Know When Antibiotics Work

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

Why we need to improve in-patient antibiotic use

- Antibiotics are misused in hospitals
- Antibiotic misuse adversely impacts patients and society
- Improving antibiotic use improves patient outcomes and saves money
- Improving antibiotic use is a public health imperative

Antibiotics are misused in hospitals

- "It has been recognized for several decades that up to 50% of antimicrobial use is inappropriate"
- IDSA/SHEA Guidelines for Antimicrobial Stewardship Programs
- http://www.journals.uchicago.edu/doi/pdf/10.1086/510393

Antibiotic are misuse in a variety of ways

- Given when they are not needed
- Continued when they are no longer necessary
- Given at the wrong dose
- Broad spectrum agents are used to treat very susceptible bacteria
- The wrong antibiotic is given to treat an infection

Antibiotic misuse adversely impacts patients- *C. difficile*

- **Antibiotic exposure is the single most important risk factor for the development of *Clostridium difficile* associated disease (CDAD).**
  - Up to 85% of patients with CDAD have antibiotic exposure in the 28 days before infection[1]

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

Antibiotic misuse adversely impacts patients- *C. difficile*

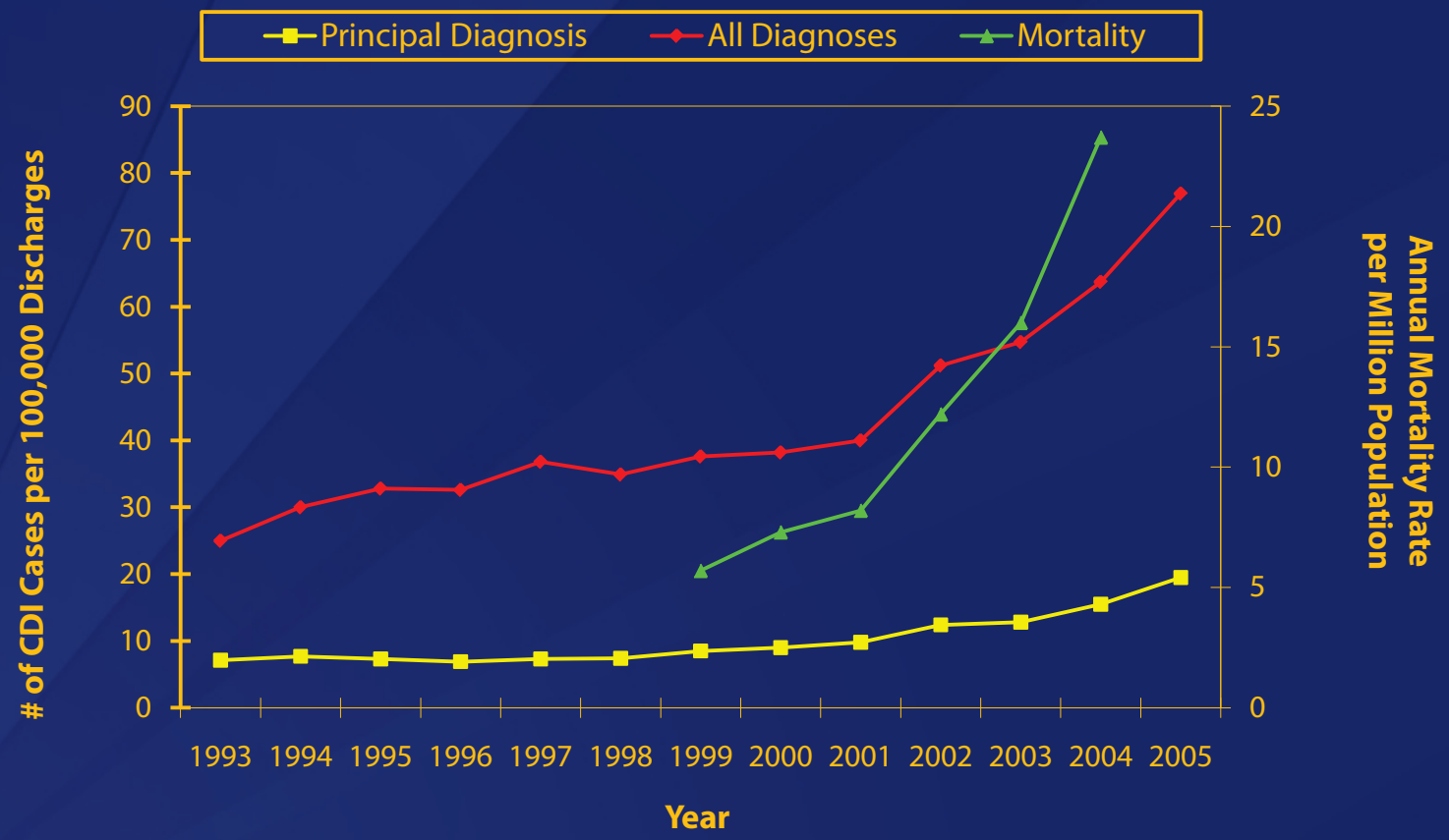
- Emergence of the NAP-1/BI or "epidemic" strain of *C. difficile* has intensified the risks associated with antibiotic exposure.

Antibiotic misuse adversely impacts patients- *C. difficile*

- **Epidemic strain of *C. difficile* is associated with increased risk of morbidity and mortality.**

McDonald LC et al. New England Journal of Medicine 2005;353:2433-41

Incidence and mortality are increasing in US



Elixhauser A, et al. Healthcare Cost and Utilization Project: Statistical Brief #50. April 2008. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb50.pdf. Accessed March 10, 2010.
Redelings MD, et al. Emerg Infect Dis. 2007;13:1417-1419.

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

Elixhauser, A. (AHRQ), and Jhung, MA. (Centers for Disease Control and Prevention). *Clostridium Difficile-Associated Disease in U.S. Hospitals, 1993–2005*. HCUP Statistical Brief #50. April 2008. Agency for Healthcare Research and Quality, Rockville, MD. And unpublished data
http://www.hcup-us.ahrq.gov/reports/statbriefs/sb50.pdf

Campbell et al. *Infect Control Hosp Epidemiol*. 2009:30:523-33.
Dubberke et al. *Emerg Infect Dis*. 2008;14:1031-8.
Dubberke et al. *Clin Infect Dis*. 2008;46:497-504.

Antibiotic misuse adversely impacts patients- *C. difficile*

- **Epidemic strain is resistant to fluoroquinolone antibiotics, which confers a selective advantage.**

McDonald LC et al. *New England Journal of Medicine* 2005;353:2433-41

Antibiotic misuse adversely impacts patients - resistance

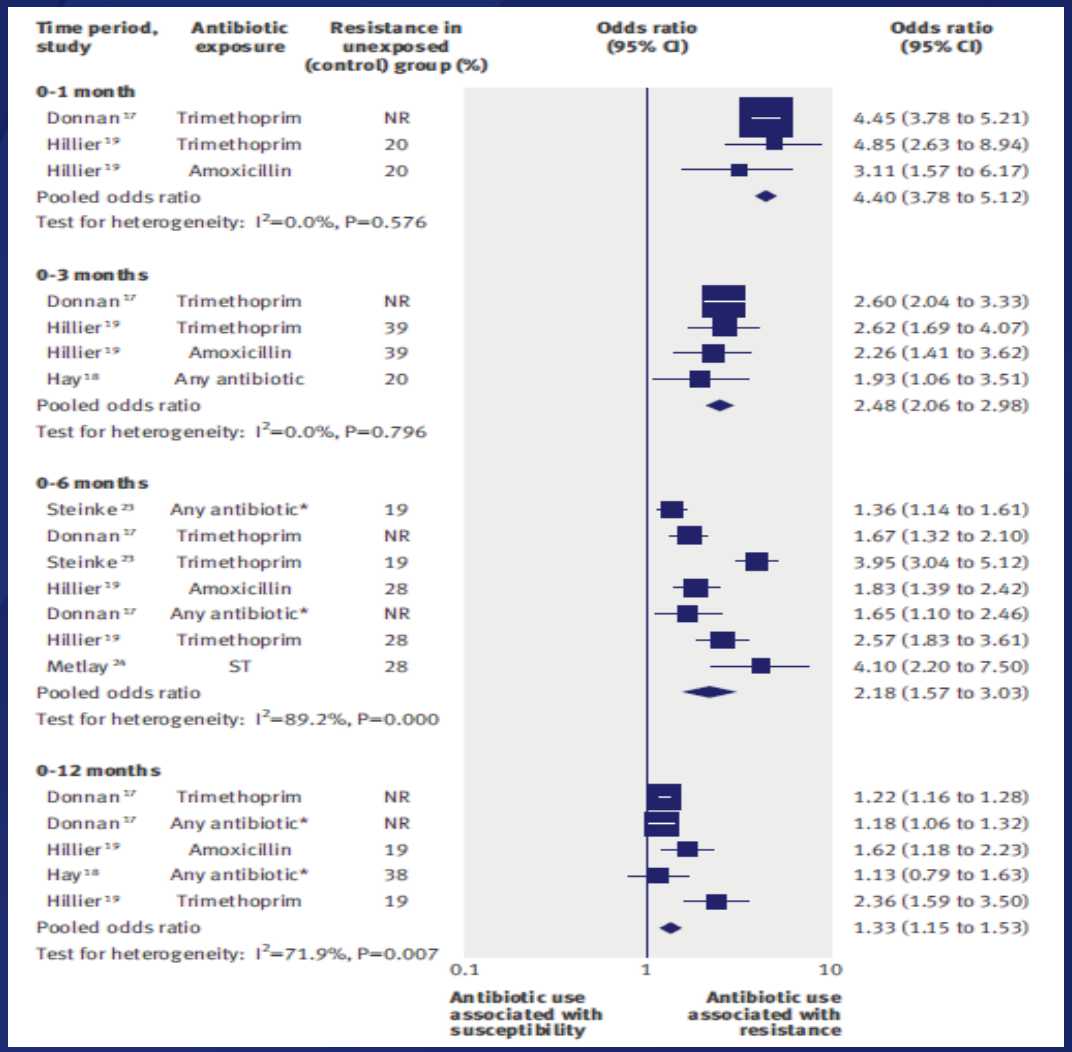
- Getting an antibiotic increases a patient's chance of becoming colonized or infected with a resistant organism.

Antibiotic exposure increases the risks of resistance

Pathogen and Antibiotic Exposure	Increased Risk
Carbapenem Resistant Enterobactericeae and Carbapenems	15 fold 1
ESBL producing organisms and Cephalosoprins	6- 29 fold 3,4

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

Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis



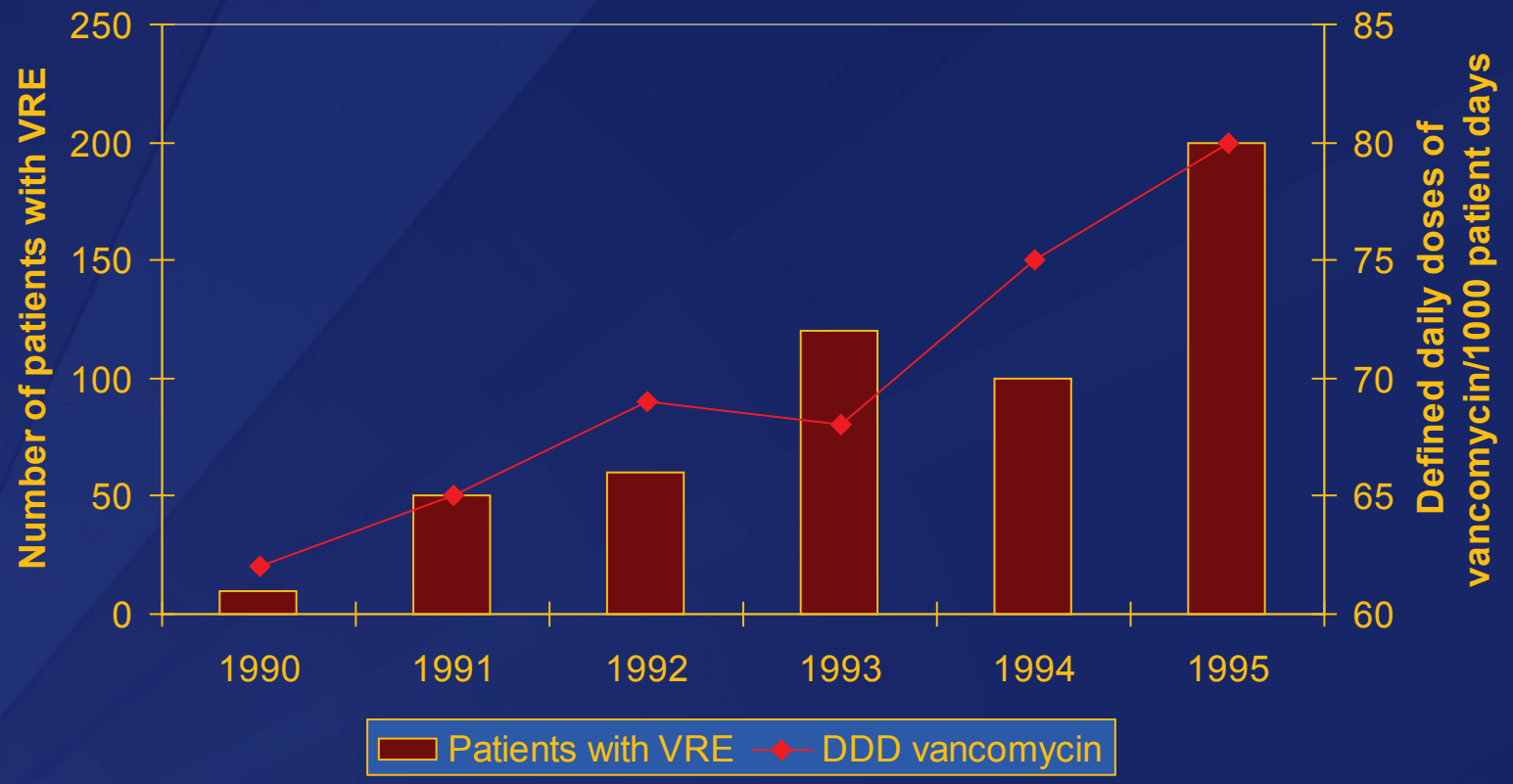
Costelloe C et al. *BMJ.* 2010;340:c2096.

Antibiotic misuse adversely impacts patients- resistance

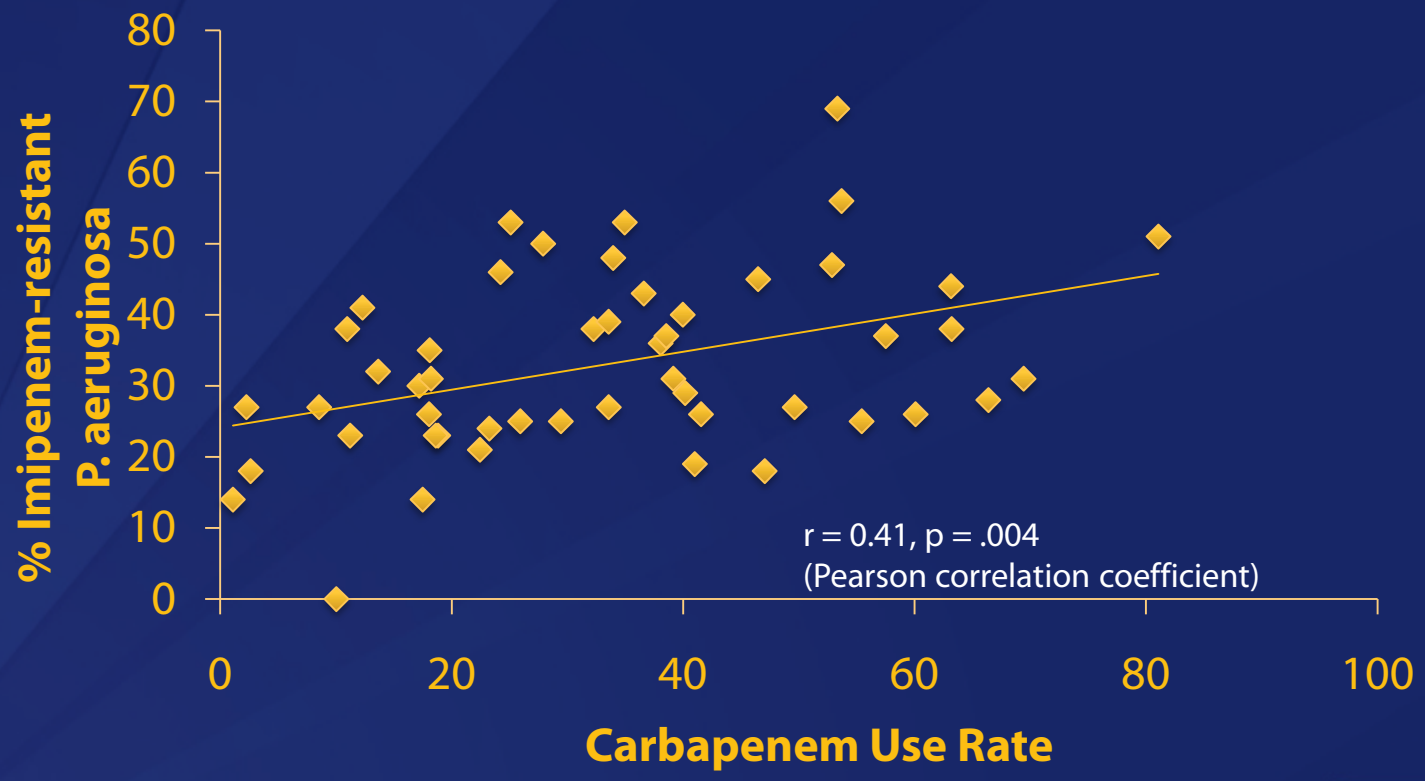
- Increasing use of antibiotics increases the prevalence of resistant bacteria in hospitals.

Association of vancomycin use with resistance

(JID 1999;179:163)



Annual prevalence of imipenem resistance in *P. aeruginosa* vs. carbapenem use rate

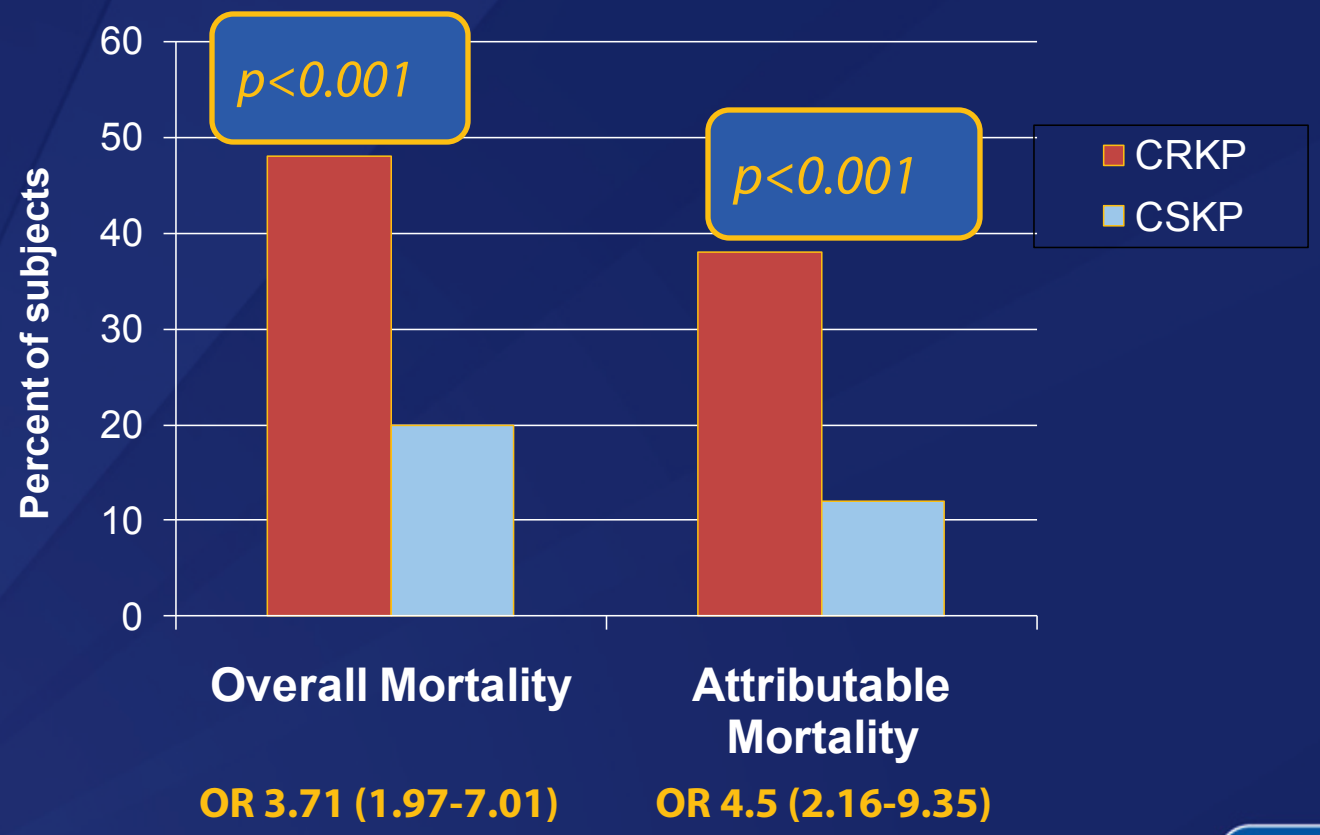


45 LTACHs, 2002-03 (59 LTACH years)

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

Antibiotic resistance increases mortality

Mortality associated with carbapenem resistant (CR) vs susceptible (CS) Klebsiella pneumoniae (KP)



Patel G et al. *Infect Control Hosp Epidemiol* 2008;29:1099-1106

Mortality of resistant (MRSA) vs. susceptible (MSSA) *S. aureus*

- **Mortality risk associated with MRSA bacteremia, relative to MSSA bacteremia: OR: 1.93; $p < 0.001$.[1]**
- **Mortality of MRSA infections was higher than MSSA: relative risk [RR]: 1.7; 95% confidence interval: 1.3–2.4).[2]**

1. *Clin. Infect. Dis.*36(1),53–59 (2003).
2. Infect. Control Hosp. Epidemiol.28(3),273–279 (2007).

Antibiotic misuse adversely impacts patients - adverse events

- **In 2008, there were 142,000 visits to emergency departments for adverse events attributed to antibiotics.[1]**

1. Shehab N et al. *Clinical Infectious Diseases* 2008; 15:735-43

Antibiotic misuse adversely impacts patients - adverse events

- National estimates for in-patient adverse events are not available, but there are many reports of serious adverse events (aside from *C. difficile* infection) from in-patient antibiotic use.

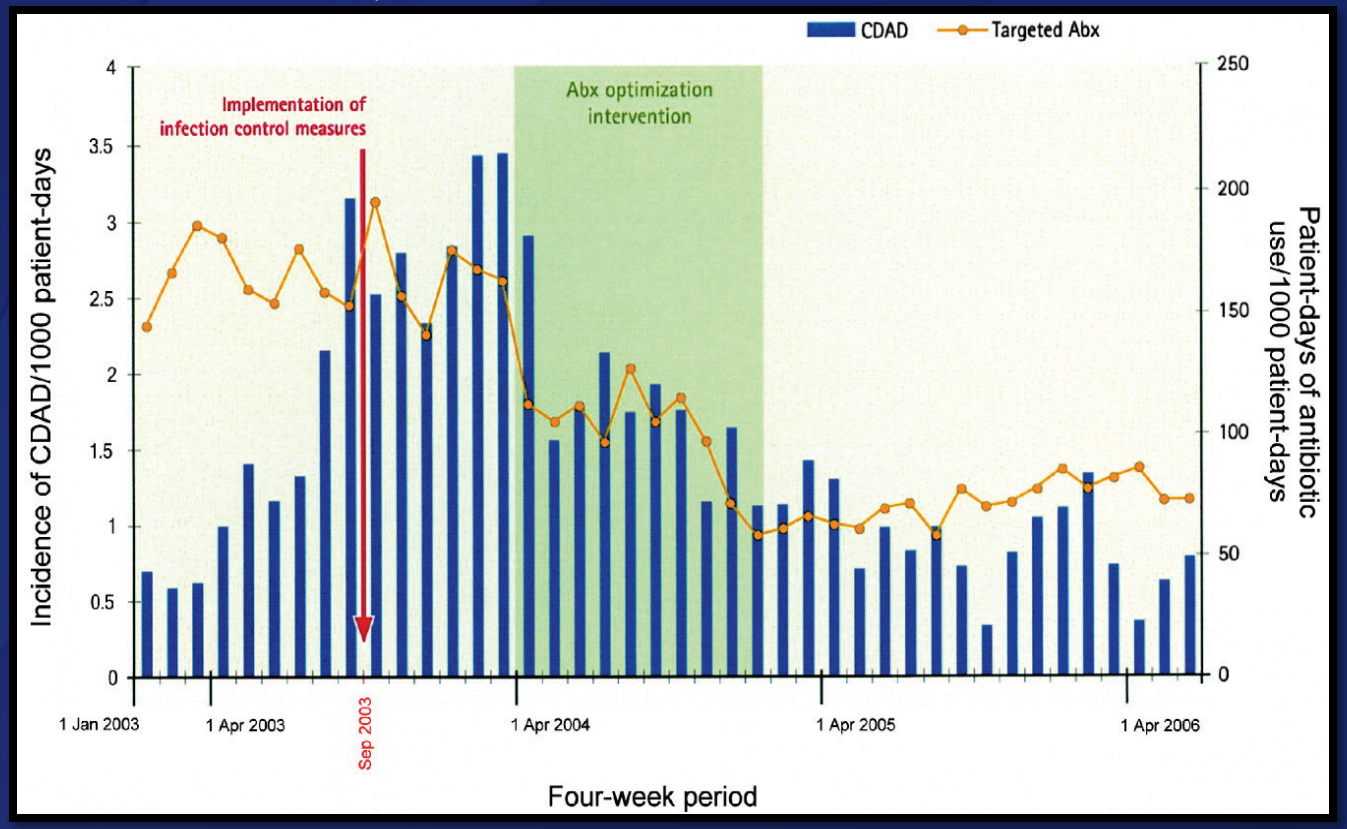
Improving antibiotic use reduces *C. difficile* infections

Impact of fluoroquinolone restriction on rates of *C. difficle* infection

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

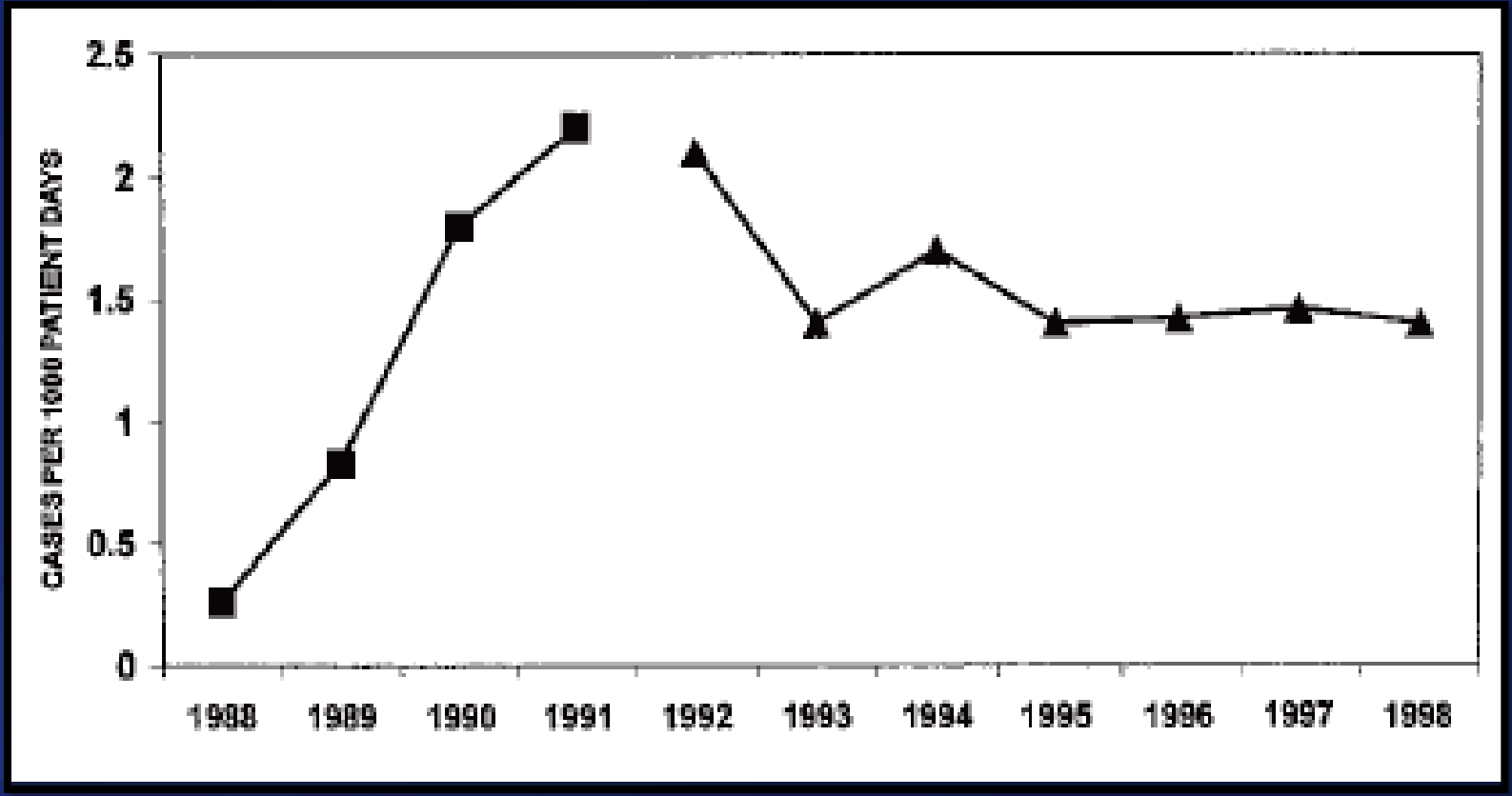
Targeted antibiotic consumption and nosocomial *C. difficile* disease

Tertiary care hospital; Quebec, 2003-2006



Valiquette, et al. *Clin Infect Dis* 2007;45:S112.

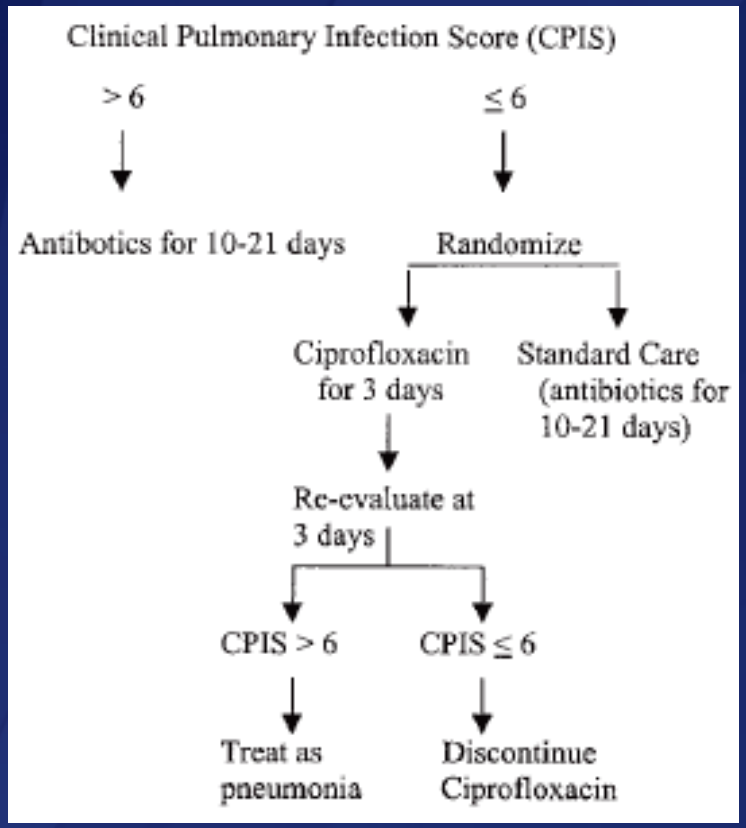
Impact of improving antibiotic use on rates of *C. difficile*



Carling P et al. *Infect Control Hosp Epidemiol*. 2003;24(9):699-706.

Improving antibiotic use reduces resistance

Stewardship optimizes patient safety: decreased patient-level resistance

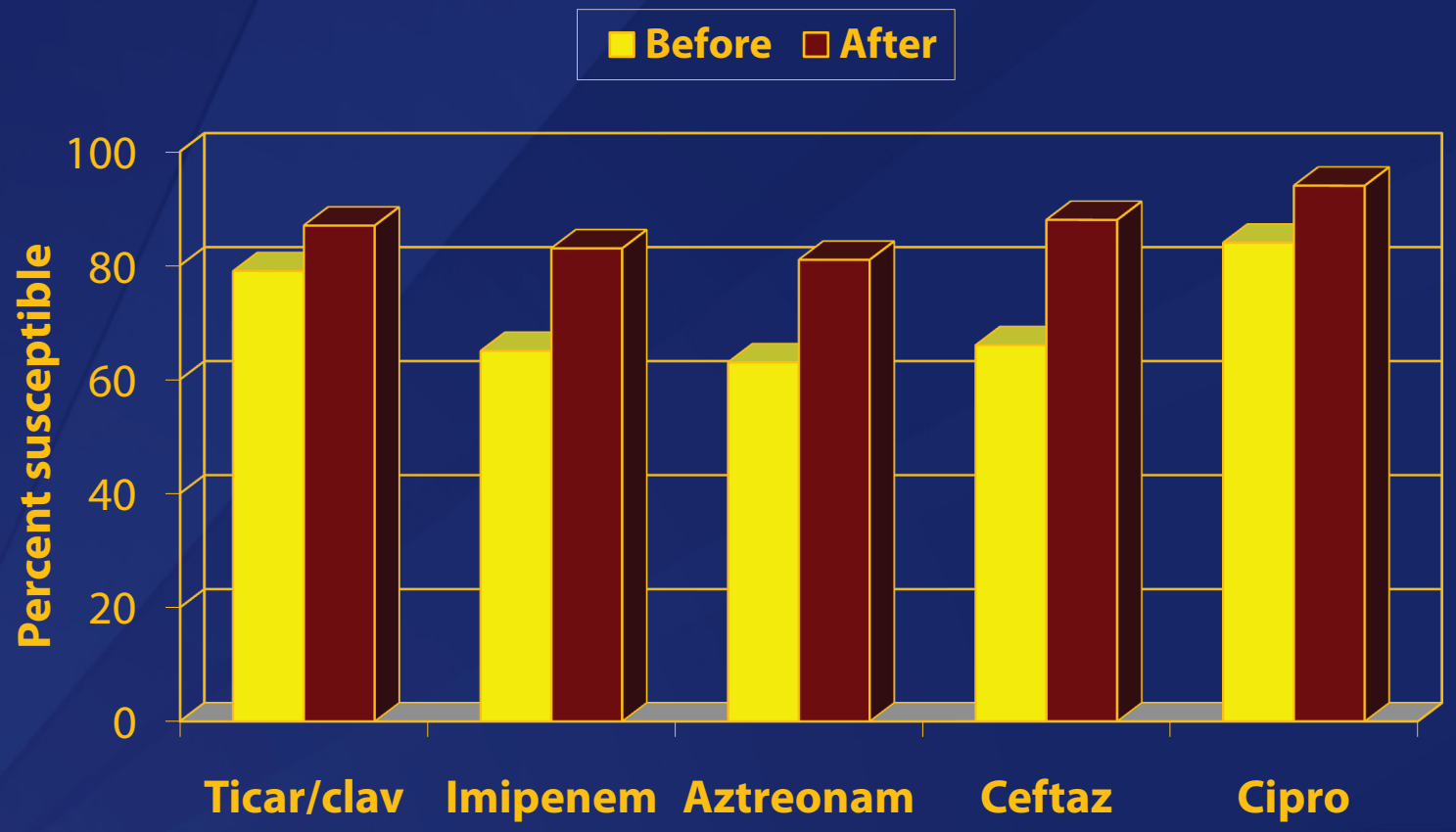


	Cipro	Standard
Antibiotic duration	3 days	10 days
LOS ICU	9 days	15 days
Antibiotic resistance/ superinfection	14%	38%

Study terminated early because attending physicians began to treat standard care group with 3 days of therapy

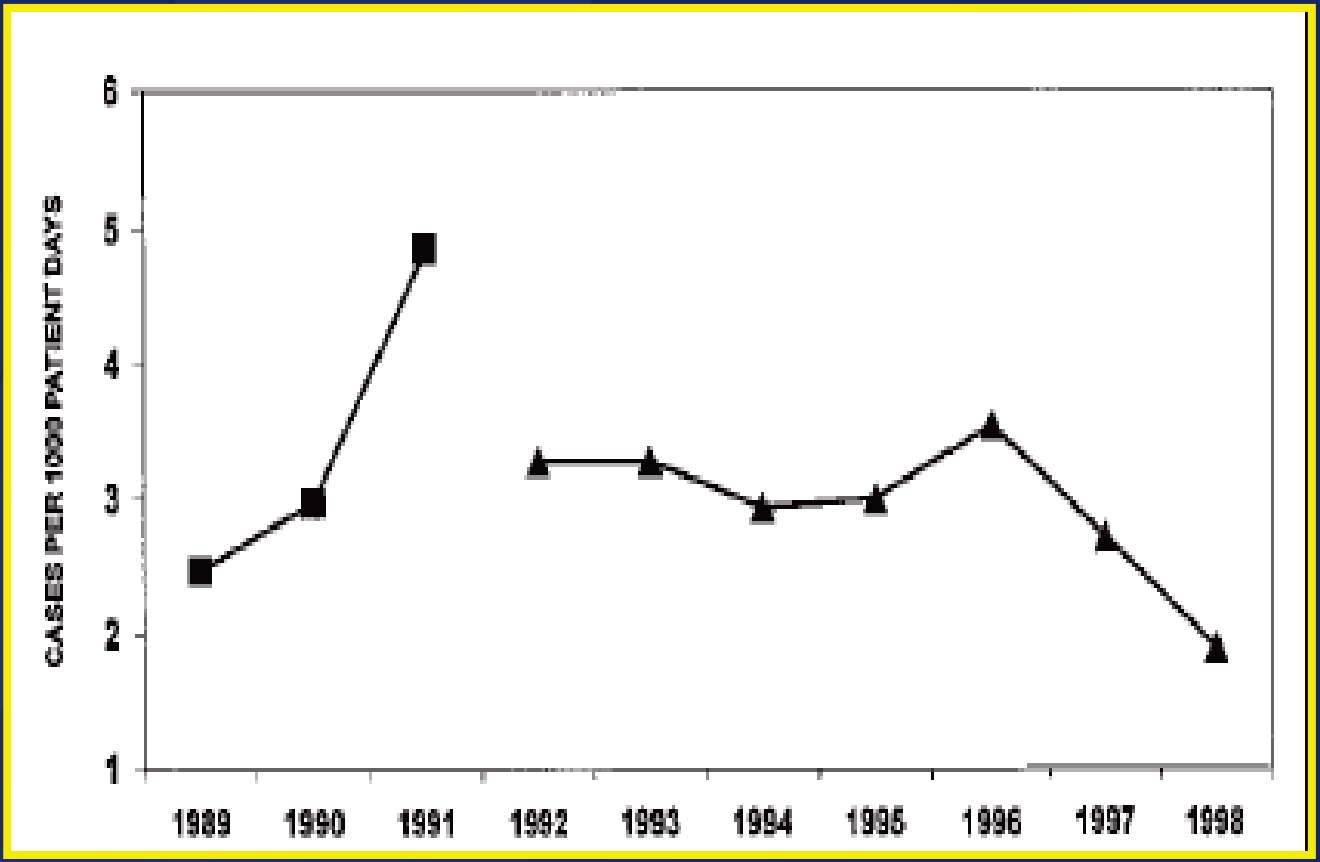
Singh N et al. *Am J Respir Crit Care Med*. 2000;162:505-11.

P. aeruginosa susceptibilities before and after implementation of antibiotic restrictions (CID 1997;25:230)



P<0.01 for all increases

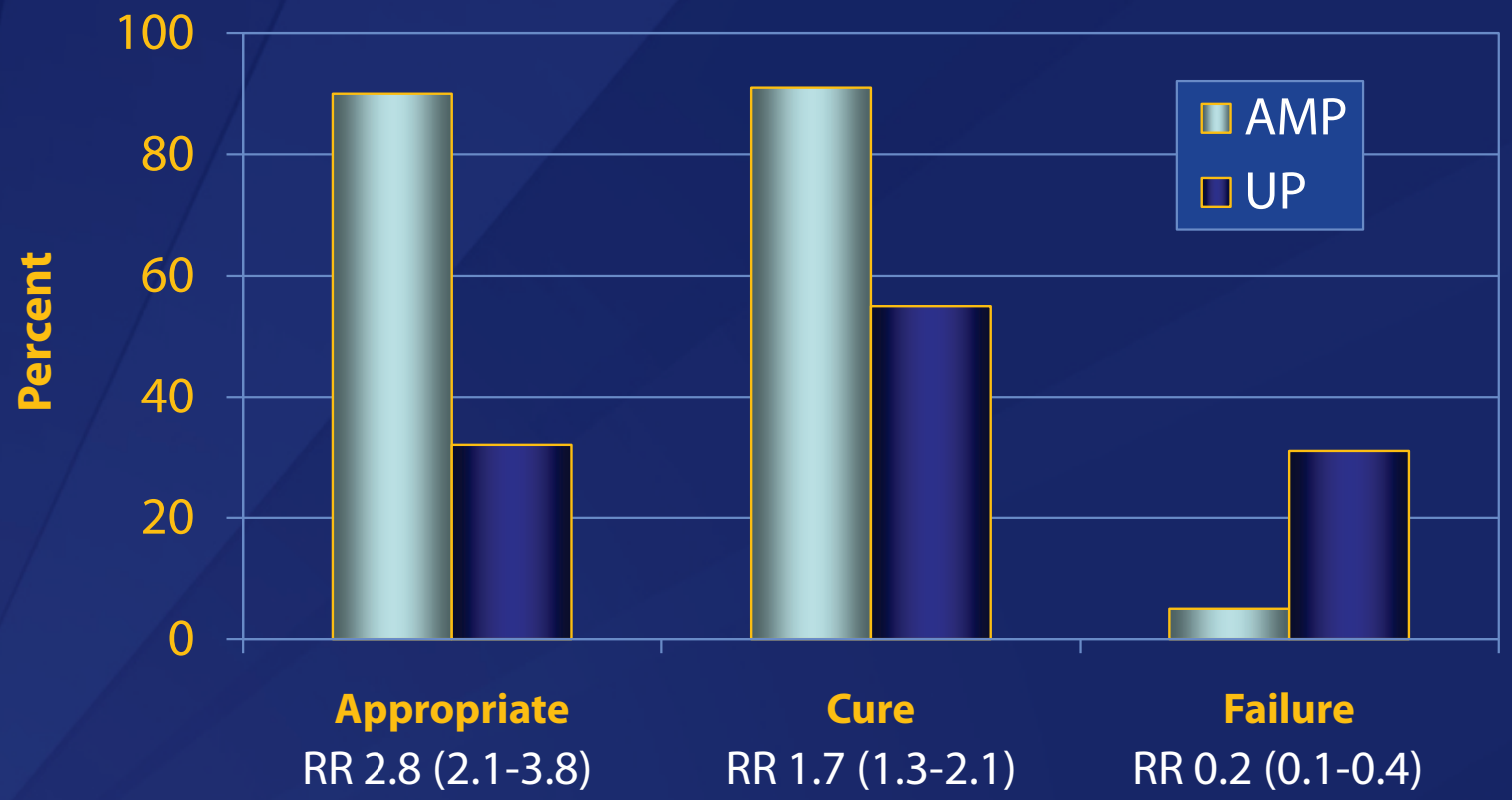
Impact of Improving Antibiotic Use on Rates of Resistant Enterobacteriaceae



Carling P et al. *Infect Control Hosp Epidemiol.* 2003;24(9):699-706.

Improving antibiotic use improves infection cure rates

Clinical outcomes better with antimicrobial management program



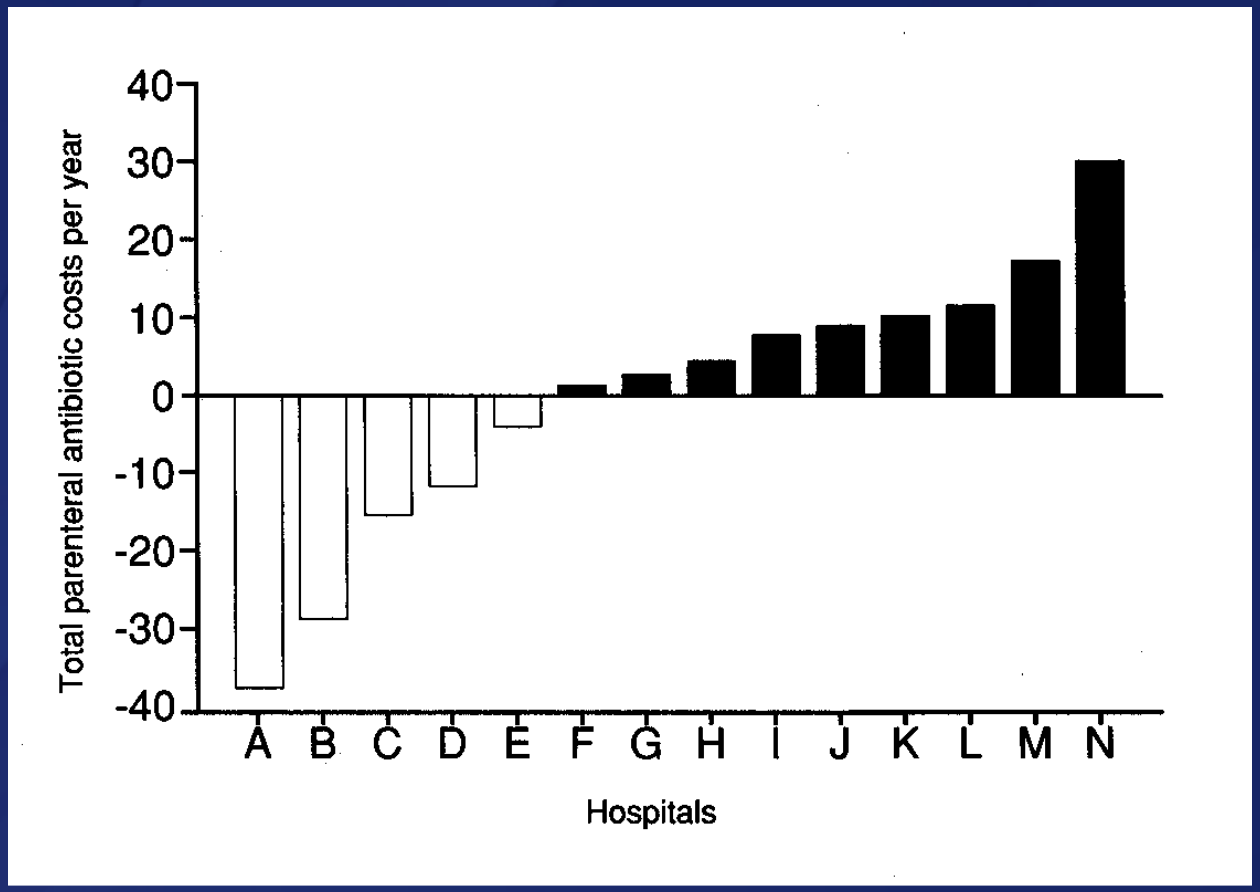
Fishman N. *Am J Med.* 2006;119:S53.

AMP = Antibiotic Management Program
UP = Usual Practice

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

Total costs of parenteral antibiotics at 14 hospitals



Carling et. al. CID,1999;29;1189.

Improving antibiotic use is a public health imperative

- Antibiotics are the only drug where use in one patient can impact the effectiveness in another.
- If everyone does not use antibiotics well, we will all suffer the consequences.

Improving antibiotic use is a public health imperative

- Antibiotics are a shared resource, (and becoming a scarce resource).
- Using antibiotics properly is analogous to developing and maintaining good roads.

Improving antibiotic use is a public health imperative

- **Available data demonstrate that we are not doing a good job of using antibiotics in in-patient settings.**
  - Several studies show that a substantial percentage (up to 50%) of in-patient antibiotic use is either unnecessary or inappropriate.

Improving antibiotic use is a public health imperative

- Bringing new antibiotics into our current environment is akin to buying a new car because you hit a pot hole, but doing nothing to fix the road.
- Fixing the "antibiotic use road" is part of the mission of public health.

Know When Antibiotics Work

Get Smart for Healthcare

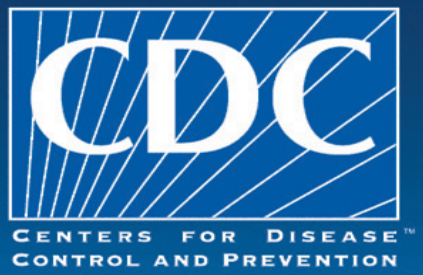
- This program is a logical extension of CDC's "Get Smart: Know When Antibiotics Work" campaign, which is focused on improving antibiotic use in out-patient settings.

Mission- Get Smart for Healthcare

- To optimize the use of antimicrobial agents in in-patient healthcare settings.

Goals- Get Smart for Healthcare

- Improve patient safety through better treatment of infections.
- Reduce the emergence of anti-microbial resistant pathogens and *Clostridium difficile*.
- Heighten awareness of the challenges posed by antimicrobial resistance in healthcare and encourage better use of antimicrobials as one solution.



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

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.

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