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Using a Delayed Antibiotic-Prescribing Education Intervention to Prevent Antibiotic Overuse in the Treatment of Respiratory Tract Infections

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Table of Contents

Abstract

Background: Antibiotics have been overprescribed to patients with respiratory infection in outpatient clinics in the United States. Antibiotic overuse has led to increased risk for antibiotic resistance and complications related to side effects. A review of the literature suggests that delayed antibiotic prescribing is an effective intervention that can be used to prevent antibiotic overuse. Delayed antibiotic prescribing is an evidence-based strategy where a patient is either issued with an antibiotic prescription and advised to delay filling it or to pick it up at an agreed location only if symptoms persist beyond the expected natural history of illness or deteriorate. *Purpose*: The purpose of this quality improvement project was to improve primary care providers' knowledge about delayed antibiotic prescribing strategy and decrease inappropriate prescribing of antibiotics in the treatment of respiratory tract infections. The study used a one-group pre- and posttest design to measure providers' knowledge of delayed antibiotic-prescribing strategy. *Results:* A convenience sample of 30 providers participated in the project. After the education intervention, there was a significant improvement in knowledge test questionnaire scores: *Paired t* (30) = 13.24, $p < .001$. 77% (n=23) of the prescribers expressed their likelihood to adopt delayed prescribing in their practice. *Discussion:* The findings indicate that the delayed antibiotics educational intervention can improve providers' knowledge, increase their likelihood to adopt intervention in practice, which may prevent complications related to antibiotic overuse. This project had limitations related to implementation and evaluation time constraints, small sample size, and lack of a control group. Ongoing education of providers and patients is an essential intervention for preventing inappropriate antibiotic use in the treatment of respiratory tract infections.

Keywords: Antibiotics overuse, delayed antibiotic prescribing, antibiotic resistance

Introduction

Antibiotic overuse in the treatment of acute respiratory infection leads to unintended consequences at the individual, population, and system levels. Antibiotics cause untoward adverse effects including agranulocytosis, photosensitivity, retinopathy, lactic acidosis, rash, and gastrointestinal intolerance among others (Barnhill, Brewer, & Carson, 2012). They may also lead to more severe reactions in patients on either initial or repeated exposure such as skin reactions like Stevens-Johnson syndrome, nephrotoxicity, anemia, and hepatitis (Nambudiri, 2014). The development of resistant organisms and the rise of secondary infections such as Clostridium difficile–associated diarrhea resulting from antibiotic overuse pose serious public health challenges (Sullivan, 2014). Antibiotic resistance is now a major threat to public health (World Health Organization [WHO], 2014).

The financial costs of antibiotic overuse and the associated complications contribute to increasing healthcare system expenditures (Nambudiri, 2014). In 2009, the US spent $10.7 billion on antibiotics, of which 6.5 billion were spent among patients who received their prescriptions from primary care offices (Suda, Hick, Roberts, Hunkler, & Danziger, 2013).

Antibiotic overuse significantly increases a person's future risk of drug resistance. Costelloe et al. (2012) found an association between antibiotics prescribed within 12 months and the presence of methicillin-resistant Staphylococcus aureus (MRSA) in patients. According to the Centers for Disease Control and Prevention (CDC; 2013), each year in the US at least 2 million people become infected with bacteria that are resistant to antibiotics, and at least 23,000 people die as a direct result of these infections. Many more people die from related complications. Antimicrobial resistance is an increasingly serious threat to global public health because it leads to poorly controlled infections, increased risk of transmission to others,

prolonged illness and hospital stays, increase in economic and social costs, as well as greater risk of death (WHO, 2014).

The number of new antibiotics developed and approved has steadily decreased in the last three decades. Between 1980 and 1982, about 19 new antibiotics were developed and approved; however, between 2010 and 2012 only one new antibiotic was approved (CDC, 2013). There is a concern that providers will run out of alternatives for treating patients who have developed resistance to first-line antibiotics.

Many programs have been proposed to prevent the adverse effects of antibiotic overuse and ensure appropriate use of antibiotics in the treatment of respiratory tract infection, such as the Get Smart programs (CDC, 2016), Antibiotic Stewardship programs (CDC, 2015), and the Global Action plan on antibiotic resistance (WHO, 2015), among others. A key to effective antibiotic overuse intervention is an understanding of the providers' knowledge about antibiotic adverse effects and resistance, as well as knowing the barriers to antibiotic overuse prevention and intervention that providers encounter in their practice.

Clinical practice recommendations to delay the use of antibiotics for non-complicated respiratory tract infections were made available to providers by the National Institute for Health and Care Excellence (NICE) in 2008. However, studies have shown that providers do not often use this strategy because of lack of awareness (Francis et al., 2012; Peters et al., 2011). Ambulatory care providers have an opportunity to prevent antibiotic overuse through the accurate diagnosis of respiratory infections as either viral or bacterial and delaying use of antibiotics for uncomplicated respiratory infections in both children and adults (Little et al., 2014).

Delayed antibiotic prescribing is a strategy where a patient is either issued an antibiotic prescription and advised to delay filling it or is told to pick up the prescription at an agreed-upon location only if symptoms persist beyond the expected natural history of illness or deteriorate. Patients with respiratory tract infections are suitable candidates for delayed antibiotic prescribing due to the self-limiting nature of these diseases and the fact that most of these infections are not bacterial in nature.

The purpose of this research translation project was to educate providers about delayed antibiotic prescribing, which is an evidence-based intervention that has proven to reduce antibiotic use in the treatment of respiratory tract infections in the primary care setting. The goal of this quality improvement program was to increase knowledge and awareness of the effects of inappropriate antibiotic prescribing in the treatment of respiratory tract infections, with an aim of preventing antibiotic overuse.

Background and Significance

Inappropriate antibiotic overuse increases the risk of antibiotic-resistant infection. Due to the low number of newly developed antibiotics to treat such infections, there is a high risk of complications and death among adults presenting with respiratory tract infections in the outpatient setting. Educating primary care providers about delayed antibiotic prescribing will reduce antibiotic overuse and contribute to the prevention of antibiotic-resistant infections, thereby decreasing the risk of complications and death

High percentages of acute respiratory infections (ARI) are treated with antibiotics although viruses cause most of them and usually antibiotics provide little or no relief to such infections. These include nonspecific respiratory tract infections, pharyngitis, bronchitis, otitis media, and pneumonia. ARI are the rationale for 75% of the antibiotic prescriptions each year,

(Gill et al., 2006). Roberts and Hicks (2012) purport that visits for ARIs account for more than one half of all antibiotic prescriptions for outpatients, and these infections lead to more nonessential and unnecessary antibiotic prescriptions than any other infectious syndrome. Shapiro, Hicks, Pavia, and Hersh (2014) claim that 41% of all the antibiotics prescribed 2007–2009 during ambulatory visits in the US were for respiratory conditions. They also note that 25% of antibiotics were prescribed for conditions for which antibiotics are not necessary. Gill et al. (2006) examined antibiotic use in a large national ambulatory care network and found out that antibiotics were prescribed for 65% of upper respiratory episodes.

Antibiotic overuse is due partly to the fact that some patients expect antibiotic prescriptions as the treatment for URI (Broniatowski, Klein, & Keyna, 2014). Studies have shown that physicians' decisions to prescribe an antibiotic may be influenced by patient or parent expectations (Stivers et al., 2003). Patients' desire for antibiotics may be rooted in a misunderstanding about viral respiratory illness and its treatment. These misconceptions are made worse by the limited ability of providers, due to time limitations and heavy workload, to educate patients about proper antibiotic use and the possible causes of most ARI (Price, Mackenzie, Metlay, Camargo, & Gonzales, 2011). Obstacles to promoting appropriate use of antibiotics include the following: patient and physician presumptions, patients' knowledge deficit about problems caused by antibiotic resistance, and primary care clinicians' and patients' impression that antibiotic resistance is a minimal risk (Costelloe et al., 2010).

A key to effective implementation of the antibiotic conservation program is an understanding of any knowledge deficit in providers and patients. These include the prescriber's attitude toward conserving antibiotics, knowledge about the causes of the particular respiratory infection, benefits of judicious evidence-based antibiotic use, the effects of antibiotic overuse to

the individual, community, and the general public. It is also important to know the barriers that providers encounter while treating patients with ARI that do not require antibiotics. Healthcare providers must understand the need to implement evidence-based interventions that can help reduce the inappropriate use of antibiotics in the treatment of respiratory tract infections.

Critical Appraisal of Research on Interventions

A comprehensive review of the literature for appropriate management of respiratory infections without clear bacterial presentation was performed utilizing the following databases: PubMed of the National Library of Medicine, Cochrane and Cumulative Index of Nursing and Allied Health Literature. The following Medical Subject Headings (MeSH) terms were used for the search: respiratory tract infections, antibiotic overuse, intervention, and delayed antibiotic prescribing. The limitations imposed on all searched articles included being published in the last 5 years and written in the English language.

The search yielded 256 articles published between 2008 and 2015. A total of 243 articles were deleted for being duplicated in the search, lacking research designs, not addressing antibiotic overuse intervention, and not addressing antibiotic-prescribing strategies. Twelve articles were retained for review. Several themes regarding the management of respiratory tract infections emerged from the reviews: physician training, decision support system, patient education, and delayed antibiotic use.

Delayed Antibiotic Prescribing

Eight studies asserted that the use of delayed antibiotic prescribing reduces antibiotic use (Francis et al., 2012; Hayes, Frisch, & Lindbaek, 2011; Little et al., 2014; NICE, 2008; Peters et al., 2011; Spurling, Del Mar, Dooley, Foxlee, & Farley, 2013; Worrall, Kettle, Graham, & Hutchinson, 2010). Delayed antibiotic prescribing or “wait-and-see prescription” or “watchful

waiting" is where a patient is either issued with an antibiotic prescription and advised to use it or to pick it up at an agreed-upon location only if symptoms persist beyond the usual natural history of illness: acute otitis media, 4 days; acute sore throat/pharyngitis/tonsillitis, 1 week; common cold, 1.5 weeks; acute cough/bronchitis, 3 weeks (NICE, 2008).

The NICE (2008) guidelines recommend that no antibiotic or a delayed antibiotic-prescribing strategy can be used for patients with the following conditions: acute otitis media, acute sore throat/acute pharyngitis/acute tonsillitis, common cold, acute rhinosinusitis, and acute cough/acute bronchitis. This is because antibiotics have limited efficacy in treating such infections. The guidelines also recommend patient teaching about the natural history (expected average total length) of the illness, reassurance that antibiotics are not needed immediately, advice about when to use the prescription, when to re-consult, and how to manage symptoms.

Little et al. (2014) compared the strategies of immediate antibiotic prescription, no prescription, and delayed antibiotic prescription using a randomized control trial. They found that delayed antibiotic prescription resulted in fewer than 40% of patients using antibiotics, and was associated with weaker beliefs in antibiotics and the need for immediate prescription. Similarly, Worrall et al. (2010) also performed a randomized control trial and found that delayed prescriptions reduce the rate of antibiotic use. Spurling et al. (2013) performed a meta-analysis of randomized trials to evaluate the use of delayed antibiotics compared to immediate or no antibiotics as a prescribing strategy for acute respiratory tract infection. They found that delayed antibiotic prescription reduces antibiotic use without an increase in complication of the respiratory tract infection.

Hayes et al. (2011) performed an observational study and found that general practitioners find delayed prescribing very reasonable, especially when treating sinusitis and that most

patients (89%) were also satisfied with the wait-and-see prescription. Peters et al. (2011) examined whether patients given delayed antibiotic prescriptions used the antibiotics. They found that less than half of the patients given a delayed prescription took the antibiotic. Francis et al. (2012) performed an observational study and found that delayed antibiotic prescribing may increase patient empowerment and satisfaction, avoid medicalization, and provide a safety net. The wait period gives the infection time to run its course, and having a delayed prescription may prevent after-hours consultations as the patient can go ahead and fill the prescription if the symptoms get worse.

Providers' Education and Use of Decision-Support System to Halt Antibiotic Overuse

Five studies proposed provider and patient education and use of a decision-support system to halt antibiotic overuse (Butler et al., 2012; Gonzales et al., 2013; Lalana-Josa et al., 2014; Mainous, Lambourne, & Nietert, 2013; Price et al., 2011). Lalana-Josa et al. (2014) investigated the use of a multidisciplinary education session about diagnosis and treatment of upper respiratory infection. The intervention did lead to a decrease in antibiotic prescribing compared to the control group, but the decrease was not statistically significant.

Mainous et al. (2013) investigated the use of a clinical-support system inform of clinical guidelines integrated into an electronic health record to assist providers in deciding whether or not antibiotic is indicated. The results showed a decline (-0.6%) in inappropriate prescribing of antibiotics among intervention practices compared to controlled practices. This study included nine states in the US that use electronic health records. It used volunteer subjects, which may have created a volunteer bias in that the participants were not randomly selected. Gonzales et al. (2013) also investigated the use of a decision-support system in the form of printed and computerized antibiotic-prescribing guidelines and found that the intervention led to a 12–16%

reduction in antibiotic prescriptions. However, the generalizability of study findings was limited because the study was conducted in one geographical setting: rural central, and northeast Pennsylvania.

Butler et al. (2012) examined a "stemming the tide of antibiotic resistance (STAR)" practice-based seminar that reflected on the general providers' antibiotic dispensing and resistance data, online educational elements, and practicing consulting skills in routine care. They found that the intervention led to a 14.1% decrease in oral antibiotic dispensing.

Price et al. (2011) examined patient responses to an interactive computerized education module to reduce unnecessary antibiotic prescribing in the emergency room setting. The study revealed that an interactive educational kiosk improved knowledge about antibiotics and ARI and that learning corresponded with changes in personal desire for antibiotics (over half of the patients who participated reported a decreased desire for antibiotics).

Synthesis of Review of the Literature

NICE (2008) provides an evidence-based practice guideline that supports delayed antibiotic prescribing and provides clear directions on how to implement it. The overall quality of this guideline is 6/7 (Brouwers et al., 2010) and it is recommended for use with a few modifications including a description of the risks and barriers to implementation and a procedure for updating the guideline. The guideline recommends determining and addressing the patient's concerns and agreeing with the patient about the use-delayed antibiotic prescription. It also recommends teaching the patient about usual natural history of the illness, symptoms management, reassurance that antibiotics are not needed immediately and why, teaching about when to use the delayed antibiotic prescription (if symptoms persist beyond average total length of illness), and when to re-consult (if symptoms worsen even after using the antibiotics).

Delayed antibiotic prescribing was found to have a significant reduction in the number of patients who used antibiotics compared to immediate antibiotic prescribing (Little et al., 2014). This study provides Level I, good quality evidence. The use of delayed antibiotic prescribing involves patient teaching about symptom-relief measures and when to fill the prescription or re-consult. This resonates with the need of the targeted population because they have a knowledge deficit about proper management of respiratory infection. Delayed antibiotic prescribing is also associated with other benefits, as discussed above, including less belief in antibiotics, no increase in complications, avoiding medicalization, providing a safety net, increasing patient satisfaction and empowerment (Francis et al., 2012; Little et al., 2014; Spurling et al., 2013).

The studies supporting provider and patient education on appropriate antibiotic use (Lalana-Josa et al., 2014), decision-making support system (Gonzales et al., 2013), and the STAR education program (Butler et al., 2012) provide Level I good quality evidence (The Johns Hopkins Hospital/The Johns Hopkins University, n.d.). The study supporting a clinical support system (Mainous, Lambourne, & Nietert, 2013) provides Level II good quality evidence. However, these studies did not find a significant reduction in antibiotic use and no other benefits beyond a small decrease in antibiotic use. The study about the computerized patient education module (Price et al., 2011) found a significant decrease in participants' desire for antibiotics (change in behavior), and it provides Level II evidence (randomized controlled trials). However, the study was done in eight Veterans Affairs (VA) and non-VA emergency room hospitals in urban areas across the US. Therefore, those results may not be generalized due to limited representation of the entire population.

In summary, delayed antibiotic prescribing appears to be the most appropriate intervention to prevent antibiotic overuse in the treatment of respiratory tract infections. This is

due to its strong supportive evidence from Level I study. It has led to reduction in the use of antibiotics (40%) compared to the other interventions identified in the literature review. This recommendation also promotes patient education about how the symptoms can be managed and when to consult, which are relevant to the patient population where the project was implemented. Delayed antibiotic prescriptions have also been found to reduce the belief in antibiotics as a cure (Little et al., 2014). Patients who find that symptoms improve without antibiotics discover that antibiotics are not the treatment of choice for most respiratory tract infections.

Most of the studies reviewed recommended appropriate diagnosis of the respiratory infections in order to differentiate between a viral and bacterial infection. The need to educate healthcare providers when to prescribe immediate antibiotics and when to recommend delayed antibiotics or no antibiotics is apparent from the literature. The importance of patient education about the cause of infection and the best treatment was also identified in the research articles.

Theoretical Framework

The aim of this quality improvement project was to decrease inappropriate antibiotic use in the treatment of respiratory infections by educating primary care providers at an outpatient setting. The DNP student used Lewin's theory of change as a theoretical framework (Lewin, 1958). The three-stage model of change included in this theory is unfreeze, change/move, and refreeze. Driving forces, which promote change, and restraining forces, which oppose change, work in conflict, and they impact change in this model (see Appendix A). The goal of Lewin's theory is to find a way to alter the balance in the direction of desired change.

The first stage was to unfreeze: develop a way for providers to let go the old pattern of prescribing antibiotics for most respiratory infections. Healthcare providers were educated on the need for appropriate antibiotic prescribing to prevent overuse and associated complications.

Available data were presented that prove antibiotic overuse has an adverse impact on individuals and communities and is a public health concern. Need for change in prescribing habits was discussed. The goal was for all the providers to understand the current problem so they could see the need for change (Lehman, 2008).

The second stage involves a change in behavior or making a new move to a more effective level. The providers were taught about the delayed antibiotic prescribing, evidence that shows that delayed prescribing reduces antibiotic use, how to issue such a prescription, and other benefits associated with this strategy. Nurses were included in the education sessions because they will reinforce the change in antibiotics prescribing by educating patients using the patient education brochure.

The third stage is where the delayed antibiotic-prescribing strategy was established as the standard operating procedure. NICE (2008) guidelines and patient education resources were posted in an easily accessible area in the hospital Website. Providers were motivated to sustain the change because they were provided with necessary training and support system (see Appendix B for the three stages of Lewin's theory).

The anticipated restraining forces include the providers' reluctance to change their prescribing habits due to more time involved in assessment, diagnosis, and teaching. The support system including the pharmacists, educators, and prompt lab results were put into place to make the change easier for the providers. Providers were also reminded that preventing antibiotic overuse in the treatment of acute respiratory infections would improve patient outcome, prevent harm, and cut down on unnecessary healthcare costs (see Appendices A & B) for more detail about the application of Lewin's Theory).

Project Design and Methods

A one-group pre- and posttest design was used to educate the providers with delayed antibiotic-prescribing strategy. This project was designed as a quality improvement project. It involved four phases. In phase one, the providers were notified of the educational sessions including the time, location, and the topic through e-mails and advertisement posters. Phase two included the implementation of the education intervention, collection of participant demographic data, and the pre- and post-content questionnaires and content evaluation survey. The third phase involved the analysis of the data collected. The final and fourth stage involved writing up the project and dissemination of the quality improvement findings.

Goals and Objectives

The goal of this quality improvement project was to improve primary care providers' knowledge about delayed antibiotic-prescribing strategy and decrease inappropriate prescribing of antibiotics in the treatment of respiratory tract infections. The objectives of this DNP project were (a) to implement education interventions designed for primary care providers to increase knowledge about delayed antibiotic prescribing in the treatment of respiratory tract infections, (b) to evaluate the effect of this intervention on knowledge improvement, increase in delayed antibiotic prescriptions, and decrease in inappropriate antibiotic use, and (c) to measure process evaluation by using questionnaires to obtain the perception of the providers about the education session.

Setting and Resources

The project was community focused, as it aimed to affect the providers and patients, to change their perspectives about antibiotics use in the treatment of respiratory tract infection and to improve knowledge about the impact of antibiotic overuse and resistance (Issel, 2014).

The project was implemented at a community-based ambulatory care center. The care center is a state-sponsored primary care and non-emergency outpatient setting staffed by medical doctors, interns, physician assistants, nurse practitioners, and registered nurses. The patient population that the center serves includes homeless people, inmates, and under-insured and uninsured adults from surrounding areas (Human and Health Services, n.d.). The care center also collaborates with group homes and shelters to care for individuals with major behavioral, developmental, and mental illness to ensure optimally integrated healthcare for this patient population (Baycove Human Services, n.d.). Most of the patients do not follow up with preventative care appointments, but they present when they have acute illnesses including respiratory infection, fever, skin and bladder infections. Most of the people seeking care in this clinic have high school and middle school levels of education. The director for medical students in the center approved the project and was the DNP student's preceptor for this quality improvement project. The clinic tends to get patients with respiratory tract infections mostly in the fall and winter season due to cold weather. The preceptor agreed that delayed antibiotic prescribing would be an effective way to manage these diseases. She also noted that there was a need to educate patients about appropriate use of antibiotics, symptoms management, and the adverse effects of antibiotic overuse.

Ethics and Human Subjects Protection

Since the project is a quality improvement initiative, the university did not require institution review board approval. The training directly involved the providers, not the patients. Participation was voluntary. Participants were advised not to write their names on the pre- and post-intervention questionnaires. All the information collected from the participants was kept confidential. No provider was singled out regarding prescribing patterns or attitudes toward

antibiotic use. The DNP student did not involve any patient in the education sessions, but made the teaching brochures for patients available to providers.

Description of the Participants

The study population included a convenience sample of 30 healthcare providers, which consisted of MDs, PAs, NPs, interns and registered nurses (Appendix C). 70% (n=21) of the participants were female and 30% (n=9) were male (Appendix D). Eligibility for participation of the education sessions required providers to be directly involved in the prescribing of medications, or assessing and teaching patients, or in training other providers.

Inclusion criteria for participation included (a) primary care providers who are directly involved in patient assessments and prescribing medications, (b) nurses who were involved in patient assessment and teaching, and (c) nurse educators. Other targeted populations included nurse informaticists because they were involved in posting NICE guidelines and patient education brochures in the organization Website and educating nurses on how they can access and print patient education materials. Pharmacists were also invited to the education because they review the antibiotic prescriptions, but they did not attend any of the education sessions. Exclusion criteria were specialists and supportive staff who are not directly involved in treating patients.

Implementation

This project was implemented over a three-month time frame with four one-hour weekly sessions. In November 2015, the first meeting was made with the DNP student's preceptor who is the director for the medical and nurse practitioners students at the Clinic. The meeting included a presentation of the proposal, the goals and objectives of the project, the implementation process, as well as the time frame. Next, the flyers describing the project were

placed in the providers' break rooms, locker room, and elevators (Appendix E). The preceptor also e-mailed all the providers and explained that although participation was voluntary, they were encouraged to attend one of the education sessions.

There were four education sessions over the project period. In each education session, the DNP student presented current statistics of antibiotics use in the treatment of respiratory tract infection, the adverse effect of antibiotic overuse at individual and community level and relevant public health concerns, and the evidence-based delayed antibiotic-prescribing intervention (how it works and how it reduces antibiotic use). This education was delivered as a PowerPoint presentation and printed handouts.

After the presentation, the DNP student introduced a skill-building exercise using a case study and guided the discussion afterward. Providers were encouraged to voice their opinions on the appropriate treatment plan for the patient in the case study (Appendix F). Nurses (RNs) and nurse educators were instructed how to access patient education materials about management of respiratory tract symptoms and how delayed antibiotic prescribing works in the hospital Website. Supportive resources such as the NICE guidelines and patient education brochures were posted on the hospital's website (Appendix G). The education sessions took place in a conference room within the ambulatory care center.

Providers were given the knowledge test questionnaire twice (before and after the education sessions) to assess their knowledge about the effect of antibiotic overuse and delayed antibiotic prescribing. At the beginning of the sessions, providers completed a survey question about how familiar they were with the delayed prescribing strategy. At the end of the sessions, providers completed a survey question about their intention to adopt the strategy in their current practice and the process/program evaluation questionnaire.

Measurements

The knowledge test questionnaire (Appendix H) was used before and after the education sessions to obtain providers' knowledge about the effects of antibiotic overuse and the delayed antibiotic-prescribing strategy. The questionnaire was developed by the DNP student using a 5-point Likert scale that consisted of 10 items relating to the problems of antibiotic overuse, the intervention of delayed antibiotic prescribing, and when and how to implement the evidence-based intervention. The process/program evaluation questionnaire consisted of six questions. It was used to assess the participants' view of the effectiveness of the education session including time and location convenience, quality of presentation, and recommendations for future improvement (Appendix I).

Data Analysis

Demographic (gender, professions) and baseline (e.g., prior experience with delayed prescribing) variables were summarized as mean ± standard deviation for continuous variables and as frequency and percentage for categorical variables. Data from the pre- and post-intervention knowledge test questionnaire were compared to see if there was a significant increase in percent of correct answers using a paired test. Microsoft Excel and IBM SPSS version 23 were used to analyze the data. Data from the process/program evaluation questionnaire were analyzed qualitatively.

Results

Characteristics of Participants

A total of 67% (n = 30) of all the primary care providers working at the project site participated in the education program and completed the pre- and posttests and process

evaluation questionnaire. 30% (n = 9) of the participants were NPs, 17% (n = 5) were PAs, 20% (n = 6) were MDs, 10% (n = 3) were MD students/Interns, and 23% (n = 7) were RNs. 70% (n = 21) of the participants were female, and 30% (n = 9) were male (Appendix I).

Comparison of Pre-, and Post-Intervention Knowledge Test Questionnaire

The percent correct score of the pretest knowledge test questionnaire was a mean of 75.33% (SD = 10.743), and the percent correct score of the posttest was a mean of 99.67% (SD = 1.826). The increase in the knowledge test score was 24%. Improvement in knowledge test questionnaire scores was significant: *paired* t (30) = 13.24, $p < .001$(Appendix J). The analysis of each item is reported in Appendix K.

A total of 13.3% (n = 4) of the participants indicated that they were not familiar with delayed antibiotic prescribing; 33.3% (n = 10) were slightly familiar; 40% (n = 12) were somewhat familiar; 10% (n = 3) were moderately familiar; and 3.3% (n = 1) were very familiar with the intervention (Appendix K). A total of 57% (n = 17) of the prescribers indicated that they were likely to adopt the delayed antibiotic-prescribing strategy, and 20% (n = 6) were very likely to apply the intervention in their practice (Appendix L). The nurses did not participate in the intention to adopt delayed prescribing survey because they do not prescribe medications.

A total of 80% of the participants indicated that the education was conducted at a convenient place and time. 20% indicated that they would prefer online education so that they can access the information at their own convenient time. All the participants pointed out that the topic was good and applicable to their practice and indicated that they would like to learn more about how to manage infections that are resistant to common antibiotics. 95% of the participants said that the PowerPoint presentation was presented well and the handouts were great for future

referral. 5% recommended that the presenter should talk more loudly in future due to interruptions from participants who came after the presentation had started.

Facilitators and Barriers

Key stakeholders included the medical director of education for medical students, nursing educators, and directors for pharmacy and quality improvement. Specifically, the medical director of education (DNP student's capstone preceptor) was the most important facilitator within the organization, a primary stakeholder who provided full support for the project. She encouraged the participation of the providers and nurses in the education sessions. Lunch was provided to motivate providers to attend the education program. The institution Website was also an excellent resource that facilitated the project implementation. The patient education brochures and NICE (2008) antibiotics-prescribing guidelines were posted on the institution Website for the providers to access as needed.

Time was a major constraint to the successful implementation and evaluation of this project. Education sessions were provided over a lunch hour, a time when most providers are still busy with their documentation. The participating MDs, NPs, PAs, and RNs required time to complete a pretest, an education session, a case-study discussion, and posttest, which took approximately over half an hour. Some of the providers came after the PowerPoint presentation had started and therefore they did not take the pretest questionnaires. Also, there was not enough time to follow up whether the prescribers were applying the delayed antibiotic-prescribing intervention after the education. Continued implementation of delayed prescribing in practice will also require providers to spend more time during patient encounters to educate the patients about appropriate use of antibiotics and the adverse effects of antibiotic overuse as well as non-pharmacological measures to relieve symptoms and prevent infection.

Discussion

The project findings showed that education intervention significantly improved the providers' knowledge about delayed antibiotic prescribing. Data collected supported that the education intervention that included PowerPoint presentation, handouts distribution, and interactive case-study group discussion increased participants' knowledge. This led to the participants expressing their likelihood to adopt the delayed antibiotic prescribing in their practice. As Costelloe et al. (2010) reported, providers' lack of knowledge about the impact of antibiotic overuse and the strategy of delayed antibiotic prescribing has been identified as an obstacle to promoting appropriate use of antibiotics. Therefore improved providers' knowledge and awareness about delayed prescribing would ultimately prevent antibiotics overuse, and further decrease inappropriate prescribing of antibiotics in the treatment of respiratory tract infections.

The education intervention utilized several strategies to improve participants' learning experience. One of them was to include statistics from the trusted sources like the CDC and the WHO. Offering statistics describing providers' inappropriate antibiotics prescribing and the effect of antibiotic overuse on the individual, community, and general public has increased participants' awareness and contributed to a strong response in the intention to adopt delayed antibiotic prescribing in their practice. Also the case-study discussions allowed the providers to apply the learned theory into practice. It also created an environment for providers to learn from each other's experience. One of the providers who had practiced medicine in Europe commented that in Europe, only the infectious disease specialists prescribe antibiotics because they are very careful not to prescribe antibiotics inappropriately. The specialists prescribe antibiotics only

when it is necessary, and they assist the general practitioners in deciding the most appropriate antibiotic based on the lab results.

There are several lessons learned from the data from the program evaluation questionnaire. Providers suggested that future education programs should include the patients with the caregivers with the aim of improving their knowledge of natural history, causes, and self-care management of most acute respiratory infections, when it is appropriate to use antibiotics, and when not to expect any antibiotic. A few prescribers requested more teaching about resistant organisms and treatment options for patients who are resistant to most common antibiotics. Some providers also suggested more study or research to find out if delayed antibiotic prescribing would be useful in the treatment of other infections besides respiratory.

Nursing Practice Implications

Increasing providers' knowledge and application of delayed antibiotic prescribing in practice is expected to improve patient outcome. By educating providers about complications associated with antibiotic use, common causes and natural history of respiratory tract infections, along with the delayed antibiotic prescribing, inappropriate antibiotic use will be reduced. This in turn will reduce the risk for resistance bacteria and unnecessary exposure to antibiotic side effects. The change in prescribing patterns is expected to contribute to better management of respiratory tract infections and improve patient safety. Delayed antibiotic prescribing promotes patient education about symptoms management, when to use antibiotics, and when to re-consult. This has proven to reduce re-consultation rate (Ivers, Arroll, & Allan, 2011). Ongoing education of providers and patients is an essential intervention for preventing inappropriate antibiotic use in the treatment of respiratory tract infections.

Limitations

The project had limitations related to a small sample size, lack of a control group, and implementation and evaluation time constraints. The education sessions were provided either early in the morning before providers started seeing patients or over lunchtime. These time slots were inconvenient for several providers who either had the debriefing at the time or preferred to leave the project site for their lunch break or to work on their documentation. Five participants came to the education sessions after the PowerPoint presentation had started and consequently were not able to take the pretest and were excluded from the data analysis. Furthermore, nurses did not take their lunch breaks at the same time, and therefore, some of them were still working between 12:00 and 1:00 p.m., the time of the education sessions. A Web-based presentation and e-mailing providers the pre- and post-questionnaires may increase the number of participants, especially for the providers who are on vacation or busy during education sessions.

Additionally, the lack of a control group would threaten the study validity. Adding a control group to the study design will strengthen the validity by providing reliable baseline data with which to compare the intervention group. Lastly, the project included a survey about the prescribers' intention to apply delayed antibiotic prescribing but, due to time constraints, did not follow up with pharmacy to check the actual number of delayed antibiotic prescriptions as a result of the education program.

Recommendations for future studies on this topic would include the following: (a) Recruit more participants by connecting with more providers through e-mails, one-on-one appointments, and a longer advertising period; (b) Provide education through multiple means including e-mails, Web-based presentation, mailing questionnaires, handouts, and even individual provider appointments to accommodate the providers who are not physically available to attend the education sessions; (c) Plan for more implementation and data collection time so

that the researcher can assess the impact of education on practice including more delayed antibiotic prescriptions and less antibiotic use for ARIs; (d) Consider offering continuing education credits to motivate providers to attend the program; (e) Include patient/caregiver education sessions to improve their knowledge about antibiotic overuse, the impact of the problem, and the evidence-based intervention to prevent the problem; and (f) Monitor the number of antibiotics used for respiratory infections 6 months before the education program and 6 months after the training and determine if there is any decrease in antibiotic use for ARIs.

Conclusion

Inappropriate antibiotic prescribing in the treatment of respiratory infections puts a patient at increased risk for antibiotic resistance, exposes patients to unnecessary side effects, and may even lead to complications and death. The quality improvement project provided education sessions for primary care providers in one ambulatory care center to improve their knowledge about delayed antibiotic prescribing. The results show there was a significant improvement in knowledge among the participants, and they expressed their intention to adopt delayed antibiotic prescribing in practice. This will prevent inappropriate use of antibiotics and in turn prevent problems associated with antibiotic overuse, improve patient safety and reduce healthcare costs. The DNP student shared the results of the project with the providers at the project implementation site through the site newsletter and e-mails. In addition, the findings will be presented at the University of Massachusetts Amherst Scholarly Day in poster form and posted on the Scholarworks@UmassAmherst Website so that other students and healthcare providers can access them.

References

Ackerman, S. L., Gonzales, R., Stahl, M. S., & Metlay, J. P. (2013). One size does not fit all: Evaluating an intervention to reduce antibiotic prescribing for acute bronchitis. *BMC Health Services Research, 13*(462).

Adorka, M., Dikokole, M., Mitonga, K. H., & Allen, K. (2013). Healthcare providers' attitudes and perceptions in infection diagnosis and antibiotic prescribing in public health institutions in Lesotho: A cross sectional survey. *African Health Sciences, 13*(2), 344-350.

Barnhill, A. E., Brewer, M. T., & Carson, S. A. (2012). Adverse effects of antimicrobials via predictable or idiosyncratic inhibition of host mitochondrial components. *Antimicrobial Agents and Chemotherapy, 56*(8), 4046-4051.

Baycove Human Services. (n.d.). *Outpatient services*. Retrieved May 14, 2015 from http://www.baycove.org/bcexternal/index.cfm?objectID=9B5045B0-7009-11DF-B090000423B5542E

Broniatowski, D. A., Klein, E. Y., & Keyna, V. K. (2014). Germs are germs, and why not take a risk? Patients' expectations for prescribing antibiotics in an inner-city emergency department. *Medical Decision Making, 35*(1), 60-67.

Brouwers, M., Browman, G. P., Burgers, J. S., Cluzeau, F., Feder, G., & Ferves, B.,...Zitzelsberger, L. (2010). AGREE II: Advancing guideline development, reporting and evaluation in healthcare. *Canadian Medical Association Journal, 182*, E839-842.

Butler, C. C., Simpson, S. A., Dunstan, F., Rollnick, S., Cohen, D., Gillepse, D.,...Hood, K. (2012). Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: Practice based randomized controlled trial. *BMJ, 334*, d8173.

Centers for Disease Control and Prevention (CDC). (2013). *Antibiotic Resistance Threats in the United States.* Retrieved from http://www.cdc.gov/drugresistance/threat-report-2013/

Centers for Disease Control and Prevention (CDC). (2014). *Get smart about antibiotics*. Retrieved from http://www.cdc.gov/getsmart/week/overview.html

Costello, C., Metcalfe, C., Lovering, A., Mant, D., & Hay, A. D. (2010). Effects of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: Systemic review and meta-analysis. *BMJ Clinical Research, 340*, c2096.

Department of Health and Human Services. (2009). Protection of human subjects. Office for Human Research Protections Title 45, Code of federal regulations, Part 46. Retrieved from http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html

Francis, N. A., Gillespie, D., Little, P., Verheij, P., Goossens, H., Coenen, S., & Butler, C. C. (2012). Delayed antibiotic prescribing and associated antibiotic consumption in adults with acute cough. *The British Journal of General Practice, 62*(602), e639-e646.

Gonzales, R., Anderer, T., McCulloch, C. E., Maselli, J. H., Bloom, F. J., Graft, T. R., & Metlay, J. (2013). A cluster-randomized trial of decision support strategies for reducing antibiotic use for acute bronchitis. *JAMA, 173*(4), 267-273.

Hayes, S., Frisch, J. C., & Lindbaek, M. (2011). Use and feasibility of delayed prescribing for respiratory tract infections: A questionnaire survey. *BMC Family Practice, 12*(34). doi: 10.1186/1471-2296-12-34

Human And Health Services. (n.d.). *Goldfarb ambulatory care center*. Retrieved May 13, 2015, from http://www.mass.gov/eohhs/gov/departments/dph/programs/hospitals/shattuck/programs/ambulatory-care.html

Issel, L. M. (2014). *Health program planning and evaluation* (3rd ed.). Burlingtom, MA: Jones & Bartlett Learning.

Ivers, N., Arroll, B., & Allan, G. M. (2011). Delayed antibiotic presribing for URTIs. *Canadian Family Physician, 57*(11), 1287.

Kaminski, J. (2011). Theory applied to informatics. Lewin's change Theory. *Canadian Journal of Nursing Informatics, 6*(1).

Lalana-Josa, P., Laclaustra-Mendizábal, B., Aza-Pascual-Salcedo, M. M., Carcas-De-Benavides, C., Lallana-Álvarez, M. J., & Pina-Gadea, M. B. (2015). Does the prescribing of antibiotics in pediatrics improve after a multidisciplinary intervention? *Enfermedades Infecciosas Microbiologia Clinica, 33*(2), 78-88.

Lehman, K. (2008). Change management: Magic or mayhem? *Journal for Nurses in Staff Development, 24*(4), 176-184.

Lewin, K. (1958). *Group decision and social change*. New York: Hartley, Holt, Rinehart and Winston.

Little, P., Moore, M., Kelly, J., Williamson, I., Leydon, G., McDermott, L.,...Stuart, B. (2014). Delayed antibiotic prescribing strategies for respiratory tract infections in primary care: Pragmatic, factorial, randomized controlled trial. *BMJ, 348*(g1606), 1-8.

Mainous, A. G., Lambourne, C. A., & Nietert, P. J. (2013). Impact of a clinical decision support system on antibiotic prescribing for acute respiratory infections in primary care: A quasi-experimental trial. *Journal of American Medical Informatics Association, 20*(2), 317-324.

Namburi, V. E. (2014). More than skin deep—The costs of antibiotic overuse: A teachable moment. *JAMA, 174*(11), 1724-1725.

National Institute for Health and Care Excellence (NICE). (2008). *Respiratory tract infections* -

antibiotic prescribing: Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care. Retrieved from http://www.nice.org.uk/gguidance/cg69/chaper/1-guidance

Peters, S., Rowbotham, S., Chisholm, A., Wearden, A., Moschogianis, S., Cordingley, L.,...Chew-Graham, C. (2011). Managing self-limiting respiratory tract infections: A qualitative study of the usefulness of the delayed prescribing strategy. *British Journal of General Practice, 61(590),* e579-89.

Price, E. L., Mackenzie, T. D., Metlay, J. P., Camargo, C. A., & Gonzales, R. (2011). A computerized education module improves patient knowledge and attitudes about appropriate antibiotic use for acute respiratory tract infections. *Patient Education and Counseling, 85*(3), 493-498.

Roberts, R. M., & Hicks, L. A. (2012). *Appropriate Antibiotic Use*. Retrieved from http://www.aafp.org/afp/2012/1101/P810.html

Shapiro, D. J., Hicks, L. A., Pavia, A. T., & Hersh, A. L. (2014). Antibiotics prescribing for adults in ambulatory care in the USA, 2007-09. *The Journal of Antimicrobial Chemotherapy, 69*(1), 234-240.

Spurling, G. K., Del Mar, C. B., Dooley, L., Foxlee, R., & Farley, R. (2013). Delayed antibiotics for respiratory infections. *The Cochrane Database of* Syst*ematic Review, 30(4)*. doi: 10.1002/14651858.CD004417.pub4

Suda, K. J., Hick, L. A., Roberts, R. M., Hunkler, L. J., & Danziger, L. H. (2013). A national evaluation of antibiotic expenditures by healthcare setting in the United States, 2009. *Journal of Antimicrobial Chemotherapy, 68*(3), 715-718.

Sullivan-Bolyari, S., & Bova, C. (2010). Experimental and quasi-experimental design. In G. LoBiondo-Wood & J. Haber (Eds.), *Nursing Research* (7th ed., pp. 177-193). St. Louis, MO: Mosby Elsevier.

Sullivan, T. (2014). Antibiotic overuse and clostridium difficile: A teachable moment. *JAMA Internal Medicine, 174*(8), 1219-1220.

World Health Organization (WHO). (2014). *Antimicrobial Resistance: Global Report on Surveillance*. Retrieved from http://apps.who.int/iris/bitstream/10665/112647/1/WHO_HSE_PED_AIP_2014.2_eng.pdf

World Health Organization (WHO). (2014). *WHO's first global report on antibiotic resistance reveals serious, worldwide threat to public health*. Retrieved from http://www.who.int/mediacentre/news/releases/2014/amr-report/en/

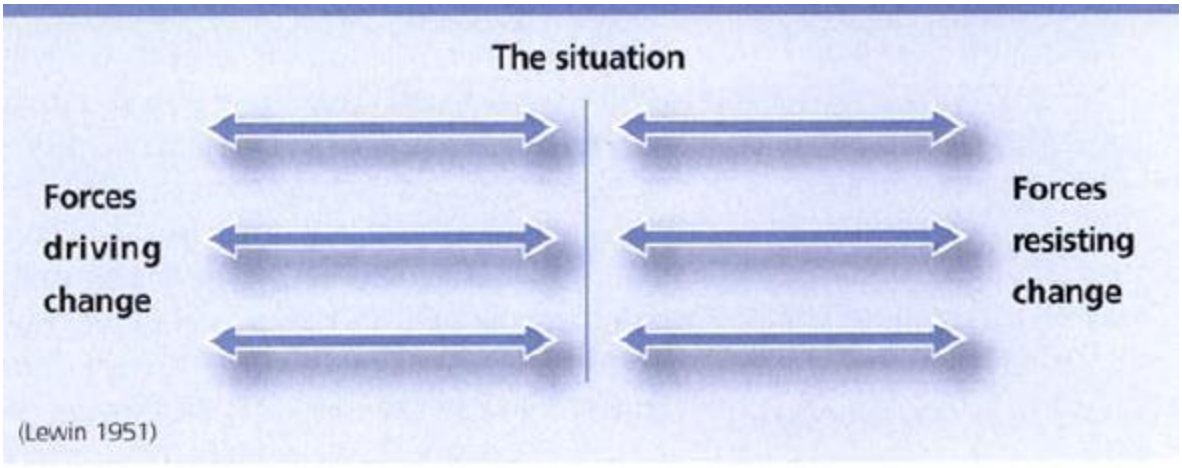
World Health Organization (WHO). (2015). *Global action plan on antimicrobial resistance*. Retrieved from http://www.who.int/drugresistance/global_action_plan/en/

Worrall, G., Kettle, A., Graham, W., & Hutchinson, J. (2010). Postdated versus usual delayed antibiotic prescriptions in primary care. *Canadian Family Physician*, *56*(10), 1032-1036.

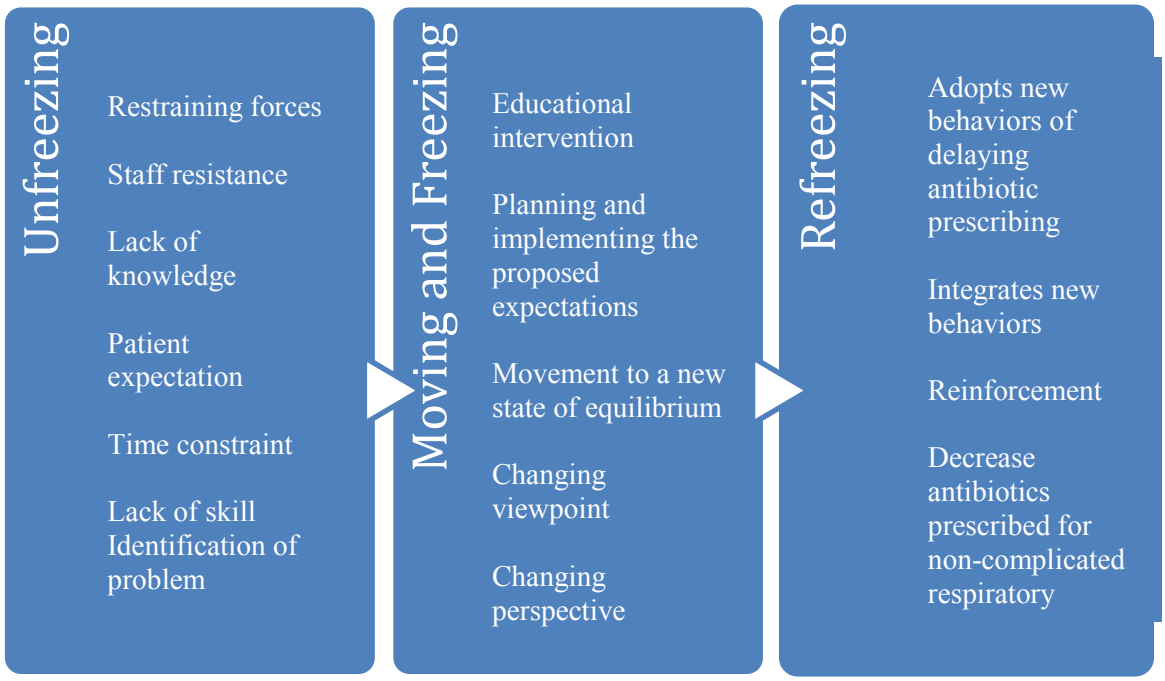
Zoorob, R., Sidani, M. A., Fremont, R. D., & Kihlberg, C. (2012). Antibiotic use in acute upper respiratory tract infections. *American Family Physician, 86*(9), 817-822.

Appendix A

Lewin's Change Theory



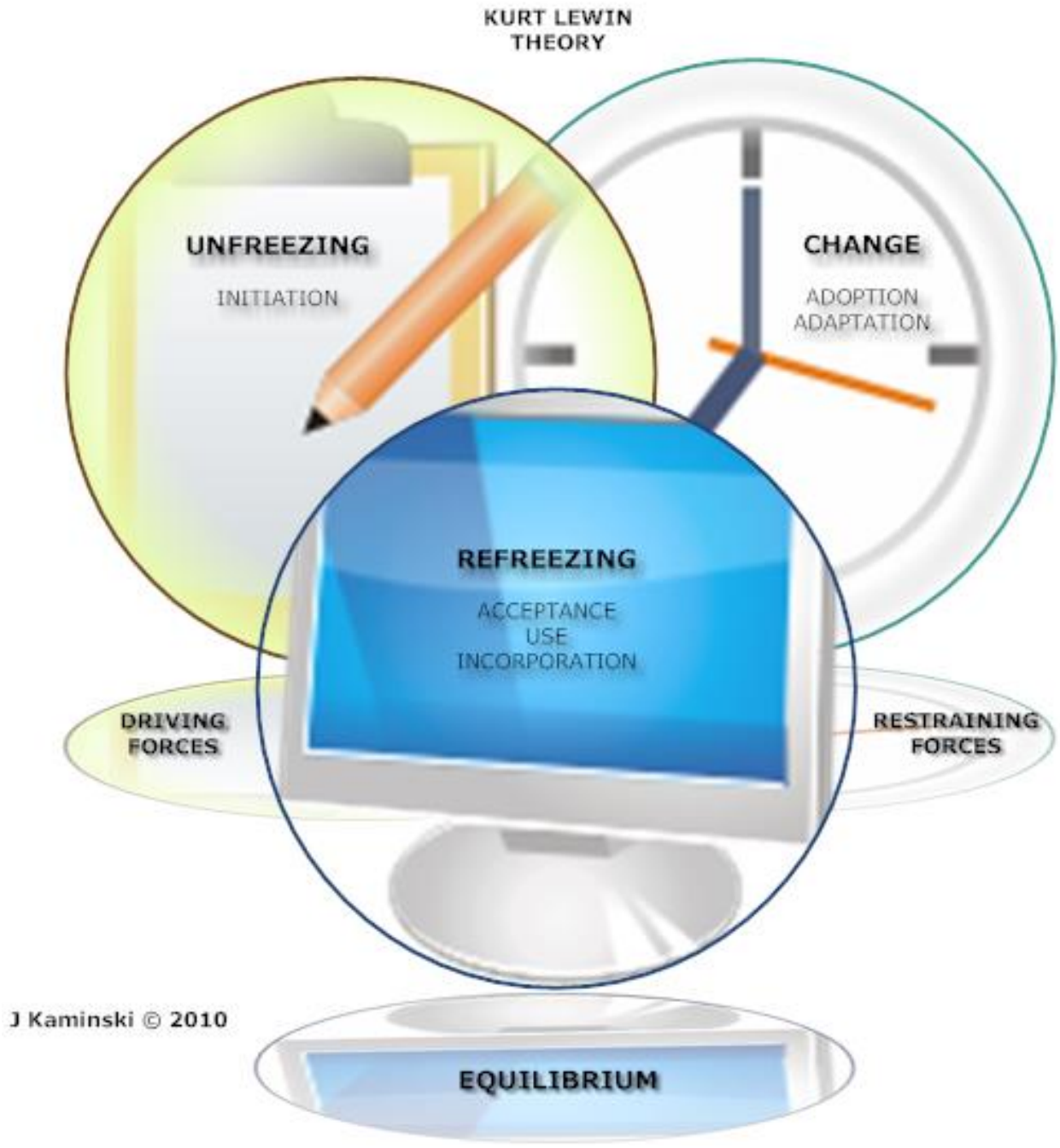
Lewins Model of Change



(Lewin's Model of Change adapted for Capstone Project by C. Muhia, 2015)

Appendix B

Lewin's Change Theory



Appendix C

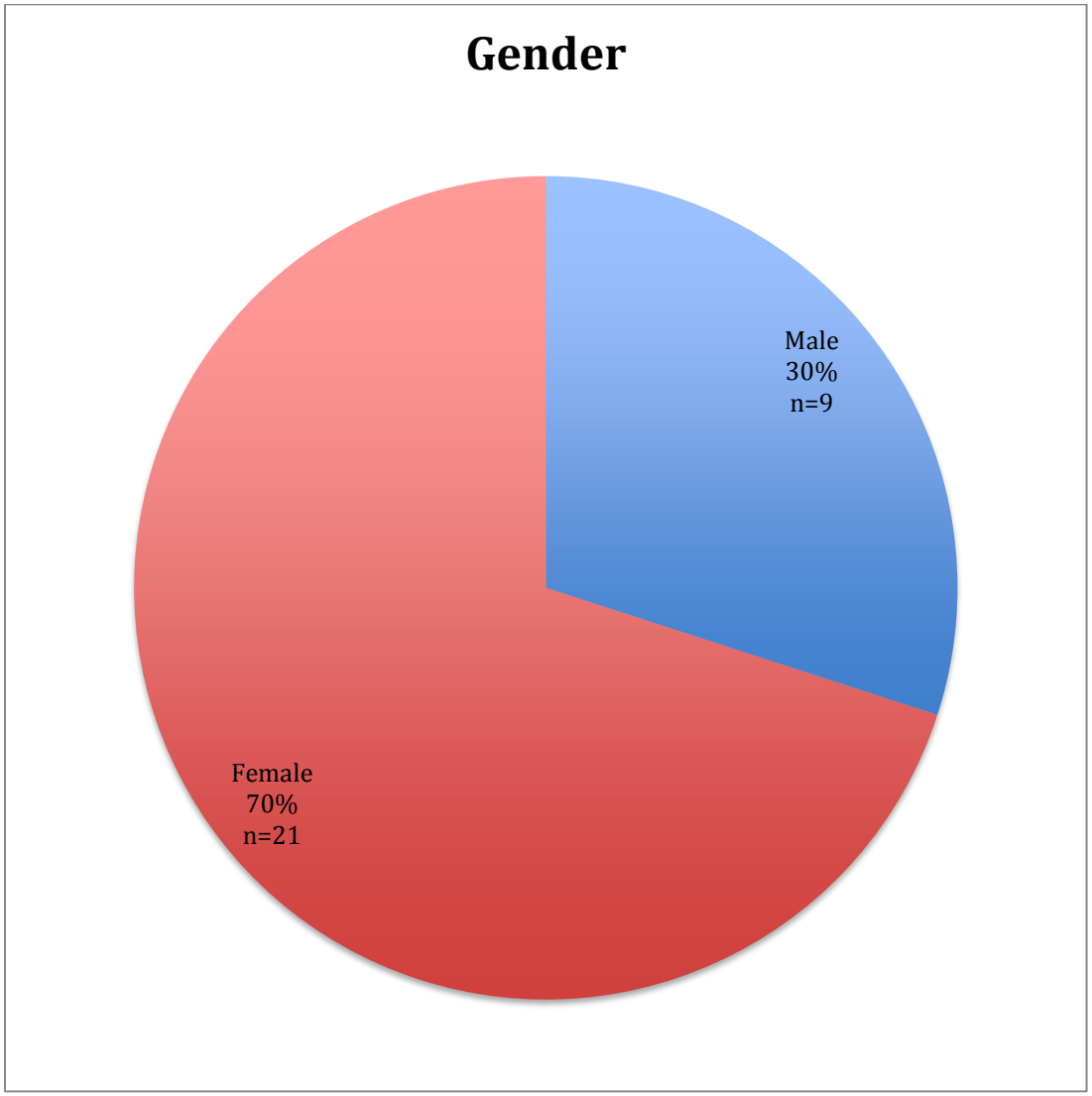
Participants Sample and Demographic Data

Participant Number	Gender	Providers' Title	Pretest Score %	Posttest Score %	Familiarity with Intervention	Intention to Adopt Intervention
1	F	MD	90	100	3/5	5/5
2	F	MD	80	100	1/5	4/5
3	F	RN	60	100	2/5	-
4	M	MD	80	100	3/5	4/5
5	M	NP	70	100	4/5	4/5
6	F	NP	70	100	3/5	4/5
7	M	MD	90	100	3/5	4/5
8	F	PA	90	100	2/5	4/5
9	F	PA	70	100	2/5	4/5
10	F	NP	80	100	3/5	4/5
11	F	NP	70	100	2/5	4/5
12	F	NP	80	100	3/5	4/5
13	F	PA	90	100	3/5	5/5
14	F	NP	70	100	3/5	4/5
15	M	MD	90	100	5/5	5/5
16	M	MD	90	100	4/5	4/5
17	F	NP	80	100	4/5	4/5

18	F	PA	70	100	3/5	4/5
19	F	RN	50	90	2/5	-
20	F	PA	80	100	2/5	4/5
21	F	NP	90	100	3/5	4/5
22	F	NP	80	100	3/5	4/5
23	F	RN	70	100	1/5	-
24	F	RN	60	100	2/5	-
25	M	RN	80	100	1/5	-
26	F	RN	60	100	2/5	-
27	F	RN	70	100	3/5	-
28	M	MD student	80	100	2/5	5/5
29	M	MD student	60	100	1/5	4/5
30	M	MD student	70	100	2/5	5/5

Appendix D

Participants' Gender



Appendix E

Advertisement Flyer

EVIDENCE-BASED PRESENTATION

TOPIC: Antibiotic Conservation in the Treatment of Acute Respiratory Infection.

BY: Catherine Muhia, DNP©

WHERE: Conference A (Ist Floor)

TIME: 12pm–1pm

DATES: 12/3, 12/10, 12/14, 12/17/2015

FYI: Free lunch available, Participation is voluntary.

Appendix F

Case Study

James is a 60-year-old male with PMH of CVA with right-sided weakness, HTN, DM and obesity. He presents to the ambulatory care clinic with complaints of productive cough, running nose, congestion, nausea, and one episode of vomiting. Cough started two days ago. Initially it was dry but now with clear to yellow sputum. Associated symptoms include fever / highest temperature 101.1^0F. Symptoms are constant, cough is keeping patient awake at night. He has tried over-the-counter medications including Robitussin and Tylenol with minimal improvement. VS: T 100.8, P 92, RR 20, BP 140/85, O2 sat 96% R.A. Lung sounds with rhonchi but clears as the patient coughs. Tests ordered: blood & urine culture, CBC, CMP, Chest X-ray, and Flu nasal swab. Decision was made to admit the patient to start him on IV Levofloxacin, Zosyn & Vancomycin x 7days for ? Pneumonia. Results of the tests: Chest X-ray with no evidence of infiltrate or consolidation, blood and urine cultures negative, negative for influenza.

Impact of antibiotics for this patient: He developed acute kidney injury from IV vancomycin. He was treated with IVF and Lisinopril was D/C. This put him at risk for uncontrolled BP, IV access put him at risk for secondary infection, IVF put him at risk for fluid overload, and he stayed in bed for one week for IV antibiotics and IVF, which put him at risk for skin breakdown.

1. Differential diagnosis for this patient.
2. Expected usual course for such illness
3. Is this a candidate for delayed antibiotic prescribing, if yes—
4. How can the patient manage his symptoms
5. When to fill prescription
6. When to re-consult

Appendix G

Patient Education Brochure

Delayed Antibiotic Prescription means that antibiotics are not needed immediately.

WHEN TO FILL THE PRESCRIPTION;

If symptoms persist beyond the natural history of illness:

Ear infection-wait for 4 days.

Natural History/ expected illness duration

Sore throat (negative for Strep)- can last for one week,

Common cold can last for two weeks,

Cough/ bronchitis (not pneumonia, asthma or tuberculosis) can last up to 3 weeks.

Symptomatic NonPharmacological Self-care strategies

Hydration/8oz or more of warm fluid/hot water,

Warm, moist air (Humidifier)

Nasal Saline/Bulb suction,

Avoid nasal irritants like Cigarette smoke, indoor and outdoor pollutants,

Sore Throat; Warm saline gargles, Lozenges, Popsicles,

Cough; Sleep with head and shoulders raised.

Incase of Fever or pain; alternate Acetaminophen with Ibuprofen.

Adults; Do not exceed 3g/day of acetaminophen.

Take Ibuprofen with Food.

When to See a Doctor

Fever over 102 for >24hrs,

Wheezing, SOB, night sweats, bloody sputum,

Chest pain, with comorbidities or if immunocompromised.

If symptoms persist or worsen even after taking antibiotics.

Appendix H

Knowledge Test Questionnaire

1. True or False: CDC estimates that 30-50% of antibiotics prescribed in hospitals are unnecessary or inappropriate.
2. True or False: Antibiotic overuse has contributed to the problem of increased drug resistance.
3. True r False: Antibiotics are indicated for acute cough or bronchitis that has persisted for 1 week.
4. True or False: Delayed antibiotic prescribing is a strategy that has proven to decrease antibiotic use.
5. True or False: It is appropriate to prescribe antibiotics for all patients with fever.
6. True or False: It is appropriate to prescribe a delayed antibiotic for non-severe bilateral or unilateral Acute Otitis media to patients (24 months or older) with mild otalgia for less than 48 hours and T <102.2F).
7. True or False: It is appropriate to prescribe a delayed antibiotic for a patient presenting with persistent sinusitis; not severe and not worsening.
8. True or False: Patients with unilateral otitis media issued a delayed antibiotic should be instructed to take the antibiotic if symptoms do not improve in 4 days since the symptoms started.
9. True or False: Acute cough or bronchitis can last up to three weeks.
10. True or False: Provider issuing a delayed antibiotic prescription should educate the caregiver or patient how to manage symptoms, when to take antibiotics and when to follow up.

PRESCRIBERS

a) On a scale of 1 to 5, how familiar are you with delayed antibiotic prescribing?
    1. Not at all familiar
    2. Slightly familiar
    3. Somewhat familiar
    4. Moderately familiar
    5. Extremely familiar
b) On a scale of 1 to 5, how likely are you to adopt delayed antibiotic prescribing in your practice?
    1. Extremely unlikely
    2. Unlikely
    3. Neutral
    4. Likely
    5. Extremely likely

Appendix I

Process/Program Evaluation Questionnaire

Team_____ Date_____

1. Was the program presented at a convenient time? Yes No

2. Was the program presented at a convenient location? Yes No

3. Was the room conducive to learning? Yes No

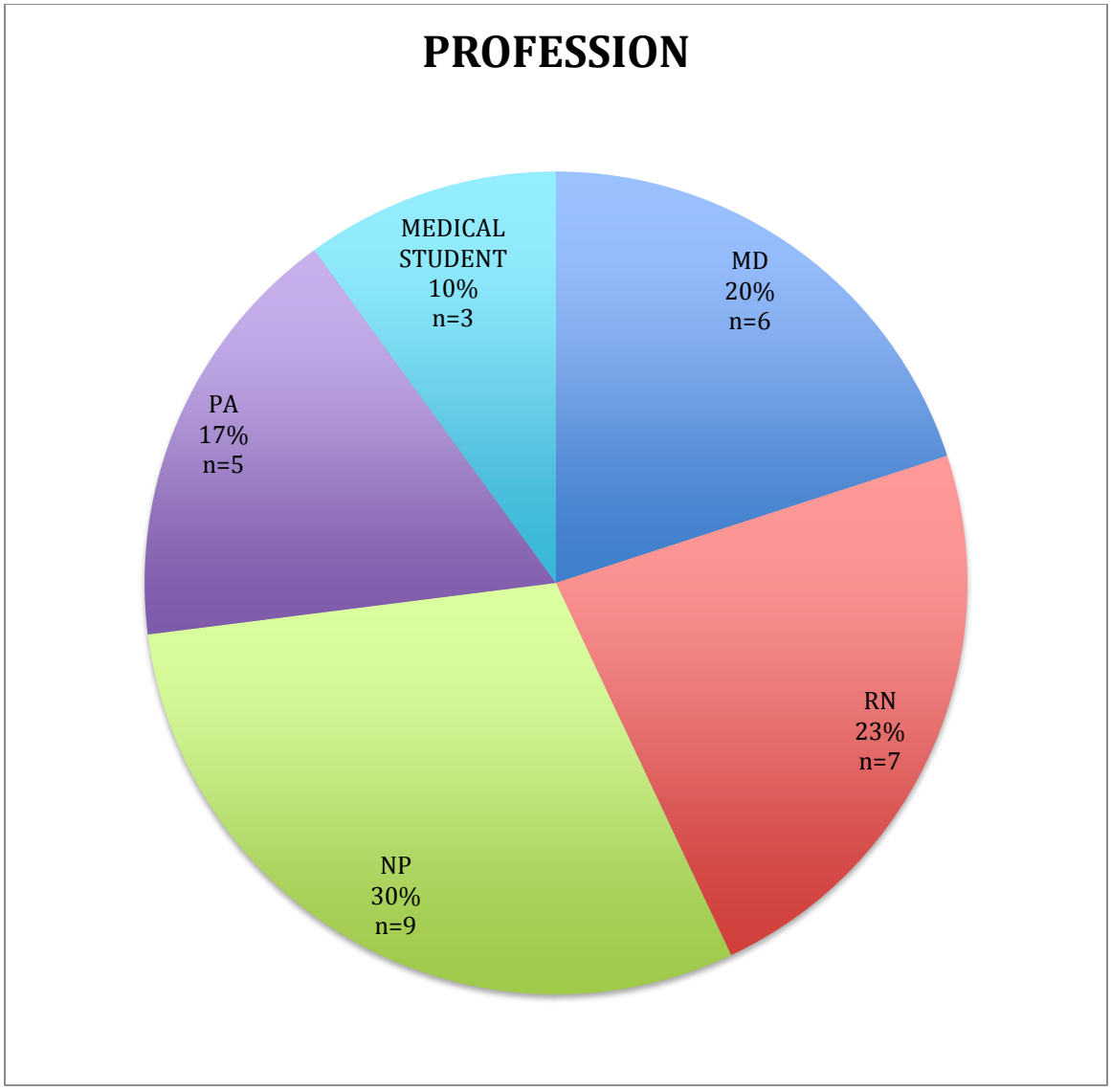
4. What did you learn from this educational intervention?

5. What recommendations do you have for improvement?

6. What other learning opportunities would you like related to this topic?

Appendix J

Participants' Profession/Title



Appendix K

Summary of Paired T-test (Pre-education vs. Post-education Scores)

	Pre-intervention (n=30)	Post-intervention (n=30)		
	Mean (SD)	*Mean (SD)*	Paired *t*	*p*
Knowledge Test Questionnaire Score	75.33 (10.743)	99.67 (1.826)	13.244	.014

Appendix L

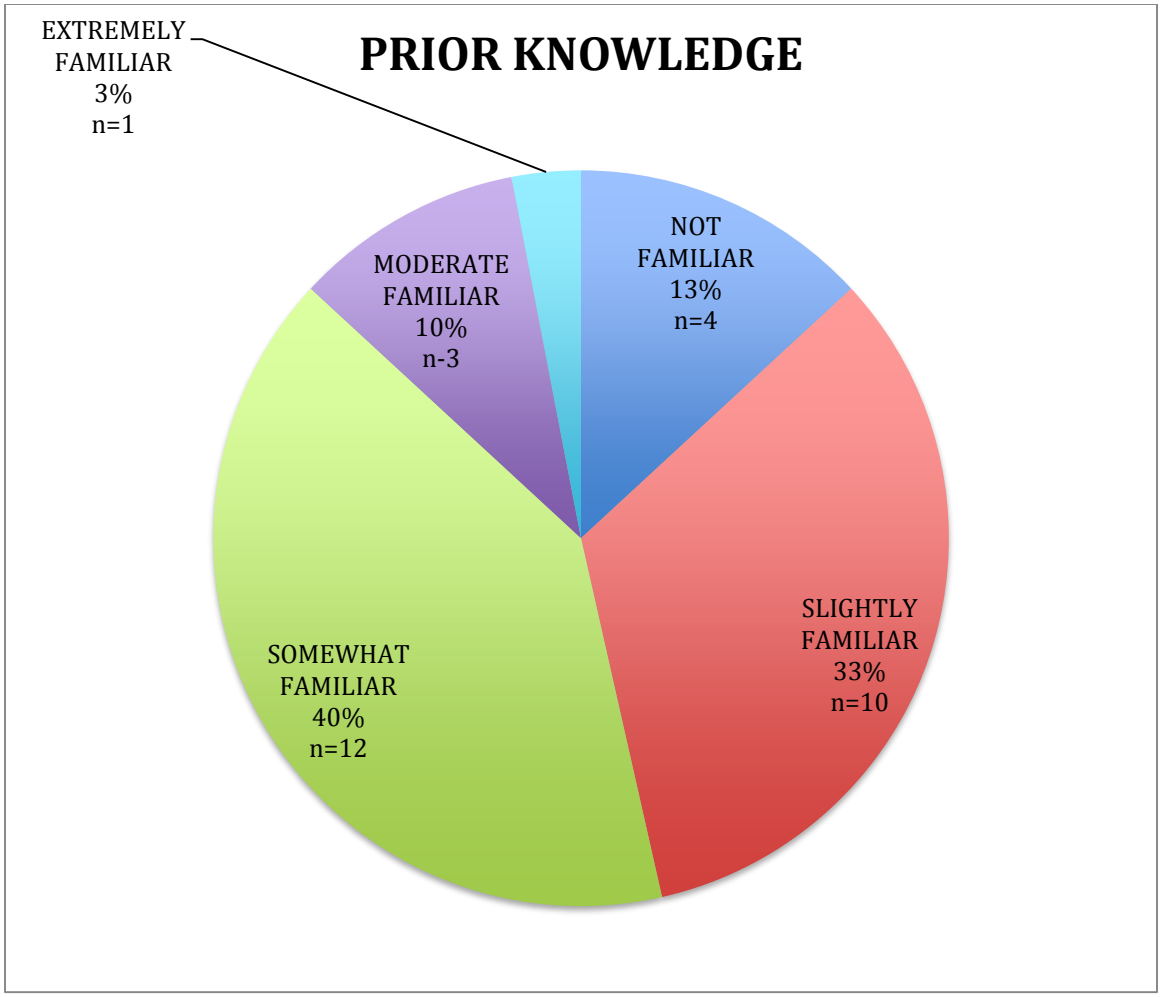
Table 5: Individual Knowledge Test Questionnaire Mean Score

Question	Pretest Score Mean %	Posttest Score Mean %
1. True or False: CDC estimates that 30-50% of antibiotics prescribed in hospitals are unnecessary or inappropriate.	100	100
2. True or False: Antibiotic overuse has contributed to the problem of increased drug resistance.	90	100
3. True 0r False: Antibiotics are indicated for acute cough or bronchitis that has persisted for 1 week.	70	100
4. True or False: Delayed antibiotic prescribing is a strategy that has proven to decrease antibiotic use.	90	100
5. True or False: It is appropriate to prescribe antibiotics for all patients with fever.	80	100
6. True or False: It is appropriate to prescribe a delayed antibiotic for non-severe bilateral or unilateral Acute Otitis media to patients (24 months or older) with mild otalgia for less than 48 hours and T <102.2F).	65	100
7. True or False: It is appropriate to prescribe a delayed antibiotic for a patient presenting with persistent sinusitis; not severe and not worsening.	40	90
8. True or False: Patients with unilateral otitis media issued a delayed antibiotic should be instructed to take the antibiotic if symptoms do not improve in 4 days since the symptoms started.	80	100
9. True or False: Acute cough or bronchitis can last up to three weeks.	75	100
10. True or False: Provider issuing a delayed antibiotic prescription should educate the caregiver or patient how to manage symptoms, when to take antibiotics and when to follow up.	90	100

Total mean score	76	99.7

Appendix M

Participants' Prior Knowledge about Delayed Antibiotic Prescribing



Appendix N

Prescribers Intention to Apply Delayed Antibiotic Prescribing in Practice