

# Appropriateness of Antibiotic Prescribing in Patients Discharged From a Community Hospital Emergency Department

By **Emily L. Bauman**, PharmD<sup>♦◇</sup>, **Justine M. Russell**, PharmD<sup>◇</sup> & **Angela R. Morelli**, PharmD<sup>◇</sup>

DOI: 10.33940/data/2022.1.1

## Abstract

**IMPORTANCE:** Every year, thousands of emergency department (ED) visits result in patients being discharged with oral antibiotic prescriptions. Published studies that assess the appropriateness of these antibiotic regimens are limited.

**PURPOSE:** The purpose of this study was to examine the appropriateness of antibiotic prescriptions written for patients discharged from a community hospital's ED.

**ENDPOINTS:** The primary objective was to determine the overall percent of appropriate antibiotic prescriptions for patients discharged from the ED. Secondary objectives included the following: identify reasons for inappropriateness categorized by antibiotic selection, dose, duration, and allergies; identify the most common antibiotics prescribed inappropriately as well as the most common disease states that led to inappropriate prescribing of antibiotics; and analyze prescribing trends based on provider type and time of day the prescription was written.

**STUDY DESIGN AND METHODS:** Patients eligible for inclusion were adults age 18 and older who presented to the ED during four chosen weeks in 2019 and who were discharged with oral antibiotics. Extracted electronic health record data was reviewed to identify the discharge diagnosis for each patient

that met the inclusion criteria. Pertinent information gathered from the patients' medical records along with a validated antimicrobial assessment tool were utilized to determine the level of appropriateness of the prescribed antibiotic regimens.

**RESULTS:** A total of 76% of the prescribed antibiotics were appropriate, 16% were inappropriate, and the remaining 8% were not assessable. Duration was the most common reason for a regimen to not be optimal. The most frequently inappropriately prescribed antibiotics included cephalexin (but it is noted cephalexin was included in almost half of the antibiotic regimens in this study), clindamycin, and azithromycin. Infections that were most frequently treated inappropriately were skin and soft tissue infections, dental infections, and sinusitis. Overall, medical residents prescribed the highest percent of appropriate regimens, and the time of day that had the highest percent of appropriate prescriptions was third shift (11 p.m. to 7 a.m.).

**CONCLUSION AND RELEVANCE:** Almost half of all the nonoptimal antibiotic regimens had an excessive duration. Targeted local education efforts and future clinical decision support can facilitate appropriate prescribing of discharge antibiotics from the ED, ultimately improving antimicrobial stewardship within the community.

**Keywords:** *emergency room, emergency department, emergency medicine, antibiotic prescriptions, oral antibiotics, discharge antibiotics, antimicrobial stewardship*

<sup>♦</sup>Corresponding author

<sup>◇</sup>Saint Vincent Hospital

Disclosure: The authors declare that they have no relevant or material financial interests.



**A**ntibacterial resistance is one of the most urgent threats to public health and it arises from the inappropriate prescribing of antibiotics. According to the Centers for Disease Control and Prevention (CDC), more than 2.8 million antibiotic resistant infections occur each year in the United States, leading to thousands of deaths. Inappropriate use of antibiotics can lead to additional complications for patients such as *Clostridioides difficile* infections, requiring hospitalization.<sup>1</sup> According to the CDC, a large number of prescribed antibiotics come from outpatient services, including emergency departments (EDs). In 2018, 13.1 million antibiotic prescriptions were written by emergency medicine physicians in the United States, comprising approximately 20% of the total outpatient antibiotic prescriptions written in the country.<sup>2</sup> Knowing that a large number of prescribed outpatient antibiotics are from EDs, it is important for them to be as appropriate as possible to minimize antibiotic resistance and antibiotic complications.

Overall, there is not an abundance of research analyzing the appropriateness of prescribed antibiotics for patients discharged from an ED. There are few existing studies that provide context in regard to specific infections that tend to be treated inappropriately and which antibiotics are prescribed often.<sup>3-5</sup> The objective of this study was to gain further insight about the antibiotic prescribing habits of ED providers for patients discharged from the ED in a community hospital.

## Purpose

The purpose of this study was to examine the appropriateness of antibiotic prescriptions written for patients discharged from a community hospital's ED and to identify opportunities to facilitate appropriate prescribing of antibiotics upon discharge from the ED.

## Study Design and Methods

This study was a retrospective chart review of patients discharged from the ED with oral antibiotic prescriptions during four chosen weeks in 2019 (February 10 through February 16, May 5 through May 11, August 11 through August 17, and November 17 through November 23). These weeks were chosen to minimize seasonal influence, as well as any variation in ED staffing. Inclusion criteria were patients being age 18 or older.

The primary objective was to determine the overall percent of appropriate antibiotic prescriptions for patients discharged from the ED, which is composed of 41 beds and has approximately 58,000 visits annually. Secondary objectives included identifying reasons for inappropriateness categorized by antibiotic selection, dose, duration, and allergy history; identifying the most common antibiotics prescribed inappropriately as well as the most common disease states that led to inappropriate prescribing of antibiotics; and analyzing prescribing trends based on provider type and time of day the prescription was written. This study focused on the appropriateness of the antibiotic regimens for the indications described in the medical records, rather than whether or not antibiotics were indicated.

After institutional review board (IRB) approval was obtained, two pharmacists independently reviewed and assessed the electronic health record (EHR) data extraction for each included patient. When necessary, progress notes and discharge diagnoses in the patient charts were reviewed to determine the indication for antibiotics along with the prescribed antibiotic dose, frequency, and duration. Factors that influence the dosing of antibiotics were evaluated; these include weight and the most recent serum creatinine values if obtained within the past 30 days of the ED visit. If no serum creatinine values were available, the standard, recommended antibiotic dosing was considered most appropriate. Using the patient's weight and creatinine values, the most appropriate dose of the antibiotic was determined using a combination of

“

**Continual quality improvement initiatives and monitoring are imperative to the core principles of antimicrobial stewardship.**

**Table 1.** Utilized Guidelines

Diagnosed Infection	Guideline Title	Year Guideline Published*
<i>Clostridium difficile</i> infection	Clinical Practice Guidelines for <i>Clostridium difficile</i> Infection in Adults and Children: 2017 Update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA) <sup>6</sup>	2018
Community-acquired pneumonia	Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults <sup>7</sup>	2007
COPD exacerbation	Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease (2018 Report) <sup>8</sup>	2018
Dental infection	Evidence-Based Clinical Practice Guideline on Antibiotic Use for the Urgent Management of Pulpal- and Periapical-Related Dental Pain and Intraoral Swelling: A Report From the American Dental Association <sup>9</sup>	2019*
Diabetic foot infection	2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections <sup>10</sup>	2012
Intra-abdominal infection	Diagnosis and Management of Complicated Intra-Abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America <sup>11</sup>	2010
Lyme disease	The Clinical Assessment, Treatment, and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis: Clinical Practice Guidelines by the Infectious Diseases Society of America <sup>12</sup>	2006
Rhinosinusitis	Executive Summary: IDSA Clinical Practice Guideline for Acute Bacterial Rhinosinusitis in Children and Adults <sup>13</sup>	2012
Sexually transmitted diseases	Sexually Transmitted Diseases Treatment Guidelines, 2015 <sup>14</sup>	2015
Skin and soft tissue infections	Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America <sup>15</sup>	2014
Streptococcal pharyngitis	Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America <sup>16</sup>	2012
Urinary tract infections	International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases <sup>17</sup>	2010

\*The most updated guidelines prior to January 2019 were used for this evaluation.

\*Note: These are the first published guidelines from the ADA, which were not available until November 2019.

appropriate guidelines if available, the institution’s antimicrobial guide, and Lexicomp<sup>a</sup>. The determined appropriate dose was compared to the prescribed dose to see if there were any differences. The guidelines that were utilized can be found in **Table 1**.

Allergies listed in the patient chart were also utilized in determining overall appropriateness. Other information that was gathered included the type of provider that prescribed the antibiotics, the time of day the antibiotic prescriptions were written, whether guidelines existed for the bacterial infection, if the prescribed regimen followed the guideline recommendations, if the prescribed regimen provided too broad of coverage or provided coverage overlap, and if the prescribed regimen was likely to treat the causative pathogen.

Antibiotic appropriateness was determined by using the validated National Antimicrobial Prescribing Survey (NAPS) tool, which can be seen in **Figure 1**. There are five defined levels of appropriateness according to this tool: level one is optimal, level two is adequate, level three is suboptimal, level four is inadequate, and level five is not assessable. Levels one and two are classified as appropriately prescribed antibiotics, and levels three and four are classified as inappropriately prescribed antibiotics.

If there was any discrepancy between the pharmacist designations of the antibiotic appropriateness of the antibiotic regimen, an emergency medicine or infectious diseases physician reviewed the chart to make the final decision on antibiotic regimen appropriateness.

<sup>a</sup> Lexicomp is a subscription-based online database containing information about clinical drugs, including practice guidelines, interaction checkers, patient education, and other medication-related resources.

**Figure 1. National Antimicrobial Prescribing Survey (NAPS) Tool<sup>18</sup>**

Appropriateness		If endorsed guidelines are present	If endorsed guidelines are absent or not applicable
Appropriate	1	Optimal*	Antimicrobial prescription follows either the Therapeutic Guidelines <sup>^</sup> or endorsed local guidelines optimally, including antimicrobial choice, dosage, route, and duration <sup>#</sup> , including for surgical prophylaxis  The antimicrobial prescription has been reviewed and endorsed by a clinician with expert antimicrobial prescribing knowledge <sup>§</sup> <b>OR</b> The prescribed antimicrobial will cover the likely causative pathogen(s) and there is not a narrower spectrum or more appropriate antimicrobial choice, dosage, route, or duration available (including for surgical prophylaxis)
	2	Adequate	Antimicrobial prescription does not optimally follow the Therapeutic Guidelines <sup>^</sup> or endorsed local guidelines, including antimicrobial choice, dosage, route, or duration <sup>#</sup> ; however, is a reasonable alternative choice for the likely causative or cultured pathogens <b>OR</b> For surgical prophylaxis, as above, and duration <sup>#</sup> is less than 24 hours  Antimicrobial prescription, including antimicrobial choice, dosage, route, and duration <sup>#</sup> , is not the most optimal; however, is a reasonable alternative choice for the likely causative or cultured pathogens
Inappropriate	3	Suboptimal	Antimicrobial prescription, including antimicrobial choice, dosage, route, and duration <sup>#</sup> , is an unreasonable choice for the likely causative pathogen(s), including: Spectrum excessively broad or an unnecessary overlap in spectrum of activity <b>OR</b> There may be a mild or non-life-threatening allergy mismatch
	4	Inadequate	Antimicrobial prescription, including antimicrobial choice, dosage, route, or duration <sup>#</sup> , is unlikely to treat the likely causative or cultured pathogens <b>OR</b> An antimicrobial is not indicated for the documented or presumed indication <b>OR</b> There may be a severe or possibly life-threatening allergy mismatch
	5	Not assessable	The indication is not documented and unable to be determined from the notes <b>OR</b> The notes are not comprehensive enough to assess appropriateness <b>OR</b> The patient is too complex, due to multiple comorbidities, allergies, or microbiology results, etc.

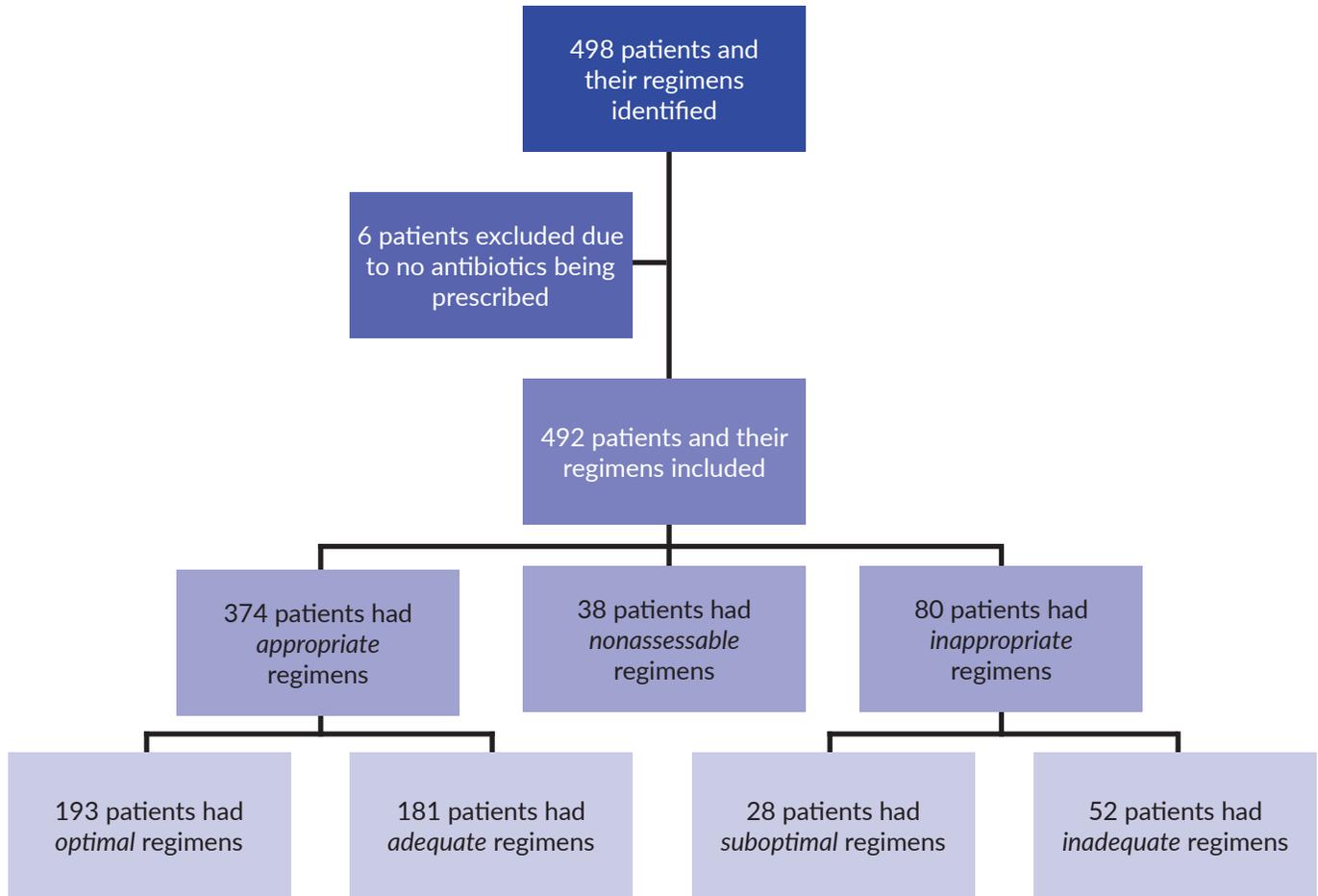
\*Taking into account acceptable changes due to the patient's age, weight, renal function or other prescribed medications, if this information is available.

<sup>^</sup>Antibiotic Expert Group. Therapeutic Guidelines: Antibiotic. Version 15 (2014). <http://online.tg.org.au/ip/>

<sup>#</sup>Duration should only be assessed if the guidelines state a recommended duration and the antimicrobial has already been dispensed for longer than this, or if there is a clear planned "end date" documented.

<sup>§</sup>Examples include infectious diseases physician or registrar, clinical microbiologist or registrar, or specialist pharmacist.

**Figure 2. Patient Flowchart**



**Table 2. Reasons Why Antibiotic Regimens Were Considered Nonoptimal**

Reason	Number of patients (%) (n=261*)
Excessive Duration	157 (46)
Inappropriate Antibiotic	103 (30)
Inappropriate Frequency	66 (19)
Inappropriate Dose	12 (4)
Allergy to Selected Antibiotic	2 (1)

\*Patients/regimens may have been included in more than one category.

**Table 3. Antibiotics Prescribed Inappropriately**

Antibiotic	Number of Prescriptions (%) (n=80 patients*)
Cephalexin <sup>‡</sup>	17 (19)
Clindamycin	15 (17)
Azithromycin	10 (11)
Amoxicillin/Clavulanate	9 (10)
Doxycycline	9 (10)
Penicillin V Potassium	8 (9)
Amoxicillin	7 (8)
Sulfamethoxazole/Trimethoprim	5 (6)
Metronidazole	3 (4)
Cefuroxime	2 (2)
Ciprofloxacin	2 (2)
Cefdinir	2 (2)

\*Patients/regimens may have included more than one prescription.

<sup>‡</sup>Cephalexin was prescribed most often (218 of 492 patients, 44% of all antibiotics).

**Table 4.** Infections Treated Inappropriately

Infection	Number of Diagnoses (%) (n=80 patients*)
Skin and Soft Tissue	27 (31)
Dental	25 (29)
Sinusitis	10 (12)
Bronchitis	7 (8)
Pneumonia	4 (5)
Acute Otitis Media	4 (5)
COPD Exacerbations	2 (2)
Pharyngitis	2 (2)
Urinary Tract	2 (2)
Sexually Transmitted	2 (2)
Asthma Exacerbations	1 (1)
Unspecified Upper Respiratory Tract	1 (1)

\*Patients/regimens may have included more than one prescription.

## Results

### Primary Objective:

A total of 498 patients and their antibiotic regimens were identified through the EHR report. Six of those patients were excluded due to no discharge antibiotics being prescribed during their ED visits, leaving 492 patients to be included in the evaluation. The breakdown of these patients and the designation of their respective regimens are displayed in **Figure 2**.

### Secondary Objectives:

The 261 patients who had nonoptimal regimens were categorized by reasons as to why they were not optimal, which included excessive duration of the prescribed regimen, inappropriate antibiotic choice, inappropriate frequency, inappropriate dose, and allergy to the selected antibiotic as displayed in **Table 2**.

A total of 80 patients had inappropriate discharge antibiotic regimens. All of the antibiotics found to have been prescribed inappropriately are listed in **Table 3**. The treated infections of each inappropriate regimen were examined to discover which were most frequently treated inappropriately and are listed in **Table 4**.

The additional secondary objectives were to see if there were prescribing trends based on provider type and time of day the prescriptions were written. When comparing the prescriptions written by advanced practice providers (APPs), residents, and attendings, APPs prescribed 206 regimens, residents prescribed 179 regimens, and attendings prescribed 107 regimens. Residents had the greatest percent of appropriate prescriptions, followed by the attendings and the APPs. These results are displayed in **Figure 3**.

**Figure 3** also illustrates the numbers of appropriate and inappropriate regimens according to time of day the prescriptions were written. 7 a.m. to 3 p.m. was chosen to represent first shift, 3 p.m. to 11 p.m. for second shift, and 11 p.m. to 7 a.m. for third shift. Second shift had the highest number of prescriptions at 214. First shift had 172 written prescriptions, and third shift had 106. Out of the three shifts, third shift had the highest proportion of appropriate regimens, followed by first shift and second shift.

## Discussion

Our evaluation has similar results as compared to a previous study published in 2019.<sup>4</sup> This past study was conducted in Queensland, Australia, where its authors analyzed the appropriateness of the antibiotics prescribed in an ED for both discharged and admitted adults and children. Antibiotic appropriateness was assessed by a panel of experts who used evidence-based guidelines with the same antibiotic assessment tool used in our evaluation (the NAPS tool). Overall, the study found that 63% of the prescribed antibiotics were appropriate, 33% were inappropriate, and 4.5% were not assessable, which are all fairly similar to our results. The most common inappropriately treated infections were dental and ear, nose, and throat infections, which are also similar to what we found.

It is worth noting that our evaluation had similarities to a study published in 2019 that assessed antibiotic selection, administration, and prescribing practices in EDs across a large hospital system.<sup>19</sup> Instead of focusing on which disease states were inappropriately treated and which antibiotics were inappropriately prescribed as we did, the authors focused on simply the most common diagnoses and administered antibiotics.

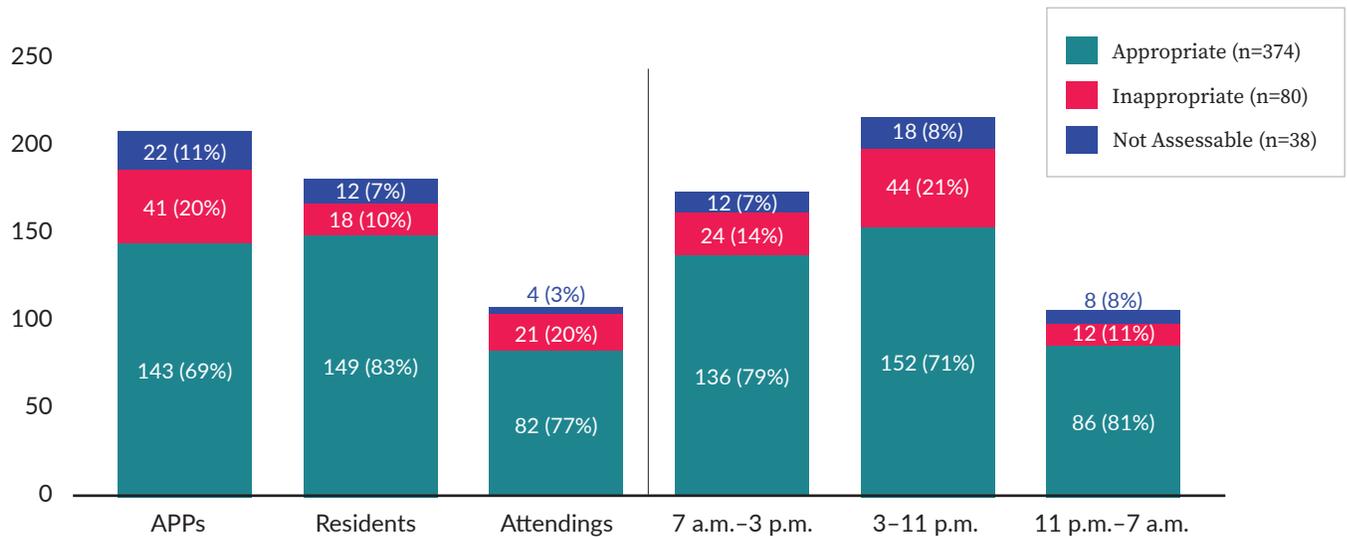
Interestingly, during the conduction of this evaluation, a best practice advice summary from the American College of Physicians was published which emphasized the importance of what we found with this evaluation. It confirms unnecessarily long durations of antibiotic therapy for common bacterial infections, such as acute bronchitis with chronic obstructive pulmonary disease (COPD) exacerbation, community-acquired pneumonia, urinary tract infections (UTIs), and cellulitis, contribute to antimicrobial overuse and resistance.<sup>20</sup>

Continual quality improvement initiatives and monitoring are imperative to the core principles of antimicrobial stewardship. The information from this evaluation was presented to local ED leadership and providers at our community hospital to emphasize the importance of minimizing antibiotic duration of therapy for common infections, noting the tip sheet “Antibiotic Prescribing Tips for Patients Discharged from the ED” we created and distributed among the ED providers (displayed as **Table 5** for reference). We believe residents may have had a slightly higher rate of appropriate prescriptions since they tend to be the population of prescribers that utilize guidelines more often. Third shift’s slight increase of appropriate prescriptions could be due to the fact that fewer prescriptions overall were written during that time of day.

We are hopeful this data will make an impact in overall patient care in our community. This evaluation may lead to the development of clinical decision tools to help providers choose appropriate antibiotic regimens upon discharge (i.e., order set development).

**Figure 3. Providers, Time of Day, and Appropriateness of Prescriptions**

**Number of Prescriptions**



**Table 5. Antibiotic Prescribing Tips for Patients Discharged From the ED\***

<b>Animal Bites<sup>15</sup></b>	<ul style="list-style-type: none"> <li>Preemptive early antimicrobial therapy of 3–5 days is recommended for moderate-severe animal bites.</li> </ul>	<ul style="list-style-type: none"> <li>Preferred prophylactic regimen is amoxicillin/ clavulanate 875/125 mg PO BID x 5 days</li> <li>Doxycycline 100 mg PO BID plus metronidazole 500 mg PO TID x 5 days (<i>only</i> if patient has penicillin allergy)</li> </ul>
<b>Dental<sup>9</sup></b>	<ul style="list-style-type: none"> <li>Antibiotics are <i>only</i> recommended if swelling or abscess is present.</li> <li>Dental caries or poor dentition <i>do not</i> need antibiotics (ADA guidelines).</li> </ul>	<ul style="list-style-type: none"> <li>Amoxicillin 500 mg PO TID x 5 days</li> <li>Penicillin VK 500 mg PO QID x 5 days</li> <li>Clindamycin 300 mg PO QID x 5 days (<i>only</i> if patient has penicillin allergy)</li> </ul>
<b>Lacerations<sup>15</sup></b>	<ul style="list-style-type: none"> <li>Uncomplicated skin lacerations receiving local wound care <i>do not</i> require prophylactic antibiotics</li> </ul>	<ul style="list-style-type: none"> <li>Cephalexin 500 mg PO QID x 5 days (<i>only</i> if signs of infection present)</li> </ul>
<b>Respiratory</b> 1. Bronchitis 2. Pneumonia <sup>7</sup> 3. Sinusitis <sup>13</sup>	<ul style="list-style-type: none"> <li><b>Bronchitis:</b> antibiotics are <i>not</i> typically indicated.</li> <li><b>Pneumonia:</b> use combination therapy for community-acquired pneumonia in patients with chronic conditions (heart, lung, liver, or renal diseases; diabetes; alcoholism; cancer; or asplenia).                             <ul style="list-style-type: none"> <li>Cefuroxime 500 mg PO BID x 5 days plus Z-pak x 5 days</li> </ul> </li> <li><b>Sinusitis:</b> antibiotics not indicated unless symptomatic for at least a week.                             <ul style="list-style-type: none"> <li>Augmentin 875/125 mg PO BID x 5 days</li> </ul> </li> </ul>	
<b>Urinary Tract<sup>17</sup></b>	<ul style="list-style-type: none"> <li>Asymptomatic bacteriuria <i>should not</i> be treated with antibiotics.</li> </ul>	<ul style="list-style-type: none"> <li>Cephalexin 500 mg PO BID x 5 days</li> <li>Nitrofurantoin 100 mg PO BID x 5 days</li> </ul>

\*These tips are based on guideline recommendations but should not be used to preclude patient-specific factors and clinical judgment.

We are hopeful these efforts will impact overall patient care in our community while minimizing the potential for antibiotic misuse. A further evaluation will be necessary to measure local improvement with this initiative.

## Limitations

This was a retrospective evaluation focusing on empiric therapy for the stated diagnoses of each patient. We primarily focused on the appropriateness of the antibiotic regimens prescribed, rather than whether or not antibiotics were indicated. The report obtained from the EHR did not contain handwritten prescriptions.

A large proportion of the patients' charts had limited documentation, making it difficult at times to assess appropriateness. Minor variances between guidelines and institutional recommendations also caused difficulty in assigning a level of appropriateness for a few of the regimens. Due to complexity and limited time, we did not analyze potential drug-drug interactions with the prescribed antibiotics and the patients' home medications.

## Conclusions

Overall, the prescribing habits of ED providers in our community hospital are appropriate but have room for improvement. Almost half of the nonoptimal antibiotic regimens had an excessive duration of therapy. Targeted provider education, competencies, and implementation of clinical decision tools can facilitate appropriate prescribing of discharge antibiotics from the ED, ultimately improving the number of optimal antibiotic prescriptions in the community and combating antimicrobial misuse.

## Acknowledgements

We would like to thank Patricia Salvador, MD, and Jestin Carlson, MD, MS, MHA, for their time and expertise with this evaluation and initiative.

## References

- Centers for Disease Control and Prevention. Be Antibiotics Aware: Smart Use, Best Care. CDC website. <https://www.cdc.gov/patientsafety/features/be-antibiotics-aware.html>. Published 2020. Accessed November 12, 2020.
- Centers for Disease Control and Prevention. Outpatient Antibiotic Prescriptions — United States, 2018. <https://www.cdc.gov/antibiotic-use/community/programs-measurement/state-local-activities/outpatient-antibiotic-prescriptions-US-2018.html>. CDC website. Published 2018. Accessed November 12, 2020.
- Siegel D, Sande MA. Patterns of Antibiotic Use in a Busy Metropolitan Emergency Room: Analysis of Efficacy and Cost-Appropriateness. *West J Med.*

1983;138(5):737–741. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1010818/pdf/westjmed00201-0113.pdf>.

4. Denny KJ, Gartside JG, Alcorn K, Cross JW, Maloney S, Keijzers G. Appropriateness of Antibiotic Prescribing in the Emergency Department. *J Antimicrob Chemother.* 2018;74(2): 515–520. <https://doi.org/10.1093/jac/dky447>.

5. Chua KP, Fischer MA, Linder JA. Appropriateness of Outpatient Antibiotic Prescribing Among Privately Insured US Patients: ICD-10-CM Based Cross Sectional Study. *BMJ.* 2019;364:k5092. <https://doi.org/10.1136/bmj.k5092>.

6. McDonald LC, Gerding DN, Johnson S, Bakken JS, Carroll KC, Coffin SE, Dubberke ER, Garey KW, Gould CV, Kelly C, Loo V, Shaklee Sammons J, Sandora TJ, Wilcox MH. Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults and Children: 2017 Update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA). *Clin Infect Dis.* 2018;66(7). <https://doi.org/10.1093/cid/cix1085>.

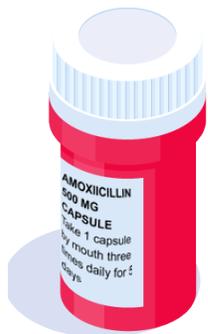
7. Mandell LA, Wunderink RG, Anzueto A, Bartlett JG, Campbell GD, Dean NC, Dowell SF, File TM, Musher DM, Niederman MS, Torres A, Whitney CG. Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults. *Clin Infect Dis.* 2007;44(Supplement\_2). <https://doi.org/10.1086/511159>.

8. Global Initiative for Chronic Obstructive Lung Disease. Global Initiative for Chronic Obstructive Lung Disease: Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease (2018 Report). GOLD COPD.org. [https://goldcopd.org/wp-content/uploads/2017/11/GOLD-2018-v6.0-FINAL-revised-20-Nov\\_WMS.pdf](https://goldcopd.org/wp-content/uploads/2017/11/GOLD-2018-v6.0-FINAL-revised-20-Nov_WMS.pdf). Published 2018. Accessed March 19, 2021.

9. Lockhart PB, Tampi MP, Abt E, Aminoshariae A, Durkin MJ, Fouad AF, Gopal P, Hatten BW, Kennedy E, Lang MS, Patton LL, Paumier T, Suda KJ, Pilcher L, Urquhart O, O'Brien KK, Carrasco-Labra A. Evidence-Based Clinical Practice Guideline on Antibiotic Use for the Urgent Management of Pulpal- and Periapical-Related Dental Pain and Intraoral Swelling. *J Am Dent Assoc.* 2019;150(11). <https://doi.org/10.1016/j.adaj.2019.08.020>.

10. Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJ, Armstrong DG, Deery HG, Embil JM, Joseph WS, Karchmer AW, Pinzur MS, Senneville E. 2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections. *Clin Infect Dis.* 2012;54(12). <https://doi.org/10.1093/cid/cis346>.

11. Solomkin JS, Mazuski JE, Bradley JS, Rodvold KA, Goldstein EJC, Baron EJ, O'Neill PJ, Chow AW, Dellinger EP, Eachempati SR, Gorbach S, Hilfiker M, May AK, Nathens AB, Sawyer RG, Bartlett JG. Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Clin Infect Dis.* 2010;50(2):133–164. <https://doi.org/10.1086/649554>.



12. Wormser GP, Dattwyler RJ, Shapiro ED, Halperin JJ, Steere AC, Klemmner MS, Krause PJ, Bakken JS, Strle F, Stanek G, Bockenstedt L, Fish D, Dumler JS, Nadelman RB. The Clinical Assessment, Treatment, and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis: Clinical Practice Guidelines by the Infectious Diseases Society of America. *Clin Infect Dis*. 2006;43(9):1089–1134. <https://doi.org/10.1086/508667>.
13. Chow AW, Benninger MS, Brook I, Brozek JL, Goldstein EJ, Hicks LA, Pankey GA, Seleznick M, Volturo G, Wald ER, File TM. Executive Summary: IDSA Clinical Practice Guideline for Acute Bacterial Rhinosinusitis in Children and Adults. *Clin Infect Dis*. 2012;54(8):1041–1045. <https://doi.org/10.1093/cid/cir1043>.
14. Sexually Transmitted Diseases Treatment Guidelines, 2015. *Ann Emerg Med*. 2015;66(5):526–528. <https://doi.org/10.1016/j.annemergmed.2015.07.526>.
15. Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJ, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014;59(2). <https://doi.org/10.1093/cid/ciu296>.
16. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, Martin JM, Van Beneden C.. Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2012;55(10). <https://doi.org/10.1093/cid/cis629>.
17. Gupta K, Hooton TM, Naber KG, Wullt B, Colgan R, Miller LG, Moran GJ, Nicolle LE, Raz R, Schaeffer AJ, Soper DE. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011;52(5). <https://doi.org/10.1093/cid/ciq257>.
18. National Centre for Antimicrobial Stewardship and Australian Commission on Safety and Quality in Health Care. Antimicrobial Prescribing Practice in Australian Hospitals: Results of the 2015 National Antimicrobial Prescribing Survey. Sydney: Australian Commission on Safety and Quality in Health Care, 2016. <https://www.safetyandquality.gov.au/sites/default/files/migrated/Antimicrobial-prescribing-practice-in-Australian-hospitals-Results-of-the-2015-National-Antimicrobial-Prescribing-Survey.pdf>. Published December 2016. Accessed November 16, 2021.
19. O’Neal F, Kramer J, Cooper M, Septimus E, Sharma S, Burgess, LH. Analysis of Antibiotic Use in a Large Network of Emergency Departments. *Am J Health Syst Pharm*. 2019;76(21):1753–1761. <https://doi.org/10.1093/ajhp/zxz193>.
20. Lee RA, Centor RM, Humphrey LL, Jokela JA, Andrews R, Qaseem A. Appropriate Use of Short-Course Antibiotics in Common Infections: Best Practice Advice From the American College of Physicians. *Ann Intern Med*. 2021;174(6):822–827. <https://doi.org/10.7326/m20-7355>.

## About the Authors

**Emily L. Bauman** (Emily.Bauman@va.gov) is a pharmacist at the Veterans Affairs Medical Center in Erie, Pennsylvania. She graduated from Lake Erie College of Osteopathic Medicine School of Pharmacy in 2020 and finished a PGY1 pharmacy residency at Saint Vincent Hospital in Erie in 2021. Her areas of interest include infectious diseases, internal medicine, and ambulatory care.

**Justine M. Russell** is a clinical pharmacy specialist in emergency medicine at Saint Vincent Hospital in Erie, Pennsylvania, a part of the Allegheny Health Network. She graduated from the University of Pittsburgh School of Pharmacy and completed a PGY1 pharmacy practice residency at Saint Vincent Hospital in Erie. Russell is a board-certified pharmacotherapy specialist and she enjoys teaching pharmacy residents and students the unique needs of the emergency department. Other professional interests include fostering multidisciplinary teamwork and advocating for safe medication practices.

**Angela R. Morelli** is a clinical pharmacy specialist in infectious disease at Saint Vincent Hospital in Erie, Pennsylvania, a part of the Allegheny Health Network. She graduated from Lake Erie College of Osteopathic Medicine School of Pharmacy and completed an acute care PGY1 pharmacy residency at University of Pittsburgh Medical Center Hamot in Erie. Morelli maintains dual board certification in pharmacotherapy as well as infectious disease and serves on the board of Pennsylvania Society of Health-System Pharmacists (PSHP). Her primary areas of interest include antimicrobial stewardship and teaching pharmacy residents and students.

This article is published under the Creative Commons Attribution-NonCommercial license.

