

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.

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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, PharmD¹

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).

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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;

TABLE 1. Nurse Competency and Education Series (n = 34)

Topic of Survey Question	Mandatory/ Required, No. (%) ^a	Optional/ Offered, No. (%) ^b	Not Offered, No. (%) ^c
Educating patients on appropriate antimicrobial use	22 (64.7)	10 (29.4)	2 (5.9)
The relationship between antimicrobial use and antimicrobial resistance	18 (52.9)	13 (38.2)	3 (8.8)
Identification of broad-spectrum antimicrobials	12 (35.3)	16 (47.1)	6 (17.6)
Interpreting culture and sensitivity results from microbiology laboratory results	16 (47.1)	12 (35.3)	6 (17.6)
Monitoring of therapeutic levels of antimicrobials	22 (64.7)	8 (23.5)	4 (11.8)
Treatment specificity of antimicrobials	12 (35.3)	16 (47.1)	6 (17.6)
Antimicrobial medication timing	29 (85.3)	4 (11.8)	1 (2.9)
Prevention of multidrug-resistant organisms	25 (73.5)	8 (23.5)	1 (2.9)
Risk factors for antimicrobial-resistant organisms	22 (64.7)	10 (29.4)	2 (5.9)
Knowledge of antimicrobial adverse effects	19 (55.9)	10 (29.4)	5 (14.7)

^aMandatory/Required: "If the topic is required for bedside registered nurse (RN) competency/skills labs/mandatory education."

^bOptional/Offered: "If education on that particular topic is offered to bedside RNs by your facility, but not mandatory."

^cNot offered: "If the education on that particular topic is not made available to bedside RNs."

28 hospitals (82.4%) educate or require competency in antimicrobial treatment specificity.

Survey respondents were asked which members of the patient care team received critical microbiology laboratory results (as defined by the hospital): 31 hospitals (91.1%) reported that the bedside RN was notified, and in 4 (11.8%) of those hospitals, the sole notification was to the bedside RN.

In a "select all that apply" question, we asked respondents to describe how bedside RNs participate in antimicrobial stewardship. Overall, 5 hospitals (14.7%) reported no bedside RN participation in antimicrobial stewardship. In 3 hospitals (8.8%), at least 1 bedside RN is on the antimicrobial stewardship program (ASP) committee; however, in 19 hospitals (55.9%), nursing leadership represents them and no bedside RNs are on the ASP committee. Bedside RNs participate in quality assurance for antimicrobial treatment in 9 responding hospitals (26.5%), and in 3 hospitals (8.8%), they participate on subcommittees that promote antimicrobial stewardship knowledge on their respective units. Finally, in just 1 hospital (2.9%), bedside RNs have an antimicrobial resistance/multi-drug-resistant organisms advisory group.

Literature and experience presume that bedside RNs have a central role in entering orders, administering antimicrobials, and evaluating antimicrobial treatment²⁻⁴; however, nursing roles may be different in each hospital. With this survey, we sought to compare the differences of bedside RN engagement in antimicrobial stewardship and to identify existing opportunities within current nursing roles.

Prior to ordering medications, nurses potentially influence prescribers.⁵ When nurses are educated regarding antimicrobial stewardship and they understand the relationship between antimicrobial use and antimicrobial resistance, they are more likely to question antibiotic orders.^{6,7} The results of this survey demonstrate that bedside RNs frequently enter antimicrobial orders, and thus have at least 1 opportunity to discuss antimicrobial indications with ordering providers. By eliminating untrue allergies, bedside RNs can potentially increase medication options available to inpatients.⁸ Respondents to the survey confirmed that bedside RNs are required to appropriately assess medication allergies.

Bedside RNs have an important role in the administration and evaluation of antimicrobial treatment, and they frequently serve as a communication hub between the patient, physician, laboratory, and pharmacy. They can initiate or support evidence-based interventions for optimal antimicrobial treatment, such as antimicrobial time-outs.⁹ Respondents to this survey reported that bedside RNs are trained to recognize broad-spectrum antibiotics, to consult culture/susceptibility results, to monitor therapeutic levels of antimicrobials, and to assess antimicrobial treatment for appropriateness.

This study had limitations. The rate of response to this survey was 37% (n = 34). Although the survey questions were specific, a nurse education director unfamiliar with antimicrobial stewardship may have misinterpreted questions related to competency in antimicrobial administration and/or evaluation.

Bedside RNs are the frontline staff who administer antimicrobials, and they access the same information that ASPs use to optimize antimicrobial treatment. By empowering bedside RNs, ASPs can potentially achieve increased compliance to and adherence with antimicrobial stewardship activities across all disciplines.

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Crystal D. Cadavid, RN, MSN, PHN, CMSRN, CIC;
Sharon D. Sakamoto, RN, MSN/MPH, PHN;
Dawn M. Terashita, MD, MPH;
Benjamin Schwartz, MD

Affiliations: Department of Public Health, County of Los Angeles, Los Angeles, California.

Address correspondence to Crystal Cadavid, Healthcare Outreach Unit, Acute Communicable Disease Control 313 N Figueroa St, Room 212, Los Angeles, CA 90012 (ccadavid@ph.lacounty.gov).

PREVIOUS PRESENTATION: A preliminary summary of these results were posted on the County of Los Angeles Department of Public Health website (<http://publichealth.lacounty.gov/acd/docs/AntimicrobialsNurseSurvey.pdf>).

Preliminary findings were presented at the local Coastline Chapter of the Association of Professionals in Infection Control and Epidemiology (APIC) March 10, 2016, in Torrance, California.

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Iterative Fecal Microbiota Transplantations for Eradicating Digestive Colonization With Carbapenemase-Producing Enterobacteriaceae: Is It Worth It?

To the Editor—Carbapenemase-producing Enterobacteriaceae (CPE) have emerged as a major source of bacterial resistance, and their dissemination is a serious public health threat.¹ Furthermore, those bacteria can disseminate outside the hospital setting. A large study including 34 hospitals in Spain demonstrated that a significant proportion of patients identified as colonized or infected with CPE during hospitalization probably acquired this organism in a nursing home during the period preceding their hospital admission.² In addition, a

recent review of the literature demonstrated that according to US-based studies, the percentage of CPE isolates that could be associated with the community ranged from 5.6% to 10.8%.³

We have recently demonstrated the less effective effect of fecal microbiota transplantation (FMT) on CPE compared to vancomycin-resistant Enterococci (VRE) fecal carriage.⁴ Those results are consistent with another recent study⁵ conducted in 6 patients colonized with CPE and showing an eradication of the colonization in only 2 of these 6 patients. In these studies, the decolonization procedure included only 1 FMT procedure. One hypothesis is that a protocol including iterative FMT separated by a several-day latency could increase the effectiveness of the procedure.

Our objective was to evaluate the impact of iterative FMT for the clearance of CPE carriage in our mouse model of digestive colonization. Ethical approval was obtained from the Ethical Committee in Animal Experimentation of Pays-de-la-Loire, France (reference no. 2015041415088410/APAFIS 513) and was conducted according to European directives concerning the use of animals in research (86/609/EEC).

In this model, 28 8-week-old mice (Swiss type) were used. The normal digestive flora were disrupted with the daily oral administration of a combination of antimicrobial agents including vancomycin (50 mg/kg), metronidazole (25 mg/kg), and ceftriaxone (25 mg/kg) over 5 days (ie, day 1 to day 5). Mice were then randomized to receive a high inoculum (5×10^9 bacteria) of a strain of *Escherichia coli* producing a New Delhi metallo- β -lactamase-1 (NDM-1). Those bacteria were inoculated to the mice via oral gavage on day 4, day 5, and day 8. Mice were housed in individual cages.

Fecal microbiota were collected daily from related (Swiss mice of the same age) untreated mice. Stool suspensions for FMT were prepared and stored as previously described.⁴ On day 10, mice were randomized to receive FMT (14 mice) or placebo (14 mice). During the experiment, 4 series of FMT or placebo administration were performed on all mice. In each series, the mice received FMT or placebo once daily for 3 successive days (from day 10 to day 12, from day 23 to day 25, from day 37 to day 39, and from day 49 to day 51) by oral gavage with 200 μ L of the stool suspension or 200 μ L of saline, respectively.

Stools were collected 3 times per week until day 57 and were weighed for quantitative cultures. Stool samples were seeded on agar media (ChromID CARBA, bioMérieux, France) after serial dilutions for CPE screening. Bacterial identification of CPE colonies was controlled using matrix-assisted laser desorption/ionization time-of-flight mass spectroscopy (MALDI-TOF MS, Vitek MS, bioMérieux). A mouse was considered decolonized when 3 successive stool samples (corresponding to 4 or 5 days of follow-up) were negative for CPE.

The evolution of the percentage of colonized mice during the follow-up period was studied using Kaplan-Meier analysis (SPSS version 15.0 software, IBM, Armonk, NY). The comparison between the FMT group and the placebo group was performed using the log-rank test. The comparison of the