Leveraging Behavioral Interventions to Achieve Appropriate Antibiotic Prescribing

*National Academies: Combating Antimicrobial Resistance*

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*Jeffrey A. Linder, MD, MPH, FACP*

Professor of Medicine and Chief
Division of General Internal Medicine and Geriatrics
Northwestern University Feinberg School of Medicine

jlinder@northwestern.edu  @jeffreylinder
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Diagnostics are Not the Answer
Outline

• Antibiotic prescribing

• Behavioral science

• BEARI (Behavioral Economics/Acute Respiratory Infection) Trial
Background: Acute Respiratory Infections

• 10% of all ambulatory visits
• 44% of antibiotics

• Inappropriate antibiotic prescribing
  – Costs
  – Antibiotic-resistant bacteria
  – Changing the microbiome
  – Adverse drug events
Antibiotic Prescribing in the US

Figure. Antibiotic Prescribing for Acute Bronchitis in the United States by Site of Care, 1996-2010

- N = 3153 representing 31 million visits

Barnett and Linder. JAMA 2014
Antibiotic Prescribing in the US

- Adults with sore throat, 1997-2010
- N = 8191 representing 92 million visits

Antibiotic Prescribing

• 506 antibiotic prescriptions per 1000 people
  • 30% unnecessary
  • 50% of ARI prescribing unnecessary
• **US**: 833 per 1000 people
• **Sweden**: 388 → 157 per 1000 people
EPIC Study (i.e. CDC searching for bugs)

A Specific Pathogens Detected

- Viral pathogen only (22%)
- Viral–viral co-detection (2%)
- Bacterial–viral co-detection (3%)
- Bacterial pathogen only (11%)
- Fungal or mycobacterial detection (1%)

Patients with a Positive Result (%)

- Human rhinovirus: 194
- Influenza A or B: 132
- S. pneumoniae: 115
- Human metapneumovirus: 88
- Respiratory syncytial virus: 68
- Parainfluenza virus: 67
- Coronavirus: 53
- Mycoplasma pneumoniae: 43
- S. aureus: 37
- Adenovirus: 32
- Legionella pneumophila: 32
- Enterobacteriaceae: 31
- Other: 74

Pathogen Detected

Changing Behavior

• Limited Success of prior interventions

• *Implicit model*: clinicians reflective, rational, and deliberate
  – “Educate” and “remind” interventions

• *Behavioral model*: decisions fast, automatic, influenced by emotion and social factors
  – Cognitive bias
  – Appeal to clinician self-image
  – Consider social motivation
Imbalance in Factors Related to Antibiotic Prescribing

Factors Driving Antibiotic Prescribing: Immediate and Emotionally Salient

- Belief that a patient wants antibiotics
- Perception that it is easier and quicker to prescribe antibiotics than explain why they are unnecessary
- Habit
- Worry about serious complications and “just to be safe” mentality

Factors Deterring Antibiotic Prescribing: More Remote and Less Emotionally Salient

- Risks of adverse reactions and drug interactions
- Recognizing the need for antibiotic stewardship
- Desire to deter low-value care and decrease unnecessary health care spending
- Prefer to follow guidelines
Antibiotic prescriptions over the course of a day

- **Average Prescribing Rate**
- **All Acute Respiratory Infection Appointments**
- **Acute Respiratory Infection Appointments Never Indicated for Antibiotics**

**Source:** athenaResearch
Nudge

Improving Decisions about Health, Wealth, and Happiness

Richard H. Thaler and Cass R. Sunstein

...with a new afterword

"One of the few books I've read recently that fundamentally changes the way I think about the world." — Steven Levitt, coauthor of Freakonomics

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Cognitive Systems

1. Automatic

2. Reflective
Original Investigation

Effect of Behavioral Interventions on Inappropriate Antibiotic Prescribing Among Primary Care Practices: A Randomized Clinical Trial

Daniella Meeker, PhD; Jeffrey A. Linder, MD, MPH; Craig R. Fox, PhD; Mark W. Friedberg, MD, MPP; Stephen D. Persell, MD, MPH; Noah J. Goldstein, PhD; Tara K. Knight, PhD; Joel W. Hay, PhD; Jason N. Doctor, PhD

**IMPORTANCE** Interventions based on behavioral science might reduce inappropriate antibiotic prescribing.

Editorial page 558
Supplemental content at jama.com
CDS and HIT often Disappoint

• Electronic health records with clinical decision support
  – Touted as a solution to problems of medical safety, cost, and quality

• Many EHR/CDS implementations
  – Do not achieve expected improvements
  – Implicitly assume clinicians follow a standard economic/behavioral model
Specific Aim

- To evaluate 3 behavioral interventions to reduce inappropriate antibiotic prescribing for acute respiratory infections
  - 3 health systems using 3 different EHRs
Interventions

1. Suggested Alternatives
2. Accountable Justification
3. Peer Comparison
### Intervention 1: Suggested Alternatives

#### Allergies
- ACE Inhibitors - Angioedema, Rash
- Morphine - Dystonia

#### Add New Medication
- **Medication:** Amoxicillin
- **Route:** [Search] [Favorites] [Cancel]

<table>
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<tr>
<th>Type</th>
<th>Retail Copay</th>
<th>Medication</th>
<th>Route</th>
<th>Restrictions</th>
<th>Alternatives</th>
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<tr>
<td>Rx-Gen</td>
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<td>PO</td>
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<td>Alternatives</td>
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<td></td>
<td>AMOXICILLIN/CLAV. SUSP 400 MG/57 MG (5 ML)</td>
<td>PO</td>
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<td>PO</td>
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<td>Alternatives</td>
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<td>AMOXICILLIN/CLAV ACID 875/125</td>
<td>PO</td>
<td></td>
<td>Alternatives</td>
</tr>
</tbody>
</table>
Intervention 1: Suggested Alternatives

Are you prescribing this antibiotic for an acute respiratory infection (ARI)?

Yes  No  Cancel
Intervention 1: Suggested Alternatives

Please select Principal ARI diagnosis:
- Non-specific upper respiratory infection
- Sinusitis
- Pharyngitis
- Acute bronchitis
- Otitis media
- Influenza
- Pneumonia
- Other [blank field]

[OK]  [Cancel]
Intervention 1: Suggested Alternatives

Warning
You are ordering: AMOXICILLIN

Alert Message:
Antibiotics are not generally indicated for non-specific upper respiratory infections. Please consider the following alternative prescriptions, treatments, and materials to help your patient.

Alternatives

Over-the-counter medications

Decongestants
- Oxymetazoline HCL (0.05 % SPRAY)
  2 SPRAY (0.05 % SPRAY) NAS BID or PRN but no more frequently than every 6 hours. Do not use more than 3 days. Dispense: 1 Bottle(s) Refills: 0
- Pseudoephedrine (30 MG TABLET)
  60 MG (30 MG TABLET Take 2) PO Q6H PRN as needed for nasal congestion. Dispense: 50 Tablet(s) Refills: 0

Antihistamines
- Diphenhydramine ORAL (25 MG TABLET)
  25 MG (25 MG TABLET Take 1) PO Q6H PRN not to exceed 6 doses in 24 hours. Dispense: 24 Tablet(s) Refills: 0
- Loratadine (10 MG TABLET)
  10 MG (10 MG TABLET Take 1) PO QD PRN Dispense: 30 Tablet(s) Refills: 0
**Intervention 1: Suggested Alternatives**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cough suppressants and expectorants</strong></td>
<td></td>
</tr>
<tr>
<td>Benzonatate (100 MG CAPSULE)</td>
<td>100 MG (100 MG CAPSULE Take 1 PO Q4H PRN for cough. Do not take more than 6 capsules in 1 day. Dispense: 30 Capsule(s) Refills: 0</td>
</tr>
<tr>
<td>Guaifenesin AC (100-10MG/5 LIQUID)</td>
<td>5 ML (100-10MG/5 LIQUID) PO Q4H PRN for cough Dispense: 180 ML(s) Refills: 0</td>
</tr>
<tr>
<td><strong>Bronchodilators</strong></td>
<td></td>
</tr>
<tr>
<td>Albuterol INHALER HFA (90 MCG HFA AER AD)</td>
<td>2 PUFF (90 MCG HFA AER AD) INH Q6H PRN for cough Dispense: 1 Inhaler(s) Refills: 0</td>
</tr>
</tbody>
</table>

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**"Excuse from work" Patient Letter.**

- Select patient's Days Off work: 4
- Save As Note
- Preview or Print

**Print patient educational materials.**

- Preview or Print

- If you still want to prescribe an antibiotic, please check the box

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Intervention 2: Accountable Justification

Patient has asthma.
Interventions 1 and 2: Combined

- **Patient insists on antibiotics.**
Intervention 3: Peer Comparison

“You are a Top Performer”
You are in the top 10% of clinicians. You wrote 0 prescriptions out of 21 acute respiratory infection cases that did not warrant antibiotics.

“You are not a Top Performer”
Your inappropriate antibiotic prescribing rate is 15%. Top performers' rate is 0%. You wrote 3 prescriptions out of 20 acute respiratory infection cases that did not warrant antibiotics.
Interventions: Summary

EHR-based Nudges

- Suggested Alternatives

Social Motivation

- Accountable Justification
- Peer Comparison
Methods: Practices and Randomization

47 Primary Care Practices

3 Health Systems, 3 EHRs
Los Angeles: 25
Boston: 22

Randomization: Blocked by Region

18 Month Follow-Up
December 2012 – April 2014
Methods: Enrollment

- **Invited:** 355 clinicians

- **Enrolled:** 248 (70%)
  - Consent
  - Education
  - Practice-specific orientation to intervention
  - Honorarium
Methods: Primary Outcome

• **Antibiotic prescribing for non-antibiotic-appropriate diagnoses**
  – Non-specific upper respiratory infections
  – Acute bronchitis
  – Influenza

• **Excluded:** chronic lung disease, concomitant infection, immunosuppression

• **Data Sources:** EHR and billing data
Methods: Analysis

• *Piecewise hierarchical model*
  – Clinician and practice-level clustering
  – 18-month baseline period
  – 18-month intervention
  – Modeled differences in the trajectory of antibiotic prescribing starting at month zero
  – Evaluated interactions
Main Results: Suggested Alternatives

-5%     p = 0.66
Main Results: Accountable Justification

-7%  \( p < .001 \)
Main Results: Peer Comparison

-5%  p = < .001
Persistence of Effects
Limitations

• Limited to enrollees
• Dependent on EHR and billing data

Strengths

• Randomized controlled trial
• Large size
• 3 different EHRs
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Summary: Behavioral Interventions

• *Doctors are people too*
• *Doctoring is an emotional, social activity*
• *Diagnostics are not the answer*
• *Behavioral principles*
  – Decision fatigue
  – (Pre-commitment)
  – Accountable justifications
  – Peer comparison
Thank You

Questions? Conversation?

jlinder@partners.org    @jeffreylinder