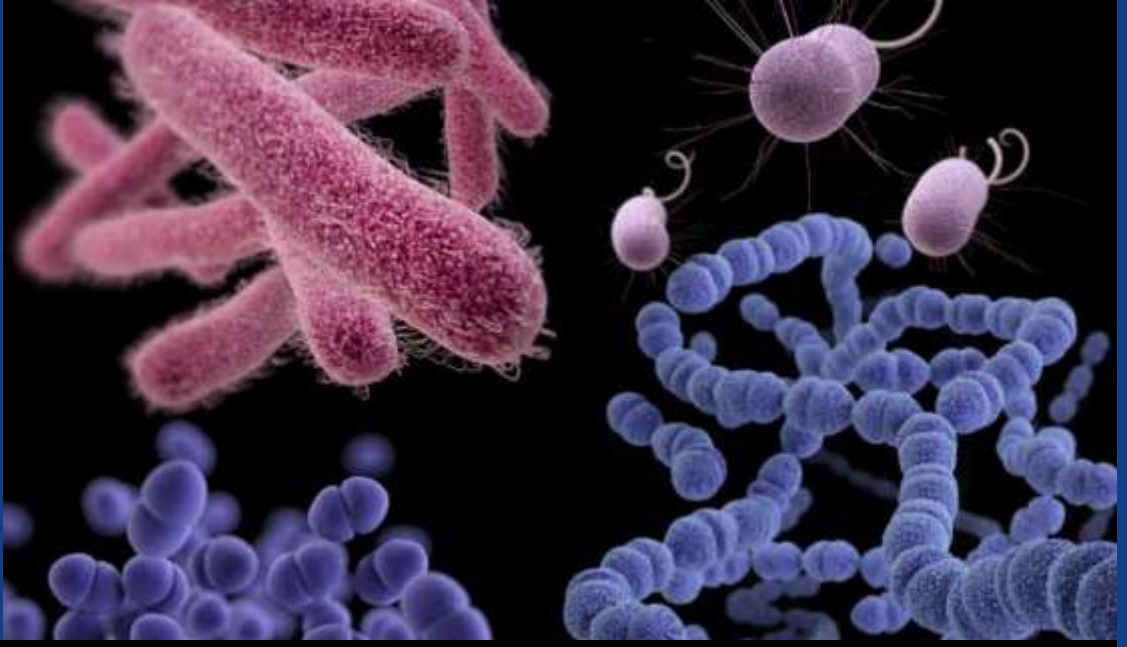
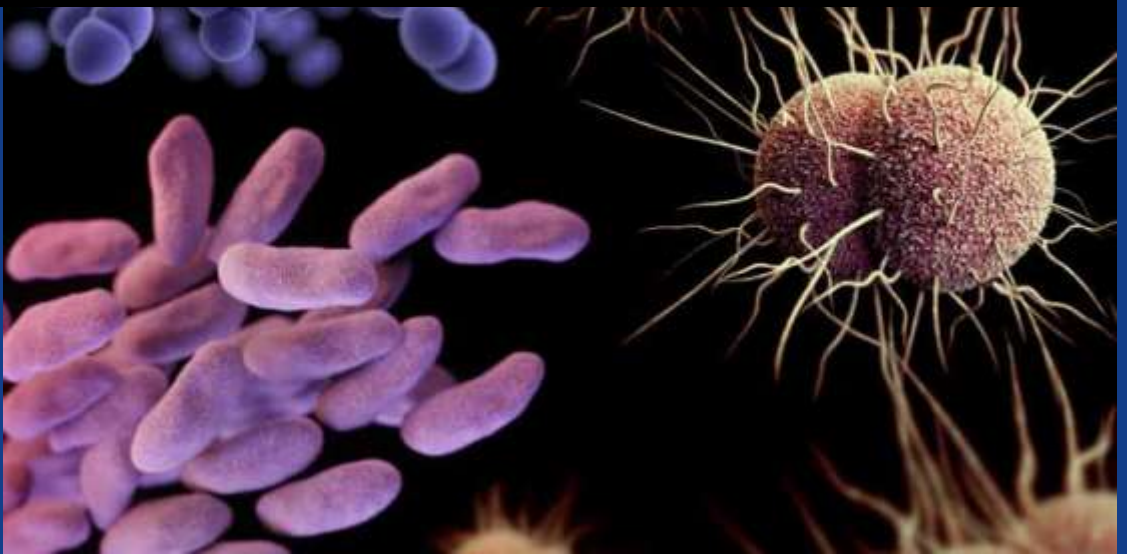


Metrics and Decision-Making for Antibiotic Stewardship in Human Medicine



Steve Solomon, MD

Director, Office of Antimicrobial Resistance

Centers for Disease Control and Prevention

Antibiotic Use and Resistance: Moving Forward Through Shared Stewardship

November 12-14, 2014

Atlanta, GA

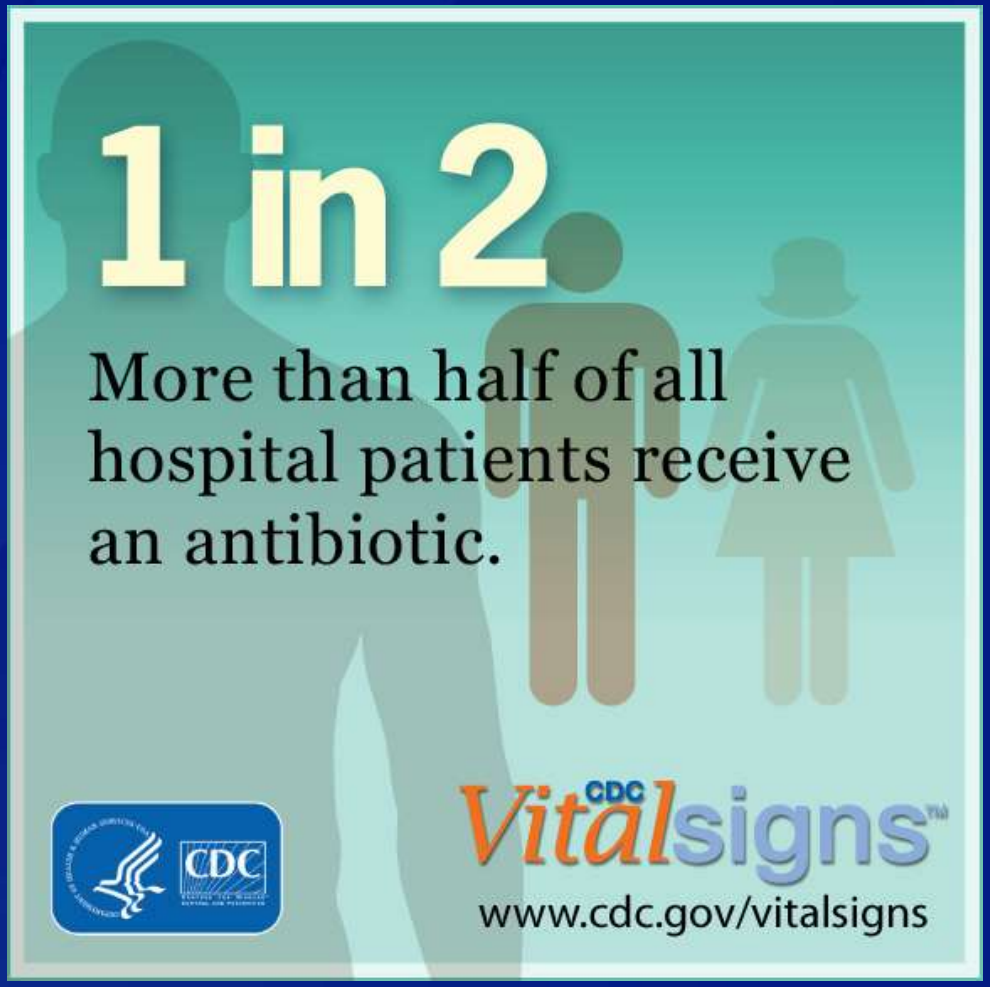
Key points

- Why measure?
- What to measure?
- How to measure?

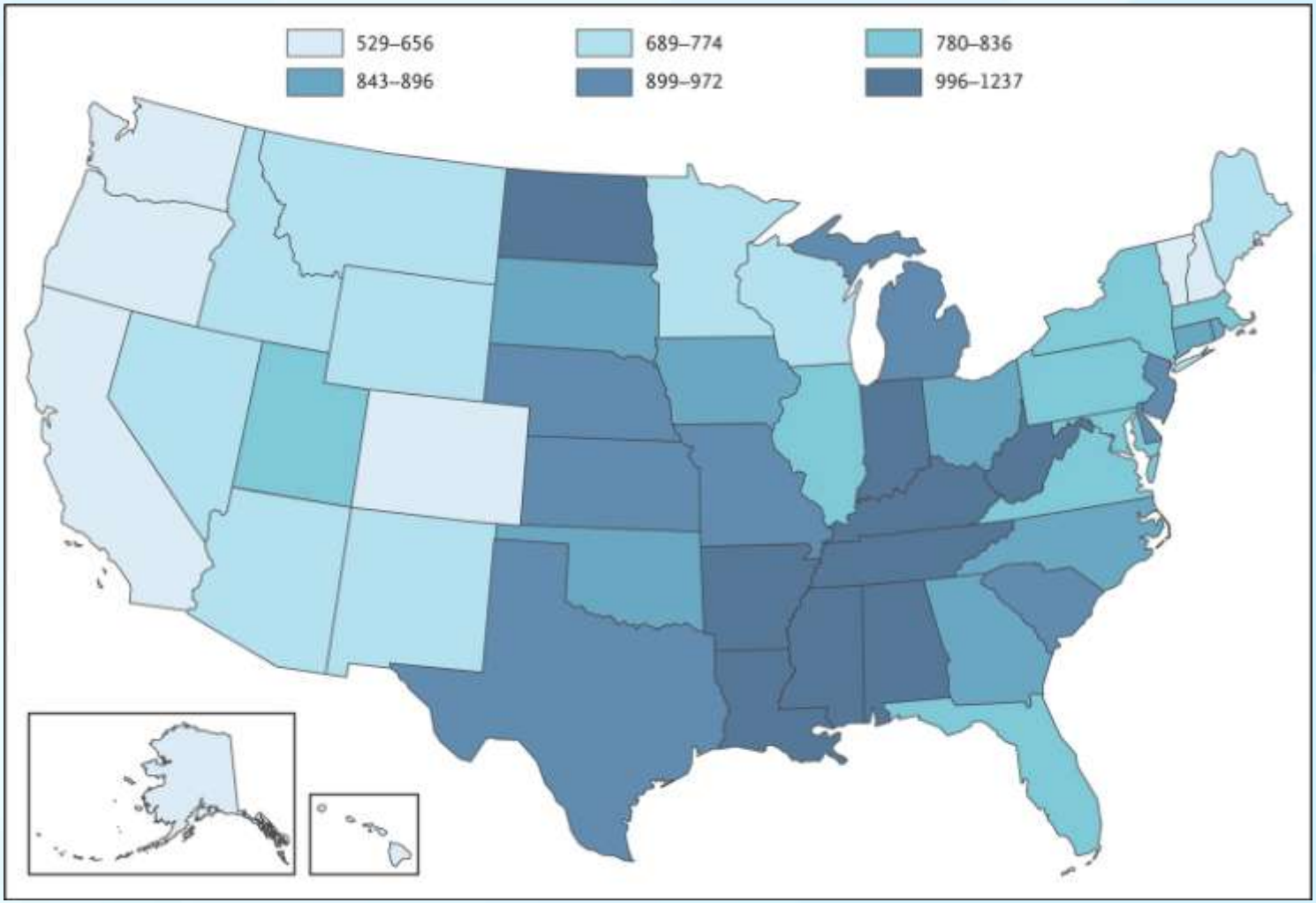
Why measure?

- What gets measured gets done.

Antibiotic use is common in healthcare



Antibiotic prescriptions per 1000 persons of all ages according to state



Hicks LA et al. N Engl J Med 2013;368:1461-1462.

Why Measure--
Goals and Objectives of Antibiotic Stewardship

- **Goals**
  - Improved population health
  - Optimal prescribing of antibiotics
  - Sustainable changes in clinical practice
- **Objectives**
  - Better clinical outcomes
  - Reduction in antibiotic resistant infections
  - Economic benefit

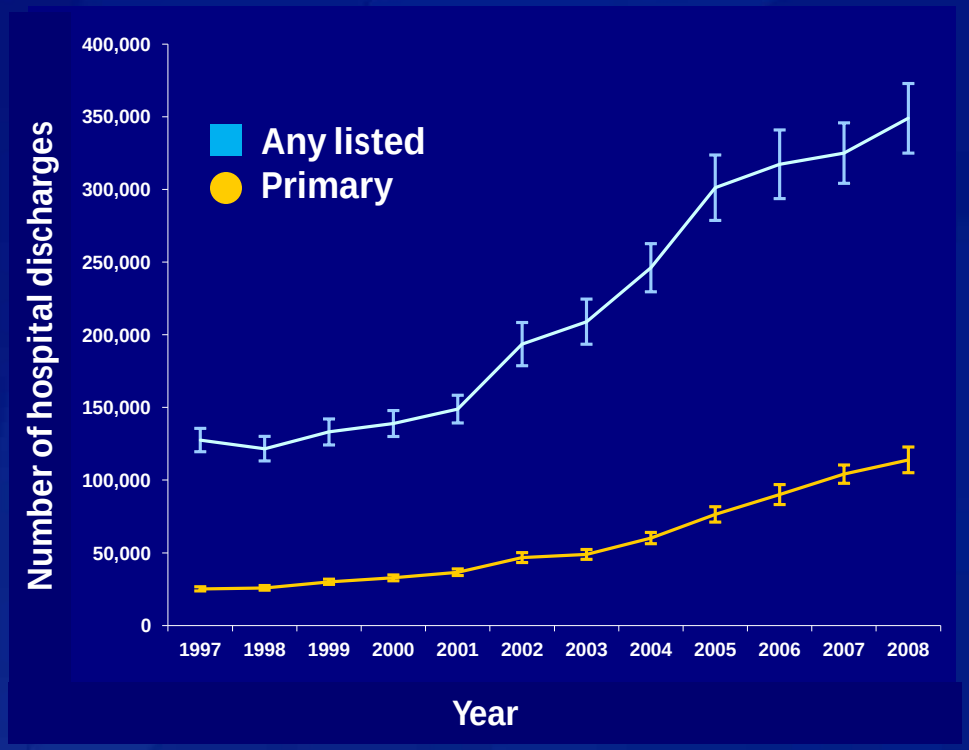
What to measure

- Outcome measures
- Process measures

Outcome measures

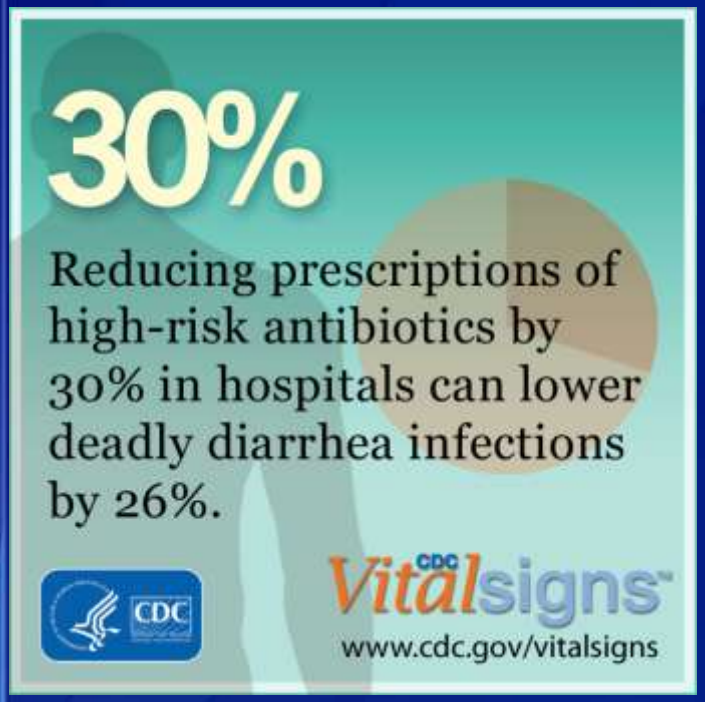
- **Better clinical outcomes**
  - Decreased morbidity, mortality overall
  - Fewer adverse events (*C. difficile* infections, adverse drug reactions, drug-drug interactions)
- **Reduction in antibiotic resistance**
  - Fewer resistant infections
  - Less spread of resistant bacteria
- **Economic benefit**
  - Lower healthcare costs for infections and complications
  - Reduced pharmacy and consumer costs for antibiotics

Estimated burden of healthcare-associated CDI



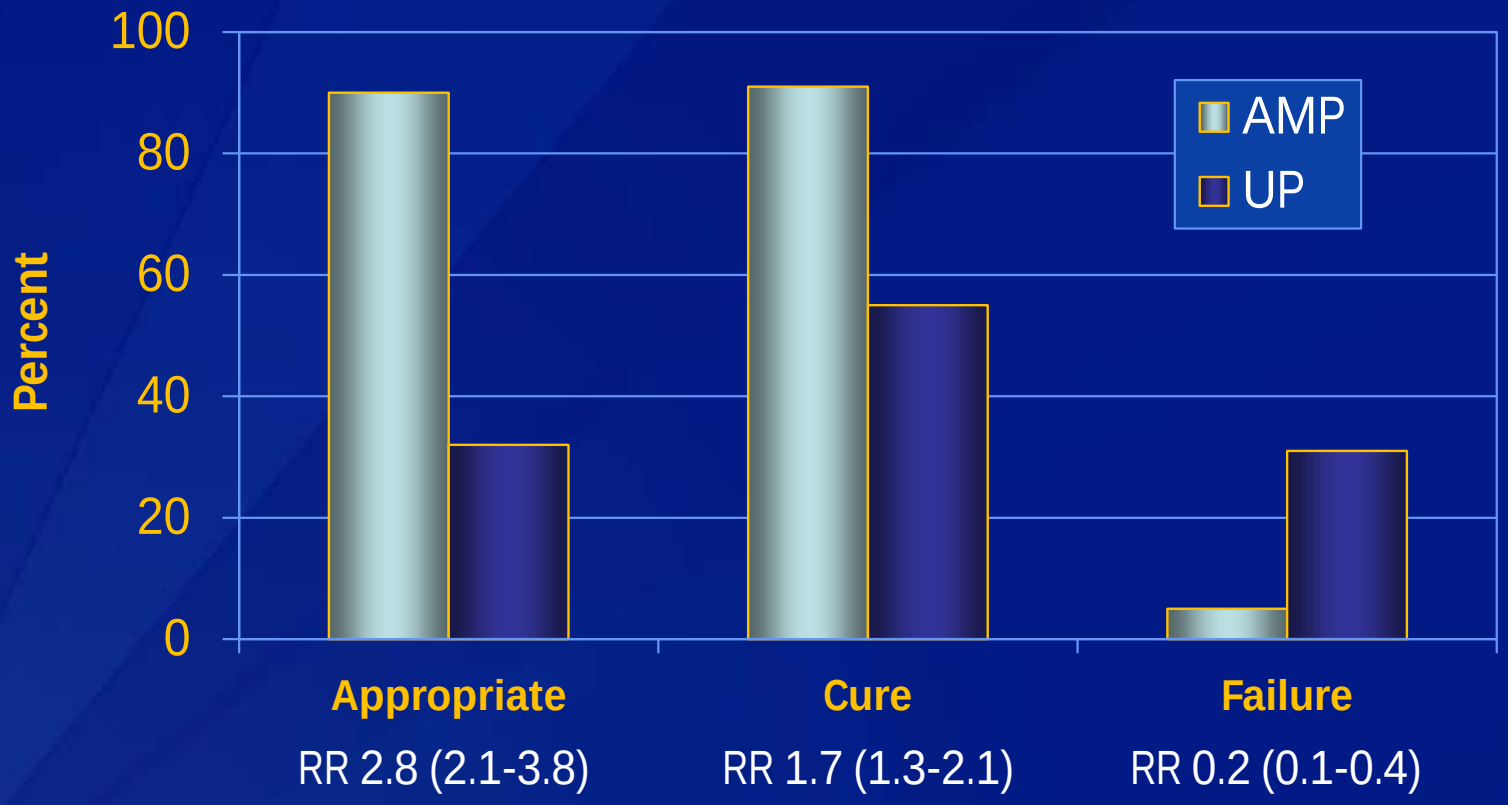
- Hospital-acquired, hospital-onset: 165,000 cases, $1.3 billion in excess costs, and 9,000 deaths annually
- Hospital-acquired, post-discharge (up to 4 weeks): 50,000 cases, $0.3 billion in excess costs, and 3,000 deaths annually
- Nursing home-onset: 263,000 cases, $2.2 billion in excess costs, and 16,500 deaths annually

Poor Prescribing Harms Patients



- Decreasing the use of antibiotics that most often lead to *C.difficile* infection by 30% could lead to 26% fewer of these infections
- Patients getting broad-spectrum antibiotics are up to 3x more likely to get another infection from an even more resistant germ

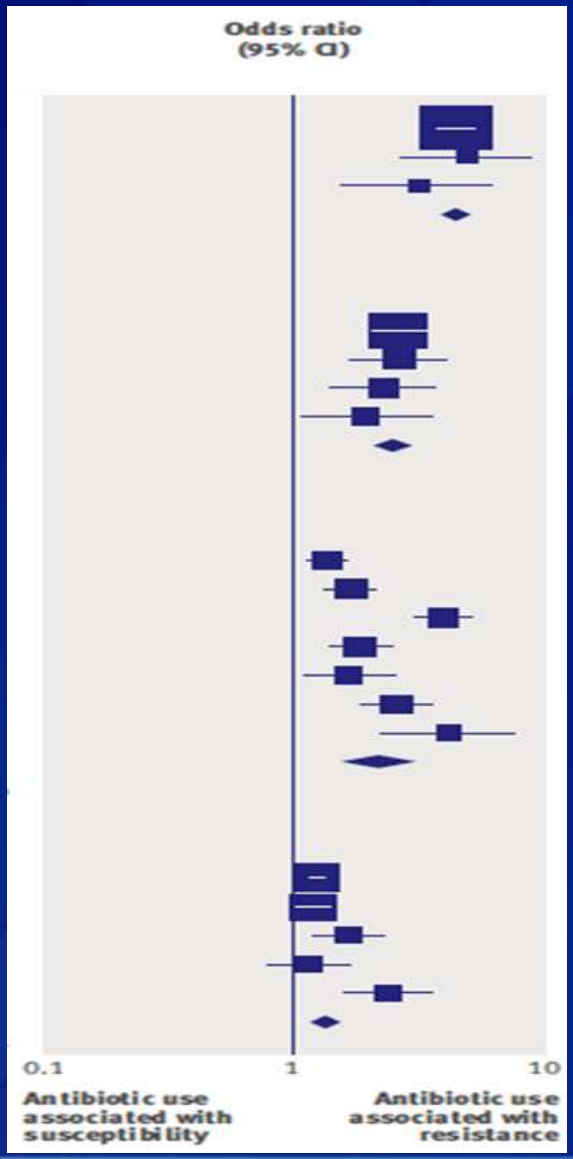
Clinical outcomes better with antimicrobial management program



AMP = Antibiotic Management Program
UP = Usual Practice

Fishman N. *Am J Med.* 2006;119:S53.

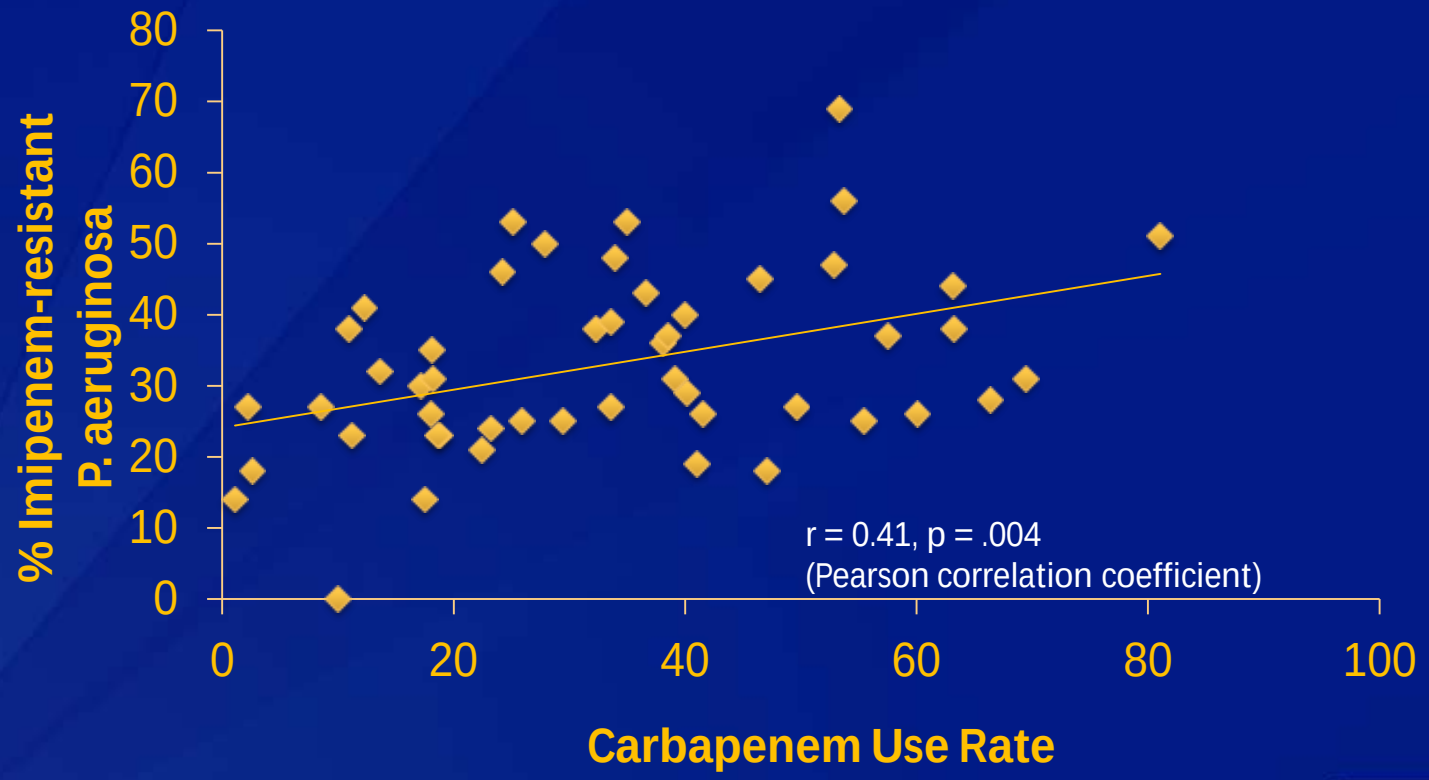
Increased resistance for individual patients



Pathogen and Antibiotic Exposure	Increased Risk
Carbapenem-resistant Enterobacteriaceae ● Carbapenems	15 fold
ESBL-producing organisms ● Cephalosporins	6 - 29 fold

Costelloe C et al. *BMJ.* 2010;340:c2096.
Patel G et al. *Infect Control Hosp Epidemiol* 2008;29:1099-1106
Zaoutis TE et al. *Pediatrics* 2005;114:942-9
Talon D et al. *Clin Microbiol Infect* 2000;6:376-84

Increased resistance in facilities--resistance in *P. aeruginosa* vs. carbapenem use rate



45 LTACHs, 2002-03 (59 LTACH years)

Gould et al. ICHE 2006;27:923-5

Rates of antibiotic resistant organism infections per 100 intensive care unit, with and without intervention

Organism	No Rotation	Rotation	*p*
Gram-positive organisms			
Staphylococcus aureus, oxacillin resistant	3.4	1.6	.02
Staphylococcus epidermidis, oxacillin resistant	7.0	4.6	.05
Enterococcus spp., gentamicin resistant	2.4	0.8	.01
Enterococcus spp., vancomycin resistant	1.6	0.8	.17
Gram-negative organisms[a]			
Stenotrophomonas maltophilia	1.4	1.3	.86
Pseudomonas spp.	2.9	1.1	.01
Acinetobacter spp.	3.0	0.5	.0003
Burkholderia cepacia	0.4	0.0	.07
Escherichia coli	0.3	0.0	.14

Raymond et al. Impact of a rotating empiric antibiotic schedule on infectious mortality in an intensive care unit. Critical Care Medicine 2001;29:1101

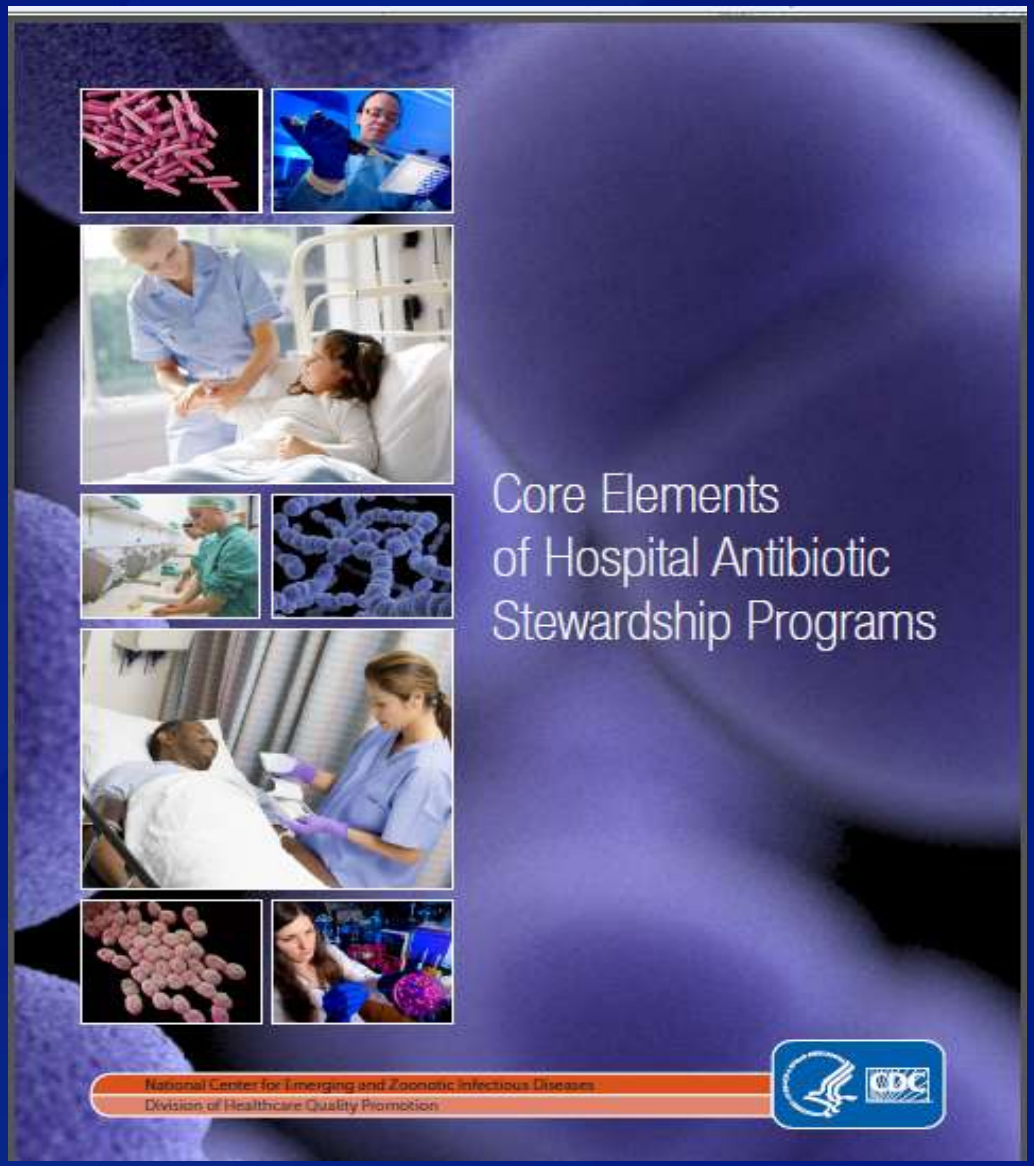
Improving antibiotic use saves money

- "Comprehensive programs have consistently demonstrated a decrease in antimicrobial use with annual savings of $200,000 - $900,000"

IDSA/SHEA Guidelines for Antimicrobial Stewardship Programs, http://www.journals.uchicago.edu/doi/pdf/10.1086/510393

Process measures

- Facility stewardship programs
- Optimal prescribing
- Rates of use

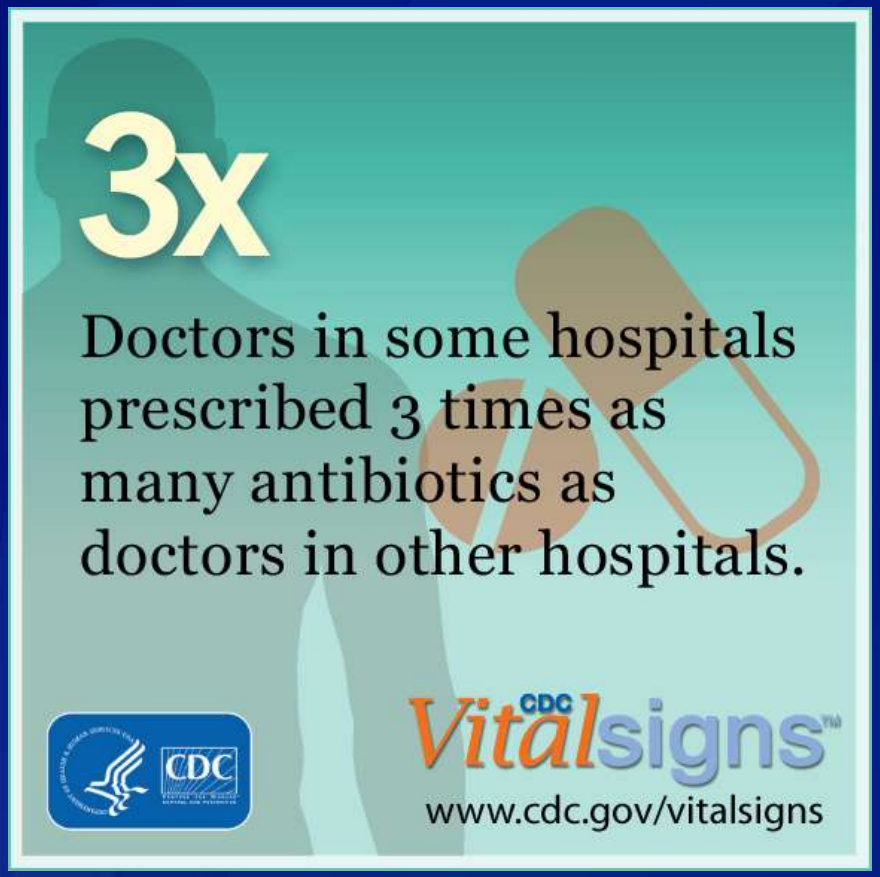


http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html

Process Measures

- **Components of the program**
  - Leadership commitment
  - Accountability
  - Drug expertise
  - Action
  - Tracking
  - Reporting
  - Education

Prescribing Practices Vary

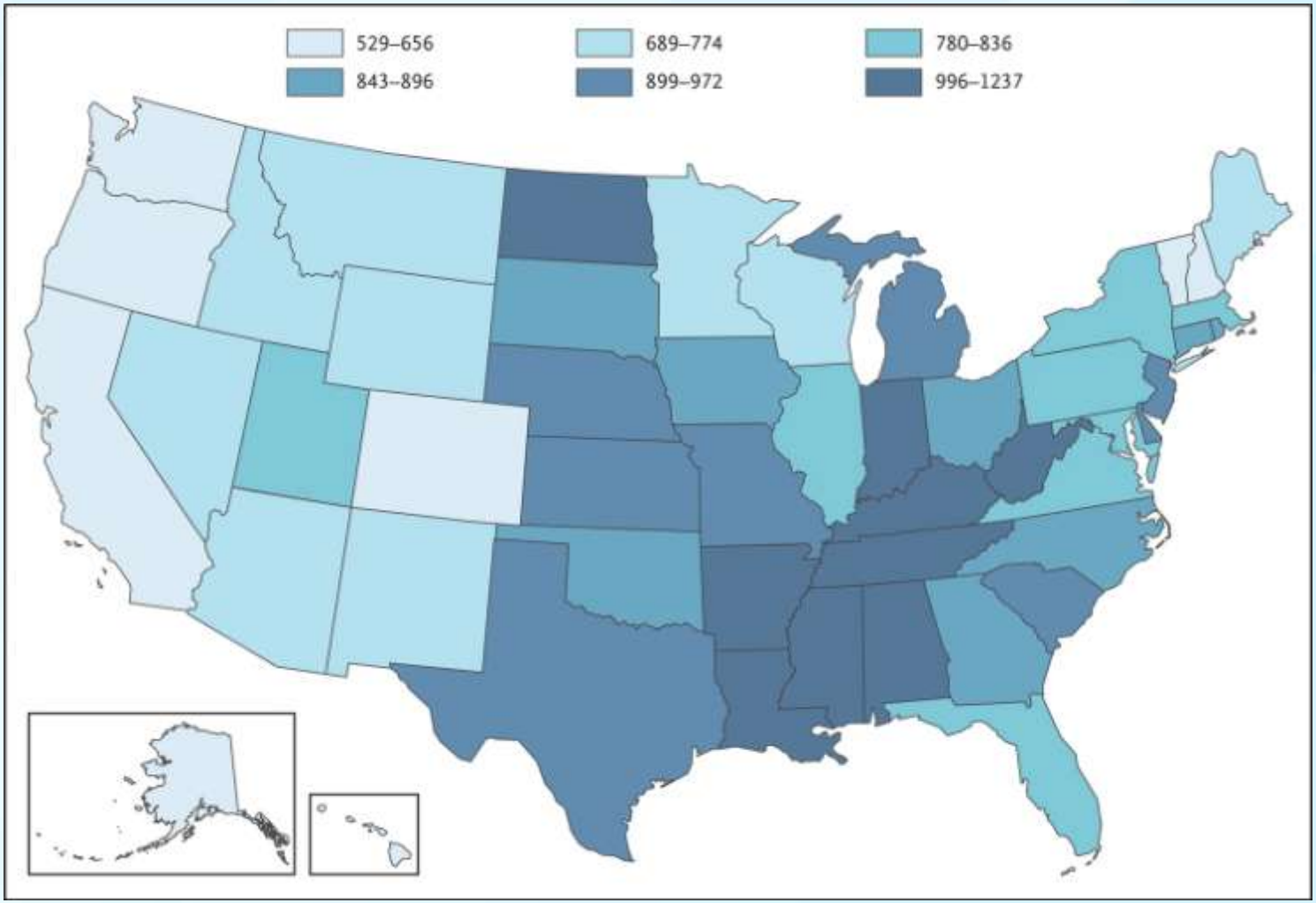


- More than half of all hospital patients receive an antibiotic
- Doctors in some hospitals prescribed 3 times as many antibiotics as doctors in other hospitals

Optimal prescribing

- **Steps in the prescribing process**
  - Indication for prescription
  - Appropriateness
    - Consistent with guidelines/best practice
  - De-escalation/antibiotic time out
    - Change of therapy as indicated to a different antibiotic or IV to PO
  - Laboratory confirmation/review

Antibiotic prescriptions per 1000 persons of all ages according to state



Hicks LA et al. N Engl J Med 2013;368:1461-1462.

How to measure

- **Healthcare clinical and administrative data**
  - Provider/prescriber-specific
  - Facility-specific
  - Aggregate—facilities, regions, national
- **Outcomes**
  - Patient outcomes
  - Laboratory data
  - Cost data
- **Process**
  - Antibiotic use data--benchmarking and tracking
  - Practice data, clinical decision support
  - Program components

Measuring Antibiotic Use

- Assessments of aggregate use
  - Proprietary data
- Facility-specific antibiotic administration data
  - Electronic records
- Detailed assessments of appropriate antibiotic use
  - Antibiotic use assessment

Mock-up: Risk-adjusted Benchmarking of Antimicrobial Use To Guide Stewardship

Antimicrobial Class-Specific Usage Rates and Standardized Utilization Ratios (SURs)				
	ABX Days			
	Observed	Predicted	SUR*	Interpretation
MICU	4000	1000	4.0	Excessive
SICU	2000	2000	1.0	Consistent
Medical Ward	3000	4000	0.75	Lower Use
Surgical Ward	1000	3000	0.33	Much Lower
Hospital	170,250	171,000	0.99	Consistent

*SUR=ratio of the observed vs. predicted usage for the patient population defined by the location (e.g., MICU , SICU, etc)

The California Antimicrobial Stewardship Program Initiative

Spotlight on Antimicrobial Stewardship Programs

The following hospitals have agreed to share progress on the implementation of their **Antimicrobial Stewardship Programs (ASP)**. Activities listed were defined by the California HAI Advisory Committee as those that comprise varying levels of Program implementation. An "√" indicates the hospital is currently performing the activity.

		Basic Program				Intermediate Program				Advanced Program		
		1. Institution-specific antimicrobial stewardship policy and/or procedures adopted	2. Physician-supervised multidisciplinary ASP committee or workgroup convened	3. ASP support provided by a physician or pharmacist with antimicrobial stewardship training from a recognized professional organization or post graduate education	4. ASP activites routinely reported to hospital quality improvement committees	5. Annual antibiogram developed (using CLSI guidelines), distributed to medical staff, and follow-up education provided.	6.Institutional guidelines for the management of common infection syndromes adopted (e.g., order sets, clinical pathways, empiric antimicrobial therapy guides, etc.)	7. Usage patterns of antibiotics (determined to be important to the local resistance ecology) monitored using Defined Daily Dosing (DDD) or Days of Therapy (DOT)	8. Regular antimicrobial stewardship education provided to hospital staff and committees	9. Antimicrobial formulary reviewed annually and changes made based on local antibiogram	10. Prospective audits of antimicrobial prescriptions performed and intervention/ feedback provided	11. Formulary restriction with preauthorization implemented
1	**Children's Hospital & Research Center** Oakland, **Major Teaching**, 190 beds ID Physician: Brian Lee, MD blee@mail.cho.org Pharmacist: Cynthia Huwe, PharmD chuwe@mail.cho.org	√	√	√	√	√	√	√	√	√	√	√
2	**Eden Medical Center** Castro Valley, **Community**, 144 beds ID Physician: Jeffrey Silvers, MD silverj@sutterhealth.org ID Pharmacist: Christopher Martinez martinc@sutterhealth.org	√	√	√	√	√	√	√	√	√	√	√
	Santa Barbara Cottage Hospital Santa Barbara, **Community**, 450 beds											

http://www.cdph.ca.gov/programs/hai/Pages/AntimicrobialStewardshipProgramInitiative.aspx

Complementary measures

- **Prescribing**
  - Objective
  - Prospective
  - May be more acceptable
- **Appropriateness**
  - Subjective
  - Retrospective
  - More difficult to interpret

Challenges

- Complexity
  - Behavioral, institutional, ecological focus
- Institutional variability
  - One size can’t fit all
- Access to and management of data
  - Electronic, proprietary, unfiltered
- Analysis of data, risk adjustment
  - Where to set the benchmarks

Summary and Conclusions

- Reduction in use is not an end in itself but a natural outcome of better practices
- Benchmarking is a useful tool, but continuous quality improvement within each setting is the process objective
- Optimal prescribing is a key goal to complement appropriateness of use
- Access to and management of electronic data is a significant challenge

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333
Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion