

Participants in Arm A were allocated to voluntary use of CDSS by the clinician at first prescription of piperacillin-tazobactam or a carbapenem, while in Arm B, CDSS use was compulsory. PRF continued for both arms.

Results. Six hundred forty-one and 616 participants were included in Arms A and B, respectively. At baseline, Charlson's co-morbidity and APACHE II scores were comparable. Initial antibiotic prescriptions were similar, and the majority were for respiratory (67.0% vs. 68.2%) or urinary (17% vs. 19.6%) infections.

CDSS recommendations were provided to 20.6% of participants in Arm A and 99.4% in Arm B ($P < 0.01$). Arm B adopted a higher number of CDSS antibiotic de-escalation (1.1% vs. 2.6%), dose optimization (9.7% vs. 30.7%), antibiotic optimization (8.9% vs. 31.3%), and duration setting recommendations (10.9% vs. 50%). The proportion of participants receiving PRF recommendations were not, however, significantly different between arms (8% vs. 11.5%, $P = 0.13$). The types of PRF recommendations and prescriber acceptance rates were also similar. The duration of antibiotic use was significantly shorter when prescribers were compelled to use the CDSS (daily defined doses ≤ 3 : 71.8% in Arm B, 64.9% in Arm A, $P < 0.01$). There was no evidence of harm from the CDSS, with similar 30-day mortality (HR 0.87, 95% CI 0.67–1.12), 30-day re-infection (20.6% vs. 23.1%, $P = 0.29$) and 30-day re-admission rates (14.4% vs. 14.1%, $P = 0.91$). The median length of hospital admission was also similar (15 IQR 5–64 vs. 15, IQR 4–70 days).

Conclusion. Compulsory use of a CDSS at antibiotic prescription did not reduce the requirement for PRF, but limited the duration of antibiotic courses, without compromising clinical outcomes

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187. Comparison of Active Versus Passive Strategies in Improving Compliance to Antimicrobial Stewardship Interventions

Sarah Si Lin Tang, BSc (Pharm) (Hons)¹; Yvonne Peijun Zhou, BSc (Pharm) (Hons)¹; Liwen Loo, BSc (Pharm) (Hons)¹; Andrea L. Kwa, PharmD¹ and Piotr Chlebicki, MBBS²; ¹Pharmacy, Singapore General Hospital, Singapore, Singapore, ²Infectious Diseases, Singapore General Hospital, Singapore, Singapore

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Background. In Singapore General Hospital, the use of the Computerized Decision Support System (CDSS) is mandatory when antibiotics audited by the hospital antimicrobial stewardship program (ASP) are prescribed. It was envisioned that CDSS could, in part, replace the need for ASP review via prospective audit-feedback (PAF). However, quality of CDSS use is prescriber-dependent, and inappropriate use (diagnosis selected is incongruent with antibiotic indication specified in patient notes) was observed. We investigated the role of prescriber enablement and engagement as strategies to improve CDSS appropriateness rates (CAR).

Methods. A series of interventions was rolled-out in January 2018. Intervention 1 (I1) was implemented hospital wide—an expanded repertoire of antibiotic guidelines, display of CDSS selected diagnosis on the hospital's electronic medical record, education and publicity via mass emails. Intervention 2 (I2) involved conducting additional roadshows but only in selected clinical departments (one major medical and two major surgical departments). CAR (prospectively evaluated by ASP team) 3-months pre- and post-implementation of these interventions were compared using interrupted time-series analysis. Its potential impact on ASP manpower in place of PAF (30 minutes/case) was estimated.

Results. An average of 1,043 antibiotic courses, piperacillin-tazobactam (75.7%) as the most common, was prescribed with CDSS per month. Unspecified sepsis (51.5%) was the most common indication. Departments with I1 alone had mediocre improvement in CAR [66.8% ($n = 1,699$) vs. 68.9% ($n = 1,760$), $P = 0.10$], while departments that received a combination of I1 and I2 saw greater improvement in CAR, with a trend toward statistical significance [60.4% ($n = 354$) vs. 68.3% ($n = 393$), $P = 0.07$]. Improvement in CAR was most apparent in the surgical departments (50.6% vs. 59.4%, $P = 0.09$). This absolute increment in CAR meant manpower savings of 6.5 hours/month, and could potentially reach 41 hours/month had both interventions been implemented and similar results achieved hospital-wide.

Conclusion. Active prescriber engagement is pivotal in effectively obtaining buy-in to and success of ASP strategies.

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188. A Novel Inpatient Antibiotic Stewardship Assistance Program (ASAP) Using Real-Time Electronic Health Record Data, Prediction Modeling and Epidemiologic Data to Provide Personalized Empiric Antibiotic Recommendations

Nirav Shah, MD¹; Mary Ellen Acree, MD²; Clayton Patros, PharmD, BCPS²; Mira Suseno, PharmD³; Jennifer Grant, MD⁴; Gary Fleming, BE¹; Bryce Hadsell, BS²; Jeffery Semel, MD, FIDSA, FSHEA⁵; Courtney Hebert, MD, MS⁶; Kamaljit Singh, MD⁶ and Lance Peterson, MD²; ¹NorthShore University HealthSystem, Chicago, Illinois, ²NorthShore University HealthSystem, Evanston, Illinois, ³Rosalind Franklin University of Medicine and Sciences College of Pharmacy, North Chicago, Illinois, ⁴Infectious Disease, NorthShore University HealthSystem, Evanston, Illinois, ⁵University of Chicago, Chicago, Illinois, ⁶Department of Pathology, NorthShore University HealthSystem, Evanston, Illinois

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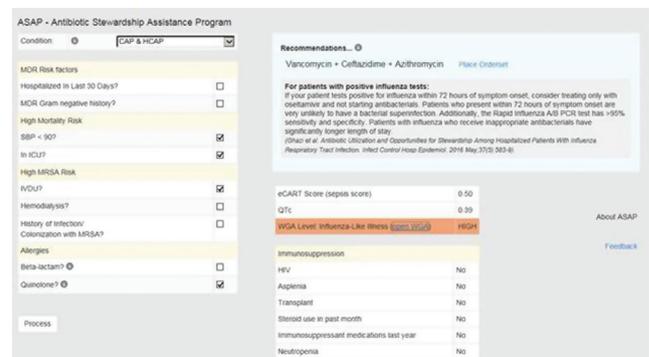
Background. Antibiotic prescribing varies amongst clinicians, which can result in inappropriate or overuse. Inappropriate antibiotics can increase the risk of adverse drug events and multi-drug-resistant organisms (MDRO). Decreasing variability and increasing alignment with guideline-based therapy may improve antimicrobial stewardship and outcomes.

Methods. We developed a point of care stewardship tool embedded in the electronic health record (EHR) that provides empiric antibiotic recommendations for four syndromes, urinary tract infection (UTI), abdominal biliary infection (ABI), pneumonia, and cellulitis. We identified key variables that alter antibiotic selection or need for infectious disease (ID) consultation such as allergy history, immunosuppression and risk factors for MDRO, and mortality. We created algorithms of preferred empiric antibiotic choices based on national and hospital guidelines using these risk factors. We used a weighted incidence syndromic combined antibiogram (WISCA) prediction model to recommend ID consultation when likelihood of coverage was below a defined threshold. We also incorporated a home-grown epidemiologic tool that takes real-time data from outpatient clinics on incidence of influenza-like-illness (ILI) to recommend influenza PCR testing during periods of high ILI risk. Data on risk factors and WISCA variables including demographics, allergy history, ICD10 codes, vitals, laboratories, and microbiology results were extracted in real-time from the EHR and sent via URL into a web server which has an embedded Windows ASP.NET C# web site and an SQL server database. The web server was then embedded back into the EHR. This tool stores recommendations into the database for stewardship auditing.

Results. Thirteen key and 20 WISCA variables are extracted from the EHR in real-time. There are eight distinct antibiotic recommendations for UTI and ABI, 12 for cellulitis, and 40 for pneumonia. An illustration of the ASAP tool is shown in Figure 1.

Conclusion. ASAP is an EHR-embedded platform that provides clinicians access to personalized antibiotic prescribing tied to best practices and optimal stewardship initiatives. Future work will look into the tool's effect on variation in care, antibiotic prescribing, and outcomes.

Figure 1:



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189. Evaluating the Impact of Mandatory Indications on Antibiotic Utilization: A Retrospective Study

April Jane Chan, BScPharm ACPR PharmD BCPS; Mark Downing, MD and Bradley Langford, BScPhm ACPR PharmD BCPS; St. Joseph's Health Centre, Toronto, ON, Canada

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Background. Mandatory indications for antimicrobial agents are recommended by a number of organizations to act as a force function, requiring prescribers to provide a reason for prescribing at the time of order entry. We evaluated the impact of introducing a mandatory indication field into electronic order entry for selected antibiotics on utilization of antibiotics at a large community hospital in the context of an established antimicrobial stewardship program.

Methods. A descriptive analysis of the mandatory indication fields for the study antibiotics (intravenous and enteral clindamycin, ciprofloxacin, metronidazole, moxifloxacin, and vancomycin) for adult patients 18 years and above for 1-year (December 1, 2015–November 30, 2016) postimplementation was conducted. An independent *t*-test was used to measure the primary outcome of change in drug utilization of study and control antibiotics before (6 months pre) and after (12 months post) the initiation of mandatory indications. Drug utilization was calculated as days of therapy (DOT)/1,000 patient-days for both the study and control antibiotics individually and as a group. Oral amoxicillin/clavulanate and intravenous piperacillin/tazobactam orders which have no mandatory indications were used to examine any associated shifts in antibiotic utilization.

Results. A total of 8,399 orders were evaluated in the 1-year post-implementation period; of which, 4,572 were for study antibiotics. The preset mandatory indications were selected 30–55% of the time. For the primary outcome, there was a statistically significant decrease in DOT/1,000 patient-days for study antibiotics as a group pre- and postintervention (mean 100 vs. 82, $P = 0.024$) as but not individually. However, there was a statistically significant increase in DOT/1,000 patient-days for the control

antibiotics (mean 78 vs. 91, $P = 0.01$), driven by the increase in piperacillin/tazobactam utilization.

Conclusion. This study showed the moderate use of preset mandatory indications which suggests that the preset list of indications can be optimized. Furthermore, mandatory indications were shown to be associated with a reduction in study antibiotics utilization but may lead to shifts in usage to other nonstudy antibiotics.

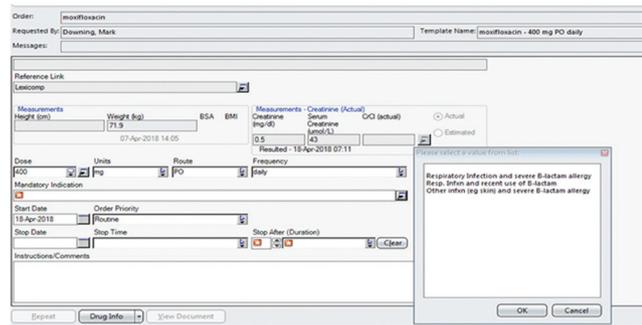


Figure 1: Screen capture of mandatory indication for moxifloxacin order during order entry

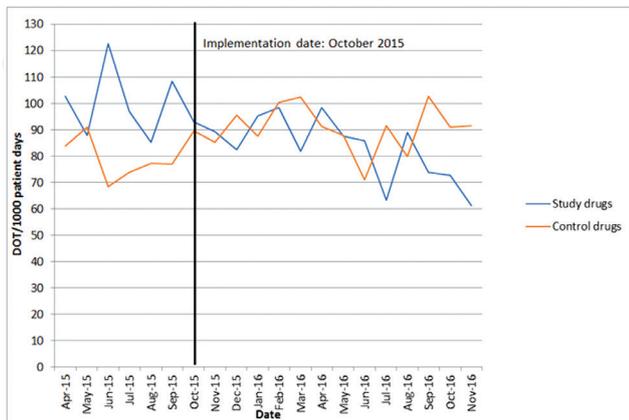


Figure 2: Antibiotic utilization pre and post-implementation of mandatory indications for study drugs

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190. Promise and Pitfalls: Analyzing the Accuracy and Perceptions of Documenting Antibiotic Indication During Order Entry

James Beardsley, PharmD^{1,2}; Mark Vestal, PharmD³; Norbert Rosario, PharmD³; Kalyn Meosky, PharmD³; James Johnson, PharmD^{1,2}; John Williamson, PharmD^{1,2}; Vera Luther, MD² and Christopher Ohl, MD, FIDSA³; ¹Department of Pharmacy, Wake Forest Baptist Health, Winston-Salem, North Carolina, ²Department of Internal Medicine, Section on Infectious Diseases, Wake Forest School of Medicine, Winston-Salem, North Carolina, ³School of Pharmacy, Wingate University, Wingate, North Carolina

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Background. The CDC and The Joint Commission recommend that prescribers document an indication (IND) when ordering antibiotics (ABX). However, to assist with ABX stewardship efforts, the IND needs to be accurate. Previous data with ABX order forms showed that the IND provided by prescribers is often erroneous. This study sought to assess the accuracy of IND documentation as well as prescriber perceptions of the indication requirement at our institution.

Methods. Patients who received ≥ 1 dose of ceftriaxone, ciprofloxacin, ertapenem, oxacillin, piperacillin/tazobactam, or vancomycin from May 1, 2017 to June 30, 2017 were identified. The electronic medical records of 30 randomly selected patients who received each study ABX were retrospectively reviewed. Patients receiving multiple ABX were evaluated only once. The primary endpoint was IND accuracy defined as agreement of IND entered during order entry and the IND documented in progress notes at the time of order entry. Secondary endpoints included correlation of entered IND and final diagnosis (DX) for empiric ABX and IND accuracy according to prescribing service and specific IND. A brief survey was emailed to prescribers to assess the burden and perceptions of requiring an IND during order entry.

Results. A total of 4,524 patients received ≥ 1 dose of a study ABX. Of the 180 patients selected for evaluation, 89.4% of INDs were accurate. 51.7% of ABX were classified as empiric, 41.1% as definitive, and 7.2% as prophylactic. ABX entered as prophylaxis were more likely to be inaccurate than empiric or definitive ABX (46%, 94%, 92%, respectively, $P < 0.05$). For empiric ABX, 78.5% of INDs documented at order entry matched the final DX. IND accuracy varied among services (81.8–94.7%, $P = \text{NS}$). Of 863 (29%) prescribers, 254 responded to the survey. Respondents felt that documenting the IND took ≤ 10 (33%) or 11–20 seconds (33%). They considered it a

“minor nuisance” (46%) or “occasionally burdensome” (27%). Most (55%) felt it had no impact on their consideration of ABX appropriateness.

Conclusion. With the exception of prophylaxis, the accuracy of ABX IND documented during order entry was sufficiently reliable to assist stewardship efforts. Although IND documentation is perceived as only a minor burden, prescribers attributed minimal beneficial effect on ABX prescribing.

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191. Accuracy of Clinical Indications for Use When Ordering Antibiotics for Cystitis in Community Hospitals

Tina Khadem, PharmD¹; J Ryan Bariola, MD²; ¹Outreach Antimicrobial Stewardship, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania and ²Division of Infectious Diseases, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania

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Background. Documentation of clinical indications of antibiotic use is essential for antimicrobial stewardship programs (ASP) to identify targets for improvement and implement syndrome-specific interventions. In 2016, the Centers for Medicare and Medicaid Services proposed a requirement to document clinical indication at the time of antibiotic order entry. Patient safety organizations also support this requirement. We evaluated the accuracy of clinical indications documented at the time of order entry in a sample of antibiotic orders as part of a system-wide ASP initiative.

Methods. Antibiotic orders with a documented indication of “genitourinary (GU)-cystitis” were retrospectively reviewed in adult, non-neutropenic hospitalized patients at three community hospitals from April to June 2017. Accuracy of the documented indication was evaluated via chart review. Patient demographics, initial antibiotic selection, ordering service, treatment duration, and infectious diseases (ID) involvement were also evaluated. Data pertaining to the appropriate diagnosis of cystitis was adjudicated by an ID physician.

Results. A total of 122 patients treated for “GU-cystitis” were reviewed (66% female, median age 77 years). Overall, only 25% of orders reviewed were consistent with cystitis per documentation in the chart. However, 42% of patients had evidence of a GU infection other than cystitis. Only 16% of patients possessed criteria for diagnosis of cystitis when adjudicated by an ID physician after additional information was obtained from the chart. About 20% of patients had evidence of asymptomatic bacteriuria and 10% of patients did not have a urinalysis and/or urine culture. The majority of patients were initially prescribed a cephalosporin (70%) or fluoroquinolone (16%). The emergency department was responsible for 52% of orders labeled as cystitis.

Conclusion. Cystitis was inaccurately selected as the indication for most of the orders reviewed. To improve accuracy, minimize provider fatigue and provide better utility to ASPs, the list of available indications should be simplified to include broader terms (i.e., GU instead of GU-cystitis). Appropriate diagnosis and treatment of cystitis remains a challenge and a target for improvement for ASPs.

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192. More Low-hanging Fruit: Antibiotic Chelation Drug Interactions

Rachel M Kenney, PharmD¹; Charles T Makowski, PharmD¹; Brian Church, PharmD² and Susan L Davis, PharmD³; ¹Henry Ford Hospital, Detroit, Michigan, ²Henry Ford Health System, Detroit, Michigan, ³Pharmacy Practice, Wayne State University, Detroit, Michigan

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Background. Attainable, low-resource antimicrobial stewardship (AMS) interventions, “low-hanging fruit” can be facilitated by electronic medical record (EMR) enhancements. Oral (PO) fluoroquinolone (FQ) or tetracycline (TCN) coadministration with di- and tri-valent cations reduces antibiotic absorption by up to 75%, is common, and may represent low-hanging fruit. We evaluated concomitant administration and outcomes in a five hospital system before and after an EMR medication safety improvement.

Methods. IRB approved quasi-experiment, emergency (ED) visits and hospital admissions September 2016–February 2017 and September 2017–February 2018. Standard of Care: cations were scheduled 0900 and 2100; FQ and TCN administration instructions stated: “Administer at least 2 hours before or 6 hours after (cations).” Intervention: April 2017 EMR change in the default timing of FQ and TCN to 0630 and 1530 with pharmacy and nurse education. Primary endpoint: coadministration, defined as administration of PO product containing calcium, magnesium, iron, or phosphate binder 2 hours before or 6 hours after PO doxycycline, ciprofloxacin, or moxifloxacin.

Results. A total of 4,414 and 5,231 patients, representing 4,887 and 5,781 encounters, received PO FQ or TCN pre- and post-intervention, respectively. Average age (years) pre: 62.1, post: 61.3. Respiratory infection most common (25% pre, 27% post) followed by genitourinary (13% pre, 12% post). Concomitant administration: 3629/17,702, 20.5% pre vs. 2,184/20,524, 10.6% post ($P < 0.001$), see Table 1. Median hospital length of stay: 3 (0.3, 6) pre, 2.9 (0.3, 5.8) post. Thirty-day all-cause readmission: 28% pre and 27.2% post.

Conclusion. A system-based change to the EMR was effective to reduce the frequency of FQ and TCN chelation interactions by half and represents a low-hanging fruit strategy for AMS programs. Our institution has subsequently employed this strategy to reduce chelation interactions with HIV integrase inhibitors.