Change In Culture: Addition of a Clinical Pharmacist to the Emergency Department Antimicrobial Culture Review Process

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Abstract

Objective: To evaluate the effectiveness of a unit based pharmacist in assisting with antimicrobial selection of female patients discharged from the emergency department with a diagnosis of an uncomplicated urinary tract infection.

Setting: Academic-affiliated emergency department in Pittsburgh, Pennsylvania.

Methods: A retrospective chart review was conducted among 870 female patients who were discharged from the emergency department with a positive urine culture requiring antimicrobial therapy revision. The primary investigator abstracted specific medical record information to determine if a pharmacist-driven culture review resulted in a higher percentage of appropriate antimicrobial selection when compared to the standard nurse/physician driven-culture review. The revised antimicrobial therapy treatment plan was deemed appropriate or not based on the "International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Disease Society of American and the European Society for Microbiology and Infectious Disease".

Results: A Chi-Square Test of Independence was conducted to evaluate the relationship between two categorical variables: (1) type of provider (physician/pharmacists) and (2) adherence to clinical practice guidelines (yes/no). The test emerged significant, $C^2 = 17.4$, $df = 2$, $p < 0.01$. Thus, a significant relationship between type of provider and appropriate treatment was found. Specifically, 52.2% of physicians used the appropriate treatment whereas 84.4% of pharmacists used the appropriate treatment.

Introduction

Problem Description

Acute uncomplicated cystitis, more commonly referred to as a urinary tract infection (UTI) is one of the most commonly diagnosed and subsequently treated conditions in the emergency department (ED). Treatment for UTIs rely on antimicrobial therapy which helps make antimicrobials the second most common therapeutic drug class prescribed during ED visits with a reported use in 15.7% of ED patients (Acquisto & Baker, 2011). When not treated properly, UTIs can progress to other serious health concerns such as pyelonephritis and urosepsis. The biggest barrier to effective antimicrobial selection is the lack of knowledge of the causative organism at the time of diagnosis. Final culture reports take several days and, because of this delay, providers in the ED setting are forced to use an empiric approach when choosing an antimicrobial.

Additional obstacles in choosing the most accurate antimicrobial include: patient age, impaired renal and/or liver functions, and lack of a properly reconciled medication history. As outlined by the "Executive Order and National Strategy to Combat Antibiotic Resistant Bacteria", antimicrobial resistance poses a growing public health threat (Percival, Valenti, Schmittling, Strader, Lopez, & Bergman, 2015). Healthcare providers must monitor and maintain competency on updated clinical practice guidelines and local resistance rates to prevent the spread of antimicrobial resistance.

The American Society of Healthcare System Pharmacist has called on hospital pharmacy departments to provide a host of clinical services to the emergency department, including participation in the development of systems that promote safe and effective medication use (Randolph, Parker, Meyer, & Zeina, 2011). Many institutions have initiated an interdisciplinary approach to include a pharmacist in the review of culture results as a way to improve antimicrobial selection, but little data exist of the effectiveness of this approach.

Urinary culture review should be a daily priority but with emergency medicine providers working in a stressful environment with high patient volumes and frequent interruptions, culture review can become a difficult task to complete. Following up on culture results and empiric antimicrobial selection for patients can be daunting and

time consuming for emergency medicine providers. Each culture must be thoroughly reviewed with careful consideration being made in the selection of the antimicrobial agent based on the ever-changing guidelines. Despite well documented and publically available clinical practice guidelines on the treatment of women with uncomplicated UTI, studies demonstrate a wide variation in prescribing practices.

Available Knowledge

Urinary tract infections remain one of the most common bacterial infections in women, with an estimated one half of all women reporting at least one UTI in their lifetime (Colgan & Williams, 2011). Classic lower urinary symptoms of dysuria, urinary frequency, urinary urgency and suprapubic pain can lead to an expected six days of discomfort. These classic symptoms account for approximately seven million office visits per year with an estimated heath care associated cost of $1.6 billion (Colgan & Williams, 2011).

The microbial spectrum of the causative organisms of UTI is well known with *Escherichia coli* being the most prevalent of the uropthogens. *Escherichia coli* accounts for 86-95% of UTIs where as other infectious organisms including *Proteus mirabilis*, *Klebsiella pneumonia*, *Citrobacter* species and *Enterococcus* species have documented infection rates ranging from 0.5 to 4.0% (Colgan & Williams, 2011).

Regardless of the most commonly known pathogens and their effective treatment, antimicrobial resistance among uropthogens has increased and the ecological adverse effects, more commonly referred to as collateral damage has been on the rise (Gupta, Hooton, Naber, Wullt, Colgan, Miller, Moran, Nicolle, Raz, Schaeffer, & Soper, 2011). Gupta et al. (2011) reports the use of broad spectrum cephalosporins has been linked with vancomycin resistant enterococci and extended spectrum beta lactamase producing *Klebsiella pneumonia*. Likewise, fluoroquinolone usage has been linked to infection with methicillin resistant *S. aureus*.

Rationale

To help providers understand and adhere to updated antimicrobial guidelines, The American Society of Health System Pharmacist has advocated for clinical pharmacist services, including an active participation in emergency departments. (Randolph, Parker, Meyer, & Zeina, 2011). This call to action was based on statistics

indicating a need for more pharmacist involvement in efforts to improve quality of care. Acquisto and Baker (2011), found that emergency medicine clinical pharmacist (EPh) are ideal candidates for this role given their ability to maintain task as a high priority, their knowledge of microbiology and empiric antimicrobial regimens. Incorporating a clinical pharmacist is recommended by the Infectious Disease Society of America and the Society for Healthcare Epidemiology of America (Acquisto & Baker, 2011). Randolph, Parker, Meyer, and Zeina (2011), convey research showing medication related problems are a significant cause of medical errors resulting in injury or death, and that adverse drug events occur frequently in the ED setting. With significant room for improvement on patient safety and quality of care, it is imperative that ED pharmacist continue to pursue patient focused clinical interventions (Randolph, Parker, Meyer, & Zeina, 2011). Jacknin, Nakamura, Smally, and Ratzan (2013) found that by providing real time monitoring and discussions of medication prescribing, ED clinical pharmacist have the potential to reduce medication errors. This same study demonstrated that when the ED clinical pharmacist was present, a 13 fold decrease in medication errors occurred.

The involvement of an ED pharmacist in the selection of antimicrobial therapy has allowed pharmacist to become more involved in direct patient care and has helped raise the standard of care for patients requiring antimicrobial therapy (Randolph, Parker, Meyer, & Zeina, 2011). By sharing the responsibility of the culture review process, a significant workload would be shifted from the emergency department provider to the pharmacist. On average, a thorough review of a single culture report takes 15 minutes; if the ED pharmacist reviews 200 cultures per month, it would effectively reduce the ED physician monthly workload by 50 hours. (Randolph, Parker, Meyer, & Zeina, 2011).

A retrospective observational study by Miller, McGraw, Tomsey, Hegde, Shang, O'Neill, and Venkat (2014) concluded that the addition of a pharmacist to post-visit review of discharged adult ED patients reduced the prevalence of revised antimicrobial regimen inappropriateness. With a P value of < 0.001, the research suggests pharmacist-reviewed cultures have lower readmission rates for treatment failure, non-compliance and allergy to medication when compared to their physician counterparts (Randolph, Parker, Meyer, & Zeina, 2011). Clinical

pharmacist can make antibiotic treatment recommendations that are safe and cost effective after assessing history, renal and hepatic function, and allergies (Jacknin, Nakamura, Smally, & Ratzan, 2013).

Acquisto and Baker (2011) discovered several institutions that have implemented a pharmacist managed antimicrobial stewardship program in the ED with a focus on culture follow up, but limited data is available on the impact of these programs. Dumkow, Kenney, MacDonald, Carreno, Malhotra and Davis (2014) recognized the prominent role in antimicrobial stewardship programs but report optimal targets for intervention in the setting have not been established.

Specific Aims

The purpose of this study was to evaluate the effectiveness of a unit based pharmacist in assisting with antimicrobial selection of female patients discharged from the emergency department with a diagnosis of an uncomplicated UTI.

The primary aim of this study is to evaluate the quality improvement project initiated in January of 2014 in which a clinical pharmacist was added to the post discharge culture review process.

Methods

Intervention

The intervention of a clinical pharmacist to the post discharge culture review process has been in place at a community hospital just outside the Pittsburgh area since January 2014. This healthcare improvement project occurs Monday through Friday, as the unit-based pharmacist is scheduled during the weekdays from 1100 to 1900. Culture review is the first task the pharmacist completes, as these cultures print at 0800 every day. The clinical pharmacist reviews the sensitivity report while accessing the patients' medical record. The pharmacist will review patient gender, allergies, age, home medications and kidney and/or liver functions if available. The clinical pharmacist compares what the patient was prescribed empirically at discharge with the sensitivity report. Using multiple electronic resources such as Micromedex database, the clinical pharmacist will confirm an appropriate selection has been made, or suggest an alternative antimicrobial agent. If an alternative agent has

been suggested, the pharmacist will consult one of the ED physicians working that day to suggest a change in pharmacologic therapy. If the physician approves, the pharmacist will then call the patient to alert them to this change. Once any and/or all questions have been answered by the pharmacist, the new prescription is called into the pharmacy of the patient's choice.

The intervention described above was compared to the previous standard of care which is still in effect on the weekends (Saturday and Sunday) when the unit based pharmacist in not present. During this practice, the emergency department triage nurse reviews the daily culture reports for organism sensitivity. The nurse then accesses the electronic medical record to check for two things; first, that the patient was prescribed an antimicrobial and second, that the antimicrobial prescribed is sensitive to the pathogen identified in the report. If the patient was not started on antimicrobial therapy or an inappropriate antimicrobial, the nurse will write down the patient's current therapy and allergies directly on the culture report. The nurse will then consult with the physician working that day to initiate or change the medication. The chosen medication is based on physician preference, knowledge, and comfort.

Once a change to the treatment plan is made, the reviewing nurse or reviewing pharmacist will contact the patient by phone, document the conversation and change to treatment in an electronic follow up form that becomes part of the patient's medical record. If the patient is unable to be contacted via phone, the reviewing nurse or reviewing pharmacist will send a pre-written generic follow- up letter to the home address listed in the chart.

Study of the Interventions

Prior to the start of this study, a structured data collection sheet was designed using IBM SPSS V.24 and Microsoft Excel. The Excel spreadsheet contained qualitative data that was then assigned a numeric digit. These numeric digits were then used to anonymously record the data being collected within SPSS. The data sheet contained information such as the reviewer of the culture (physician versus pharmacist), patient attributes, such as gender and age as well as the causative organism.

After the daily culture review, the reviewing nurses and the reviewing pharmacist placed the culture reports in a large three ring binder. This binder was stored in a secured cabinet within the nurses' station. Each week, the binder was emptied by the primary investigator. Using the Excel spread sheet as a systematic guide, the data collected was converted into a numeric code and documented within SPSS. Once the culture was reviewed, it was destroyed in accordance with institutional policy.

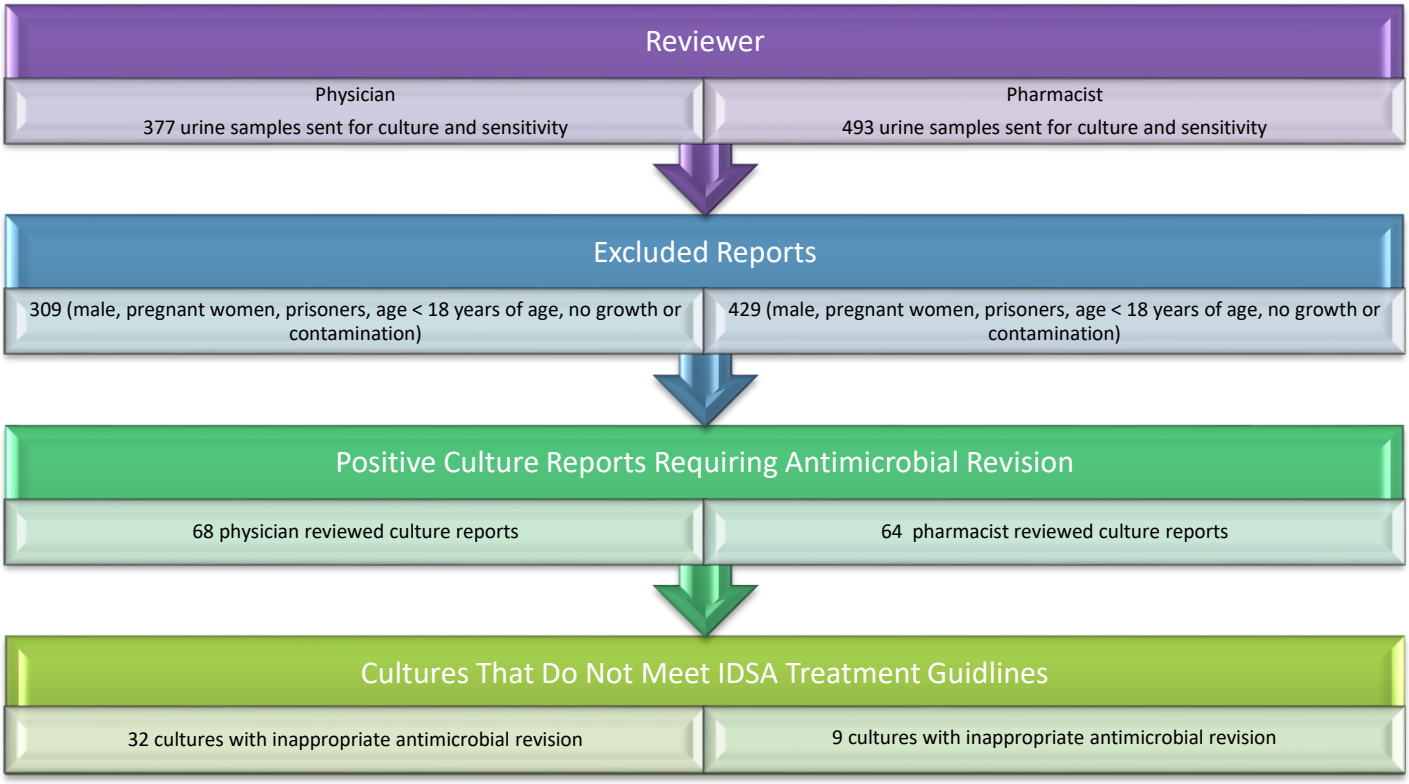
Measures

A retrospective chart review was performed on any urinary culture report of discharged adult visits (≥18 year of age), excluding men, pregnant women, prisoners, those with a diagnosis of pyelonephritis and those who had died. Charts reviewed were of those who were seen in the emergency department from May 2016 through October 2016. Culture results were deemed contaminants based on the protocol of the institutions laboratory. Cultures deemed contaminated or those with no organism growth were not subject to prescription revision.

It was hypothesized that the addition of unit based pharmacist would decrease the number of inappropriate antimicrobial revisions. Revisions to antimicrobial therapy were deemed potentially inappropriate based on the International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis published by the Infectious Disease Society of America and the European Society for Microbiology.

The institutional review board at this particular hospital as well as the university approved this study.

Analysis



Results

The primary investigator used SPSS version 24.0 to a Chi-Square Test of Independence was conducted to evaluate the relationship between two categorical variables: (1) type of provider (physician/pharmacists) and (2) adherence to clinical practice guidelines (yes/no). The test emerged significant, $C^2 = 17.4$, $df = 2$, $p < 0.01$. Thus, a significant relationship between type of provider and appropriate treatment was found. Specifically, 52.2% of physicians used the appropriate treatment, whereas 84.4% of pharmacists used the appropriate treatment.

Discussion

Summary and Interpretation

This study begins to provide quantification of the positive impact a unit-based pharmacist has in assisting with the selection of antimicrobials for patients discharged from the emergency department. Data collected suggest

that a pharmacist-driven culture review process is significantly more effective than a nurse/physician-driven culture review process.

The most common reason the antimicrobial treatment plan was deemed inappropriate was because the duration of therapy that was too long. Of the revised nurse/physician reviewed culture reports, 71.8% (n = 23) were placed on a treatment plan that was too long in comparison to the pharmacist reviewed reports at 14.0% (n=9). With the increased prevalence of antimicrobial resistance on the rise, it is imperative that antimicrobials be prescribed judiciously.

Physician and nursing staff buy in helped contribute to the success of this study.

Limitations

This study was limited by the grossly underestimated amount of contaminated urine cultures which accounted for 61.1% (n= 424) of all urine cultures reviewed and subsequently deemed not applicable to this study. An additional 17.2% (n = 150) of the total cultures were from male patients and could not be used based on the clinical guidelines published by the Infectious Disease Society of America. In total, researchers identified 15 unique uropthogens within the sample of charts reviewed and because of this, treating uncomplicated cystitis based solely on one set of clinical guidelines may be proven to be inappropriate.

Data collected from this single center study was not designed to determine whether or not pharmacist-reviewed cultures would decrease the likelihood of a repeat visit secondary to failed antimicrobial therapy nor was this study designed to evaluate whether or not a pharmacist can improve patient and safety outcomes.

During the data collection period, there was one unit based pharmacist involved in the culture review process and thus the study should be replicated within multiple facilities and with a larger sample to ensure generalizability.

Conclusions

The results of this research indicate that the inclusion of a unit based pharmacist significantly reduces the amount of inappropriately revised antimicrobial treatment plans. The pattern of significance in the improvement of accurate antimicrobial selection when a unit based pharmacist is involved with the treatment plan suggests that these clinical professionals should be added to the interdisciplinary team of emergency medicine providers. As a result of this study, the unit based pharmacist will continue to review urine cultures Monday through Friday.

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