LETTERS TO THE EDITOR

Evaluating the Need for Antibiotic Stewardship Prospective Audit and Feedback on Weekends

To the Editor—Initial empiric broad-spectrum antibiotic prescribing is appropriate for many hospitalized patients. However, antibiotic therapy should be tailored once additional information is obtained. The Center for Disease Control and Prevention (CDC) recommends a 72-hour antibiotic timeout after starting antibiotic therapy to determine whether modifications are required, to document indication, and to define a duration of therapy.[1,2] The primary objective of this study was to compare time from initial order placement to antibiotic modification (de-escalation or discontinuation) for initially appropriate empiric antibiotic orders when the 72-hour timeout period fell on weekends versus weekdays.

This single-center retrospective cohort analysis was performed at Michigan Medicine and included patients receiving restricted antimicrobials over a 2.5-week period in May 2016. Patients were included for evaluation if an order was placed for a restricted antimicrobial: meropenem, ertapenem, ceftaroline, ceftolozane/tazobactam, ceftazidime/avibactam, daptomycin, linezolid, quinupristin/dalfopristin, voriconazole, posaconazole, isavuconazole, CMV-IVIG, amphotericin B, inhaled ribavirin, tigecycline, or colistin. Pediatric patients and those that received an antifungal agent for prophylaxis per a transplant or oncology protocol were excluded. The primary objective of the study was to evaluate the days of unnecessary restricted antimicrobial therapy in 2 cohorts: (1) patients for whom orders underwent stewardship review at 72 hours following the start of restricted antibiotics during weekdays and (2) patients for whom the 72-hour timeout period fell on Saturday, Sunday, or Memorial Day. Determinations regarding unnecessary antibiotic use after the 72-hour timeout period included only initially appropriate empiric antibiotic orders.

The antimicrobial stewardship program (ASP) at Michigan Medicine includes 4 full-time equivalents (FTE) for infectious disease (ID) pharmacists (2.75 FTE dedicated to adult patients and 1.25 FTE for pediatric patients), and 1.5 FTE of stewardship support for ID physicians. The ASP implemented a preauthorization process for 16 restricted antimicrobials in 2006, which requires prescribers to page a member of the ASP (or to obtain an official ID consult) for approval 7 days per week between 7:00 AM and 11:00 PM. No approval is required overnight, but a stewardship pharmacist reviews the order during the next business day. A pharmacist member of the antimicrobial stewardship team conducts daily prospective audit and feedback of all restricted agents Monday through Friday to ensure compliance with institutional guidelines and antimicrobial criteria, to facilitate de-escalation when appropriate, and to define the optimal duration of therapy. A daily report of adult patients receiving restricted antimicrobials is entered into a database that is used to track utilization of restricted antimicrobials, to facilitate day-to-day patient follow-up, and to track stewardship intervention. Data obtained during weekends or holidays are not reviewed immediately due to the absence of stewardship services. Instead, these assessments and subsequent changes are delayed until Monday or the next routine week day when stewardship team members are present.

A total of 118 restricted antimicrobial orders were reviewed; 91 were included in the analysis and 27 were excluded. The rate of initial appropriate prescribing was 76 of 91 (83.5%), and all 15 initially inappropriate orders were de-escalated or discontinued. Of the initially appropriate antimicrobial orders, modifications were made to the orders of 23 of 76 patients (30.3%); 10 orders were discontinued and 13 were de-escalated. The mean time to modification was 57.2 hours. The time to appropriate modification was significantly shorter when the 72-hour timeout period occurred during the weekday versus the weekend (41.4 vs 132 hours; $P = .001$). When the 72-hour stewardship review fell on Saturday or Sunday, patients received an average of 3.775 days of unnecessary restricted antimicrobials, compared to when the 72-hour timeout fell on weekdays. This finding extrapolates to 2,257 days of unnecessary restricted antimicrobial therapy annually when stewardship review does not occur on the weekends.

The results of this analysis suggest that stewardship review of initially appropriate empiric antibiotic therapy results in significantly less unnecessary antibiotic days of therapy when the 72-hour timeout falls on weekdays versus weekends (ie, when ASP review does not occur). Extrapolation of our brief 2.5-week analysis suggests that the lack of stewardship review on weekends results in 2,257 days of unnecessary restricted antibiotic therapy. To our knowledge, this is the first analysis to quantify the impact of 72-hour stewardship follow-up being limited to weekdays. Previously, Sigfried et al[3] evaluated the impact of implementing a pharmacy-resident driven stewardship review on weekends and compared their results to a historic control period without stewardship review. They demonstrated a numeric reduction in total antibiotic days of therapy with implementation of stewardship services on weekends: 799.3 versus 740.7 days of therapy per 1,000 patient days ($P = .08$).[3]

This study is limited by a brief 2.5-week study period, which is subject to intraprescriber variability; therefore, the extrapolation to annual results may be not be accurate. Part of the study window occurred over a 3-day holiday weekend, which added delays to review and adjustment of therapy. Additionally, our stewardship team followed all restricted antibiotic orders daily Monday through Friday, and we arbitrarily utilized the 72-hour timeout mark to compare weekends versus weekdays. Finally, the impacts on clinical outcomes, resistance, adverse effects, and costs were not assessed.

A 72-hour stewardship review of restricted antimicrobials on weekdays results in significantly fewer unnecessary antimicrobial days of therapy compared to weekends (when the

72-hour review is not performed). Quantifying the impact of stewardship activities on weekends versus weekdays may help programs determine whether stewardship services should be performed 7 days per week, may help quantify the impact of stewardship service performed during the week, and can provide data when additional resources are requested.

Tracelyn Freeman, BS;[1,2]
Greg Eschenauer, PharmD;[1,2]
Twisha Patel, PharmD, BCPS;[1]
Tejal Gandhi, MD;[1,3]
Lindsay Petty, MD;[1,3]
Carol Chenoweth, MD;[1,3]
Maressa Santarossa, PharmD, BCPS;[1]
Jerod Nagel, PharmD[1]

Affiliations: 1. University of Michigan Medicine, Ann Arbor, Michigan; 2. University of Michigan, College of Pharmacy, Ann Arbor, Michigan; 3. University of Michigan, Medical School, Ann Arbor, Michigan.

Address correspondence to Jerod Nagel, 1111 E. Catherine St, Room 300, Ann Arbor, MI 48109 (nageljl@umich.edu).

REFERENCES

1. Core elements of hospital antibiotic stewardship programs. Center for Disease Control website. https://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html. Published 2015. Accessed March 14, 2017.
2. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. *Clin Infect Dis* 2016;62:e51–e77.
3. Siegfried J, Merchan C, Scipione MR, Papadopoulos J, Dabestani A, Dubrovskaya Y. Role of postgraduate year 2 pharmacy residents in providing weekend antimicrobial stewardship coverage in an academic medical center. *Am J Health Syst Pharm* 2017;74: 417–423.

Bedside Registered Nurse Roles in Antimicrobial Stewardship: A Survey of Acute-Care Hospitals in Los Angeles County

To the Editor—Recent literature suggests that current activities of bedside registered nurses (RNs) can contribute to antimicrobial stewardship; however, roles and capability have not been closely assessed. In November 2015, we surveyed all Los Angeles County (LAC) acute-care hospitals (ACHs) to capture bedside RN roles and to determine the antimicrobial-related education and training hospitals provide them.

An online survey was created in Google forms. In November 2015, we sent invitation links to all LAC ACH nurse education directors or their designees who could best speak to nurse education and competency. Responses were received by mid-January 2016. The Institutional Review Board (IRB) of the LAC Department of Public Health (DPH) designated this survey as IRB exempt. Question formats included multiple choice, select all that apply, or fill in with text. A single question with several subparts comprised the bulk of the survey. Each subpart listed a different activity or knowledge component related to antimicrobials, which respondents identified as "mandatory/required," "optional/offered," or "not offered" for bedside RNs in their hospital. We combined responses of "mandatory/required" and "optional/offered" to identify topics that hospitals include in bedside RN knowledge and competency. Additional questions included policies related to antimicrobial administration and orders, as well as communication of results. A response rate of the survey was calculated following guidelines provided by American Association for Public Opinion Research (AAPOR) Standard Definitions.[1]

The rate of response to this survey was 36.6%. The 34 hospitals represented in this survey comprise approximately one-third of LAC's 93 ACHs. Most surveys were filled out by Nurse Education Directors (n = 19); however, additional surveys were completed by nurse education designees such as Clinical Nurse Specialists or Bedside Nurse Educators (n = 9), Directors of Nursing (DONs) or Chief Nursing Officers (n = 4), or other nurse administrators (n = 2).

In 33 hospitals that responded (97%), bedside RNs are required to appropriately assess medication allergies prior to an antimicrobial order. In 5 hospitals (14.7%), physicians' antimicrobial orders are entered by bedside RNs most of the time, and in 8 hospitals (23.5%), bedside RNs enter those antimicrobial orders about half the time. In 32 hospitals (94.1%), resources are provided for bedside RNs to educate inpatients about appropriate antimicrobial use, and 22 hospitals (64.7%) required this patient education (Table 1). In 31 hospitals (91.1%), bedside RNs are offered education on or are required to understand the relationship between antimicrobial use and antimicrobial resistance.

ADMINISTERING AND EVALUATING TREATMENT

Overall, 28 hospitals (82.4%) reported that they educate or require their bedside RNs to be competent in identifying broad-spectrum antibiotics; 28 (82.4%) educate or require competency in interpreting culture/susceptibility results; 30 hospitals (88.2%) educate or require bedside RNs to be competent in monitoring therapeutic levels of antimicrobials;