Resident Physician Prescribing Variability Demonstrates Need for Antimicrobial Stewardship in Continuity Clinic: A Pilot Study

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ABSTRACT

Background Inappropriate antimicrobial use is common in the outpatient setting but often goes unaddressed by stewardship education. Residents might benefit from directed stewardship education.

Objective We conducted a needs assessment of resident knowledge, attitudes, and behaviors regarding antibiotic use and stewardship in outpatient continuity clinics.

Methods Internal medicine (IM) residents with continuity clinic at Minneapolis Veterans Affairs Health Care System were eligible. Antimicrobial prescriptions and number of visits were extracted from the Computerized Patient Record System (July 1, 2017–March 31, 2018). Antimicrobial rate (prescriptions per 1000 visits) was calculated for each resident. Results from a resident survey that included demographics, attitudes, and case-based multiple-choice knowledge questions were linked by unique identifier to antimicrobial rate.

Results Prescription and visit data were available for 37 residents. Mean monthly antimicrobial rate was 51 prescriptions per 1000 visits (range 8–239). Surveys were completed by 19 residents (51%). Respondents were 32% female, 32% interns, and 11% international medical graduates. An online resource was most commonly used for prescribing guidance, whereas lectures and small group sessions for residents were rated as the most helpful educational modalities. Many respondents reported being unprepared to perform basic tasks related to antimicrobial stewardship. Median percentage correct was 57% of case-based knowledge questions (interquartile range 50%–71%).

Conclusions Antimicrobial rates among IM residents at a VA outpatient continuity clinic are low and vary by provider. Residents agree with key antimicrobial stewardship concepts but lack preparation in tasks related to antimicrobial stewardship. Knowledge regarding antimicrobial prescribing was low.

Introduction

The US Centers for Disease Control and Prevention estimates that 50% of outpatient antimicrobial prescriptions are inappropriate and 30% are completely unnecessary.[1] The overuse of antimicrobials is an avoidable contributor to antimicrobial resistance,[2] health care costs,[3] and adverse drug events such as clostridioides difficile infection, allergy, kidney failure, and death.[4–7] Antimicrobial stewardship is a crucial response to antimicrobial overprescribing and its deleterious effects. Stewardship began in the acute setting, but 80% of inappropriate antimicrobial prescribing occurs outpatient.[8] Optimal outpatient stewardship is largely undefined.[9] Inpatient stewardship directed at family medicine and internal medicine (IM) resident physicians improved guideline-concordant prescribing[10]; however, no studies have described similar outpatient programs. IM residents in the United States have reported a high degree of prescribing autonomy,[11] making them a key target for stewardship education.

Antimicrobial stewardship training focused on IM residents is currently limited but relates directly to the Accreditation Council for Graduate Medical Education Milestones.[12] Training focused on clinical knowledge (milestone 6) necessary for antimicrobial stewardship is lacking; one study across multiple residency and fellowship programs found less than 1% of learning topics were related to antimicrobial stewardship except in infectious diseases programs.[13] Similarly, 22% of residents from multiple specialties reported no antimicrobial education within the last year.[14] Several studies using case-based quizzes showed that resident knowledge was poor, with 28% to 60% responding correctly.[14–16] Additionally, 90% of residents reported desiring more antimicrobial education, and 67% desired feedback on their own prescribing.[14]

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Editor's Note: The online version of this article contains the survey used in the study.

Due to the gap in antimicrobial stewardship education directed to resident physicians, we undertook this study. This pilot study describes needs assessment of outpatient antimicrobial stewardship training for IM residents as preparation for educational interventions to manage patients (milestone 3), monitor self-practice (milestone 12), improve systems (milestone 10), and learn via feedback (milestone 15).[12] We assessed a priori the correlation between level of training, site of training, and percentage correct on knowledge questions with antibiotic prescribing.

Methods

All University of Minnesota IM resident physicians with outpatient continuity clinic at the Minneapolis Veterans Affairs Health Care System (MVAHCS) as of July 2017 were eligible for enrollment (n = 37). Continuity clinic at MVAHCS involves a half day of scheduled appointments (no same-day appointments) with access to point-of-care antimicrobial decision support software tied to order entry.

The MVAHCS Institutional Review Board approved the survey as minimal-risk research and exempted prescription monitoring as quality improvement.

All outpatient resident antimicrobial prescriptions were extracted from the Computerized Patient Record System (CPRS) at MVAHCS with those outside of continuity clinic excluded from analysis. Prescriptions were deidentified and recorded monthly. Continuity clinic visits were extracted from CPRS. Antimicrobial rate was calculated as prescriptions per 1000 patient visits averaged over the 9 months of the study. Verbal informed consent was obtained for a paper survey with a unique identifier to link responses with individual prescribing data. Two survey reminder emails were sent.

Measurement Instrument

Survey questions (provided as online supplemental material) were developed with permission from a subset of 75 questions in a published unvalidated study.[16] Twenty-one questions covered demographics (n = 5), attitudes (n = 5), and stewardship knowledge (n = 11). Attitude questions, unaltered from the previous survey, rated 39 statements regarding antimicrobial stewardship, terminology, and educational resources via 5-point Likert scales. Knowledge questions were brief clinical vignettes with multiple choice answers designed based on Infectious Diseases Society of America guidelines when available[17,18] to span antimicrobial stewardship concepts such as spectrum of activity, de-escalation of empiric antimicrobials, and effective use of laboratory testing. These questions were reviewed by 4 infectious disease specialists, an infectious disease fellow, and an epidemiologist involved in statewide antimicrobial stewardship initiatives who provided feedback, modified, and came to consensus on the final survey items. The survey was pretested with several chief residents to determine administration time and clarify ambiguous wording.

Statistical Analysis

Responses were characterized by descriptive statistics. Correlations between antibiotic prescribing rate, percentage correct, and demographic variables were chosen a priori, with a *P* value of .05 considered to be significant, and calculated using Pearson's correlation coefficients in SAS 9.4 (SAS Institute Inc, Cary, NC).

Results

All 37 IM residents at the site participated from July 1, 2017 to March 31, 2018. Mean antibiotic prescribing rate was 51 of 1000 patient visits (range 8 to 239). During 3604 patient visits, 182 individual antimicrobials were prescribed. Residents saw 1 to 6 patients per half-day session. On average, each resident prescribed 5 antimicrobials during the 9-month period. The most common antibiotics prescribed were doxycycline (n = 41), acyclovir (n = 15), then amoxicillin, azithromycin, and valacyclovir (n = 12 each). The median duration for antimicrobials was 10 days, and the mode was 5.

Nineteen of 37 residents responded to the survey (51%). Mean age was 30 years (range 26–35). There were 6 female respondents (32%). Respondents were in postgraduate year 1 (32%, 6 of 19), 2 (26%, 5 of 19), and 3 (42%, 8 of 19). Two respondents completed medical school internationally (11%, 2 of 19). Respondent attitudes are presented in the FIGURE. Forty-seven percent of respondents (9 of 19) felt they could easily explain the term "antimicrobial stewardship," while 53% (10 of 19) reported a general sense of what the term meant.

Of 11 knowledge questions, the median percentage correct was 57% (interquartile range 50%–71%). Variation in correct answers to individual questions was high. All respondents answered 2 questions (PO to IV conversion and perioperative antibiotics) correctly. There was one correct response to a question assessing guideline-concordant vancomycin use. Knowledge of mechanisms of resistance to antimicrobials was low (21%–47% correct).

Advancing level of training did not correlate with antimicrobial prescribing rates. Interestingly, increased training level correlated with decreased

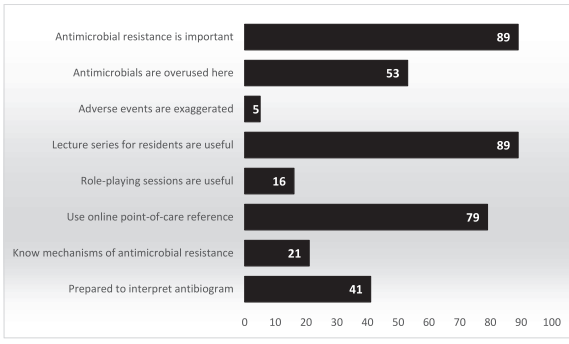

FIGURE
Attitudes Toward Antimicrobial Stewardship
Note: All numbers displayed are percentages of respondents (n = 19).

percentage correct on knowledge questions ($P = .010$). Site of medical school training had no correlation with antimicrobial rate or percentage correct on knowledge questions. Antimicrobial prescribing rates did not correlate with percentage correct on knowledge questions.

Discussion

Antimicrobial prescribing rates varied widely among resident physicians; however, on average, antimicrobial prescription rate was 51 per 1000 patient visits. No previous studies have found such a low prescribing rate. An appropriate rate of prescribing in resident clinic is unknown. A study of outpatient general IM clinics found that nationally the antibiotic prescription rate is 506 per 1000 patient visits.[1] A 1-day continuity clinic on a fixed day may not be a common place for patients to present with acute infections, due to availability of same-day walk-in clinics and the emergency department at MVAHCS. Antimicrobial prescription rates are likely affected by a multitude of variables, but in our study did not correlate with level of training, medical school site, or knowledge. However, our small numbers may not provide enough power to detect these correlations.

Assessing knowledge, attitudes, and prescribing rates was the first step toward an educational program for IM residents to begin outpatient antimicrobial stewardship education at MVAHCS. We found that IM residents have low knowledge, agree with antimicrobial stewardship concepts, and desire additional knowledge. Low knowledge (61% correct) is consistent with other studies of resident knowledge, which reported scores of 28%–60%.[14–16] Correct responses varied by topic, with topics such as mechanisms of antibiotic resistance presenting challenges for many respondents. These apparent knowledge gaps provide targets for further educational interventions. Possible interventions include small group skills sessions, academic detailing, and prospective audit and feedback.

Limitations of this study include the small sample of participants from a single site over a short time period. Survey data were obtained through self-report and also based on an unvalidated survey adapted from a previously published 75-question survey instrument.[16] Our population and clinic type limits application of this study to other clinic settings, which may be more heterogeneous and have more acute infectious visits (no walk-in or same-day appointments available). Resident physicians work with multiple attending physicians who may also influence resident prescribing.

Conclusions

Antimicrobial prescribing in an IM resident VA clinic was variable and lower than expected. Although residents agree with many antimicrobial stewardship concepts, they feel unprepared for specific tasks. Knowledge regarding antimicrobial prescribing was similar to other studies at 61% correct.

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