Antibiotic Stewardship in Urinary Tract Infection Therapy

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September 29, 2022

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Abstract

Introduction: Urinary tract infections (UTI) are common reasons women are treated in the primary care settings. But UTI therapy often does not follow the most current evidence-based clinical practice guidelines (CPG). Antibiotic stewardship for primary care providers (PCP) is recommended by the Centers for Disease Control and Infectious Diseases Society of America. It is important to analyze clinic level antibiotic stewardship for appropriate antibiotic therapy for UTI. **Review of Evidence:** Research supports four main elements of outpatient antibiotics stewardship: commitment, action for policy and practice, tracking and reporting, and education and expertise. When PCP monitor prescribing practices within a clinic, data can be gathered, and feedback given that allows for assessment of prescribing practices and education to reinforce the use of evidence-based CPGs. These practices can help improve discernment related to antibiotic stewardship. **Implementation plan:** A gap analysis was conducted to review current, internal data related to antibiotics prescribed for UTI therapy. A comparison of current data to CPG determined the percentage of prescriptions that align with CPG. A two-fold intervention consisted of 1.) Education of PCP on the CPG related to UTI therapy; 2.) Implementation into practice of the CPG related to UTI therapy.

Evaluation: Pre and post intervention chart review data compared effectiveness of the practice change education. **Conclusion:** The percentage of providers that more closely followed CPG related to antibiotics in UTI therapy did increase.

Appropriate Urinary Tract Infection Therapy

Urinary tract infections (UTI) are common reasons patients seek care from primary care providers (PCP). Around 50% of women will have problems with UTI symptoms at some point in their life and UTI symptoms account for over 8 million doctor visits each year (Cleveland Clinic, 2020). These women will generally receive a prescription for an antibiotic to help with the infection. It is important that PCP are familiar with current evidence-based practice (EBP) guidelines when treating UTI to provide appropriate healthcare and avoid potential pitfalls that can occur with incorrect antibiotic prescribing.

Background

The Infectious Diseases Society of America (IDSA) published CPG in 2011 after collaboration with an international panel (Gupta, et al., 2011). Unfortunately, the best practice for treatment of UTI is not always used, with compliance rates of current practice guidelines at around 40% (Heppner, et al., 2020). This means that women often receive inappropriate antibiotic therapy. In the spirit of antibiotic stewardship, it is important for prescribers to treat uncomplicated UTI according to guidelines. Uncomplicated UTI do not have a universal definition but generally are considered to be infections that involve the bladder with no signs and symptoms that suggest the infection may have spread beyond the bladder (such as fever, flank pain, nausea &/or vomiting) (Hooton & Gupta, 2021).

The Centers for Disease Control (CDC) and IDSA both recommend antibiotic stewardship programs for providers who routinely prescribe antibiotics. The CDC published The Core Elements of Outpatient Antibiotic Stewardship to help clinicians more closely follow EBP when it comes to treatment with antibiotic therapy (Sanchez, et al., 2016). This report discusses the four main elements of outpatient antibiotic stewardship which are commitment, action for policy and practice, tracking and reporting, and education and expertise. When PCP monitor prescribing practices within their clinic group, data can be gathered which can then be given as feedback. This feedback allows group members to assess their prescribing practices and then education can be provided to reinforce the use of EBP and CPG. These practices can help improve discernment related to antibiotic prescribing and help to ensure that the right drug, the right dose, and the right duration are all chosen when an antibiotic is needed (Sanchez, et al., 2016).

Choosing an antibiotic that is not recommended is considered to be a high-priority condition in the CDC's Core Elements (Sanchez, et al., 2016). An example of this is when a broad-spectrum antibiotic (such as a fluoroquinolone) is used when a narrow spectrum antibiotic choice would be considered more appropriate (Pendergrass & Pendergrass, 2017). Current clinical practice guidelines set forth by the IDSA do not recommend fluoroquinolones for uncomplicated UTI unless patients are unable to tolerate one of the recommended antibiotics (Gupta, et al, 2011). In outpatient clinics, quality assurance initiatives that monitor prescribing practices, implement education and changes as appropriate are more in line with the suggested principles set forth by the CDC and IDSA.

Problem Statement

Incorrect antibiotic prescribing for UTI is a problem in many clinic settings. This is an area where PCP have the ability to improve adherence to CPG and practice antibiotic stewardship. Through chart review, PCP will have a greater understanding of when antibiotic prescribing errors occur and then will be able to make practice changes.

Organizational "Gap" Analysis of Project Site

A preliminary chart audit was conducted to gather internal clinic data related to the ordering of antibiotics for UTI. This established a performance measure that was trended against a standard expected measure to determine when improvement happens. The expected measure is a compliance rate of 85% - 90% as recommended by the IDSA (Gupta, et. al., 2011).

Review of the Literature

The Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Pub Med databases were used to search for terms related to uncomplicated UTI, antibiotic therapy related to UTI therapy and antibiotic stewardship. The search was conducted to include literature published from January 2016 through February 2022. Key terms of uncomplicated UTI, antibiotic therapy, antibiotic stewardship and primary care were used in different combinations to research literature pertaining to quality improvement and antibiotic stewardship projects. Clinical practice guidelines related to UTI therapy was also searched in both databases.

After international, multi-disciplinary cooperation, the IDSA recommends specific CPG related to the treatment of UTI (Gupta, et. al., 2011). Although the clinical definition of uncomplicated UTI differs some, the IDSA specifies that patients with uncomplicated UTI as nonpregnant, premenopausal women that have no co-morbidities and no known urologic conditions. The American Urologic Association (AUA) also recommends the same course of treatment for women with uncomplicated UTI and also gives a similar definition for uncomplicated UTI (Kaplan & Yates, 2020).

Extensive literature exists detailing the divergence of actual clinical practice for the treatment of UTI versus what is outlined in the CPG by the IDSA and AUA. A retrospective observational secondary analysis was conducted on 44.9 million female patients who were treated for uncomplicated UTI between the years of 2015-2019. It was found that the overall concordance rate of antibiotic treatment was at 58.4% or 26.2 million visits out of 44.9 million. In 2015, the concordance rate was less than 50% and one of the key findings of this research was that 3.7 million women in the United States receive non-recommended antibiotic therapy each year. Fluoroquinolones were found to be greatly overused even though they are not recommended in the clinical practice guidelines published by the IDSA. Concordance rates went up greatly with women aged 18 to 44 years and if the treatment was given by an obstetrician-gynecologist (OB/GYN). OB/GYN treatment of UTI had greater than 80% concordance rates (Langner, et. al., 2021).

A study that included over 400 outpatients, it was found that UTI therapy in an academic emergency department setting was only correct in following CPG 56% of the time. This was considering the correct antibiotic for the correct duration of treatment days. 68% of the women treated were given an appropriate antibiotic and of those that received the correct antibiotic, only 44% received the antibiotic for the correct duration of treatment (Chardavoyne & Kasmire, 2020). This study also compared three groups of providers: physicians, resident physicians and advanced practice providers. The three groups were all similar in practicing trends and no statistical difference was found when comparing prescribing accordance to CPG.

Another study including a group of five primary care offices identified that while greater than 60% of patients received the correct antibiotic, only 25% of patients received that antibiotic for the correct duration of treatment (Giancola, et. al., 2020). This study included a total of 1,649 patients: 787 patient cases reviewed during the pre-intervention period and 862 cases reviewed during the post-intervention period. Almost all of the incorrect prescribing related to duration of therapy were related to too many days of treatment. This study sought to identify if using prescribing instructions embedded into the electronic medical record would improve adherence to CPG. The default prescription instructions were set to be within the recommended range but were modifiable if the clinician chose to change them. After implementing this change, adherence rates went up considerably, from 25% to 76%.

A self-assessment survey given to emergency department providers before an education in-service on UTI therapy revealed that the majority of providers believed their practice reflected an evidence-based model and that they were confident about the antibiotics prescribed for UTI. In actuality, chart reviews revealed that pre-intervention prescribing concordance rates were closer to 50%-60% when considering the choice of antibiotic, the dosage and the duration of therapy. For the purpose of a quality improvement project, this group utilized a multi-disciplinary approach to instruct providers on appropriate therapy and to develop a treatment algorithm. After implementation of education and treatment algorithms, there was statistical improvement in all of the antibiotic prescribing categories (Heppner, et. al., 2020).

Due to the concern of incorrect antibiotic prescribing tendencies, many projects have been developed to practice antimicrobial stewardship related to outpatient UTI therapy. In an antimicrobial stewardship project involving emergency department providers and the treatment of UTI for patients being discharged home, the development of a treatment protocol and electronic order set helped improve adherence to CPG (Zalmanovich, et. al., 2021). In this study, a multidisciplinary team developed a treatment algorithm for patients with a UTI diagnosis then presented in-service training explaining the protocol to the ED clinicians. The goal of the program was adherence to the treatment order sets and it was found that after intervention, adherence rates increased from around 40% to more than 80%.

Clinical decision support tools to treat UTI in the primary care setting have also been an effective way to increase antibiotic stewardship. In a family medicine resident clinic, fluoroquinolones were found to be prescribed 42% of the time when women had a diagnosis of UTI and only 20% were prescribed nitrofurantoin which is the recommended antibiotic according to the IDSA. Meant as a practice improvement project, this pilot study developed a clinical decision support tool into the electronic health record that could be pulled into the patients' chart by either the nurse during the triage process or by the provider during the clinic visit. A multidisciplinary team was used to develop the tool and included a site specific antibiogram in the consideration of antibiotics that should be used. The tool was used to help guide providers in the care of their patients who needed treatment for UTI. Fluoroquinolone prescriptions decreased significantly after implementation of a clinical decision support tool and the use of nitrofurantoin increased (Eudaley, et. al., 2019).

These data are typical of current literature findings and give examples as to why UTI treatment falls under the high priority condition criteria listed by the CDC in the "Core Elements of Outpatient Antibiotic Stewardship" report (Sanchez, et. al., 2016). Antibiotic stewardship related to UTI therapy is important for PCP to consider when prescribing treatment for patients. Analyzing data related to practice trends helps PCP understand where actual practice deviates from CPGs recommended by the experts in urology and infectious diseases. Education for PCP has been shown to improve antibiotic therapy and is a way to practice antibiotic stewardship.

Evidence-based Practice: Verification of Chosen Option

This antibiotic stewardship quality improvement project details practice trends of an internal medicine clinic related to antibiotic therapy for UTI using retrospective chart reviews. After chart review was complete, the information gathered was presented to the clinicians and an in-service was given that details CPG. The PICO question used to guide this Doctor of Nursing Practice (DNP) project asks "In women at an internal medicine office (P) Can education and implementation of EBP clinical guidelines (I) Compared to no EBP clinical guidelines (C) Improve prescribing practices of healthcare providers related to uncomplicated UTI (O) over a one-month period?”.

Theoretical Framework

Problematic prescribing of antibiotics is an example of the gap that is often found between EBP and what occurs in “real life”. Only about half of new, effective research makes it into general practice and then it usually takes close to 20 years for proven effectiveness (EBP) to be thoroughly utilized (Bauer & Kirchner, 2019). The ideas behind implementation science seek to understand why proven EBP does not readily translate to actual practice. The theory of implementation science is used to identify barriers that lead to decreased utilization of EBP. After these barriers are identified, implementation science helps develop ways to overcome these barriers so that EBP can be implemented into every day practice. Implementation science fosters the utilization of EBP and encourages not only providers but also healthcare organizations to incorporate EBP for the effect of improving healthcare (Eccles, et al., 2012). Research in the implementation science field can also study de-implementation to identify practices that are ineffective but still in use.

This project used implementation science to identify areas of opportunity for antibiotic stewardship education as well knowledge of current, CPG. The project director (PD) sought to encourage use of evidence-based CPG in the hopes that antibiotic prescribing more closely aligns with IDSA recommendations. Also, the idea of de-implementation helped the PD further promote providers to change prescribing practices that they are currently using because of their personal status quo. Then, the ideas of implementation science were used to highlight the ways that the providers at the clinic site can improve prescribing practice to more closely align with CPG.

Implementation science has been shown to be an effective way to approach antibiotic stewardship programs. During a redesign of antibiotic prescribing in a group of emergency departments and urgent care centers, implementation science theory guided the implementation of change process. The goal was to adapt an outpatient antibiotic stewardship program and using several phases, this project was successful in addressing the problem of unnecessary antibiotic prescribing (Yadav, et al., 2019).

When considering using an Implementation Science approach in primary care, Prathivadi et al. (2022) suggest using an inside out approach. Consideration of the clinic's patient demographics such as local needs, cultural beliefs, and education levels is an important first step when trying to implement changes. Needs assessments should also be conducted before beginning any change process. Identifying roadblocks and also how to best get cooperation are all very important for PCP when beginning to introduce need for EBP change. However, the theory of implementation science can help facilitate changes so that PCP offices can best incorporate EBP into their daily routine (Prathivadi, et al., 2022).

Goals, Objectives and Expected Outcomes

The goal for this DNP project was to implement an antibiotic stewardship program to increase adherence to CPG related to therapy of uncomplicated UTI in an internal medicine office. The objectives were to 1) research current practice trends, 2) disseminate data gathered to the PCP, 3) educate on CPG, 4) discuss how improvements can be made going forward so that actual practice is more harmonious with CPG and 5) monitor response to the intervention of education. The response to intervention was monitored over a 2-month period. The expected outcome was that antibiotic prescriptions given to treat uncomplicated UTI will more closely align with CPGs.

Methods (Plan)

This proposed project used an EBP quality improvement project approach. The overarching goal of the project was to improve antibiotic stewardship in the care of women receiving treatment for UTI by implementing into practice CPG. The specific objectives of the project were to 1) improve healthcare provider knowledge of current EBP guidelines for UTI; and; and 2) improve clinic level compliance to CPG for prescribing antibiotics related to treatment of UTI. The project was conducted by a Doctor of Nursing Practice student (the project director [PD]) as part of coursework for the University of Alabama.

Project Design

A pre and post intervention design was used for this quality improvement project. Pre-intervention chart review gave data about how often the PCP at this clinic prescribe according to CPG for UTI therapy. After presentation of the preliminary data, an educational in-service was given. Educational tools and regular reminders via clinic visits helped to reinforce to the PCP about the need for appropriate treatment for patients that have UTI. A post intervention chart review was conducted at the 2-month mark to assess improvement in adherence to CPG.

Project Site and Population

The site for this project was a privately-owned internal medicine office located in Bartlett, TN which is a suburb of Memphis, TN and part of the Memphis-metro area. The clinic's particular zip code demographic area shows that around half the population is white, 22% are black and 17% Hispanic with about 89% of the population that has graduated from high school and/or gone on to higher education (Social Explorer, 2021). Seven percent of the population is under the poverty level and almost 75 % of the population has private insurance. This clinic services patients that use many different private insurance plans, Medicare, and cash paying patients. The clinic does not accept Tenn Care which is the state of Tennessee's Medicaid program.

Charts for female patients with a diagnosis of uncomplicated UTI were included in the pre-education analysis. Charts were searched for diagnosis codes that reflect uncomplicated UTI diagnosis. The women had to be nonpregnant, without evidence of a sexually transmitted disease and without structural urologic abnormalities. They also could not show signs of more severe disease such as fever and the symptoms of nausea and vomiting. Once inclusion criteria were met, charts were reviewed to record the number of patients that were treated according to CPG.

The internal medicine clinic for this project has one doctor and three full-time board-certified family nurse practitioners. They provide typical primary care services for adult patients, most of whom have multiple medical diagnoses and co-morbidities. The plan was to have in person and email communication with the providers of the clinic. In addition to the providers who see the patients, the lab technicians and office manager will also be utilized for this project. The lab technicians will be able to help the PD understand urine collection and testing techniques and help gather information as needed on urine cultures. They also were able to flag possible patients that meet inclusion criteria for appropriate antibiotic treatment. The office manager was instrumental in helping to schedule meeting times and facilitate the communication process. At this clinic, the clinic manager also is utilized for medical coding. She was able to assist in the chart review by searching charts that met diagnosis criteria.

Project Procedure

The clinic manager at the clinic helped the PD search for diagnosis codes related to UTI over the past 3-month period. This provided the pre-intervention information needed to analyze current practice trends as they relate to antibiotic treatment of UTI. Inclusion criteria included women who fell under the uncomplicated UTI definition set forth by the IDSA. Once those patient charts were reviewed, the PD evaluated how often the clinicians followed the CPG.

After the pre-implementation chart review, the PD began the education portion of the project. This included information related to why antibiotic stewardship is important, the reasons why UTI therapy is considered a high-priority condition and a review of the current practice guidelines related to this diagnosis. A detailed description of pre-intervention findings was presented so that clinicians could see how their practice deviates from the practice standard. At the end of a 2-month period, another chart review was conducted to evaluate if the PCP improved their consistency with CPG.

Measurement Instruments

To measure the outcomes of this project, a percentage of compliance with current clinical practice guidelines was calculated. As reported by the IDSA, some deviation from recommendations are to be expected but a compliance rate of 80-95% is considered a goal compliance rate (Gupta, et. al., 2011). They also give a set of performance measures to guide assessment of appropriate treatment. For uncomplicated UTI in women, the use of recommended antibiotics and the avoidance of fluoroquinolones would be considered appropriate within the clinical practice guidelines (Gupta, et. al., 2011). This QI project aimed to improve the compliance percentage after implementation of CPG and PCP education.

Data Collection Procedures

The pre-intervention portion of this project was a chart review. The medical coder for the internal medicine clinic (and is also the clinic manager) agreed to assist in researching charts with appropriate International Classification of Diseases (ICD) 10 codes that relate to uncomplicated UTI. After the charts were identified, a chart review was conducted by the PD to assess for appropriate inclusion criteria. Charts that meet inclusion criteria were further reviewed to record what antibiotic was given for UTI treatment and for how long. Charts were reviewed to cover a 3-month period. Once the data was gathered, statistical analysis was calculated to determine the number of charts outside the CPG recommendations.

The next phase of the project was an education-based intervention. The PD provided an educational session that discussed the importance of antibiotic stewardship and why UTI therapy is considered to be a high priority condition. A review of the CDC's "Core Elements of Outpatient Antibiotic Stewardship" (Sanchez, et. al., 2016) was also be given. The planned intervention portion of the project included a dissemination of the information gathered in the pre-intervention period. The PD discussed the findings and where improvements could be made so that antibiotic prescribing practice is more in line with the CPG given by the IDSA and as a way to practice antibiotic stewardship in the primary care setting. Gentle reminders were given during periodic clinic visits to help clinicians deciding on appropriate care.

After the education intervention, the PD had check-ins with the PCP at regular intervals. Two months after the education intervention, another chart review took place. At that time, enough patients had been treated for UTI to begin the analysis of data.

Statistical Power Analysis

Using an uncorrected Chi-square test and assuming a significance level of 0.05, an estimated total sample size of 48 participants (24 per group) was needed to detect a 35% increase in antibiotic prescription compliance post intervention with 80% power (See Appendix A: Table 1a). Assuming a significance level of 0.05, an estimated total sample size of 34 participants (17 per group) was needed to detect a 35% increase in duration of time compliance post intervention with 80% power (See Appendix A: Table 1b). Various sample size estimates for individual protocol elements are provided in Tables 1a and 1b. G*Power 3.1.9.7 was used for power analyses (Faul, et al., 2007).

STATISTICAL ANALYSIS

Descriptive Analyses

Descriptive statistics was used to summarize demographic and clinical characteristics of the study cohort using appropriate measures of central tendency and spread for continuous variables and frequency (percentages) for categorical variables. Missing data was not imputed.

Pre-Post Test Analysis

We compared compliance of PCP via chart review (Protocol adherence and Duration of time) pre and post intervention (in-service educational intervention) using a Chi-Square test. The significance level for these comparisons was set at $p \leq 0.05$. All statistical analyses were conducted using JMP Pro 15.

Statistical Power Analysis

G*Power 3.1.9.7 used for power analyses. Using an uncorrected Chi-square test and assuming a significance level of 0.05, an estimated total sample size of 48 participants (24 per group) was needed to detect a 35% increase in *antibiotic prescription* compliance post intervention with 80% power (Table 1a). Assuming a significance level of 0.05, an estimated total sample size of 34 participants (17 per group) was needed to detect a 35% increase in *duration of time* compliance post intervention with 80% power (Table 1b). Various sample size estimates for individual protocol elements are provided in Tables 1a and 1b.

Cohort Summary

On average, participants were 64.3 years with a treatment length of 7.4 days, with 16.3% of participants reporting having had at least one urinary tract infection. CPG were not followed by healthcare providers 69.1% of the time (Table 1). Specifically, antibiotic prescription guidelines were not followed 43.6% of the time (n = 24 participants), with Ciprofloxacin being the most incorrectly prescribed antibiotic (n=10, 41.7%), followed by Cephalexin (n = 6, 25.0%). Duration of time guidelines were not followed 36.3% (n = 20) of the time.

Results

Patient charts were reviewed pre and post the educational intervention to determine the proportion of healthcare providers who followed clinical practice guidelines. The educational intervention was significantly associated with antibiotic prescription guidelines (p = .0040) (See Appendix A: Table) and duration of time guidelines (p = .0305) (See Appendix A: Table 2). A higher percentage of healthcare providers in the post intervention group (75.0%) correctly prescribed antibiotics, in comparison to the proportion of providers in the pre- intervention group (37.0%). A higher percentage of PCP in the pre-intervention group (77.8%) correctly followed duration of time guidelines, in comparison to the proportion of PCP in the post intervention group (50.0%) (See Appendix A: Table 2).

Interpretation/Discussion

This project found that the PCP of the clinic did improve in following CPG for UTI therapy, although the percentage of times CPG were followed is still quite short of the IDSA recommendation of 85-90% (Gupta, et. al., 2011). The correct antibiotic was used more often after the educational intervention, but the time component (number of days of treatment) actually fell below the pre-education intervention findings. The use of the other recommended antibiotics, sulfamethoxazole/ trimethoprim and fosfomycin, did not increase. As in the study by Langner et. al., 2021, fluoroquinolones continued to be greatly overused even though they are not recommended in the clinical practice guidelines published by the IDSA.

The PCP were more likely to prescribe the recommended nitrofurantoin but prescribed the antibiotic for longer than recommended. This is similar to the findings published by Giancola,et. al. (2020) where the greatest fall out to prescribing antibiotics for UTI was also duration of treatment. Extended duration of treatment was also found to be the greatest area of incorrect prescribing in the study published by Chardavoyne & Kasmire (2020). Emphasis on length of treatment, in addition to the type of antibiotic prescribed, may help this group of PCP in the long term change process of correctly prescribing antibiotics for UTI.

This is the first time that this clinic has participated in an antibiotic stewardship program. The CDC recommends these programs so that clinicians can improve antibiotic prescribing practices, implement lasting change and bring awareness to the problem of inappropriate antibiotic prescribing so that patients are protected from the dangers surrounding the misuse of antibiotics (Sanchez, et al., 2016). The information gathered in this project shows that improvement has been made after promotion of CPG, but further improvement is needed. Sustained awareness and promotion of CPG may help these PCP in the care of their patients so that antibiotic prescribing practices continue to improve.

The ideas behind the theory of implementation science may help these clinicians continue to improve and move forward in their antibiotic stewardship journey. Consideration of the findings of this project will bring light to their current practice trends and hopefully assist them in “getting over the hump” of practice change. Antibiotic stewardship awareness has been brought to the forefront in an effort for the clinicians at this facility to implement the recommendations of both the CDC and the IDSA.

Cost-Benefit Analysis/Budget

There was minimal cost associated with this project. Most of the work was done by the PD who worked on the project as a fulfilment of her DNP degree. The PD is paying for tuition privately. The clinic manager agreed to assist with the review of medical codes to flag charts to use in the project but she will do this during her normal work day and will not have any extra cost for the clinic. The cost of her participation will be offset by education for the providers at the clinic and the quality improvement project for the clinic. Lunch and learn sessions were paid for by the PD. All presentation costs and education materials were also paid for by the PD.

Timeline

After the project was granted permission to proceed, the PD provided an in-service to the PCP of the internal medicine office to give details of the project procedures. This included importance of antibiotic stewardship and an overview of CPG related to UTI antibiotic therapy. The PD then conducted a pre-intervention chart review. The chart review covered a 3-month period to get the adequate number of patients who had been treated for UTI. After the initial education intervention was completed, the PD visited the clinic at regular 2-week intervals. These visits served as check ins to again review CPG and gave the providers opportunities to discuss progress and ask questions as needed. 2 months after the intervention, a 2nd chart review was conducted to collect post-education patient data. At this time, enough patients had been treated to compare pre and post intervention findings. The data from the post intervention period was analyzed and compared to the first set of data. Final comparison results were then presented to the PCP to discuss any changes in prescription practices that were found.

Ethical Considerations/Protection of Human Subjects

Approval from The University of Alabama (UA) Institutional Review Board (IRB) was obtained prior to initiating the QI project. The project involved the collection and assessment of existing agency data by the PD in a manner that subjects could not be identified directly. No demographic data such as name, telephone number, address, or medical record number was retained in the database. The data collected for this project was de-identified and restricted to use for analysis and statistical reporting as aggregate data only. No individual data was reported. The nature of the data collected represents a minimal risk of harm if the information were revealed. The degree of potential harm is no greater than those ordinarily encountered in routine health care. Human subjects will be further protected by the Health Insurance Portability and Accountability Act (HIPAA). There was no manipulation of variables; Minimal risk to subjects exists.

All education interventions were based on the CDC's recommendation of antibiotic stewardship in the outpatient setting. The PD also completed the CDC's CEU training course on antibiotic stewardship which will help ensure that the most up to date and accurate information was presented to the PCP during the intervention.

Conclusion

Antibiotic stewardship programs are encouraged and recognized by the CDC and IDSA as a means to ensure responsible practice by PCP. Treatment for uncomplicated UTI often does not follow recommended, evidence-based CPG and is considered a high priority area for improvement by the CDC. Through chart review, statistical analysis of collected data and PCP educational intervention, this project used the four main elements of antibiotic stewardship to promote antibiotic stewardship through implementation of EBP clinical practice guidelines at an internal medicine clinic with the goal of improving treatment regimens related to UTI therapy.

Although the educational intervention was shown to statistically improve adherence to CPG, the PCP at this internal medicine clinic are still far below the recommended adherence rate of 90%. This is an example of why the theory of implementation science is needed to help providers accept proven treatment guidelines. Education and encouragement of CPG does not always stimulate practice change. Further intervention and education may be needed as well as a deeper-dive into the reasons behind the hesitancy to follow CPG.

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Appendix A

Table 1a. Sample size estimations for protocol compliance (appropriate antibiotic prescription)

% Increase in Compliance	Baseline Proportion	Post Intervention Proportion	Sample size per group	Power
20	0.5	0.70	74	80%
25	0.5	0.75	46	80%
30	0.5	0.80	31	80%
30	0.4	0.70	33	80%
35	0.4	0.75	24	80%

Table 1b. Sample size estimations for protocol compliance (duration of time)

% Increase in Compliance	Baseline Proportion	Post Intervention Proportion	Sample size per group	Power
20	0.60	0.80	64	80%
25	0.60	0.85	39	80%
30	0.60	0.90	25	80%
35	0.60	0.95	17	80%

Table 1c. Summary statistics of study participants

Characteristics	Total (N = 55)	Pre (N = 27)	Post (N = 28)
Age, years, Mean (SD)	64.3 (18.4)	61.1 (19.2)	67.3 (17.4)
Treatment Length, days, Mean (SD)	7.4 (2.3)	6.8 (2.2)	8.0 (2.2)
# Urinary Tract Infections, N (%)			
None	46 (83.6)	21 (77.8)	25 (89.3)
At least 1	9 (16.3)	6 (22.2)	3 (10.7)
Guidelines Followed, N (%)			
Yes	17 (30.9)	7 (25.9)	10 (35.7)
No	38 (69.1)	20 (74.1)	18 (64.3)

Table 2. Adherence to clinical protocol guidelines by intervention

	Intervention		
Guidelines, N (%)	**Pre N = 27**	**Post N = 28**	**p-value**[1]
Antibiotic Prescription			**.0040**
Yes	10 (37.0)	21 (75.0)	
No	17 (63.0)	7 (25.0)	
Duration of Time			**.0305**
Yes	21 (77.8)	14 (50.0)	
No	6 (22.2)	14 (50.0)	

[1]Likelihood Ratio Chi-square test. Bold = statistically significant at the 5% level.