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Intervention to Reduce Broad-Spectrum Antibiotics and Treatment Durations Prescribed at the Time of Hospital Discharge: A Novel Stewardship Approach

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Abstract

Objective—For most common infections requiring hospitalization, antibiotic treatment is completed after hospital discharge. Post-discharge therapy is often unnecessarily broad-spectrum and prolonged. We developed an intervention to improve antibiotic selection and shorten treatment durations.

Design—Single center, quasi-experimental retrospective cohort study.

Methods—Patients prescribed oral antibiotics at hospital discharge before (July 2012 – June 2013) and after (October 2014 – February 2015) an intervention consisting of: 1) institutional guidance for oral step-down antibiotic selection and duration of therapy, and 2) pharmacy audit of discharge prescriptions with real-time prescribing recommendations to providers. The primary outcomes were total prescribed duration of therapy and use of antibiotics with broad gram-negative activity (fluoroquinolones or amoxicillin-clavulanate).

Results—300 cases from the pre-intervention period and 200 from the intervention period were included. Compared with the pre-intervention period, use of antibiotics with broad gramnegative activity decreased during the intervention (51% vs 40%, p = 0.02), particularly fluoroquinolones (38% vs 25%, p = 0.002). The difference in total duration of therapy did not reach statistical significance (10 days [interquartile range (IQR) 7–13] vs 9 [IQR 6–13], p = 0.13); however, the duration prescribed at discharge declined from 6 days (IQR 4–10) to 5 (IQR 3–7) (p = 0.003).

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During the intervention, there was a non-significant increase in the overall appropriateness of discharge prescriptions (52% vs 66%, p = 0.15).

Conclusions—A multifaceted intervention to optimize antibiotic prescribing at hospital discharge was associated with less frequent use of antibiotics with broad gram-negative activity and shorter post-hospital treatment durations.

Keywords

antibiotic stewardship; hospital discharge; transition of care; oral antibiotics

Introduction

Improving antibiotic use to slow the emergence of antibiotic resistance and decrease *Clostridium difficile* infections is a national priority [1]. The Infectious Diseases Society of America, Society for Hospital Epidemiology of America, and Centers for Disease Control and Prevention (CDC) provide recommendations for implementing antibiotic stewardship interventions in hospitals [2, 3]. Most of these interventions are geared toward improving antibiotic use during the hospitalization itself; however, a number of studies have demonstrated that for common infections, approximately two-thirds of the total treatment course is completed after the patient is discharged [4–8]. In addition, antibiotics dispensed at the time of hospital discharge are frequently suboptimal due to an overly broad spectrum of activity or excessive duration [8]. This suggests that antibiotic stewardship interventions focused solely on inpatient antibiotic use ignore a substantial component of antibiotic misuse. New interventions are necessary to address this important opportunity for antibiotic stewardship. We developed an intervention specifically focused on improving hospital discharge antibiotic prescribing. We hypothesized that such an intervention would decrease unnecessary antibiotic exposure by reducing use of antibiotics with broad gram-negative activity and by shortening treatment durations.

Methods

Study setting and population

Denver Health is an urban, academic, integrated healthcare system with a 477-bed teaching hospital. Most inpatients are admitted to medical or surgical teaching services; a minority are managed by a non-teaching hospitalist service. For patients admitted to teaching services, resident housestaff are primarily responsible for management orders, including antibiotic prescriptions at hospital discharge.

Intervention

Based on data from our institution demonstrating substantial opportunity to improve discharge prescribing [8], we implemented a multifaceted intervention with two main components: 1) the development and dissemination of an institutional guideline for oral-step down antibiotic selection and duration of therapy for common infections, and 2) prospective audit of discharge prescriptions with real-time recommendations to providers to promote adherence to the institutional guideline.

- *Guideline for discharge therapy:* We developed a table with institution-specific recommendations for oral step-down therapy and treatment duration for the following conditions: community-acquired pneumonia (CAP); urinary tract infection (UTI) including uncomplicated cystitis, complicated cystitis, uncomplicated pyelonephritis, and catheter-associated infection; skin infections including cellulitis, cutaneous abscess, or wound infection; healthcare-associated and hospital-acquired pneumonia; chronic obstructive pulmonary disease (COPD) exacerbation; *Clostridium difficile* infection; and *Helicobacter pylori* infection (eFigure 1). The recommendations were obtained from a combination of pre-existing institutional clinical practice guidelines and national guidelines [9–15]. The final version of the guideline was approved by the Antimicrobial Subcommittee, the Pharmacy and Therapeutics committee, the hospital's Clinical Guidelines Committee, and the Chief Clinical Officer.

  In September 2014, data supporting the rationale for the intervention and the discharge prescribing guidance was presented to housestaff, attending physicians, and pharmacists. Laminated pocket-sized copies of the guideline were provided to all clinicians and pharmacists, and an electronic copy was posted on the hospital intranet. Throughout the intervention period, the chief medical resident and Infectious Diseases (ID) pharmacist distributed the pocket cards to all incoming housestaff and faculty during orientations. An institutional smartphone application containing all of Denver Health's antibiotic treatment recommendations, including for the target conditions listed above, was made available to all providers in November 2014.

- *Prospective audit with real-time feedback to prescribes:* Staff pharmacists were trained by the ID pharmacist to cross-reference prescriptions for oral antibiotics submitted to the discharge pharmacy with the above institutional guideline. Beginning in September 2014, when the prescription did not appear to be consistent with the guideline, the ID pharmacist was contacted who then performed a review of pertinent clinical and laboratory data. When appropriate, the prescribing physician was contacted to recommend modifications to the discharge prescription to promote adherence to the institutional guidance. The frequency and result of these audit and feedback episodes were recorded using a standardized reporting form. Prior to the start of the intervention, the audit and feedback process was pilot-tested for a 3-week period to determine feasibility and the impact on the discharge process.

Study design

To determine the effects of the intervention, we performed a quasi-experimental, retrospective cohort study including adult inpatients prescribed an oral antibiotic at the time of hospital discharge before and after the intervention. The pre-intervention cohort was a previously published cohort discharged between1 July 2012 and 30 June 2013 [8]. The intervention cohort included patients discharged between 1 October 2014 and 28 February 2015.

Data Collection

Identical case-finding methods and data collection procedures were used for both time periods [8]. Patients 18 years or older who filled a prescription for oral antibiotic(s) at a Denver Health pharmacy within 7 days of hospital discharge were initially identified through the institution's data warehouse. To derive the study cohorts, electronic health records were manually reviewed by a single investigator (N.Y.) to determine eligibility, and for included cases, to abstract data. Cases were excluded that involved antibiotic prescriptions unrelated to the hospital stay, intravenous antibiotics at discharge, long-term prophylactic or suppressive antibiotics, absence of documentation of the indication for antibiotics, transfer to or from an outside institution, leaving against medical advice, failure to fill prescribed antibiotics within 48 hours of hospital discharge, infection with non-bacterial pathogens, and multiple hospitalizations for the same ongoing infection. For patients with multiple hospitalizations over the course of the study, only the initial hospitalization resulting in an oral antibiotic prescription was included. A standardized data abstraction form was used to record demographic and clinical characteristics, microbiologic data, inpatient antibiotic therapy, discharge antibiotics (indication, agent, dose, and treatment duration), and clinical encounters within the Denver Health system during the 30 days following hospital discharge. The study was approved by the Colorado Multiple Institutional Review Board.

Appropriateness review

To assess the appropriateness of discharge prescriptions, two ID physicians and an ID pharmacist (K.S., H.Y., T.J.) reviewed the data abstraction form and discharge summary for a random sample of 100 cases from the pre-intervention and intervention periods (50 per period). To blind these investigators to the time period of each case, the lead investigator (N.Y.) redacted service dates and other potentially identifying information from the documents reviewed. After discussion of each case among the three investigators, a prescription was classified as appropriate when at least two judged the indication, antibiotic selection, dose, and prescribed duration to be consistent with institutional guidance. With respect to duration of therapy, prescribed durations two or more days longer or shorter than recommended in the institutional guidance were classified as inappropriate. For infections without institutional guidance, the assessment of appropriateness was based on national guideline recommendations, or if none existed, expert opinion.

Outcomes

All endpoints were specified prior to the study. The primary outcomes were changes in the total prescribed duration of therapy, defined as the number of calendar days of inpatient antibiotics plus the duration prescribed at discharge, and the proportion of patients prescribed antibiotics with a broad spectrum of gram-negative activity, defined as fluoroquinolones or amoxicillin/clavulanate. Secondary end-points included change in the appropriateness of discharge prescriptions and rates of dermatologic, gastrointestinal or nephrotoxic adverse drug events, re-hospitalization, *C. difficile* infection, and treatment failure within 30 days of discharge. Treatment failure was defined as a change in antibiotic regimen or extension of planned treatment duration due to inadequate clinical response. Given their relative frequency, subgroup analyses for cases involving CAP, UTI, and skin

infection were performed to evaluate for changes in antibiotic selection and duration of therapy.

Statistical Analysis

Based on pre-intervention period data [8] and the results of prior antibiotic stewardship interventions at our institution [4, 16], we hypothesized the current intervention would reduce prsecription of antibiotics with broad gram-negative activity from 51% of cases to 38% (25% relative reduction) and the median treatment duration from 10 days to 8 (20% reduction). We calculated that by including the 300 existing cases from the pre-intervention period, a minimum of 200 cases in the intervention period would be necessary to provide at least 80% power at an alpha of 0.05 to detect the hypothesized differences. To determine the number of cases that would need to be reviewed to assess for a change in the appropriateness of discharge prescriptions, we hypothesized the proportion of discharge prescriptions classified as appropriate would increase from 47% to 66% (40% relative increase) and determined that 100 cases (50 in each group) were needed to provide 80% power at an alpha of 0.05 to demonstrate the hypothesized difference. The Pearson $\chi 2$, Fisher exact, or Wilcoxon rank-sum test were used to perform comparisons between the periods. *P* values <0.05 were considered statistically significant. All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC).

Results

For the 12-month pre-intervention period, the initial electronic search yielded 1825 cases with an oral antibiotic prescribed at discharge, of which 376 were manually reviewed and 300 were included for analysis (Figure 1). For the 5-month intervention period, 777 cases were identified by the initial search, of which 288 cases were manually reviewed and 200 were included for analysis. The frequency of reasons for exclusion were similar between the two periods (Figure 1). Nearly all antibiotics were filled within 24 hours after hospital discharge (295 [98%] pre-intervention, 197 [99%] intervention).

There were no significant differences between the two groups in baseline demographic and clinical characteristics (Table 1). The most common indications for the discharge antibiotic prescriptions were UTI, CAP, and skin infections (Table 1). The frequency of indications was similar among the two groups; however, there were significantly more COPD exacerbations during the intervention period (8% vs 18%, p = 0.001).

Microbiology testing and results were similar among the two groups: 74% of patients in the pre-intervention period and 76% in the intervention period had at least one specimen collected for culture, and 31% and 29%, respectively, had a positive culture. The most common organisms identified were *Escherichia coli* (10% vs 11%), streptococcal species (8% vs 11%), and *Staphylococcus aureus* (7% vs 4%).

In total, the proportion of patients discharged with antibiotics with broad gram-negative activity significantly declined during the intervention (51% vs 40%, p = 0.02); this was primarily due to a reduction in prescription of fluoroquinolones (38% vs 25%, p = 0.002) (Table 2). Prescription of azithromycin increased during the intervention period (12% vs

20%, p = 0.03). There was a non-significant reduction in the total prescribed duration of therapy (median 10 days [interquartile range (IQR) 7–13] to 9 days [IQR 6–13], p = 0.13); however, the duration prescribed at hospital discharge significantly declined (median 6 days [IQR 4–10] to 5 days [IQR 3–7], p = 0.003).

In subgroup analyses of 179 cases of CAP, UTI, or skin infection from the pre-intervention period and 110 cases from the intervention period, the findings were similar but more pronounced (Table 3). Discharge prescriptions for antibiotics with broad gram-negative activity (50% vs 35%, p = 0.01) and for multiple antibiotics (9% vs. 2%, p = 0.02) declined. There was a non-significant reduction in the total prescribed duration of therapy (median 9 days [IQR 7–13] to 8 days [IQR 6–11], p = 0.09), but the duration prescribed at discharged decreased from a median of 6 days (IQR 4–10) to 4 days (IQR 3–6) (p = 0.002). The changes in discharge prescribing were particularly pronounced in cases of CAP and skin infections; in cases of UTI, little change occurred (Table 3).

Appropriateness of discharge prescriptions

In the random sample of 100 cases for which the Infectious Diseases specialists performed a blinded assessment of the appropriateness of the discharge prescriptions, there was a nonsignificant increase in the overall appropriateness of the prescriptions during the intervention period (52% vs 66%, p = 0.15) (Table 4). Antibiotic selection was more frequently appropriate during the intervention (72% vs 90%, p = 0.02).

Pharmacy audit and feedback of discharge prescriptions

During the 5-month intervention period, a total of 918 patients were prescribed oral antibiotics at discharge. Of those, the prescriptions from 363 (40%) cases were reviewed by a pharmacist. In 99 (27%) of the 363 cases reviewed, a provider was contacted by telephone to discuss the prescription. A recommendation to change the discharge prescription was made in 85 cases, of which 66 (67%) were accepted. The most common reasons prompting a recommendation to change the prescription were opportunities to optimize antibiotic choice (n=29, 44%) or dose (n=28, 42%), and to reduce treatment duration (n=20, 30%).

Clinical outcomes

A follow-up encounter within 30 days of hospital discharge was documented in 209 (70%) cases in the pre-intervention period and 144 (72%) in the intervention period. There were no significant differences in the incidence of treatment failure (15% vs 15%), re-admission for the same condition (8% vs 8%), *C. difficile* infection (2% vs 0%), or adverse drug events (7% vs 3%).

Discussion

To our knowledge, this is the first description of an antibiotic stewardship intervention designed specifically to optimize oral antibiotic prescriptions at the time of hospital discharge. A number of previous studies have demonstrated that for infections commonly managed in the hospital, 60–70% of the total antibiotic course is completed after discharge [4–8]. Thus, ensuring appropriate antibiotic selection at discharge represents an important

opportunity to reduce use of antibiotics with overly broad-spectrum activity. Furthermore, since the total duration of therapy is determined by the duration of the discharge prescription, the discharge prescription is the critical point at which to intervene to shorten treatment durations.

Clinical care guidelines often include recommendations for inpatient therapy, the transition to oral therapy, and treatment durations. Our intervention was unique in that it did not attempt to alter inpatient prescribing but rather focused on the discharge prescription. The tools that we developed provided clinicians with point-of-care access to the most appropriate discharge antibiotic and shortest effective duration of therapy for common infections. To our knowledge, this is the first description of a stewardship intervention incorporating prospective audit with provider feedback of discharge prescriptions. The audit and feedback process was intended to correct prescriptions that did not adhere to institutional guidance. Our data show that less than half of all prescriptions were reviewed by pharmacy; this may have been in part due to evening and weekend discharges when prescriptions were not reviewed. It is also noteworthy that of the prescriptions reviewed, a recommendation to change therapy was required in less than a quarter of cases. Ideally, as more providers become familiar with the institutional discharge prescribing guidance, even fewer interventions by pharmacy would be required over time; however, the longer-term sustainability and effectiveness of this intervention is not known and requires additional study.

It is worth noting that the intervention had a more robust impact on prescribing for the subgroup of cases involving CAP, UTI, or skin infections. Interestingly, the greatest changes in prescribing were observed in CAP and skin infections, conditions for which successful syndrome-specific antibiotic stewardship interventions had been implemented in our hospital prior to the pre-intervention period of this study [4, 16]. These prior interventions had led to substantial reductions in use of antibiotics with broad gram-negative activity and shorter treatment durations. It is therefore noteworthy that despite these prior improvements, the current intervention led to additional reductions in broad-spectrum antibiotic use and treatment durations. In contrast, the current intervention was not associated with significant changes in prescribing for UTIs, which had not previously been a focus of intervention in our hospital. Although the reasons for the variable success of this intervention on particular infections cannot be determined from this study, our findings suggest that the intervention may be most effective as a complementary approach to syndrome-specific stewardship interventions. A multilevel intervention that actively targets both inpatient and discharge prescribing may therefore have the greatest impact on antibiotic use.

Our study has several limitations. First, it was performed at a single academic safety-net hospital which limits its generalizability. Second, by including all types of infections in the analysis, the effect of the intervention was likely diluted since the intervention was most likely to affect prescribing for a target group of infections. We designed the study in this manner because it provides the most complete assessment of the overall impact of the intervention on discharge antibiotic use, to avoid the potential selection bias associated with limiting the analysis to certain infections, and because the intervention had the potential to impact prescribing for all types of infections. Third, there was a relatively long gap between

the pre-intervention period and the start of the intervention. This is because the intervention itself was designed and implemented after collection of and in response to the pre-intervention period data [8]. We are not aware of any factors that would have impacted hospital discharge prescribing practices during this time. Fourth, although interrupted time series analysis would have been the preferred statistical approach in this setting, this was not felt to be feasible given the lack of sufficient time points over the short intervention period. Fifth, seasonal variation in infections (and therefore prescribing patterns) was a potential confounding factor since the intervention spanned the winter months. This is likely why COPD exacerbations were more common during the intervention period; this may have biased our results toward the null since COPD exacerbations are routinely treated with 5-day courses of azithromycin and were unlikely to have been impacted by the intervention. Sixth, the study was not designed to determine the effects of the individual components of the intervention but rather the effects of the bundled intervention. The impact of audit and feedback of discharge prescriptions, the component of the intervention requiring ongoing personnel time, is therefore not known. Finally, the study may have been underpowered to detect differences in total duration of therapy and appropriateness of discharge prescriptions.

In summary, a novel intervention combining institutional guidance for oral-step down antibiotic selection and duration of therapy with pharmacy-led audit of discharge prescriptions with feedback to providers led to a decrease in use of antibiotics with broad gram-negative activity and shorter post-hospital treatment courses. The intervention was particularly effective in cases of CAP and skin infections. Antibiotic prescribing at the time of hospital discharge may be an underappreciated opportunity to improve overall antibiotic use for common infections, and intervening at this point in time may be an important complement to currently recommended antibiotic stewardship interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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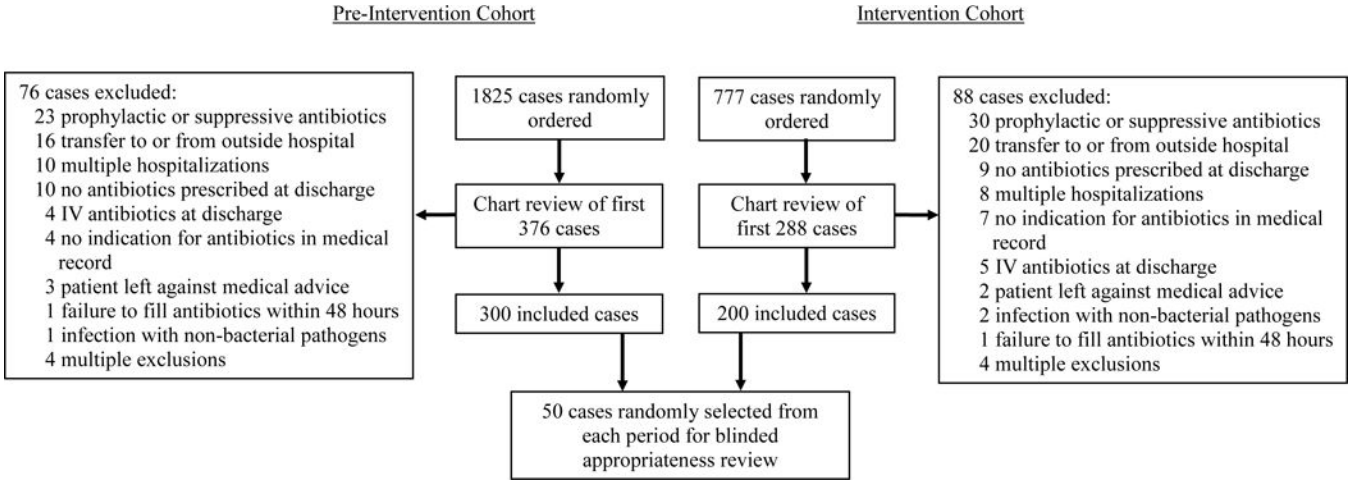

Figure 1.

Study diagram. In the pre-intervention study period, 1825 adult cases were identified electronically. A total of 376 charts were manually reviewed until 300 included cases was reached. In the intervention period, 777 adult cases were identified electronically. A total of 288 charts were manually reviewed until 200 included cases was reached. 50 included cases from each period were randomly selected for blinded appropriateness review.

Table 1

Demographic and clinical characteristics of patients discharged on oral antibiotics

	Pre-intervention period n=300 [a]	Intervention period n=200 [a]
Age, mean (standard deviation)	52.8 (15.8)	52.6 (17.8)
Male	171 (57)	110 (55)
Comorbidities		
Diabetes mellitus	87 (29)	66 (33)
Antibiotic use within 6 months	67 (22)	57 (29)
COPD	48 (16)	36 (18)
Hospitalization within 90 days	46 (15)	33 (17)
HIV infection	17 (6)	3 (2)
Pregnancy	13 (4)	6 (3)
Cirrhosis	13 (4)	11 (6)
History of multi-drug resistant organism [b]	12 (4)	5 (3)
End-stage renal disease	9 (3)	5 (3)
Failed outpatient antibiotics [c]	17 (6)	7 (4)
Hospital length of stay, median days (IQR)	4 (3–5)	4 (3–6)
ICU admission	53 (18)	35 (18)
Infectious Diseases consultation	42 (14)	29 (15)
Indications for discharge antibiotics		
Urinary tract infection	72 (24)	42 (21)
Community-acquired pneumonia	52 (17)	35 (18)
Skin and soft tissue infection	62 (21)	34 (17)
Gastrointestinal infection	46 (15)	22 (11)
Osteoarticular infection	22 (7)	16 (8)
COPD exacerbation [d]	23 (8)	36 (18)
Head and neck infection	15 (5)	18 (9)
Bacteremia	15 (5)	9 (5)
Other	40 (13)	26 (13)
≥2 indications for therapy	37 (12)	25 (13)

[a] No significant differences between pre-intervention and intervention cohort (p>0.05 for all subgroups) with the exception of COPD exacerbation

[b] Defined as prior infection with methicillin-resistant *Staphylococcus aureus*, vancomycin resistant *Enterococci*, or extended spectrum beta-lactamase producing *Enterobacteriaceae*.

[c] Defined as lack of clinical response to outpatient therapy requiring hospital admission.

[d] COPD exacerbations significantly more frequent in intervention cohort (p=0.001) IQR, interquartile range; ICU, intensive care unit; COPD, chronic obstructive pulmonary disease; HIV, human immunodeficiency virus

Table 2

Antibiotic selection and prescribed duration of therapy

	Pre-intervention period n=300	Intervention period n=200	p-value
Broad gram-negative antibiotic	152 (51)	80 (40)	0.02
Fluoroquinolone	115 (38)	50 (25)	.002
Amoxicillin/clavulanate	37 (12)	30 (15)	0.39
Azithromycin	37 (12)	39 (20)	0.03
Metronidazole	29 (10)	11 (6)	0.09
Clindamycin	26 (9)	23 (12)	0.30
Trimethoprim/sulfamethoxazole	20 (7)	11 (6)	0.60
Doxycycline	19 (6)	16 (8)	0.47
Penicillin or amoxicillin	15 (5)	6 (3)	0.27
Clarithromycin	11 (4)	2 (1)	0.07
Nitrofurantoin	8 (3)	5 (3)	0.91
2nd- and 3rd-generation cephalosporins [a]	4 (1)	4 (2)	0.72
Other	10 (3)	2 (1)	0.14
Received ≥2 antibiotics	50 (17)	21 (11)	0.05
Total prescribed duration of therapy, median (IQR)	10 (7–13)	9 (6–13)	0.13
Duration of inpatient therapy, median (IQR)	3 (3–5)	4 (3–5)	0.01
Duration of prescribed at discharge, median (IQR)	6 (4–10)	5 (3–7)	0.003

[a] includes cefdinir, cefixime, cefpodoxime, and cefuroxime

Table 3

Subgroup analyses of cases of community-acquired pneumonia, urinary tract infection, or skin infection

	Pre-Intervention period	Intervention period	p-value
CAP, UTI, or skin infection	n=179	n=110	
Antibiotic prescribed at discharge			
Broad gram-negative antibiotic	89 (50)	38 (35)	0.01
Fluoroquinolone	71 (40)	27 (25)	0.008
Amoxicillin/clavulanate	18 (10)	11 (10)	0.99
Azithromycin	16 (9)	20 (18)	0.02
Received ≥2 antibiotics	16 (9)	2 (2)	0.02
Total prescribed duration of therapy, median (IQR)	9 (7–13)	8 (6–11)	0.09
Duration of inpatient therapy, median (IQR)	4 (3–5)	4 (3–5)	0.44
Duration prescribed at discharge, median (IQR)	6 (4–10)	4 (3–6)	0.002
Community-acquired pneumonia	n=52	n=35	
Antibiotic prescribed at discharge			
Broad gram-negative antibiotic	31 (60)	11 (31)	0.01
Fluoroquinolone	26 (50)	9 (26)	0.02
Amoxicillin/clavulanate	5 (10)	2 (6)	0.70
Azithromycin	16 (31)	20 (57)	0.01
Received ≥2 antibiotics	3 (6)	0	0.27
Total prescribed duration of therapy, median (IQR)	8 (6–9)	6 (5–7)	0.003
Duration of inpatient therapy, median (IQR)	4 (3–5)	4 (3–5)	0.64
Duration prescribed at discharge, median (IQR)	4 (3–5)	3 (2–4)	0.02
Urinary tract infection	n=72	n=42	
Antibiotic prescribed at discharge			
Broad gram-negative antibiotic	43 (60)	23 (55)	0.60
Fluoroquinolone	41 (57)	18 (43)	0.15
Amoxicillin/clavulanate	2 (3)	5 (12)	0.10
Received ≥2 antibiotics	6 (8)	1 (2)	0.26
Total prescribed duration of therapy, median (IQR)	10 (8–13)	9 (7–12)	0.58
Duration of inpatient therapy, median (IQR)	4 (3–5)	4 (3–5)	0.79
Duration prescribed at discharge, median (IQR)	6 (4–9)	5 (3–7)	0.35
Skin infection	n=62	n=34	
Antibiotic prescribed at discharge			
Broad gram-negative antibiotic	21 (34)	5 (15)	0.04
Fluoroquinolone	10 (16)	1 (3)	0.09
Amoxicillin/clavulanate	11 (18)	4 (12)	0.44
Received ≥2 antibiotics	9 (15)	1 (3)	0.09
Total prescribed duration of therapy, median (IQR)	12 (8–15)	9 (7–12)	0.02
Duration of inpatient therapy, median (IQR)	4 (3–5)	4 (3–5)	0.96

	Pre-Intervention period	Intervention period	p-value
Duration prescribed at discharge, median (IQR)	7 (6–12)	5 (4–7)	<0.001

Table 4

Appropriateness of discharge prescriptions as classified during blinded Infectious Diseases panel review

	Pre-intervention period n=50	Intervention period n=50	p-value
Discharge antibiotic appropriate	26 (52)	33 (66)	0.15
Condition warrants antibiotics at discharge	46 (92)	48 (96)	0.68
Antibiotic selection appropriate	36 (72)	45 (90)	0.02
Correct dose of antibiotic(s)	42 (84)	46 (92)	0.22
Duration of therapy appropriate	30 (65)	34 (71)	0.56