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Improving Nurses' Knowledge and Perceptions on Antibiotic Stewardship: A Quality Improvement Project

Stela Karkatselos, MSN, APRN, FNP-BC
Florida International University, snaco001@fiu.edu

Dr. C. Victoria Framil, DNP, APRN, ANC-BC, CNE
Florida International University, cframil@fiu.edu

Barbara Russell, BSN, RN, BSHSA, MPH, CIC, FAPIC
Florida Department of Health, barbararussell627@gmail.com

Improving Nurses' Knowledge and Perceptions on Antibiotic Stewardship: A Quality Improvement Project

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By
Stela Karkatselos, MSN, APRN, FNP-BC

Supervised by
Dr. C. Victoria Framil, DNP, APRN, ANC-BC, CNE

Approval Acknowledged: DocuSigned by: Michael Sanchez, DNP, APRN, FNP-BC, FAANP 27267E9FF76F460..., DNP Program Director
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Contents

Abstract

Improving nurses' knowledge and perceptions on antibiotic stewardship (AS) was the focus of this quality improvement project. The development of a pre-test and post-test survey along with the distribution of an educational PowerPoint presentation on nurses' role on AS was introduced for the intervention. Survey participants were recruited anonymously through Florida Nurses Association's (FNA) membership database and were contacted via e-mail communications. Recruited participants included staff nurses, nurse educators, nurse managers, and nurse practitioners.

The quality improvement project implemented two surveys to assess nurses' knowledge and perceptions on AS. Recruited participants completed the pre-test survey initially to assess their baseline knowledge. Following the pretest survey, participants then viewed an educational PowerPoint presentation on AS and nurses' role. Upon completing the pretest survey and educational power point presentation, participants then completed the posttest survey which mimicked the pretest questions.

The educational power point presentation provided evidence-based practice guidelines and research on nurses' role on AS. This included how to evaluate and document allergies in the patient's chart, obtain urine or blood cultures prior to antibiotic initiation, following up on culture sensitivity testing results and verifying the correct antibiotic is being utilized, and questioning the provider if the right drug, right route, right time, right dose, and right duration was prescribed. In conclusion, the posttest survey revealed that nurses had an increased knowledge and perception on AS and their role. Despite the small sample size, the desired outcome of improving nurses' knowledge and perceptions on AS was achieved.

Introduction

Since the discovery of penicillin in 1928, antibiotics have revolutioned health care. Antibiotics are considered beneficial to public health due to their ability to treat and prevent bacterial infections. However, increased global demand and misuse has led to accelerated advancement of antimicrobial resistance (AMR) (Fletcher-Miles & Gammon, 2020). The National Institute for Health and Care Excellence (NICE) defines AMR as the 'loss of effectiveness of any anti-infective medicine, including antiviral, antifungal, antibacterial and antiparasitic medicines' (*Antimicrobial Stewardship*, 2015). AMR is influenced by a range of factors including gene mutation and new resistant strains in microorganisms, overuse of antibiotics across humans, animals and agriculture, poor sanitation, ineffective preventative measures and infection control, and lack of new antimicrobial medication is the past 30 years (Furber et al., 2017). Roughly 70% of the world's bacteria have developed resistance to antibiotics (Furber et al., 2017). With slowing down of new antibiotic medications and increased antimicrobial resistance across the globe, there is a dire need to implement new methods to combat AMR. A proposed approach to this idea is the establishment of antimicrobial stewardship programs (ASPs) (Firouzabadi & Mahmoudi, 2019). These programs direct clinicians to select the appropriate antibiotic with correct dosing and duration to reach effective treatment with lower toxicities and costs to the patients (Firouzabadi & Mahmoudi, 2019). There is also growing need to partner with nurses to promote effective AS, as nurses too, play an integral role in fighting AMR.

Background

The overuse of antibiotics clearly drives the evolution of resistance. A multifaced approach is required to minimize AMR. Without the evolution of new antimicrobial medications,

antibiotic use should be limited and only utilized when it is deemed appropriate to do so. Although patients must comply with antibiotic regimes, healthcare professionals are the key holders in limiting the spread of resistance (Furber et al., 2017). By providing appropriate guidelines supported by evidence-based practice, the volume of antibiotics being prescribed and dispensed unnecessarily may be reduced.

In coordinated efforts to optimize antibiotic use, the Centers for Disease Control and Prevention (CDC), called on hospital organizations to implement ASPs in their institutions. After the United Nations General Assembly pledged to combat AMR in 2016, given the rising global concerns, the Joint Commission mandated hospitals to implement ASPs in 2017. However, ASPs have been primarily focused on pharmacists and physicians (Carter et al., 2018). Nurses, who act as caregivers, educators, and gatekeepers between patients and their providers, play a significant role in AS. Unfortunately, studies show nurses have been absent from ASPs and only 38% were familiar with the term "antibiotic stewardship" (Carter et al., 2018). Therefore, there is a growing need to educate nurses on AS and encourage them to participate in the effort to combat AMR.

Scope of the Problem

Studies have predicted by the year 2050 AMR will cause 10 million deaths globally and raise the costs of health care to trillions of dollars (Chaib et al., 2019). In the United States, antibiotic-resistant bacteria cause at least 2.8 million infections and more than 35,000 deaths each year (Kost, 2020). The rising level of AMR is threatening the ability to treat common infectious diseases. If this crisis is not addressed with urgency, the world is heading in a pre-penicillin era, where people will die from minor injuries and common infections.

Overuse, inappropriate prescribing, excessive agricultural use, availability of new antibiotics choices and regulatory barriers are the contributing factors to AMR. Microbes, which

include bacteria, fungi, and viruses, are living organisms that reproduce and spread. Through mutation and gene transferring, these microbes have evolved and have become resistant to antibiotics. This evolution is a direct result of inappropriate use of antibiotics. In the absence of proper diagnostic testing, the use of broad-spectrum antibiotics has also been noted to accelerate AMR (*Causes of antimicrobial (drug) resistance,* 2011). More than half of the antibiotics produced in the United States are used agriculturally, which has been debated to increase antibiotic resistance. More concerning is the lack of new antibiotic development in the last 30 years, which is referred to as the "antibiotic discovery void". Last year a new class of antibiotics was discovered dates to 1976 (Riley, n.d.). Additionally, all the largest pharmaceutical companies have abandoned the antibiotic field due to prohibitive costs, lack of research funds, and issues with regulations and licensing rules.

Hospital organizations have implemented ASPs to combat the AMR crisis, but for years, these efforts have been directed towards pharmacists and physicians only, leaving a large gap in the interdisciplinary care team, including nurses. Nurses are well educated and skilled healthcare professionals who understand antibiotics and can promote proper antibiotic use. Infection control and patient advocacy are considered key nursing roles, however, nurse roles in AS have not yet been well defined (Mostaghim et al., 2017).

Consequences of the Problem

The preservation of antibiotic treatment and its ability to cure has become a globally shared goal (Catalan-Matamoros et al., 2019). The alarming rising rate of antibiotic resistance will bring dire health and economic burden soon. Already affecting the healthcare system today, costs of medical treatment will reach trillions of dollars. This would mean higher insurance costs, prescription costs, and hospitalization costs. As first and second-line antibiotic treatments

options become limited or unavailable, health care professionals will be forced to use antibiotics that are more toxic, leading to organ failure, longer hospitalizations, lengthier recuperation, more frequent doctor's visits, and even death (Ventola, 2015). Patients with antibiotic resistant infections were found to be hospitalized for 6.4 to 12.7 more days, and the cost per patient was estimated to range from $18, 588 to $ 20,069 (Ventola, 2015). AMR will also burden families due to lost wages. (Ventola, 2015). In theory, without effective antibiotics due to AMR, even the most preventable or manageable infections today, will become deadly infections in the future, bringing the evolution of infection prevention and management back to the pre-penicillin era.

Knowledge Gaps

AS plays a key role in the prevention of the emergence of multi-drug resistant organisms (MDROs) and conserves the effectiveness of antibiotic drugs. The CDC promotes proper use of antibiotics as an essential patient safety concern and national priority (Abbas et al., 2019). ASPs involve a multidisciplinary team approach which includes physicians, pharmacists, microbiologists, and nurses (Abbas et al., 2019). The nurse's role in AS has been identified, but among nurses, there is a lack of knowledge and perception on what that role is.

A recent publication by the American Nursing Association (ANA), identified some potential nursing roles in AS. These included verifying details of drug allergies upon initial patient assessment, obtaining blood cultures prior to antibiotic initiation, initiating septic protocol treatment, verifying or de-escalating antibiotic use by verifying microbiology results and reporting to prescribing physician, assessing adverse events caused by antibiotics, performing “time-outs” and assessing the need for continued antibiotic use, advocating for transition of intravenous to oral antibiotics when applicable, educating patients on proper antibiotic use, preventative care through vaccination and proper hygiene (Abbas et al., 2019).

Currently, AS training is not a required curriculum in nursing education programs. Additionally, nursing staff have yet to be formally integrated into ASPs across the U.S. and are minimally represented in national AS conferences (Abbas et al., 2019). The lack of familiarity of AS among nurses results in knowledge deficit and decreased confidence in their role as antibiotic stewards. Although nurses hold themselves accountable in the process of medication administration, their expertise deficit in antibiotic use and AMR prevention impacts how well they can communicate medication safety concerns and antibiotic suggestions (Wong, 2020). Research is limited on the role of nurses in AS, but it cannot be denied that nurses do indeed play a supporting and key role, which is why exploring the impact of nurses on AS is so crucial in fighting AMR.

Summary of the Literature Review

A literature search was conducted from Florida International University's online library. The following databases were used for a comprehensive electronic literature search: CINAHL, PubMed (which includes MEDLINE), and Google Scholar. Key words used to conduct the search included: antibiotic stewardship, antibiotic use, antimicrobial resistance, nurses role in antibiotic stewardship, nurse perception on antibiotic stewardship. The Boolean Operator “AND” was utilized to combine the key words in multiple combinations to increase evidence yield. Search was limited to 10 years (2012-2022). Search limits were English only, full text, academic journals, nursing journals, clinical journals, and free full text. The Melnyk and Fineout-Overhold Rating System of Hierarchy (2011) was used to select evidence. The levels of evidence are:

> “Level I - systematic review or meta-analysis of randomized control trials (RCT’s); Level II - evidence obtained from RCT’s; Level III - evidence from controlled trials without randomization; Level IV - evidence from case-controlled and cohort studies; Level

> V evidence from systematic reviews of descriptive and qualitative studies; Level VI - evidence from single descriptive or qualitative studies and Level VII - evidence from opinion of authorities or reports of expert committees" (Melnyk & Fineout-Overholt, 2011, p.12).

There were enough studies found that supported nurse roles in ASPs. The literature search identified 89 articles, in which 27 were identified from CINHAL database, 42 from the PubMed database, 10 from MEDLINE, 5 from the CDC website, and 5 from the NIH website. Of these, 39 records were excluded for being older than 10 years, 19 were excluded due to publication type. After the application of inclusion, exclusion, and screening of title and abstracts of articles, 8 articles were chosen in this method to include in the literature review.

The literature selected for the quality improvement project was directly related to the clinical question and educational intervention. Studies were selected by relevance to the clinical problem, population, educational intervention, and improved nurse outcomes. The literature review supported the need of education and provided background and significance to the project. While all evidence levels were included for review, studies with levels I, II, and III were selected based on inclusion criteria. Appendix A shows the critical appraisals of studies selected for inclusion within this integrative review of literature.

Characteristics of the Included Studies

Monsees, E/2018	The purpose of this study was to identify nurses' roles and confidence in participating in ASPs. The sample size included 180 staff nurses from a 354 pediatric hospital with a well-established ASP. Participants completed an online survey that identified 10 practices that fall within nursing responsibility and stewardship process. The study conveyed

	nurses were confident in assessing for an adverse drug reaction history, obtaining cultures prior to antibiotics, and participating in patient education. Study also showed that these nurses were less confident in reviewing microbiology results to determine antibiotic appropriateness. Study revealed that some of the barriers to these findings included nurse exclusion in rounding, interdisciplinary power differentials, and nursing input less frequently considered. The study concluded that nurse participation in antibiotic stewardship programs could improve by improving education on microbiology and antibiotic use, and by including nurses during rounding and allowing room for their contribution in patient care. The limitations to the study were lack of psychometric soundness, it was conducted in a pediatric unit limiting generalizability, and it did not measure their knowledge or competence in AS nurse responsibility. This study is a Level III hierarchy due to being an exploratory study with a cross-sectional design.
Mostaghim, M/2017	The aim of this study was to identify nurses' role, perceptions, and attitude in regard to antibiotic stewardship in pediatric and adult settings. The survey took place electronically and via paper survey across three public hospitals which included adult and pediatric wards. The three hospitals had established AS programs. There was a total of 142 surveys completed and included in the analysis. Results of the study indicated that more than half of the nurses were familiar with term AS but equally unfamiliar with antimicrobials. In terms of their

	role in AS, nurses replied that doctors and infectious disease were more linked to these programs. The majority of nurses were interested in receiving support from the AS or ID team and pharmacists and acknowledged the role of nurse prescribers and educators. The study concluded that the majority of nurses are familiar that they play a role in AS, however, more education and clarification is needed to specify the roles of nurses in AS. The limitations to the study were that the survey was conducted in hospitals with established ASPs, where responses may differ from those without ASPs, and the number of responses may not represent all staff across these three hospitals. This study is a Level III hierarchy due to being an exploratory study with a cross-sectional design.
Abbas, S/2019	The purpose of this study was to determine the knowledge, attitudes, and practices of nursing staff members regarding ASPs and identify barriers to their participation in such programs. The study took place as cross-sectional study in an 860-bed hospital in Virginia. This hospital had an established ASP in place for the last two decades. Study methods included a survey and mandatory online AS module. A total of 164 nurses completed the survey. Over 50% of participants were familiar with the concept of AS. They also identified nurses as AS participants. Education, regular reporting, and monitoring of antibiotic prescription and resistance patterns as core elements of ASPs were included in the findings. In conclusion, the study revealed that the

	majority of nurses were familiar with the term ASP. However, only 75% were familiar that their institution has an ASP program, and an equal amount were not familiar with how to contact their ASP team. Additionally, most of the nurses surveyed had no previous training in ASPs. Limitations of the study included lack of ability to determine the true survey response rate and lack of demographic information of study participants. This study is a Level III hierarchy due to being an exploratory study with a cross-sectional design.
Carter, E.J/2018	The purpose of this study was to explore nurses' attitudes towards 5 nurse driven AS practices. The focus was on nurses' role in questioning the need for urine cultures, ensuring proper culture technique, accurate allergy recording, prompt transition from intravenous to oral antibiotics, and antibiotic timeout. They study conducted focused group interviews with nurses and nurse managers stationed in intensive care units (ICUs) and medical-surgical units in two academic hospitals which care for adult and pediatric patients. A nurse researcher and advanced practice nurse was present during the interviews to take note and later transcribed the information for accuracy. There was a total of 9 focus groups with a total of 61 participants. Results of the study revealed that nurses' believed AS was an extension of their roles as patient advocates. They also believed that they are highly positioned to optimize antibiotic use. Participants questioned nurses' ability to make valuable contributions to antibiotic stewardship due to their limited role

	in antibiotic prescribing. The study concluded that nurses are enthusiastic about their role in AS but face barriers which include knowledge gaps in antibiotics. This due to lack of education on antibiotics pre and post nursing curriculums. No limitations were identified in the study. This study is a Level II hierarchy due to being an exploratory study with a randomized controlled trial (RCT).
Wong, L.H/2020	The purpose of this study was to understand nurses' involvement in AS and explore distinctive facilitators and barriers. The study was carried out using focus groups from three major public hospitals. Participants were recruited based on having at least one year of nursing experience, then focus groups were broken down by department to ensure maximum variation. There was a total of 15 focus groups involving 104 nurses. Findings concluded that nurses saw themselves as gatekeepers in ensuring appropriate antibiotic administration. On the contrary, they were less confident in their knowledge of antibiotic use and AMR prevention, which affected how they were perceived by their patients and interdisciplinary team. Study confirmed that nurses play a key role in patient safety and antibiotic use, however, they lack expertise and knowledge in AS. Continuing education and training, can help correct this gap in knowledge and confidence. This study is a Level III hierarchy due to being an exploratory study with a cross-sectional design.

Fisher, C.C/2018	The purpose of this study was to identify barriers and facilitators to nurses' engagement with ASP activities. The study was carried out using 1-on-1 interviews with nurses to conduct a qualitative review. This was conducted in a 400-bed tertiary referral hospital. A sample of 15 nurses were considered in the study. Barriers identified in the study included lack of prescriber cooperation, prescriber accessibility, self-confidence, insufficient knowledge, low priority activity for nurses, IV to Po step-down viewed as sole role of prescriber, concerns with adverse consequence of IV to PO antimicrobial step-down, no standardized procedures for patient eligibility to step-down, and no prompts to remind nurses to assess VI to Po step-down. Facilitators included nurse capability to assess patients for appropriateness from IV to PO step-down, opportunities to collaborate with other nursing staff to confirm step-down appropriateness, variety of existing resources for nurse education and training, and confidence in ability to promote Iv to PO step-down. Study concluded nurses play a key role in AS through promotion of IV to PO step-down of antibiotics. Limitations to the study were due to small sample size of 15, the method of interview rather than focus groups, and limited generalization. Level III hierarchy due to being an exploratory study with a cross-sectional design.
Manning, M.L/2022	The purpose of this study was to create a framework for nurses to fully engage in AS roles. A systematic review was performed to retrieve literature from peer-reviewed journals on nursing frameworks on AS.

	The review indicated that the SCAN-P Framework provided the context and clarity necessary to guide nurses to participate and lead AS roles. The letter S represents scope and standards of nursing practice, letter C for context, culture and competency, and AN-P for antibiotic stewardship nursing practices supporting the safe and responsible use of antibiotics. This study revealed that the SCAN-P Framework can serve as a tool for nurses engagement in AS and improvement in their role as advocates and educators in their patient's care. No limitations were listed in the study. This is a systematic review and thus considered a Level I evidence.
van Huizen, P/2021	The purpose of this study was to explores nurses' role in AS and investigate the best practice in use of intravenous antibiotics. The study conducted a systematic review using seven databases. A total of 43 sources were used in evidence. The research conducted in this study indicated that nurses' role in AS often aligned with monitoring of antibiotic prescribing practices, including preparing, administering, and disposing of intravenous (IV) antibiotics. Little evidence was found, however, on consistent policy, guidelines, an education on nurse's role on AS. The study concluded that when using best policies and guidelines in IV use, development of antimicrobial resistance is minimized. The study also indicated that there is increased need for education and support of nurses in AS roles. Limitations in the study included the exclusion of full text-articles and publications not in the

	English language. This is a systematic review and thus considered a Level I evidence.

Nurses' Current Practice in Antibiotic Stewardship

Routine nursing practice focuses on infection prevention and reduction of antimicrobial use (van Huizen, 2021). Nurses' perceived role in AS is lacking acknowledgement that they are already fulfilling their role as stewards by performing their routine nursing tasks. The literature review revealed that when nurses are performing allergy adverse event assessment and history, questioning medical necessity for urine cultures, ensuring proper technique in obtaining urine and blood cultures, initiating antibiotic time out, requesting for transition of IV antibiotics to PO antibiotics, and questioning the prescribing provider on prescribed antibiotic and use, they are performing AS tasks which help fight against AMR (Carter et al., 2018). Additionally, nurses have a consistent presence in patient care through monitoring, documenting, and medication administration (Mostaghim et al., 2017). This allows nurses to advocate for their patients and act as gatekeepers in proper antibiotic administration and use. By acknowledging these skills as nursing AS roles, nurses will have an increased perception, confidence, and involvement in AS overall.

Deficit of Nurses in Antibiotic Stewardship Programs

Most physicians are aware of the drivers of antibiotic resistance, however, this is not reflected in clinical practice. AMR was discovered in the early 1940s, and over the years, bacteria have adapted and have become more resistant than ever before, posing a real global health threat. By adopting evidence-based practices, such as ASPs, AMR crisis can be addressed effectively (Gupte et al., 2018). The purpose of ASPs is to promote appropriate

antibiotic prescribing practices and decrease the spread of infections. ASPs are typically made up of pharmacists, physicians, and infection preventionists. However, literature has advocated for the formal inclusion of nurses in ASPs. This is due to nurses' widespread involvement in activities that relate to antibiotic use. The absence of nurses limits the success of ASPs (Carter et al., 2019). Literature review revealed that nurses were often familiar with the term AS but lacked understanding or knowledge of what their role was in terms of infection prevention. Another study pointed out the barriers in nurse stewardship were due to interdisciplinary power differentials, nurse output not actively sought out and nurse exclusion in ASPs (Monses et. al., 2018).

Nurses' Knowledge Deficit in Antibiotic Stewardship Role

When it comes to AS and nurses' knowledge and perceptions, the literature review highlighted that nurses were familiar with their role in infection control and patient advocacy but were less familiar with their role in AS or required more opportunities and support from other members of the interdisciplinary team. Additionally, the literature review pointed out that nurses' knowledge and confidence lied in assessing for an adverse drug reaction history, obtaining cultures prior to antibiotics, and participating in patient education. They were less confident in reviewing microbiology results to determine antibiotic appropriateness (Monses et. al., 2018). Studies showed 57% of nurses reported that their knowledge of antimicrobials was minimal or limited (Mostaghim et al., 2017). Another barrier discussed in the literature review, explained that nurses felt discomfort when questioning prescriber orders. To overcome these challenges, nurses suggested that they receive more education on appropriate indications of antibiotic use and microbiology testing. In summary, nursing engagement in AS remains

suboptimal due lack of knowledge, confidence, and participation opportunities and education efforts in increasing nurses' knowledge in AS need to be implemented.

Synthesis of the Literature

Several merged themes were found in this extensive review of the literature search in combating AMR through AS approach with the integration of nurses and their knowledge, attitudes, and perceptions of AS. Within the scope of this literature review, evidence supports that nurses indeed are key members of the interdisciplinary approach to AS, yet there is a lack of representation of nurses in ASPs. Pharmacists and physicians have been tasked with leading ASPs, but this has limited the scope of all health care professionals seeking to promote appropriate antibiotic use (Manning et al., 2022). The nursing profession defines its own scope in AS. Nurses are the gatekeepers of patient advocacy and safety, which in many ways resembles nurses' approach to infection prevention (Manning et al., 2022). The literature review included quantitative and qualitative studies that indicated nurses are often unfamiliar with the term antibiotic stewardship or unaware that their routine nursing tasks and skills impact antibiotic decisions and infection prevention already (Manning et al., 2022). The unfamiliarity of nurses' identification as stewards is not surprising as there is lack of education in AS in nursing programs and lack of representation and integration of nurses in ASPs. However, the literature search explained these are modifiable barriers, in which nurses were more responsive to enhancing their knowledge through education and training. Nurses also seek promotion in their capability to assess patients for step-down, ability to communicate assessment results with the team, and participate in their organization's ASP (Fisher et al., 2018). In summary, the literature review revealed that there is a deficit in nurses' knowledge, attitudes, and perceptions on AS, but

a consensus can be made that there is potential improvement through the integration of education and training, and the collaboration of nurses in ASPs.

PICO Clinical Question

P- In nurses who work in either acute, inpatient, or outpatient settings

I- does providing education on their role in antibiotic stewardship

C- N/A

O- Increase their knowledge and perceptions on antibiotic stewardship?

Primary DNP Project Goal

The primary goal of this quality improvement project is to improve nurses' knowledge and perceptions in AS. By achieving this project goal, the improvement of nurses' knowledge and perceptions on AS will subsequently result in increased participation and inclusion of nurses in ASPs. ASPs were developed to combat the global health crisis of AMR. By improving nurses' knowledge and participation in AS, ASPs will become more effective in fighting AMR, while decreasing mortality and health care costs. Currently nurses lack knowledge and understanding in AS.

Review of literature revealed that most nurses are familiar with proper allergy assessments and documentation, retrieval of cultures prior to antibiotic initiation, and patient education and prevention. However, barriers identified in the literature review included lack of knowledge of antimicrobials, ability to understand culture sensitivity reports, confidence in questioning providers about antibiotic use, and inclusion or promotion of nurse in ASPs. The proposed solution to these barriers is to provide more education and training on antimicrobial use, along with increased promotion of nurses in ASP roles.

Objectives

The SMART Goal Form from the CDC will be used in this quality improvement project to understand the process of developing SMART goals. "SMART" stands for specific, measurable, attainable, realistic, and timely objectives (*Develop Smart Objectives*, 2022b). The goals are shown in Table 1.

Table 1. SMART Analysis

Not-so-SMART objective: Improve nurses' knowledge and perceptions on antibiotic stewardship.	
Key Component	**Objective**
Specific- What is the specific task?	To increase nurses' knowledge and perceptions on AS by providing education and guidelines on their role and participation as stewards.
Measurable-What are the standards or parameters?	Surveys/questionnaires will be provided to nurses after approval by the Internal Review Board (IRB) of FIU (Florida International University) and clearance from Florida Nurses Association (FNA) research committee. Data will be collected using Qualtrics.
Achievable- Is the task feasible?	The project is feasible secondary to the availability of nurses willing to participate in this project.
Realistic- Are sufficient resources available?	Florida Nurses Association (FNA) is an organization with over 4,000 members, of which are nurses. This large pool of recruits will allow for a potentially large sample size. Recruiting will occur over e-mail communications and data collection through Qualtrics.
Time-Bound- What are the start and end dates?	The project will be implemented between January 2023 and March 2023.
SMART objective 1: From January 2023 through March 2023, implementation and use of surveys and educational power point presentation will be used with the initiative of increasing nurses' knowledge and perceptions on AS.	

(Centers for Disease Control and Prevention, 2021c).

Definition of Terms

Antibiotic Stewardship (AS): the optimal selection, dosage, and duration of antimicrobial treatment 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 (Hand, 2013).

Antibiotic Stewardship Program (ASP): a coordinated program that promotes the appropriate use of antimicrobials (including antibiotics), improves patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms (*Antimicrobial Stewardship Programs (ASP)*, 2022).

Antimicrobial Resistance (AMR): germs, like bacteria and fungi, develop the ability to defeat the drugs designed to kill them. That means the germs are not killed and continue to grow. Resistant infections can be difficult, and sometimes impossible, to treat (*About Antimicrobial Resistance*, 2022).

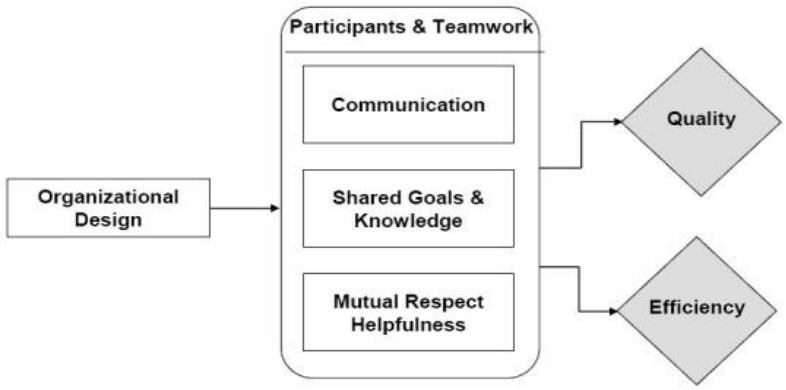
Steward: One who conducts, supervises, or manages something; especially, the careful and responsible management of something entrusted to one's care.

Conceptual Underpinning and Theoretical Framework

The Relational Coordination Framework will be utilized as the conceptual underpinning for this quality improvement project. Founded by Jody Gittell, the purpose of this framework is to understand dynamics, present in teamwork and collaboration, and how the relationship of an individual's work relates to the overall goals of everyone that is involved (McDonald et al, 2007). The framework is characterized by frequency, timeliness, communication, helpfulness, shared goals and knowledge, and mutual respect. Figure 1 illustrates Gittell's links between coordination, organizational design, and performance (McDonald et al., 2007). In the objective of improving nurses' knowledge and perception on AS, this framework uses communication by

surveying nurses' baseline knowledge and understanding of AS. The shared goals and knowledge element of the framework then aims to increase nurses' knowledge through educational training. By promoting and accepting nurses as stewards of AS, mutual respect is met. As a result, quality and efficient care is provided to the patient cared by these nurses who have now improved their knowledge in AS.

Figure 1. Gittell's Relational Coordination Framework



(McDonald et. al., 2007)

Lewin's Change theory will be utilized as the theoretic framework to guide this quality improvement project. Lewin's Change Theory proposes that one is influenced by restraining forces aimed to keep the status quo and driving forces which push in the direction of change (Manchester et al., 2014). Figure 2 illustrates Lewis' change theory steps: unfreezing, movement, and refreezing. Unfreezing is defined as creating problem awareness and relieving old patterns (Wojciechowski et al., 2016). In relation to the quality improvement project objective, unfreezing relates to the lack of knowledge and barriers of nurses' perceptions in their role of AS. The second step, movement, which aims to find alternatives and benefits of change, is the utilization of educational guidelines and training to improve nurses' knowledge on AS (Wojciechowski et al., 2016). The third step, refreezing, is the process of stabilizing a new equilibrium into the system (Wojciechowski et al., 2016). Literature review explained that nurses

are less involved or accepted in ASPs. Refreezing would occur similarly when nurses are promoted and integrated in ASPs, changing their role perception in AS.

Figure 2. Lewin's Change Theory

(Wojciechowski, Pearsall, Murphy & French, 2016)

Methodology

Setting, Participants and Description of Approach and Project Procedures

This quality improvement project was set to take place online. No in-person contact was made. Targeted recruits for the purpose of this project were nurses, however, nurses practitioners were also allowed to participate. Recruits' years of experience, education level, position, and department did not exclude them from participating, but information was collected for data purposes. Recruitment occurred via email communication. With the permission of FNA's research committee, members were contacted and asked to participate. Recruits' participation was completely voluntary and no compensation or prize money was granted. Participants' identity remained confidential throughout the project.

Pre and posttest surveys were conducted via a digital survey website called Qualtrics. Qualtrics is a secure web application used for creating and managing online surveys and questionnaires. The pretest survey included 6 demographic questions and 34 questions assessing nurses' knowledge on antimicrobial resistance, prescribing antibiotics, antibiotic stewardship, process of continuing education and monitoring. The purpose of the pretest survey was to gather participant's baseline knowledge on these concepts. The pretest questionnaire is presented in Appendix B. Once participants completed the pretest survey, they were then directed to click on

a link that would open a PowerPoint presentation. Using literature review and research from nursing and medical journals or articles on AS, as well as CDC guidelines, the presentation provided education and training on antibiotic resistance, prescribing antibiotics, antibiotic stewardship, and learning and monitoring concepts. Specifically, the PowerPoint focused on roles and tasks directly associated with nurses and AS. Participants completed this at their own pace. Once participants completed reading the PowerPoint, they were then directed to complete the posttest survey. The posttest survey questions mimicked the questions of the pretest, with the exclusion of the demographic questions, those were not repeated. Refer to Appendix B again to review the questions of the survey. Recruitment and participation were done in 4 weeks.

This quality improvement project was dependent on nurses' voluntary participation. It was also dependent on the nurses' willingness to read and update their knowledge on the current education that was provided on AS. The purpose of this project was to enhance nurses' knowledge, confidence, and participation in AS.

SWOT Analysis

SWOT analysis is a method used to evaluate the strengths, weaknesses, opportunities, and threats of the proposed quality improvement project (*Do a SWOT Analysis*, 2022c). Strong component in this project is the opportunity to use FNA as a resource in recruiting participants. Since FNA has over 4,000 members, there is potential for a large number of recruits. Additionally, the online accessibility of the surveys and educational portion, gives participants the opportunity to complete the project from any device and at any time. The ability to retain participants, however, can be seen as a threat since communication and participation is strictly done online. For further SWOT analysis details see table 2.

Table 2. SWOT Analysis

Internal Factors	
Strengths	**Weaknesses**
• Focus group; nurses/nurse practitioners • Easily accessible survey tool and education delivery • Experienced staff	• Recruitment of nurses to participate in project (online only) • Brief time interval to carry out project goal
External Factors	
Opportunities	**Threats**
• Large pool of potential recruits • Incentive for nurses to increase their knowledge in AS	• Lack of prescriber cooperation/inclusion • Lack of nurse representation in AS • Continuation and maintenance of the project after it has been implemented.

Protection of Human Subjects

The proposed quality improvement project qualified as exempt research according to the U.S Department of Health and Human Services Office for Human Research Protections pursuant to 45 CFR 46.104:

> (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.
>
> (ii) Any disclosure of the human subjects' responses outside the research would not place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or
>
> (iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

For this quality improvement project, participant recruitment occurred via email communication. Demographic information was requested, however, names and other personally, identifying information were omitted form the study. No identifying information was included on the surveys and the documents were not coded or linked to the individual's identity. All electronic data was maintained on an encrypted device requiring a password for access. Surveys were completed through Qualtrics web portal, to which only the principal investigator had access to. The topic addressed would not place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation.

Electronic consent was obtained prior to any participation in the project. Consent was obtained voluntarily by the participant. Electronic consent was obtained via Qualtrics web portal. Consent was provided to reassure potential participants that their participation is voluntary and no risk. No personal information was asked or disclosed, and there were no negative consequences to not participating in the project. The study was approved by FIU IRB and FNA research committee.

Data Collection

Participants were recruited via e-mail communication. In this e-mail, a web link was provided which would guide participants to the Qualtrics online survey application portal. Participants were asked to sign an electronic consent before accessing the pretest and posttest surveys. Participation in the study was completely voluntary and anonymous. Once the electronic consent was signed, participants were then directed to the pretest survey. See Appendix B for pretest survey questions. Once participants answered all the pretest questions, they were then guided to access the educational PowerPoint presentation on AS. The participants were able to

self-guide themselves through the entire presentation. At the end of the PowerPoint presentation, participants were then guided to the posttest survey. The posttest survey contained the exact same questions as the pretest survey, but demographic questions were omitted. Refer to Appendix B for posttest survey questions. The entire project was presented and completed in one setting, where participants would access the pretest, move on to the PowerPoint presentation, and then finish with the posttest survey. Time required to complete the survey varied among participants as this was a self-guided project. The pretest was designed to assess nurses' baseline knowledge and perceptions on AS, while the posttest then assessed nurses' knowledge and perceptions on AS after they were provided with education and guidelines on the subject matter.

Data Management

Participant consent was obtained electronically via Qualtrics online survey application. Survey response data was also obtained via the Qualtrics web application. All data collected was password protected. Only authorized student researcher was able to access or view the data. The information in this web platform was not linked to the participant's identity. Participant personal information was not inquired during the survey process. At the end of the survey period, data was downloaded and analyzed by the quality improvement team.

Data Analysis

Frequency counts were used to examine the distribution of categorical demographic variables as well as other descriptive variables. Paired samples t-tests were used to determine whether scores assessing Antimicrobial Resistance (AR), Prescribing Antimicrobials (PA), Antimicrobial Stewardship (AS), and Monitoring and Learning (ML) changed significantly from pre to post. Prior to conducting parametric tests, the assumption of normality was tested. In the event that scores were not found to be normally distributed, the Wilcoxon Signed Rank test was

used instead of the Paired Samples t-test.

Results

Pretest and Posttest Participant Demographics

Participant demographic characteristics for the sample of 25 participants are provided in Table 3. Participants were mostly staff nurses (40%) and educators (24%) but also included nurse practitioners (16%), managers (12%), and others (8%). Years in the role varied with 12% being new to the role (less than 1 year), 40% having 1-5 years in the role, 24% having 6-10 years of experience and 24% having more than 10 years of experience in the current role. More than half of the participants earned a Master's Degree or higher (52%), 44% earned a Bachelor's, and only one has a diploma. Age varied with 28% between 25 and 34 years old, 36% between 35 and 44 years old, 4% between 45 and 54, 28% between 55 and 64 and only one person being 65 or older (4%). Lastly, there was wide representation across primary specialty with respondents representing outpatient (20.8%), emergency/urgent care (16.7%), home health/skilled nursing (12.5%), and surgical/transplant (8.3%). Other specialties with only one respondent included ambulatory, rehabilitation, care coordination, hospice and palliative care, ICU, inpatient/outpatient cardiac, perianesthesia, progressive care, public health, and telemetry. Table 3 reflects participant demographics.

Table 3. Participant Demographics

Characteristic	N (%)
Primary Role	
Staff Nurse	10 (40)
Educator	6 (24)
Manager	3 (12)
Nurse Practitioner	4 (16)
Other	2 (8)
Years in Role	
<1 year	3 (12)
1-5 years	10 (40)

6-10 years	6 (24)
>10 years	6 (24)
Highest Degree	
Diploma	1 (4)
Bachelor's	11 (44)
Master's or Higher	13 (52)
Age	
25-34	7 (28)
35-44	9 (36)
45-54	1 (4)
55-64	7 (28)
65+	1 (4)
Primary Specialty	
Emergency/Urgent Care	4 (16.7)
Outpatient	5 (20.8)
Ambulatory	1 (4.2)
Home Health/Skilled Nursing	3 (12.5)
Surgical/Transplant	2 (8.3)
Rehabilitation	1 (4.2)
Other	8 (33.3)

Analysis of Pretest and Posttest Results

The pretest and posttest questions were divided into four competencies: Antimicrobial Resistance (AR), Prescribing Antibiotics (PA), Antimicrobial Stewardship (AS) and Monitoring and Learning (ML). Table 4 shows the mean and standard deviation (SD) results in AR, AS, and ML competencies. Table 5, using the Wilcoxon Signed Rank Test, shows competency results on PA. When comparing results from the pretest survey to the posttest survey, improvements were noted, though some less subtle than others. Based on these findings, educational intervention between pre and posttest improved nurses' knowledge and perceptions on AS.

In antimicrobial resistance (AR) competency, scores were not found to change significantly from pretest ($M = 19.19$) to posttest ($M = 19.29$), $t(20) = -0.10$, $p = .923$. In prescribing antibiotics (PA) competency, posttest scores were found to significantly violate normality. Therefore, the Wilcoxon Signed Rank test was used. PA scores were found to be significantly different from pretest ($M = 23.00$) to posttest ($M = 21.00$), $W = 156.00$, $p = .002$.

Participants were also asked whether the use of antibiotics can cause harm. In response to this question, most participants (84%) either agreed or strongly agreed to this statement. In antimicrobial stewardship (AS) competency, scores were found to increase significantly from pretest ($M = 47.19$) to posttest ($M = 51.71$), $t(20) = -6.21$, $p < .001$. Participants were also asked if they questioned a treating provider and when proved as to what they questioned, participants indicated that they mostly questioned the reason for antibiotic (16.7%), but some also questioned the choice of antibiotic (4.8%), dose of antibiotic (2.4%), route of antibiotic (2.4%), or duration of antibiotic (4.8%). In the last competency, monitoring and learning (ML), scores were found to increase significantly from pretest ($M = 28.43$) to posttest ($M = 29.67$), $t(20) = -3.08$, $p = .006$. Participants were also asked whether their health care setting had access to an infectious disease specialist. Most participants indicated yes (66.7%) but some said they were not sure, or it did not apply (25%). Additionally, when asked how many times in the past month they had an infectious disease specialists consult on a patient, 33.3% indicated they had not and another 29.2% indicated that they were unsure, or it did not apply. However, for those that did, 16.7% said they consulted on 1-2 patients, 4.2% for 3-5 patients, and 16.7% said they consulted 6 or more times in the past month. Participants were also asked to what extent they relied on various sources to provide care to patients with infectious diseases. While multiple sources were utilized, the most frequently relied on sources included personal clinical experience, infectious disease specialists, and infection control. Finally, when asked what interventions would be most helpful in improving the appropriate use of antibiotics in your health care setting, participants endorsed antibiotic restrictions (26.2%), primary interventions (23.8%), auditing charts (23.8%), evaluating antibiotics after 48 hours of therapy (40.5%), educational modules (26.2%), lectures (11.9%), and knowledge of accurate allergy reporting (26.2%).

Table 4. Antimicrobial Resistance (AR), Prescribing Antibiotics (PAP, and Monitoring and Learning (ML) Competency Results

	Competency	Mean	N	SD	SE
Pair 1	Antimicrobial Resistance Pretest	19.1905	21	3.34094	0.72905
	Antimicrobial Resistance Posttest	19.2857	21	2.30527	0.50305
Pair 2	Antimicrobial Stewardship Pretest	47.1905	21	5.33497	1.16419
	Antimicrobial Stewardship Posttest	51.7143	21	3.63515	0.79325
Pair 3	Monitoring & Learning Pretest	28.4286	21	1.9396	0.42857
	Monitoring & Learning Posttest	29.6667	21	2.45628	0.53601

Table 5. Antibiotic Prescribing (AR) Competency Results

Total N	**21**
Test Statistic	15.000
Standard Error	22.795
Standardized Test Statistic	-3.093
Asymptomatic Sig. (2-sided test)	0.002

Discussion

This quality improvement project assessed the knowledge of nurses regarding the magnitude of AMR, the use of unnecessary antibiotics prescribed in their health care setting, understanding of AS, recognition of the need of educational resources, how and who to contact in the interdisciplinary team regarding antibiotic use, and potential nursing roles in AS. Results indicated that the majority of the participants were familiar with the term AS and that they played a key role in combating AMR. However, the study also revealed that the participants were less confident and less likely to participate in ASPs due to their lack of antimicrobial

knowledge and inclusion as part of the interdisciplinary team. In order to fill these gaps of knowledge and perceptions on AS, an educational PowerPoint presentation was provided to the participants. In summary, the posttest results, when compared to the pretest findings, indicated that use of educational modules and training can indeed improve nurses' knowledge and perception in AS.

Limitations

In this quality improvement project, a few revisions were mandated by the IRB before final approval. IRB approval was eventually attained on November 22 of 2022, a month later than initially anticipated. After receiving IRB approval from FIU, there was a second approval wait period by FNA's research committee to permit distribution of the project surveys to its organization's members. This process required an additional 8 weeks. Surveys were finally distributed on January 31, 2023. The project was intended to run for a duration of three months, but due to the delays mentioned above, the project was implemented for 4 weeks instead. As a result, less time was allowed for participant recruitment and data collection. Despite having a large recruiting pool from FNA's 4,000 plus members, a total of (n=25) were included in this project. Although this was a small sample size for research standards, the project achieved desired outcomes. This indicates that if given longer time for recruitment and implementation, positive outcomes can be achieved on a larger scale.

Implications to Nursing Practice

The role of nurses in AS is not well understood. However, there is a growing recognition of the need to partner with nurses to promote effective AS (Carter et al., 2018). Nurses can have a significant impact on the development of antimicrobial resistant bacteria in hospitals and in the community (van Huizen et al., 2021). There are various tasks that nurses perform which

contribute to AS practices.

The literature review revealed the following nursing roles as AS practices: 1) assessing and documenting accurate drug allergies; 2) questioning the need for urine cultures; 3) performing proper sterile technique when obtaining cultures, performing catheterization, or drug administration through intravenous (IV) lines; 4) encouraging prompt transition from IV to oral antibiotics; 5) initiating antibiotic timeout; 6) educating patients on proper antibiotic use; and 7) encouraging vaccination and proper hygiene practices. These practices prove that nurses are much involved in AS but have failed to be recognized as such.

Nurses play a vital role in health care as patient advocates. They are well educated, healthcare professionals who are equipped to administer medications while providing the safest and most efficient care to their patients. It is for this reason, and the reasons stated above, that nurses do indeed play a role in AS. However, there is lack of representation and recruitment of nurses in AS. There is also a need to provide more education and guidelines to nurses to improve their AS skills and knowledge. This quality improvement project revealed that nurses' knowledge and perception on AS did indeed improve after educational intervention. Therefore, by incorporating more education and training on AS, nurses will in turn improve their knowledge and skills, improving the overall efforts in fighting AMR.

Conclusion

AMR is one of the most threatening problems to humanity. Antibiotics are becoming increasingly ineffective in treating even the most common infectious diseases (Manning et al, 2022). World Health Organization (WHO) rates AMR as a global threat to health, food security and development. AMR will lead to prolonged illness, longer hospitalizations, increased costs, ineffective treatment, organ failure, and even death and disability (Manning et al., 2022). Misuse

of antibiotics is the leading cause of AMR. Misuse refers to inappropriate or excessive use of antibiotics such as self-medicating, using without need, sharing, or interrupted doses (Manning et al., 2022). Due to the impact AMR has on global health, large organizations like the CDC and Joint Commission have established care plans to slow down the progression. These care plans are often referred to ASPs. ASPs have been shown to reduce antibiotic misuse, improve patient outcomes and minimize adverse events associated with antibiotic use (Manning et al., 2022).

For years, AS has been led by pharmacists, physicians, and microbiologists, but there is a growing recognition of the need to partner with nurses to promote effective AS (Carter et al, 2018). There is limited information on nurses' role in AS, but it is perceived as an extension of the nurse's role as patient advocate (Carter et al., 2018). Literature review revealed that nurses are eager to participate in AS, but lacked knowledge and expertise in antibiotic use and AMR prevention (Wong et al., 2020). It is for this reason that this quality improvement project aimed to evaluate nurses' knowledge and perceptions on AS post educational intervention.

A pretest survey was used to evaluate nurses' baseline knowledge on AS. Participants were then guided to view an educational PowerPoint presentation on AS. The study then concluded with a posttest survey which mimicked the pretest questions and was used to evaluate for improvement in nurses' knowledge on AS. The surveys tested participants on their knowledge on AMR, AS, prescribing antibiotics, and monitoring and learning. When comparing the pretest answers to the posttest answers, results showed that participants showed improvement in all four competency levels. Although, the project had a small study sample, the evaluation of the results proved that nurses were more knowledgeable and enthusiastic about participating in AS.

In closing, the study revealed that nurses responded well to education and training for

improving their knowledge on AS. Nurses are indeed an extension of AS and play a key role in AMR risk identification and management. Given the small study sample, further validation may be needed, but at any scale, an improved outcome was achieved. This proves that educational training can serve as a beneficial tool in improving nurses' knowledge and perceptions on AS.

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Appendices

Appendix A

Evidence as the Basis of Practice

Evidence	Level of Evidence	Finding	Conclusion	Use of Evidence in QI project
Monsees, Popejoy, Jackson, Lee, and Goldman (2018) Integrating staff nurses in antibiotic Stewardship: Opportunities and barriers.	III	Nurses were confident in assessing adverse drug reactions, obtaining cultures, and patient education, but less confident in understanding microbiology results to determine antibiotic appropriateness.	Barriers to nurse engagement were identified and could be addressed by improving education in microbiology and principles of antibiotic use	Educating nurses on antibiotic appropriateness and microbiology will increase nurse participation in AS.
Mostaghim, Snelling, McMullan, Konecky, Bond, Adhikari, Chubaty, Lovell, and Bajorek (2017) Nurses are underutilized in antimicrobial stewardship- Results of a multisite survey in pediatric and adult hospitals.	III	Overall, nurses were familiar with the term AMR and their role in AS, but equally reported lack of knowledge in antimicrobials.	Nurses consider AMS activities within their roles but are underutilized in AMS programs. Further engagement, education, support, and acknowledgement are required to improve nursing participation.	Nurses need more education on antimicrobial use to improve their role and knowledge on AS.
Abbas, Lee, Pakyz, Markley, Cooper, Vanhoozer, Doll, Bearman and Stevens (2019) Knowledge, attitudes, and practices of bedside nursing staff regarding antibiotic	III	Overall, nurses were familiar with AS but barriers such as time constraints and physician pull back inhibited participation.	Nurse daily workflow falls in line with AS roles but lack of nurse acceptance in ASPs has been a barrier.	Nurses understand their role in AS but lack integration.

stewardship: A cross-sectional study.				
Carter, Greendyke, Furuya, Srinivasan, Shelley, Bothra, Saiman and Larson (2018) Exploring the nurses' role in antibiotic stewardship: A multisite qualitative study of nurses and infection preventionists.	II	Nurses' role in AS included questioning necessity of urine cultures, ensuring proper culture technique, and transition of IV to PO antibiotics. Remaining recommendations were perceived to lack relevance or to challenge traditionally held nursing responsibilities	Nurses desire participation in AS but more efforts need to be made to consider nurse-driven ASPs.	Nurses play a key role in AS due to their AS-driven daily workflow.
Wong, Ibrahim, Guo, Kwa, Lum, Chung, Somani, Lye and Chow (2020) Empowerment of nurses in antibiotic stewardship: a social ecological qualitative analysis.	III	Nurses saw themselves as gatekeepers to ensure proper antibiotic administration, however they lacked knowledge in antibiotic use and AMR prevention.	The lack of knowledge in AMR prevention reflected how nurses are perceived by patients, physicians, and the community.	Nurses understand they play a role in AS but lack the knowledge in antibiotic use and AMR prevention.
Fisher, Cox, Gorman, Lesko, Holdsworth, Delaney and McKenna (2018) A theory-informed assessment of the barriers and facilitators to nurse-driven antimicrobial stewardship.	III	Study revealed 9 modifiable barriers including insufficient knowledge and lack of self-confidence. Facilitators included nurse education and training.	Nurses have potential to improve AMS through education and training.	Nurses can improve their knowledge and confidence through improved education and training.
Manning, Pogorzelska-Maziarz, Hou, Vyas, Kraemer, Carter and Monsees (2022) A	I	Antibiotic Stewardship Nursing Practice SCAN-P Framework	Nurses play a role in AS as educators and advocates when given the tools to perform	With appropriate tools and knowledge

novel framework to guide antibiotic stewardship nursing practice.		provides the much-needed context and clarity to help guide local-level nurses to participate in and lead AS nursing practice.	these roles. The SCAN-P Framework was a useful tool in doing so.	nurses can fulfill their AS roles.
Huizen, Kuhn, Russo, and Connell (2021) The nurses' role in antimicrobial stewardship: A scoping review.	I	Nurse's role should be able to monitor antibiotic prescribing, however, there is limited knowledge or inconsistencies in policies, guidelines, and education.	The role of nurses in antimicrobial stewardship needs to be supported through education and evidence-based guidelines.	Education and training support nurses' role in AS.

Appendix B

Pretest and Posttest Survey Questions

Pretest and Posttest Survey Questions
1. Electronic Consent Question
2.What is your primary role? 1. Staff Nurse 2. Educator 3. Manager 4. Nurse Practitioner 5. Other (please describe)
3.How many years have you been in this role? 1. Less than 1 year 2. 1-5 years 3. 6-10 years 4. More than 10 years
4. Please indicate you highest degree. 1. Diploma 2. Associates 3. Bachelors 4. Masters or higher
5. What is your age? 1. 18-24 2. 25-34 3. 35-44 4. 45-54 5. 55-64 6. 65+
6. Which of the following best describes your primary specialty? 1. Emergency/Urgent Care 2. Outpatient 3. Ambulatory Services 4. Home Health/Skilled Nursing 5. Surgical/Transplant 6. Rehabilitation 7. Other (please specify)
7. How familiar are you with the term “antibiotic stewardship”? 1. Not familiar at all 2. Somewhat familiar 3. Moderately familiar 4. Very familiar 5. Extremely familiar
8. How would you rate your knowledge of antibiotic stewardship? 1. No knowledge 2. Poor 3. Fair

4. Good 5. Excellent
9. How important do you believe it is to have an antibiotic stewardship program in your health care setting? 1. Not sure 2. Not at all important 3. Important 4. Very important 5. Extremely important
10. When giving a patient an antibiotic, how often do you know WHY he/she is receiving the antibiotic? 1. Not sure 2. Not often 3. Often 4. Very often 5. Always
11. If you have a question about the antibiotic being given, who do you ask for clarification? 1. Charge Nurse 2. Primary Medical Team 3. Infectious Disease Team 4. Antibiotic Stewardship Program 5. I don't ask anyone
12. In the past 30 days, have you questioned a treating provider about the choice of antibiotic, dose, route, or duration? 1. I don't know 2. Never 3. No, not in the last 30 days 4. Yes 5. Always
13. If you answered yes or always to the question above, what did you question the treating provider about? (Select all that apply) 1. Choice of antibiotic 2. Dose of antibiotic 3. Route of antibiotic 4. Duration of the antibiotic 5. Reason for antibiotic
14. Do you think nurses should be involved in interventions aimed to improve antibiotic use? 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree

15. Would you feel comfortable raising concerns to the treatment team about the antibiotic(s) a patient is getting? 1. Extremely uncomfortable 2. Somewhat uncomfortable 3. Neither comfortable nor uncomfortable 4. Somewhat comfortable 5. Extremely comfortable
16. Have you ever given an antibiotic that you thought was inappropriate? 1. Definitely not 2. Probably not 3. Might or might not 4. Probably yes 5. Definitely yes
17. A course of antibiotics should always be completed. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
18. There is no harm in prescribing antibiotics “just in case”. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
19. Antibiotics are effective in treating bacterial infections. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
20. Antibiotics are not effective in treating viral infections. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
21. The use of antibiotics can cause harm. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
22. Antibiotics are excessively used nationally. 1. Strongly disagree

2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
23. Antibiotics are overused in my health care setting. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
24. Strong knowledge of antibiotics is important for my job. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
25. I would like more education on the appropriate use of antibiotics. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
26. Appropriate use of antibiotics can cause antibiotic resistance. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
27. It is my responsibility to ensure appropriate antibiotic use in my health care setting 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
28. I am interested in the status of antibiotic use in my health care setting. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
29. Inappropriate use of antibiotics causes resistance. 1. Strongly disagree 2. Somewhat disagree

3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
30. Prescribing broad-spectrum antibiotics when equally effective narrow spectrum antibiotics are available increases antibiotic resistance 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
31. The incidence of antibiotic-resistance organisms can be reduced by changing antibiotic prescribing patterns. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
32. Spread of antibiotic resistance can be reduced by changing infection control practices. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
33. The development of new antibiotics will help combat current resistance trends. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
34. Assessment and documentation of allergies are important to ensure appropriate antibiotic use. 1. Strongly disagree 2. Somewhat disagree 3. Neither agree nor disagree 4. Somewhat agree 5. Strongly agree
35. Does your health care setting have access to infectious disease specialists? 1. Yes 2. No 3. Not applicable/not sure
36. Do you feel having an infectious disease specialist available would improve patient care?

1. Strongly disagree
2. Somewhat disagree
3. Neither agree nor disagree
4. Somewhat agree
5. Strongly agree

37. In the past month, about how many times has an infectious diseases specialist consulted a patient you have cared for?

1. None
2. 1-2 times
3. 3-5 times
4. 6 or more times
5. Not sure/Not applicable

38. How often do you give out resources and educational materials on antibiotic use and management of infections?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

39. My practice setting allows me to have time to provide advice on antibiotic use to individuals

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

40. To what extent do you rely on the following sources of information to provide care to patients with infectious diseases?

	Never	Sometimes	About half the time	Most of the time	Always
Colleague					
Infectious disease specialist					
Peer reviewed articles/journals					
UpToDate					
Clinical textbooks					
Personal clinical experience					
Infection Control					

Pharmacist					
Internet Search					
Other (Please describe)					

41. What interventions do you think would be most helpful in improving the appropriate use of antibiotics in your health care setting? (Select all that apply)

1. Antibiotic restrictions
2. Pharmacy interventions
3. Auditing of charts
4. Evaluating antibiotics use after 48 hours of therapy
5. Online education modules
6. Lectures
7. Knowledge of accurate allergy reporting
8. Other (please describe)

Appendix C

Project Timeline

Date	Task
May 9, 2022	o Description of research problem and purpose
June 30, 2022	o Completion of Literature Review
July 21, 2022	o Project planning and SWOT analysis
August 27, 2022	o Project proposal
September 9, 2022	o Project proposal to DOH
October 25, 2022	o Project proposal to FNA
November 22, 2022	o IRB Approval From FIU
December 31, 2022	o Cleared to send out survey to FNA members
January 31, 2023	o Participant recruitment and data collection began
February 28, 2023	o Data collection and survey completed
March 11, 2023	o Data analysis and statistical data compiled

Appendix D

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FLORIDA INTERNATIONAL UNIVERSITY

MEMORANDUM

To: Dr. Carmen V. Framil

CC: Stela Karkatselos

From: Carrie Bassols, BA, IRB Coordinator CeB

Date: November 22, 2022

Proposal Title: "Improving nurses' knowledge and perceptions on antibiotic stewardship to combat antibiotic resistance: A quality improvement project."

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #: IRB-22-0508 **IRB Exemption Date:** 11/22/22
TOPAZ Reference #: 112372

As a requirement of IRB Exemption, you are required to:

1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
1) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A
For further information, you may visit the IRB website at http://research.fiu.edu/irb.

Appendix E

RE: Fellow FNA member and DNP student

WF

Willa Fuller

WFuller@floridanurse.org

You skarkatselos@outlook.com

Friday, January 27, 1:24 PM

High Priority

Hi Stela, We have approval to send out your recruitment letter to FNA members. When would you like me to deploy

Willa

Appendix F

October 3, 2022
C. Victoria Framil, DNP, APRN, ANP-BC, CNE
Clinical Associate Professor
Nicole Wertheim College of Nursing & Health Sciences
Florida International University

Dear Dr. Framil,

Thank you for inviting Florida's Department of Health to participate in the DNP Project of Stela Karkatselos. It is understood that Stela Karkatselos will be conducting this quality improvement project as part of the requirements for the Doctor of Nursing Practice program at Florida International University. After reviewing the proposal of the project titled "Improving nurses' knowledge and perceptions on antibiotic stewardship" she has been granted permission to conduct the project with this organization.

The project will be implemented in two sessions, using a pre- and post- test survey to assess current practices. The department is also aware of staff participation in supporting the student to complete this project, including electronic consent, online surveys, and educational intervention. All parts of the project will be completed virtually and electronically.

The project intends to evaluate nurses' knowledge and perceptions on antibiotic stewardship and provide educational interventions to improve upon that knowledge and ideas. The project will be conducted with consent and volunteer participation of nurses in Florida. Before implementation of this project, the Florida International University Institutional Review Board will evaluate and approve the procedures to conduct it. Evidence suggests that improving nurses' knowledge on antibiotic stewardship will provide better nursing care, improve patient outcomes, decrease medical costs and hospitalizations, and decrease antibiotic resistance.

The educational intervention will be a voice-over PowerPoint presentation that will last approximately 20 minutes. Any data collected by Stela Karkatselos will be kept confidential and participant's information will be de-identified. Data will be stored in a password protected computer.

Stela Karkatselos is expected to not interfere with normal department procedures and will behave professionally. I support the participation of Florida Department of Health Infection Prevention Department in this quality improvement project and look forward in collaborating with Florida International University.

Sincerely,

DocuSigned by:
Barbara Russell
9D63B16CA953409...

Barbara Russell, RN, BSHSA, MPH, CIC, FAPIC
Infection Preventionist Region 7
Infection Prevention
Florida Department of Health

Appendix G

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ADULT ONLINE CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Improving nurses' and nurse practitioners' knowledge and perceptions on antibiotic stewardship.

SUMMARY INFORMATION

Antibiotic resistance is a global health issue. Nurses and nurse play a key role in defeating antibiotic resistance and advocating for antibiotic stewardships. This quality improvement project aims to learn the gaps in antibiotic stewardships and provide educational material fill in or improve those said gaps.

Things you should know about this study:

- **Purpose:** The purpose of the study is to improve knowledge and perceptions on antibiotic stewardship.
- **Procedures**: If you choose to participate, you will be asked to complete a pre- and post- test survey and view an educational video PowerPoint.
- **Duration:** This will take about 45-70 minutes to complete all 3 parts.
- **Risks**: There will be no risks associated should you choose to participate.
- **Benefits:** The main benefit to you from this research is that you will learn or improve your knowledge and skills on antibiotic stewardship.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Participation:** Taking part in this research project is voluntary.

Please carefully read the entire document before agreeing to participate.

PURPOSE OF THE STUDY

The purpose of this study is to obtain information on current nurses' knowledge and perceptions on antibiotic stewardship and antibiotic resistance. Upon completion of the pre-test, you will be directed to view an educational PowerPoint video which will be provided to help build upon that knowledge and bridge the gaps on having a successful antibiotic stewardship. In turn, this will help reduce the risks associated with antibiotic resistance.

NUMBER OF STUDY PARTICIPANTS

If you decide to be in this study, you will be one of hundreds of people in this research study.

DURATION OF THE STUDY

Your participation will involve about 45-70 minutes of your time in total. There will be a pre- and post-test survey that will take up to 15-20 minutes each to complete. You will also watch a PowerPoint presentation that can take up to 15-30 minutes to complete.

PROCEDURES

If you agree to be in the study, we will ask you to do the following things:
1. Take a pre-test survey that will take 15-20 minutes to complete.
2. Watch an educational PowerPoint that will take 15-30 minutes to complete.
3. Take a post-test survey immediately after you watch the PowerPoint presentation which would take 15-20 minutes to complete.

RISKS AND/OR DISCOMFORTS

The study has the following possible risks to you:

- There will be no physical, psychological, societal, or economical risks to you with this study.

BENEFITS

The study has the following possible benefits to you:

- Obtain a better understanding of the term "antibiotic stewardship"
- Improve your knowledge and skills that comply with an antibiotic stewardship
- Play a key role in improving patient outcomes

ALTERNATIVES

There are no known alternatives available to you other than not taking part in this study. Any significant new findings developed during the research which may relate to your willingness to continue participation will be provided to you.

CONFIDENTIALITY

The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report, we might publish, we will not include any information that will make it possible to identify you. Research records will be stored securely and only the researcher team can access them. However, your records may be inspected by authorized University or other agents who will also keep the information confidential.

USE OF YOUR INFORMATION

Your information collected as part of the research will not be used or distributed for future research studies even if identifiers are removed.

COMPENSATION & COSTS

You will not receive a payment for your participation, which is voluntary. There are no costs to you for participating in this study.

RIGHT TO DECLINE OR WITHDRAW

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. You will not lose any benefits if you decide not to participate or if you quit the study early. The investigator reserves the right to remove you without your consent when he/she feels it is in the best interest.

RESEARCHER CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Stela Karkatselos, APRN at Florida International University, (917) 400-0412, snaco001@fiu.edu.

IRB CONTACT INFORMATION

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. By clicking on the “consent to participate” button below I am providing my informed consent.