Pharmacist-led antimicrobial stewardship program in an urgent care setting

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Purpose. While many programs have demonstrated pharmacist-led antimicrobial stewardship successes in inpatient and emergency department (ED) settings, there is a paucity of literature exploring these initiatives in urgent care (UC) sites. This study aimed to determine the impact of implementing a pharmacist-led antimicrobial stewardship program (ASP) in the UC setting.

Methods. A retrospective quasi-experimental study was conducted evaluating UC patients with positive urine or wound cultures following discharge. A collaborative practice agreement was implemented in 2015 allowing for pharmacist-led UC culture follow-up via a stewardship-focused protocol. The primary outcome of this study was to compare guideline-concordant antibiotic prescribing between the pre-ASP and post-ASP groups. Secondary outcomes included comparing the number of patients who required follow-up, time to follow-up, UC or ED revisits within 72 hours, and hospital admission within 30 days between groups.

Results. A total of 300 patients were included in the study (pre-ASP, $n = 150$; post-ASP, $n = 150$). Total guideline-concordant prescribing for all diagnoses was significantly improved in the post-ASP group (pre-ASP, 41.3% versus post-ASP 53.3%, $p = 0.037$). Additionally, guideline-concordant antibiotic selection improved in the post-ASP group (pre-ASP, 51% versus post-ASP, 68%, $p = 0.01$). Follow-up was required for 27 (18%) patients in the pre-ASP group compared with 16 (10.7%) in the post-ASP group ($p = 0.07$). Median time to follow-up call was longer in the post-ASP group (38 versus 71 hours, $p < 0.001$). There were no differences in UC and ED revisits within 72 hours ($p = 1.0$) or hospital admissions within 30 days ($p = 0.723$).

Conclusion. A pharmacist-led urgent care ASP was associated with significantly improved guideline-concordant antimicrobial prescribing.

Keywords: antimicrobial stewardship, guideline adherence, pharmacist, urgent care, urinary tract infection, wound infection

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Inappropriate antimicrobial prescribing is a major contributor to antimicrobial resistance, which has been recognized as one of the most serious threats to public health. Each year, more than two million people in the United States become infected with drug-resistant microorganisms, and many of these infections cannot be treated with first-line antimicrobial therapy.[1] By the year 2050, deaths attributable to antimicrobial resistance are expected to reach 10 million patients annually, world-wide. This alarming rate exceeds the annual number of deaths caused by cancer (8.2 million) and is almost ten times that of motor vehicle accidents (1.2 million).[2] In the United States, in addition to significant mortality, antimicrobial resistance adds $20 billion in excess direct health care costs and up to $35 billion in annual societal costs as a result of lost productivity.[1]

To combat the growing threat of antimicrobial resistance, antimicrobial stewardship programs (ASPs) in acute care hospitals have been mandated by the Joint Commission.[3] Additionally, the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America have published guidelines for developing ASPs in acute care hospitals, which include recommendations for core and supplemental program strategies as well as optimal program leadership.[4] Numerous studies have demonstrated that the implementation of an ASP in the inpatient setting leads to a reduction in the use of inappropriate antimicrobials.[5-8] As a direct result, hospital lengths of stay, prevalence of resistant pathogens, and total costs of care also decrease.[6-10]

While the impact of ASPs in inpatient settings has been repeatedly demonstrated, there is a paucity of literature examining ASP interventions in ambulatory care settings. Antibiotic prescribing in outpatient settings exceeds that of inpatient prescribing, with more than 150 million antibiotic prescriptions annually; of these prescriptions, more than 30% are either unnecessary or inappropriately prescribed.[11-13] The Centers for Disease Control and Prevention (CDC) has recently published their Core Elements of Outpatient Antibiotic Stewardship which include evidence-based antimicrobial stewardship best practices.[14] Urgent care centers are an important target for outpatient antimicrobial stewardship initiatives as they are a high-volume ambulatory setting allowing for patients to achieve expedited care. According to the Urgent Care Association of America, in 2016 nearly 85 million visits were reported at urgent care facilities, with 96% reporting an increase in patient volumes compared with previous years.[15,16] With the large annual volume of patients treated and associated antibiotic prescribing, there is a need to expand the reach of ASPs to urgent care sites. The purpose of this study was to evaluate the impact of a pharmacist-led ASP in the urgent care setting.

KEY POINTS

- The impact of a pharmacist-led urgent care stewardship program that included education, distribution of antibiograms and guidelines, and culture follow-up was evaluated via a quasi-experimental study design.
- The pharmacist-led urgent care antimicrobial stewardship program significantly improved guideline-concordant antimicrobial prescribing for urinary tract and wound infections.
- There was no difference in urgent care or emergency department revisit within 72 hours or hospital admission within 30 days between groups.

Methods

Study site. This study was conducted at two free-standing urgent care sites affiliated with Mercy Health Saint Mary's hospital in Grand Rapids, MI. Both centers offer comprehensive care for adults and children 12 hours per day, 7 days a week. Each facility is staffed by physicians and midlevel practitioners who, combined, treat more than 32,000 patients each year.

The inpatient ASP at Mercy Health Saint Mary's was initiated in July 2013 and is led by 1.0 full-time equivalent (FTE) Infectious Diseases (ID) pharmacist and supported by 0.1 FTE ID physician. An initial focus of the ASP was to target stewardship interventions in the hospital's emergency department (ED) through engagement of 2.0 FTE emergency medicine pharmacists and ED physician leadership. In March 2014, the health system's Pharmacy and Therapeutics Committee approved a collaborative practice agreement (CPA) that allowed for pharmacist-led culture follow-up for patients discharged to home from the ED. The CPA has treatment protocols that follow local susceptibility patterns along with national guidelines and was developed by ED and ID pharmacists in conjunction with ED and ID physician support. The ED and ID pharmacy staff review a printed report of all preliminary and finalized microbiology results, Monday through Friday. This report includes culture results (urine, wound, respiratory, stool, blood) and serologies (HIV, hepatitis B, hepatitis C, herpes virus); an additional electronic report is emailed to the ED and ID pharmacists daily that includes all patients tested for sexually transmitted infections (gonorrhea, chlamydia, syphilis). Only positive cultures and serologies are reviewed for intervention (e.g., susceptibility mismatch, drug-drug interaction, renal function adjustment, de-escalation opportunities, and notification of results with follow-up counseling). Pharmacists independently review microbiology results and contact patients for follow-up assessment and intervention if needed; this includes prescribing antibiotic therapy per CPA protocol based on provider diagnosis documented in the electronic medical record.

In April 2015 the CPA was expanded, with support from urgent care physician leadership, to include pharmacist-led culture follow-up for discharged patients at both urgent care facilities. The ID and ED pharmacists conduct urgent care follow-up activities from the main hospital; the urgent care centers do not have on-site pharmacist coverage. Additionally, the urgent care CPA allows postgraduate year 1 (PGY1) pharmacy residents and fourth year Pharm.D. students to conduct follow-up under the supervision of a preceptor. Urgent care culture follow-up is one of the PGY1 residency program's longitudinal learning experiences and provides additional antimicrobial stewardship and transitions-of-care education for trainees. Along with initiating the pharmacist-led culture follow-up program, education was provided by the ID and ED pharmacy team to the urgent care provider staff, including orientation to the hospital's outpatient antibiograms and outpatient empiric therapy guidelines. A descriptive pilot study conducted at our site of all 2016 data demonstrated that during the 1-year period 1,461 positive urgent care culture results were reviewed by clinical pharmacists for antimicrobial appropriateness.[17] Of these, 320 (22%) required pharmacist intervention in the form of a follow-up telephone call. Furthermore, 106 (33%) required a new antibiotic prescription at follow-up. The most common cultures requiring audit and follow-up included urine and wound cultures. The pharmacists' workload for the urgent care culture follow-up program includes an average of 12 positive cultures audited per day with a median of 15 minutes per patient required to conduct follow-up audit, intervention, and documentation.

Study design. This retrospective, quasi-experimental study was approved by the institutional review board (IRB). Two time periods were designated for comparison, the pre-ASP phase (all of 2014) and the post-ASP phase (all of 2016). Patients were eligible for inclusion if they presented to either the Mercy Health East Beltline or Rockford urgent care facilities, were discharged to home following their visit, and had a positive urine or wound culture reported during either study period. Patients were excluded who required inpatient admission following an urgent care visit, left against medical advice prior to being seen by a provider, or were diagnosed with epididymitis. Following IRB approval, a patient list was obtained from the electronic medical record of all patients discharged from urgent care with a positive urine or wound culture during the study time periods. Patients were selected from the data pull using a random number generator which assigned de-identified patient identification numbers to the corresponding facility identification number. Patients were screened for inclusion and exclusion eligibility and collected until the desired sample size was met in each group.

Endpoints. The primary objective of the study was to compare total guideline-concordant antibiotic prescribing (defined as the combination of appropriate agent, dosage, and duration of therapy prescribed empirically and at follow-up) between the pre-ASP and the post-ASP period. Secondary objectives compared between study periods included the number of patients who required a follow-up call, time to follow-up contact, urgent care or ED revisit within 72 hours, and hospital admission within 30 days.

Statistical analysis. To detect a 10% absolute difference in the primary endpoint of total guideline-concordant antibiotic prescribing, using a two-sided test with $\alpha = 0.05$ and $\beta = 0.2$ (80% power), we estimated that approximately 150 patients per period would need to be enrolled in the study (300 patients total). Therefore, 150 randomized patients meeting inclusion criteria were collected for analysis for each of the two study periods. The culture breakdown of two-thirds urine and one-third wound was intentionally planned to simulate the typical ratio of urine versus wound cultures reviewed in the routine pharmacist workload for culture follow-up.

All statistical analyses were performed using SPSS software, version 22 (IBM, Corporation, Armonk, NY). Descriptive statistics were used to present demographic and urgent care visit information. Categorical variables are presented as numbers and percentages. A chi-square test was performed to compare the primary endpoint of total guideline-concordant antibiotic prescribing between the pre- and post-ASP periods. Subgroup analyses of the primary endpoint were conducted of patients with both urine and wound cultures. Secondary endpoints collected as categorical data were analyzed using the chi-square test. The Mann-Whitney U test was performed to compare nonparametric interval data, including time to appropriate follow-up between the pre- and post-ASP periods.

Results

Baseline characteristics. A total of 300 patients were included in the study, 150 for the pre-ASP period and 150 for the post-ASP period. Patient characteristics were similar at baseline; however, more patients were treated by a physician provider in the pre-ASP than the post-ASP period (Table 1). The majority of patients during each period were female, had medical insurance, and reported no allergies to medications. Table 1 also lists the breakdown of culture types and diagnoses between groups. The study included 200 patients with urine cultures, 100 from each study period; 100 patients with wound cultures were also included, 50 in each study period. Diagnoses were similar between groups, with the largest number of patients presenting with acute cystitis and an equal number of patients presenting with cellulitis and abscess in each period.

Impact on prescribing of pharmacist-led ASP. Total guideline-concordant antimicrobial prescribing for all patients including all diagnoses was significantly improved during the post-ASP period compared with the pre-ASP period (53.3% and 41.3%, respectively; $p = 0.037$). In the subgroup of patients with urine cultures a significant improvement in total guideline-concordant antimicrobial prescribing was also demonstrated during the post-ASP period compared with the pre-ASP period (58% and 43%, respectively; $p = 0.034$). In the subgroup of patients with wound cultures, the difference between total guideline-concordant antimicrobial prescribing was not significant (38% and 44% for pre- and post-ASP periods, respectively; $p = 0.542$).

Of the 300 patients, 231 (77%) were prescribed antibiotics, 120 during the pre-ASP period (71 for positive urine cultures and 49 for positive wound cultures), and 111 during the post-ASP period (63 for positive urine cultures and 48 for positive wound cultures). Among patients who received antibiotics, the frequency of total guideline-concordant antibiotic prescribing did not differ significantly between the post- and pre-ASP periods (37% and 27%, respectively; $p = 0.093$). The frequency of guideline-concordant antibiotic selection was significantly higher during the post-ASP period than the pre-ASP period (68% and 51%, respectively; $p = 0.01$), but there was no significant difference in the frequency of guideline-concordant dosage (74% and 70% for post- and pre-ASP periods, respectively; $p = 0.287$) or duration of therapy (65% and 61% for

Table 1. Patient and Provider Characteristics and Diagnoses[a]

Variable	Pre-ASP Period (*n* = 150)	Post-ASP Period (*n* = 150)	*P*
Patient characteristics			
Mean ± S.D. age (yr)	35.3 ± 19.6	37.7 ± 21.1	0.299
No. (%) male	43 (28.7)	42 (28.0)	0.898
No. (%) without insurance	6 (4.0)	9 (6.0)	0.074
No (%) without medication allergy	104 (69.3)	100 (66.7)	0.621
Provider characteristics, no. (%)			< 0.001
Physician provider	147 (98.0)	86 (57.3)	
Midlevel provider	3 (2.0)	64 (42.7)	
Diagnosis for urine cultures, no. (%) (*n* = 100 in each group):			0.163
Acute cystitis	57 (57.0)	57 (57.0)	
Complicated UTI or pyelonephritis	14 (14.0)	6 (6.0)	
Noninfectious or asymptomatic bacteriuria	29 (29.0)	37 (37.0)	
Diagnosis for wound cultures, no. (%), (*n* = 50 in each group)			1.0
Cellulitis	23 (46.0)	23 (46.0)	
Abscess	27 (54.0)	27 (54.0)	

[a]ASP = antibiotic stewardship program; UTI = urinary tract infection.

post- and pre-ASP periods, respectively; $p = 0.283$).

Follow-up interventions and patient outcomes. Based on the CPA criteria for follow-up, 27 patients during the pre-ASP period (18%) and 16 patients during the post-ASP period (11%) required a follow-up telephone call after urgent care discharge ($p = 0.07$). The reason for follow-up telephone call attempts appear in Table 2. The majority of patients were able to be contacted with one call (79% and 69% during pre- and post-ASP periods, respectively). One and 5 patients during the pre- and post-ASP periods, respectively, were lost to follow-up after 3 contact attempts. New prescriptions were given to 13 (68%) of the 19 patients and 3 (23%) of the 13 patients who received follow-up during the pre-ASP and post-ASP periods, respectively ($p = 0.029$). All of the pre-ASP follow-up interventions required physician consultation, whereas only 1 physician consultation was required during the post-ASP period. The case that fell outside of the scope of the CPA was a pediatric patient who required ciprofloxacin. The mean time from discharge home to first patient contact (for provision of appropriate antimicrobial treatment) was 38 hours (range, 10-87 hours) during the pre-ASP period and 71 hours (range, 48.5-120 hours) during the post-ASP period ($p < 0.001$). There were no differences between study periods in patient-centered outcomes, including frequency of urgent care or ED revisit within 72 hours (3.3% and 2.7% in pre- and post-ASP periods, respectively; $p = 1.0$) and hospital admission within 30 days (3.3% and 2% in pre- and post-ASP periods, respectively; $p = 0.723$).

Discussion

Our study found that the implementation of a pharmacist-led urgent care ASP, including culture follow-up, resulted in improved total guideline-concordant antimicrobial prescribing for patients with wound and urinary tract infections. With the high volume of antibiotic prescribing in the outpatient setting, urgent care sites are an important target for ASP intervention. Previous studies focusing on ASP initiatives in urgent cares have focused on pediatric populations. A study conducted by Saha and colleagues[18] examined a nurse-driven culture follow-up program in a pediatric urgent care network. Antibiotic discontinuation rates were compared between the previous standard of care and an implemented protocol created by a multidisciplinary taskforce. The authors concluded that antimicrobial discontinuation rates increased from 4% to 84% within 48 hours of urgent care visits after the implementation of the urine culture follow-up protocol. In addition, the investigators reported that 3,429 antibiotic days were avoided due to early antibiotic discontinuation. Weddle and colleagues[19] conducted a pre–post intervention study at four urgent care centers affiliated with a free-standing children's hospital. The institution's ASP team provided 30-minute educational sessions to nurse practitioners. A 2% absolute reduction in inappropriate antibiotic prescribing was observed in the post-education cohort ($p = 0.02$). Additionally, our institution has evaluated the impact of a stewardship-focused culture follow-up program and its impact on the treatment of pharyngitis in the ED and urgent care settings.[20] Significantly fewer patients diagnosed with pharyngitis were prescribed antibiotics at follow-up call in the post-stewardship group compared with the pre-stewardship group (71% and 97%, respectively; $p < 0.001$). To date, these are the only published studies examining the impact of ASP implementation in the urgent care setting.

While resources to conduct ASP interventions in the outpatient setting are typically scarce, the extension of our

Table 2. Reasons for Follow-Up

Reason	No. (%) Patients With Reason for Follow-Up[a] Pre-ASP Period (n = 19)	*Post-ASP Period* (n = 13)
Susceptibility mismatch	12 (63)	8 (62)
No antibiotic at discharge	3 (16)	1 (8)
Multiple antibiotics at discharge	1 (5)	4 (31)
Other	3 (16)	0

[a]p = 0.129 for difference in distribution of reasons between study periods; ASP = antimicrobial stewardship program.

Eight patients in the pre-ASP group and three patients in the post-ASP group are not accounted in the table due to incomplete documentation of follow-up.

stewardship program to the urgent care setting was made possible by leveraging the current ID and ED pharmacy resources within our health system as well as incorporating our pharmacy residents and student trainees. The urgent care program was designed following our current ED ASP model, and our findings are similar to previously studied ED programs that found favorable outcomes following the implementation of pharmacist-led ED ASP initiatives. Davis and colleagues[21] concluded that the implementation of a pharmacist-driven culture follow-up program in the ED led to a 30% increase in interventions for inappropriate antimicrobial prescriptions compared with the previous nursing management review of positive cultures. Additionally, in a study published by Dumkow and colleagues,[22] guideline-concordant empiric antibiotic prescribing improved with the implementation of a pharmacist-led culture follow-up program compared with the previous standard of care (73% and 63.1%, respectively; $p = 0.081$).

Additional benefits of ED culture follow-up initiatives have included improved time to patient follow-up and a significant reduction in ED revisits within 96 hours and hospital admission within 30 days.[21-24] In our study we observed a significantly longer time from discharge home to first patient contact during the post-ASP period. This was an unexpected finding, as previous ED culture follow up studies have shown a decrease in time to culture review and ED readmission with pharmacist audit.[21-24] We hypothesize that the main reason for this difference is that our current urgent care stewardship program does not have 24/7 pharmacist coverage and microbiology reports do not currently print on the weekends. During the pre-ASP period, the paper report from the Microbiology Laboratory also printed only on weekdays, but the urgent care providers would receive inbox notification of culture results in real-time. Despite the increase in time to first contact, there was no difference observed between study periods in the number of urgent care or ED revisits within 72 hours or hospital admissions within 30 days, which were low during both study periods. As a standard of practice, patients being discharged are instructed by urgent care staff to return for reevaluation if needed. While the extended time to follow-up was an unexpected finding, it did not appear to result in more patients needing to return for reevaluation because their culture results were not addressed quickly enough. Potential solutions for our pharmacy team to decrease the time to follow-up include receiving the culture reports on weekends and incorporating urgent care weekend coverage into the PGY1 residency program's longitudinal requirements.

Our findings highlight the importance of pharmacists as leaders in antimicrobial stewardship activities. In the ED setting, clinical pharmacists have been recognized by several disciplines for their important role in patient care including the promotion of judicious antimicrobial prescribing.[25,26] In July 2017, the Society of Infectious Diseases Pharmacists published a position statement regarding ED clinical pharmacists' participation in ASPs.[26] The organization highly supports the involvement of ED clinical pharmacists in activities such as culture follow-up, creation of guidelines and clinical pathways, and assistance in empiric therapy selection. Furthermore, the most successful stewardship programs are those that promote collaboration among pharmacists and key stakeholders.[27,28] While we saw a significant improvement in total guideline-concordant prescribing among the entire cohort, the most significant improvements in prescribing were observed with antimicrobial selection and among patients with urine cultures. Improvements in appropriate dosing and durations of therapy prescribed were only modest. We suspect that this modest improvement was due to the lack of consistent audit and feedback to prescribers. Furthermore, in our current electronic medical record, there are no order sets for urinary tract or wound infection to assist providers in choosing the appropriate antibiotic agent, dosage, or duration of therapy, and the current default dosages and durations of therapy do not match our institutional guidelines. We observed a significant difference between study periods in the type of urgent care provider involved; this was the result of an institution-wide practice model change between study periods. However, the same education was provided to all providers during the post-ASP period, and each provider group practices at both urgent care sites. We do not expect that this difference would account for significant inter-period prescribing deviations. As a result of these findings, future strategies to further improve prescribing at our urgent care sites include more consistent provider education, formulating a mechanism for expedited, regular feedback, and working with our electronic medical record to improve the default settings for dosing and duration of therapy.

There are limitations to our study that must be considered. First, as with all retrospective investigations there was a risk of selection bias as well as reliance on appropriate documentation. In an attempt to overcome these limitations, we chose to select a random sample of patients meeting inclusion criteria from both time periods. Documentation was standardized in the post-ASP group but not standardized in the pre-ASP group. Additionally, we chose to study only the two most common disease states and culture types—urinary tract and wound infections. This could potentially underestimate the impact of the pharmacists' intervention as several other culture types included in the CPA (e.g., blood, pharyngeal, sexually transmitted infections) were not included in this study. Of note, local susceptibility patterns and empiric guideline recommendations did not change between the study periods. This is important when examining potential confounding variables as prescribing should not have dramatically changed between periods. Additionally, limitations may also exist due to the quasi-experimental study design, including potential bias in the assessment of appropriate empiric treatment, the lack of study group randomization, and the potential for regression toward the mean during the post-ASP period.[29] Lastly, while we met our desired sample size estimate for our primary outcome, our study was likely underpowered for the secondary endpoints and subgroup analyses. For our primary outcome we included the entire cohort of 300 patients, including those who did not receive antibiotics, despite a positive culture. We felt that the inclusion of patients who did and did not receive antibiotics gave the best picture of our urgent care prescribing practices. The inclusion of patients who did not receive antibiotics in this endpoint is important as our stewardship team educates and encourages providers to avoid prescribing antibiotics for asymptomatic bacteriuria or for well-drained abscesses without surrounding cellulitis. Furthermore, as part of our CPA, the pharmacist must complete a symptom assessment prior to prescribing antibiotics at follow-up, even in the presence of a positive culture. If symptoms are absent or resolved at follow-up no antibiotics are prescribed. Despite these limitations our study supports pharmacists as leaders in ASP expansion initiatives. Healthcare systems may be able to utilize existing ASP resources to support urgent care stewardship.

Conclusion

Implementation of a pharmacist-led urgent care ASP was associated with a significant improvement in guideline-concordant antimicrobial prescribing for urine and wound cultures.

Disclosures

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