

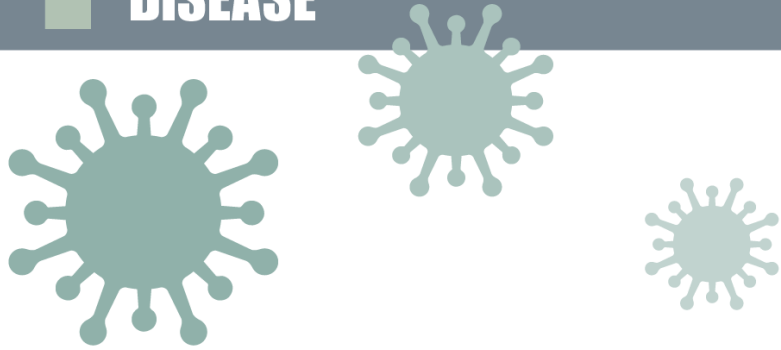
Antibiotic Stewardship

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Centers for Disease Control and Prevention

Fighting back against antibiotic resistance

1 PREVENTING INFECTIONS, PREVENTING THE SPREAD OF DISEASE



2 TRACKING



3 IMPROVING ANTIBIOTIC PRESCRIBING AND USE, AKA "STEWARDSHIP"



4 DEVELOPING NEW DRUGS AND DIAGNOSTICS



Antimicrobial Stewardship: A Rose by Any Other Name?

- ❑ *Antimicrobial stewardship* refers to strategic efforts to optimize antimicrobial prescribing
- ❑ The “name” has evolved over time
 - Antibiotic control
 - Antibiotic management
 - Antibiotic stewardship
 - Antibiotic safety

Overall Goal: Protect Patient

Right drug

Right dose

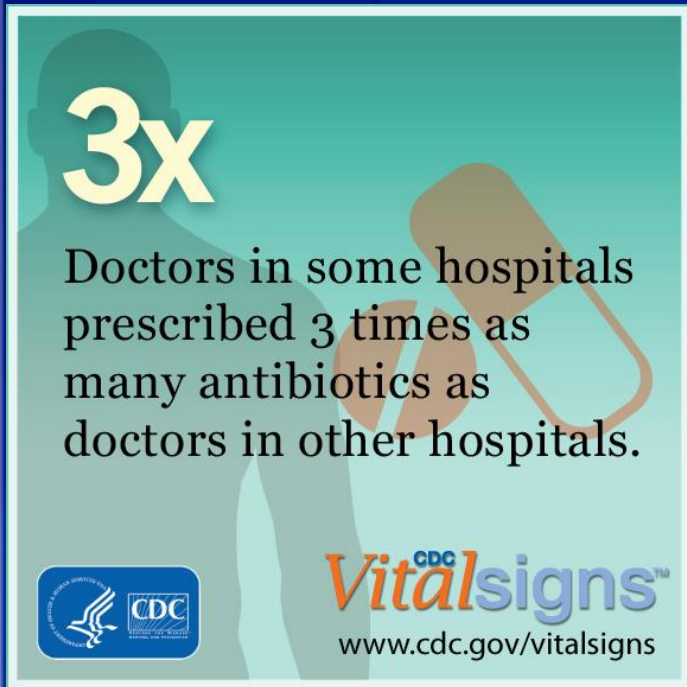
Right duration

Recognize when not needed

Antibiotic Misuse

- ❑ **Between 20-50% of antibiotic prescriptions are either unnecessary or inappropriate**
 - *Given when they are not needed*
 - *The wrong antibiotic is chosen to treat an infection*
 - *Continued when they are no longer necessary*
 - *Given at the wrong dose*
 - *Broad spectrum agents are used to treat very susceptible bacteria*

Prescribing Practices Vary, Errors Common

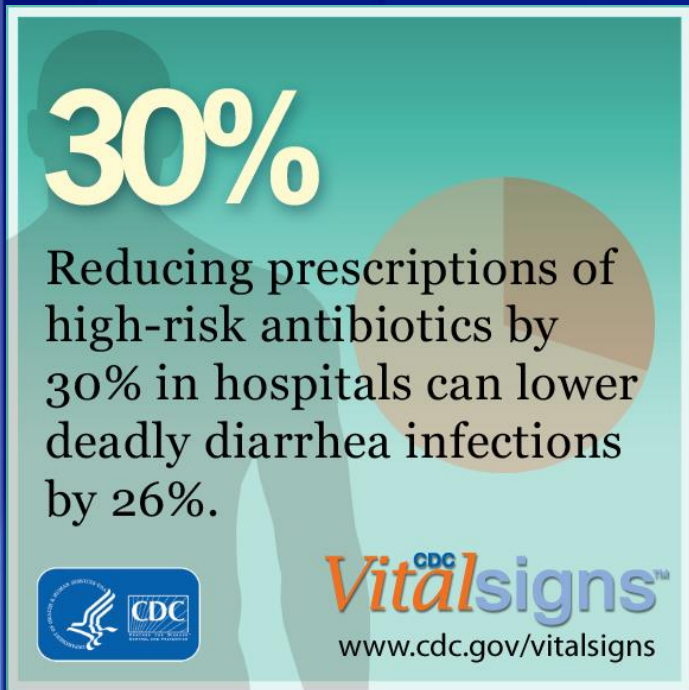


- ❑ More than half of all hospital patients receive an antibiotic
- ❑ Doctors in some hospitals prescribed 3 times as many antibiotics as doctors in other hospitals

Assessment of Treatment of UTI in 36 Hospitals

Treatment	No.	(%)
Patients treated for UTI present on admission, without indwelling catheter	111	—
Urine culture was not ordered, although standard practice before treatment	18	(16.2)
Urine culture was positive, but no documented symptoms were present	23	(20.7)
Urine culture was negative, and no documented symptoms were present	3	(2.7)
No. of patients with potential for improvement in prescribing	44	(39.6)

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

***Clostridium difficile* Infections**

Antibiotic exposure is the single most important risk factor

- ❑ Exposure to antibiotics increases the risk of *C. diff* infection by at least 3 fold for at least a month¹
- ❑ Up to 85% of patients with *C. diff* infection have antibiotic exposure in the 28 days before infection²



1. Stevens et al. *Clin Infect Dis*. 2011 Jul 1;53(1):42-8

2. Chang HT et al. *Infect Control Hosp Epidemiol* 2007; 28:926–931

Antibiotic-Related Adverse Events

- ❑ **Antibiotics account for nearly 1 in 5 (19.3%) drug-related adverse events**
 - >140,000 ER visits/year due to adverse effect of antibiotics
 - Admission required for 6.1% of adverse events

- ❑ **Side Effects: Fluoroquinolones (an example)**
 - Increased INR
 - QT interval prolongation
 - Tendon rupture
 - Risk of hypo- and hyperglycemia

Antibiotic Use Drives Resistance

For individuals

- ❑ Getting an antibiotic increases a patient's chance of becoming colonized or infected with a resistant organism

Within healthcare settings

- ❑ Increasing use of antibiotics increases the prevalence of resistant bacteria in hospitals

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



Rationale for Antimicrobial Stewardship

- ❑ **Improve Patient Care and Safety**
 - Prevent *C. difficile* infections
 - Minimize adverse events
 - Good clinical practices

- ❑ **Reduce Resistance**
 - Decrease deaths
 - Preserve antimicrobial effectiveness

The Public Health Perspective

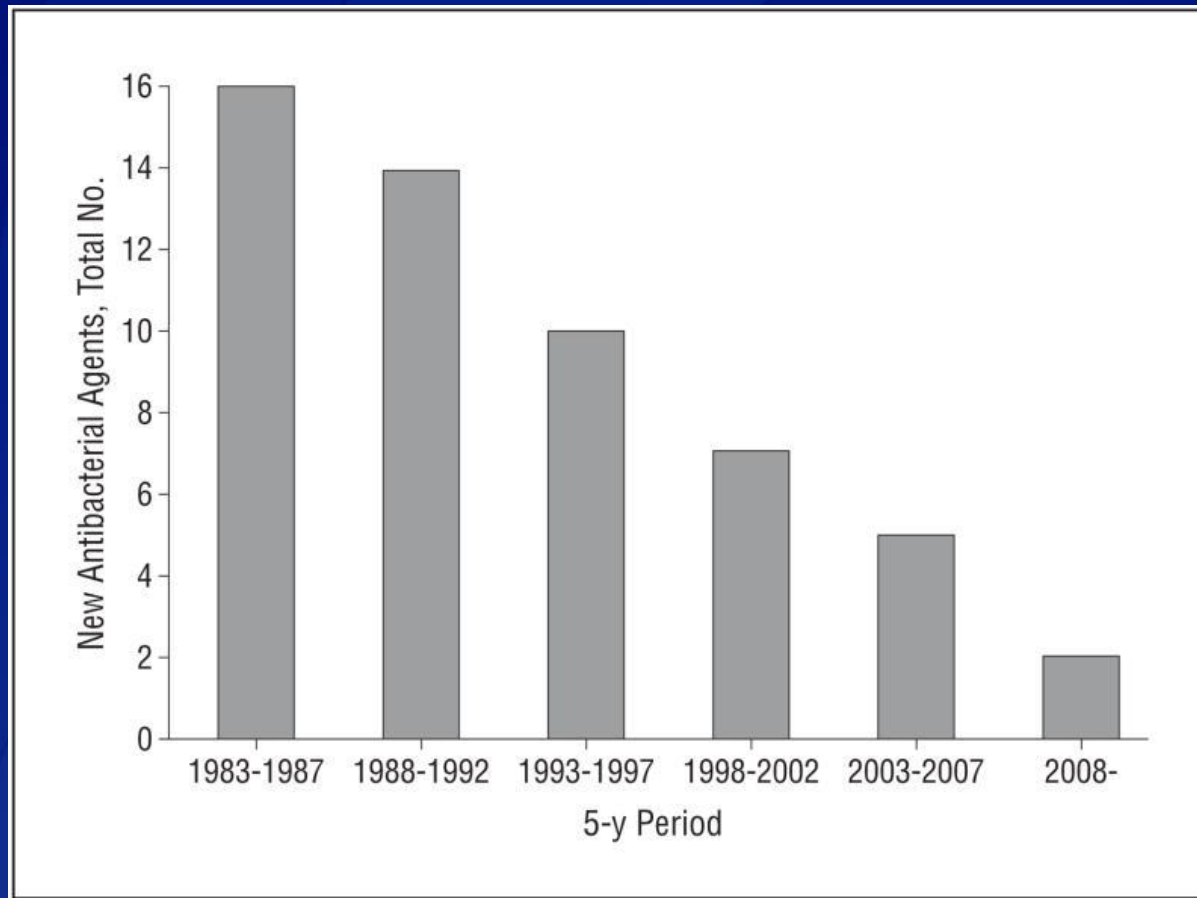
- ❑ Infection control efforts will reduce transmission, but cannot prevent development
- ❑ Addressing *C. difficile* and multidrug resistant organisms without addressing overuse and misuse of antibiotics can only go so far
- ❑ Better antibiotic prescribing gets at the root of the issue

The Public Health Perspective

❑ Antibiotics are a Shared Resource

- Antibiotic use in one patient can impact the effectiveness in another
- If everyone does not use antibiotics wisely, we will all suffer the consequences
- Antibiotics are becoming a scarce resource

Reason for Concern: Declining New Antimicrobials in the U.S.



- Drug development takes 10 years
- ~\$400-800 million per approved agent
- No new gram (-) coverage in the pipeline

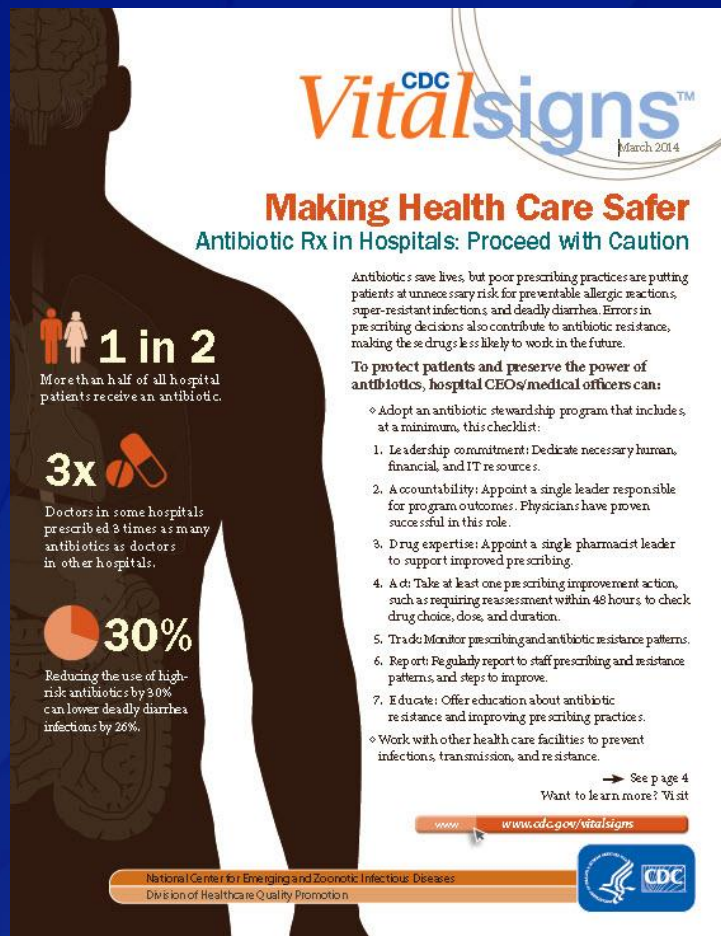
Additional Benefit: Cost Savings

- ❑ **Improving antibiotics use saves money**
 - Comprehensive programs have consistently demonstrated a decrease in antimicrobial use with annual savings of \$200,000 - \$900,000
- ❑ **Cost savings due to:**
 - Less pharmacy expenditure
 - Limiting increased costs associated with resistant infections (Length of stay, Readmission)

STRATEGIES FOR PROMOTING APPROPRIATE USE

CDC Vital Signs: Improving Antibiotic Prescribing Practices in Hospitals

7 Key Elements



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

Building the Foundation

□ Facility leadership support

- Formal statement that leadership supports efforts to improve and monitor antibiotic prescribing
- Assurance that involved staff has time, authority, and accountability
- Funding can augment efforts
 - Staff time to accomplish goals
 - Training for staff
 - IT support

Core Contributors

Infection Preventionists

- Risk assessment and prevention planning skills
- Collect, analyze and report antibiotic-related data

Laboratory

- Input into specimen collection and proper use of relevant tests
- Review information flow of results to clinicians
- Create and interpret a facility antibiotic resistance report

Nursing

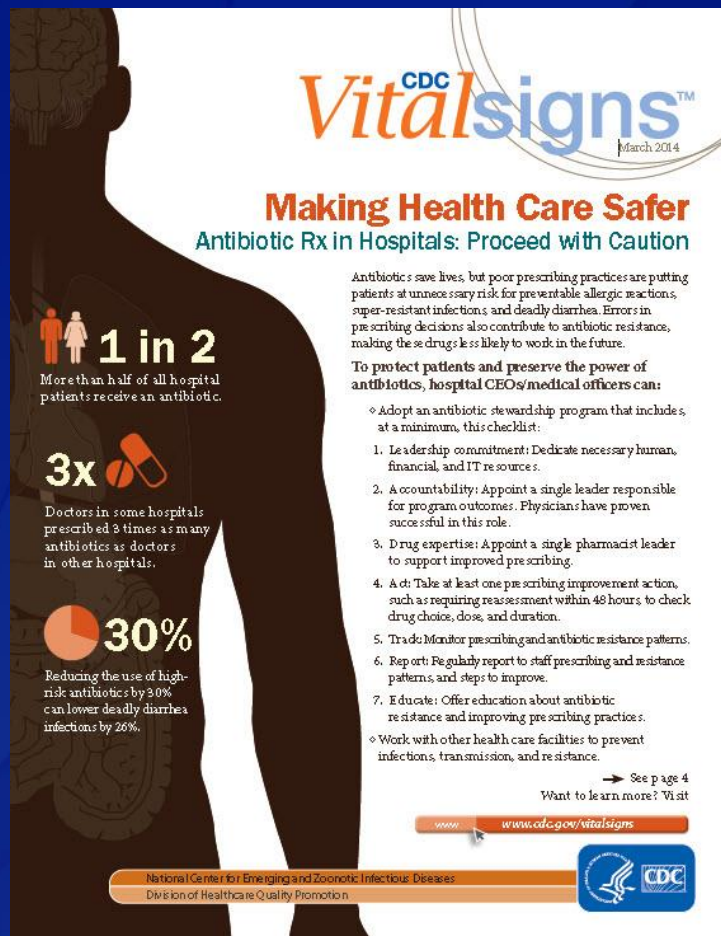
- Review medications as part of their routine duties
- Could contribute through prompting discussions of antibiotic treatment, indication, and duration

Information Technology (IT)

- Create ways integrate guidelines and policies with decision support at point of care
- Track antibiotic use through medication administration records

CDC Vital Signs: Improving Antibiotic Prescribing Practices in Hospitals

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Starting points

❑ The Antibiotic Formulary

- Know what antibiotics are available to prescribers
- Characterize their use in your facility, especially among broad-spectrum agents

❑ Guidelines

- Develop facility-specific guidelines, to assist with antimicrobial selection
 - Surgical prophylaxis
 - Pneumonia
 - Urinary tract infections

Interventions

- ❑ **Guidelines, policies, and protocols alone will probably not change practice**
- ❑ **Active interventions are most effective**
 - **Prospective audit**
 - **Formulary restriction and preauthorization**
 - **Antibiotic 'Time Out'**

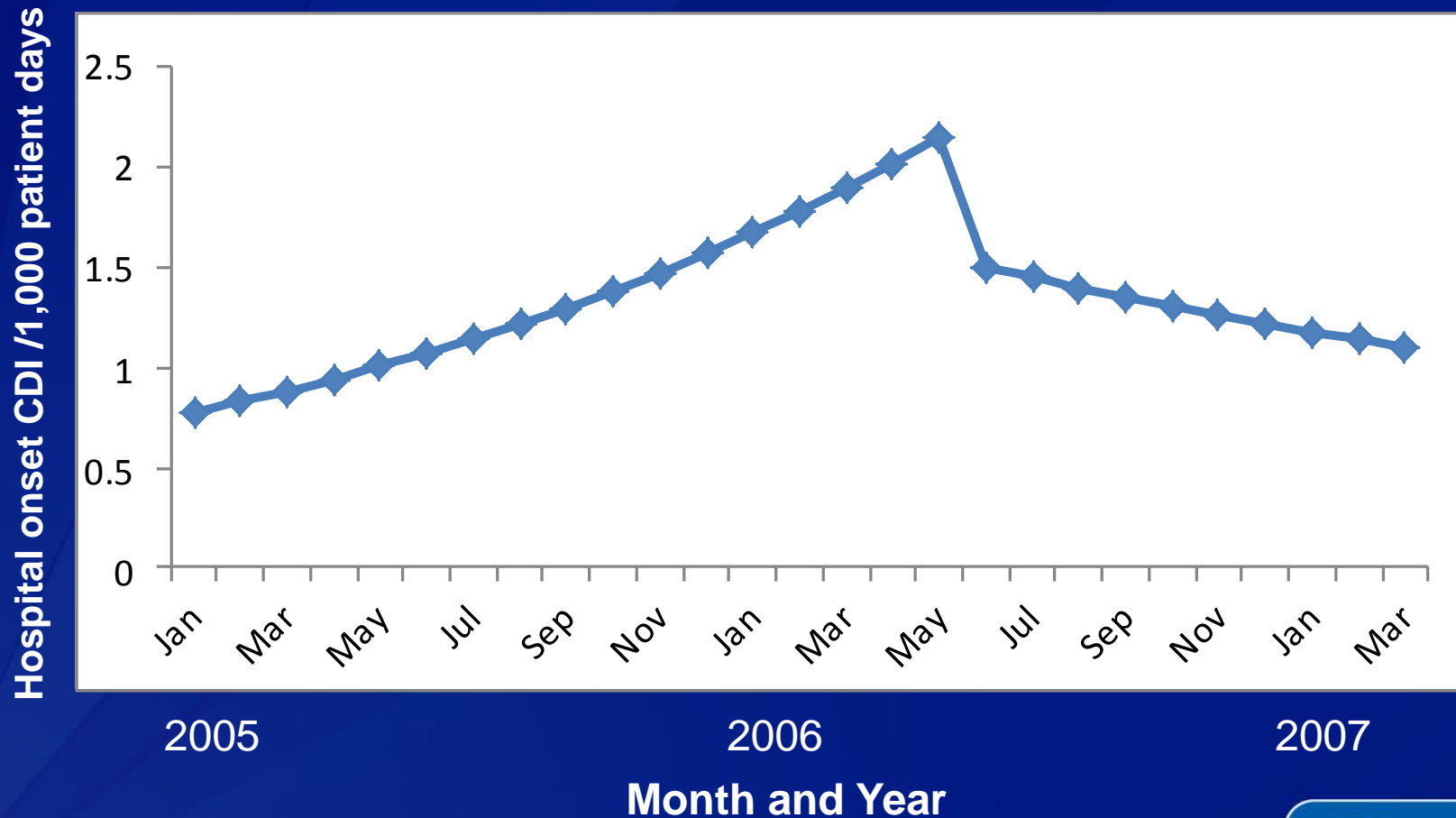
Prospective Audit

- ❑ An physician or pharmacist reviews orders and intervenes with modification of order and feedback to prescriber
- ❑ Results in improved use, decreased costs
- ❑ Caveats:
 - Time and labor intensive
 - Many settings do not have capacity
 - Providers may not be receptive

Formulary restriction and preauthorization

- ❑ Specific antibiotics cannot be ordered without authorization
- ❑ Useful in response to healthcare-associated outbreak

Impact of Fluoroquinolone Restriction on Rates of *C. difficile* Infection (CDI)



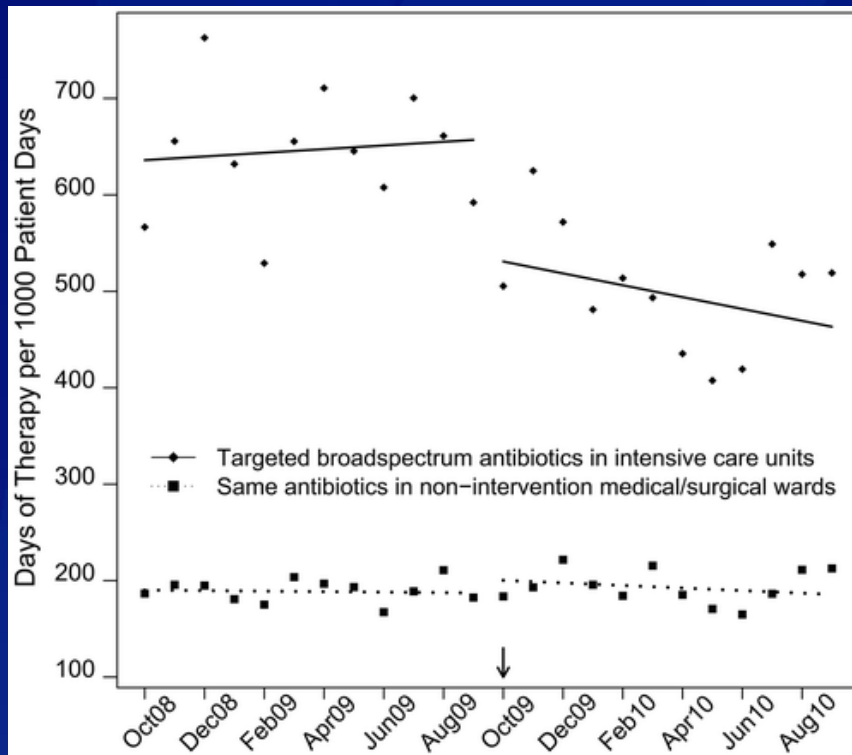
Kallen et al. *Infect Control Hosp Epidemiol.* 2009 Mar;30(3):264-72.



An Antibiotic 'Time Out'

- ❑ **The 'time out' concept is borrowed from surgery**
- ❑ **A concrete point in time dedicated to reviewing antimicrobial choice and duration**
 - Reappraise therapy when more clinical data are available (usually in 48-72 hours)
 - Decide about continuation, narrowing therapy and specify a duration
- ❑ **Recommended changes are better received and more likely to be followed at a later time point**

ICU Antibiotic 'Time Out' Results



- Broad spectrum use decreased
 - 644 to 503 days of therapy/1,000 pt days
 - Cost savings of \$95,000/year
- *C. diff* infections
 - ICU: Decreased 11 to 6 cases
 - Control wards: Increased 87 to 116 cases
- Meropenem susceptibility increased from 78.2% to 83.4% in ICU isolates

What are the 'Drivers' of Appropriate Use?

❑ Appropriate initiation

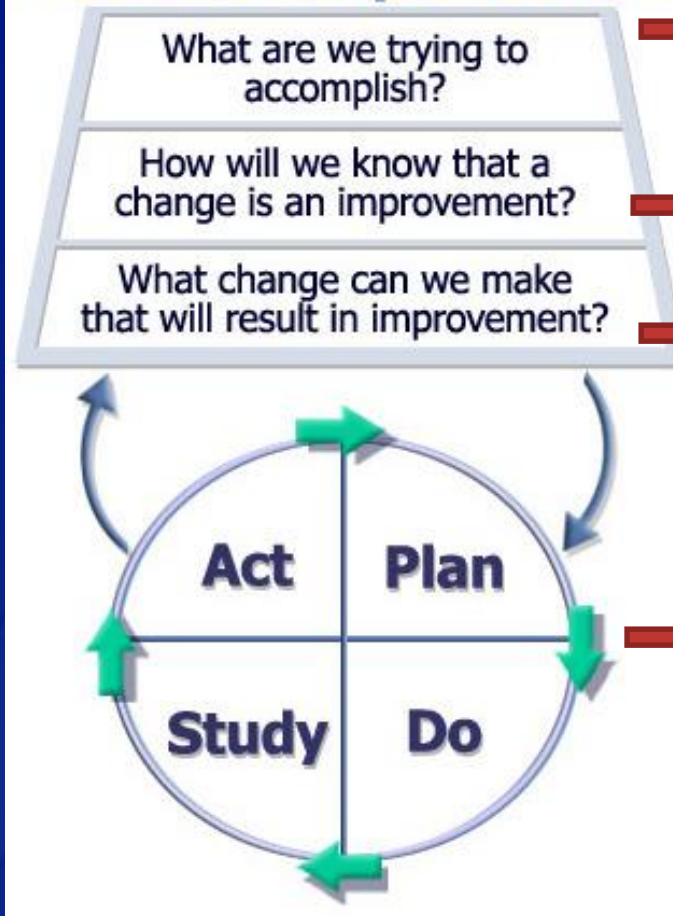
- What to treat. What not to treat.
- Obtaining cultures
- Choosing based on guidelines and local susceptibility
- Start promptly

❑ Appropriate administration and de-escalation

- Correct dosing, route, and timing
- Stop or change based on culture
- Reconciling antibiotics at all transition in care

Model for Improvement

Model for Improvement



Choose something to improve

Establish a measure

Plan how to improve

Specific 'Tests of Change'

Moving Stewardship to the Front Lines

- ❑ Every practitioner and each facility should embrace the responsibility to optimize antibiotic use
 - Not “create a stewardship program”
 - But “implement a specific intervention”
- ❑ Starting point: Identify specific ideas that people can do to improve antibiotic use

Measurement Matters

- ❑ You cannot improve something you cannot measure

- ❑ However...measurement of antibiotic use remains a major challenges in stewardship
 - Does higher use equate to inappropriate use?
 - Stewardship involve often multiple interventions.
 - Can resistance patterns reflect good prescribing?

Indicator Types

Indicators

Examples

Structure

- Program infrastructure
- Policies & guidelines

Process

- Adherence to recommended practices
- Antimicrobial use (process /outcome)

Outcomes

- *C. Diff* infections
- Resistance patterns

Process Measures

❑ Percent of patients for whom

- Cultures were obtained prior to first dose of antibiotics
- Antibiotic start date was documented at the point of care
- Antibiotic stop date/duration was documented
- Antibiotic indication was documented

❑ Follow up on culture results

- Was antibiotic selection modified to culture result?

❑ Percent of patients who received treatment according to facility guidelines

Recommended based on pilot testing

<http://www.cdc.gov/getsmart/healthcare/learn-from-others/driver-diagram/measurement-framework.html>

CDC Strategies to Measure and Improve Antibiotic Use in Hospitals

- ❑ Measure use and stewardship programs
 - Overall antibiotic use
 - Appropriate antibiotic use
 - Stewardship programs in US hospitals
- ❑ Improve Use
 - Education and promotion
 - Policies
- ❑ Innovate

CDC Approach to Measuring Antibiotic Use

- ❑ Broad (ideally national) assessments of aggregate use.
- ❑ Facility specific assessments of antibiotic administration data
 - NHSN AU option
- ❑ Detailed assessments of appropriate antibiotic use.
 - EIP antibiotic use assessment

Measurement of Use

❑ Antibiotic Use Module

- National Healthcare Safety Network (NHSN) module
- Provides facilities a mechanism to report and analyze antimicrobial use
- Antimicrobial use is captured by pharmacy information software
- Launched in 2012, but in early stages of uptake

Antibiotic Use Data for a Hospital (AU Analysis Output Example)

□ Line List Rate Tables, by Location

National Healthcare Safety Network

Rate Table - All Submitted AU Data - Antimicrobial Utilization Rates by Location

Rate per 1,000 Days Present

As of: February 3, 2012 at 3:52 PM

Date Range: All AU_RATESLOCATION

Org ID=10846 CDC Location=IN:ACUTE:CC:M Location=INMEDCC

Summary Yr/Mon	Antimicrobial Category	Antimicrobial Class	Antimicrobial Days	Days Present	Rate per 1000 Days Present
2011M01	Antibacterial	-- All --	90165	10000	9,016.500
2011M01	Antibacterial	Aminoglycosides	438	10000	43.800
2011M01	Antibacterial	Carbapenems	12	10000	1.200
2011M01	Antibacterial	Cephalosporins	57	10000	5.700
2011M01	Antibacterial	Fluoroquinolones	12	10000	1.200
2011M01	Antibacterial	Folate pathway inhibitors	6	10000	0.600

*Data is for example only



Measure Antibiotic Use in US Hospitals

- ❑ Current efforts to measure overall and appropriate antibiotic use will inform our development a metric to submit to the National Quality Forum.
 - Seeking a metric based on the measure in the AU option- antibiotic days per 1000 patient days present.

Challenges With A Quality Measure on Antibiotic Use

- ❑ Will require good benchmarking to help facilities know if they are outliers.
- ❑ Being an “outlier” does not necessarily mean there is a problem.
- ❑ The measure would allow facilities to compare and might suggest areas where further review is warranted.

Measure Antibiotic Stewardship Programs in US Hospitals

- ❑ CDC adding questions on Antibiotic Stewardship Programs to the annual facility survey of NHSN.
 - Would provide information from ~4000 hospitals reporting data to NHSN.
- ❑ Questions will be based on the items in the “Core Elements” documents.
 - Will provide some details on how the programs are being implemented, rather than mere presence of a program.

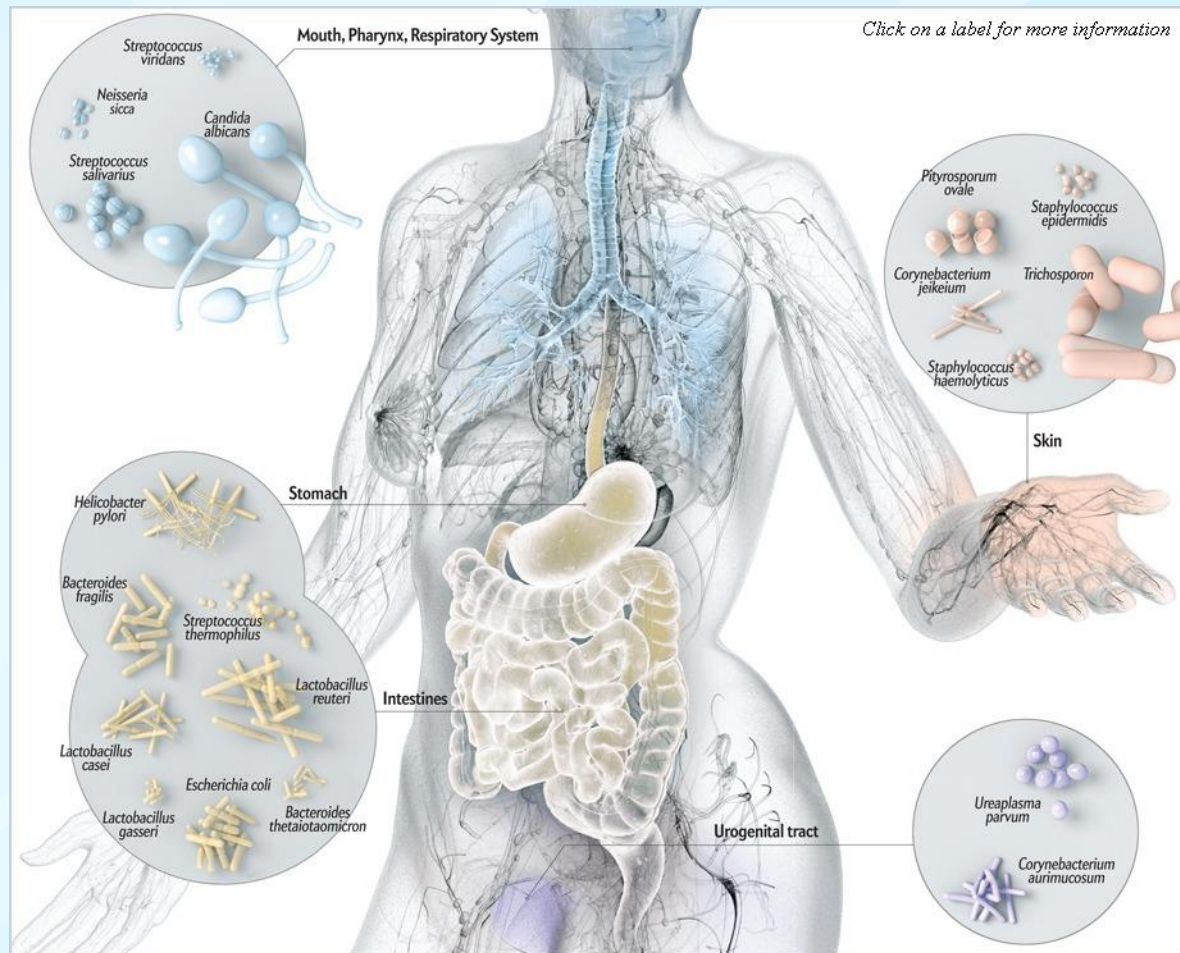
Improve Use- Policies

- ❑ CDC continues to work with CMS to support and inform discussions on policy options to improve antibiotic use.
- ❑ Collaboration on policies to promote development of new drugs (LPAD)

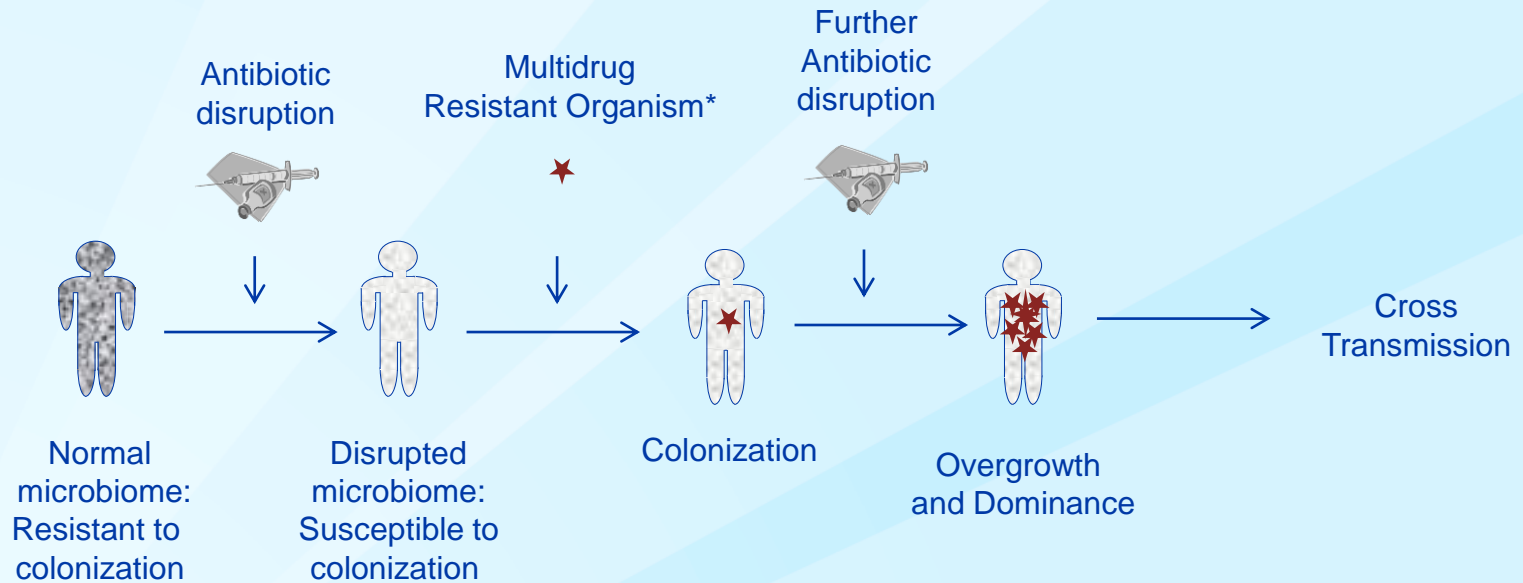
Innovate

- ❑ CDC funding a multi-year project to do a multi-center assessment of post-prescription antibiotic reviews on a variety of outcomes.
- ❑ CDC partnered with Prevention Epicenters and Emerging Infections Program investigators to submit a letter of intent to PCORI on a large-scale stewardship intervention to reduce *C. difficile*.

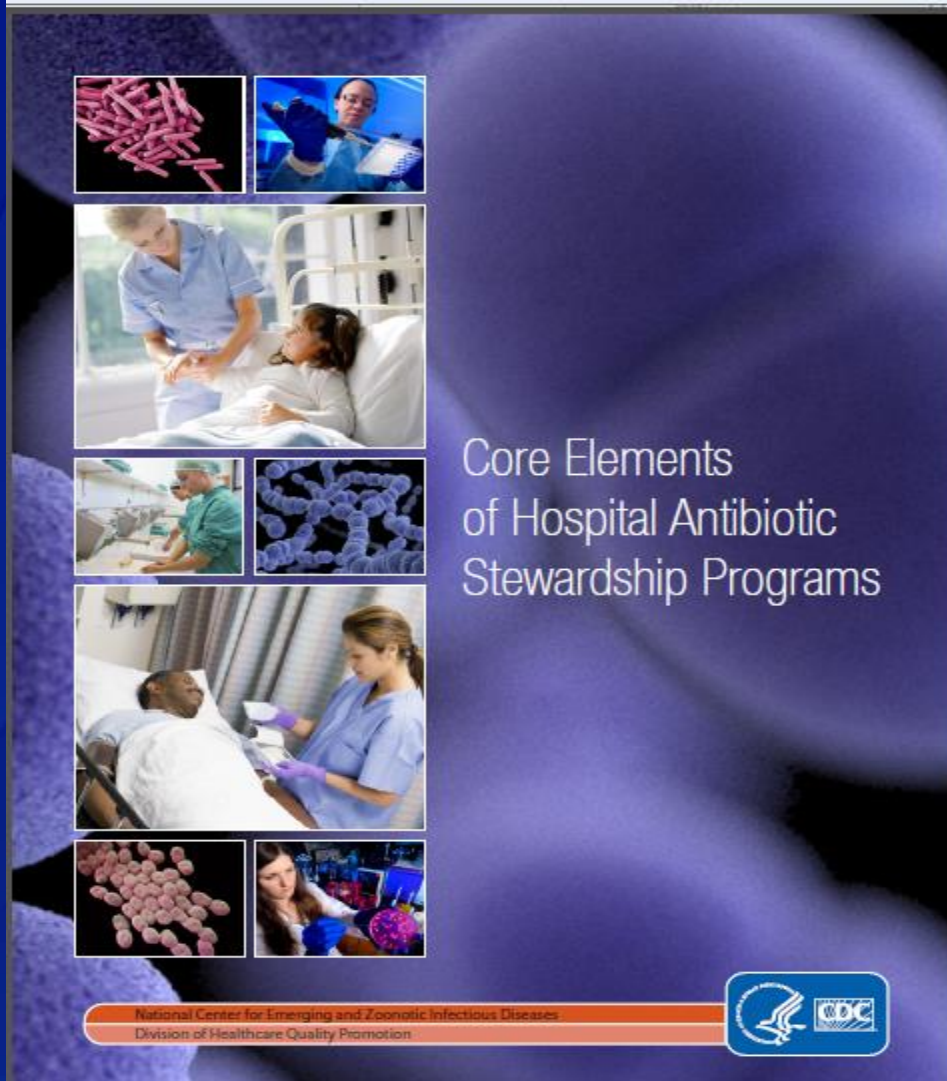
The Human Microbiome



Antibiotic Resistance Threat from Microbiome Disruption



*Examples include carbapenem-resistant enterobacteriaceae, vancomycin-resistant enterococci, extended-spectrum beta-lactamase producing enterobacteriaceae. May also include transfer of genetic transfer of resistance determinants



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

CDC's Get Smart Programs

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Get Smart: Know When Antibiotics Work

Antibiotics cure bacterial infections, not viral infections such as:

- Colds or flu;
- Most coughs and bronchitis;
- Sore throats not caused by strep; or
- Runny noses.

Learn more about antibiotic use >>

Drug Resistance

Superbugs ranked, CDC outlines four core actions to halt resistance

[Learn More >](#)

ANTIBIOTIC RESISTANCE THREATS in the United States, 2013

[Email page link](#)
[Print page](#)

Appropriate Antibiotic Use

Antibiotics Aren't Always the Answer

Upper respiratory infections: sinus infection, sore throat, ear infection, bronchitis, and colds...

Antibiotic Resistance

FAQs, definitions, bacteria versus viruses...

Symptom Relief

Learn more about how to feel better when you don't need antibiotics...

Fast Facts

About antibiotic resistance and appropriate antibiotic use...

Info for Specific Groups

For Everyone
Information sheets, brochures, posters, fact sheets

Healthcare Professionals
Tools, CEs, and other resources for clinicians and pharmacists

Program Planners
Program planning, evaluation, surveillance tools

Partners
Information for current and potential partners of the Get Smart program

Media
Virtual press kit, PSAs, logo use, and media tips

Spanish-Speakers
Information and materials (posters...) in Spanish

Get Smart for Healthcare

Studies indicate that 30-50% of antibiotics prescribed in hospitals are unnecessary or inappropriate. There is no doubt that overprescribing and misprescribing is contributing to the growing challenges posed by *Clostridium difficile* and antibiotic-resistant bacteria. Studies demonstrate that improving prescribing practices in hospitals can not only help reduce rates of *Clostridium difficile* infection and antibiotic resistance, but can also improve individual patient outcomes, all while reducing healthcare costs. Get Smart for Healthcare is a CDC campaign focused on improving prescribing practices in inpatient healthcare facilities.

Hospital Rx
Patients at risk
Antibiotic Prescribing in Hospitals: Proceed with Caution

[Learn More >](#)

30%
Reducing prescriptions of high-risk antibiotics by 30% in hospitals can lower deadly diarrhea infections by 26%.

[CDC](#) [Vitalsigns](#)
www.cdc.gov/vitalsigns

[Email page link](#)
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To receive email updates about this page, enter your email address:

[What's this?](#) [Submit](#)

Campaign Materials

- Print Materials
- Treatment Guidelines for Upper Respiratory Tract Infections
- Print Materials Bulk Order (Special offer during Get Smart About Antibiotics Week)
- Online Materials
- Radio/TV Materials



Get Smart for Healthcare Topics

[Overview and Evidence to Support Stewardship](#)

[Implementation Resources](#)

[Stewardship Program Examples](#)

Healthcare-Associated Infection Topics

[Dialysis Safety](#)

[Hand Hygiene](#)

[Healthcare-associated Infections \(HAI\)](#)

[Injection Safety](#)

[National Healthcare Safety Network \(NHSN\)](#)

[Nursing Homes and Assisted Living](#)

[Protecting Healthcare Personnel](#)

Get Smart Week



Antibiotic Prescribing in Hospitals: Improvements Needed
[2:42]
March 04, 2014

CDC Safe Healthcare BLOG

Join the conversation

Contact Us:

Centers for Disease Control and Prevention
1600 Clifton Rd
Atlanta, GA 30333
800-CDC-INFO
(800-232-4636)
TTY: (888) 232-6348
[Contact CDC-INFO](#)

1 in 2
More than half of all hospital patients receive an antibiotic.

[CDC](#) [Vitalsigns](#)
www.cdc.gov/vitalsigns

Avoiding Unintended Consequences

- ❑ Promote prompt use when needed
 - Severe infection
 - Early treatment of sepsis
- ❑ Promote use of new drugs when needed

Conclusions

- ❑ **Improving antibiotic use is an important public health priority**
 - **It is also a healthcare quality and safety issue**
- ❑ **Many opportunities exist to improve prescribing**
 - Guidelines, policies and education are a start, but not enough
 - Stewardship programs can exist in any hospital setting
 - Small interventions can have big impact
- ❑ **Measurement of practices and antibiotic use fuels improvement**
- ❑ **Innovative strategies in the future**



Thank you

For more information please contact Centers for Disease Control and Prevention

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E-mail: cdcinfo@cdc.gov Web: 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.

National Center for Emerging and Zoonotic Infectious Diseases

Division of Healthcare Quality Promotion

