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# Accuracy of Provider-Selected Indications for Antibiotic Orders

**Emily L. Heil, PharmD**[1], **Lisa Pineles, MA**[2], **Poonam Mathur, MD**[3], **Daniel J. Morgan, MD, MS**[2], **Anthony D. Harris, MD, MPH**[2], **Arjun Srinivasan, MD**[4], **Kerri A. Thom, MD, MS**[2], and **CDC Prevention Epicenters**

[1]Department of Pharmacy Science and Practice, University of Maryland School of Pharmacy, Baltimore, Maryland [2]Department of Epidemiology and Public Health, University of Maryland School of Medicine, Baltimore, Maryland [3]Department of Medicine, Division of Infectious Diseases, University of Maryland School of Medicine, Baltimore, Maryland [4]Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia.

## Abstract

Documentation of antibiotic indication provides helpful information for antimicrobial stewardship, but accuracy is not understood. Review of 396 antibiotic orders in a pediatric ICU and adult medicine step-down unit found 90% agreement between provider-selected indication and independent review. Prompts to enter antibiotic indication during order entry provide largely accurate information.

The need for antimicrobial stewardship to optimize the use of antibiotics has garnered national attention with recent regulatory standards from The Joint Commission and the proposed Condition of Participation from the Centers for Medicare and Medicaid Services (CMS).[1,2] Guidance on the implementation of an effective stewardship program has been published by the Centers for Disease Control and Prevention (CDC) in their Core Elements of Hospital Antibiotic Stewardship Programs, as well as guidelines from stakeholder societies.[3,4] A core element of stewardship outlined in these recommendations is documentation of the dose, duration, and indication for all prescriptions. Additionally, in 2011, CMS added “Antibiotic orders [should] include an indication for use” to their surveyor worksheets.[5]

Documentation of indications may help stewardship programs track antibiotic utilization patterns and improve prescribing.[6,7] However, for these indications to be utilized by antimicrobial stewardship programs, there is an assumption that the indication entered reflects the true indication. This assumption can be problematic because antibiotics are often ordered empirically without a definite indication at the time of order, and initial indications are not often updated once a definitive diagnosis has been obtained. Given that hospitals around the country are looking to implement antibiotic indications at the time of order to

Address correspondence to Emily L. Heil, PharmD, 20 N Pine St, N413, Baltimore, MD 21224 (eheil@rx.umaryland.edu).

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meet stewardship standards, the aim of our study was to assess the accuracy of indications in an antibiotic order compared to the indication, or lack thereof, determined by expert review at time of ordering and after 2–3 days.

## METHODS

This study was a subset analysis of the Prevent Antibiotic Overuse (PAUSE) Study:CDC PAR-3, Impact of Post-Antibiotic Prescription Review on Antibiotic Use and Resistance study protocol.[8,9] The PAUSE study was a multicenter, quasi-experimental study that investigated the implementation of a postantibiotic prescription review audit tool (ie, antibiotic time out) on antibiotic utilization. For the current study, patients were included from 2 inpatient units at the University of Maryland Medical Center (UMMC); the Medical Intermediate Care Unit and the Pediatric Intensive Care Unit. Indications for antibiotics upon ordering, selected from a standardized dropdown list, have been a required field in the computerized order entry system at UMMC since 2012. During the first 6 months, an "other" option with free text entry was offered, and the indication list was subsequently updated to include indications that frequently included a free-text response. Indications lists are specific to each antibiotic and are organized by organ system with common infectious syndromes (eg, Respiratory, pneumonia or Respiratory, tracheitis); there is no longer an "other" category or the opportunity to free text an indication. The addition of the indications requirement was an IT-only intervention in our EMR Epic (Verona, Wisconsin), and no specific education was done on how to complete antibiotic indications. This study had 2 phases. In the first phase and as part of the parent study, investigators performed an in-depth review of each medical record to assess antibiotic indication as well as appropriateness between 48 and 72 hours after antibiotic initiation. Each record was reviewed by at least 1 infectious disease physician who was blinded to the order indication.

The antibiotic indication, as assessed by study investigators, was the true indication to be compared with the indication included in the antibiotic order. This analysis looked at the frequency that antibiotic indication chosen by the ordering physician matched the investigator-assessed true indication. To account for discordance that might be attributable to diagnostic information available during the study investigator assessment that was not available at the time of antibiotic order, the second phase of the study involved study investigators completing additional chart review to assess indication at the time of initial order for cases of discordant indications. The University of Maryland, Baltimore, Institutional Review Board approved the study.

## RESULTS

In total, 396 antibiotic orders in 336 patients from April 1, 2015, through December 31, 2015, were reviewed. The most common indication from the order was "Respiratory, pneumonia" (132 of 396, 33.3%) followed by "Bacteremia/Sepsis" (116 of 396, 29.3%) and genitourinary-urinary tract infection, "GU-UTI" (29 of 396, 7.3%). The most common indications as assessed by the study team were the same; "Respiratory, pneumonia" (152 of 396, 38.4%), "Bacteremia/Sepsis" (100 of 396, 25.3%), and "GU-UTI" (27 of 396, 6.8%). There were 100 (25.3%) antibiotic orders in which the clinician-selected indication differed

from the study investigator–assessed indication at 48–72 hours. The highest rates of discordance were seen with the “GU-UTI” indication (11 of 29, 38%) followed by “Bacteremia/Sepsis” (44 of the 116 incorrect, 37.9%) (Table 1). For “Bacteremia/Sepsis,” the discordance was often due to a more specific diagnosis or source being identified. More discordance was seen in adults (64%) than in the pediatric unit (36%) and with piperacillin/tazobactam (31%) and vancomycin (29%), which is the standard broad-spectrum empiric regimen at our institution. Further chart review performed for the 100 discordant order indications to assess indication at the time of the initial order found that the indication written in the order matched the empiric indication at the time of order in 60 cases (60%), decreasing the overall discordance rate to 10% (40 of 396).

## DISCUSSION

We found 90% concordance between the provider indication documented at the time of initial order entry and independent review by infectious diseases physicians following an information technology (IT)–only intervention of provider documentation. Discordant indications occurred in 25% of cases when comparing the indication entered at the time of initial order and the indication at 48–72 hours. However, when reviewing the clinical information at the time of antibiotic order, 60 of these cases were deemed to have concordant indications with the clinical scenario at the time, decreasing the overall discordance rate to 10%. Accuracy of indication selection by providers is important as evaluations of antibiotic appropriateness, utilization, and benchmarking by the antimicrobial stewardship team may rely on the documented indications in the system.

A similar analysis by Patel et al[7] identified 86% accuracy in a random sample of 50 orders for antimicrobial treatment at Northwestern Memorial Hospital. Our analysis of a larger sample of orders identified 90% accuracy in antibiotic indication. As expected, one of the highest rates of discordance was seen with the “bacteremia/sepsis” indication. This finding may be attributable to 2 factors. First, “Bacteremia/Sepsis” is the first option listed and could have been selected out of convenience. “Alert fatigue” is a growing problem with use of electronic health records, and the forced field for indication selection does add an additional click for providers to address.[10] Second, this indication is relatively nonspecific, and for many antibiotics at the time of order, specific indication is unknown. Higher rates of discordance were seen when study investigators reviewed orders at 48 hours where more diagnostic information may be available. Further review of discordant orders revealed that the indication selected in the order was actually correct based on the information available at the time of the order. Our study is limited by the single-center design and population included. Although our study represented adults and pediatrics at varying acuity levels, it did not represent a wide variety of units or services.

To improve accuracy, an electronic order entry system prompt to re-enter the antibiotic indication between 48 and 72 hours could be implemented, as more information may then be available. Ideally, this intervention would be part of an antibiotic time-out improving the accuracy of antibiotic indications and antimicrobial stewardship data. Based on our findings, prompts to enter antibiotic indication at the time of order entry provide largely accurate information.

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**Table 1.**

Indications for Antibiotics from Prescribers at Time of Order Compared with Expert Review Assessment of Indication at Time of Order and at 48–72 Hours After Ordering Across 336 Patients

| Indication Selected by Prescriber at Time of Initial Order | Indication Match With Assessment at Time of Order, No (%) | Indication Match With Assessment at 48–72 Hours, No. (%) |
|---|---|---|
| All indications (n = 396) | 356 (90) | 296 (75) |
| Respiratory, pneumonia (n = 132) | 128 (97) | 123 (93) |
| Bacteremia/Sepsis (n = 116) | 102 (88) | 73 (62) |
| GU-UTI (n = 29) | 24 (83) | 18 (61) |
| Skin and soft-tissue infection (n = 16) | 13 (81) | 9(56) |
| GI, peritonitis (n = 12) | 7(58) | 6 (50) |
| Neutropenic fever (n = 12) | 10 (83) | 7 (58) |
| Bacteremia, central-line infection (n = 8) | 6 (75) | 6 (75) |
| Bone/Joint infection (n = 7) | 7 (100) | 7 (100) |
| CNS infection (n = 7) | 6 (86) | 6 (86) |
| Surgical prophylaxis (n = 6) | 6 (100) | 6 (100) |
| Other, <5 eligible orders per indication (n = 51) | 47 (92) | 35 (67) |

Note. GU-UTI, genitourinary-urinary tract infection; GI, gastrointestinal tract; CNS, central nervous system.

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