Pharmacist Impact In Antimicrobial Stewardship To The Academic Internal Medicine Team

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Citation

A Garmaza, S Brown, G E Gilbert. *Pharmacist Impact In Antimicrobial Stewardship To The Academic Internal Medicine Team*. The Internet Journal of Infectious Diseases. 2020 Volume 18 Number 1.

DOI: 10.5580/IJID.55490

Abstract

Purpose: The antimicrobial stewardship standards developed by The Joint Commission became effective January 1, 2017 and address the growing antimicrobial resistance that threatens patient's safety. A multi-disciplinary antimicrobial stewardship team is necessary to support Medication Management Standard MM.09.01.01: antimicrobial stewardship program based on current scientific literature. Previous studies show that pharmacist interventions can reduce the average antibiotic length of therapy (LOT) and decrease the number of Clostridium difficile infections. The primary objective of this quality improvement project is to evaluate the impact of pharmacist involvement in antimicrobial stewardship on inpatient antibiotic days of therapy (DOT). Secondary objectives will evaluate the LOT by indication, overall antibiotic LOT, time to targeted treatment based on culture results, intravenous (IV) to oral (PO) time conversion, and antibiotic related pharmacist interventions.

Summary: There were no significant differences in the time it to switch patients from IV to PO antibiotics (P value=0.6907), in the time to targeted treatment (P value=0.3674), or in the length of stay (P value=0.4414). However, there were significant differences in the number of DOT (P value=0.0777) and the LOT (P value=0.0675).

Conclusion: Review of data shows a decrease in antibiotic days of therapy with pharmacist involvement.

BACKGROUND

The antimicrobial stewardship standards developed by The Joint Commission became effective January 1, 2017 and addresses the growing antimicrobial resistance that threatens patient's safety. A multi-disciplinary antimicrobial stewardship team is necessary to support Medication Management Goal MM.09.01.01: antimicrobial stewardship program based on current scientific literature, use organization-approved multidisciplinary protocols, and collect, analyze, and report data. 5 The Infectious Diseases Society of America (IDSA) and the Society of Healthcare Epidemiology of American (SHEA) 2016 guideline recommends a multi-disciplinary program consisting of infectious disease (ID) physicians and clinically trained pharmacists and to reduce the antibiotics therapy to the shortest effective duration.4 CDC estimates that 20-50% of antibiotics are unnecessary or inappropriate in the inpatient setting.7 Previous studies show that pharmacist interventions can reduce the average antibiotic length of therapy (LOT), days of therapy (DOT), promote improved antibiotic selection based on hospital or guideline driven protocol, and decrease the number of Clostridium difficile infections.1, 2, 3, 9,10 Due to limited resources, our institution has decentralized clinically trained pharmacists but they are not trained in infectious disease specialty. Antimicrobial stewardship is just one part of the duties that the clinical pharmacists have to perform, but due to time constraints and other clinical consults, antimicrobial stewardship is not a priority. The stewardship activities are a priority to pharmacy residents that are on the Internal Medicine and Infectious Disease experiences.

Our institution is a 319 bed acute care hospital. The hospital is pending accreditation for the ACGME for Internal Medicine and Family Medicine residents. The hospital has more than 82,000 Emergency Department visits annually and more than 16,500 annual inpatient admission. The antimicrobial stewardship program was started in 2014 and has evolved to include pharmacist presence on the Internal Medicine teaching team rounds starting in 2017. The pharmacy residency program started in 2017 and pharmacy residents were able to start rounding two to three times per

week with the academic Internal Medicine teams during Internal Medicine rotation, which lasts for 5 weeks. The Internal Medicine teams are made up of Internal Medicine residents, interns, and students that follow a maximum of 20 patients at a time. Pharmacists duties included working up patients before rounds and making any interventions needed during rounds, which pertained to antimicrobial stewardship and general practice. Our current model included Pharmacy Residency Director or Clinical Coordinator to round with the pharmacy residents or students during rounds.

Due to limited recourses, pharmacists are only able to be present during rounds 4 to 5 months out of the year. Rounds with the medical team were for 3 hours per day, 3 days per week. During infectious disease experience, infectious disease physicians did not prepare for the rounds ahead of time and rounding was about 3 hours per week. The pharmacy residents performed patient review prior to scheduled rounds, spending approximately 6 hours per week. Data collected included age, gender, race, prior antibiotic treatment, length of hospital stay, IV to PO time, time to targeted treatment, antibiotic days of therapy, antibiotic length of therapy, pharmacist's interventions, and type of infection.

The primary objective of this quality improvement project is to evaluate the impact of pharmacist involvement in antimicrobial stewardship on inpatient antibiotic days of therapy (DOT). Secondary objectives will evaluate the LOT by indication, overall antibiotic LOT, time to targeted treatment based on culture results, intravenous to oral time conversion, and antibiotic related pharmacist interventions.

INCLUSION/EXCLUSION CRITERIA

A retrospective chart review was conducted of hospitalized patients. Two groups were compared, a pre-intervention group from a time period prior to pharmacist participation with antibiotic review and a post-intervention group with pharmacist evaluation of antibiotic regimen.

Inclusion: Patients admitted to the internal medicine teaching teach between June 21, 2016 and August 27, 2016 for the control group and between March 27, 3017 to May 27, 2017 for the intervention group. Diagnostic related grouping (DRG) were utilized for kidney and urinary tract infections (463, 689, 690), simple pneumonia and pleurisy (139, 193, 194, 195), chronic obstructive pulmonary disease (140, 190, 191, 192), respiratory signs, symptoms and minor diagnoses (144), and cellulitis and other skin infections (383, 603). Patient had to receive at least one dose of the antibiotic and age had to be >=18 years of age. Patients were excluded if Infectious Disease service was consulted, if patient developed a more complex disease (sepsis, meningitis, osteomyelitis, intra-abdominal infections), and any formulary restricted antibiotics were used. (Figure 9)

STATISTICS USED

Descriptive statistics were utilized, as we were not able to review then number of patients needed in order to reach power for the study. Inferential statistics utilizing Wilcoxon-Mann-Whitney test for data that was not normally distributed. The priori level of significance was set at 0.01 for descriptive statistics. Data was analyzed by an independent statistician.

RESULTS

Pre-intervention

There were 84 patients in the pre-intervention period – 64% (n=54) of whom were female (Table 1). Most patients were White (91%; n=74). Median age was 70 with range of 20 to 96 years. About one-third (30%; n=22) of patients switched from intravenous (IV) to oral (PO) antibiotics in four days while 15% (n=11) and 16% (n=12) of patients were switched from IV to oral antibiotics in three and five days, respectively. The average number of days it took to switch patients from IV to oral antibiotics was 4.4 days (SD=2.5 days). The median number of days it took to switch patients from IV to oral antibiotics was four days (IQR: 2). The distribution of days to switch can be seen in Figure 1.

About two-thirds (66%; n=19) patients had zero days to targeted treatment after results. The remaining patients (n=10) were approximately distributed between one and five days. The average time to targeted treatment was 0.86 (sd=1.41) with a median time to targeted treatment before intervention of 0 (IQR: 2). The distribution of time to targeted treatment before intervention can be seen in Figure 2.

Length of hospital stay ranged for 2 to 15 days. About one-third of patients (35%; n=29) were in the hospital for four days. Seventeen percent (n=14) patients were hospitalized for two days. The average length of stay was 4.9 days (sd=2.6 days) with a median length of stay of 4 days (IQR: 3). The distribution of time to targeted treatment before intervention can be seen in Figure 2a.

The number of days patients received antibiotic therapy ranged from 1 to 19 days and clustered about 3 to 7 days.

About one-fifth (18%; n=15) of patients pre-intervention received antibiotic therapy in four days. Ten (12%), nine (11%), eight (10%), and seven (8%) patients received antibiotic therapy in 5, 6, 7, and 3 days, respectively. The average number of days to antibiotic therapy was 6.3 days (sd=3.7 days) and a median of 5.5 days (IQR: 4 days) in the pre-intervention period. The distribution of days to antibiotic therapy pre-intervention can be seen in Figure 3.

Length of therapy of therapy, pre-intervention, ranged from 1 to 12 days. About one1third of patients (36%; n=30) had a length of therapy lasting four days. Fourteen percent and 13% of patients had therapy lasting three and five days, respectively, in the pre-intervention period. Pre-intervention, on average, therapy lasted 4.5 days (sd=2.2 days) with a median of 4 days (IQR: 2). The distribution of the length of therapy in the pre-intervention period can be seen in Figure 4.

Fifty-six percent (n=47) of the interventions in antibiotic change included a pharmacist.

Post-intervention

There were 68 patients in the post-intervention period – 57% (n=39) of whom were female (Table 1). Most patients were White (91%; n=61) – the same percentage in the post-intervention portion of the study. Median age was 73 with range of 31 to 96 years. Over one-third (39%; n=21) of patients switched from intravenous (IV) to oral antibiotics in four days while about one-fifth (19%; n=10) of patients were switched from IV to oral antibiotics in three days. The average number of days it took to switch patients from IV to oral antibiotics was 4.5 days (sd=2.0 days). The median number of days it took to switch patients from IV to oral antibiotics was four days (IQR: 1.8). The distribution of days to switch can be seen in Figure 5.

Almost three-fourths (72%; n=13) patients had zero days to targeted treatment after results. The remaining patients (n=5) received treatment in one (n=4; 22%) to two (n=1; 6%) days. The average time to targeted treatment was 0.33 (sd=0.59) with a median time to targeted treatment before intervention of 0 (IQR: .75). The distribution of time to targeted treatment before intervention can be seen in Figure 6.

Length of hospital stay ranged for 2 to 20 days. About three-fourths (76%; n=52) of the hospital stays were approximately equally distributed between a 2 to 5-day hospital length of stay. The average length of stay for the post-intervention group was 5.0 days (sd=3.4 days) with a median length of stay of 4 days (IQR: 2). The distribution of time to targeted treatment before intervention can be seen in Figure 6a.

The number of days patients received antibiotic therapy ranged from 1 to 14 days and clustered about 2 to 4 days. One-fifth (22%; n=15) of patients post-intervention received antibiotic therapy in three days. Eleven (16%) and nine (13%) patients received antibiotic therapy in 2 and 4 days, respectively. The average number of days to antibiotic therapy was 5.5 days (sd=3.6 days) and a median of 4 days (IQR: 4.2 days) in the post-intervention period. The distribution of days to antibiotic therapy post-intervention can be seen in Figure 7.

Length of therapy of therapy, post-intervention, ranged from 1 to 14 days. One quarter of patients (25%; n=17) had a length of therapy lasting three days. One-fifth of patients (19%; n=13) and 16% (n=11) of patients had therapy lasting two and four days, respectively, in the post-intervention period. Post-intervention, on average, therapy lasted 4.0 days (sd=2.4 days) with a median of 3 days (IQR: 3). The distribution of the length of therapy in the post-intervention period can be seen in Figure 8.

Fifty-nine percent (n=40) of the interventions in antibiotic change included a pharmacist.

There were no significant differences in the time it to switch patients from IV to oral antibiotics (P value=0.6907), in the time to targeted treatment (P value=0.3674), or in the length of stay (P value=0.4414). However, there were significant differences in the number of days to treatment (P value=0.0777) and the length of treatment (P value=0.0675).

Table 1

Baseline characteristics

	Control (n=84)	Intervention (n=68)
Age	Median: 70 (range 20-96)	Median: 73 (range 31-96)
Sex	Male: 36% (n=30)	Male: 43% (n=29)
Race	88% White (n=74)	90% White (n=61)
Abx prior to admission	29% (n=26)	30% (n=21)

Figure 1

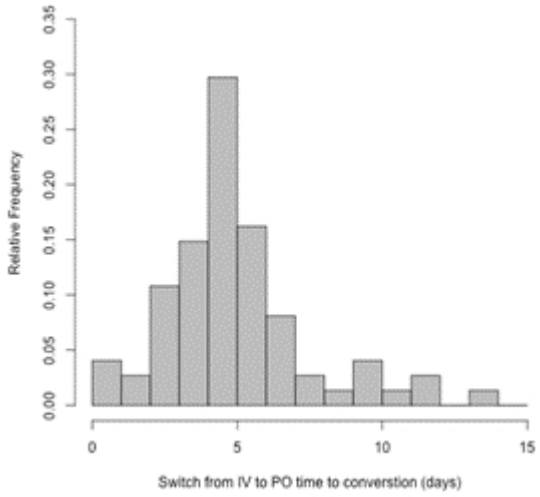


Figure 2a

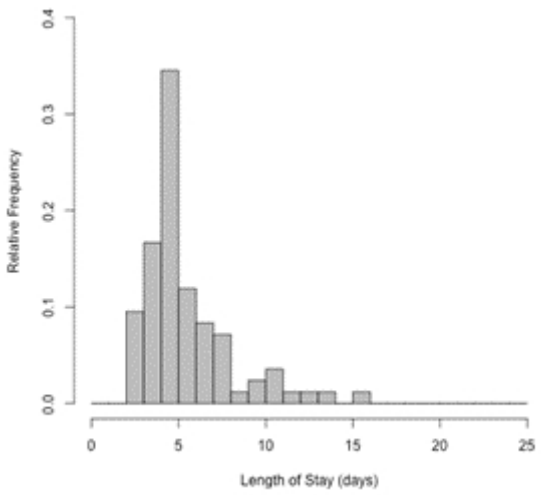


Figure 2

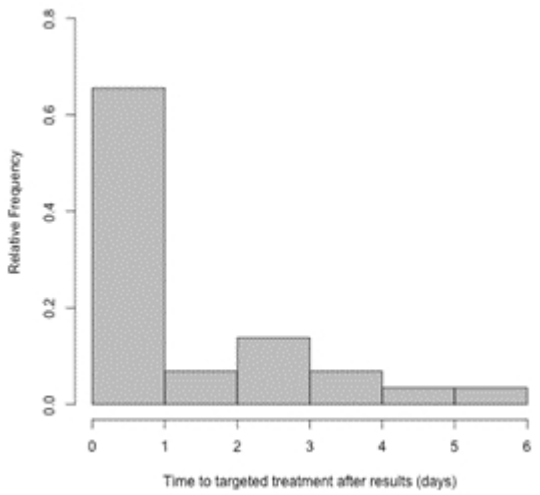


Figure 3

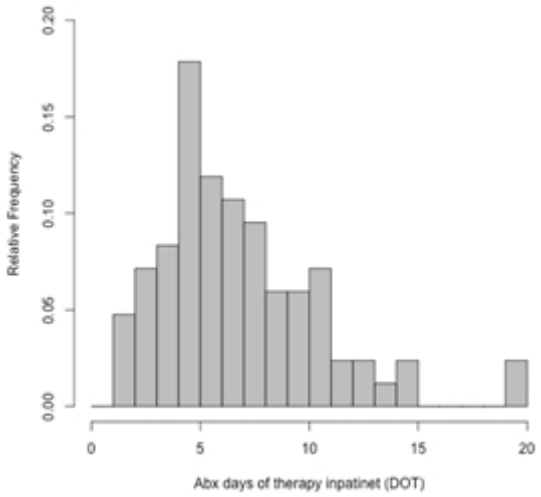
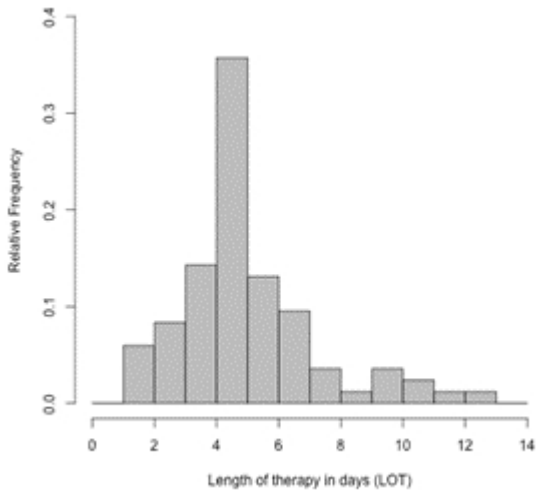


Figure 4



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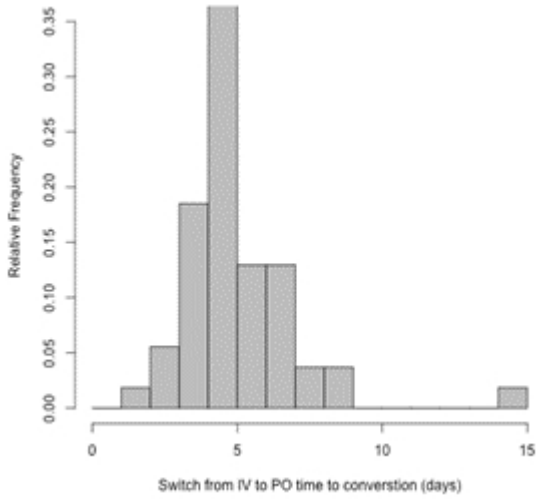

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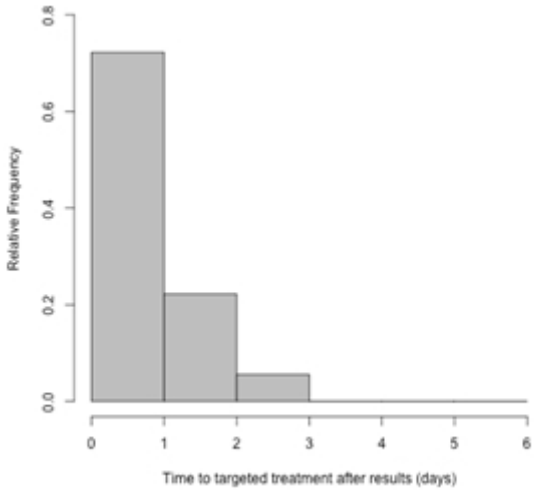


Figure 6a

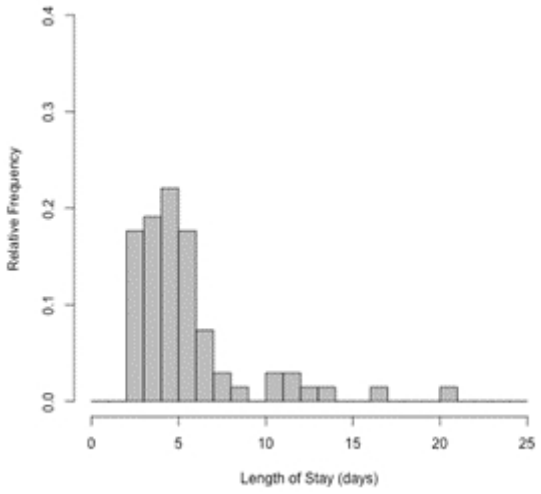


Figure 7

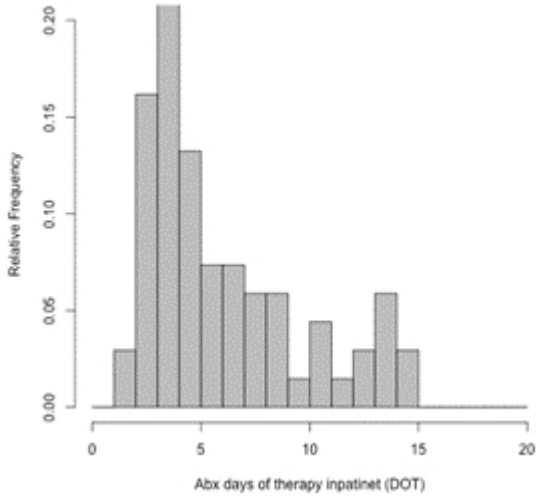


Figure 8

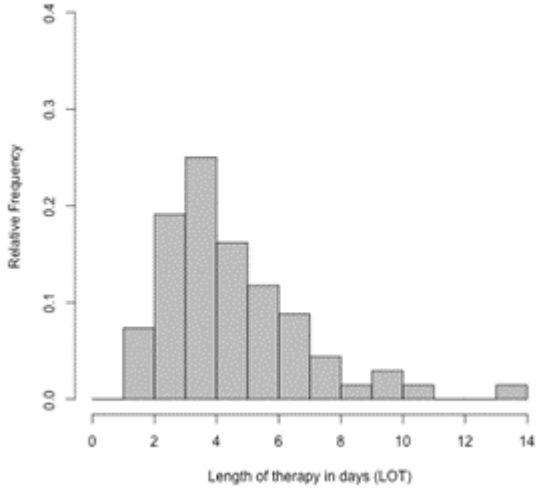
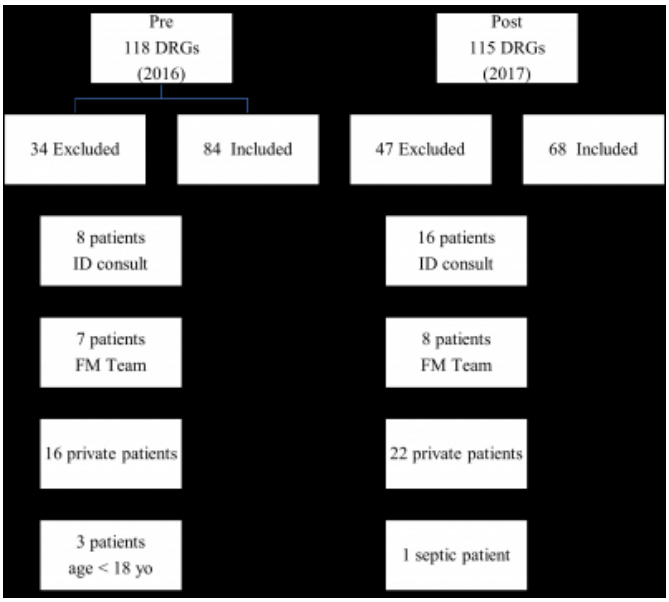


Figure 9

Patient selection



DISCUSSION

Overall DOT showed a 12.7% decrease and LOT showed an 11% decrease when pharmacist was present on the internal medicine team. No statistical significant changes were seen for time to targeted treatment, IV to PO conversions, and number of antibiotic related pharmacist interventions in the study population.

Urinary, pulmonary, and skin and soft tissue infections were selected based on the pre-defined treatment length recommendations by the IDSA guidelines. Patients were excluded if they had a more complicated infection that did not have a predefined treatment length. We did not look at the subgroups for the pulmonary, urinary, and skin and soft tissue infections as the patient population size would not have been large enough to see any significance.

We tried to reduce the bias by selecting to collect the data prior to pharmacist participation on the Internal Medicine team and the time when the pharmacy residents were on Internal Medicine rotations. We were not able to account for any interventions that were discussed during rounds and were not recorded in Cerner. Other confounders could not be excluded from the study. The National guidelines from CMS and The Joint Commission publishing requirements for conditions of participation and for the antimicrobial stewardship program were released in the beginning of 2017 and providers may have been more aware at that time of antimicrobial stewardship. In addition, a clinical pharmacist did an antimicrobial stewardship lecture to the IM residents

prior and after the pre-intervention date. This may have affected the post-intervention data as residents may have been more aware of the appropriate utilization of antibiotics.

Limitations of this quality improvement projects is that it is a single center study and may not be generalizable to other institutions. The sample size was small and we were not able to gather enough data to achieve power. Pre-intervention group timeline was selected as pharmacists were not part of the rounding teaching team for internal medicine and the pharmacy residency program has not started. The post-intervention group time was selected due to pharmacy residents and students being on the internal medicine and infectious disease rotations where they would interact with the internal medicine team daily to make interventions.

We were also looking at the patients on the academic teaching internal medicine team and not at the rest of the patient population at the hospital. There was about a 13% increase in total antibiotic interventions that was seen at ourinstitution when comparing pre- and post-intervention time. This could be due to pharmacist being able to have more interventions on patients that were not followed by the academic internal medicine teams. When comparing the different timelines, there was an increase in patient admission of about 5% which does not account for the increase in number of total antibiotic interventions between those time periods.

The study would benefit from a larger sample size to help with analyzing the data. Due to time constraints, our pharmacy residents and preceptors are not able to round with IM teaching teams daily and are only able to do so during internal medicine rotations, which turns out to be two to three times per week for about 3 months out of the year. Clinical pharmacists are able to utilize antibiotic worklists to help to de-escalate therapy or IV to PO conversions but it is not their priority as they concentrate on patient care issues and consults during the day.

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