## Supplementary Evidence Supporting Outpatient Stewardship Systematic Reviews

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<th>Reference</th>
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</table>
• Physician educational materials  
• Audit and feedback  
• Educational meetings  
• Educational outreach visits  
• Financial and healthcare system changes  
• Physician reminders  
• Patient-based interventions  
• Multi-faceted interventions  
Outcomes  
• Improve selection, dose and duration of antibiotics prescribed  
• Reduce incidence of pathogens with antimicrobial resistance | Methods  
• Systematic review  
Participants  
• Healthcare consumers or primary care providers  
Setting  
• Primary care clinics and ambulatory care clinics | • 39 studies  
• Only small changes observed for single interventions using printed educational materials or audit and feedback.  
• Active educational interventions are more effective than nonactive interventions.  
• Delayed prescriptions effectively reduced antibiotic use by patients without negatively affecting patient outcomes.  
• Multifaceted interventions were more successful in decreasing inappropriate antibiotic prescribing. | • Multifaceted interventions are most effective.  
• No single intervention is recommended for all settings. |
• Provider and or patient education  
• Provider feedback  
• Delayed prescribing  
• Communication skills training  
• Guidelines  
• Restriction Policies  
• Computerized clinical decision support  
• Financial incentives  
• Rapid diagnostics  
• Costs reporting  
Outcomes  
• Prescribing outcomes  
• Patient outcomes  
• Microbial outcomes  
• Costs | Methods  
• Systematic review  
Participants  
• Primarily healthcare consumers and primary care providers  
Setting  
• Primary care clinics and ambulatory care clinics | • 50 studies  
• Stewardship programs using communication skills training and laboratory testing can lower antibiotic use.  
• Several stewardship interventions can effectively improve antibiotic prescribing.  
• Patient outcomes were not often reported, but did not appear to worsen due to intervention. | • Outpatient antibiotic stewardship programs can improve antibiotic prescribing without negatively affecting patient outcomes.  
• Sustainability and scalability of specific interventions is less clear. |
• Education  
• Communication  
• Clinical  
• System-level  
• Multifaceted interventions  
Outcomes  
• Improvement of appropriate antibiotic prescribing  
• Reduction in antibiotic resistance  
• Reduction in overall antibiotic prescribing for acute respiratory tract infections (RTIs) | Methods  
• Systematic review  
Participants  
• Healthcare consumers (both adults and children) with acute RTIs  
• Primary care providers  
Setting  
• Primary care clinics and ambulatory care clinics | • 133 studies  
• Four interventions showed evidence of improving antibiotic prescribing with without worsening patient outcomes due to reductions in antibiotic prescribing:  
  o Clinic-based parent education (21% reduction).  
  o Public patient education campaigns combined with clinician education (7% prescribing reduction).  
  o Procalcitonin for adults (12% to 72% prescribing reduction). | • Several interventions safely reduced antibiotic prescribing or improved appropriate antibiotic prescribing without adversely affecting patient outcomes.  
• These include education for patients, parents, and clinicians, procalcitonin testing in adults, and electronic clinician decision support. |
### Interventions to reduce unnecessary antibiotic prescribing: A systematic review and quantitative analysis

**Methods**
- Systematic review and quantitative analysis

**Participants**
- Healthcare consumers (both adults and children) with acute respiratory infections
- Primary care providers

**Setting**
- Primary care clinics and ambulatory care clinics

- **Outcomes**
  - Reduction in inappropriate antibiotic prescribing
  - Prescribing antibiotics for non-bacterial illnesses
  - Prescribing broad-spectrum antibiotics when narrow-spectrum agents are indicated

- **Interventions**
  - Clinician education
  - Patient education
  - Audit and feedback
  - Clinician reminders
  - Financial or regulatory incentives

- **Outcomes**
  - Reduction in proportion of patients receiving antibiotics

- **Setting**
  - Primary care clinics and ambulatory care clinics

- **Participants**
  - Systematic review
  - Healthcare consumers (both adults and children) with acute respiratory infections

- **Methods**
  - Systematic review and quantitative analysis

- **Setting**
  - Primary care providers

- **Outcomes**
  - Reduction in proportion of patients receiving antibiotics

### Differences for interventions with a before and after measurement with a control group

- **Interventions**
  - Educational materials (patients, clinicians, and the general public)
  - Educational meetings
  - Consensus procedure
  - Local opinion leaders
  - Near-patient testing
  - Audit and feedback
  - Financial incentives
  - Communications skills training

- **Outcomes**
  - Difference of differences for interventions with a before and after measurement with a control group
  - Differences for interventions with a before and after

- **Participants**
  - Systematic review
  - Healthcare consumers (both adults and children) with acute outpatient infections
  - Primary care providers

- **Setting**
  - Primary care clinics in high income countries

- **Methods**
  - Systematic review
  - Healthcare consumers (both adults and children) with acute outpatient infections
  - Primary care providers

- **Setting**
  - Primary care clinics in high income countries

- **Participants**
  - Systematic review

- **Methods**
  - Systematic review

### Variations in outcomes across interventions targeting improvements in antibiotic prescribing

- **Outcomes**
  - Antibiotic resistance was measured in two studies, neither of which showed a reduction in resistance.
  - No individual intervention was most effective at reducing prescribing.
  - Active educational strategies target clinicians appeared more effective than passive strategies.

- **Interventions**
  - Clinician education, including communication skills training, is important to optimize antibiotic use.
  - Combination interventions appear more effective than individual interventions.

- **Setting**
  - Primary care providers

- **Participants**
  - Systematic review

- **Methods**
  - Systematic review

- **Outcomes**
  - Reductions in inappropriate antibiotic prescribing.
  - No single intervention was clearly more effective than others.
  - Active clinician education interventions appear more effective than passive education.

### Closing the quality gap: A critical analysis of quality improvement strategies


- **Interventions**
  - Clinician education
  - Patient education
  - Delayed prescriptions
  - Audit and feedback
  - Clinician reminders
  - Financial or regulatory incentives

- **Outcomes**
  - Reductions in inappropriate antibiotic prescribing
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- **Setting**
  - Primary care clinics and ambulatory care clinics

- **Participants**
  - Systematic review

- **Methods**
  - Systematic review and quantitative analysis

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  - Reductions in inappropriate antibiotic prescribing
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  - Financial incentives
  - Communications skills training

- **Outcomes**
  - Difference of differences for interventions with a before and after measurement with a control group
  - Differences for interventions with a before and after

- **Participants**
  - Systematic review

- **Methods**
  - Systematic review

- **Setting**
  - Primary care clinics and ambulatory care clinics

- **Participants**
  - Systematic review

- **Methods**
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  - Differences for interventions with a before and after

- **Participants**
  - Systematic review

- **Methods**
  - Systematic review

- **Setting**
  - Primary care clinics and ambulatory care clinics

- **Participants**
  - Systematic review

- **Methods**
  - Systematic review

- **Outcomes**
  - Reductions in inappropriate antibiotic prescribing.
  - No single intervention was clearly more effective than others.
  - Active clinician education interventions appear more effective than passive education.
measurement without a control group  
- Difference in after measurement for interventions with a control group but without a before measurement  
- Interventions with the largest effect sizes included communication skills training and point-of-care testing.

### Commitment

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</table>
- Poster containing a public commitment to use antibiotics judiciously with clinician picture and signature displayed in examination rooms at point of clinician-patient encounter  
**Outcomes**  
- Antibiotic prescribing rates for acute respiratory infections (ARIs) for which antibiotics are inappropriate | **Method**  
- Randomized clinical trial  
**Participants**  
- 15 primary care providers  
**Setting**  
- 5 primary care clinics in the United States |  
- 954 adults with ARI  
- Poster group had a 19.7% decrease in inappropriate prescribing for acute respiratory infections compared with controls, \( p = 0.02 \), controlled for baseline rates of antibiotic prescribing. |  
- Public commitments in a poster are a low-cost intervention that can result in reduced inappropriate prescribing. |
- No intervention; observational study  
**Outcomes**  
- Level of variability in antibiotic stewardship programs (ASPs) by hospital characteristic and location | **Method**  
- Observational study  
**Participants**  
- Hospitals enrolled in the National Healthcare Safety Network  
**Setting**  
- 2014 National Healthcare Safety Network Annual Hospital Survey |  
- 4184 US hospitals  
- On self-report, 39% of hospitals have an ASP meeting all 7 CDC defined core elements of inpatient antibiotic stewardship.  
- 59% of hospitals with more than 200 beds (59%) had an ASP meeting all Core Elements  
- 25% of hospitals with less than 50 beds had an ASP meeting all Core Elements  
- States reporting a percentage of hospitals with all 7 core elements ranged from 7% to 58%.  
- Written support and salary support for ASP were significantly associated with having an ASP meeting all Core Elements. |  
- There is wide variability with ASP implementation.  
- Hospital leadership support appears crucial for comprehensive ASPs  
- ASPs can be established in hospitals of all sizes. |

### Action

**Delayed Prescribing Practices or Watchful Waiting**

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</table>
- Watchful waiting/observation therapy with no prescription or with a delayed antibiotic prescription  
**Outcomes**  
- Antibiotic use for AOM at 3 days (primary) and 7–10 days (secondary) | **Methods**  
- Prospective randomized trial  
**Participants**  
- Children aged 2 to 12 years diagnosed with AOM and who met criteria for observation  
**Setting**  
- 2014 National Healthcare Safety Network Annual Hospital Survey |  
- 232 patients enrolled, 206 patients completed follow-up.  
- At 3 days: 87% parents of children in the observation group with no antibiotic prescription reported no antibiotic use versus 62% parents of children in the observation group with a delayed antibiotic prescription. |  
- Observation therapy was well accepted by parents of children with AOM.  
- Observation without an antibiotic prescription led to lower antibiotic use for AOM than observation with a delayed antibiotic prescription without affecting visit satisfaction. |
### Interventions:

**4 antibiotic prescriptions strategies for acute uncomplicated respiratory tract infections.**
- **Delayed antibiotic prescription given to patients at the visit with instructions to wait to fill it unless not improving**
- **Delayed antibiotic prescription awaiting patient at clinic, patient to return and collect prescriptions if not improving**
- **No antibiotic prescription issued at visit**

### Methods:

**Open-label, randomized clinical trial**

### Participants:

- Adults with acute, uncomplicated respiratory infections

### Setting:

- 23 primary care clinics in Spain

### Interventions:

**No intervention; observational study**

### Outcomes:

- Primary: symptom duration and severity
- Secondary: antibiotic use, patient satisfaction, and belief about antibiotic effectiveness among patients complicated respiratory infections.

### Methods:

**Prospective observational cohort study**

### Participants:

- Adult patients with acute cough

### Setting:

- 14 primary care networks in 13 European countries

### Interventions:

**One of 3 prescribing strategies**
- Delayed antibiotics available by request after 14 days

### Methods:

**Randomized controlled trial**

### Participants:

- 807 patients recruited

### Setting:

- Factorial design involving 6 groups: leaflet or no leaflet and 1 of 3 prescribing strategies

### Interventions:


### Setting:

- Pediatric emergency department of an urban public hospital in the United States (New York)

### Methods:

<table>
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<th>Intervention</th>
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<th>Outcomes</th>
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<tbody>
<tr>
<td>Little P, et al. Delayed antibiotic prescribing strategies for respiratory tract infections in primary care: pragmatic, factorial, randomized controlled trial. Brit Med J 2014. 348:g1606.</td>
<td>• Delayed antibiotic prescribing strategies &lt;br&gt; o Re-contact for a prescription (i.e., patient calls for the prescription) &lt;br&gt; o Post-dated prescription &lt;br&gt; o Post-visit collection of a prescription &lt;br&gt; • No antibiotic prescription</td>
<td>• Open, pragmatic, randomized controlled trial</td>
<td>• 37 English general practitioners &lt;br&gt; • Patients aged ≥3 years with acute uncomplicated lower respiratory infections</td>
<td>• Immediate antibiotic group, used antibiotics, were &quot;very satisfied&quot; with visit, and believed in the antibiotic effectiveness.</td>
</tr>
<tr>
<td>McCormick DP, et al. Nonsevere acute otitis media: a clinical trial comparing outcomes of watchful waiting versus immediate antibiotic treatment. Pediatrics 2005.115(6):1455–65.</td>
<td>• Watchful waiting (WW) versus immediate antibiotic prescription &lt;br&gt; • Educational intervention</td>
<td>• Single-blind, randomized controlled trial (investigators were blinded)</td>
<td>• Children aged 6 months to 12 years with nonsevere AOM</td>
<td>• Immediate antibiotic treatment was associated with decreased treatment failures and improved symptom resolution compared with WW, but also higher adverse drug events and higher likelihood of carriage of multi-drug resistant S. pneumoniae. &lt;br&gt; • Classification of AOM severity, parent education, symptom management, follow-up care, and access to effective antibiotics when needed are all important in implementing watchful waiting for children with AOM.</td>
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Communication Skills Training

### Reference Skills Training

#### Interventions and Outcomes

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<tr>
<td>Little P, et al. Effects of internet-based training on antibiotic prescribing rates for acute respiratory tract infections: a multinational, cluster, randomized factorial controlled trial. Lancet. 2013. 382(9899):1175–82.</td>
<td>• Internet based training on communication skills, C-reactive protein (CRP) testing, or both versus standard care</td>
<td>• Cluster randomized controlled trial</td>
<td>• 4264 patients</td>
<td>• Internet training for CRP testing and communications skills led to reductions in antibiotic prescribing for RTIs.</td>
</tr>
<tr>
<td>Spiro DM, et al. Wait-and-see prescription for the treatment of acute otitis media: a randomized controlled trial. JAMA. 2006. 296(10):1235–41.</td>
<td>• Physician enhanced communication skills training</td>
<td>• Pragmatic, cluster-randomized controlled trial</td>
<td>• 379 patients</td>
<td>• Communications training led to sustained reductions in the percent of RTIs leading to antibiotic prescriptions, while CRP testing did not.</td>
</tr>
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</table>

#### Methods

- **Participants**: 246 primary care clinics in 6 European countries
- **Setting**: 246 primary care clinics in 6 European countries
- **Interventions**: 3 behavioral interventions
  - Suggested alternatives to antibiotics placed within electronic health records for these diagnoses
  - Accountable justification required in medical record for non-recommended antibiotic prescribing
  - Peer comparison to top-performing peers

#### Conclusions

- **ACCOUNTABLE JUSTIFICATION AND PEER COMPARISON INTERVENTIONS**
  - **31,712 visits for acute respiratory tract infections for which antibiotics are not indicated**
    - Controls: 24.1% to 13.1%
    - Suggested alternatives: 22.1% to 6.1% (p = 0.66 for differences compared with control group)
    - Accountable justification: 23.2% to 5.2% (p<0.001)
    - Peer comparison: 9.9% to 3.7 (p<0.001)
- **wait and see antibiotic prescriptions reduced antibiotic use in children with AOM.**
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<th>Clinical Decision Support</th>
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</thead>
<tbody>
<tr>
<td>• Rate of antibiotic prescribing for acute respiratory tract infections for which antibiotics are not indicated</td>
<td>McGinn TG, et al. Efficacy of an evidence-based clinical decision support in primary care practices: A randomized clinical trial. JAMA Intern Med 2013. 173(17):1584–11.</td>
<td>Intervention • Clinical decision support involving integration of Walsh rule for streptococcal sore throat and Heckerling rule for pneumonia</td>
<td>Methods • Randomized clinical trial Participants • Attending physicians, fellows, residents and nurse practitioners</td>
<td>• 168 primary care providers with 984 visits with clinical decision rule triggered</td>
<td>• Clinical prediction rules integrated into EHRs can reduce inappropriate antibiotic prescribing.</td>
</tr>
<tr>
<td>• Compared with the control group, no intervention showed significant diagnosis shifting.</td>
<td></td>
<td>Outcomes • Frequency of antibiotic prescriptions and streptococcal tests in experimental versus control group</td>
<td>• Patients with complaints consistent with pharyngitis or pneumonia</td>
<td></td>
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<td></td>
<td>Jenkins TC, et al. Effects of clinical pathways for common outpatient infections on antibiotic prescribing. Am J Med. 2013;126(4):327–35 e312.</td>
<td>Intervention • Clinical decision support targeting antibiotic prescribing for common conditions</td>
<td>Methods • Quasi-experimental study Participants • Clinicians working in primary care clinics</td>
<td>• 8 primary care clinics</td>
<td>Clinical decision support was associated with reduced antibiotic prescriptions for non-pneumonia ARIs and reduced use of broad-spectrum antibiotics during one year of implementation.</td>
</tr>
<tr>
<td></td>
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<td>Outcomes • Change in antibiotic prescribing over time for non-pneumonia acute respiratory infections (ARIs)</td>
<td>Setting • Primary care clinics in the United States (Colorado), including adult and pediatric clinics; urban, suburban and rural clinics; academic and private providers</td>
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<td>• Change over time in broad-spectrum antibiotic prescriptions for ARIs</td>
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<td></td>
<td>Gonzales R, et al. A cluster randomized trial of decision support strategies for reducing antibiotic use in acute bronchitis. JAMA Intern Med 2013. 173(4):287–73.</td>
<td>Interventions • Clinical decision support, through the electronic medical record, or printed tools targeting antibiotic prescribing for acute bronchitis</td>
<td>Methods • Cluster randomized controlled trial Participants • Primary care clinicians</td>
<td>• 12,776 visits for acute bronchitis</td>
<td>Clinical decision support strategies for acute bronchitis can help reduce overuse of antibiotics in primary care.</td>
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<tr>
<td></td>
<td></td>
<td>• Clinician and patient education • Audit and feedback</td>
<td>Setting • 33 primary care practices in the United States (Pennsylvania)</td>
<td></td>
<td>• The observed effect in print-based versus computer-based interventions showed no significant differences.</td>
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<td>• Controls without interventions</td>
<td></td>
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<td></td>
<td>Outcomes • Reductions in antibiotic prescribing for acute uncomplicated bronchitis.</td>
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<td></td>
<td>Rattinger GB, et al. A sustainable strategy to prevent misuse of antibiotics for acute respiratory infections. PLoS One 2012. 7(12):e51147.</td>
<td>Intervention • Clinical decision support promoting adherence to clinical practice guidelines for acute respiratory infections (ARIs)</td>
<td>Methods • Non-randomized retrospective controlled study Participants</td>
<td>• 3831 patients</td>
<td>A clinical decision support system decreased unwarranted use of fluoroquinolones and azithromycin for ARI and improved antibiotic use for ARI in an outpatient veterans’ healthcare system.</td>
</tr>
<tr>
<td></td>
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<td>Outcomes</td>
<td>• Clinical decision support was associated with greater clinical practice guideline adherence (RR = 2.57 95% CI, 1.87 to 3.54).</td>
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<tr>
<td>Linder JA, et al.</td>
<td>Documentation-based clinical decision support to improve antibiotic prescribing for acute respiratory infections in primary care: A cluster randomized controlled trial. Inform Prim Care 2009. 17(4):231–40.</td>
<td><strong>Intervention</strong></td>
<td>• Electronic health record-based clinical decision support for acute respiratory infection (ARI) — “ARI Smart Form” versus standard care</td>
<td>• 21,961 visits for ARLs</td>
<td>• A clinical decision support tool for ARIs, the ARI Smart Form, was rarely used by clinicians and thus did not improve antibiotic prescribing for ARIs.</td>
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<td></td>
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<td><strong>Outcome</strong></td>
<td>• Antibiotic prescribing for acute respiratory tract infections</td>
<td>• ARI Smart Form only used in 6% of eligible visits.</td>
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<tr>
<td></td>
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<td><strong>Setting</strong></td>
<td>• 27 primary care clinics in the United States (Massachusetts)</td>
<td>• Antibiotic prescribing for intervention clinics was not different compared with controls: odds ratio (OR) 0.8; 95% CI 0.6–1.2.</td>
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<td><strong>Participants</strong></td>
<td>• Primary care providers</td>
<td>• When ARI Smart Form was used (per protocol analysis), ARI prescribing was modestly improved.</td>
<td></td>
</tr>
<tr>
<td>Forrest, C. B., et al.</td>
<td>Improving adherence to otitis media guidelines with clinical decision support and physician feedback. Pediatrics 2013. 131(4): e1071–1081.</td>
<td><strong>Intervention</strong></td>
<td>• Clinical decision support (CDS) in an electronic health record system</td>
<td>• 24 practices with 139,305 visits for AOM and OME</td>
<td>• Both CDS and audit and feedback effectively increased adherence to guidelines for treatment of AOM and OME.</td>
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<td>• Audit and feedback to clinicians with peer comparison</td>
<td>• Guidelines were adhered to in 15% and 5% of AOM and OME cases, respectively during the baseline period.</td>
<td>• The effect of the individual interventions did not appear to be additive.</td>
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<td>• Physician guideline adherence for management of acute otitis media (AOM) and otitis media with effusion (OME)</td>
<td>• Improvements in guideline adherence was larger in visits with CDS and audit and feedback.</td>
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<td>• Primary care network in the United States (Pennsylvania, New Jersey, and Delaware)</td>
<td>• Audit and feedback combined with CDS did not improve guideline adherence beyond levels observed for audit and feedback alone.</td>
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**Call Centers, Nurse Hotlines, or Pharmacist Consultations**

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<th><strong>Interventions and Outcomes</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Outcomes</strong></td>
<td>• Clinical outcomes associated with related cases</td>
<td>• For 88% of initial advice calls, self-care advice over the phone alone was sufficient.</td>
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<td>• Sufficiency of advice as evidence by no return calls within 7 days leading to a “higher” level of care, such as an in-person appointment.</td>
<td>• Most follow-up calls made by the patient were for additional advice or other information.</td>
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**Tracking and Reporting**

**Audit and Feedback**

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<tr>
<td>Reference</td>
<td>Study Title</td>
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<tr>
<td>Gerber JS, et al.</td>
<td>Effect of an outpatient antimicrobial stewardship intervention on broad-spectrum antibiotic prescribing by primary care pediatricians: A randomized trial</td>
<td>JAMA 2013. 309(22): 2345–52.</td>
<td>United States (New Jersey)</td>
<td>18 pediatric primary care practices in the United States</td>
</tr>
<tr>
<td>Meeker et al.</td>
<td>Effect of behavioral interventions on inappropriate antibiotic prescribing among primary care practices: A randomized clinical trial</td>
<td>JAMA 2016;315(6):562–70.</td>
<td>United Kingdom (Wales)</td>
<td>248 primary care clinicians</td>
</tr>
<tr>
<td>Butler CC, et al.</td>
<td>Effectiveness of multifaceted educational program to reduce antibiotic dispensing in primary care: Practice based randomized controlled trial</td>
<td>BMJ 2012. 344:d8173.</td>
<td>United States</td>
<td>47 primary care practices in United Kingdom (Wales)</td>
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### Education

#### Evidence Supporting Educational Efforts Targeting Parents and Patients to Improve Antibiotic Use

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<tr>
<td>Metlay JP, et al. <em>Cluster-randomized trial to improve antibiotic use for adults with acute respiratory infections treated in emergency departments</em>. <em>Ann Emerg Med</em> 2007. 50(3):221–30.</td>
<td><strong>Intervention</strong> • Clinician and patient education • Audit and feedback on prescribing practices for upper respiratory infections (URIs) and acute bronchitis <strong>Outcomes</strong> • Primary: Proportion of patients URIs and acute bronchitis with antibiotic prescribed • Secondary: antibiotic prescribing for antibiotic-appropriate respiratory infections, return ED visits within 2 weeks, and hospital admission within 2 weeks</td>
<td><strong>Methods</strong> • Cluster-randomized controlled trial <strong>Participants</strong> • Emergency department (ED) clinicians and patients <strong>Setting</strong> • Hospital EDs, including veterans and non-veterans hospitals in the United States</td>
<td>• 16 EDs with 5,665 visits by adults for acute respiratory infections • Intervention sites had a significant decrease in antibiotic prescribing for URIs and acute bronchitis (−10%; 95% CI −18 to −2%), compared with no change in control sites (0.5% 95% CI −3 to 5%). • No significant increases in emergency department return visits or patient satisfaction was observed among control or intervention sites.</td>
<td>• Multifaceted education interventions combined with audit and feedback can decrease antibiotic prescribing for ED patients with URIs and acute bronchitis.</td>
</tr>
<tr>
<td>Hallsworth M, et al. <em>Provision of social norm feedback to high prescribers of antibiotics in general practice: a pragmatic national randomized controlled trial</em>. The Lancet 2016. 387:1743–52</td>
<td><strong>Interventions</strong> • Audit and feedback as a letter from England’s Chief Medical Officer sent to the high-prescribing practices defined as the top 20% for their National Health Service (NHS) Local Area Team versus no communication • Patient education materials versus no materials • Rate of antibiotics dispensed per 1000 weighted population, controlling for past prescribing</td>
<td><strong>Methods</strong> • Pragmatic factorial randomized controlled trial <strong>Participants</strong> • General practitioners (GP) <strong>Setting</strong> • GP practices NHS clinics across England</td>
<td>• 1581 practices • Letters sent to 3227 GPs • Intervention group had 126.98 antibiotics dispensed per 1000 population versus and 131.25 antibiotics dispensed per 1000 population in the control group (difference of 3.3%, p&lt;0.001). • Estimated 73,406 fewer antibiotics dispensed in intervention group. • No difference in antibiotic prescribing for patient educational materials.</td>
<td>• Audit and feedback from an important figure (e.g., England’s Chief Medical Officer) reduced antibiotic prescribing at the national level.</td>
</tr>
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</table>

### Methods

**Intervention** • No intervention; observational study. **Outcome** • Communication techniques used by providers that were associated with prescribing antibiotics for acute respiratory tract infections (ARTIs) and with parent visit satisfaction

**Participants** • Pediatric providers • Parents of children (6 months to 10 years old) presenting with complaints consistent with ARTIs **Setting** • 10 pediatric practices in the United States (Washington)

**Methods** • Cross-sectional study with parent and provider post-visit surveys

**Interventions and Outcomes** • Parent expectations for antibiotics, physician-parent communication, and

**Intervention** • No intervention; observational study. **Methods** • Qualitative study involving pre- and post-visit survey

**Participants** • 10 physicians and 295 parents

**Outcomes** • No intervention; observational study.

**Conclusions** • Communication strategies combining explanations of why antibiotics are not needed with recommendations for treating symptoms may help providers decrease inappropriate antibiotic prescribing while helping maintain parental visit satisfaction. • A contingency plan can be considered for parents expecting antibiotics for their children who do not need antibiotics.
<table>
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| • Physician perception of parental pressure for antibiotics  
• Physician-perceived pressure to prescribe antibiotics  
• Parental visit-specific satisfaction | • Physicians and eligible parents who attended acute care visits for their child | • 2 private practice pediatric clinics in the United States (California) | • Half of parents expected antibiotics before the visit, but only 1% of visits verbally requested them.  
• Physicians perceived parental expectation for antibiotics 34% of the time without a direct request by parents for antibiotics.  
• Offering a contingency plan of possibly receiving future antibiotics if their child did not improve was associated with higher satisfaction among parents who expected but did not receive antibiotics. | • Parents of pediatric patients are interested in information about antibiotic-associated ADEs.  
• Adult patients may be less receptive about receiving information about antibiotic-associated ADEs. |

### Evidence Supporting Educational Efforts Targeting Clinicians to Improve Antibiotic Use

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</table>
| Butler CC, et al. Effectiveness of multifaceted educational program to reduce antibiotic dispensing in primary care: Practice based randomized controlled trial. BMJ 2012;344:d8173. | Intervention  
• Multifaceted clinician education, including communication skills, targeting antibiotic prescribing versus standard care  
• Audit and feedback of practice antibiotic dispensing data | Methods  
• Computer assisted telephone focus groups  
Participants  
• Adult patients and mothers of young children  
Setting  
• United States | • Familiarity with side effects of antibiotics were common.  
• Few mothers were familiar with severe antibiotic-associated ADEs.  
• Most mothers felt strongly that information about severe ADEs should be shared with parents at the time an antibiotic is prescribed.  
• Adult patients did not believe that antibiotic-associated ADEs was a significant issue. | • A clinician educational intervention led to reductions in antibiotic dispensing with no changes in hospital admissions, return visits, or costs. |
• No intervention; observational study.  
Outcomes  
• Patient and parent knowledge and attitudes about antibiotics and adverse drug events (ADEs) from antibiotics  
• straightened to the full | Methods  
• Computer assisted telephone focus groups  
Participants  
• Adult patients and mothers of young children  
Setting  
• United States | • Physician perception of parental pressure for antibiotics  
• Physician-perceived pressure to prescribe antibiotics  
• Parental visit-specific satisfaction | • Adult patients may be less receptive about receiving information about antibiotic-associated ADEs. |
• Clinician education targeting antibiotic prescribing for acute respiratory tract infections (ARTIs)  
• Posters directed at providers placed in exam rooms  
• Patient education through an interactive computerized education (ICE) module.  
• Patients who chose not to participate in the ICE were considered to have been | Methods  
• Prospective, nonrandomized controlled trial  
Participants  
• Adults with ARTIs  
Setting  
• Urban urgent care clinic serving the major public hospital in the United States (Colorado) | • 554 adults with ARTIs  
• Antibiotic prescribing for patients diagnosed with acute bronchitis decreased from 58% to 30% in those exposed to the limited intervention, and to 24% among those exposed to full intervention (p<0.001 compared with baseline).  
• Antibiotic prescribing for nonspecific upper respiratory tract infections decreased from 14% to 3% in those exposed to the limited intervention, and to 1% among those exposed to the full | • A combination of patient and provider educational materials can reduce antibiotic prescribing for adults with ARTIs. |
**Interventions and Outcomes**


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<tr>
<td><strong>Intervention</strong></td>
<td>• Clinician education using interactive and case-based learning targeting antibiotic prescribing for upper respiratory tract infections (URIs)</td>
<td>• Prospective nonrandomized controlled trial</td>
<td>• 30 primary care physicians</td>
<td>• An educational program involving interaction and case-based learning improved antibiotic prescribing for URIs by primary care providers.</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>• Improvements in antibiotic prescribing for URIs</td>
<td>• Primary care physicians</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>• Clinician education using interactive and case-based learning targeting antibiotic prescribing for upper respiratory tract infections (URIs)</td>
<td>• Four primary care clinics within a staff model health maintenance organization in the United States (Michigan)</td>
<td>• In the control group, no significant decline in antibiotic prescribing was observed.</td>
<td></td>
</tr>
</tbody>
</table>

**Academic Detailing**

**Reference**

**Interventions and Outcomes**

**Methods, Participants, and Settings**

**Results**

**Conclusions**


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<tr>
<td><strong>Intervention</strong></td>
<td>• Academic detailing on antibiotic prescribing for respiratory tract infections</td>
<td>• Cluster randomized controlled trial</td>
<td>• 382 general practitioners</td>
<td>• Education interventions improved antibiotic prescribing among general practitioners in Norway.</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>• Clinician education</td>
<td>• General practitioners</td>
<td>• Reductions in antibiotic prescribing were observed in the intervention group compared with the control groups (odds ratio 0.72, 95% confidence interval 0.61 to 0.84).</td>
<td></td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>• Audit and feedback</td>
<td>• Setting</td>
<td>• Prescribing of non-penicillin V drugs also decreased in the intervention arm (0.64, 0.49 to 0.82).</td>
<td></td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>• Improvements in antibiotic prescribing for respiratory tract infections</td>
<td>• General practice clinics in Norway</td>
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