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Children's National

Enhancing Judicious Use of Antibiotics:
Tools for the Primary Care Pediatrician

Rana Hamdy, MD, MPH, MSCE
Future of Pediatrics
June 20, 2017

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Objectives

1. To describe antibiotic use in outpatient pediatrics
2. To quantify unintended consequences of antibiotic use
3. To define antimicrobial stewardship
4. To identify behaviors and tools that enhance judicious antibiotic prescribing

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We use a lot of antibiotics in outpatient pediatrics

~ 75 million antibiotic prescriptions to children/ yr

Characteristic	Prescriptions, No. in Millions (%)[a]	Prescriptions per 1000 Persons, Rate
Age group, y		
0–2	15.4 (21)	1287
3–9	29.1 (40)	1018
10–19	29.3 (40)	691
Antibiotic agent (top 5)		
Amoxicillin	24.9	300
Azithromycin	15.2	183
Amoxicillin-clavulanate	7.2	87
Cefdinir	6.1	74
Cephalexin	4.6	56

Hersh, *Pediatrics* 2011. 128(6):1053-61

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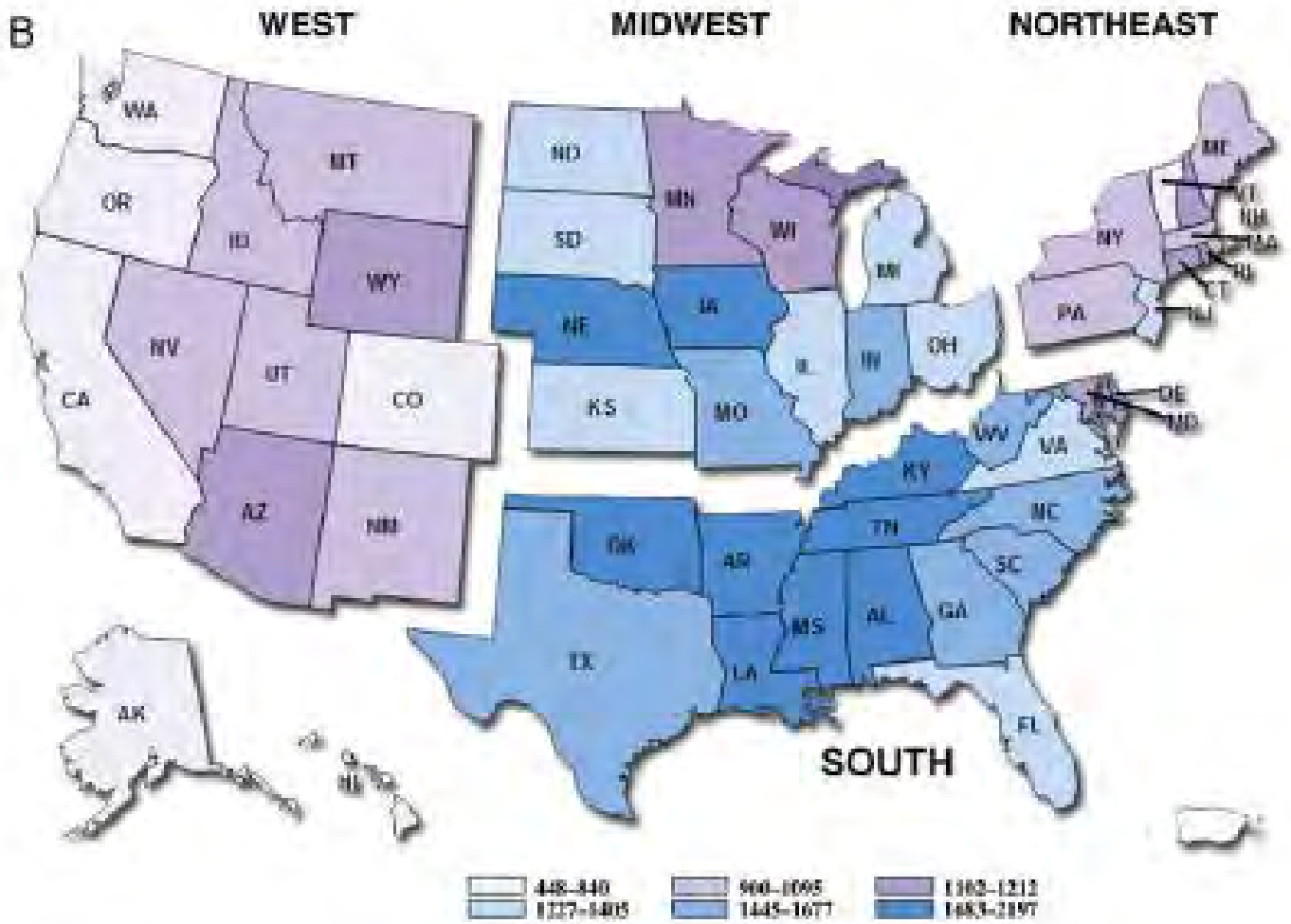
Antibiotics are prescribed variably

Antibiotic prescriptions to children < 2 years in 2011



Hicks, *Clin Infect Dis* 2015. 60(9):1308-16

1 in 3 antibiotic prescriptions is unnecessary

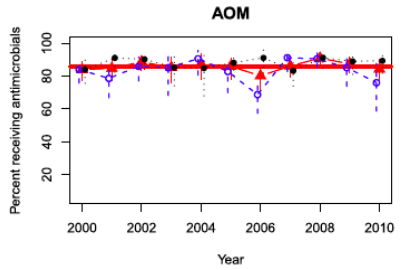
TABLE 1 Antibiotic-Prescribing Patterns Across Diagnostic Conditions

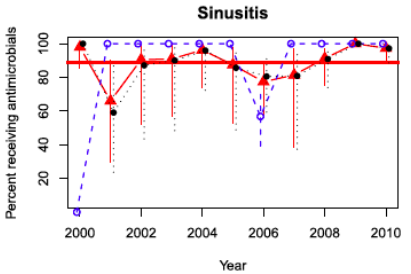
Condition	Across-Condition Contribution to Antibiotic Prescribing, %
Respiratory	72.3
ARTIs for which antibiotics are indicated	48.9
ARTIs for which antibiotics are not indicated	13.1
Other respiratory conditions for which antibiotics are not definitely indicated	10.3
Other	27.7
Skin/cutaneous/mucosal	11.9
Urinary tract infections[a]	2.0
Gastrointestinal infections	0.3
Miscellaneous infections	1.9
Other	11.6
Total	100[a]

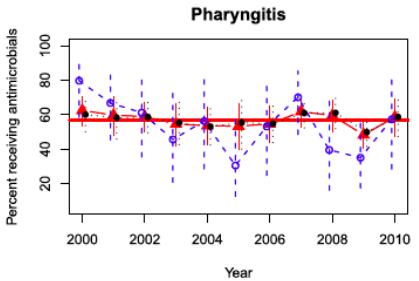
Kronman et al. *Pediatrics.* 2014. 134(4):e956-65.

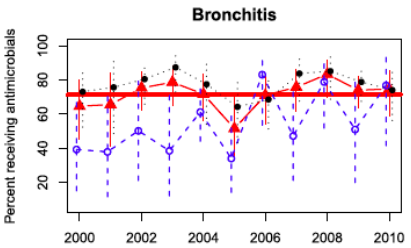
11.4 million potentially preventable antibiotic prescriptions per year

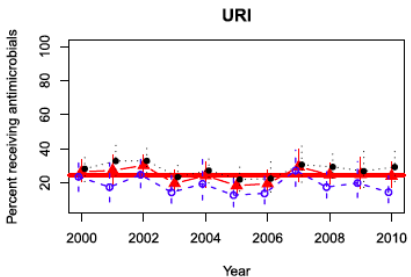
- AOM:
  - Bacterial prevalence: **64.7%** (95% CI: 50.5% - 77.7%)
  - Actual prescribing: **85.9%** (79-92.4%)
- Sinusitis:
  - Bacterial prevalence: **78%**
  - Actual prescribing: **88.8%** (60.2-100%)
- Pharyngitis:
  - *S. pyogenes* isolated in **20.2%** (95% CI: 15.9-25.2%)
  - Actual prescribing: **56.9%** (43.5-65.3%)
- Bronchitis:
  - Bacterial prevalence: presumed **0%**
  - Actual prescribing: **71.5%** (51.5-91.4%)
- URI:
  - Bacterial prevalence: presumed **0%**
  - Actual prescribing: **24.4%** (14-28.2%)











Kronman et al. *Pediatrics.* 2014. 134(4):e956-65
Wald et al. *J Pediatr.* 1984. 104(2):297-302

Consequences of antibiotic use include:

1. Antibiotic resistance
2. Adverse drug events
3. *Clostridium difficile* infections
4. Effects on the microbiome

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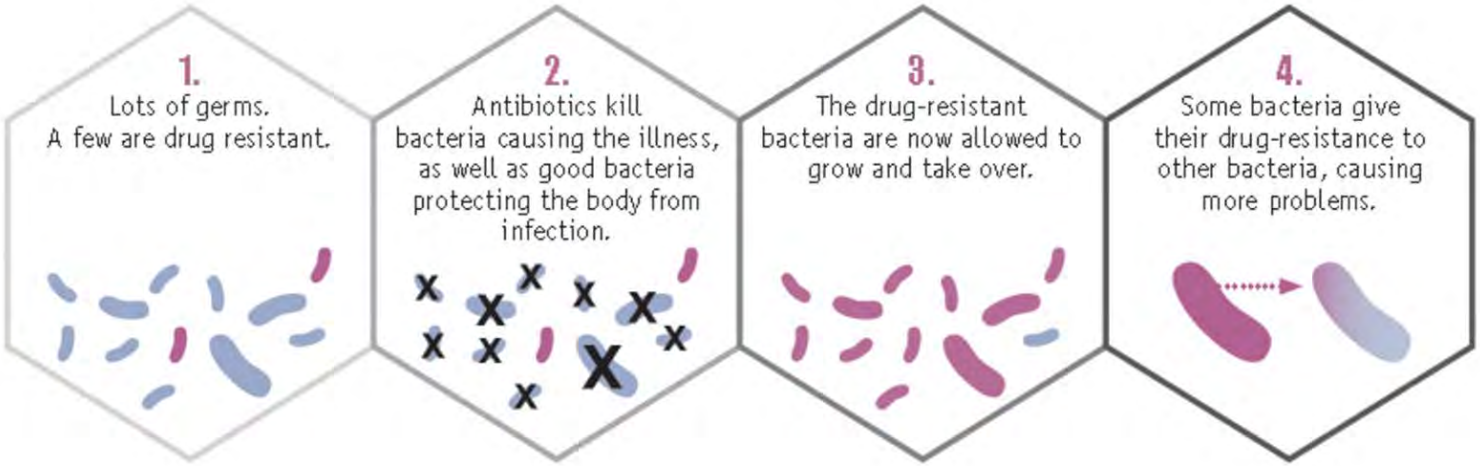
Antibiotic use is the #1 driving factor leading to antibiotic resistance



- **Broader spectrum antibiotics**
- **Inadequate doses**
- **Longer durations**

→ **Antibiotic resistance**

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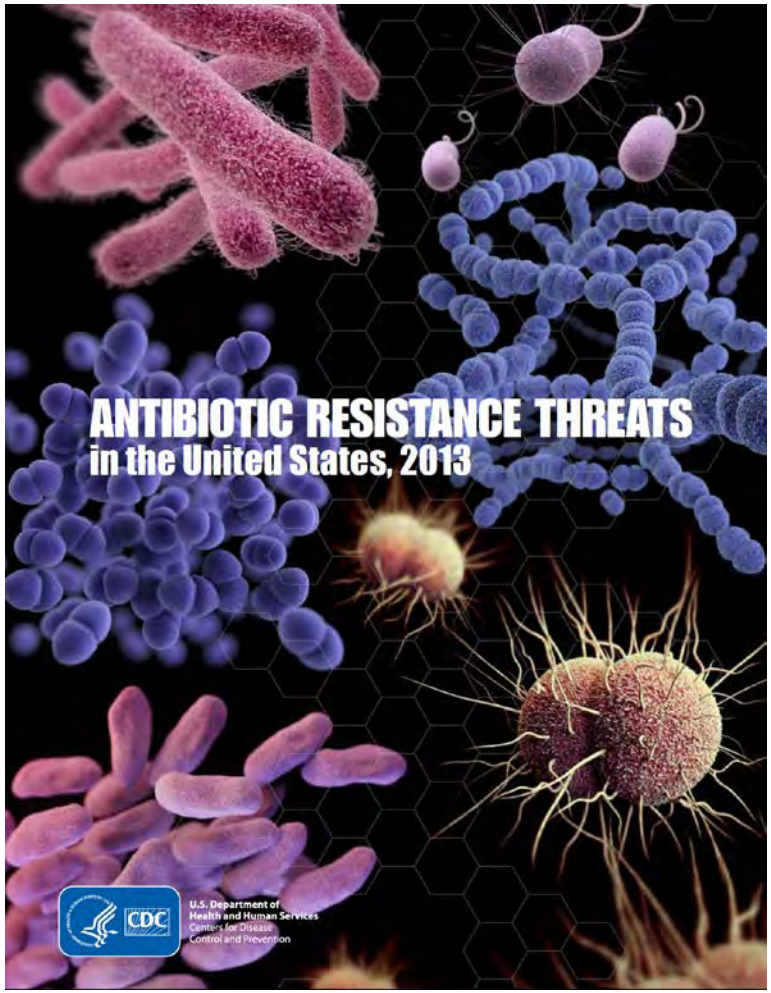
Antibiotic Resistance is "one of the world's most pressing health problems"



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Antibiotic resistance is affecting outpatient pediatrics: *Staphylococcus aureus*

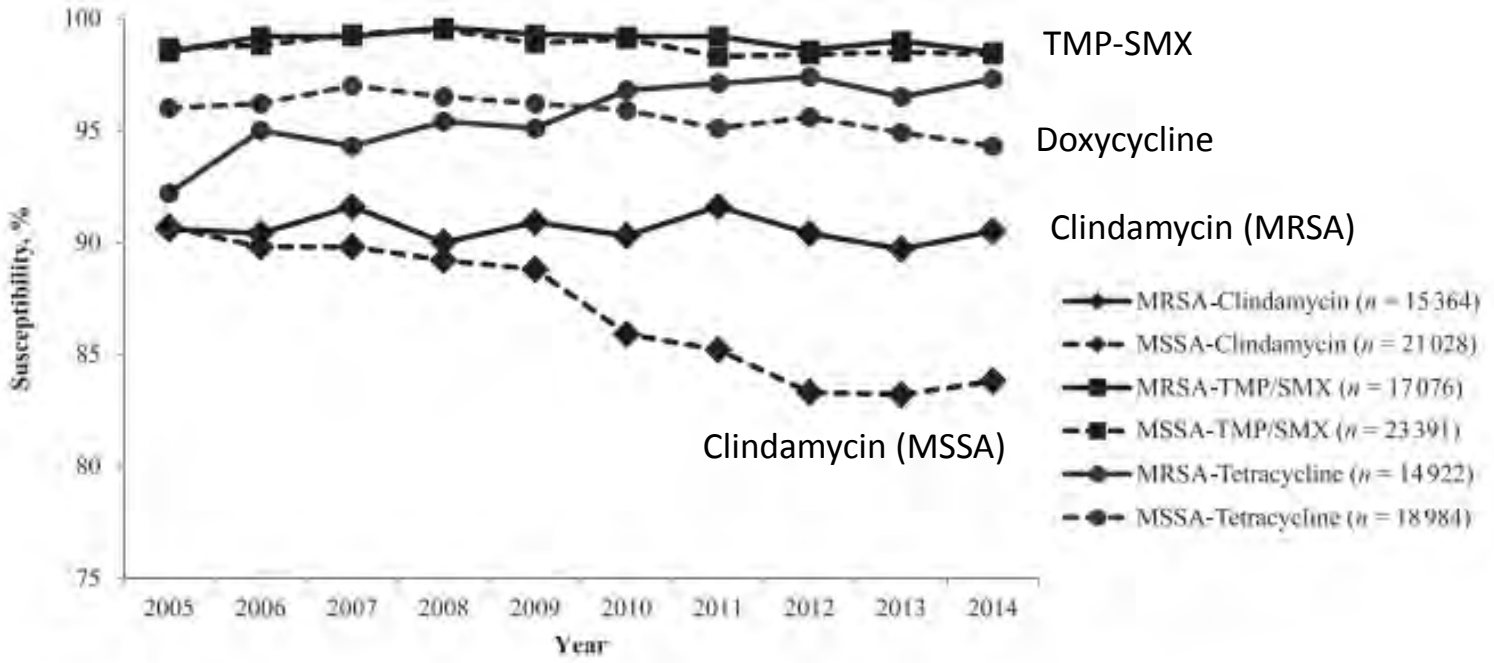

FIGURE 1
Antibiotic susceptibilities to MRSA and MSSA among pediatric patients in 2005–2014.

Sutter DE et al. *Pediatrics.* 2016. 137(3): e20153099

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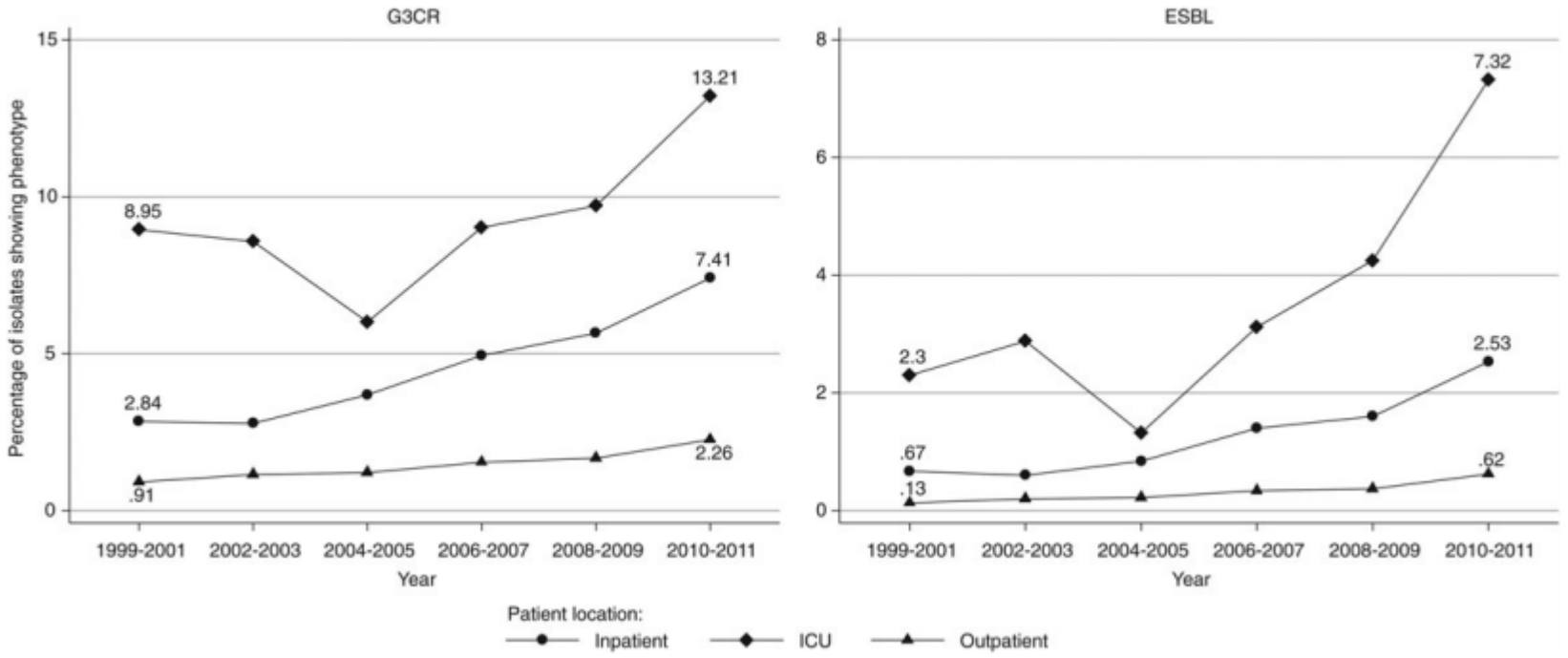
Antibiotic resistance is affecting outpatient pediatrics: Gram negative infections



Logan LK et al. *JPIDS.* 2014. 3(4): 320-8.

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Antibiotic resistance is affecting outpatient pediatrics: Gram negative infections

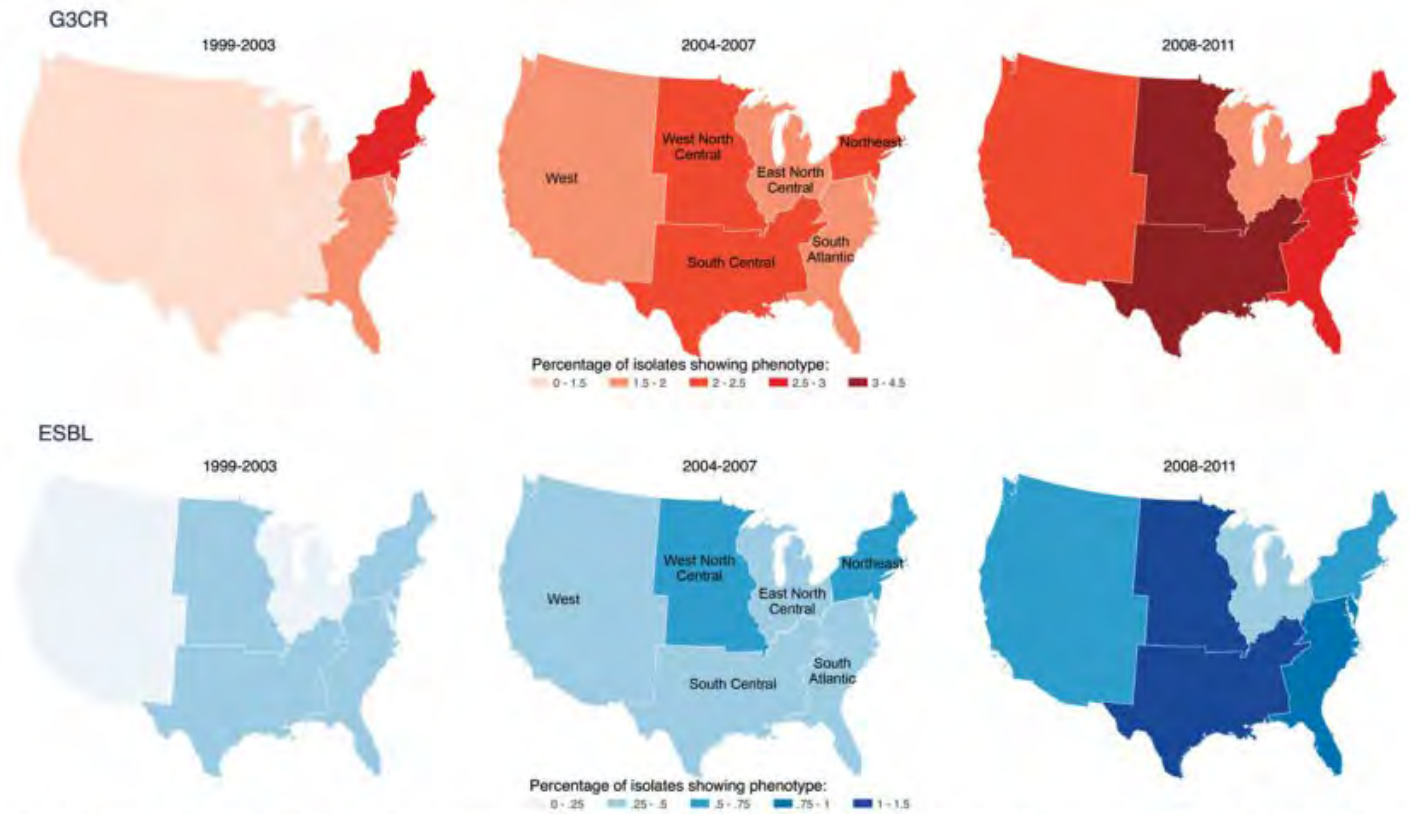

Figure 3. Regional trends in the prevalence of third-generation cephalosporin resistant (G3CR) and extended-spectrum β-lactamase (ESBL) phenotypes among pediatric *Enterobacteriaceae* isolates in The Surveillance Network–USA database, 1999–2011. Maps show the period percentage of isolates in each region that belonged to a resistance phenotype. The 6 regions correspond to the 4 United States Census regions (West, Northeast, South, Midwest), with Midwest and South, respectively, split into East and West North Central, and West–South Central and South Atlantic. Isolates from sites in Alaska and Hawaii are included in the West region.

Logan LK et al. *JPIDS.* 2014. 3(4): 320-8.

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Adverse Effects of Antibiotics

- **1 in 5 ED visits for adverse drug events is due to an antibiotic**
- 10%–25%: antibiotic-associated diarrhea
- 2%: skin reaction
- 1 in 5,000: anaphylactic reaction
- Overall:
  - **number needed to harm (NNH) = 13**
  - NNH = 6, including diarrhea

Bartlett JG. *NEJM.* 2002: 346(5)
Shehab N et al. *CID* 2008:47;
Gruchalla RS, Pirmohamed M. *NEJM*. 2006;354
Neugut AI et al. *Arch Intern Med*. 2001;161.

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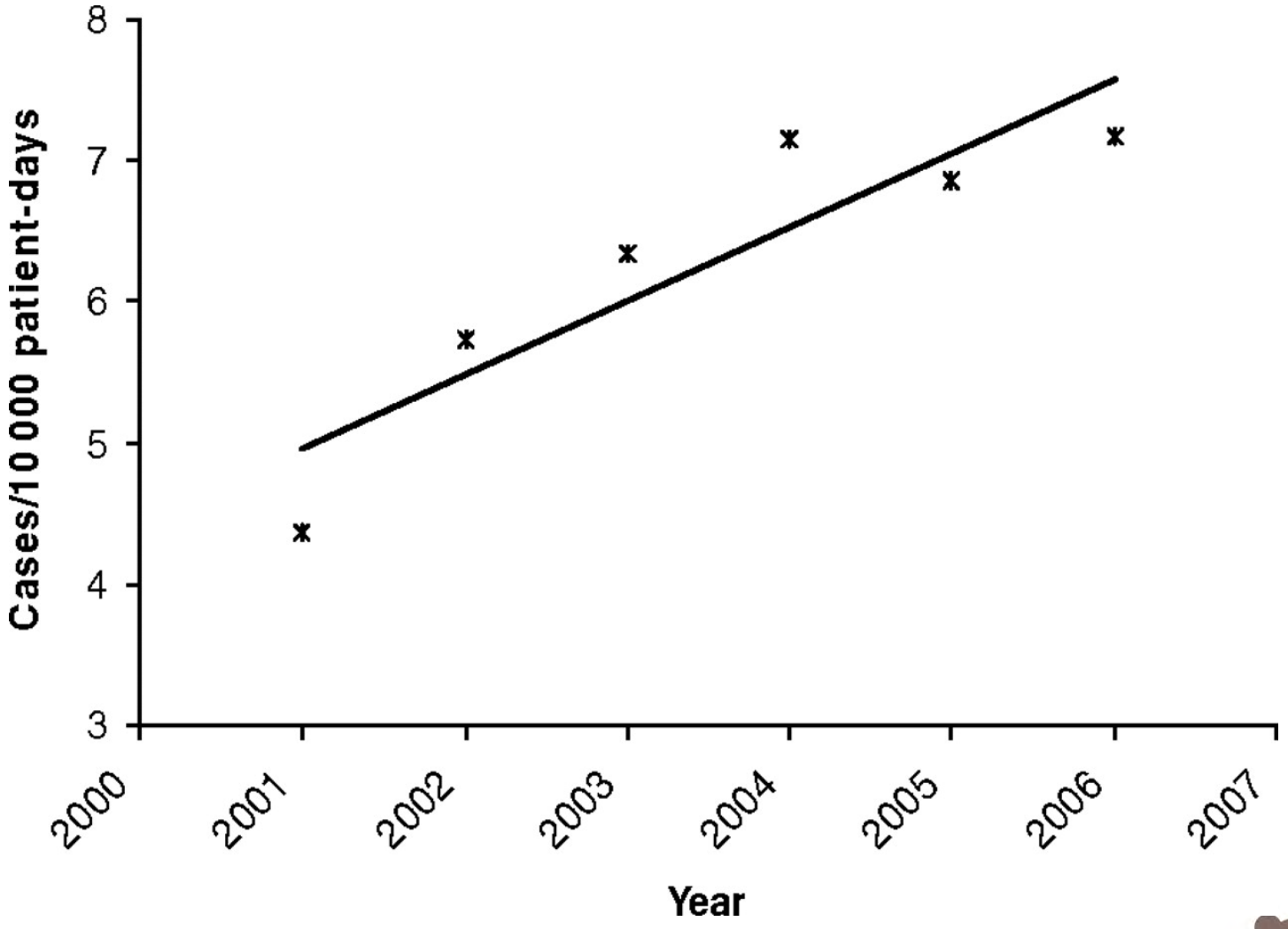
Incidence of *C. difficile* infections in children is increasing



Kim et al. *Pediatrics* 2008;122:1266-1270

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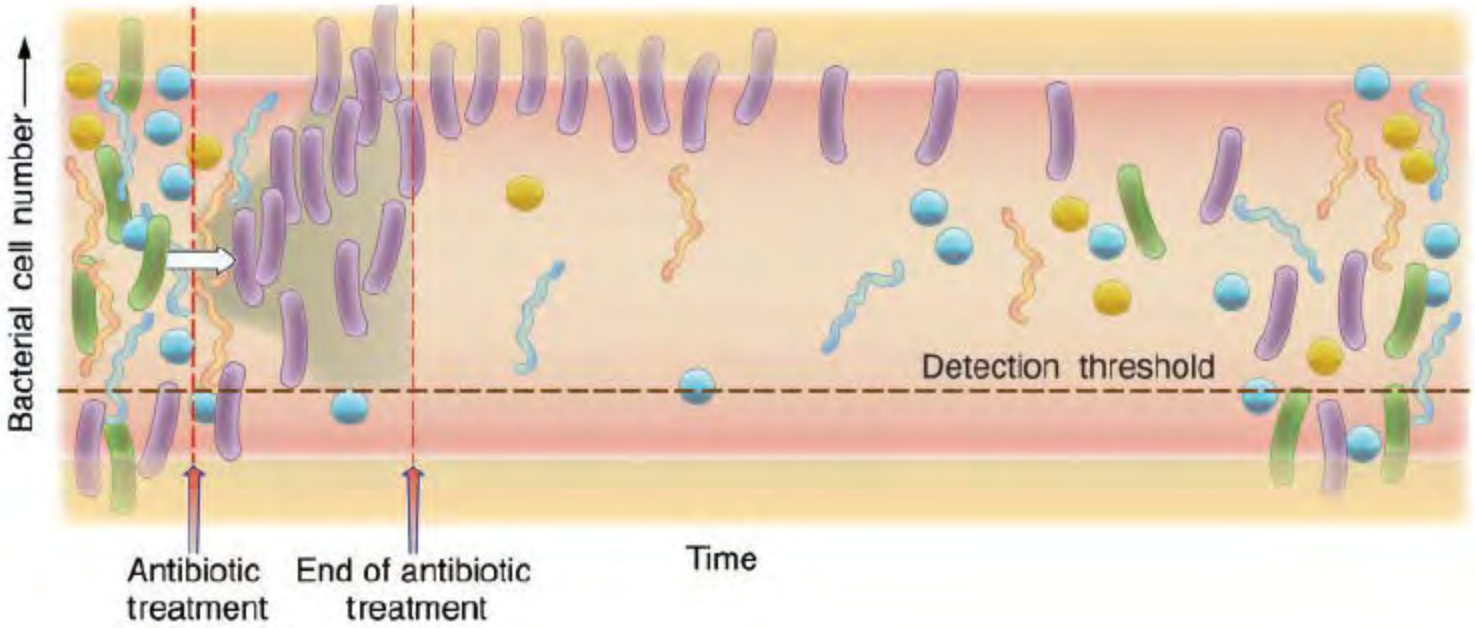
Antibiotics Cause Prolonged Alterations to Gut Flora



Green: susceptible bugs
Purple: resistant bugs

Jernberg C et al. *Microbiology*. 2010;156:3216.
Jernberg C et al. *ISME* 2007;1:56.

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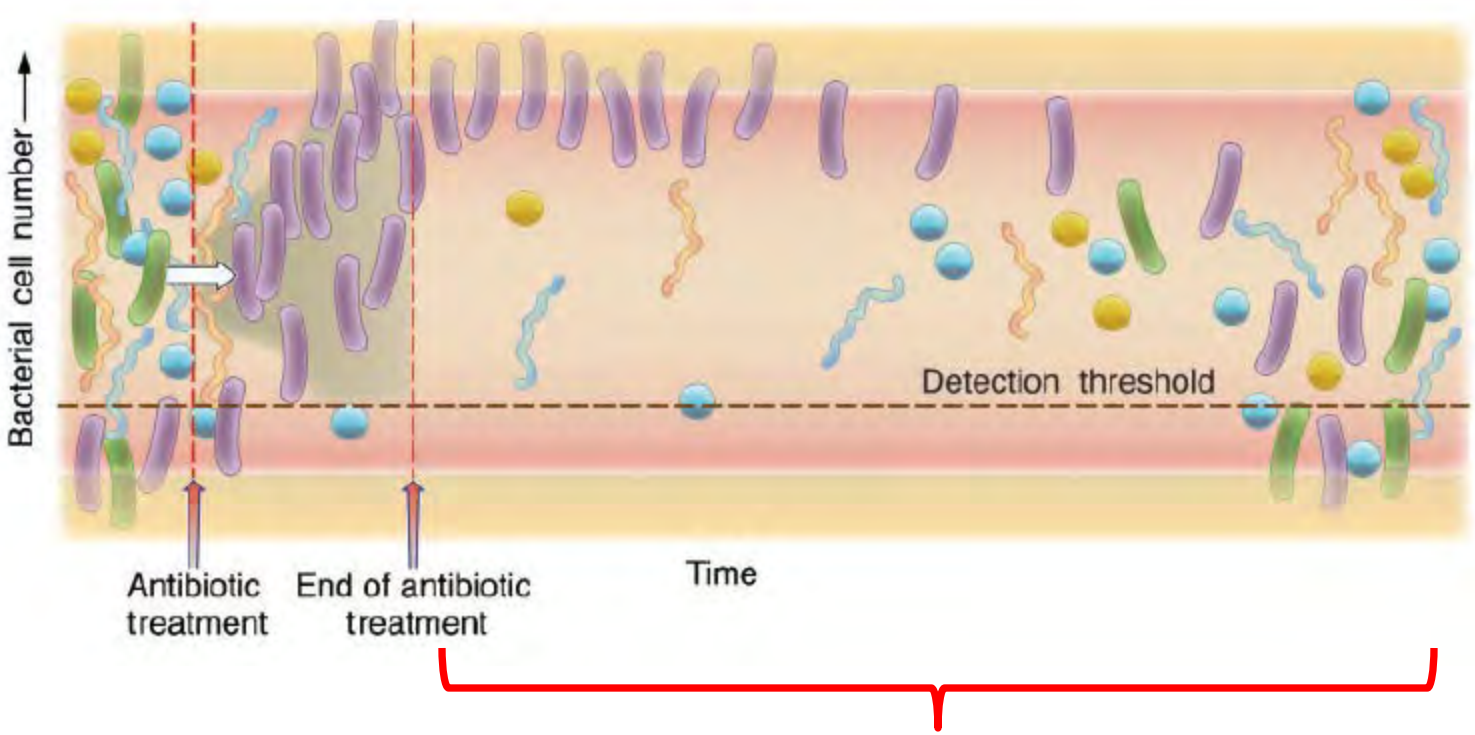
Antibiotics Cause Prolonged Alterations to Gut Flora



Green: susceptible bugs

Purple: resistant bugs

2 years!

Jernberg C et al. *Microbiology*. 2010;156:3216.
Jernberg C et al. *ISME* 2007;1:56.

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COMMENT

HOMININS Did modern humans replace Neanderthals or co-exist with them? **p.395**

HISTORY Sigmund Freud and William Halstead on cocaine **p.397**

BIODIVERSITY DNA bank needed to conserve all species, not just plants **p.399**

OBITUARY Jonathan Widom, genomic map-maker, remembered **p.400**

P. DUREUIL/PHOTOALTO/ALAMY

Dosed up: could excessive prescription of antibiotics be hampering children's ability to fight disease?

Stop the killing of beneficial bacteria

Concerns about antibiotics focus on bacterial resistance — but permanent changes to our protective flora could have more serious consequences, says **Martin Blaser**.

The average child in the United States and other developed countries has received 10–20 courses of antibiotics by the time he or she is 18 years old[1]. In many respects, this is a life-saving development. The average US citizen born in 1940 was expected to live to the age of 63; a baby born today should reach 78, in part because of antibiotics. But the assumption that antibiotics are generally safe has fostered overuse and led to an increase in bacterial resistance to treatments.

Other, equally serious, long-term consequences of our love of antibiotics have received far less attention. Antibiotics kill the bacteria we do want, as well as those we don't. Early evidence from my lab and others hints that, sometimes, our friendly flora never fully recover. These long-term changes to the beneficial bacteria within people's bodies may even increase our susceptibility to infections and disease. Overuse of antibiotics could be fuelling the dramatic increase in conditions such as obesity, type 1 diabetes, inflammatory bowel disease, allergies and asthma, which have more than doubled in many populations (see graph).

We urgently need to investigate this possibility. And, even before we understand the full scope, there is action we should take. ▸

Thus the call for Antimicrobial Stewardship …

- To ensure optimal
  - selection
  - dosage
  - route
  - duration
- to result in the **best clinical outcome**
- with **minimal toxicity** to the patient and minimal impact on subsequent resistance.

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Antimicrobial Stewardship promotes principles of judicious antibiotic use

- No antibiotics for viral infections
- Use narrowest spectrum antibiotic effective
- Use adequate dosing
- Limit duration for established infections based upon current evidence
- Narrow therapy when organism is isolated
- Stop antibiotics if bacterial infection is unlikely

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Case #1

- 7 year old girl with cough, low-grade fever, rhinorrhea x 2 days
- Reassuring exam

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Case #1: Next steps?

A. Supportive care, he has a URI

B. It's probably viral, but prescribe an antibiotic "just in case"

Start the presentation to activate live content

If you see this message in presentation mode, install the add-in or get help at PollEv.com/app

are antibiotics prescribed for U

A. Lack of knowledge by clinicians that antibiotics are not needed for URIs

B. It's just easier sometimes: Lack of time to explain that antibiotics are not needed

C. Parental expectations for antibiotics causes pressure on clinician to prescribe

D. Fear of missing a possible a bacterial process

E. All of the above

Start the presentation to activate live content

If you see this message in presentation mode, install the add-in or get help at PollEv.com/app

tal expectations: Can you tell w parent expects antibiotics?

A. Yes, definitely

B. Usually

C. No

Start the presentation to activate live content

If you see this message in presentation mode, install the add-in or get help at PollEv.com/app

Pediatricians' perceptions of parental expectations for antibiotics do not match parents' reported expectations

- 10 physicians, 306 parents of children

	Physician thinks parent wants abx	Physician doesn't think parent wants abx
Antibiotic prescribed	62%	7%
Bacterial diagnosis given	70%	31%

- Physician antibiotic prescribing behavior **not** associated with **actual** parental expectations for receiving antibiotics.
- Not providing expected antibiotics did not affect satisfaction.

Mangione-Smith et al. *Pediatrics.* 1999. 103(4):711-8.

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Framing:
How we communicate with parents is critical

1. Explanation for why antibiotics are not needed

coupled with

2. Positive treatment recommendations

and

3. Contingency plan

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Communication strategies:
#1: Explanation for why antibiotics are not needed

This is a nasty cold, so antibiotics won't make you better faster.

You have a chest cold, and antibiotics won't help.

The strep test is negative, meaning your sore throat is caused by a virus, and antibiotics won't help.

Fleming-Dutra et al. *Am Fam Physician.* 2016. 94(3):200-2.

Communication strategies

Always combine explanations for why antibiotics are not needed with positive treatment recommendations.

Fleming-Dutra et al. *Am Fam Physician.* 2016. 94(3):200-2.

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Communication strategies:
#2: **Positive** treatment recommendations

Taking ibuprofen and drinking plenty of fluids will help you feel better.

Honey can actually soothe your child's cough and help her sleep better.

Fleming-Dutra et al. *Am Fam Physician.* 2016. 94(3):200-2.

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Communication strategies: #3: Contingency plan

If you are not better in 3 or 4 days, call or come back and we can reassess the need for antibiotics then.

If your child is still sick in a week or if he develops a fever, come back and see me.

Fleming-Dutra et al. *Am Fam Physician.* 2016. 94(3):200-2.

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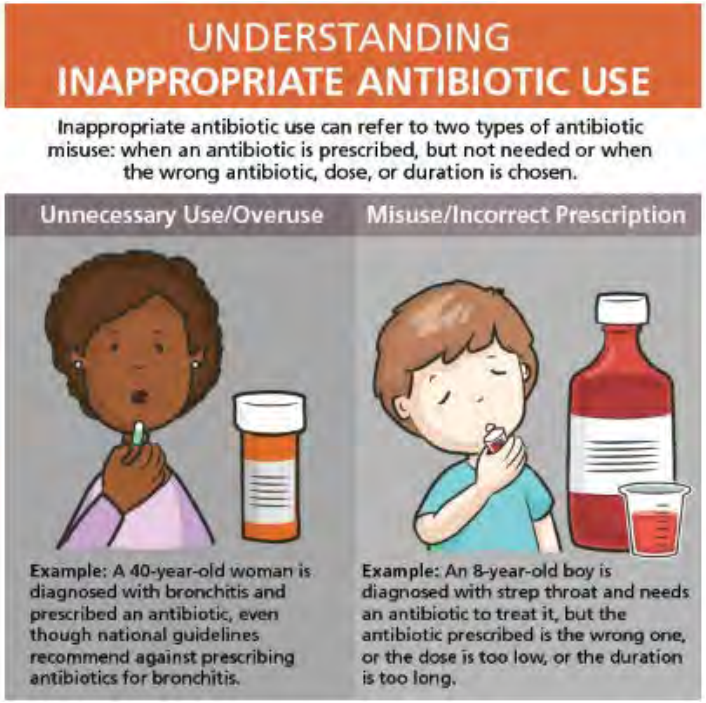
Patient/ parental education outside the clinic room

- Educational pamphlets
- Available for free at:

  www.cdc.gov/getsmart



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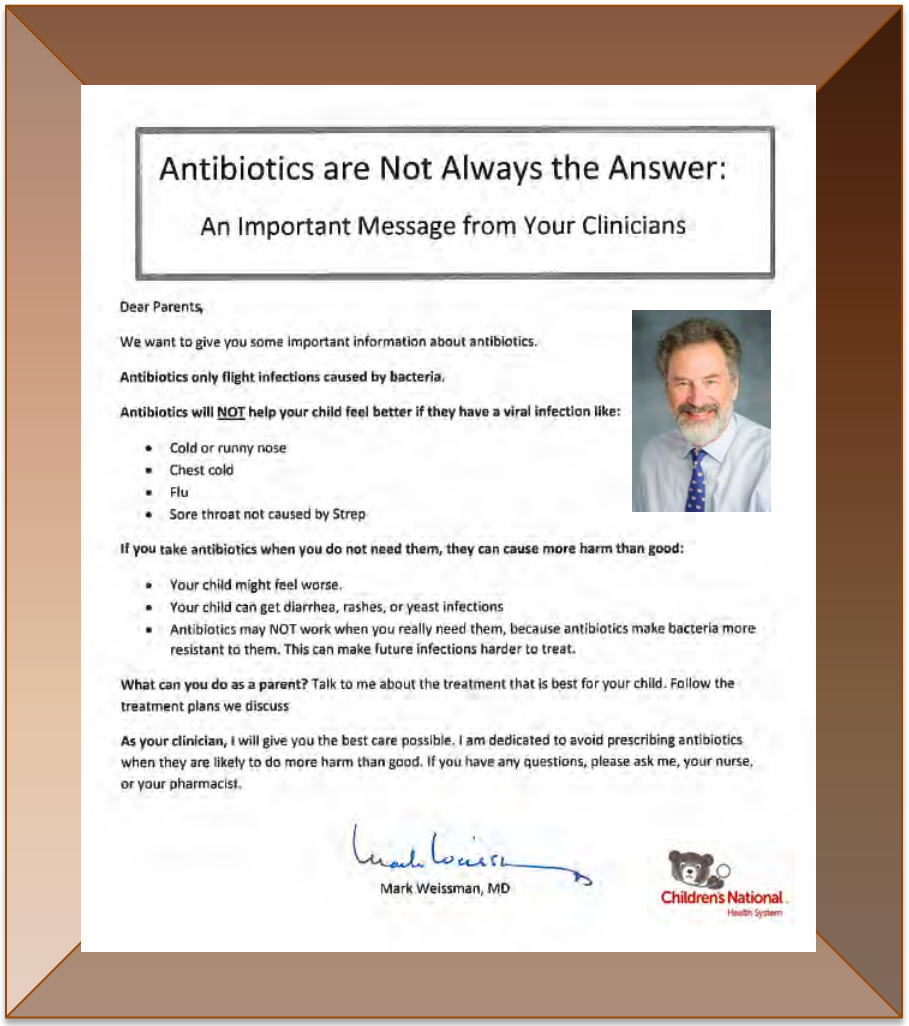
Display a poster asserting your commitment to using antibiotics only when necessary



Antibiotics are Not Always the Answer:

An Important Message from Your Clinicians

Dear Parents,

We want to give you some important information about antibiotics.

Antibiotics only flight infections caused by bacteria.

Antibiotics will NOT help your child feel better if they have a viral infection like:

- Cold or runny nose
- Chest cold
- Flu
- Sore throat not caused by Strep

If you take antibiotics when you do not need them, they can cause more harm than good:

- Your child might feel worse.
- Your child can get diarrhea, rashes, or yeast infections
- Antibiotics may NOT work when you really need them, because antibiotics make bacteria more resistant to them. This can make future infections harder to treat.

What can you do as a parent? Talk to me about the treatment that is best for your child. Follow the treatment plans we discuss

As your clinician, I will give you the best care possible. I am dedicated to avoid prescribing antibiotics when they are likely to do more harm than good. If you have any questions, please ask me, your nurse, or your pharmacist.

Mark Weissman, MD

Children's National Health System

Meeker et al. *JAMA*. 2014. 174(3):425-31

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Case #2

- 4 year old girl with right ear pain
- Low grade fever, eating fine, otherwise well.
- On exam:

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e #2: For uncomplicated acute o media, I tend to prescribe antibiotics:

A. Always

B. Sometimes

C. Rarely

Case #2: **Observation** for acute otitis media if > 2 years and not severe

	< 6 months	6-24 months	> 2 years
Not severe, unilateral	Amoxicillin x 10 days	**Observation**	**Observation**
Not severe, Bilateral	Amoxicillin x 10 days	Amoxicillin x 10 days	**Observation**
Severe disease	Amoxicillin x 10 days	Amoxicillin x 10 days	Amoxicillin x 5 days

*Severe disease: T > 39 ^{o}C; severe otalgia

Hoberman et al. *NEJM.* 2017. 375(25):2446-2456.
Lieberthal et al. *Pediatrics.* 2013. 131(3):e964-99.

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Delayed antibiotic prescriptions for acute otitis media

Your child has an ear infection that will likely clear up on its own. If the ear still hurts in 2 days or gets worse, call or come back and we will recheck the ears.

Your child has an ear infection that will likely clear up on its own. Just in case it doesn't, here is an antibiotic prescription. Fill this prescription in 2 days if the ear still hurts, or earlier if your child gets worse. Feel free to call me with any questions.

Fleming-Dutra et al. *Am Fam Physician.* 2016.

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Case #3

- 7 year old boy with 1 week of progressively worsening cough, high fevers, crackles in the right base

- You diagnose him with community-acquired pneumonia and prescribe high-dose amoxicillin

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3: When a guideline recommends a range of d… duration of antibiotic therapy, I tend to prescri…

A. The longest duration

B. The shortest duration (with or without follow up at time of stopping)

C. Somewhere in the middle

Tip: If the patient has clinically improved, use the shortest duration shown to be effective:

Condition	Shortest effective duration	References
Acute otitis media	5 days (> 2 years) 10 days (<2 years)	Lieberthal et al. *Pediatrics.* 2013. 131(3):e964-99 Hoberman et al. *NEJM.* 2017. 375(25):2446-2456.
Pneumonia	5 days	Greenberg et al. *Ped Infect Dis J.* 2014. 33(2):136-42.
Cellulitis	5 days	Stevens et al. *Clin Infect Dis.* 2014. 59(2):e10-52.
Abscess (if no surrounding cellulitis)	I&D only No antibiotics indicated	Stevens et al. *Clin Infect Dis.* 2014. 59(2):e10-52.

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Beyond the individual practitioner:
How can our practice as a whole improve antibiotic prescribing?

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Measure appropriate antibiotic prescribing in your practice

A performance measure tool: Healthcare Effectiveness Data and Information Set (HEDIS)

1. **Appropriate testing for children with pharyngitis**
    - Mean performance nationally: 80% (Goal: 100%)
2. **Appropriate treatment (no antibiotics) for children with upper respiratory infection (URI)**
    - Mean performance nationally: 83% (Goal: 100%)

Roberts R et al. *Am J Managed Care.* 2016; 22(8): 519-523.

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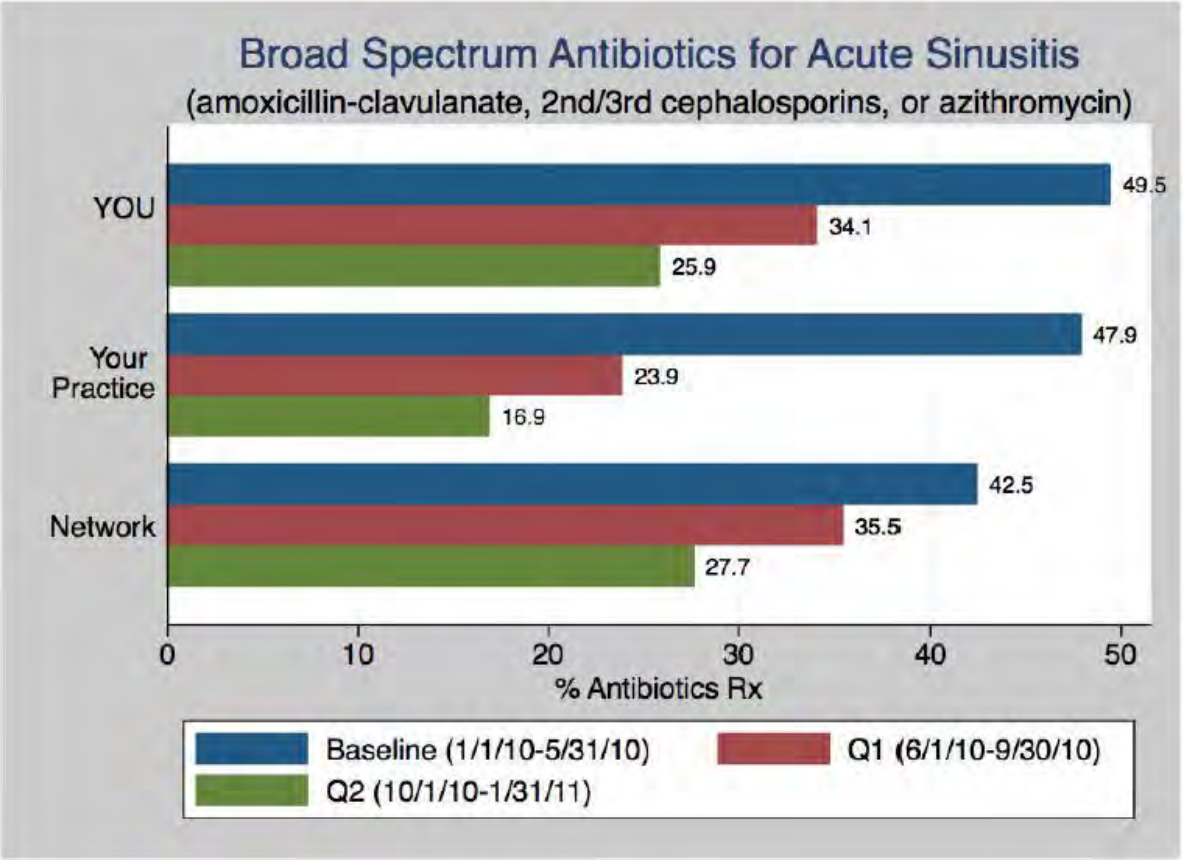
Individualized feedback reports can be an effective tool



Gerber JS et al. *JAMA.* 2013. 309(22):2345-52.

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Other clinical decision support (i.e. accountable justification) can effectively reduce unnecessary antibiotic prescriptions

You have elected to prescribe an antibiotic for a diagnosis for which antibiotics are not indicated. Please enter a justification for this antibiotic prescription in the text box below. If you do not write a justification, the phrase

"No justification for prescribing antibiotics was given."

will appear in the patient chart.

Meeker et al. *JAMA.* 2016. 315(6):562-70.

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Take-home points

- Judicious use of antibiotics essential to preserving their effectiveness
- Broader spectrum, longer duration, inadequate doses of antibiotics → antibiotic resistance.
- Your toolkit:
  - positive messaging,
  - delayed prescribing for AOM,
  - displaying a commitment poster,
  - educational pamphlets
  - individualized feedback to prescribers

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THANK YOU!

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