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Concise Communication

Impact of the expansion of antimicrobial stewardship services during transitions of care at an academic hospital

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Abstract

Antimicrobial stewardship of anti-infectives prescribed upon hospital discharge was implemented to improve the rate of appropriate prescribing at discharge. Appropriate prescribing significantly improved from 47.5% to 85.2% ($P < .001$), antimicrobial days of therapy decreased, and 30-day readmission rates decreased. Discharge antimicrobial stewardship was effective in improving anti-infective prescribing practices.

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Standards for outpatient antimicrobial stewardship programs (ASPs) from The Joint Commission went into effect recently, but they do not specifically address the role of ASPs upon hospital discharge.[1–4] Antibiotic courses are often completed after hospital discharge, and more than half of discharge prescriptions may be inappropriate, leading to readmissions and adverse effects such as *Clostridioides difficile* infection (CDI).[5,6] Targeted interventions on discharge have been shown to reduce the prescribing of parenteral therapy and antibiotics after surgical procedures.[7,8] Although these initiatives have been successful in specific populations, they do not completely address overall appropriateness of antimicrobial prescribing at hospital discharge. The objective of this initiative was to determine the impact of an ASP expansion on patients discharged with appropriate anti-infective therapy.

Methods

The before-and-after study was approved as quality improvement project by the institutional review board. The current ASP consists of a pharmacist and an infectious disease physician who perform prospective audit and feedback to optimize inpatient antimicrobial therapy. Staffing does not allow for routine evaluation of all discharge prescriptions; this initiative added a second pharmacist to perform ASP services on discharge.

This project took place from November through December 2018. The discharge ASP pharmacist manually reviewed the electronic records and included patients with discharge orders for anti-infectives. Exclusion criteria included leaving against medical advice, an infectious diseases physician prescribing discharge therapy, prophylactic antibiotic orders without clear guidelines for appropriateness, patients discharged from the transition of care unit (where an existing pharmacist led a medication review) or discharged from a hospital ward other than a general medical or surgical unit.

The discharge ASP pharmacist used a worksheet to abstract clinical information for each patient (Appendix 1 online). Anti-infective regimens were evaluated for appropriateness of indication, drug choice, dose, and duration of therapy using existing recommendations from the Infectious Diseases Society of America (IDSA) and national clinical guidelines (Table 1).[3] The discharge ASP pharmacist provided recommendations to the medical team if inappropriate. Worksheets from both the preintervention and postintervention groups were deidentified and independently reviewed by another ASP pharmacist for validation of appropriateness.

Key outcomes of this initiative were the percentage of patients discharged on appropriate therapy and type of intervention made. Other outcomes included recommendation acceptance rates, antimicrobial days of therapy (DOT), CDI occurrence, and percentage of readmissions or healthcare visits for treatment failure within 30 days. Demographic data were collected via chart review in addition to infectious diagnosis, diabetes diagnosis, length of stay, and readmission risk score. The readmission risk score is an evidence-based measurement tool developed for the electronic medical record in use at the institution that has not yet been validated externally. Using 27 factors, it calculates a percent risk for unplanned readmission within 30 days of discharge (Appendix 2 online). Descriptive statistics were utilized in addition to the Student *t* test for continuous variables and the Pearson χ^2 test and Fisher exact test for categorical variables. Statistical testing was 2-sided and $P < .05$ was considered statistically significant. Our statistician utilized SPSS software for statistical analysis (IBM, Armonk, NY).

Results

We included 122 patients in this study: 61 patients in both the preintervention and postintervention groups. Furthermore,

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Table 1. Examples of Antimicrobial Stewardship Criteria for Evaluating Appropriate Anti-Infective Use at Discharge[3,a]

Avoidance or Discontinuation of Anti-infectives	• Do not continue anti-infectives if recommended duration has been completed (ie, 3 days for noncomplicated cystitis, 5 days for community-acquired pneumonia (CAP) if clinical stability has been reached by day 3) • Do not continue anti-infectives if treatment is not indicated (ie, asymptomatic bacteriuria)
Correct Drug	• Select appropriate therapy based on culture result (ie, if MSSA a β-lactam antibiotic is preferred over trimethoprim/sulfamethoxazole or doxycycline) • If no positive culture, follow national guidelines on when and how to de-escalate antibiotics • Select the correct agent based on correct assessment of allergy history
Correct Dose	• Evaluate for appropriate dosing based on renal function, infection type, and weight (ie, if trimethoprim/sulfamethoxazole for MRSA pyoderma: weight <70 kg, use 1 double-strength (DS) tablet twice daily; if >70 kg, use 2 DS tablets twice daily)
Correct Duration	• Evaluate for appropriate guideline-driven duration of therapy based on good clinical response and indication: ○ Uncomplicated cystitis = 3 days ○ Uncomplicated pyelonephritis = 7 days ○ CAP = 5–7 days total ○ HAP = 7 days ○ Intra-abdominal infections = 4–7 days ○ Sinusitis = 7 days ○ Nonsuppurative cellulitis = 5 days

Note. CAP, community-acquired pneumonia; MSSA, methicillin-sensitive *Staphylococcus aureus*; MRSA, methicillin-resistant *Staphylococcus aureus*; HAP, hospital-acquired pneumonia.
[a]Criteria were utilized for evaluating appropriate use in addition to national guidelines.

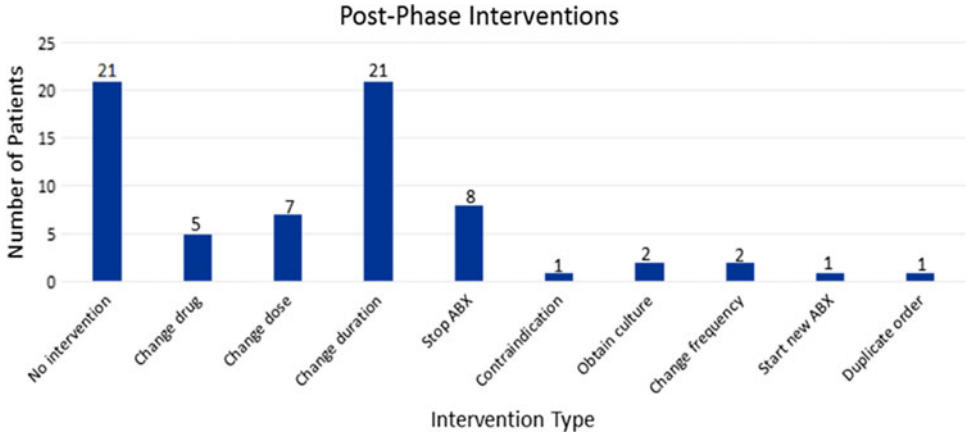

Fig. 1. Types of recommendations made regarding discharge anti-infective therapy. Recommendations were made in the postintervention group only. The number of patients per category is listed above each bar. In total, 48 recommendations were made across 40 patients. Note. ABX, antibiotic.

123 patients were excluded from the preintervention group and 99 were excluded from the postintervention group, most commonly due presence of an infectious disease consultation with recommendations for discharge anti-infectives (n = 127) or discharge from an excluded unit (n = 77). There were no significant differences between these groups among baseline characteristics including age (mean, 64–66 years), gender (59% women), and readmission risk percentage (16.2% before vs 14.9% after). The percentages of accepted ASP interventions prior to inclusion were similar before and after the intervention (92% vs 88%; $P = 1$). Urinary tract infections most commonly occurred, followed by lower respiratory tract infections, acute bacterial skin and skin structure infections, and intra-abdominal infections.

We detected no discrepancies between the discharge ASP pharmacist and the second ASP pharmacist in the determination of prescription appropriateness. The percentage of appropriate therapy on discharge was 47.5% before the ASP expansion compared to 85.2% after the ASP expansion (relative risk [RR], 0.28; 95% CI, 0.147–0.5381; $P < .001$). In the postintervention phase, 48 recommendations were made across 40 patients upon discharge, with an 81% acceptance rate. Recommendations included change in duration (44%), followed by discontinuation (17%), change in dose (14.5%), and change in drug (10%) (Fig. 1). The average duration of therapy was 7.8 days in the postintervention group compared to 8.9 days in preintervention group ($P = 0.079$). Antimicrobial DOTs were also lower after the intervention than before the intervention (555 days vs 626.5 days, respectively). Antimicrobial DOTs of the original discharge prescriptions in the after ASP expansion group would have been 643 days without any intervention.

No new incidences of CDI occurred in the study group. The total 30-day readmission rate was 19.7% in the preintervention group versus 11.5% in the postintervention group (RR, 0.583; 95% CI, 0.2464–1.38; $P = .212$). The number of readmissions related to infection included 6 patients in the preintervention group versus 2 patients in the postintervention group. One adverse event, gastrointestinal upset, was documented per group.

Discussion

A discharge ASP expansion intervention significantly increased the rate of appropriate anti-infective prescribing. Although our study population was small, the percentage of appropriate therapy at baseline was similar to that seen reported in previous studies of

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discharge anti-infective prescribing.[5] Readmissions seen at 30 days decreased, albeit not significant. A larger sample size would be necessary to determine a significant difference. Nonetheless, most interventions involved reducing the duration of or discontinuing antibiotics, leading to a reduction in antimicrobial DOT. Therefore, a major strength of this intervention is that this ASP expansion decreased antimicrobial burden without increasing adverse events or treatment failure. In fact, no new incidences of CDI occurred, and only 1 adverse event was reported per group. Our study was limited by retrospective data collection after discharge, potential lack of documentation, and the coexistence of other ASP practices in place to reduce CDI rates.

The similarity between groups, including risk for readmission, was a strength of the project. Another strength was the independent review for determination of appropriateness, which limited the bias associated with this clinical decision. In practice, pharmacists trained in ASP would not undergo this blind review process. One additional pharmacist full-time equivalent (FTE) was utilized on a trial basis to determine whether the ASP expansion could increase appropriate prescribing. Having demonstrated this, less time may be spent on documentation for the independent review, which may lead to a reduction in the FTEs required to expand the ASP or to include more patients. Data on time spent per patient would be useful to determine the need for an additional FTE versus ability to train existing pharmacists to share this role. Other factors to consider for feasibility of ASP expansion include need for continued surveillance of discharge orders, availability of ASP physician for consultation, and time spent completing non-ASP duties if existing pharmacists are utilized.

This project demonstrated that the expansion of an ASP significantly improved the rate of appropriate discharge anti-infective prescribing. A larger patient population is necessary to fully describe the effect on readmissions, adverse events, and treatment failure. Time spent on ASP will also be useful to determine the real-world feasibility of expanding to a larger population.

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