

Background. The outcomes associated with the acceptance or refusal of a recommendation from an antimicrobial stewardship program (ASP) on an individual level have not been studied yet. Our objective was to compare the clinical characteristics and mortality of patients for whom a recommendation from an ASP, based on prospective audit and feedback and triggered by a computerized decision support system, was accepted or refused.

Methods. We performed a retrospective cohort study of all hospitalized adult patients who received intravenous or oral antimicrobials in two tertiary care hospitals in Canada between 2014 and 2016, and for whom a recommendation was issued by an ASP.

Results. We identified 1,251 recommendations throughout the study period. Among the recommendations made by the pharmacist to prescribers, 1,144 (91.5%) were accepted. The most frequent interventions were immediate scheduling end of treatment ($n = 364$, 29%), dosing/frequency adjustments ($n = 321$, 26%), streamlining ($n = 251$, 20%), and switching from intravenous to oral therapy ($n = 247$, 20%). The antimicrobials most frequently targeted by recommendations were piperacillin/tazobactam ($n = 273$, 22%) and fluoroquinolones ($n = 267$, 21%). Overall, the length of the antimicrobial targeted by the recommendation was significantly shorter when a recommendation was accepted (0.37 days vs. 2.11 days; $P < .001$). In the multiple logistic regression analysis, the independent risk factors associated with in-hospital mortality were the Charlson score, issuance of a recommendation for a patient in the intensive care unit, the duration between admission and the recommendation, issuance of a recommendation in 2016 (compared with 2014), and age of the patient. A recommendation issued on a fluoroquinolone or oral penicillin/first generation cephalosporin was associated with lower odds of mortality. After adjustment, refusal of a recommendation by the attending physician was associated with a higher, albeit nonsignificant, risk of mortality (AOR, 1.81; 95% CI, 0.89–3.68; $P = .10$).

Conclusion. The duration of the antimicrobial treatment was significantly shorter when a recommendation triggered by an ASP program was accepted. This decrease in antimicrobial duration was not associated with increased mortality.

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1542. Safety of Stopping Antibiotics Prescribed “Just in Case” - Comparison of Mortality, Readmissions and Clostridium difficile in Patients with Accepted Stewardship Interventions Compared with Declined

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Background. Antibiotics are often prescribed “just in case” when clinical conditions mimic an infection, such as the shortness of breath in heart failure, the erythema of venous stasis or when bacterial culture results are misleading such as asymptomatic bacteriuria (ABU) and *C. difficile* colonization. Through prospective audit and feedback (PAF), antimicrobial stewardship programs (ASP) may guide providers toward appropriate antibiotic use. However, the safety of stopping antibiotics needs to be assessed. We retrospectively reviewed the clinical outcomes of patients with accepted ASP recommendations and compared these to patients in whom the primary team declined ASP recommendations.

Methods. The ASP database was used to identify patients receiving written PAF to stop antibiotics prescribed for noninfectious conditions from January 1, 2016 to December 31, 2016. The primary objective was to compare antibiotic days of therapy (DOT), total length of therapy (LOT), hospital length of stay (LOS), 30-day mortality, and the incidence of *C. difficile* within 6 months of the ASP intervention, occurring among patients whose primary treating team accepted vs. rejected the ASP recommendation. We compared the two groups using Chi-square and student t-test to determine statistical significance for categorical and continuous variables, respectively.

Results. There were 232 ASP recommendations to stop antibiotics for noninfectious conditions: 150 (65%) interventions were accepted. Baseline demographic characteristics, comorbidities, intensive care admission and surgery during that hospitalization were similar between the two groups. The most common noninfectious conditions were ABU (55%), followed by respiratory (19%) and intra-abdominal (17%). The median antibiotic DOT and LOT were significantly reduced in the accepted group, 3 (3–5) vs. 8 (5–12.25) days ($P < 0.001$) and 3 (2–4) vs. 7 (5–10) days ($P < 0.001$), respectively. There were no statistical differences in 30-day mortality, 30-day readmission, and *C. difficile* within 6 months.

Conclusion. Our institutional ASP’s PAF to stop antibiotics for noninfectious conditions led to a significant reduction in antimicrobial exposure without negatively affecting mortality or hospital outcomes.

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1543. A Multi-Faceted Antimicrobial Stewardship Program (ASP) Intervention Using Clinical Pharmacists Reduces Antibiotic Use and Hospital-Acquired Clostridium difficile Infection (HA-CDI)

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Background. ASPs continue to investigate novel ways to improve appropriate antibiotic utilization. The impact of an ASP-led, multi-faceted coaching and real-time feedback model directed towards clinical pharmacists was evaluated.

Methods. A single-center, pre-post quasi-experimental study was conducted with a four-month historical control period (11/2016–2/2017) and four-month intervention period (4/2016–7/2016) to reduce the use of ceftriaxone, fluoroquinolones, and clindamycin. Clinical pharmacists were responsible for ensuring the appropriate use of these restricted antimicrobials with limited guidance by the ASP in the historical control period. The intervention was multi-faceted: ASP pharmacists provided daily coaching and feedback on use of targeted agents to the clinical pharmacists, clinical pharmacists made recommendations to optimize therapy, and in-person monthly sessions were held where a dashboard consisting of aggregated utilization data and HA-CDI rates was discussed by the ASP pharmacist. Segmented regression analysis was used to determine the significance of this intervention on the utilization of the antibiotics, measured by days of therapy (DOT) per 1000 patient-days (PD). Rates of HA-CDI were also compared between the groups.

Results. The use of fluoroquinolones (34.4 vs. 26.2 DOT/1000 PD; Δ -23.9%), ceftriaxone (17.7 vs. 13.6 DOT/1000 PD; Δ -23.2%), and clindamycin (18.7 vs. 13.3 DOT/1000 PD; Δ -28.9%) decreased during the intervention period. Using segmented regression analysis, a significant decreasing rate of antibiotic use of all three agents was observed during the intervention period (Table). A significant decreasing rate of HA-CDI was also seen (rate ratio (RR): 0.787, 95% CI: 0.743–0.833, $P < 0.001$).

Conclusion. A multi-faceted coaching and feedback intervention targeting clinical pharmacists with substantial ASP oversight can significantly reduce inappropriate antibiotic use and HA-CDI in a large hospital.

Table: Segmented Regression Analysis

| Drug | Effect | Rate Ratio | 95% CI | P-value |
|------------------|-------------------|------------|-------------|---------|
| Fluoroquinolones | Intervention*time | 0.971 | 0.949–0.995 | 0.016 |
| Ceftriaxone | Intervention*time | 0.842 | 0.795–0.891 | <0.001 |
| Clindamycin | Intervention*time | 0.931 | 0.904–0.958 | <0.001 |

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1544. Impact of System-wide Adoption of CDC Core Elements on Antimicrobial Use and Clostridium difficile Infection in a Large Health System

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Background. Inappropriate Antimicrobial use, its associated resistance and suboptimal patient outcomes are important quality and safety concerns. Antimicrobial stewardship programs (ASP) can help reduce the risk of development of multi-drug resistant organisms, and Clostridium difficile infections. The Centers for Disease Control and Prevention (CDC) recommended core elements for successful implementation of ASPs in 2014. We describe the adoption of the core elements and associated outcomes at a large health system in the United States.

Methods. We organized our program based on the seven core elements. We focused on 1) making antimicrobial stewardship a system priority with full leadership support, 2) creating an infrastructure to promote and disseminate best practices, 3) standardizing indications for use of the different antimicrobial classes promoting most narrow-spectrum agents, and 4) building capacity for hospitals to achieve their goals from local leadership buy-in to infrastructure to do the work.

Results. Local ASPs were established in 89 hospitals. 3.3 million defined daily doses (DDDs) were used in FY15 compared with 2.9 million in FY16 and 2.8 million in FY 17. There was a drop in systemic antimicrobial use from 877 (FY15) to 809 (FY16) and 776 (FY17) DDDs/ 1000 patient-days ((7.7% and 4.1% reduction in FY 16 and FY 17; $P < 0.001$) (Figure 1 and 2). In addition, hospital onset *C. difficile* lab ID events standardized infection ratios (SIR) dropped from 0.89 (events=2292) in FY15 to 0.84 (events=2056) in FY16 (5.6% reduction) and 0.75 in FY 17 (events=1818), a 10.7% reduction compared with FY16.

Conclusion. Implementation of the CDC core elements in a very large system has led to both an improvement in total systemic and targeted antibiotic use and reduction in *C. difficile* infections.

Figure 1: Antimicrobial Use Comparison FY15 vs. FY16

| Antibiotic | FY15 | | | FY16 | | | Percent Change | P-value | 95% CI |
|------------------------------|---------------------|------------------|--|---------------------|------------------|--|----------------|-------------------|-----------------------|
| | Defined Daily Doses | Patient Days | Defined daily dosage per 1000 patient days | Defined Daily Doses | Patient Days | Defined daily dosage per 1000 patient days | | | |
| Aztreonam (n=89) | 14,043 | 3,725,254 | 3.8 | 8,715 | 3,634,316 | 2.4 | -36.4% | p<0.001 | (-1.45, -1.29) |
| Ceftriaxone (n=89) | 6,644 | 3,725,254 | 1.8 | 3,680 | 3,634,316 | 1.0 | -43.2% | p<0.001 | (-0.82, -0.72) |
| Daptomycin (n=89) | 42,858 | 3,725,254 | 11.5 | 27,369 | 3,634,316 | 7.5 | -34.5% | p<0.001 | (-4.11, -3.83) |
| Ertapenem (n=89) | 25,040 | 3,725,254 | 6.7 | 16,720 | 3,634,316 | 4.6 | -31.6% | p<0.001 | (-2.23, -2.01) |
| Linezolid (n=89) | 17,274 | 3,725,254 | 4.6 | 13,017 | 3,634,316 | 3.6 | -22.8% | p<0.001 | (-1.15, -0.96) |
| Quinolones (n=89) | 503,927 | 3,725,254 | 135.3 | 296,553 | 3,634,316 | 81.6 | -39.7% | p<0.001 | (-54.2, -53.2) |
| Tigecycline (n=89) | 5,287 | 3,725,254 | 1.4 | 2,815 | 3,634,316 | 0.8 | -45.4% | p<0.001 | (-0.69, -0.60) |
| Vancomycin (n=89) | 274,584 | 3,725,254 | 73.7 | 347,629 | 3,634,316 | 95.7 | 29.8% | p<0.001 | (21.5, 22.4) |
| Total Systemic (n=89) | 3,266,519 | 3,725,254 | 876.9 | 2,940,873 | 3,634,316 | 809.2 | -7.7% | p<0.001 | (-68.9, -66.3) |

Figure 2: Antimicrobial Use Comparison FY16 vs. FY17

| Antibiotic | FY16 | | | FY17 (Estimated based on 9 months) | | | Percent Change | P-value | 95% CI |
|------------------------------|---------------------|------------------|--|------------------------------------|------------------|--|----------------|-------------------|-----------------------|
| | Defined Daily Doses | Patient Days | Defined daily dosage per 1000 patient days | Defined Daily Doses | Patient Days | Defined daily dosage per 1000 patient days | | | |
| Aztreonam (n=89) | 8,715 | 3,634,316 | 2.4 | 5,657 | 3,616,665 | 1.6 | -34.8% | p<0.001 | (-0.90, -0.77) |
| Ceftriaxone (n=89) | 3,680 | 3,634,316 | 1.0 | 2,869 | 3,616,665 | 0.8 | -21.7% | p<0.001 | (-0.26, -0.18) |
| Daptomycin (n=89) | 27,369 | 3,634,316 | 7.5 | 21,062 | 3,616,665 | 5.8 | -22.7% | p<0.001 | (-1.83, -1.59) |
| Ertapenem (n=89) | 16,720 | 3,634,316 | 4.6 | 8,600 | 3,616,665 | 2.4 | -48.3% | p<0.001 | (-2.31, -2.14) |
| Linezolid (n=89) | 13,017 | 3,634,316 | 3.6 | 10,330 | 3,616,665 | 2.9 | -20.3% | p<0.001 | (-1.31, -0.94) |
| Quinolones (n=89) | 296,553 | 3,634,316 | 81.6 | 237,595 | 3,616,665 | 65.7 | -19.5% | p<0.001 | (-16.3, -15.5) |
| Tigecycline (n=89) | 2,815 | 3,634,316 | 0.8 | 1,260 | 3,616,665 | 0.3 | -55.0% | p<0.001 | (-0.46, -0.39) |
| Vancomycin (n=89) | 347,629 | 3,634,316 | 95.7 | 280,816 | 3,616,665 | 77.6 | -18.8% | p<0.001 | (-18.4, -17.6) |
| Total Systemic (n=89) | 2,940,873 | 3,634,316 | 809.2 | 2,807,366 | 3,616,665 | 776.2 | -4.1% | p<0.001 | (-34.3, -31.7) |

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1545. Reduction of *Clostridium difficile* Infection in a Community Teaching Hospital Associated with Antimicrobial Stewardship Team Interventions on Fluoroquinolone Utilization

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Background. In April 2016, the Antimicrobial Stewardship Program (ASP) at Summa Health System – Akron Campus (SHS-AC) began reviewing all fluoroquinolone use in addition to other daily responsibilities. The decision to do so was made following the formation of a *Clostridium difficile* reduction taskforce, comprised of Infection Control, Environmental Services, and the ASP. The primary goal of the taskforce was to reduce cases of hospital acquired *C.difficile* infections by 10%. The ASP collectively decided to focus on fluoroquinolone antimicrobials during the first year of implementation.

Methods. A retrospective review of all ASP interventions at SHS-AC was performed from April 2016-April 2017. The ASP reviewed all patients on a fluoroquinolone without Infectious Diseases consultation. The appropriateness of the dose and assessment of EKGs (if available) was performed on all patients. Patients were reviewed for the following information: indication, renal function, contraindications (e.g., QTc prolongation), drug-drug interactions (e.g., warfarin), and allergy status. Data collected included: infection source, intervention type, acceptance rate, hospital acquired *C.difficile* rate, and fluoroquinolone utilization.

Results. A total of 612 recommendations were made by the ASP on fluoroquinolone use, with a 95% acceptance rate. Interventions included: change to alternative agent based on indication or culture results (302/612), stop or change antimicrobials due to contraindication or major drug interaction (86/612), and discontinue antimicrobial use (224/612). Ciprofloxacin utilization decreased from 15.8 days of therapy (DOT)/1000 patient-days in 2015, to 9.7 DOT/1000 patient-days in 2016. Levofloxacin utilization decreased from 11.2 DOT/1000 patient-days to 5.2 DOT/1000 patient-days in 2016. The healthcare associated *C.difficile* infection rate also decreased from 7.24/10,000 patient-days in 2015, to 4.78/10,000 patient-days in 2016.

Conclusion. Fluoroquinolone evaluation and intervention performed by the ASP resulted in a reduction of fluoroquinolone utilization and likely contributed to the reduction of healthcare associated *C.difficile* rates.

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1546. Reduction in Antibiotic Consumption Upon Implementation of Antibiotic Indication Requirement

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Background. In recent years, antimicrobial stewardship has become an important topic, shaping policy throughout healthcare, most notably in inpatient institutions. Various strategies are implemented (often in combination) to achieve the goal of more responsible use of antimicrobials. While many facilities have initiated requirements for antimicrobial indications when ordering antimicrobials, there is little data to support their effect. We evaluated the effect of requiring antimicrobial indications on their overall use.

Methods. In July 2016 we implemented a requirement that an indication must be included on all antimicrobial orders placed in our electronic medical record among inpatients in a 772-bed urban academic hospital. We performed a pre- and post-intervention retrospective analysis of defined daily dosage (DDD) of antimicrobials per 1000 patient-days. DDD/1000 patient-days were calculated based on purchase data, evaluating total antimicrobial use, as well as breakdowns for specific classes and individual agents. Our pre-intervention period was from 7/1–12/31/15 and post-intervention period was 7/1–12/31/16. This was the only new stewardship intervention employed during the study period.

Results. There was a 21.7% overall reduction in the DDD/1000 patient-days of systemic antibiotics with net reductions in all major drug classes (Table). The largest reductions occurred in the penicillins and extended-spectrum penicillin drug classes.

| Drug class | 2015 | 2016 | % change |
|-------------------------------|-------|-------|----------|
| Total systemic antibiotics | 872.8 | 683.6 | -21.7% |
| Cephalosporins | 208.4 | 204.1 | -2.1% |
| Penicillins | 244.7 | 191.1 | -21.9% |
| Extended-spectrum penicillins | 142 | 118.4 | -16.6% |
| Quinolones | 25.9 | 23.3 | -10% |
| Carbapenems | 10.9 | 9.6 | -12% |

Conclusion. Requiring antimicrobial orders to list an indication resulted in decreased overall use. Larger prospective studies should be done to confirm the generalizability of these results.

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1547. Impact of a Stewardship Initiative to Decrease Treatment of Asymptomatic Bacteriuria and Pyuria in the Emergency Department

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Background. Antibiotic treatment of asymptomatic bacteriuria (AB) provides no benefit and can lead to negative outcomes. The impact of asymptomatic pyuria (AP) on antibiotic use is not well characterized, nor is the impact of treating AB/AP in the emergency department (ED). The purpose of this study was to determine whether a multi-faceted stewardship initiative decreased unnecessary antibiotic treatment of AB/AP in the ED of an 885-bed academic medical center.

Methods. Beginning in Dec 2015, a series of interventions were implemented, including inservices, pocket cards, electronic order entry alerts, and elimination of reflex urine cultures for abnormal urinalyses. Patients discharged from the ED in Aug-Oct 2015 (pre-intervention group) and Dec 2016-Feb 2017 (post-intervention group) were consecutively screened retrospectively. Asymptomatic patients ≥18 yrs old with ≥10⁵ CFU/mL organisms on urine culture or >12 WBC/hpf on urinalysis were included. Patients with pregnancy, separate infection requiring antibiotics, immunocompromised state, paraplegia, neurogenic bladder, or altered genitourinary anatomy were excluded. The primary outcome was the proportion of patients with AB and/or AP prescribed antibiotics within 72 hours of ED discharge. Secondary outcomes were the number of urine cultures ordered in the ED and the number of patients returning to the ED with symptomatic urinary tract infection (UTI) within 30 days. 32 patients in each group were required to achieve 80% power, assuming 30% difference in primary outcome.

Results. 74 patients met study criteria (37 in each group). 52 patients (70%) had AP without AB. Antibiotic treatment and the number of urine cultures ordered decreased significantly in the post group.

| Outcome | Pre | Post | P Value |
|--|--------------|-------------|---------|
| Patients treated for AB and/or AP | 37/37 (100%) | 12/27 (32%) | <0.001 |
| Patients treated for AP without AB | 25/25 (100%) | 6/27 (22%) | <0.001 |
| Urine cultures ordered per 1,000 ED discharges | 66.3 | 37.9 | 0.004 |
| Patients returning to ED within 30 days | 3/37 | 4/37 | NS |

Conclusion. A multi-faceted stewardship initiative significantly decreased treatment of AB/AP in the ED. AP appears to contribute significantly to unnecessary antibiotic use in the ED and would be a valid target for stewardship initiatives.

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