

United States Outpatient Antibiotic Prescribing and Goal Setting

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Life-Saving Benefits of Antibiotics

- Once deadly infectious bacterial diseases treatable, substantially reducing deaths compared to pre-antibiotic era
- Important adjunct to modern medical advances
 - Surgeries
 - Transplants
 - Cancer therapies



Antibiotic Resistance

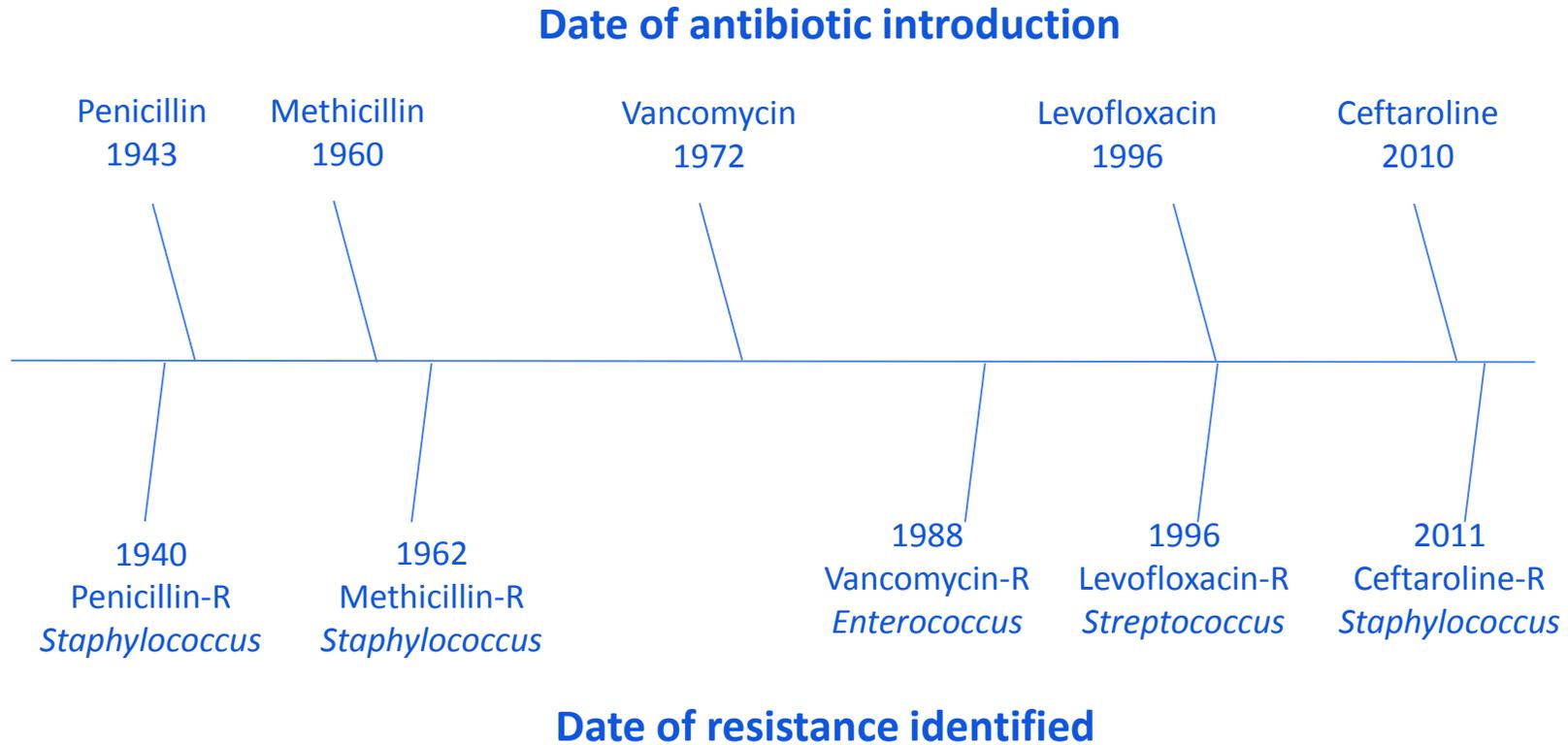
Estimated minimum number of illnesses and deaths caused annually by antibiotic resistance*:

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

**bacteria and fungus included in this report*

\$20 billion in excess direct healthcare costs annually

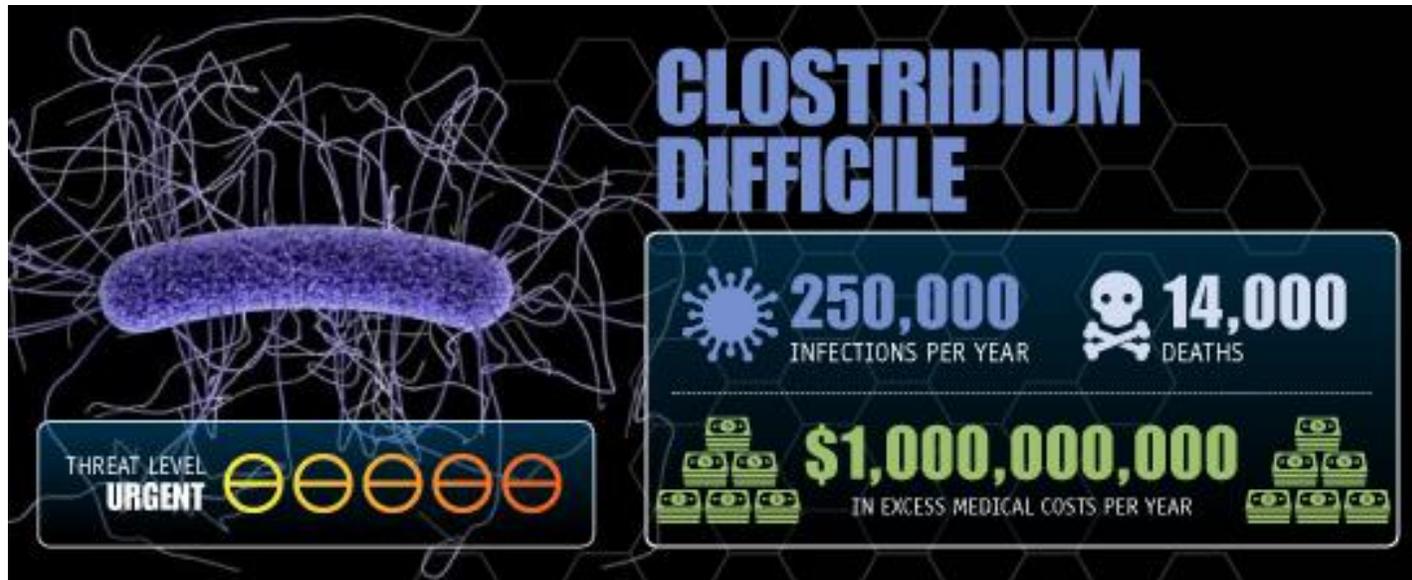
Antibiotic use drives resistance



It's a matter of patient safety

- Adverse events from antibiotics range from minor to severe
 - Side effects like rash or antibiotic-associated diarrhea
 - Allergic reactions, including anaphylaxis (life-threatening)
- 1 in 1000 antibiotic prescriptions leads to an emergency department (ER) visit for an adverse event
 - 142,000 ER visits per year for antibiotic-associated adverse events
 - Antibiotics are most common cause of drug-related emergency department visits for children
- Long-term consequences: growing evidence that antibiotics associated with chronic disease through disruption of the microbiota and microbiome

It's a matter of patient safety: *Clostridium difficile*



More recent estimate: 453,000 infections and caused 15,000 deaths in the US annually

Where Do We Want to Be?

- Every patient gets optimal antibiotic treatment
 - Antibiotics only when they are needed
 - If needed
 - Right antibiotic
 - Right dose
 - Right duration

- **Antibiotic stewardship** is the effort to measure and optimize antibiotic use



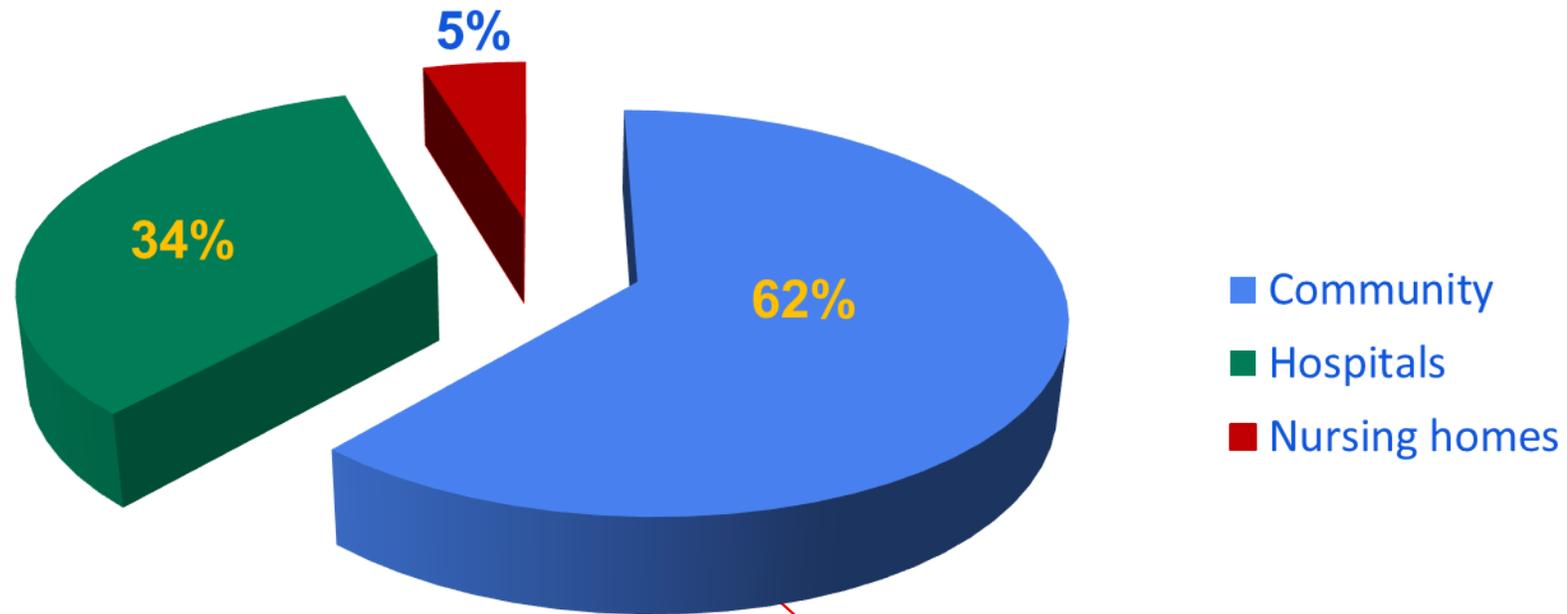
NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

By 2020, significant outcomes of Goal 1 will include:

- Establishment of antibiotic stewardship programs in all acute care hospitals and improved antibiotic stewardship across all healthcare settings.
- Reduction of inappropriate antibiotic use by 50% in outpatient settings and by 20% in inpatient settings.

Antibiotic expenditures in United States by treatment setting

Total 2009 cost: \$10.7 billion



Estimate 80-90% of antibiotic use occurring in outpatient setting

Suda et al. J Antimicrob Chemother 2013; 68: 715–718

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/362374/ESPAUR_Report_2014_3_.pdf

<https://www.folkhalsomyndigheten.se/pagefiles/20281/Swedres-Svarm-2014-14027.pdf>

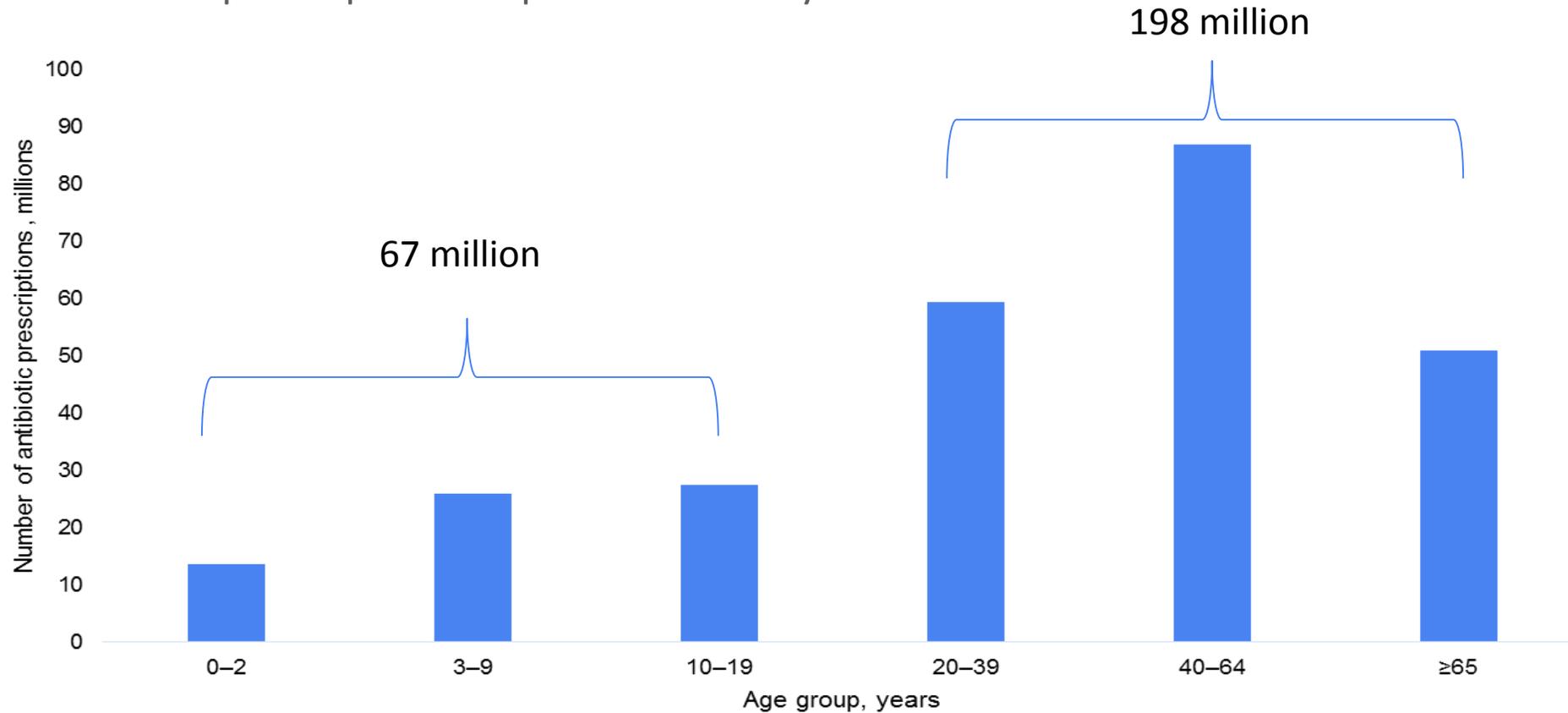


How many antibiotics are we prescribing in the outpatient setting and for what?

Identify opportunities for improvement in outpatient antibiotic prescribing

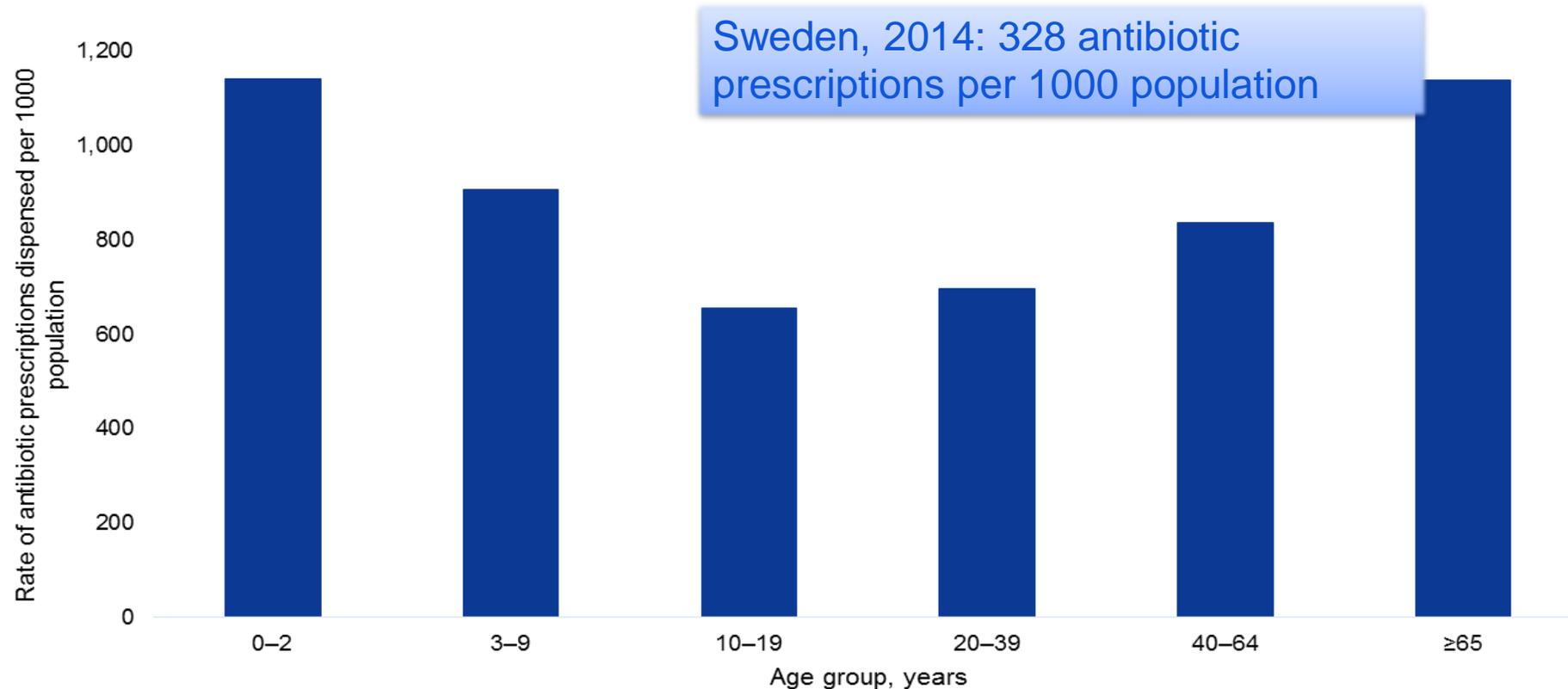
Community Antibiotic Prescriptions Dispensed in the United States, 2013

- 269 million prescriptions dispensed annually in the US

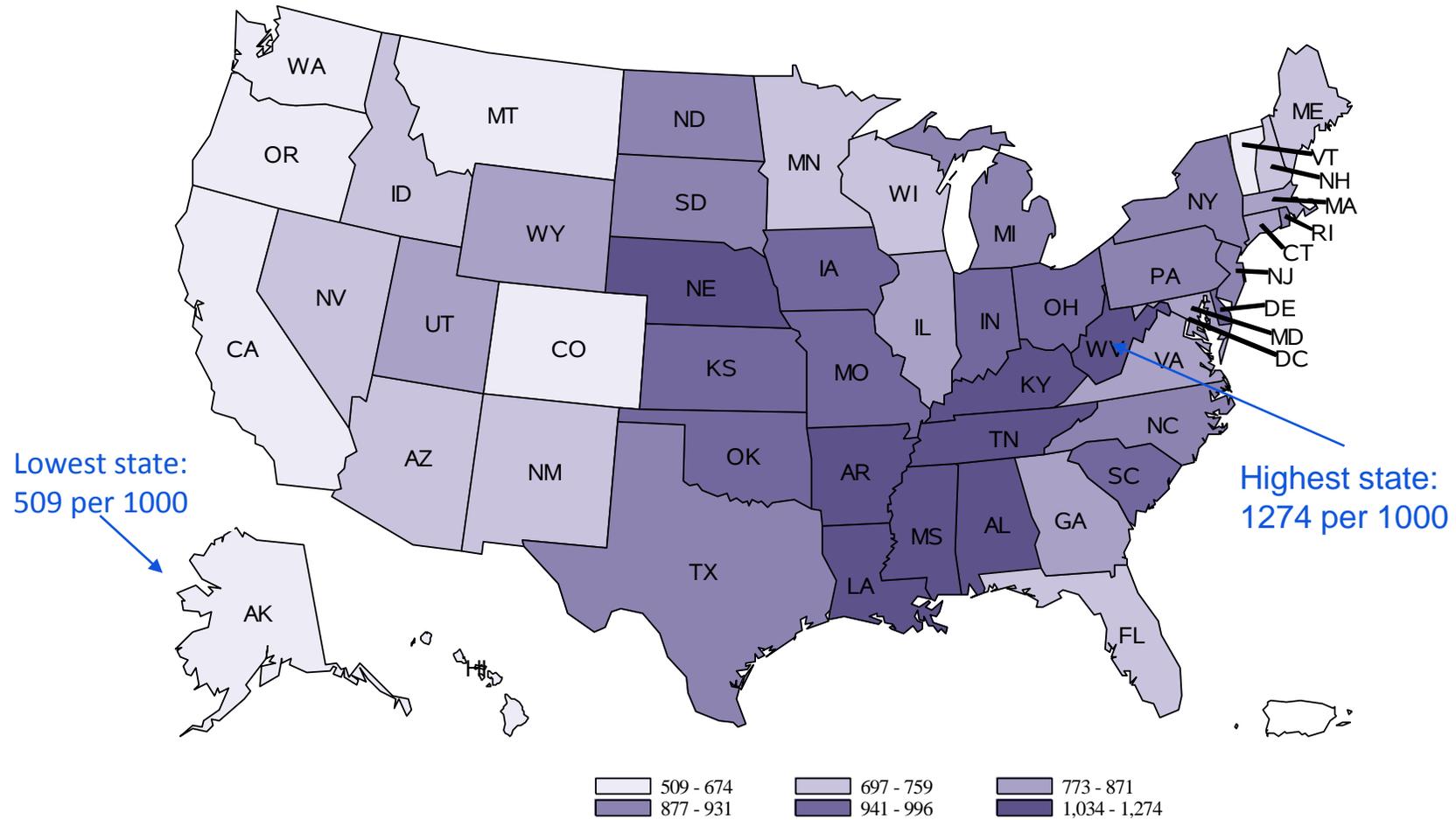


Community Antibiotic Prescriptions Dispensed per 1000 Persons in the United States, 2013

- 849 antibiotic prescriptions dispensed per 1000 population in outpatient settings (4 prescriptions for every 5 people)



Community Antibiotic Prescriptions Dispensed per 1000 Persons in the United States, 2013



Hicks CID 2015; 60(9):1308-16; CDC. Outpatient antibiotic prescriptions — United States, 2013. Available via the internet: http://www.cdc.gov/getsmart/community/pdfs/annual-reportssummary_2013.pdf

Community Antibiotic Prescriptions per 1000 Persons in the United States, 2013

- IMS Health Xponent
 - Dispensing data from community pharmacies
 - No indication or diagnoses associated with these prescriptions
 - Can't assess appropriateness

Research

Original Investigation

Prevalence of Inappropriate Antibiotic Prescriptions Among US Ambulatory Care Visits, 2010-2011

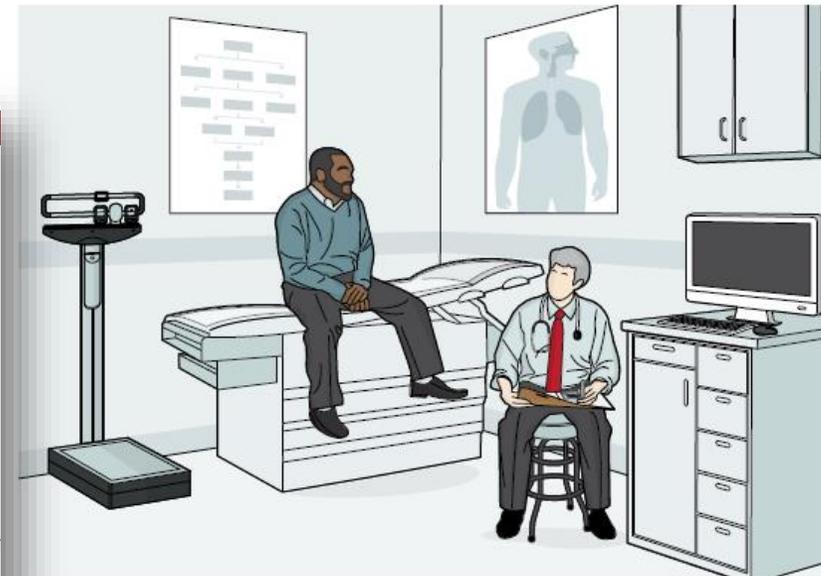
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IMPORTANCE The National Action Plan for Combating Antibiotic-Resistant Bacteria set a goal of reducing inappropriate outpatient antibiotic use by 50% by 2020, but the extent of inappropriate outpatient antibiotic use is unknown.

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jama.com

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Antibiotic Use in Outpatient Settings

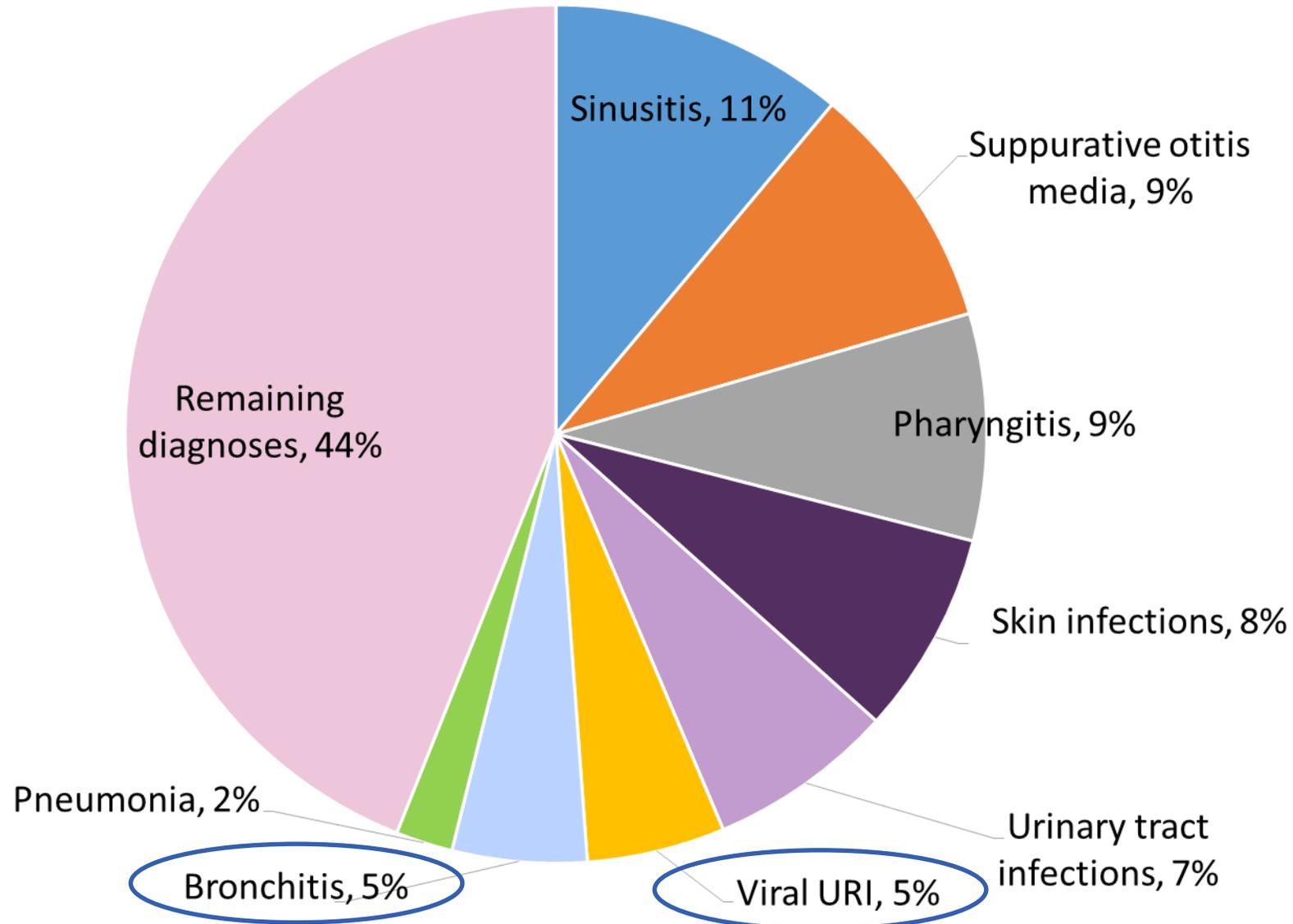
Health experts create national targets to reduce unnecessary antibiotic prescriptions

Fleming-Dutra et al. JAMA 2016;315(17): 1864-1873.
The Pew Charitable Trusts. May 2016.

Data Sources

- National Ambulatory Medical Care Survey (NAMCS)
 - Sample of visits to non-federal employed office-based physicians
- National Hospital Ambulatory Medical Care Survey (NHAMCS)
 - Sample of visits to emergency and outpatient departments in non-institutional, general and short-stay hospitals
- “Designed to meet the need for objective, reliable information about the provision and use of ambulatory medical care services in the United States”
 - Data include demographics, diagnoses, and medications
 - Nationally representative
- Included visits from 2010–11

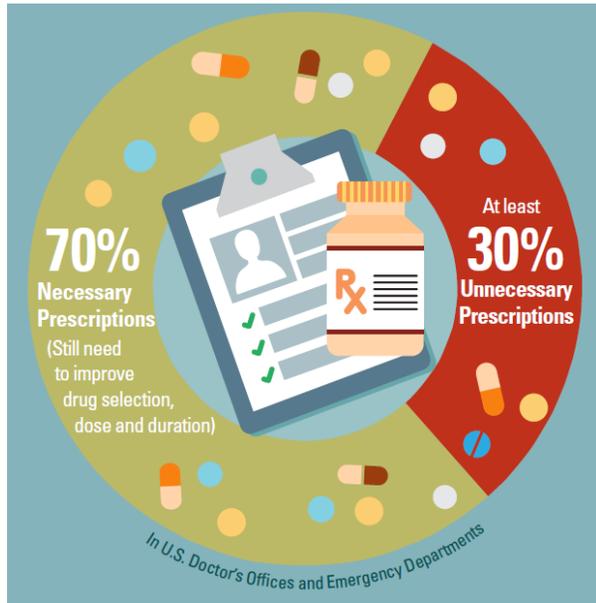
Diagnoses leading to antibiotics — United States, 2010–11



Targets for appropriate antibiotic prescribing by condition

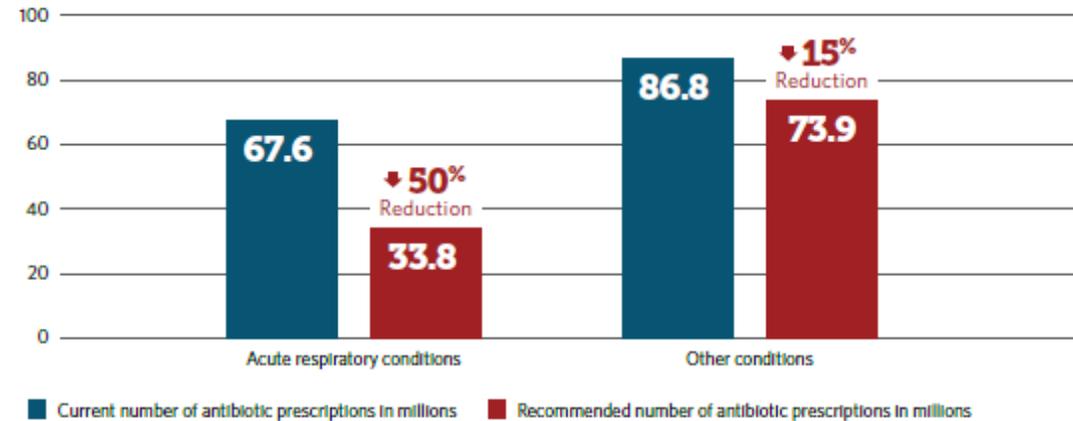
- No reduction in antibiotics
 - Pneumonia, urinary tract infections and miscellaneous bacterial infections
- No antibiotics
 - Bronchitis, bronchiolitis, viral upper respiratory infection (URI), influenza, non-suppurative otitis media, viral pneumonia, asthma, and allergy
- Test for bacterial infection
 - Pharyngitis (all-cause)
- Reduction in antibiotics to level of the lowest prescribing region
 - Sinusitis
 - Suppurative otitis media
 - All other remaining conditions

Setting National Targets: Outpatient Antibiotic Prescribing



47 million unnecessary antibiotic prescriptions per year

Outpatient Antibiotic Prescribing Reduction Targets



Source: Analysis of NAMCS and NHAMCS data on U.S. antibiotic prescribing, 2010-2011
© 2016 The Pew Charitable Trusts

Fleming-Dutra et al. JAMA 2016;315(17): 1864-1873.
<http://www.pewtrusts.org/~media/assets/2016/05/antibioticuseinoutpatientsettings.pdf>;

Meeting the CARB goal

NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

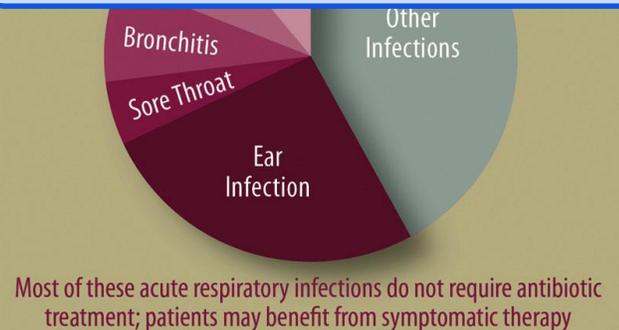
- Reduction of inappropriate outpatient antibiotic use by 50% by 2020
- 30% of outpatient antibiotic use is inappropriate
- Goal: Reduction of overall outpatient antibiotic use by 15% by 2020

Have we made any progress?

Good News / Bad News Antibiotics prescribed for acute respiratory infections in kids younger than 15 years of age



2000–10 antibiotic prescribing
Pediatric: decreased 18%
Adults: no change
Older adults: increased 30%



Source: MMWR. 2011;60:1153-6



Why are providers prescribing antibiotics inappropriately? What can we do?

Understand barriers to appropriate prescribing

Why might providers prescribe antibiotics inappropriately?

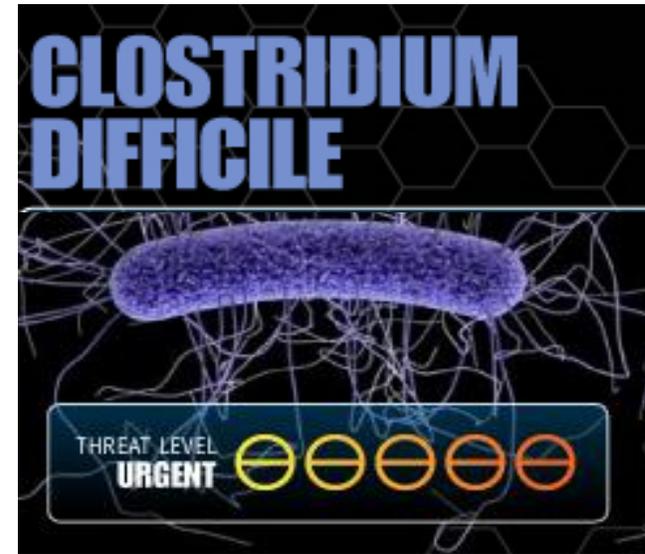
- Lack of knowledge of appropriate indications?
- Fear of complications?
- Patient pressure and satisfaction?
- Habit?

Why might providers prescribe antibiotics inappropriately?

- ~~Lack of knowledge of appropriate indications~~
 - Providers generally know the guidelines
- Fear of complications
 - Providers cite fear of infectious complications

What if something bad happens?

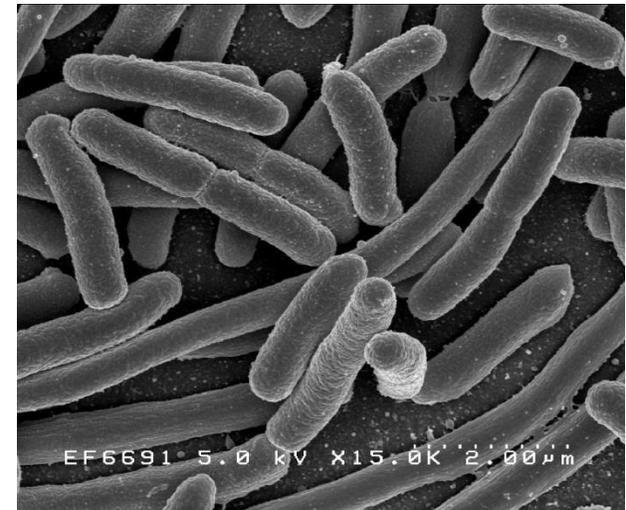
- Without an antibiotic
 - Complications to common respiratory infections are very rare
 - Over 4000 patients with colds need to be treated to prevent 1 case of pneumonia
- With an antibiotic
 - Side effects
 - Diarrhea in 5-25%
 - Yeast infections
 - Allergic reactions and anaphylaxis
 - 1 in 1000 antibiotics lead to ED visit for adverse events
 - *Clostridium difficile* infection



Antibiotics, microbiome and disease

- Exposure to antibiotics during childhood associated with developing of juvenile idiopathic arthritis
 - Dose-dependent relationship
 - Strongest association within 1 year of diagnosis
- Exposure to antibiotics during infancy possibly associated elevated body mass index (BMI) and food allergies
- Association may be mediated through changes in the microbiota

Saari. Pediatrics 2015;135(4): 617-26;
Gerber JAMA 2016;315(12): 1258-1265.
Scott Gastroenterology 2016;151:120-129.
Horton Pediatrics 2015 ePub 7/22/2015
Love Allergy, asthma & clinical immunology 2016;12: 41-41.

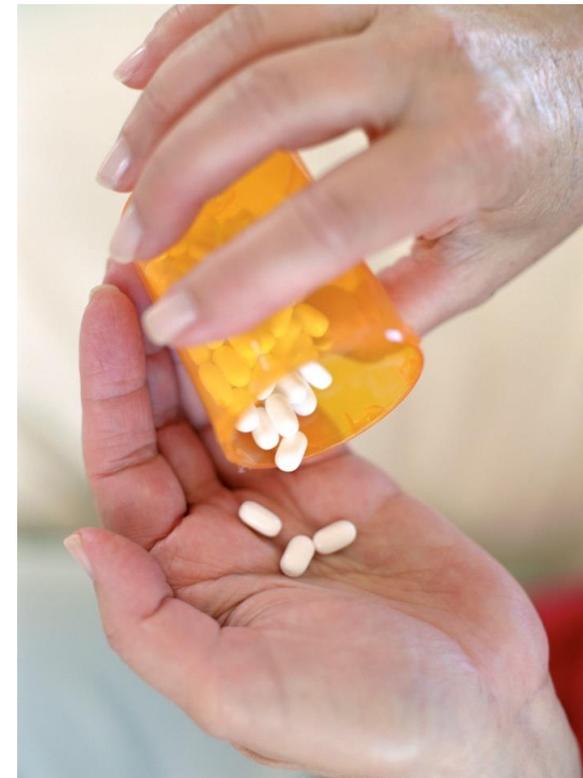


Why might providers prescribe antibiotics inappropriately?

- ~~Lack of knowledge of appropriate indications~~
 - Providers generally know the guidelines
- Fear of complications
 - Providers cite fear of infectious complications
 - *Also adverse events*
- Patient pressure and satisfaction
 - Providers universally cite patient requests for antibiotics
 - Providers worry about losing patients to other providers

Physician perception of patient expectations

- Overt requests for antibiotics are rare
- When physicians think patients/parents want antibiotics, they are more likely to prescribe
 - 62% when they thought parent wanted antibiotics
 - 7% when they thought parent did **not** want antibiotics
- Physicians are terrible at predicting which patients want antibiotics



Why do we think patients want antibiotics?

- Physicians thought parents wanted antibiotics when
 - Parents suggested a candidate diagnosis
 - Parents questions non-antibiotic treatment plan
- Parents who questioned the treatment plan were equally likely to expect or not expect antibiotics
- Two different conversations
 - One that the physician understands
 - One that the patient is having



Stivers. *Journal Family Practice* 2003; 52(2):140-8.

Mangione-Smith. *Arch Pediatr Adolesc Med* 2006;160(9): 945-952.

Patient satisfaction

- Parents are still satisfied if they don't get antibiotics
- Parents are dissatisfied if communication expectations are not met

- What do parents want?
 - Explanation + positive recommendations
 - Contingency plan



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

Mangione-Smith *Arch Pediatr Adolesc Med* 2001;155:800-6.

Mangione-Smith *Ann Family Med* 2015; 13(3) 221-7.

Communication training as a public health intervention?

- Enhanced communications training reduces antibiotic prescribing for respiratory infections in all ages
- Effect appears to be sustainable over time



Cals Ann Family Med 2013;11(2)157-64.
Little Lancet 2013;382(9899)1175-82.

Why might providers prescribe antibiotics inappropriately?

- ~~Lack of knowledge of appropriate indications~~
 - Providers generally know the guidelines
- Fear of complications
 - Providers cite fear of infectious complications
 - *Also adverse events*
- Patient pressure and satisfaction
 - Providers universally cite patient requests for antibiotics
 - *Effective communication can help*
- Habit?

Provider variability: Habit of prescribing antibiotics

- In a large study of 1 million VA outpatient visits for acute respiratory infections (ARIs, many of which did not require antibiotics)
 - Highest 10% of providers prescribed antibiotics in $\geq 95\%$ of ARI visits
 - Lowest 10% prescribed antibiotics in $\leq 40\%$ of ARI visits
- In a pediatric network, antibiotic prescribing variability among 25 practices
 - 18 to 36% of acute visits resulted in antibiotic prescriptions by practice
 - 15 to 57% of antibiotics were broad-spectrum by practice

Child with same complaint in high use practice: 2x as likely to get antibiotics and 4x as likely to get broad-spectrum antibiotics

Jones. *Ann Int Med* 2015;163(2):73-80.

Gerber. *JPIDS* 2015;4(4): 297-304.

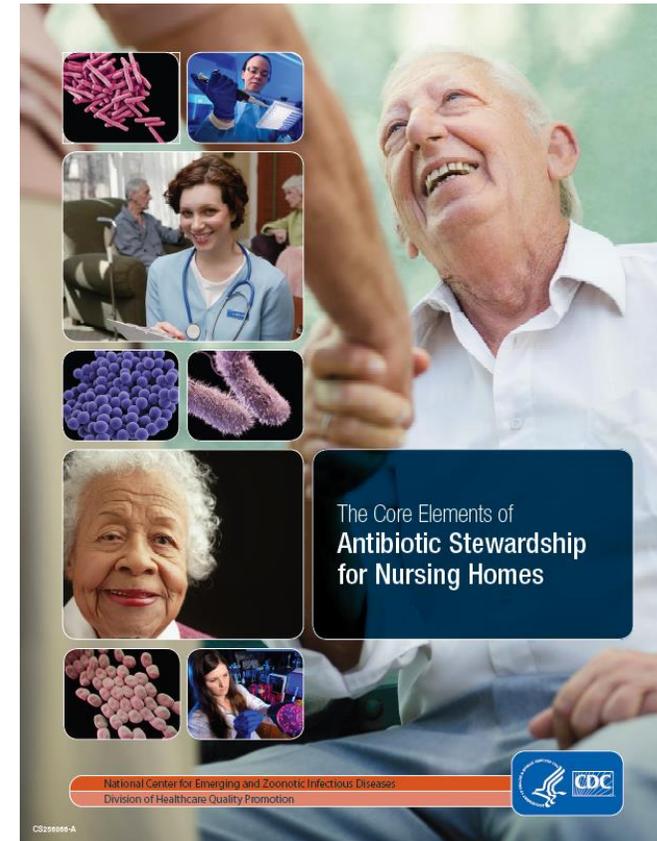
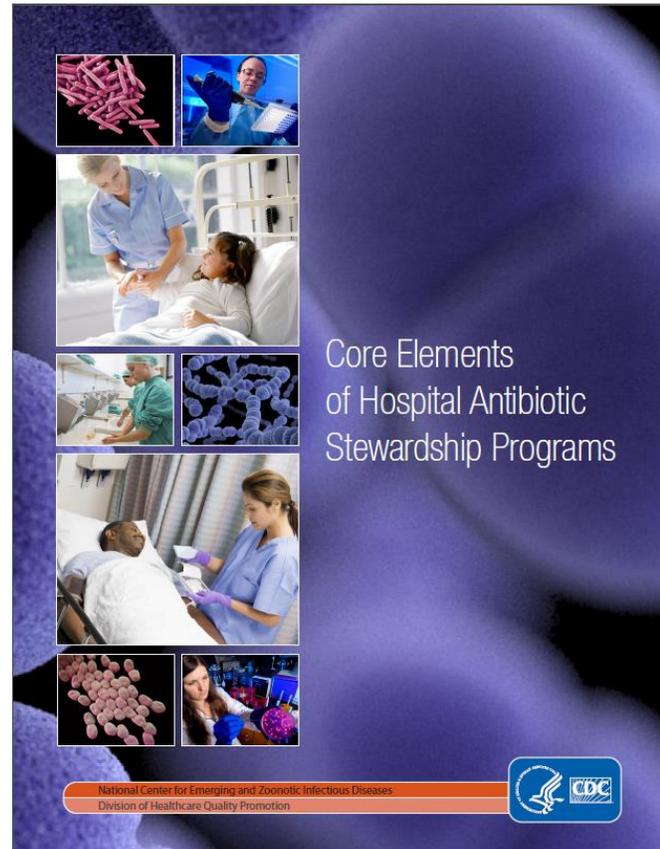


How can we change clinician antibiotic prescribing practices?

Identify effective interventions to improve outpatient antibiotic prescribing

Core Elements for Antibiotic Stewardship in Hospitals and Nursing Homes

- Leadership commitment
- Accountability
- Drug expertise
- Action
- Tracking
- Reporting
- Education



Core Elements of Outpatient Antibiotic Stewardship expected late 2016

What works in the outpatient setting?

- Educational methods — decisions are based on knowledge
 - Guidelines
 - Clinical decision support
- Behavioral methods — decisions are influenced by psychosocial factors
 - Communications training
 - Public commitments
- Both categories
 - Audit and feedback with comparisons to peers
 - Academic detailing (one-on-one education)

Clinical decision support

- Effective intervention
 - Acute bronchitis: 12–14% reduction in antibiotic prescribing
 - Pharyngitis: reduced antibiotics use
 - Pneumonia: improved antibiotic selection
- Important considerations
 - Print and electronic tools are likely equally effective
 - Tools need to be **used** to be effective
 - In one study, tool was used in 6% of eligible visits
 - Alert fatigue is a problem

Behavioral Clinical Decision Support: Accountable Justification

- “Antibiotic justification note” in medical record
 - Triggered by diagnosis for which antibiotics are not indicated and antibiotic prescription
 - Free text field
 - If no text entered: “No justification given” appeared in medical record
 - Note disappeared if antibiotic prescription deleted
- Idea: Clinicians want to preserve their reputation
- Reduced inappropriate antibiotic prescribing from 23.2% to 5.2% pre and post-intervention (-7.0% difference in differences, $p < 0.001$)

Public commitment posters

- Simple intervention: poster-placed in exam rooms with provider picture and commitment to use antibiotics appropriately
- Randomized-controlled trial
- Principle of behavioral science: desire to be consistent with previous commitments

“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 do to more harm than good.”

- Adjusted absolute reduction: -20% compared to controls, $p=0.02$

Audit and feedback with peer comparisons

- Randomized controlled-trial of audit-and-feedback for unnecessarily broad-spectrum antibiotics for sinusitis in children
 - Quarterly feedback reports
 - Included clinician's data and the average performance of their peers in their practice and network
- Results
 - All clinicians improved their antibiotic selection
 - Clinicians in the feedback group performed significantly better than control clinicians
 - Antibiotic selection patterns reverted to baseline once audit-and-feedback was stopped

Peer Comparison to Top Performers

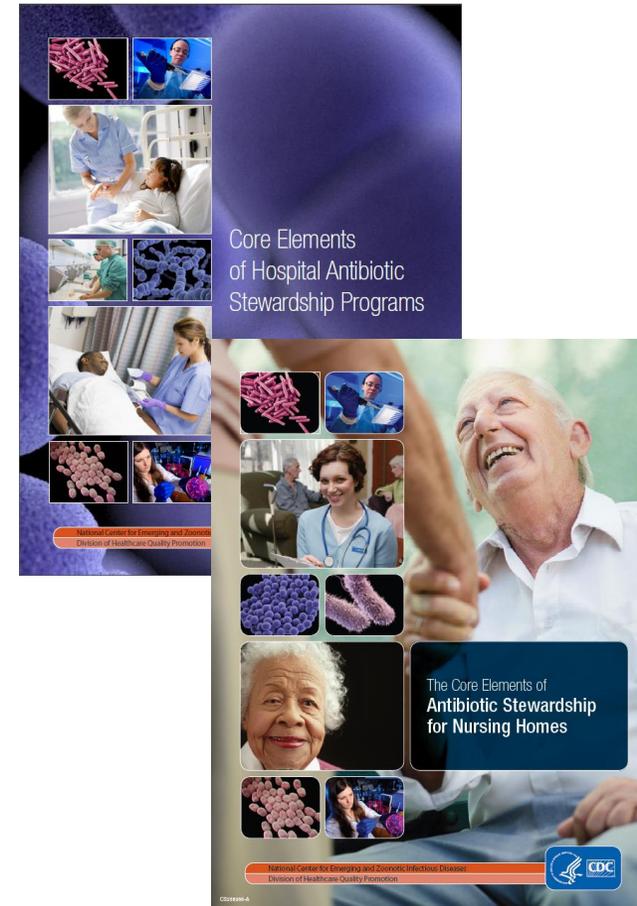
- “You are a Top Performer”
- “You are not a Top Performer”
- Mean antibiotic prescribing decreased from 19.9% to 3.7% (-16.3%)
 - Statistically significant versus controls

Peer Comparison: Further evidence

- National Health Service randomized trial of letters to general practitioner (GP) practices (1581 practices included)
 - Your practice is prescribing antibiotics at a rate higher than 80% of your local GP practices
 - Included actions to improve prescribing
 - From England's Chief Medical Officer
- 3.3% relative reduction in antibiotic prescribing relative to controls
 - Estimated ~73,000 antibiotic prescriptions saved
- Concluded it was cost effective
 - Materials to send letters v. cost of antibiotic prescriptions

CDC's Core Elements for Antibiotic Stewardship in Hospitals and Nursing homes

- Commitment
- Accountability
- Drug expertise
- Action
- Tracking
- Reporting
- Education



*Outpatient Core Elements
expected late 2016*

The Get Smart Campaign

- CDC launched the National Campaign for Appropriate Antibiotic Use in the Community, 1995
- *Get Smart: Know When Antibiotics Work*, 2003
- Program works closely with variety of partners to reduce unnecessary antibiotic use in community
- Focus on increasing awareness among healthcare providers and general public
 - www.cdc.gov/getsmart



Get Smart Week: November 14-20, 2016



Summary

- Outpatient prescribing in the United States can be improved
 - 30% of outpatient antibiotic prescriptions in the United States are unnecessary
 - National goal is to reduce inappropriate outpatient antibiotic prescribing by 50% by 2020
 - 15% of all outpatient antibiotic prescribing
- Providers prescribe antibiotics inappropriately
 - Fear of complications
 - Perceived patient expectations
 - Provider prescribing pattern variability

Summary

- Interventions can be effective in improving antibiotic use
 - Likely need to address more than just knowledge deficits
 - Incorporating principles of behavioral science can help change behavior
- Interventions that work include
 - Display a poster-commitment to using antibiotics appropriately
 - Implement clinical decision support, accountable justification
 - Audit and feedback with peer comparisons
 - Communications training
 - So many more! (www.cdc.gov/getsmart)
- Stay tuned for the *Core Elements of Outpatient Antibiotic Stewardship*



**Thank you!
Questions?**

GetSmart@cdc.gov

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

