

resistant pathogens. Antibiotics are also responsible for a high percentage of emergency department visits for adverse drug events. Despite this, ambulatory and urgent care providers often cite patient expectations as a reason for inappropriate antibiotic prescribing practices. We investigated patient and community understanding of antibiotics and antimicrobial resistance to inform how they can be engaged as partners in combating antimicrobial resistance in our southwestern Virginia community. **Methods:** From July to September 2023, we conducted an online survey of patients and community members within the footprint of a large healthcare system in Southwest Virginia. Electronic medical records were used to randomly select and directly email the survey link to a representative sample of ambulatory patients who met criteria. Respondents were also recruited through the health system's social media channels and through posters with quick response (QR) codes in outpatient offices. The survey used Likert scales and multiple-choice questions to understand experiences with and perceptions about antibiotics and antimicrobial resistance. We conducted a descriptive analysis of survey responses. **Results:** In total, 2,021 individuals completed the survey. Nearly 16% of respondents agreed with the statement "antibiotics can kill viruses" and almost 12% more were unsure. Thirty percent of respondents either agreed with or were unsure about the statement "antibiotics work on most coughs and colds". When asked more directly about antimicrobial resistance, almost a quarter (25%) of respondents agreed with or were unsure about the statement "there is no connection between taking antibiotics and the development of resistant bacteria". Responding to questions about possible negative effects of antibiotics, over 9% disagreed with the statement "antibiotics can kill the 'good' bacteria that normally live on the skin and in the gut" and another 19% were unsure. Similarly, over 20% disagreed with or were unsure about

the statement "bacteria that do not respond to antibiotics could infect me or my family". Reflecting on their own providers, nearly 83% of respondents trusted their doctor's or nurse's advice about antibiotic necessity. **Conclusions:** There are opportunities for patient and community engagement around antibiotic effectiveness for common viral illnesses and about the negative effects of overuse of antibiotics. Our data suggests most patients trust their providers as it relates to antibiotic prescribing and may be receptive to discussions and strategies that promote antimicrobial stewardship.

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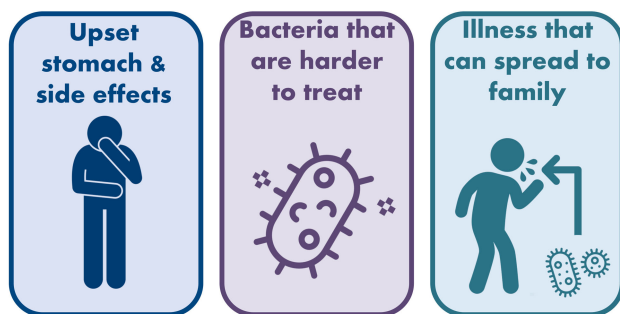
Teaching Antimicrobial Decision-Making in Medical Education: A Qualitative Study

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Background: Inappropriate use of antimicrobials contributes to the growing threat of antibiotic resistance. While physicians encounter infections in virtually every facet of medical practice, research has shown that physicians have difficulty determining the need for antimicrobials and choosing the right drug. Physicians' difficulties with antimicrobial prescribing likely begin early in medical education, yet little is known about how medical students learn to make antimicrobial choices. Our study sought to better understand how medical students learn antimicrobial decision-making, including the impact of a new learning tool introduced in the Infectious Diseases (ID) and Microbiology preclinical course. **Method:** From 2021–2023, we conducted 18 individual interviews with a purposive sample of medical students at the University of Michigan who had taken the preclinical ID/Microbiology course during the 2019–2021 curricular years. We asked participants how they learned to make antimicrobial decisions and how the course and clinical rotations influenced their understanding of antimicrobial choice. The six participants who took the 2021 course were additionally asked how an antimicrobial decision-making tool introduced that year impacted that process (Figure 1). The tool was adapted from prior work on antimicrobial reasoning (Abdoler et al, 2020). Participants were asked whether they remembered being introduced to the tool (approximately 18 months prior) and if they utilized it during their clinical rotations. Results were analyzed using Dedoose Software to facilitate thematic analysis. **Result:** Several themes emerged on analysis. Nearly

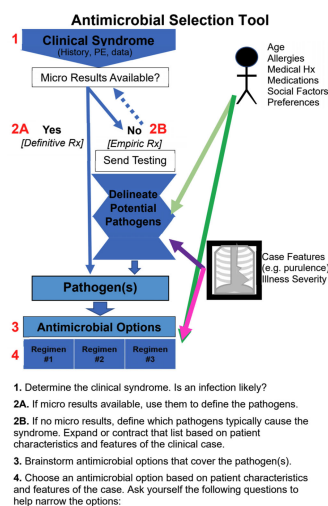
ANTIBIOTICS – WHAT COULD IT HURT?

The following are potential issues caused by unnecessary antibiotic usage:



Avoiding unnecessary antibiotic usage reduces risks and helps keep our medicines working for future generations

This is all part of Carilion's commitment to provide the best treatment for your community, its patients, and you



In the context of this patient & infection, does the antimicrobial regimen:

- pose excessive risks to the patient in terms of adverse effects?
- interact with the patient's other meds?
- have adequate absorption?
- go to the site of infection?
- have a route optimal for this patient (IV, PO)?
- need dose adjustment for liver/kidney function?
- have too frequent dosing for the patient to adhere to? (i.e. TID, QID)
- involve too many pills (excessive pill burden)?
- have data for efficacy in this clinical situation?
- have broader spectrum than necessary?
- have availability & affordability?
- pose risks in pregnancy/lactation (if applicable)?

Resources for Managing Infections

-On the clinical homepage, antimicrobial stewardship guidelines: <https://www.msd.umich.edu/asp/index.html>

- IDSA guidelines
- CDC guidelines
- For antimicrobial dosing: Lexicomp, Micromedex, etc.

all participants reflected that they learned elements of antimicrobial decision-making during clinical rotations, through observation or direct interaction with physician mentors and patients. Several participants described the preclinical period as content learning, with clinical rotations providing a space to consolidate and scaffold knowledge, as well as transfer knowledge to new situations or tasks. Of the 6 students interviewed regarding the antimicrobial decision-making tool, only one remembered it and could accurately describe its components prior to being shown the tool during the interview. **Conclusion:** Results suggest that participants view the pre-clinical ID/Microbiology course primarily as an opportunity to learn content, and perceive learning antimicrobial decision-making directly from practicing physicians in the clinical portion of medical school. An antimicrobial decision-making tool introduced during the preclinical ID/Microbiology course in 2021 did not impact students' conceptualization of how they learned this skill. Given that practicing physicians often make antimicrobial prescribing errors, regular re-introduction of the tool during clinical rotations may help bridge preclinical antimicrobial educational content to the clinical phase of learning, counteract inappropriate antimicrobial lessons encountered clinically, and ground students' burgeoning antimicrobial prescribing skills in a logical reasoning model.

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Outcomes in Patients with Untreated Versus Treated Asymptomatic Bacteriuria within 5 Veterans Affairs Facilities

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Background: Asymptomatic bacteriuria (ASB) is often treated with antibiotics despite recommendations against screening for and treating ASB in most populations. Some providers cite concern for progression of ASB to a symptomatic urinary tract infection (UTI) as the justification for antibiotic use. While the 2019 Infectious Diseases Society of America (IDSA) ASB guidelines refute this concern, most evidence is derived from studies done in females, potentially limiting external validity. The purpose of this study is to compare the outcomes of patients with ASB who received antibiotic treatment versus those who did not in a primarily male population. **Methods:** This is a multi-center, retrospective, cohort study conducted by the 5 sites within the Veterans Affairs MidSouth Healthcare Network. Patients with a positive urine culture (defined as cultures with a colony forming unit count >100,000) collected from January 1, 2021 through December 31, 2021 were identified. ASB was determined via chart review using pre-determined criteria (positive culture in the absence of reported or documented signs or symptoms attributable to UTI as defined by the 2019 IDSA ASB guidelines). Additional data collected included antibiotic use, clinic visits and hospital admissions related to UTI or sepsis from a UTI. The primary outcome was the comparison of UTI incidence at 30 days, 6 months, and 1 year in those untreated versus treated with antibiotics. Secondary outcomes included a comparison of admissions with sepsis from UTI and adverse drug reactions (ADRs) between the cohorts. Continuous data were analyzed using a Student's t-test. Discrete data were analyzed using either a Chi-squared or Fisher's exact test. **Results:** The study population was primarily elderly (73 years, range 27-99 years) and male (79.7%). Of the 281 patients with ASB, 127 (45.2%) and 154

(54.8%) were untreated and treated, respectively. The incidence of UTI was 3% versus 1% ($p = 0.41$) at 30 days, 10% versus 12% ($p = 0.61$) at 6 months and 11% versus 12% ($p = 0.94$) at 12 months in the untreated and treated cohorts, respectively. There was no difference in admissions for UTI, sepsis from UTI or ADRs at 30 days. **Conclusion:** This study found no difference in the development of symptomatic UTI in veterans with untreated ASB compared to those treated with antibiotics. These findings align with current ASB guideline recommendations and support avoidance of unnecessary antibiotic use in the veteran population.

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Epidemiology and Duration of Therapy in Patients with Gram-negative Bloodstream Infections: Retrospective Analysis

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Background: Longer courses of antibiotics can be associated with antimicrobial resistance and adverse effects. Randomized clinical trials support treating gram-negative bloodstream infections (GN-BSI) for a shorter duration with a consensus that a seven-day course of antibiotics is appropriate for uncomplicated GN-BSI. Prior to the implementation of a GN-BSI treatment guideline at our institution, we aimed to evaluate the characteristics of patients with GN-BSI and the duration of antibiotic therapy (DOT). **Method:** We retrospectively reviewed adult inpatients who had a blood culture with at least 1 gram-negative organism within 6 months (November 2022 to April 2023). Patients were excluded if they had a concomitant gram-positive bloodstream infection or if they were transitioned to comfort-focused care within 48 hours of their first positive blood culture. Complicated GN-BSI was defined as exhibiting any of the following: involvement of bone, joint, endovascular system, or foreign body, an inability to achieve source control, immunocompromised status, or failure to demonstrate clinical improvement or culture clearance within 72 hours. The primary outcome of this study was the mean DOT in patients with GN-BSI. **Result:** 100 patients met the inclusion criteria. *Escherichia coli*, identified in 54 cases, emerged as the most frequent organism. Urine (41) was the predominant source of bacteremia. Cefepime (48) was the most common empiric agent used. Of the 91 patients with available ceftriaxone susceptibility results, 84% had a susceptible organism. Amongst the 51 patients classified as having a complicated GN-BSI, the leading reason was immunosuppression. Table 1 presents a comparative analysis of complicated vs. uncomplicated GN-BSI. The average DOT for complicated GN-BSI was longer than the uncomplicated infections (20 vs. 11 days, $P < 0.005$). Additionally, fewer patients transitioned to oral therapy in the complicated group (33% vs. 67%, $P < 0.005$). **Conclusion:** At our institution, patients with uncomplicated GN-BSI have a shorter DOT and are more likely to transition to oral therapy than those with complicated GN-BSI. However, the mean DOT for uncomplicated infections remained longer than seven days and a large number of uncomplicated GN-BSI patients did not transition to oral therapy, indicating room for improvement in local practice through antimicrobial stewardship initiatives.

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Table 1. Complicated vs. Uncomplicated Gram-negative Bloodstream Infections

	Total (N=100)	Complicated GN-BSI (N=51)	Uncomplicated GN-BSI (N=49)
DOT in days- mean (SD)	15 (10)	20 (12)	11 (3)
Transition to oral therapy -no. of patients (%)	50 (50%)	17 (33%)	33 (67%)
Infectious Diseases Consulted- no. of patients (%)	59 (59%)	37 (73%)	22 (45%)