Efforts to Reduce Unnecessary Antibiotic Prescribing: Are They Worth It? A Best Evidence Review

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Best Evidence Reference:
Interventions to Reduce Unnecessary Antibiotic Prescribing. A Systematic Review and Quantitative Analysis
Ranji SR, Steinman MA, Shojania KG, Gonzales R
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Abstract
The study that this review is based on was selected from Medscape Best Evidence, which uses the McMaster Online Rating of Evidence System. Of a possible top score of 7, this study was ranked as 6 for relevance and 5 for newsworthiness by clinicians who used this system.

There is a public health crisis related to higher rates of bacterial antimicrobial resistance, and the overuse of antibiotics contributes to this problem. A new systematic review examines the efficacy of programs to reduce the unnecessary use of antibiotics. This information should be valuable to physicians, administrators, and public health officials as we enter the cold and flu season.

Commentary

Bacterial Resistance to Antibiotics

Bacterial resistance to antibiotics is a major public health problem, increasing morbidity and mortality as well as healthcare costs. In one study of pneumonia at a hospital in St. Louis, the rate of hospital-acquired pneumonia was double that of community-acquired pneumonia.[1] The most common pathogen identified overall was methicillin-resistant Staphylococcus aureus (MRSA), exceeding rates of traditional pathogens such as Streptococcus pneumoniae and Haemophilus influenzae. The mortality rates associated with hospital-acquired and community-acquired pneumonia were 24.6% and 9.1%, respectively. Moreover, given the high rate of resistant organisms among patients with hospital-acquired pneumonia, the rate of original antibiotic prescriptions that were appropriate for the given infection was only 71.7%.

In a wider study examining S pneumoniae resistance among isolates from 104 US laboratories in 2005 to 2006, researchers found that the rates of resistance to penicillin, amoxicillin-clavulanate, and cefdinir were 16%, 6.4%, and 19.2%, respectively.[2] The least effective agents against S pneumoniae were trimethoprim-sulfamethoxazole and azithromycin, with resistance rates of 23.5% and 34%, respectively. Resistance varied by region of collection, and rates of multidrug resistance were up to 25% in some areas.

Antimicrobial resistance has significantly changed clinical practice for infections beyond the respiratory tract. In a study of resistance in urinary tract infections in one health maintenance organization in the United States, the prevalence of resistance among isolates of Escherichia coli to ampicillin, cephalothin, and sulfamethoxazole exceeded 20% in each of the study years 1992 to 1996.[3] The overall prevalence of resistance to trimethoprim-sulfamethoxazole doubled between 1992 and 1996.
Inappropriate Antibiotic Prescribing

Inappropriate antibiotic prescribing contributes to the problem of higher bacterial resistance. One study examining antibiotic prescribing habits in Europe found widely divergent rates of prescriptions in different countries. In countries with the highest use of antibiotics, prescription rates peaked during cold and flu season, but this was not true in countries with lower overall prescribing habits. Most importantly, rates of antimicrobial resistance were higher in countries with the highest consumption of antibiotics.

There is good evidence that there is a high rate of unnecessary antibiotic prescriptions in the United States. Whereas the prevalence of sore throat caused by bacterial infection among adults is between 5% and 17%, a study of physician practice in 1989 and 1999 found that antibiotics were prescribed during 73% of visits. Moreover, most of these patients received antibiotics that were not recommended for pharyngitis, with a high number of prescriptions being for extended-spectrum antibiotics. Another study found that more than half of children with sore throats received antibiotics, a rate significantly higher than the regular prevalence of bacterial pharyngitis. Furthermore, more than one quarter of these children received an inappropriate antibiotic.

Methods for Reducing Inappropriate Use

Given the costs of the widespread use of antibiotics, reducing inappropriate use is a public health priority. The current study examines the sum of research into this area and compares advantages of different methods to reduce antibiotic prescriptions.

Researchers searched for relevant studies using the Cochrane Collaboration Effective Practice and Organization of Care database, which focuses on quality improvement efforts in healthcare. Studies eligible for inclusion focused on programs to discourage the practice of prescribing antibiotics for acute nonbacterial illnesses in the outpatient setting. Research had to include data on antibiotic prescribing habits before and after the intervention.

The study authors identified 935 citations, of which 43 studies were included in the final analysis. If a study included multiple interventions, the authors included each intervention as a separate trial. This process yielded 30 trials for quantitative analysis; another 18 trials were evaluated but could not be used in this analysis.

The included studies were evaluated using 8 quality measures, such as the targeting of specific conditions vs general antibiotic prescribing and assessment of outcomes with chart review vs other administrative data. The overall research quality was only fair, and most studies failed to meet criteria for internal validity and generalizability.

The collective body of research in the quantitative analysis examined the following interventions to reduce antibiotic prescribing (listed in order of descending frequency of citations):

- Clinician education alone;
- Delayed prescription (clinician advice to use the antibiotic prescription only if symptoms did not improve or grew worse);
- Patient education alone;
- Clinician education plus patient education;
- Clinician education, patient education, and chart audits with feedback to clinicians;
- Clinician education plus chart audit/feedback;
- Clinician education with reminders plus patient education; and
- Patient education with chart audit/feedback for clinicians.

Of the total studies, 38 addressed prescription habits for acute respiratory infections. At baseline, the median proportion of visits in which patients received an antibiotic prescription was 38.5%. The interventions were associated with a collective 9.7% decrease in the number of visits in which an antibiotic was prescribed, equating to a relative decrease of 25%.

In general, active education for clinicians, such as seminars, was more effective than passive education, such as chart
audit and feedback, although this difference just missed statistical significance. In addition, educational efforts targeting antibiotic prescribing habits for all acute respiratory infections were generally more effective than interventions for specific infections, such as the common cold or bronchitis. However, there were few differences between the individual interventions listed above, so the authors could not recommend a particular approach. Factors particular to each individual study, such as sample size, patient age, or target disease, did not affect the results of the quantitative analysis.

Among the 18 trials that were evaluated outside the quantitative analysis, interventions that targeted clinicians only were less successful than programs targeting both clinicians and patients. Four studies involving active clinician education combined with mass media efforts to educate patients produced generally positive results.

Seven studies examined the strategy of delayed prescriptions for acute respiratory infection. The median rates of antibiotic use in control vs intervention cohorts in these studies were 75% and 37.5%, respectively. However, the authors of the current study note that this reduction only brought antibiotic use levels to the average pre-intervention level in most studies, and therefore the strategy of delayed prescriptions may not be helpful.

Three studies examined antimicrobial resistance. All study interventions from these trials reduced the rate of antibiotic prescribing; however, only one was associated with a reduction in colonization with penicillin-resistant *S pneumoniae*. Two studies demonstrated reduced antibiotic prescribing costs of 18% and 31%, respectively, although the overall cost-benefit analysis of these interventions was not addressed. There were no adverse outcomes reported for any study intervention. Specifically, the interventions were not associated with an increase in medical services, and in nearly all trials there were no adverse effects regarding patient satisfaction.

Overall, the study researchers calculated that the collective interventions could reduce the rate of antibiotic prescriptions by 8.0 to 41.8 prescriptions per 1000 patient-years.

The current study was limited because the researchers could not perform a meta-analysis. Such an analysis was not possible because of the disparate nature of the interventions and their data. The researchers could only broadly characterize the study interventions, and their extrapolations into population effect sizes of the interventions were only exploratory and not conclusive.

The researchers in this study should be encouraged that the attention regarding inappropriate antibiotic prescriptions appears to be having a positive impact on clinical practice. In a study of US prescription data between 1996 and 2001, the use of antibiotics for respiratory tract infections among children decreased by 5.1%. The overall use of antibiotics among children fell by 8.5%. Interestingly, the decline in the use of antibiotics was most pronounced among non-Hispanic white children compared with black or Hispanic children. The decrease in overall antibiotic use was entirely the result of a reduced rate of antibiotic prescribing at clinician visits, as opposed to a decrease because of less contact with physicians.

Have we reached our goal in reducing the use of unnecessary antibiotics? The answer is clearly no. But the collective research into interventions to reduce antibiotic use provides evidence that educational programs can have a significant benefit. Innovations in the delivery of healthcare, such as the electronic health record and e-prescribing, group medical visits, and the employment of a healthcare team that includes community health educators, offer the promise of further reducing inappropriate antibiotic prescriptions. However, these interventions still require the commitment and integrity of individual clinicians and patients to reduce prescription rates and have a positive impact on rates of bacterial resistance.

**Clinical Pearls**

- In a study examining *S pneumoniae* resistance, the least effective agents were trimethoprim-sulfamethoxazole and azithromycin.

- Interventions for reducing inappropriate antibiotic use that were assessed in the systematic review equated to a relative decrease of 25%. Overall, the collective interventions could reduce the rate of antibiotic prescriptions by 8.0 to 41.8 prescriptions per 1000 patient-years.

- Although no invention strategy in the study was clearly superior, in general, active education for clinicians was more effective than passive education, and educational efforts targeting antibiotic prescribing habits for all acute respiratory infections were generally more effective than interventions for specific infections.

- Interventions were not associated with an increase in medical services, and in nearly all trials there were no adverse effects regarding patient satisfaction.

- Between 1996 and 2001, prescriptions for antibiotics for upper respiratory tract infections among children decreased by 5.1% and prescriptions for overall use decreased by 8.5%.
References


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Disclosure: Charles P. Vega, MD, has disclosed that he has served as an advisor or consultant to Novartis.