%) and ER (9.1%).

Attitudes Toward Antimicrobial Use

Some of the approaches that influence the APNs' decision to use antibiotics were as follows:

- I start with broad-spectrum and tailor upon culture results (72.7%).
- I base my decisions on the hospital antibiotic program (27.3%).
- I ask a resident or attending (9.1%)
- I ask another APN or PA (0.0%).
- I use the same 1 or 2 antibiotics (0.0%).
- I ask the patient (0.0%).

- Other (18.2%)

Most respondents (66.7%) agreed that starting antibiotics on patients that are ill or immunocompromised without any culture results is the first step. Table 2 summarized the results of questions related to APN attitudes. With the educational presentation, APN attitudes slightly varied as demonstrated in Table 3.

Table 2

Preprogram Attitudes that Influence APN Decision to Select an Antibiotic (N = 11)

Consideration	Never/Rarely	Sometimes	Often/Always
Cost saving for the patient	11.1%	44.4%	2.2%
Cost saving for the hospital	11.1%	44.4%	22.2%
Risk of missing and infection	0%	22.2%	33.3%
Patient demands and expectations for antibiotics	55.6%	0%	0%
Patient is critically ill or immunocompromised	0%	22.2%	11.1%
Reassurance when using an antibiotic, even if it might be the wrong one	33.3%	22.2%	0%
Unexplained fever or leukocytosis, even if cultures are negative	0%	55.6%	11.1%
Risk of developing Clostridium difficile (C. diff) colitis	0%	44.4%	22.2%
Other	57.1%	14.3%	14.3%

Table 3

Post program Attitudes that Influence APN Decision to Select an Antibiotic N = 11)

Consideration	Never/Rarely	Sometimes	Often/Always
Cost saving for the patient	11.1%	44.4%	22.2%
Cost saving for the hospital	22.2%	44.4%	0%
Risk of missing and infection	0%	22.2%	44.4%
Patient demands and expectations for antibiotics	33.3%	11.1%	0%
Patient is critically ill or immunocompromised	0%	22.2%	66.7%
Reassurance when using an antibiotic, even if it might be the wrong one	44.4%	22.2%	0%
Unexplained fever or leukocytosis, even if cultures are negative	11.1%	55.6%	22.2%
Risk of developing Clostridium difficile (C. diff) colitis	22.2%	44.4%	11.1%
Other	14.3%	14.3%	0

Perceptions About Antibiotic Use and Resistance

Perceptions about antibiotic use and resistance is summarized in Table 4 below; it gives the results after the educational PowerPoint presentation. Seventy-seven percent of the respondents agreed that antibiotics are overused nationally while 33% agreed that they are overused within the institution. Most respondents agreed that antimicrobial resistance is an issue nationally (66.6%) with 22.2% responding it to be of concern within the organization. Almost all respondents agreed that inappropriate use of antibiotics can harm patients (88.9%) and that inappropriate use of antibiotics causes antimicrobial

resistance (87.5%). Overall, 55.5% of respondents agreed or strongly agreed they were concerned about antimicrobial resistance in the community when prescribing an antibiotic, with 11.1% of the respondents agreeing that they themselves overprescribe. Most respondents (88.9%) agreed that strong knowledge of antibiotics is important to their health care careers.

Table 4

Preprogram Perceptions Among APNs About Antimicrobial Use and Resistance (N = 11)

Perceptions	Disagree or Strongly Disagree	Neutral	Agree or Strongly Agree
Antibiotics are overused nationally.	0%	22.2%	77.8%
Antibiotics are overused in my hospital.	11.1%	55.6%	33.3%
Antibiotic resistance is a not significant problem nationally.	33.3%	0%	66.6%
Antibiotic resistance is not a significant problem in my hospital.	55.6%	22.2%	22.2%
Better use of antibiotics will reduce problems with antimicrobial resistance.	0%	11.1%	88.9%
Strong knowledge of antibiotics is important in my health care career.	0%	11.1%	88.9%
I am confident that I use antibiotics optimally in the ICU.	22.2%	33.3%	44.4%
I am confident that I use antibiotics optimally in the non-ICU setting.	11.1%	33.3%	55.6%
I overprescribe antibiotics.	55.5%	33.3%	11.1%

Other APNs overprescribe antibiotics.	55.6%	33.3%	11.1%
Antibiotic management programs are an obstacle to good patient care.	66.6%	33.3%	0%
I would like more feedback on my antibiotic selections.	0%	55.6%	44.4%
I would like more education on antibiotics.	0%	33.3%	66.6%
I am less likely to use restricted antibiotics if infectious disease approval is required.	11.1%	22.2%	66.6%
Interactions with pharmaceutical representatives do not influence my antibiotic selections.	66.6%	11.1%	22.2%
Locally developed guidelines for antibiotic treatment would be more useful than national ones.	44.4%	22.2%	33.3%
I am concerned about antimicrobial resistance in the community when I prescribe antibiotics.	11.1%	33.3%	55.5%
I am concerned about antimicrobial resistance in my hospital when I prescribe antibiotics.	11.1%	33.3%	55.5%
New antibiotics will be developed in the future that will keep up with the problem of "resistance."	55.5%	33.35	11.1%
Prescribing broad spectrum antibiotics when equally effective narrower ones are available increases antimicrobial resistance.	22.2%	11.1%	66.6%
Poor infection control practices by health care professional's causes the spread of antimicrobial resistance.	0%	44.4%	55.5%
Inappropriate use of antibiotics causes antimicrobial resistance.	0%	12.5%	87.5%
Inappropriate use of antibiotics can harm	0%	11.1%	88.9%

patients.			
Inappropriate use of antibiotics is professionally unethical.	0%	22.2%	77.8%

Table 5

Post program Perceptions Among APNs About Antimicrobial Use and Resistance (N = 11)

Perceptions	Disagree or Strongly Disagree	Neutral	Agree or Strongly Agree
Antibiotics are overused nationally.	0%	22.2%	77.8
Antibiotics are overused in my hospital.	0%	55.6%	44.4%
Antibiotic resistance is a not significant problem nationally.	11.1%	22.2%	66.6%
Antibiotic resistance is not a significant problem in my hospital.	55.6%	22.2%	22.2%
Better use of antibiotics will reduce problems with antimicrobial resistance.	0%	0%	100%
Strong knowledge of antibiotics is important in my health care career.	0%	0%	100%
I am confident that I use antibiotics optimally in the ICU.	22.2%	33.3%	44.4%
I am confident that I use antibiotics optimally in the non-ICU setting.	11.1%	33.3%	55.6%
I overprescribe antibiotics.	55.5%	33.3%	11.1%
Other APNs overprescribe antibiotics.	55.6%	33.3%	11.1%
Antibiotic management programs are an obstacle to good patient care.	88.8%	11.2%	0%

I would like more feedback on my antibiotic selections.	0%	44.4%	55.6%
I would like more education on antibiotics.	0%	11.2%	88.8%
I am less likely to use restricted antibiotics if infectious disease approval is required.	0%	22.2%	77.8%
Interactions with pharmaceutical representatives do not influence my antibiotic selections.	66.6%	22.2%	11.1%
Locally developed guidelines for antibiotic treatment would be more useful than national ones.	44.4%	22.2%	33.3%
I am concerned about antimicrobial resistance in the community when I prescribe antibiotics.	11.1%	33.3%	55.5%
I am concerned about antimicrobial resistance in my hospital when I prescribe antibiotics.	11.1%	33.3%	55.5%
New antibiotics will be developed in the future that will keep up with the problem of "resistance."	55.5%	33.35	11.1%
Prescribing broad spectrum antibiotics when equally effective narrower ones are available increases antimicrobial resistance.	11.1%	22.2%	66.6%
Poor infection control practices by health care professional's causes the spread of antimicrobial resistance.	0%	33.3%	66.6%
Inappropriate use of antibiotics causes antimicrobial resistance.	0%	12.5%	87.5%
Inappropriate use of antibiotics can harm patients.	0%	0%	100%
Inappropriate use of antibiotics is professionally unethical.	0%	22.2%	77.8%

Perceptions Towards Continuing Education Resources

Perceptions toward the most useful resources regarding education about antibiotics are summarized in Table 6. Overall, 22.2% of the respondents were not familiar with the ASP, and 55.6% perceived it as a useful or very useful resource. Infectious diseases colleagues (55.6%), medical journals (44.4%), and continuing education courses or live lectures (22.2%) were rated as the least useful resources.

Knowledge

The antibiotic knowledge portion of the survey consisted of 10 questions of which respondents answered correctly 75% with a range of 30% to 100%. The highest scores were for the appropriate selection of antimicrobials for the management of MRSA (63.6%), prevention of catheter-associated urinary tract infections (100%), and identification of the most expensive oral antibiotic (81.8%). The lowest scores were for the questions about management of anaerobic infections (20%) and extended spectrum beta-lactamase (ESBL) positive bacteremia (30%). Seventy-two percent scored corrected on the key determinant of survival in the treatment of pneumonia and 72.7% answered correctly the most appropriate antibiotic regimen for surgical prophylaxis. Table 7 demonstrates these results along with those after the educational presentation.

Table 6

Perceptions Toward Various Educational Resources as a Source for Continuous Education on Antibiotics (Pre/Post)

Resource	Useful or Very Useful (%)	Not Familiar (%)	N
Antimicrobial Stewardship Program	55.6/77.7	22.2/0	7
Ward rotations/Huddles	55.6/66.6	11.1/0	6
Grand rounds	55.6/55.6	11.1/11.1	6
Infectious diseases colleagues (fellows or faculty)	55.6/66.6	11.1/0	6
Pharmaceutical representatives	22.2/33.3	11.1/0	3
Off-campus lecture sponsored by a pharmaceutical company	22.2/33.3	11.1/0	3
CE online or live lectures	22.2/33.3	11.1/0	3
Medical journals	44.4/55.5	11.1/0	5
Sanford Guide	11.1/33.3	22.2/0	3
Up to date	44.4/55.5	11.1/0	5
Google	0/11.1	11.1/0	1
Internet Web sites	0/11.1	11.1/0	1

Table 7

APNs and Antibiotic Knowledge (Pre/Post)

Drug Choice	Doxycycline 9.1%/11.1%	Trimethoprim/ Sulfamethoxazole (Bactrim) 27.3%/11.2%	Vancomycin 63.6% /77.7%	Cefazoline 0%
Blood Culture	Daptomycin 0%/0%	Piperacillin-Tazobactam 30%/15%	Ceftriaxone 20.0%/15%	Meropenem 50.0%/70%
C. Diff	Levofloxacin 9.1%/0%	Clindamycin 27.3%/72.7%	Ceftriaxone 9.1%/0%	All the above 54.5%/27.3%
Vancomycin Guidelines	For the eradication of MRSA colonization 54.5%/72.7%	For the treatment of Methicillin Susceptible Staphylococcus Aureus (MSSA) bacteremia in a patient with renal failure 45.5%/27.3%	Treatment of 1 out of 4 positive blood cultures with Staphylococcus Haemolyticus in a patient with no central lines 0.0%/0%	
Costly Abx	Fluconazole 0%/0%	Linezolid 81.8%/100%	Levofloxacin 9.1%/0%	Clindamycin 9.1%/0%
Inpatient Abx	Prompt initiation of an agent with a narrow spectrum coverage, based on the most likely pathogen 0%/0%	Streamlining of the empiric regimen (i.e., revising an antibiotic based on culture) 100.0%/100%	Treatment duration of approximately 2 weeks 0.0%/0%	Treatment of colonized patients to prevent infection 0.0%/0%
Surgical Prophylaxis	Begin cefazolin 30 min. to 1 hr. pre-op; repeat dose after 3-4 hrs. Intra-op; repeat dose	Begin cefazolin 30 minutes to 1 hour preoperatively; repeat the dose after 3-4 hours	Begin cefazolin 8 hours before surgery; then repeat the dose every 8 hours for 24 hours	Begin cefazolin 24 hours before surgery; then repeat the dose every 8 hours postoperatively

	every 8 hr. and discontinue after 24 hrs. 72.7%/0%	intraoperative; repeat dose every 8 hours until the surgical drains are removed 9.1%/0%	postoperatively 9.1%/100%	for 3 days 9.1%/0%
PNA Tx	Antimicrobial treatment of sufficient duration 18.2%/27.3%	Appropriatenes s of initial empiric antimicrobial therapy 72.7%/72.7%	Use of an antimicrobial that has been recently FDA--approved 0.0%/0%	Hospitalization in the ICU 9.1%/0%
Anaerobic Bx	Clindamycin 20.0%/10%	Ampicillin/ Sulbactam (Unasyn) 20.0%/10%	Metronidazole (Flagyl) 20.0%/70%	Ciprofloxacin 40.0%/10%
Decreasing UTI	Administration of prophylactic antibiotics 0.0% /0%	Washing the collecting bags with hydrogen peroxide 0.0%/0%	Removal of indwelling catheters whenever possible 100%/100%	Changing of the indwelling catheter weekly 0.0%/0%

Recommendations

Nurse practitioners in acute care hospital settings should devise a collaborative plan to incorporate more antimicrobial stewardship education and assistance when ordering antibiotics. Clinical onboarding should include educational modules and reference guides that are updated based on the most up to date research and evidence-based practice guidelines. Reinforcement of awareness and appropriate prescribing should be including to both board certification and hospital privileges.

Strengths and Limitations of the Project

Project strengths are that this is the first survey exploring APNs' knowledge, attitudes, and perceptions toward antibiotic use, resistance, and antimicrobial stewardship interventions within this acute hospital setting. The survey was Web-based and allowed rapid distribution and turnaround time for responses; it was also anonymous, which likely reduced the tendency of respondents to provide "socially desirable" answers. In the future, this survey could be validated and applied across facilities engaging APNs in antimicrobial stewardship.

Potential limitations included the low response rate. The rate was likely a result, in part, to the many functions of hospital-based APNs that do not require antibiotics, which may have led some of them to not answer the survey. Also, the recent high turnover rate of the APNs could have added to the lower response rate. Since the beginning of the survey at least one-third of the APNs have either willingly left or been dismissed due to various reasons. It is also possible that some APNs do not perceive antimicrobial use and resistance to be a problem and thus elected not to participate in the study. Other limitations were that the questionnaire was self- reported, had not been externally validated, and was conducted in a single institution versus outpatient centers for comparison.

Section 5: Dissemination Plan

Introduction

Throughout the course of the doctoral project, the results obtained related to NPs' perceptions, values, and knowledge about ASPs, which guided my plan for dissemination of the information not only to the APN and ASP personnel but to nurse educators and stakeholders and leadership within the organization. The goal was to help increase both funding and time for the creation of an education model for prescribers ordering antibiotics. With the increase of resistance, the more knowledge and guidance when prescribing—as well as follow-up on microbiology results—the less likelihood resistance within the community will increase. The dissemination of these results for the APN occurred during the monthly meeting, and organization-wide during midday grand rounds in the auditorium. With the assistance of both the ASPs, Informatics Nurse Specialist, and Information Technology the creation of advisory pop-ups and antibiotic restrictions are in effect within my organization. When ordering antibiotics, a review of cultures is conducted, and review of choice is assessed by the pharmacy department. For those antibiotics that are at risk for resistance development, approval from an infectious disease specialist or pharmacist is granted based on condition of what exactly? and microbiology results. The goal of decreasing and even eradicating antibiotic resistance due to overprescribing and/or inappropriate prescribing due to the increase in knowledge and available sources was expected.

Analysis of Self

My overall part and contribution as well as participation as part of the Walden DNP project graduation completion was not only exciting, intense and satisfying. After completing multiple research classes within my master's program, with the help of Dr. Whitehead, applying that knowledge learned to real life practice to assist in quality program improvement for my institution's electronic health record when ordering and prescribing antibiotics. The assessment and education of the APN, specifically NP's within the organization while using Knowles adult learning theory allowed for an easier and more impactful evaluation of learned outcomes. The frustration with low participation at first decreased my interest but after further evaluation and analysis as to some of the reasons such as NP's resignation and having more CNS who do not prescribe allowed me to better understand and except such limitations. My future goals will include additional antibiotic inappropriate prescribing within my own department with implementation of consult dot phrases that can be placed in notes for all patient providers to follow recommendations regarding antibiotic use.

Summary

With the current burden of antibiotic resistance, it is imperative that health care professionals collaborate within all disciplines to greatly benefit patients. This survey and data obtained not only suggests that antimicrobial stewardships are helpful to NP's, but various areas of improvement have been highlighted and interventions should be planned to target these. These results can better assist nursing education address the barriers and

facilitate targeted NP's education within the institution and sister facilities regarding antimicrobial resistance. The results also demonstrated that potential opportunities for interdisciplinary efforts with infection control and the public health department role for assistance to improving patient safety and quality in care.

References

Abbo, L., Smith, L., Pereyra, M., Wyckoff, M., Hooton, T. (2012). Nurse practitioners' attitudes. perceptions and knowledge about antimicrobial stewardship. *The Journal of Nurse Practitioners, 8*(5): 370-376.

Armitage, K.B., Besser, R., McMiliian J. (2005). Choosing antibiotics wisely in an age of resistance. *Patient Care for The Nurse Practitioner, 39*(4): 48-54.

Bekkers, M.J., Simpson, S.A., Dunstan, F., Hood, K., Hare, M., Evans, J, Butler, C. (2010). Enhancing the quality of antibiotic prescribing in primary care: Quality evaluation of a blended learning intervention. *BMC Family Practice*, *11*:34

Center for Disease Control and Prevention (CDC). (2013). *Antibiotic resistance threats in the United States.* Retrieved from http: www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf

Center for Disease Control and Prevention (CDC). (2014). *National Strategy for Combating Antibiotic-Resistant Bacteria*. Retrieved from http: www.whitehoutse.gov/sites/default/files/docs/carb_natioal_strategy.pdf [http://perma.cc.RPP6-JTM2]

Center for Disease Control and Prevention (CDC). (2015). *National Healthcare Safety Network (NHSN).* Retrieved from https://www.cdc.gov/nhsn/about-nhsn/index.html

Center for Disease Control and Prevention (CDC). (2018). *Antibiotic/Antimicrobial Resistance*. Retrieved from https://www.cdc.gov/drugresistance/index.html

Clapper, T. C. (2010). Beyond Knowles: What those conducting simulation need to know about adult learning theory. *Clinical Simulation in Nursing*, *6*(1), e7-e14. DOI: 10.1016/j.ecns.2009.07.003

Dellit, T.H., Owens, R.C., McGowan, J.E. Jr., et al. (2007). Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Journal of Antimicrobial Chemotherapy, 63*(2): 230-237.

de Kraker, M.E., Davey, P.G., Grundman, H. (2011). Mortality and hospital stay associated with resistant Staphylococcus aureus and Escherichia coli bacteremia: estimating the burden of antibiotic resistance in Europe. *Plos Medicine, 8*(10).

Edgar, T., Boyd, S.D., Palame, M.J. (2009). Sustainability for behavior change in the fight against antibiotic resistance: a social marketing framework. *Journal of Antimicrobial Chemotherapy, 63*(2): 230-237.

Edwards, R., Drumright. L, Kiernan, M., Homes, A. (2011). Covering more territory to fight resistance: Considering nurses' role in antimicrobial stewardship. *Journal of Infection Prevention, 12*(1): 6-10.

Fineout-Overholt, E., Melnyk, B. M., Stillwell, S. B., & Williamson, K. M. (2010). EVIDENCE-BASED PRACTICE Step by Step Critical Appraisal of the Evidence: Part III. *American Journal of Nursing*, *110*(11), 43–51.

Gangat, A., Hsu, J. (2015). Antibiotic stewardship: A focus on ambulatory care. *South Dakota State Medical Association,* Special Edition: 44-48.

Gerding, D.N. (2001). The search for good antimicrobial stewardship. *Joint Commission Journal of Quality Improvement, 27*:403-404.

Giblin, T.B., Sinkowitz-Cochran, R.L., Harris, P.L., et al. (2004). Clinician's perceptions of the problem of antimicrobial resistance in healthcare facilities. *Arch Intern Med, 164*(15): 1662-1668.

Giusti, M., Cerutti, E. (2016). Antibiotic stewardship programs and the internist's role. *Italian Journal of Medicine, 10*: 329-338.

Manning, M.L., Pfeiffer, J., Larson, E. (2016). Combating antibiotic resistance: The role of nursing in antibiotic stewardship. *American Journal of Infection Control*, *44*:1454-1457.

Mundinger, M.O., Kane, R.L., Lenz, E.R. et al. (2000). Primary care outcomes in patients treated by nurse practitioners or physicians: a randomized trial. *Journal of the American Medical Association*, *283*(1): 59-68.

Munro, N. (2015). Antimicrobial resistance: thinking outside the box. *AACN Advanced Critical Care, 26*(3): 225-230.

"PENICILLIN'S FINDER ASSAYS ITS FUTURE". (1945). Penicillin's finder assays its future: Sir Alexander Fleming says improved dosage method is needed to extend use. *New York Times*, 21.

Nealy, K.L., McCarty, D.J., Woods, J.A. (2016). Managing Drug Resistant Organism in Acute Care. *The Nurse Practitioner*, *41*(2): 38-44.

Ness, V., Price, L., Currie, K., Reilly, J. (2016). Influences on independent nurse prescribers' antimicrobial prescribing behavior: a systematic review. *Journal of Clinical Nursing*, *25*, 1206-1217.

Owens, R.C. Jr., Shorr, A.F. Deschambeault, A.L. (2009). Antimicrobial stewardship: shepherding precious resources. *American Journal of Health System Pharmacology*, *66*(12): 15-22.

Ortoleva, C. (2010). An approach to consistent patient education. *AORN Journal, 92*(4), 437-444.

Patel, G., Huprikar, S., Factor, S.H. Jenkins, S.G., Calfee, D.P. (2008). Outcomes of

Carbapenem-resistant Klebsiella pneumoniae infection and the impact of antimicrobial and adjunctive therapies. *Infection Control Hospital Epidemiology*, *29*(12): 1099-1106.

Pratt, M. G. (2008). Fitting oval pegs into round holes: Tensions in evaluating and publishing qualitative research in top-tier North American journals. *Organizational Research Methods*, *11*, 481– 509.

Running, A., Kipp, C., Mercer, V. (2006). Prescriptive patterns of nurse practitioners and physicians. *Journal of American Academy of Nurse Practitioners*, *18*(5): 228-233.

Sandord, N. (2016). The Battle Against Antimicrobial Drug Resistance: Analyzing Recent Developments and the Necessity for Major Agricultural Reforms. *William and Mary Environmental Law and Policy Review*, *40*(3): 988-1011.

Smith, M. K. (2002). 'Malcolm Knowles, informal adult education, self-direction and andragogy'. The Encyclopedia of Informal Education. Retrieved from http://infed.org/mobi/malcolm-knowles-informal-adult-education-self-directionand-andragogy/

Spellberg, B., Guidos, R., Gilbert, D., et al. (2008). The Epidemic of antibiotic-resistant infections: a call to action for the medical community form the Infectious Disease Society of America. *Clinical Infectious Diseases*, *46*(2): 155-164.

World Health Organization (WHO). (2018). *Antibiotic resistance*. Retrieved from http://www.who.int/news-room/fact-sheets/detail/antibiotic-resista

Appendix A: Survey Tool

Antimicrobial use at NYU Langone Brooklyn impacts thousands of patients and families every day. Inappropriate use of these medications negatively impacts patient safety, quality of care, and cost of delivering care. As healthcare leaders we must take an active role in the prevention of antimicrobial resistance in order to provide the best care to our patients and community.

Appropriate antimicrobial use is a priority at NYU Langone Brooklyn. Currently with the Antimicrobial Stewardship Program and myself, are leading a study to improve our education and most importantly our patients' safety and quality of care.

Please and complete the following anonymous survey as soon as possible. The survey should take you 10-15 minutes to complete. Please don't skip any questions, as all your answers are extremely important!

This survey is part of my Doctor of Nursing Practice project at Walden University. The Consent to Participate in an Anonymous Questionnaire will be part of the survey and by clicking the link you imply consent. Thank you for your participation!

IF YOU DON'T PRESCRIBE ANTIBIOTICS PLEASE DISREGARD THE SURVEY

Thank you for your support of this DNP project and your commitment to improving patient outcomes. You may contact me directly at evelyn.fabian@waldenu.edu if you would like results of the survey.

ASP, NYU Langone Brooklyn

Evelyn Fabian, FNP-BC, DNP-Student at Walden University, VIR NP at NYU Langone Brooklyn

Permission to use the survey from: Lillian Abbo. MD Co-Director Antimicrobial Stewardship Program Jackson Memorial Hospital University of Miami Miller School of Medicine

Antibiotic Survey for Nurse Practitioners

1. **How many years have you been licensed as a Nurse Practitioner?**
    a. Less than 1
    b. 1-3
    c. 4-6
    d. 7-9
    e. 10 or more
2. **What is your MAIN specialty area?**
    a. Midwife
    b. ER/trauma/burns
    c. Pediatrics
    d. Cardiology
    e. Critical care
    f. Hematology/oncology
    g. Infectious diseases
    h. Internal medicine
    i. Neurology
    j. OB/GYN
    k. General surgery
    l. Transplant
    m. Other
3. **How do you select antibiotics in a patient with no culture information? Check all that apply.**
    a. I start with broad spectrum and tailor upon culture results
    b. I base my decisions on the hospital antibiotic program
    c. I ask a resident or attending
    d. I ask another NP or PA
    e. I use the same 1 or 2 antibiotics
    f. I ask the patient
    g. Other

4. **The following question is answered using a Likert Scale from 1 – 5.**
    1 = never; 2 =rarely; 3 = sometimes; 4 = often; 5= always

    Which of the following might influence your decision to select an antibiotic?
    a. Cost savings for the patient
    b. Cost savings for the hospital
    c. Risk of missing an infection
    d. Patient demands and expectations for antibiotics
    e. The patient is critically ill and/or immunocompromised
    f. Reassurance when using an antibiotic even if it might be the wrong one
    g. Unexplained fever or leukocytosis even if cultures are negative

h. Treat colonization to prevent infection
i. Risk of developing Clostridium difficile colitis
j. Other

5. **The following question is answered on a Likert Scale from 1 – 6**
   1 = never useful; 2 = rarely; 3 = sometimes; 4 = often; 5 = always useful; 6 = not familiar

   How useful are the following sources of information with respect to your LEARNING and CONTINUING EDUCATION about antibiotics?
   a. Antimicrobial Stewardship Program
   b. Ward rotations
   c. Grand rounds
   d. Infectious Diseases colleagues (fellows and/or faculty)
   e. Pharmaceutical representatives
   f. Off campus lecture sponsored by pharmaceutical company
      CME online or live lectures
   g. Medical or nursing journals
   h. Sanford Guide
   i. Up to date
   j. Google
   k. Internet Websites
   l. Other
6. **The following question is answered using a Likert Scale from 1 – 5.**
   1 = never; 2 =rarely; 3 = sometimes; 4 = often; 5= always

   What are your perceptions for each of the following statements?
   a. Antibiotics are overused nationally
   b. Antibiotics are overused at my hospital
   c. Antibiotic resistance is not a significant problem nationally
   d. Antibiotic resistance is not a significant problem at my hospital
   e. Better use of antibiotics will reduce problems with antibiotic resistant organisms
   f. Strong knowledge of antibiotics is important in my healthcare career
   g. I am confident that I use antibiotics optimally in the ICU
   h. I am confident that I use antibiotics optimally in the non-ICU setting
   i. j. I overprescribe antibiotics
   j. Other NPs and/or PAs overprescribe antibiotics
   k. Antibiotic utilization/management programs are an obstacle to good patient care
   l. I would like more feedback on my antibiotic selections
   m. I would like more education on antibiotics
   n. I am less likely to use restricted antibiotics if Infectious Disease approval is required
   o. Interactions with pharmaceutical representatives do not influence my antibiotic selecti ons

p. Locally developed guidelines for antibiotic treatment would be more useful to me tha n national guidelines
q. I am concerned about antibiotic resistance in the community when I prescribe antibiot ics
r. I am concerned about antibiotic resistance in my hospital when I prescribe antibiotics
s. New antibiotics will be developed in the future that will keep up with the problem of "resistance"
t. Prescribing broad spectrum antibiotics when equally effective narrower spectrum anti biotics are available increases antibiotic resistance
u. Poor Infection Control practices by healthcare professionals causes spread of antibioti c resistance
v. Inappropriate use of antibiotics causes antibiotic resistance
w. Inappropriate use of antibiotics can harm patients
x. Inappropriate use of antibiotics is professionally unethical

Select one response to each of the following questions

7. **Which one of the following drugs would you choose as first line to treat a patient with Methicillin Resistant Staphylococcus aureus (MRSA) bacteremia?**
    a. Doxycycline
    b. Trimethoprim/Sulfamethoxazole (Bactrim)
    c. Vancomycin
    d. Cefazoline

8. **The lab calls you with a positive blood culture for extended spectrum beta lactamase positive (ESBL) E. coli, which one is your preferred empiric antibiotic to treat this bacteremia?**
    a. Daptomycin
    b. Piperacillin. -Tazobactam
    c. Ceftriaxone
    d. Meropenem

9. **Which of the following antibiotics can potentially increase the risk for developing Clostridium difficile colitis?**
    a. Levofloxacin
    b. Clindamycin
    c. Ceftriaxone
    d. All the above

10. **According to Centers for Disease Control and Prevention (CDC) guidelines, intravenous vancomycin use is discouraged in which of the following situations?**
    a. For the eradication of MRSA colonization
    b. For the treatment of Methicillin Susceptible Staphylococcus Aureus (MSSA) bacteremia in a patient with renal failure

c. Treatment of 1 out of 4 positive blood cultures with Staphylococcus Haemolyticus in a patient with no central lines

11. Which one of the following antibiotics cost more than $1000/week for the usual oral regimen?

a. Fluconazole
b. Linezolid
c. Levofloxacin
d. Clindamycin

12. Which one of the following statements is most appropriate when using antibiotics in hospitalized patients?

a. Prompt initiation of an agent with a narrow spectrum coverage, based on the most likely pathogen
b. Streamlining of the empiric regimen (i.e., revising antibiotic based on culture)
c. Treatment duration of approximately 2 weeks
d. Treatment of colonized patients to prevent infection

13. When you use antibiotics for surgical prophylaxis, which one of the following regimens is most appropriate?

a. Begin cefazolin 30 min. to 1 hr. pre-op; repeat dose after 3-4 hrs. Intra-op; repeat dose every 8 hr. and discontinue after 24 hrs.
b. Begin cefazolin 30 minutes to 1 hour preoperatively; repeat the dose after 3-4 hours intraoperative; repeat dose every 8 hours until the surgical drains are removed
c. Begin cefazolin 8 hours before surgery; then repeat the dose every 8 hours for 24 hours postoperatively
d. Begin cefazolin 24 hours before surgery; then repeat the dose every 8 hours postoperatively for 3 days

14. In the treatment of pneumonia, the key determinant of survival appears to be:

a. Antimicrobial treatment of sufficient duration
b. Appropriateness of initial empiric antimicrobial therapy
c. Use of an antimicrobial that has been recently FDA approved
d. Hospitalization in the ICU

15. Which one of the following drugs is NOT active against anaerobic bacteria?

a. Clindamycin
b. Ampicillin/ Sulbactam (Unasyn)
c. Metronidazole (Flagyl)
d. Ciprofloxacin

16. A high number of urinary tract infections are occurring in hospitalized patients

who have indwelling urinary catheters in place. Which one of the following will most likely decrease the frequency of urinary tract infections in these patients?

a. Administration of prophylactic antibiotics
b. Washing the collecting bags with hydrogen peroxide
c. Removal of indwelling catheters whenever possible
d. Changing of the indwelling catheter weekly

Thank you.

Your time and responses are extremely valuable!!!

Appendix B: Permission for Use of Tool

Request for Permission
Evelyn Fabian

From: Evelyn Fabian <evelyn.fabian@waldenu.edu>
Sent: Friday, April 13, 2018 9:34:03 AM
To: Abbo, Lilian M.
Subject: Request for Permission

Good Morning Dr. Abbo,

My name is Evelyn Fabian and currently, I am a Family Nurse Practitioner who is enrolled at Walden University to obtain my Doctor of Nursing Practice (DNP). If you are not aware, students enrolled in DNP programs are required to develop a scholarly project that will impact practice and nursing care. Currently, after an assessment of my current working facility, antibiotic stewardship is in place, but the lack of knowledge of the providers has been proven time after time with errors in antibiotic use. We routinely see patients receiving prior antibiotics despite them being on broad-spectrum antimicrobials in the hospital. This causes increased antimicrobial exposure to our patients which puts them at higher risk for drug-resistant organisms, c.diff infection, and other adverse reactions (especially when given cephalosporin's on top of ongoing beta-lactam use). I would love to use your instrument with our Antimicrobial Stewardship and ID PharmD to determine a way to minimize periop antibiotic errors.

I am writing to you to request the permission to use your tool to develop a presentation for knowledge enhancement of the providers and APN as well as improve ways to decrease antibiotic errors and inappropriate use.

Thank you for your time and consideration

Evelyn Fabian, FNP-BC
DNP student of Walden University
347-835-9913

From: Abbo, Lilian M. <LAbbo@med.miami.edu>
Sent: Friday, April 13, 2018 11:23:25 AM
To: Evelyn Fabian
Subject: Re: Request for Permission

Evelyn

I will be glad to share but kindly specify which one of the articles are you referring to as I have a few studies where we used surveys (need journal/ year/ manuscript tile)

On a separate note, I am not sure that this will change your behaviors in periop antibiotics We implemented a pre and post antibiotic dosing guideline and intraoperative redosing of antibiotics (ICHE 2011) that lead to more meaningful changes and compliance with stopping unnecessary antibiotic doses or wrong selection

Lilian Abbo, M.D. FIDSA
Chief Infection Control & Antimicrobial Stewardship
Jackson Health System
Associate Professor of Infectious Diseases
Department of Medicine & Miami Transplant Institute
University of Miami Miller School of Medicine
JHS Office: 305-585-7571
UM ID Office: 305- 243-4598
www.ugotabug.med.miami.edu

From: Evelyn Fabian <evelyn.fabian@waldenu.edu>
Sent: Friday, April 13, 2018 12:48:51 PM
To: Abbo, Lilian M.
Subject: Re: Request for Permission

Dr. Abbo

The article I read was:

Nurse Practitioners' Attitudes, Perceptions, and Knowledge About Antimicrobial Stewardship from the Journal of Nurse Practitioners Volume 8 Issue 5 May 2012

And yes, just as you stated I am looking into trying to implement a new antibiotic dosing guide for Periop procedures to avoid unnecessary antibiotic administration.

Evelyn Fabian, FNP-BC
DNP student

From: Abbo, Lilian M. <LAbbo@med.miami.edu>
Sent: Friday, April 13, 2018 2:01:55 PM
To: Evelyn Fabian
Subject: Re: Request for Permission

Survey attached
If you go to our website www.ugotabug.med.miami.edu

Got A Bug? Antimicrobial Stewardship Program at Miller ...

www.ugotabug.med.miami.edu

The Antimicrobial Stewardship Program Website for the Jackson Health System and the University of Miami Hospitals. Antimicrobial Resistance is an...

We have the surgical prophylaxis guidelines w pre and post op

Good luck!

Lilian Abbo, M.D. FIDSA
Chief Infection Control & Antimicrobial Stewardship
Jackson Health System
Associate Professor of Infectious Diseases
Department of Medicine & Miami Transplant Institute
University of Miami Miller School of Medicine
JHS Office: 305-585-7571
UM ID Office: 305- 243-4598
www.ugotabug.med.miami.edu

Evelyn

Fri 4/13, 4:06 PM
Abbo, Lilian M. <LAbbo@med.miami.edu>
Sent Items

Thank you.

Appendix C: Education Program

ANTIBIOTIC RESISTANCE IN A ACUTE INPATIENT HOSPITAL SETTING

DOCTOR OF NURSE PRACTITIONER SCHOLARLY PROJECT

EVELYN FABIAN DNP STUDENT WALDEN UNIVERSITY, 2019

INTRODUCTION

- Each year in the U.S., at least 2 million people get an antibiotic-resistant infection, and at least 23,000 people die. (CDC, 2018)
- Antibiotic treatment is the most important risk factor in C. diff infections with an estimated 453,000 cases occurring in the U.S. in 2011. (Lessa et al, 2015)
- Infections caused by antibiotic-resistance germs are difficult, and sometimes impossible, to treat.
- Resistance to antibiotics has increased dramatically in the United States, with serious associated medical, social, and economic consequences.

PROBLEM

Antibiotic expenditures totaled $10.7 billion in 2009. (Suda et al., 2013)

Inappropriate antibiotic use and overuse as described by the CDC (2018), accounts for up to 50% of the time not optimally prescribed and when they are, result in: not being needed, incorrect dose and duration.

According to the literature on antibiotic resistance it is expected that if providers and prescribers are not careful or knowledgeable, the incidence of antibiotic resistance will only increase over the next couple of years. (CDC, 2018).

With such high cost related to antibiotic prescriptions, it is a responsibility as a DNP prepared nurse to educate and advocate for practice change based on EBP outcomes.

SIGNIFICANCE

Addressing antibiotic resistance and raising awareness is vital to protecting public health and our environment.

While addressing this goal will require time and resources, it is necessary to prevent the more costly possibilities of widespread diseases, greater infections, and lack of effective medicines. (Sanford, 2016).

Through the use of this staff educational project, the newly gained knowledge will support the mission of Walden University to promote positive social change through the decrease of antibiotic resistance and unnecessary prescriptions for infections that do not require them such as those with viral etiology.

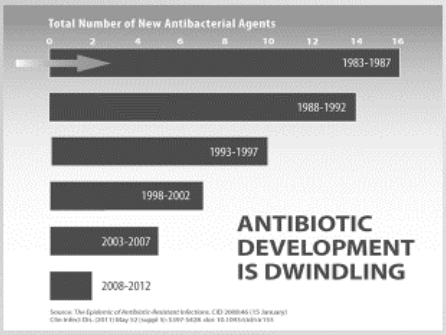
LEARNING OBJECTIVES

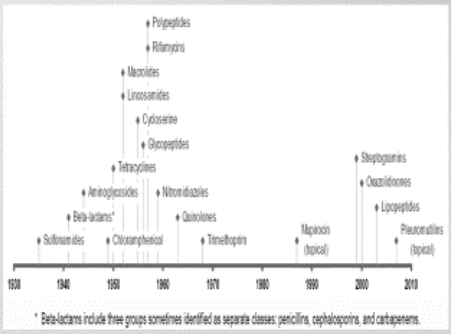
At the end of this session, participants will be able to:

- Define the term 'antibiotic'
- List the names of commonly used antibiotics
- Identify key risks associated with antibiotic use
- Describe the role of the healthcare team in improving antimicrobial use

CURRENT ANTIBIOTIC RESISTANCE THREAT IN THE UNITED STATES

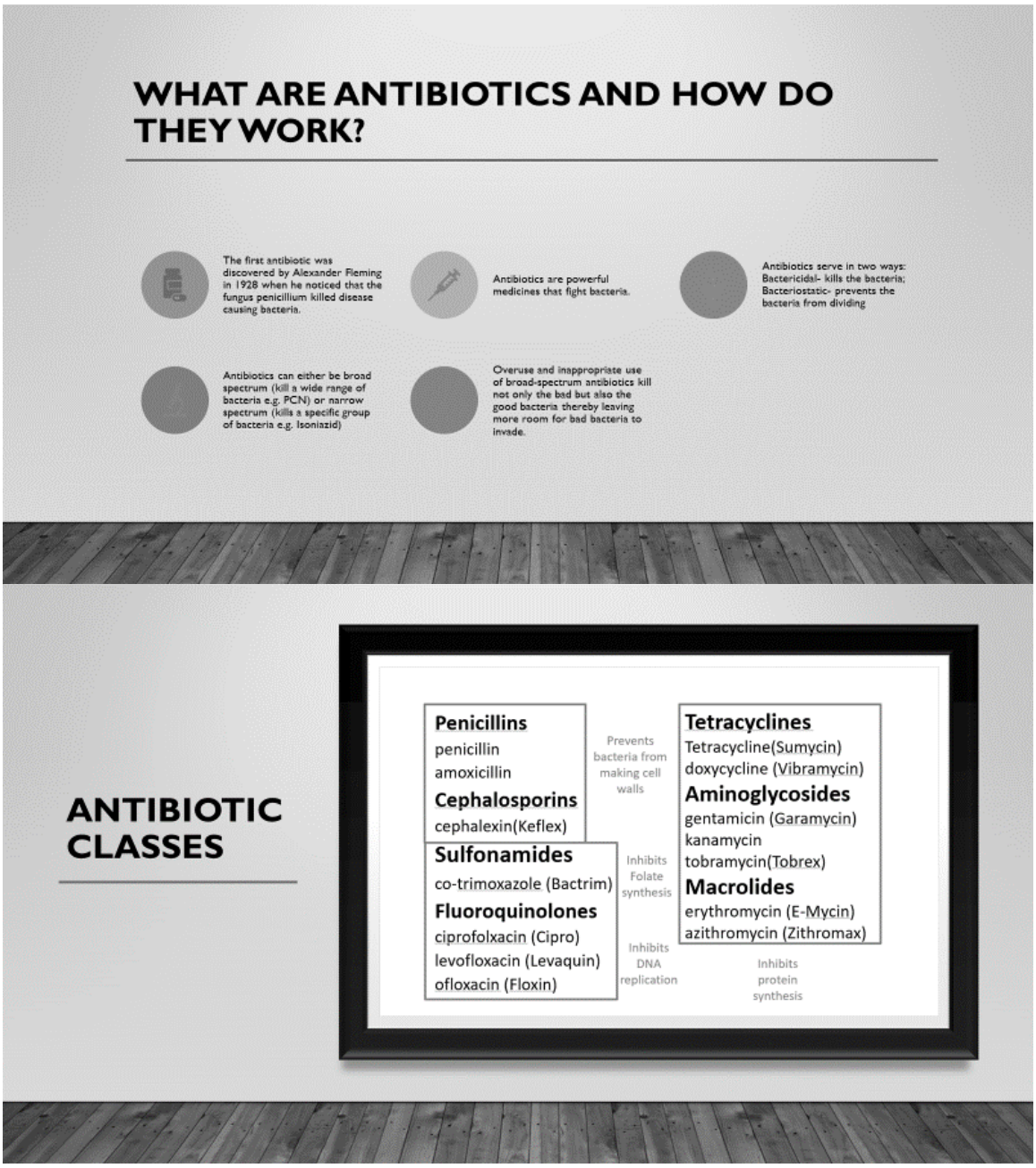
ANTIBIOTICS HISTORY IN REVIEW





PROJECT QUESTION

- The project question is: Do nurse practitioners' attitudes, perceptions and knowledge about antimicrobial stewardship significantly increases after an education program on antimicrobial stewardship?
- NP's provide a significant amount of medical care that is likely to increase with health care reform (Running et al., 2006); therefore, it is imperative that nurses exhibit sensible antimicrobial-prescribing practices.
- ASP's usually promote behavior changes by addressing the beliefs and motivations of target groups. (Giblin et al., 2004).


WHAT ARE ANTIBIOTICS AND HOW DO THEY WORK?
The first antibiotic was discovered by Alexander Fleming in 1928 when he noticed that the fungus penicillium killed disease causing bacteria.
Antibiotics are powerful medicines that fight bacteria.
Antibiotics serve in two ways: Bactericidal- kills the bacteria; Bacteriostatic- prevents the bacteria from dividing
Antibiotics can either be broad spectrum (kill a wide range of bacteria e.g. PCN) or narrow spectrum (kills a specific group of bacteria e.g. Isoniazid)
Overuse and inappropriate use of broad-spectrum antibiotics kill not only the bad but also the good bacteria thereby leaving more room for bad bacteria to invade.
ANTIBIOTIC CLASSES
Penicillins
penicillin
amoxicillin
Cephalosporins
cephalexin(Keflex)
Prevents bacteria from making cell walls
Tetracyclines
Tetracycline(Sumycin)
doxycycline (Vibramycin)
Aminoglycosides
gentamicin (Garamycin)
kanamycin
tobramycin(Tobrex)
Macrolides
erythromycin (E-Mycin)
azithromycin (Zithromax)
Sulfonamides
co-trimoxazole (Bactrim)
Inhibits Folate synthesis
Fluoroquinolones
ciprofolxacin (Cipro)
levofloxacin (Levaquin)
ofloxacin (Floxin)
Inhibits DNA replication
Inhibits protein synthesis


ANTIBIOTIC INDICATIONS
Antibiotics can be used to treat (or prevent) a wide range of bacterial infections
Sepsis is an example of a serious infection with high mortality → must be treated promptly
A sore throat is an example of a less serious infection where antibiotics are only needed in high-risk cases → refer to guidelines
ANTIBIOTIC IMPORTANCE
Antibiotics are life-saving medicines
Only effective if the antibiotic works against the organism causing infection
Risk of side effects and harm
Use of antibiotics can contribute to the problem of antimicrobial resistance

ANTIBIOTIC SELECTION

Choosing the most appropriate antibiotic for a patient is very important

Antibiotics are often selected according to their class and 'spectrum' of activity (e.g. broad vs. narrow)

Growing cultures in the micro lab can help to identify the bacteria and decide which antibiotic may be best to use

What if we don't know the causative organism?

Guidelines recommend the most appropriate antibiotic to be used until results are available ('empirical therapy')

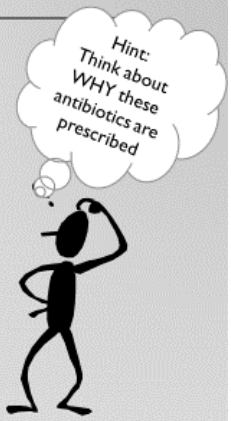
POP QUIZ: BROAD VS NARROW SPECTRUM

- Which of the following antibiotics are considered broad spectrum?

Piperacillin-tazobactam	Metronidazole
Cephazolin	Moxifloxacin
Benzylpenicillin	Meropenem
Ceftriaxone	Trimethoprim

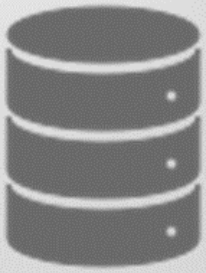
ANSWERS

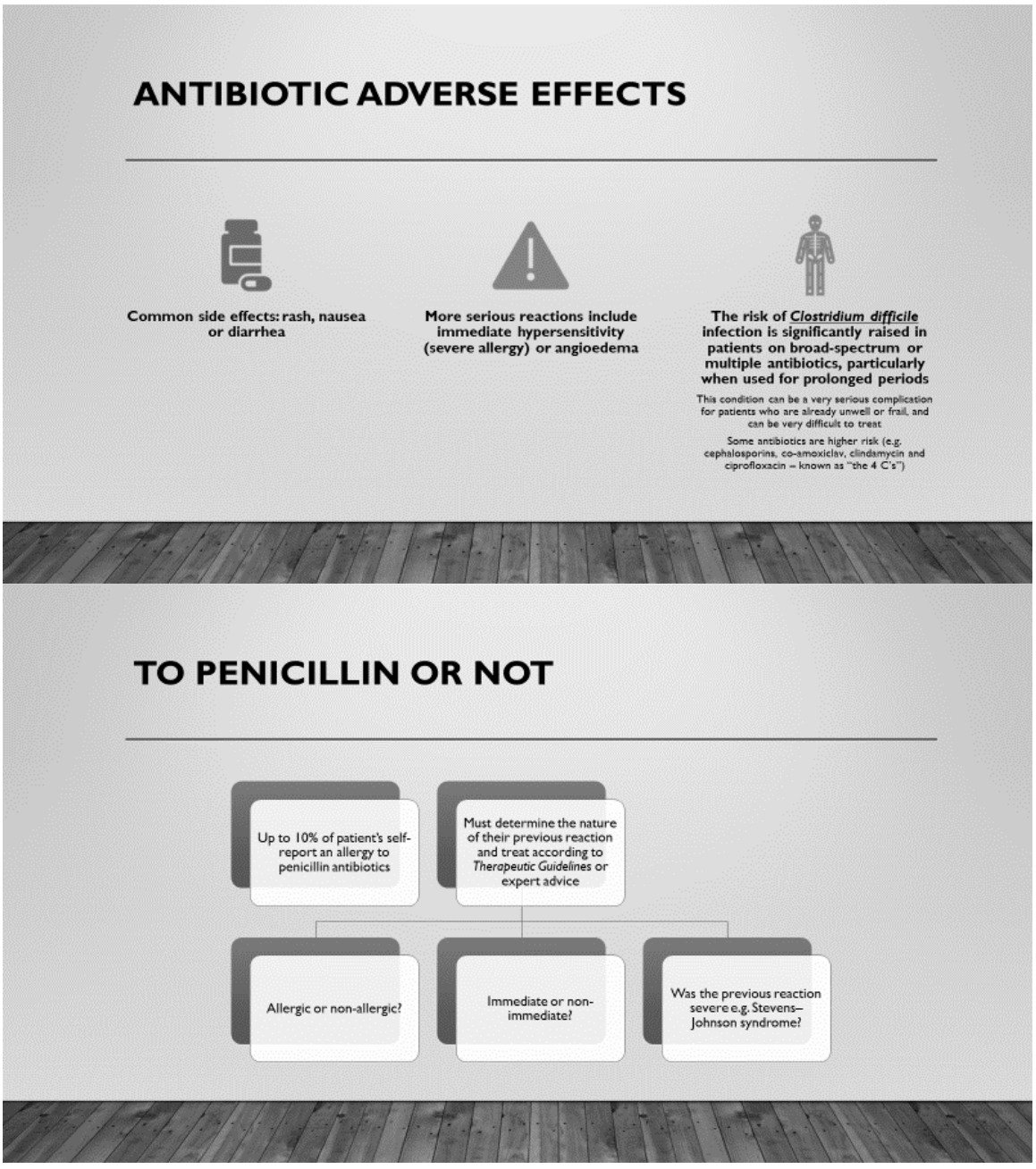
Broad	Narrow
Narrow	Broad
Narrow	Broad
Broad	Narrow



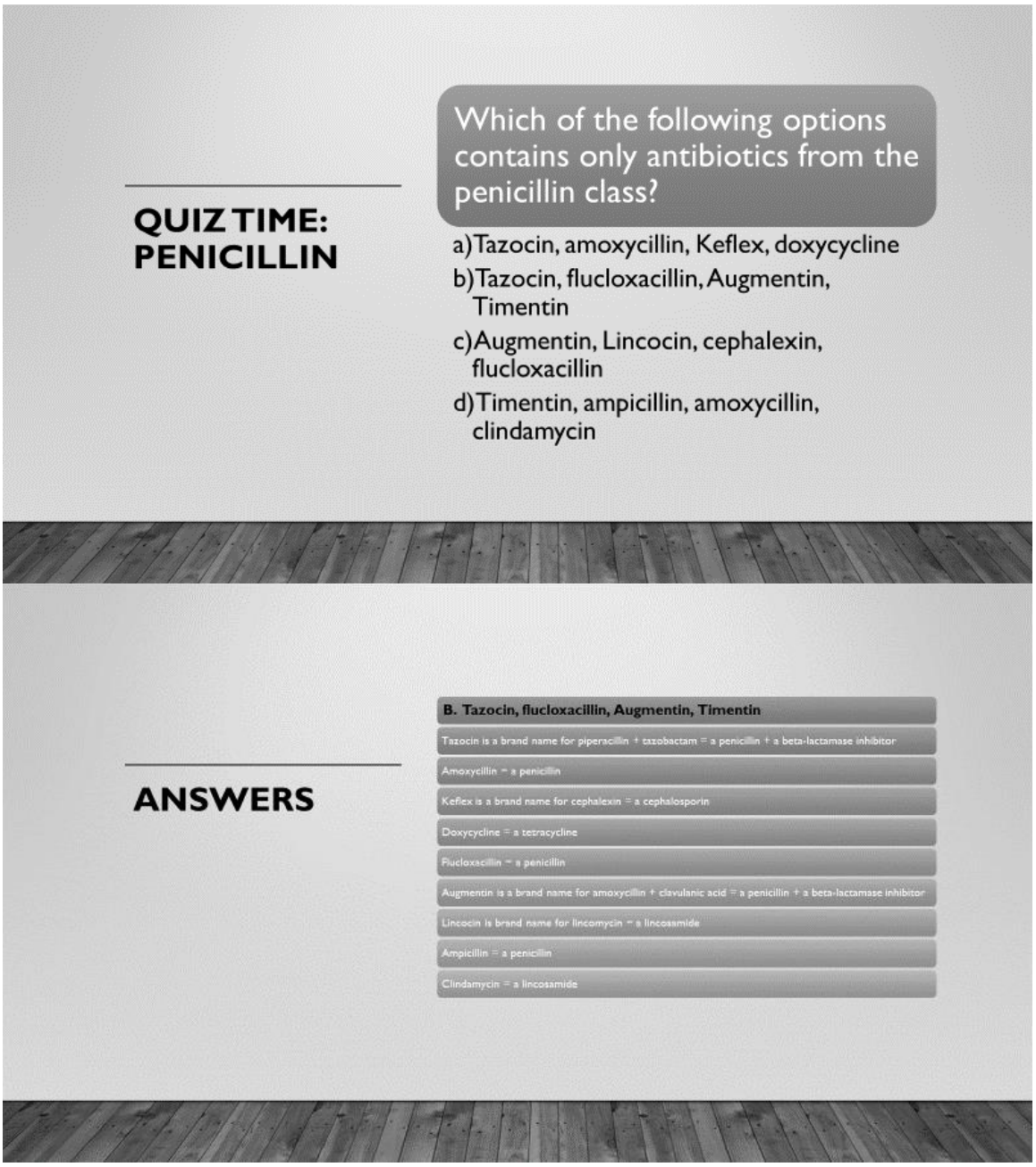
HOW TO DEESCALATE ANTIBIOTICS

- Once micro results are available, therapy can be targeted at the causative organism based on its antibiotic susceptibilities
  - May mean switching to a more narrow-spectrum antibiotic, which reduces negative effects on the body's natural flora
  - Care needed when interpreting microbiology reports → seek advice if needed




ANTIBIOTIC ADVERSE EFFECTS
Common side effects: rash, nausea or diarrhea
More serious reactions include immediate hypersensitivity (severe allergy) or angioedema
The risk of Clostridium difficile infection is significantly raised in patients on broad-spectrum or multiple antibiotics, particularly when used for prolonged periods
This condition can be a very serious complication for patients who are already unwell or frail, and can be very difficult to treat
Some antibiotics are higher risk (e.g. cephalosporins, co-amoxiclav, clindamycin and ciprofloxacin – known as "the 4 C's")

TO PENICILLIN OR NOT
Up to 10% of patient's self-report an allergy to penicillin antibiotics
Must determine the nature of their previous reaction and treat according to Therapeutic Guidelines or expert advice
Allergic or non-allergic?
Immediate or non-immediate?
Was the previous reaction severe e.g. Stevens–Johnson syndrome?


QUIZ TIME:
PENICILLIN
Which of the following options contains only antibiotics from the penicillin class?
a) Tazocin, amoxycillin, Keflex, doxycycline
b) Tazocin, flucloxacillin, Augmentin, Timentin
c) Augmentin, Lincocin, cephalexin, flucloxacillin
d) Timentin, ampicillin, amoxycillin, clindamycin
ANSWERS
B. Tazocin, flucloxacillin, Augmentin, Timentin
Tazocin is a brand name for piperacillin + tazobactam = a penicillin + a beta-lactamase inhibitor
Amoxycillin = a penicillin
Keflex is a brand name for cephalexin = a cephalosporin
Doxycycline = a tetracycline
Flucloxacillin = a penicillin
Augmentin is a brand name for amoxycillin + clavulanic acid = a penicillin + a beta-lactamase inhibitor
Lincocin is brand name for lincomycin = a lincosamide
Ampicillin = a penicillin
Clindamycin = a lincosamide

ANTIBIOTIC RESISTANCE

- When bacteria develop new ways to defend against antibiotics, this is called 'antibiotic resistance'
- Resistance to an antibiotic means the drug is no longer effective against the infecting bacteria
- Examples:
  - Methicillin-resistant *Staphylococcus aureus* (MRSA) cannot be treated with flucloxacillin
  - Vancomycin-resistant enterococci (VRE) cannot be treated with vancomycin
  - Carbapenem-resistant Enterobacteriacese (CRE) cannot be treated with meropenem or other carbapenems

HOW TO PREVENT ANTIBIOTIC RESISTANCE

Appropriate assessment and testing to ensure bacterial infection before prescribing antibiotics.

Only taking antibiotics that are prescribed and complete the full course even if symptoms are relieved sooner.

When broad spectrum antibiotics are prescribed ensure diligent follow up of cultures to deescalate and transition to a narrow antibiotic when indicated.

Avoiding infections through immunization, safe food preparation, handwashing, and using antibiotics as directed and only when necessary.

CDC's National Healthcare Safety Network (NHSN) is used by healthcare facilities to electronically report infections, antibiotic use, and resistance allowing to track and benchmark antibiotic resistance in all bacteria, as well as track antibiotic usage.

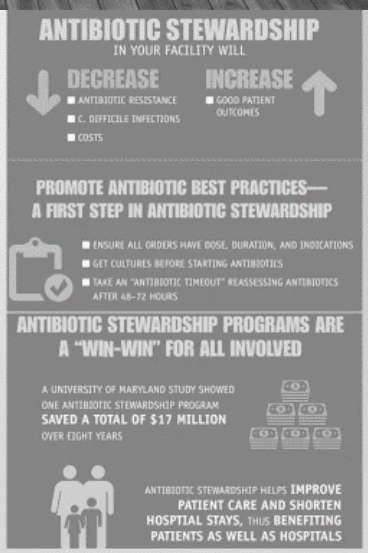

QUIZ TIME: ANTIBIOTIC RESISTANCE
Which of the following strategies reduce the development and/or spread of antibiotic resistance?
a) Targeted interventions to reduce unnecessary use of antibiotics
b) Performing hand hygiene before and after touching a patient or surrounds
c) Ensuring environmental cleaning procedures are complete and consistent
d) Using narrow spectrum antibiotic(s) that will treat a patient's infection
e) All of the above
ANSWER
a) Targeted interventions to reduce unnecessary use of antibiotics (reduces development)
b) Performing hand hygiene before and after touching a patient or surrounds (reduces spread)
c) Ensuring environmental cleaning procedures are complete and consistent (reduces spread)
d) Using narrow spectrum antibiotic(s) that will treat a patient's infection (reduces development)
e) All of the above

ANTIBIOTIC STEWARDSHIP PROGRAM (ASP)

- Was developed to promote appropriate and responsible use of antibiotics through:
- Optimizing therapy: best drug, dose, route and duration
- Reviews and address patient tolerance and safety to avoid adverse events or drug-drug interactions
- Assist with allergy recommendations
- Culture and Sensitivity review
- IV to PO and discharge recommendations

ASP AT NYU LANGONE BROOKLYN

- Supports the practices of providers throughout NYU Langone Health to ensure the appropriate utilization of antimicrobials, with the goal of providing the highest quality of care to the patients we serve, while minimizing the risks associated with antimicrobial overuse.
- Is composed of seven elements: Leadership Commitment, Accountability, Drug Expertise, action, Tracking and Monitoring Antibiotic Prescribing, Use and Resistance, Reporting and Education
- Collaborates with IT to enhance ordering and chart review related to antimicrobial usage for all providers



HOW CAN NURSE PRACTITIONERS HELP

Obtain
- Obtain cultures before starting therapy

Document
- Document the reason for prescribing an antibiotic and the intended duration in the patient's clinical notes and medication chart

Use
- Use local guidelines or Therapeutic Guidelines: Antibiotic for empiric therapy

Review
- Review empiric antibiotics after 48 hours (or sooner if results are available)
- Switch patients to a safer or narrow spectrum antibiotic if appropriate

Discuss
- Discuss antibiotic therapy with their patients

TEAMWORK AND COLLABORATION

It is everyone's job to:

- Communicate the patient's condition and reason for antibiotic therapy among the team
- Review the patient's response
- Talk to the patient about their antibiotic therapy

KEY HIGHLIGHTS TO REMEMBER

- Antibiotics are essential medicines in healthcare and are used to treat bacterial infections
- There are many types of antibiotics used in hospital patients
- Using the most suitable antibiotic in a patient minimizes the risk of harm to the patient
- Antibiotic resistance is a global problem, and responsible antibiotic use is needed
- Discussing antibiotic therapy with patients during their hospital stay can help to ensure antibiotics are used properly

QUESTIONS

REFERENCES

- CDC. (2018). *About Antibiotic Resistance*. Retrieved from https://www.cdc.gov/drugresistance/about.html
- CDC. (2018). *CDC's Role*. Retrieved from https://www.cdc.gov/drugresistance/cdc_role.html
- Lessa, F.C. et al. (2015). Burden of C. Diff infection in the United States. *N Engl J Med*, 372: 825-234.
- Sanchez, G. V., et al. (2016).Core Elements of Outpatient Antibiotic Stewardship. MMWR RECOMMENDATIONS AND REPORTS, 65(6). Retrieved from https://ezp.waldenulibrary.org/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=edswsc&AN=000387983500001&site=eds-live&scope=site
- Suda, K.L., et al. (2013). A national evaluation of antibiotic expenditures by healthcare setting in the United States,2009. *J Antimicrob Chemother*, 68:715-718.
- Clinical Excellence Commission (2014). Sepsis Kills clinical presentation adult inpatient. Sydney: Clinical Excellence Commission. Available at: http://www.cec.health.nsw.gov.au/programs/sepsis/education#education1.
- Collignon, P (2002). Antibiotic resistance. *Med J Aust*, 177: 325-329.
- eTG complete [Internet] (2014). Melbourne: Therapeutic Guidelines Limited. Available at: www.ciap.health.nsw.gov.au (accessed 28 Aug 2014).
- Kumar A, Roberts D, Wood KE, Light B, Parrillo JE, Sharma S, Suppes R, Feinstein D, Zanotti S, Taiberg L, Gurka D, Kumar A, Cheang M. (2006). Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med*. Jun;34(6):1589-96.

Appendix D: E-mail Invitation to Participate

Time sent:	**03/07/2019 9:00am**
From:	Sent manually via Participant List by **fabiae01 (**Evelyn Fabian**)**
To:	**[undisclosed e-mail address]**
Subject:	**DNP Project on Antibiotics**
Please take this survey. You may open the survey in your web browser by clicking the link below: Antibiotic Survey for Nurse Practitioners If the link above does not work, try copying the link below into your web browser: https://redcap.nyumc.org/apps/redcap/surveys/?s=BDSsLyNXi5 This link is unique to you and should not be forwarded to others	

Appendix E: Program Evaluation

EDUCATION EVALUATION FORM

As a learner please assist in the evaluation of this presentation. Please circle the number beside each statement that best reflects the extent of your agreement. Thank you.

	Disagree			Agree	
Content					
1. The content was interesting to me.....	1	2	3	4	5
2. The content extended my knowledge of the topic.....	1	2	3	4	5
3. The content was consistent with the objectives.....	1	2	3	4	5
4. The content was related to my job.....	1	2	3	4	5
5. Objectives were consistent with purpose/ goals of activity.....	1	2	3	4	5
Setting					
1. The room was conducive to learning.....	1	2	3	4	5
2. The learning environment stimulated idea exchange.....	1	2	3	4	5
activity.....	1	2	3	4	5
Faculty/Presenter Effectiveness					
1. The presentation was clear and to the point.....	1	2	3	4	5
2. The presenter demonstrated mastery of the topic.....	1	2	3	4	5
3. The method used to present the material held my attention.....	1	2	3	4	5
4. The presenter was responsive to participant concerns.....	1	2	3	4	5
Instructional Methods					
1. The instructional material was well organized.....	1	2	3	4	5
2. The instructional methods illustrated the concepts well.....	1	2	3	4	5
3. The handout materials given are likely to be used as a Future reference.....	1	2	3	4	5

1. The teaching strategies were appropriate 1 2
2. 3

Learner Achievement of Objectives

1. List the 10 General Recommendations applying to spacing and Administration of routinely recommended childhood vaccines…… 1 2 3 4 5
2. Identify the VPDs discussed in the presentation and the antigens from The childhood Immunization Schedule used to prevent the VPDs… 1 2 3 4 5
3. Describe the difference between recommended and required Vaccines, identify a properly documented Immunization Certificate 3231, and name the acceptable Exemptions For Immunizations in Georgia……..... 1 2 3 4 5
4. List the vaccines recommended for HCW and describe the VAERS reporting system and discuss why NVICP was created…. 1 2 3 4 5

Comments