

# Inappropriate Antibiotic Prescribing: Wind at Our Backs or Flapping in the Breeze?

Adam L. Hersh, MD, PhD,<sup>a</sup> Matthew P. Kronman, MD, MSCE<sup>b</sup>

Despite long-standing recognition by clinicians and the public, the problem of inappropriate antibiotic prescribing is, unfortunately, persistent. Inappropriate antibiotic prescribing not only harms our communities by contributing to the spread of antibiotic-resistant infections, but it also directly harms patients by leading to adverse drug events, unnecessary costs, and serious complications, such as *Clostridium difficile* colitis. Inappropriate antibiotic prescribing encompasses several domains (Table 1). The most important is unnecessary antibiotic prescribing (or overuse), which refers to prescribing an antibiotic when it is not indicated (eg, for a viral infection). At least 30% of all antibiotics prescribed in outpatient settings in the United States are considered unnecessary; this estimate rises to 50% for respiratory tract infections, which collectively are responsible for the largest number of antibiotic prescriptions overall.<sup>1</sup> But there are several other important types of inappropriate antibiotic prescribing, including prescribing for an unnecessarily prolonged duration, selecting an unnecessarily broad-spectrum antibiotic, or using intravenous therapy when oral therapy would be equally effective. The National Action Plan for Combating Antibiotic-Resistant Bacteria recently set a target to reduce inappropriate antibiotic use in outpatient settings by 50%,<sup>2</sup> multiple national health care organizations have committed to improving outpatient antibiotic stewardship, and the Centers for Disease Control and Prevention has recently released recommendations

on the core elements of outpatient stewardship.<sup>3</sup> Achieving this ambitious national goal requires defining and addressing all aspects of inappropriate antibiotic use.

In this issue of *Pediatrics*, Handy et al<sup>4</sup> examined antibiotic selection for outpatient pneumonia among children within a large pediatric primary care network. In aggregate, amoxicillin (the guideline recommended first-line agent for most children with pneumonia) was prescribed to only 41% of patients, whereas macrolides and other broader-spectrum agents were prescribed to 59% of patients. However, use of these agents was not consistent across practices; the percentage of patients prescribed macrolides ranged from a low of 22% in 1 practice to a high of 83% in another, even after statistical adjustment. As has been seen previously, the investigators found that both patient-level clinical factors (eg, age) and nonclinical factors (eg, practice location) influenced antibiotic selection, adding to a growing literature indicating that antibiotic prescribing decisions may be influenced by a variety of biases rooted in social and demographic characteristics (Table 1).

If this is the case, however, how will we be able to successfully push back against forces that facilitate antibiotic overuse and instead reduce inappropriate antibiotic prescribing in the outpatient setting by 50%? We can begin by first noting that many tools for improving antibiotic use in the outpatient setting already exist, such as decision support,<sup>5</sup> behavioral nudges,<sup>6</sup> and guidelines from

<sup>a</sup>Division of Infectious Diseases, Department of Pediatrics, University of Utah, Salt Lake City, Utah; and <sup>b</sup>Division of Infectious Disease, Department of Pediatrics, University of Washington, Seattle, Washington

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Address correspondence to Adam L. Hersh, MD, PhD, Division of Infectious Diseases, Department of Pediatrics, University of Utah, 295 Chipeta Way, Salt Lake City, UT 84108. E-mail: adam.hersh@hsc.utah.edu

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**TABLE 1** Domains of Inappropriate Antibiotic Prescribing

Types of Inappropriate Antibiotic Prescribing	Factors That May Be Associated With Inappropriate Prescribing
Unnecessary antibiotic prescribing: prescribing for a condition where an antibiotic is not indicated. Example: prescribing an antibiotic for a viral upper respiratory infection.	Clinical factors
Inappropriate antibiotic selection: use of nonguideline recommended agent for a specific condition that does warrant treatment (often an unnecessarily broad-spectrum agent when narrower-spectrum agents are recommended). Example: prescribing azithromycin for pharyngitis caused by group A <i>Streptococcus</i> .	Patient age Severity of illness
Inappropriately prolonged duration of therapy (when shorter-course therapy is equally effective). Example: use of 2 wk of antibiotic therapy for cellulitis or sinusitis.	Previous infection history Recent antibiotic exposure
Inappropriate antibiotic route: use of intravenous or intramuscular agents when oral agents are likely to be equally effective. Example: use of a complete course of intravenous antibiotic therapy instead of conversion to oral therapy for osteomyelitis.	Immunocompromised status Nonclinical factors
	Patient race or insurance status Geographic region of visit Time of day Experience level of provider Type of provider (advanced practice provider versus physician) Academic versus nonacademic practice Urban versus rural location Provider perceptions of parental expectations for antibiotics Medication cost Medication dosing interval and side-effect profile

the American Academy of Pediatrics on the most common infectious conditions for which antibiotics are prescribed, such as acute otitis media, pharyngitis, sinusitis, and pneumonia.<sup>7</sup> In addition, the study by Handy et al<sup>4</sup> and previous work demonstrate that large care networks have extraordinary potential to first characterize variability in antibiotic prescribing practices<sup>8</sup> and then translate this information into interventions designed to improve antibiotic prescribing through audit and feedback of prescribing practices.<sup>9</sup> The most successful interventions may need to capitalize on the natural competitive desire of many physicians through the use of benchmarking to highlight those who are “top performers” versus those who are not.<sup>10</sup>

Much work in improving antibiotic prescribing remains to be done, although we believe we have the wind at our backs. The promising findings from recent interventions and the unprecedented level of focus on this issue combine to provide substantial momentum in the right direction. The work of Handy et al<sup>4</sup> highlights the fact that

both clinical and nonclinical factors may contribute to inappropriate prescribing and that all domains of inappropriate antibiotic use must be targeted to achieve our national goals for reducing inappropriate use.

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