OUTPATIENT ANTIMICROBIAL STEWARDSHIP

Jeffrey S Gerber, MD, PhD
Children’s Hospital of Philadelphia
University of Pennsylvania School of Medicine
DISCLOSURE STATEMENT

I have no conflicts of interest to report
LEARNING OBJECTIVES

• Explain the need for outpatient antimicrobial stewardship

• Describe outpatient antimicrobial stewardship interventions that have been effective

• Propose what is needed to further improve outpatient antibiotic prescribing
WHY OUTPATIENT STEWARDSHIP?

“...because that’s where the money is.”

- Willie Sutton, criminal (1901-1980)

- >90% of antibiotic exposure in outpatients
US Outpatient Antibiotic Prescribing Variation According to Geography, Patient Population, and Provider Specialty in 2011

Lauri A. Hicks,¹ Monina G. Bartoces,¹ Rebecca M. Roberts,¹ Katie J. Suda,² Robert J. Hunkler,³ Thomas H. Taylor Jr,¹ and Stephanie J. Schrag¹

¹Centers for Disease Control and Prevention, Atlanta, Georgia; ²Department of Veterans Affairs, University of Illinois at Chicago; and ³IMS Health, Plymouth Meeting, Pennsylvania

- IMS Health Xponent database
- 262.5 million antibiotic prescriptions dispensed in 2011
- 842 prescriptions per 1000 persons

Clinical Infectious Diseases 2015;60(9):1308–16
Table 2. Antibiotic Courses Prescribed and Prescriptions Per Provider in 2011, by Provider Specialty

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Figures 1. Geographic Variation of Antimicrobial Prescribing Rate Per 1000 Persons, 2011

Clinical Infectious Diseases 2015;60(9):1308–16
ANTIBIOTIC USE: OUTPATIENT CHILDREN

Chai G et al. *Pediatrics* 2012;130:23-31
Figure 1. Antibiotic Prescriptions per 1000 Persons of All Ages According to State, 2010. Hicks L et. Al. NEJM April 11, 2013
### OUTPATIENT ANTIBIOTIC PRESCRIBING (Rx/1000)

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Sweden</th>
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<tbody>
<tr>
<td><strong>All</strong></td>
<td>833</td>
<td>388</td>
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<tr>
<td>quinolones</td>
<td>105</td>
<td>25</td>
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<tr>
<td>macrolides</td>
<td>185</td>
<td>12</td>
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<td>12</td>
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<tr>
<td>0-2</td>
<td>1,365</td>
<td>462</td>
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<tr>
<td>3-9</td>
<td>1,021</td>
<td>414</td>
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<td>10-19</td>
<td>677</td>
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<td>20-39</td>
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<td>40-64</td>
<td>797</td>
<td>339</td>
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<td>&gt;65</td>
<td>1020</td>
<td>556</td>
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Hicks LA et al. NEJM 2010;368:1461-2
NATIONAL SUMMARY DATA

Estimated minimum number of illnesses and deaths caused by antibiotic resistance *:

At least **2,049,442** illnesses,
**23,000** deaths

*bacteria and fungus included in this report

---

Estimated minimum number of illnesses and death due to *Clostridium difficile* (*C. difficile*), a unique bacterial infection that, although not significantly resistant to the drugs used to treat it, is directly related to antibiotic use and resistance:

At least **250,000** illnesses,
**14,000** deaths

WHERE DO INFECTIONS HAPPEN?
Antibiotic-resistant infections can happen anywhere. Data show that most happen in the general community; however, most deaths related to antibiotic resistance happen in healthcare settings, such as hospitals and nursing homes.
• 32% of CDI are community-associated

• reducing antibiotic prescribing rates by 10% among persons ≥20 years old was associated with a 17% decrease in CDI

• reductions in prescribing penicillins and amoxicillin/clavulanate were associated with the greatest decreases in CA-CDI rates

Dantes et. al. Open Forum Infectious Diseases. 2015
RESISTANCE ASIDE...

- 5%–25% diarrhea
- 1 in 1000 visit emergency department for adverse effect of antibiotic
  - comparable to insulin, warfarin, and digoxin
- 1 in 4000 chance that an antibiotic will prevent serious complication from ARTI

Shehab N. CID 2008:47; Linder JA. CID 2008:47
ANTIBIOTIC USE FOR ARTIs

• 21% of all ambulatory visits for children receive an antibiotic RX

• 72% for ARTI

Hersh *Pediatrics* 2011;128;1053
IS THERE ROOM FOR IMPROVEMENT?

although prescribing rate for ARTIs has declined significantly, this has been modest, and …

• antibiotic use for ARTIs remains common
• most are caused by viruses
• use of broader-spectrum antibiotics for ARTI has increased
• the most commonly prescribed individual antibiotic agent was azithromycin

Grijalva *JAMA* 2009;302(7):758-766
Hersh *Pediatrics* 2011;128;1053
Hicks LA et al. *NEJM* 2010;368:1461-2
Figure. Percentage of Visits in Which Antibiotics Were Prescribed That Are First-line and Non-First-line for Otitis Media, 2010-2011

A Otitis media

B Sinusitis

C Pharyngitis

- Amoxicillin-penicillin
- Amoxicillin-clavulanate
- Macrolide
- Broad cephalosporin
- Fluoroquinolone
- Others
Excluding: preventive visits, CCC, antibiotic allergy, prior antibiotics
Standardized by: age, sex, race, Medicaid

Gerber et al., JPIDS, 2014
Antibiotic Prescribing for Adults With Acute Bronchitis in the United States, 1996-2010

Physicians prescribed extended macrolides at 36% (95% CI, 32%-41%) of acute bronchitis visits and most antibiotics did not change significantly over time (48% of visits in 1996 compared with 51% in 2010).

Since 2005, a Healthcare Effectiveness Data and Information Network initiative provided a national estimate of antibiotic prescribing for acute bronchitis.

Acute bronchitis is a cough-predominant acute respiratory illness of less than 3 weeks' duration. For more than 40 years, the antibiotic prescribing rate for acute bronchitis should be zero.

Discussion

There were 3153 sampled acute bronchitis visits meeting our inclusion and exclusion criteria between 1996 and 2010. We calculated standard errors for all results using logistic regression with robust variance estimates that accounted for the sampling design.

Table. Visits and Antibiotic Prescribing for Adults With Acute Bronchitis in the United States, 1996-2010

<table>
<thead>
<tr>
<th>Specialty or Setting</th>
<th>Proportion of Visits Receiving Any Antibiotic</th>
<th>Adjusted OR (95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Primary care</td>
<td>71% (95% CI, 66%-76%)</td>
<td>1.0 (Reference)</td>
</tr>
<tr>
<td>Emergency department</td>
<td>73% (95% CI, 69%-76%)</td>
<td>1.1 (0.9-1.4)</td>
</tr>
</tbody>
</table>

For trends across periods, we segmented the study period into 3-year periods.

The prevalence of antibiotic prescribing was highest in primary care settings (71%) compared with emergency department (73%) settings.

We included independent variables, such as age group, sex, and year of visit, in the logistic regression model.

Conclusion

In the United States, antibiotic prescribing for acute bronchitis in primary care settings remained high from 1996 to 2010, and there was no change over time.

Study strengths included national sample size and use of probability survey data. Limitations included potential underreporting of visits, referrals for outpatient visits, and the inability to control for practice factors.
• diagnosis-specific rates of total and appropriate antibiotic prescribing determined based on national guidelines and regional variation
  • 30% overall reduction suggested
  • 50% for ARTIs
HOW CAN WE DO THIS?
FIGHTING BACK AGAINST ANTIBIOTIC RESISTANCE

Four Core Actions to Prevent Antibiotic Resistance

1. PREVENTING INFECTIONS, PREVENTING THE SPREAD OF RESISTANCE
   Avoiding infections in the first place reduces the amount of antibiotics that have to be used and reduces the likelihood that resistance will develop during therapy. There are many ways that drug-resistant infections can be prevented: Immunization, safe food preparation, handwashing, and using antibiotics as directed and only when necessary. In addition, preventing infections also prevents the spread of resistant bacteria.

2. TRACKING
   CDC gathers data on antibiotic-resistant infections, causes of infections and whether there are particular reasons (risk factors) that caused some people to get a resistant infection. With that information, experts can develop specific strategies to prevent those infections and prevent the resistant bacteria from spreading.

3. IMPROVING ANTIBIOTIC PRESCRIBING/STEWARDSHIP
   Perhaps the single most important action needed to greatly slow down the development and spread of antibiotic-resistant infections is to change the way antibiotics are used. Up to half of antibiotic use in humans and much of antibiotic use in animals is unnecessary and inappropriate and makes everyone less safe. Stopping even some of the inappropriate and unnecessary use of antibiotics in people and animals would help greatly in slowing down the spread of resistant bacteria. This commitment to always use antibiotics appropriately and safely—only when they are needed to treat disease, and to choose the right antibiotics and to administer them in the right way in every case—is known as antibiotic stewardship.

4. DEVELOPING NEW DRUGS AND DIAGNOSTIC TESTS
   Because antibiotic resistance occurs as part of a natural process in which bacteria evolve, it can be slowed but not stopped. Therefore, we will always need new antibiotics to keep up with resistant bacteria as well as new diagnostic tests to track the development of resistance.

ANTIBIOTIC STEWARDSHIP

IN YOUR FACILITY WILL

DECREASE
- ANTIBIOTIC RESISTANCE
- C. DIFFICILE INFECTIONS
- COSTS

INCREASE
- GOOD PATIENT OUTCOMES

PROMOTE ANTIBIOTIC BEST PRACTICES—A FIRST STEP IN ANTIBIOTIC STEWARDSHIP

- ENSURE ALL ORDERS HAVE DOSE, DURATION, AND INDICATIONS
- GET CULTURES BEFORE STARTING ANTIBIOTICS
- TAKE AN “ANTIBIOTIC TIMEOUT” REASSESSING ANTIBIOTICS AFTER 48-72 HOURS

ANTIBIOTIC STEWARDSHIP PROGRAMS ARE A “WIN-WIN” FOR ALL INVOLVED

A UNIVERSITY OF MARYLAND STUDY SHOWED ONE ANTIBIOTIC STEWARDSHIP PROGRAM SAVED A TOTAL OF $17 MILLION OVER EIGHT YEARS

ANTIBIOTIC STEWARDSHIP HELPS IMPROVE PATIENT CARE AND SHORTEN HOSPITAL STAYS, THUS BENEFITING PATIENTS AS WELL AS HOSPITALS
ANTIMICROBIAL STEWARDSHIP

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

- ASPs recommended for hospitals
- most antibiotic use occurs in the outpatient setting
- is outpatient “stewardship” achievable?
ANTIMICROBIAL STEWARDSHIP

• Core Strategies
  • prior authorization
  • prospective audit & feedback
  • formulary restriction

• Supplemental Strategies
  • education
  • clinical guidelines
  • IV to PO conversion
  • dose optimization
<table>
<thead>
<tr>
<th>Core Strategies</th>
<th>Supplemental Strategies</th>
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<tbody>
<tr>
<td>prior authorization</td>
<td>education</td>
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<tr>
<td>prospective audit &amp; feedback</td>
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<td>formulary restriction</td>
<td>IV to PO conversion</td>
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<td></td>
<td>dose optimization</td>
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</tbody>
</table>
WHAT HAS BEEN DONE?
CLINICAL DECISION SUPPORT
A Cluster Randomized Trial of Decision Support Strategies for Reducing Antibiotic Use in Acute Bronchitis

Ralph Gonzales, MD, MSPH; Tammy Anderer, PhD, CRNP; Charles E. McCulloch, PhD; Judith H. Maselli, MSPH; Frederick J. Bloom Jr, MD; Thomas R. Graf, MD; Melissa Stahl, MPH; Michelle Yefko; Julie Molecavage; Joshua P. Metlay, MD, PhD

Background: National quality indicators show little change in the overuse of antibiotics for uncomplicated acute bronchitis. We compared the effect of 2 decision support strategies on antibiotic treatment of uncomplicated acute bronchitis.

Methods: We conducted a 3-arm cluster randomized trial among 33 primary care practices belonging to an integrated health care system in central Pennsylvania. The printed decision support intervention sites (11 practices) received decision support for acute cough illness through a print-based strategy, the computer-assisted decision support intervention sites (11 practices) received decision support through an electronic medical record–based strategy, and the control sites (11 practices) served as a control arm. Both intervention sites also received clinician education and feedback on prescribing practices, as well as patient education brochures at check-in. Antibiotic prescription rates for uncomplicated acute bronchitis in the winter period (October 1, 2009, through March 31, 2010) following introduction of the intervention were compared with the previous 3 winter periods in an intent-to-treat analysis.

Results: Compared with the baseline period, the percentage of adolescents and adults prescribed antibiotics during the intervention period decreased at the printed decision support intervention sites (from 80.0% to 68.3%) and at the computer-assisted decision support intervention sites (from 74.0% to 60.7%) but increased slightly at the control sites (from 72.5% to 74.3%). After controlling for patient and clinician characteristics, as well as clustering of observations by clinician and practice site, the differences for the intervention sites were statistically significant from the control sites (P = .003 for control sites vs printed decision support intervention sites and P = .01 for control sites vs computer-assisted decision support intervention sites) but not between themselves (P = .67 for printed decision support intervention sites vs computer-assisted decision support intervention sites). Changes in total visits, 30-day return visit rates, and proportion diagnosed as having uncomplicated acute bronchitis were similar among the study sites.

Conclusions: Implementation of a decision support strategy for acute bronchitis can help reduce the overuse of antibiotics in primary care settings. The effect of printed vs computer-assisted decision support strategies for providing decision support was equivalent.

Trial Registration: clinicaltrials.gov Identifier: NCT00981994

In this cluster randomized trial comparing the effectiveness of different implementation strategies for delivering clinical algorithm–based decision support for acute bronchitis in primary care, we found that both printed and computerized (computer-assisted) approaches were equally effective at improving antibiotic treatment rates for uncomplicated acute bronchitis. Error bars for each estimate reflect 95% CIs.

**Figure 3**: Antibiotic prescription rates by intervention type and period. The adjusted odds ratios for antibiotic treatment during the intervention period compared with the baseline period were 0.57 (95% CI, 0.40-0.82) for PDS intervention sites vs control sites and 0.64 (95% CI, 0.45-0.91) for CDS intervention sites vs control sites. However, a significant proportion (about 0.5% to 1.5%) of visits at all sites and periods were not prescribed antibiotics.

**Figure 4**: Effect of decision support strategies on antibiotic prescription rates. The key finding from our study is that, when coupled with other traditional patient and physician education materials, both PDS and CDS strategies can achieve modest differences among practice sites, 0.64 (95% CI, 0.45-0.91) for CDS intervention sites (from 74.0% to 74.3% at the CDS intervention sites) but not between themselves (P = .003 for control sites vs PDS intervention sites, 0.67 for PDS intervention sites vs control sites).
EDUCATION OF CLINICIANS AND PATIENTS
Impact of a 16-Community Trial to Promote Judicious Antibiotic Use in Massachusetts


• cluster RCT in 16 MA communities (1998 to 2003)
• clinician guideline dissemination, small-group education, frequent updates and educational materials, and prescribing feedback
• parents received educational materials by mail and in primary care practices, pharmacies, and child care settings
• using health-plan data, measured changes in antibiotics dispensed among children aged 3 to 72 months
TABLE 2 Impact of Community-Level Intervention According to Age Group and Insurance Type

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th></th>
<th>Intervention</th>
<th></th>
<th>Intervention Impact</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted Rate, Baseline Year 1</td>
<td>Adjusted % Change</td>
<td>Unadjusted Rate, Baseline Year 1</td>
<td>Adjusted % Change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>3 to &lt;24 mo</td>
<td>2.8</td>
<td>-20.7</td>
<td>2.9</td>
<td>-21.2</td>
<td>-0.5</td>
</tr>
<tr>
<td></td>
<td>24 to &lt;48 mo</td>
<td>1.7</td>
<td>-10.3</td>
<td>1.7</td>
<td>-14.5</td>
<td>-4.2</td>
</tr>
<tr>
<td></td>
<td>48 to &lt;72 mo</td>
<td>1.4</td>
<td>-2.5</td>
<td>1.4</td>
<td>-9.3</td>
<td>-6.7</td>
</tr>
</tbody>
</table>

*Note: P values are calculated using mixed models, accounting for clustering by community, baseline prescribing rate, differences in baseline trend (year 1 to 2), secular trend during the 5-year study period. We observed no antibiotic use in both control and intervention communities during the 5-year study period. We observed dramatic impact in antibiotic use, even in control communities.*
AUDIT AND FEEDBACK
Effect of an Outpatient Antimicrobial Stewardship Intervention on Broad-Spectrum Antibiotic Prescribing by Primary Care Pediatricians
A Randomized Trial

- cluster-RCT of 18 practices, 170 clinicians
- common EHR
- focused on **antibiotic choice** for encounters for bacterial infections with established guidelines
  - streptococcal pharyngitis
  - acute sinusitis
  - Pneumonia
- (all should get penicillin or amoxicillin)
INTERVENTION: TIMELINE

- On-site education
- Feedback reports
- 20 months baseline data
- 12 months of audit/feedback
Broad Spectrum Antibiotics for Acute Sinusitis
(amoxicillin-clavulanate, 2nd/3rd cephalosporins, or azithromycin)

- **YOU**
  - Baseline (1/1/10-5/31/10): 49.5%
  - Q1 (6/1/10-9/30/10): 34.1%
  - Q2 (10/1/10-1/31/11): 25.9%

- **Your Practice**
  - Baseline (1/1/10-5/31/10): 47.9%
  - Q1 (6/1/10-9/30/10): 34.1%
  - Q2 (10/1/10-1/31/11): 23.9%

- **Network**
  - Baseline (1/1/10-5/31/10): 42.5%
  - Q1 (6/1/10-9/30/10): 35.5%
  - Q2 (10/1/10-1/31/11): 27.7%
Broad spectrum antibiotics use for acute visits

Rate (95% CI) of prescribing before, during, and after intervention

- **Control Practices**
- **Intervention Practices**

Start audit and feedback

JAMA. 2013;309(22):2345
Broad spectrum antibiotics use for acute visits

Rate (95% CI) of prescribing before, during, and after intervention

- Control Practices
- Intervention Practices

Start audit and feedback

End of audit and feedback

Standardized Rates (%) of Prescribing

Month before(-) and after intervention

JAMA.2013;309(22):2345
Broad spectrum antibiotics use for acute visits

Rate (95% CI) of prescribing before, during, and after intervention

- **Control Practices**
- **Intervention Practices**

Start audit and feedback

End of audit and feedback

JAMA.2013;309(22):2345
WHAT DO CLINICIANS THINK?
QUALITATIVE ANALYSES

• most did not believe that their prescribing behavior contributed to antibiotic overuse

• reported frequently confronting parental pressure, sometimes acquiescing to:
  • appear competent
  • avoid losing patients to other practices that would “give them what they want”

Szymczak, ICHE, 2014, vol. 35, no. s3
“We have lots of parents who come in and they know what they want. They don’t care what we have to say. They want the antibiotic that they want because they know what is wrong with their child.”

Szymczak, ICHE, 2014, vol. 35, no. s3
CLINICIAN PERCEPTIONS

- interviewed 10 physicians, 306 parents
- **physician perception** of parental expectations for antimicrobials was the only predictor of prescribing antimicrobials for viral infections
  - when they thought parents wanted antimicrobial:
    - 62% vs. 7% prescribed antibiotic

Mangione-Smith et al. *Pediatrics* 1999;103(4)
WHAT DO PARENTS THINK?
WHAT DO PARENTS WANT?

• direct parental request for antibiotics in 1% of cases
• parental expectations for antibiotics were not associated with physician-perceived expectations
• parents who expected antibiotics but did not receive them were more satisfied if the physician provided a contingency plan
• failure to meet parental expectations regarding communication events during the visit was the only significant predictor of parental satisfaction (NOT failure to provide expected antimicrobials)

PARENT PERCEPTIONS

• survey of 1500 Massachusetts parents in 2013
  • high level of trust in physicians
• 5 focus groups (31 parents) – knowledge/attitudes surrounding antibiotic use in 2011:
  • concerned about antibiotic resistance
  • expressed desire to use antibiotics only when necessary
  • it appears that parents have become more informed and sophisticated regarding appropriate uses of antibiotics

Finkelstein, Clin Peds. 2014:53(2); Vaz, Pediatrics. 2015:136(2)
WHAT DO PARENTS THINK?

• interviewed >100 parents of kids presenting with ARTIs from waiting rooms

• parents did not plan to demand an antibiotic for their child
  • deferred to medical expertise about the need for antibiotic therapy, contrary to what pediatricians report
  • parents are aware of the downsides of antibiotics and may be willing to partner to improve appropriate use

Szymczak, ID Week, San Diego, 2015
COMMUNICATION

• parent and clinician surveys after 1,285 pediatric ARTI visits to 28 pediatric providers from 10 Seattle practices

• positive treatment recommendations (suggesting actions to reduce child’s symptoms) were associated with decreased risk of antibiotic prescribing

Mangione-Smith et al. Ann Fam Med 2015;13:221-227
Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: a multinational, cluster, randomised, factorial, controlled trial

Paul Little, Beth Stuart, Nick Francis, Elaine Douglas, Sarah Tonkin-Crine, Sibyl Anthierens, Jochen W L Cals, Hasse Melbye, Miriam Santer, Michael Moore, Samuel Coenen, Chris Butler, Kerenza Hood, Mark Kelly, Maciek Godycki-Cwirko, Artur Mierzecki, Antoni Torres, Carl Llor, Melanie Davies, Mark Mullee, Gilly O’Reilly, Alike van der Velden, Adam W A Geraghty, Herman Goossens, Theo Verheij, Lucy Yardley, on behalf of the GRACE consortium

- 246 practices, 4264 patients, 6 European countries

- training in enhanced communication skills:
  - gathering information on patient concerns/expectations
  - exchange of information on symptoms, natural disease course
  - Tx; agreement of a management plan

- communication training led to a >30% reduction in antibiotic prescribing for ARTI
NON-CLINICAL DRIVERS OF ANTIBIOTIC PRESCRIBING?

- perceived parental pressure
- presence of trainees
- time of day
- patient race
- practice location

Linder, JAMA Internal Medicine 2014;174(12)
Gerber et al., Pediatrics 2013;131:677–684
Handy LK, ID Week 2015
• 10,414 children Dx with pneumonia
• 30 practices
• 41% amoxicillin
• 43% azithromycin
HUMAN BEHAVIOR AND PRESCRIBING

- behavioral determinants and social norms influence antibiotic prescribing
- therefore, different levers that shape clinician behavior need to be considered at the point of care, where the decision to prescribe is made
NOVEL SOCIO-BEHAVIORAL STRATEGIES
• QI interventions often neglect psychosocial and professional factors that may affect clinical decisions

• intervention that takes advantage of clinicians’ desire to be consistent with their public commitments

• simple, low-cost behavioral “nudge” in form of a public commitment device: a poster-sized letter signed by clinicians and posted in their examination rooms indicating their commitment to reducing inappropriate antibiotic use for ARTIs
Antibiotics, like penicillin, fight infections due to bacteria … but these medicines can cause side effects like skin rashes, diarrhea, or yeast infections. If your symptoms are from a virus and not from bacteria, you won’t get better with an antibiotic, and you could still get these bad side effects.

Antibiotics also make bacteria more resistant to them. This can make future infections harder to treat. This means that antibiotics might not work when you really need them. Because of this, it is important that you only use an antibiotic when it is necessary …

Your health is very important to us. As your doctors, we promise to treat your illness in the best way possible. We are also dedicated to avoid prescribing antibiotics when they are likely to do more harm than good.
cant decrease in unnecessary antibiotic prescribing rates for edge, the present intervention is the first attempt to apply the main consistent with a prior public commitment. To our knowl-

ing of poor performance either by administrators or cli-
vicians themselves will result in changes to delivery or new 

Abbreviation: ARI, acute respiratory infection.

Table 4. Changes in Adjusted Ratesa of Inappropriate Antibiotic Prescribing for ARIs

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Poster Condition</th>
<th>Control Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Final Measurement</td>
</tr>
<tr>
<td>Inappropriate prescribing rate, % (95% CI)</td>
<td>43.5 (38.5 to 49.0)</td>
<td>33.7 (25.1 to 43.1)</td>
</tr>
<tr>
<td>Absolute percentage change, baseline to final measurement (95% CI)</td>
<td>-9.8 (0.0 to -19.3)</td>
<td>9.9 (0.0 to 20.2)</td>
</tr>
<tr>
<td>Difference in differences between poster condition and control (95% CI)</td>
<td>-19.7 (-5.8 to -33.04)b</td>
<td></td>
</tr>
</tbody>
</table>

DIS (Healthcare Effectiveness Data and Information Set) and International
Suggested alternatives

- antibiotics are generally not indicated for this”

Accountable justification

- free text, or “no justification given”

Peer comparison

- top decile “top performer” or “not top performer”
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.
Figure 2. Adjusted Rates of Antibiotic Prescribing at Primary Care Office Visits for Antibiotic-Inappropriate Acute Respiratory Tract Infections Over Time

A. Accountable justification
B. Peer comparison
C. Suggested alternatives

Prescribing rates for each intervention are marginal predictions from hierarchical regression models of intervention effects, adjusted for concurrent exposure to other interventions and clinician and practice random effects. Error bars indicate 95% CIs. Model coefficients are available in eTable 3 in Supplement 2.

Table 2. Unadjusted Visit Counts and Antibiotic Prescribing Rates for Antibiotic-Inappropriate Acute Respiratory Tract Infections During the Baseline and Intervention Periods, by Study Group
SUMMARY

• antibiotic prescribing in the ambulatory setting is common and has only slightly improved in certain areas over time

• many investigators and public health entities have implemented promising strategies to improve use, such as education, audit with feedback, and decision support

• socio-behavioral approaches, such as improving communication and holding clinicians accountable can also be effective
WHAT WE NEED

- Widespread implementation of the approaches we already have
- mechanism for tracking antibiotic use for benchmarking/feedback
  - overall antibiotic use; by condition/setting to identify targets
  - antibiotic choice (FQ, macrolides, 3rd ceph)
- additional targets:
  - duration of Tx (UTI, CAP, AOM)
  - hospital discharge (OPAT, oral)
  - Emergency Department
  - ambulatory surgery
THANK YOU

gerberj@chop.edu

Get Smart About Antibiotics Week
November 14–20, 2016

www.cdc.gov/gets SMART
Know When Antibiotics Work