Antibiotic Stewardship in the Hospital Setting

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Stewardship

- stew-ard-ship (noun)|ˈst(y)oōərd sh ip|
  - a position whose responsibility it is to take care of something

What is Antibiotic Stewardship?

- A program that encourages judicious use of antibiotics
- Antibiotics are so effective, non-toxic and inexpensive that they are easy to use and so, prone to misuse
  - When the diagnosis is uncertain, antibiotics are often prescribed anyway
- Stewardship strives to optimize antibiotic therapy
  - Maximize effectiveness
  - Reduce toxicity
  - Reduce induction of resistance
  - Optimize cost
  - Encourage step-down and discontinuation

Why we need to improve in-patient antibiotic use

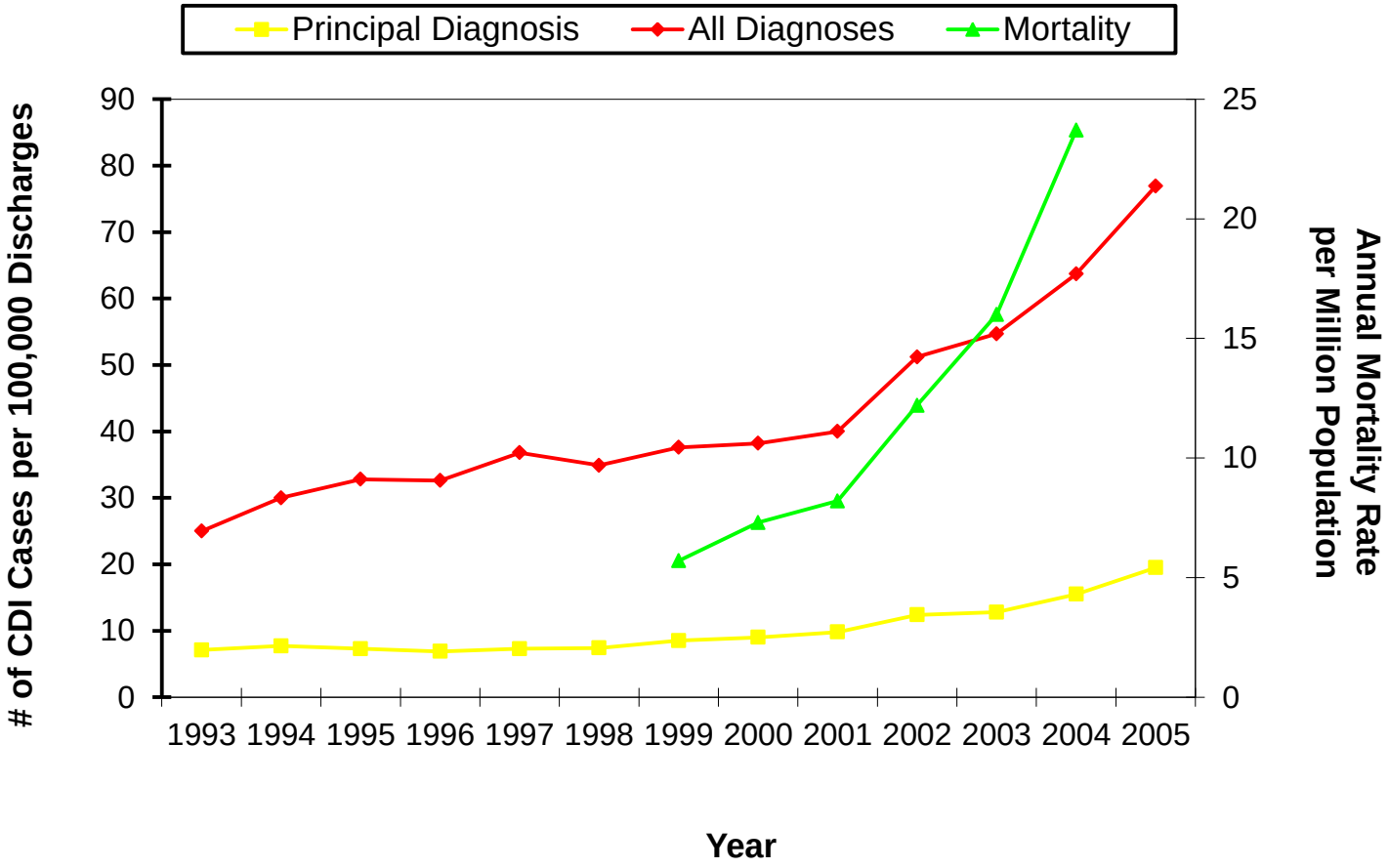
- Antibiotics are misused in hospitals
- Antibiotic misuse adversely impacts patients and society
- Improving antibiotic use improves patient outcomes and saves money
- Improving antibiotic use is a public health imperative

Antibiotics are misused in hospitals

- "It has been recognized for several decades that up to 50% of antimicrobial use is inappropriate"
  - 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

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

CDI - Incidence and Mortality are increasing



• 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.

Antibiotic misuse adversely impacts patients - CDI

- Antibiotic exposure is the single most important risk factor for the development of *Clostridium difficile* infection (CDI).
  - 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 - CDI

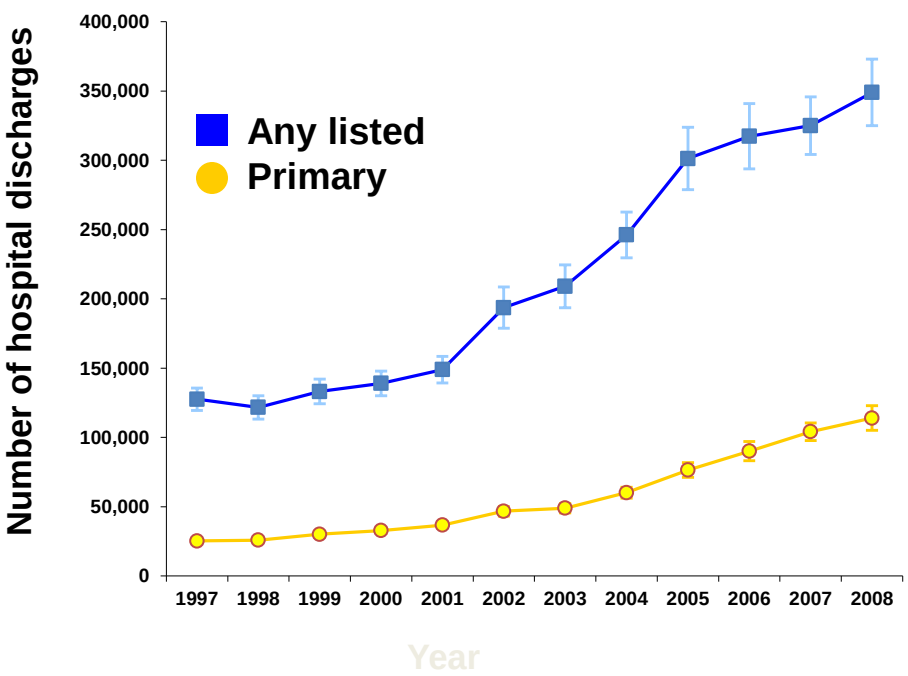
- Emergence of the NAP-1/BI or “epidemic” strain of C. difficile has intensified the risks associated with antibiotic exposure.

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

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

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

Estimated burden of Healthcare-associated CDI



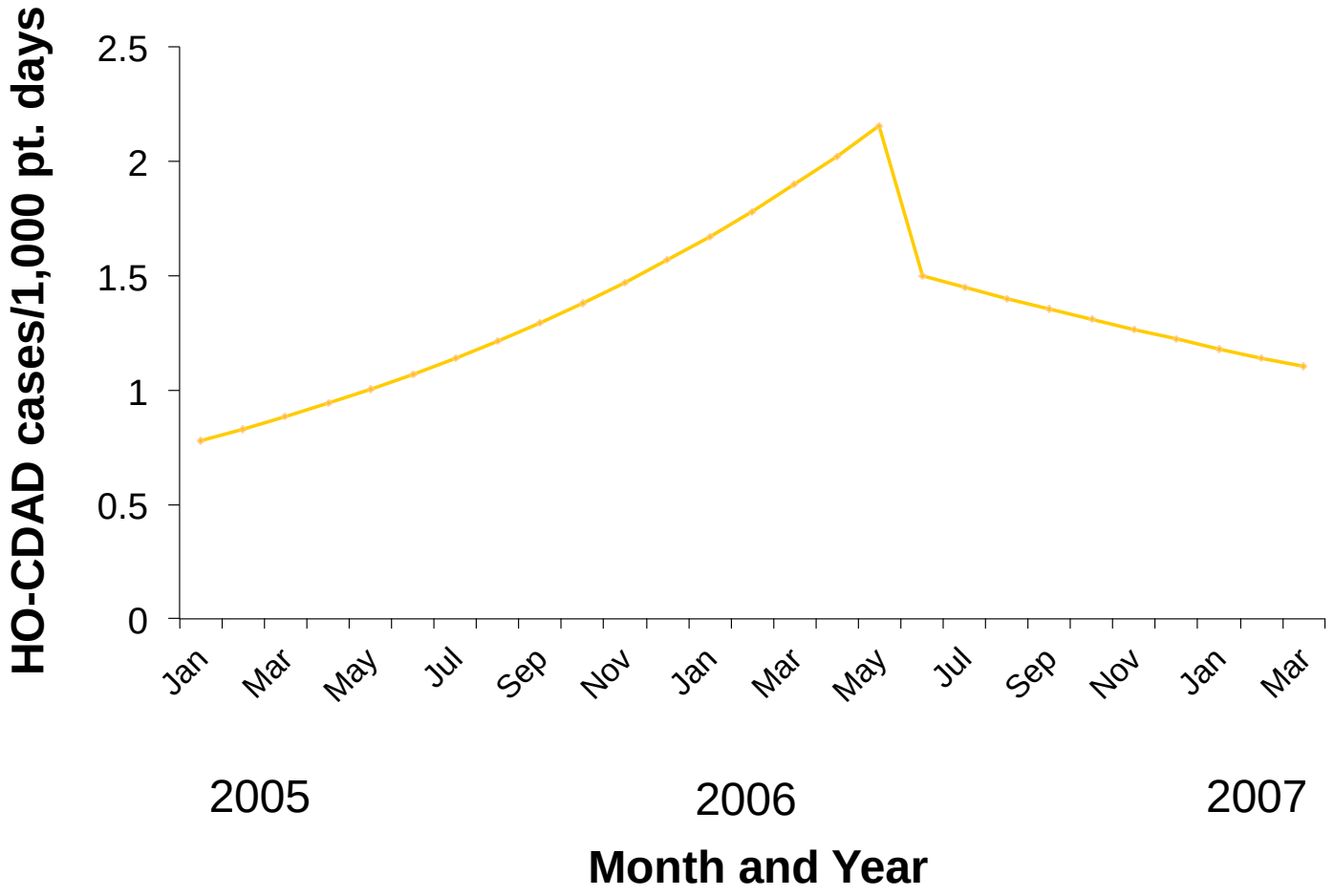
- Hospital-acquired, hospital-onset: 165,000 cases, $1.3 billion in excess costs, and 9,000 deaths annually
- Hospital-acquired, post-discharge (up to 4 weeks): 50,000 cases, $0.3 billion in excess costs, and 3,000 deaths annually
- Nursing home-onset: 263,000 cases, $2.2 billion in excess costs, and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

Improving antibiotic use reduces *C. difficile* infections

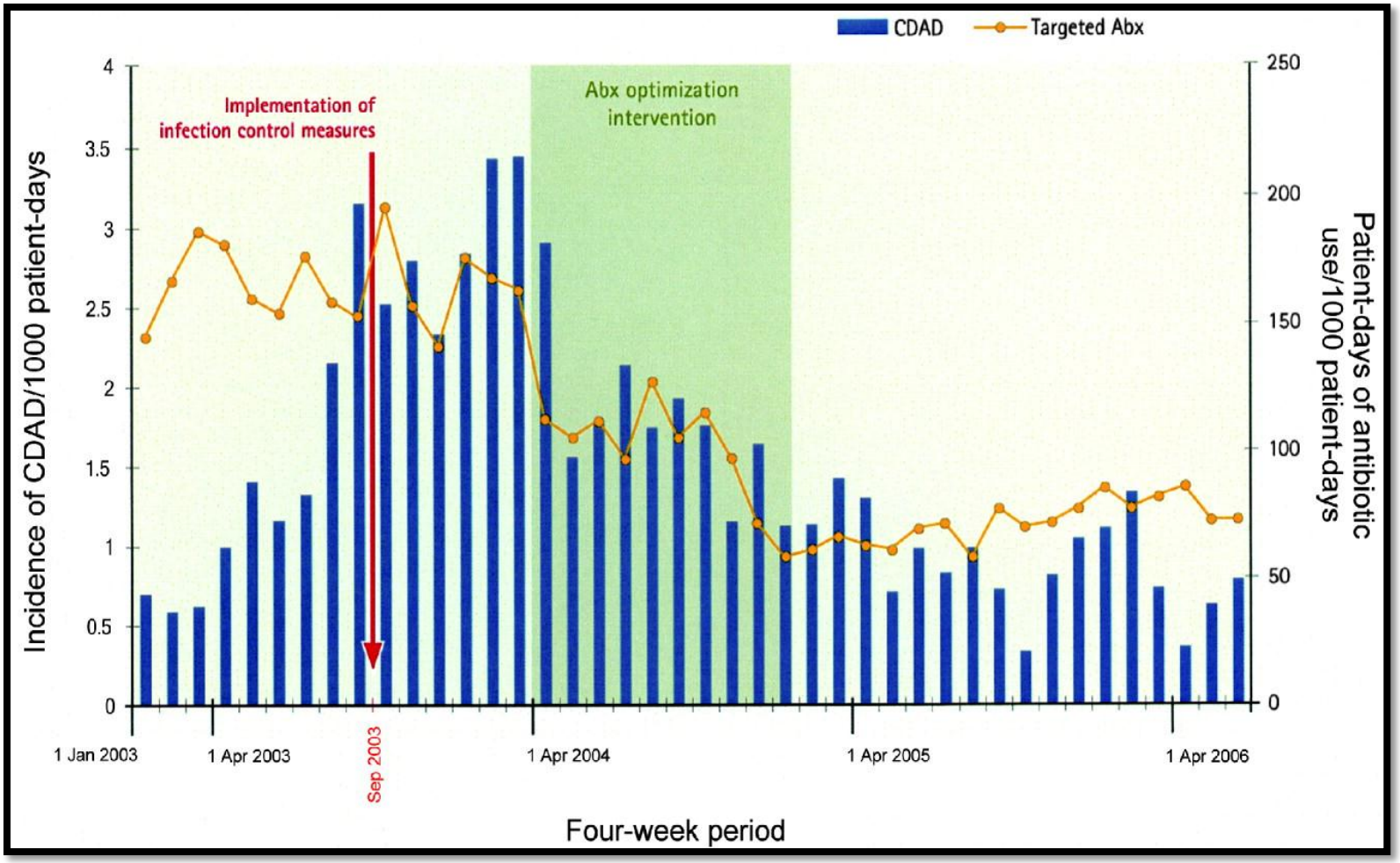
Impact of fluoroquinolone restriction on rates of *C. difficile* infection



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

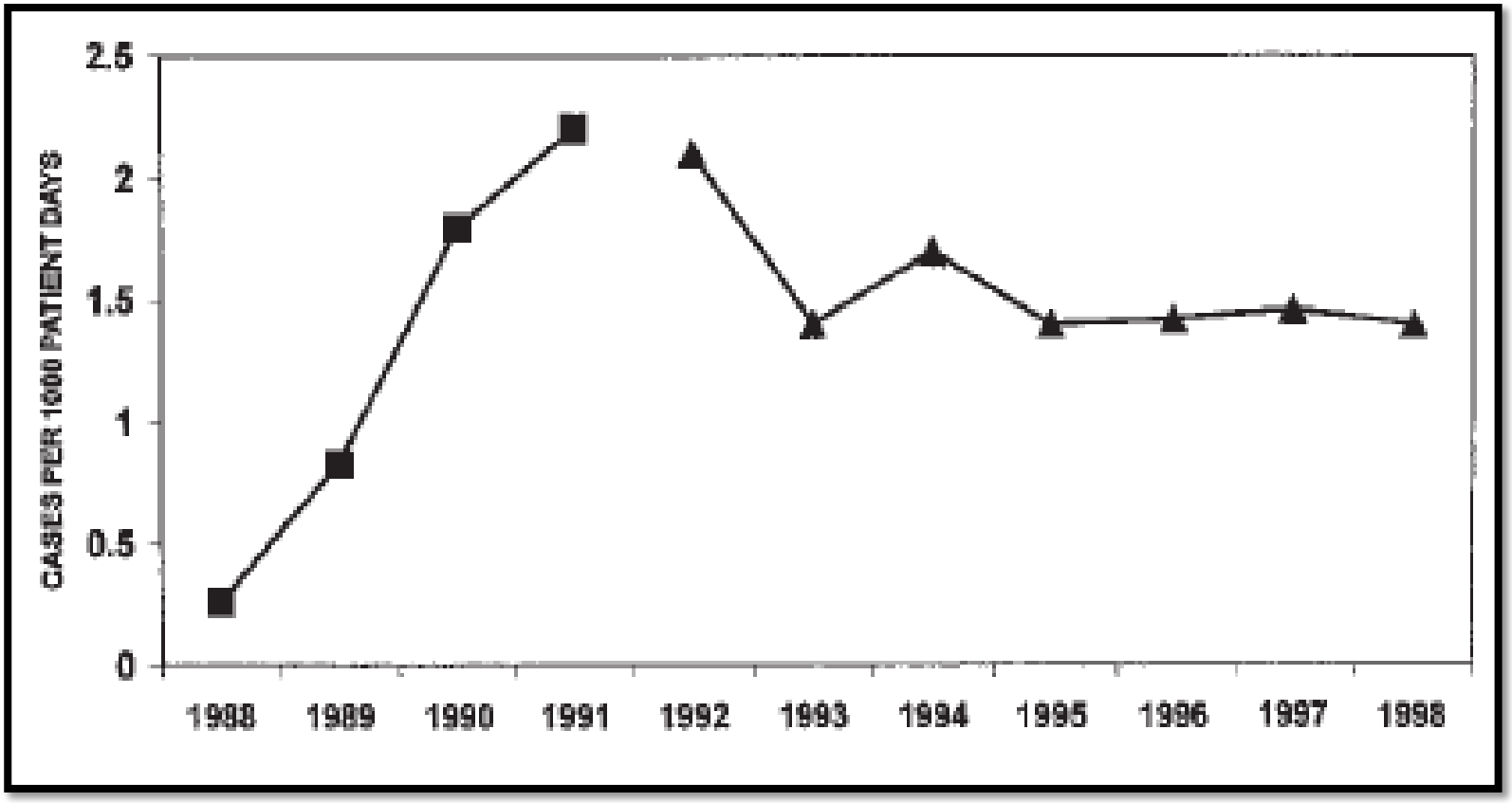
Targeted antibiotic consumption and nosocomial CDI

CHUS; Quebec, 2003-2006

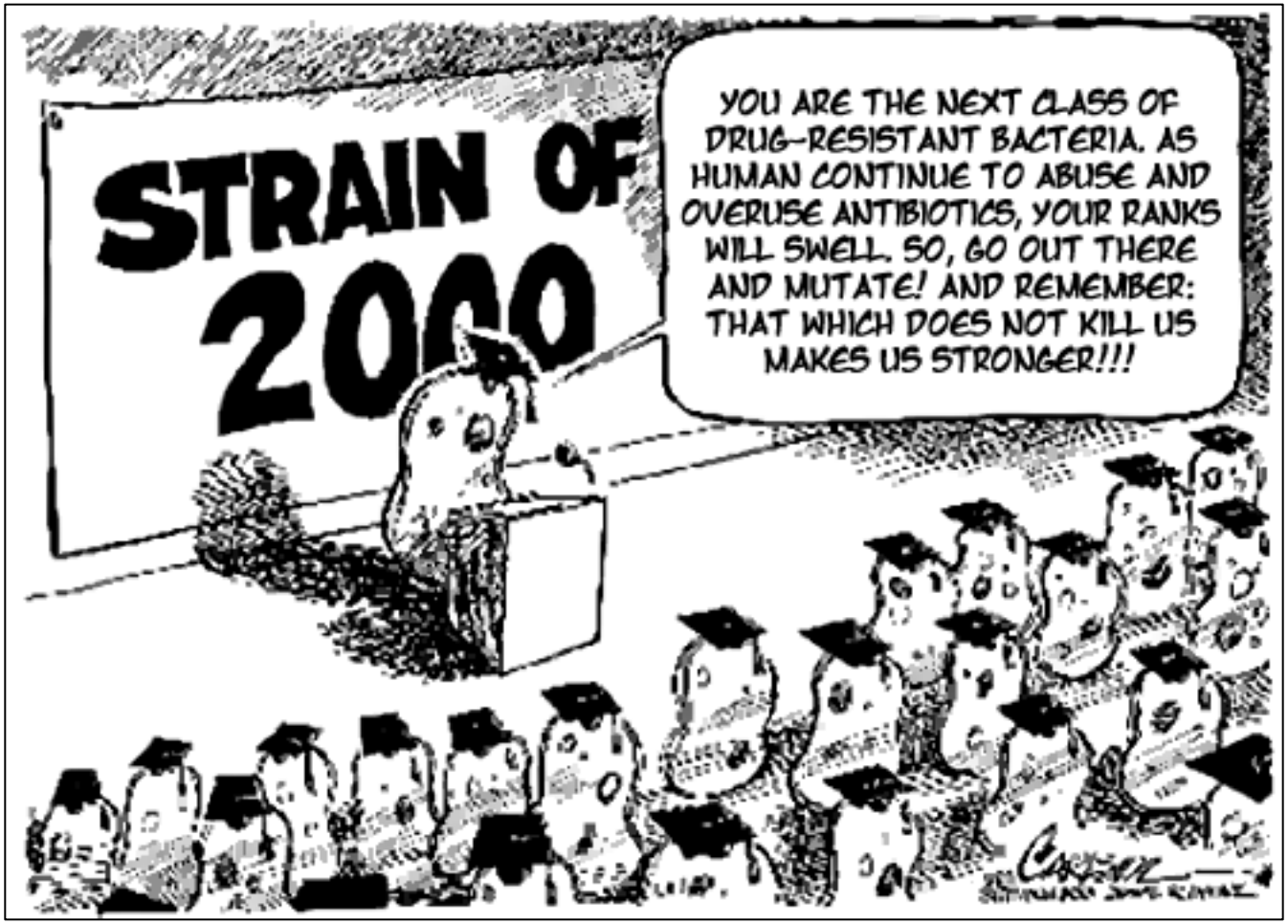


Valiquette L et al. *Clin Infect Dis* 2007;45:S112.

Impact of improving antibiotic use on rates of CDI



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


STRAIN OF 2000
YOU ARE THE NEXT CLASS OF DRUG-RESISTANT BACTERIA. AS HUMAN CONTINUE TO ABUSE AND OVERUSE ANTIBIOTICS, YOUR RANKS WILL SWELL. SO, GO OUT THERE AND MUTATE! AND REMEMBER: THAT WHICH DOES NOT KILL US MAKES US STRONGER!!!

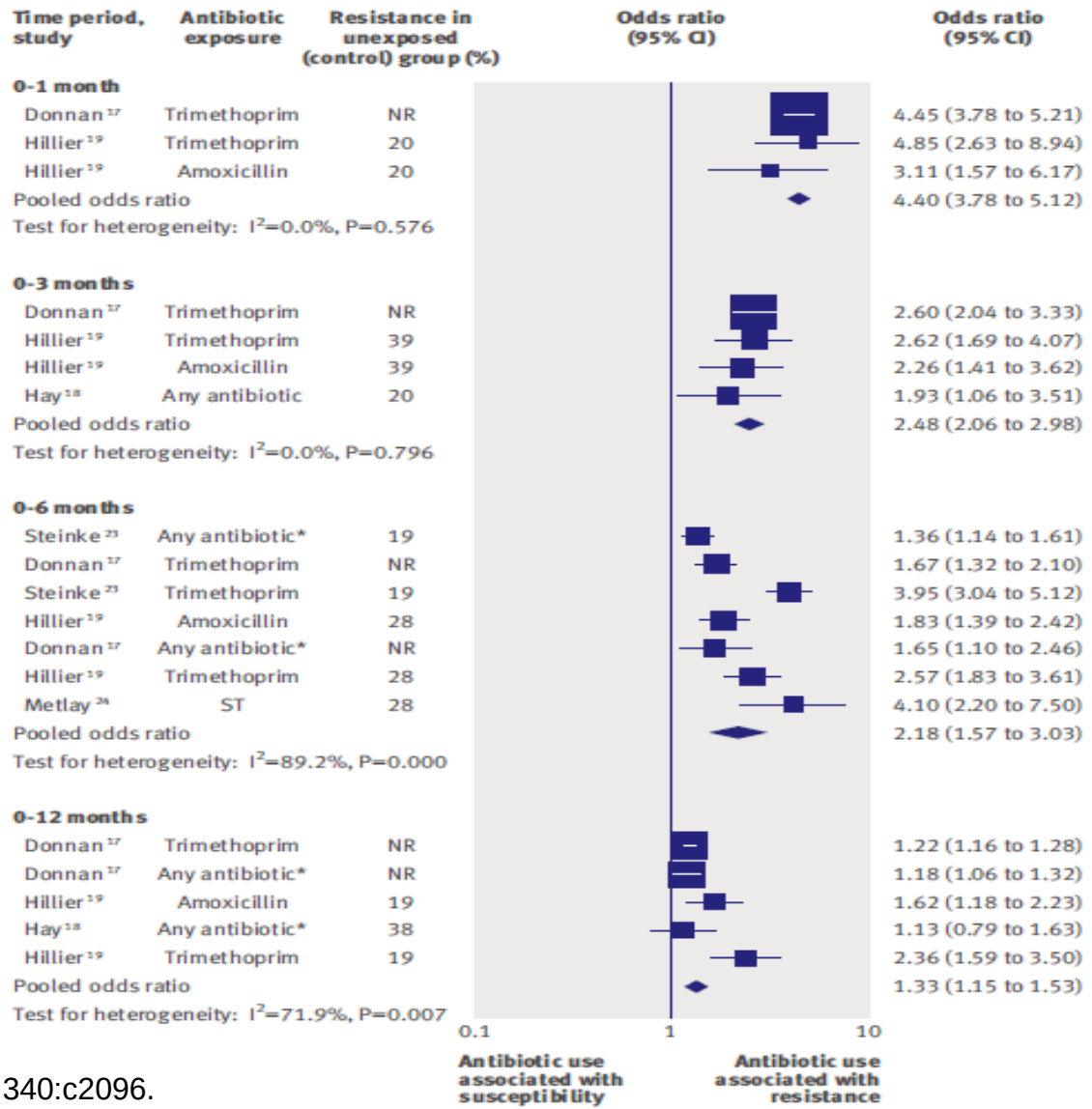
Antibiotic misuse adversely impacts patients - resistance

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

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

- 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 1º Care On Antimicrobial Resistance In Individual Patients: Systematic Review And Meta-analysis

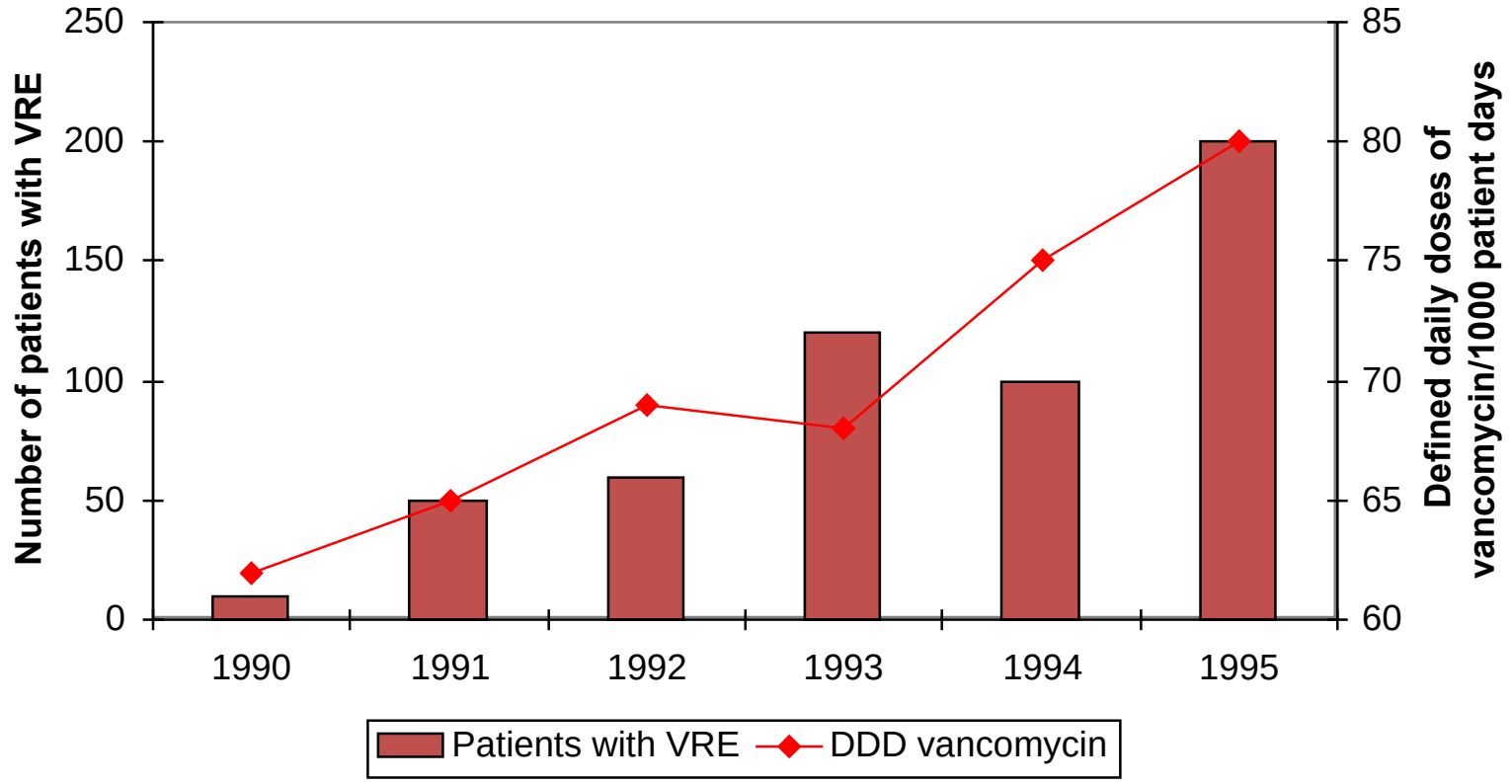


Costelloe C et al. *BMJ.* 2010;340:c2096.

Antibiotic misuse adversely impacts patients- resistance

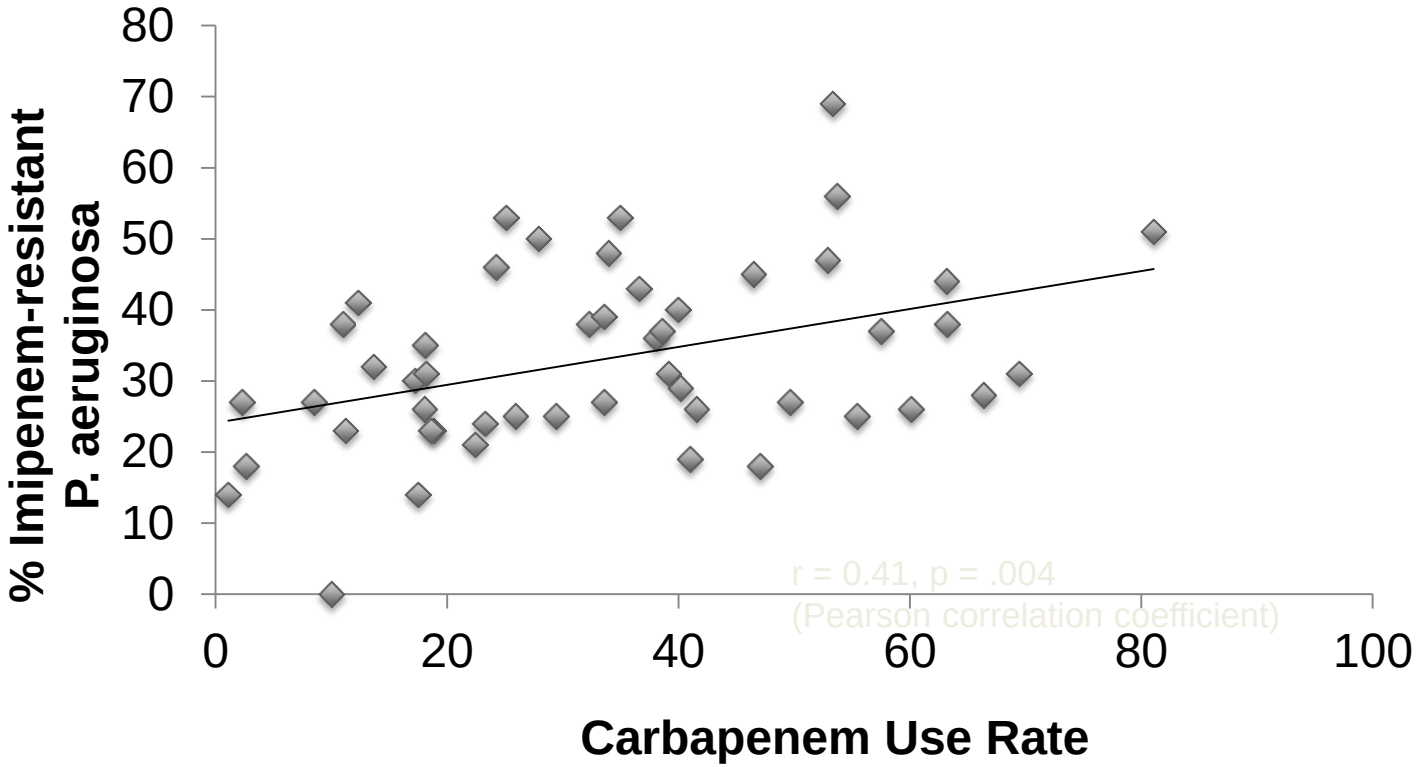
- Increasing use of antibiotics increases the prevalence of resistant bacteria in hospitals.

Association of Vancomycin Use with Prevalence of VRE



J Infect Dis1999;179:163

Annual Prevalence of Imipenem Resistance in *P. aeruginosa* vs. Carbapenem Use Rate

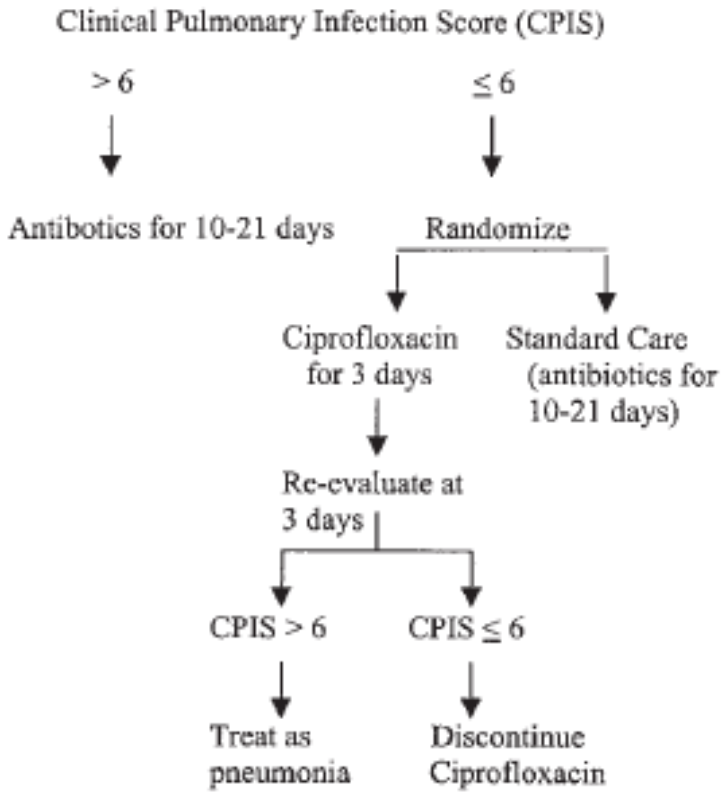


45 LTACHs, 2002-03 (59 LTACH years)

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

Improving antibiotic use reduces resistance

Stewardship Optimizes Patient Safety: Decreased Patient-level Resistance

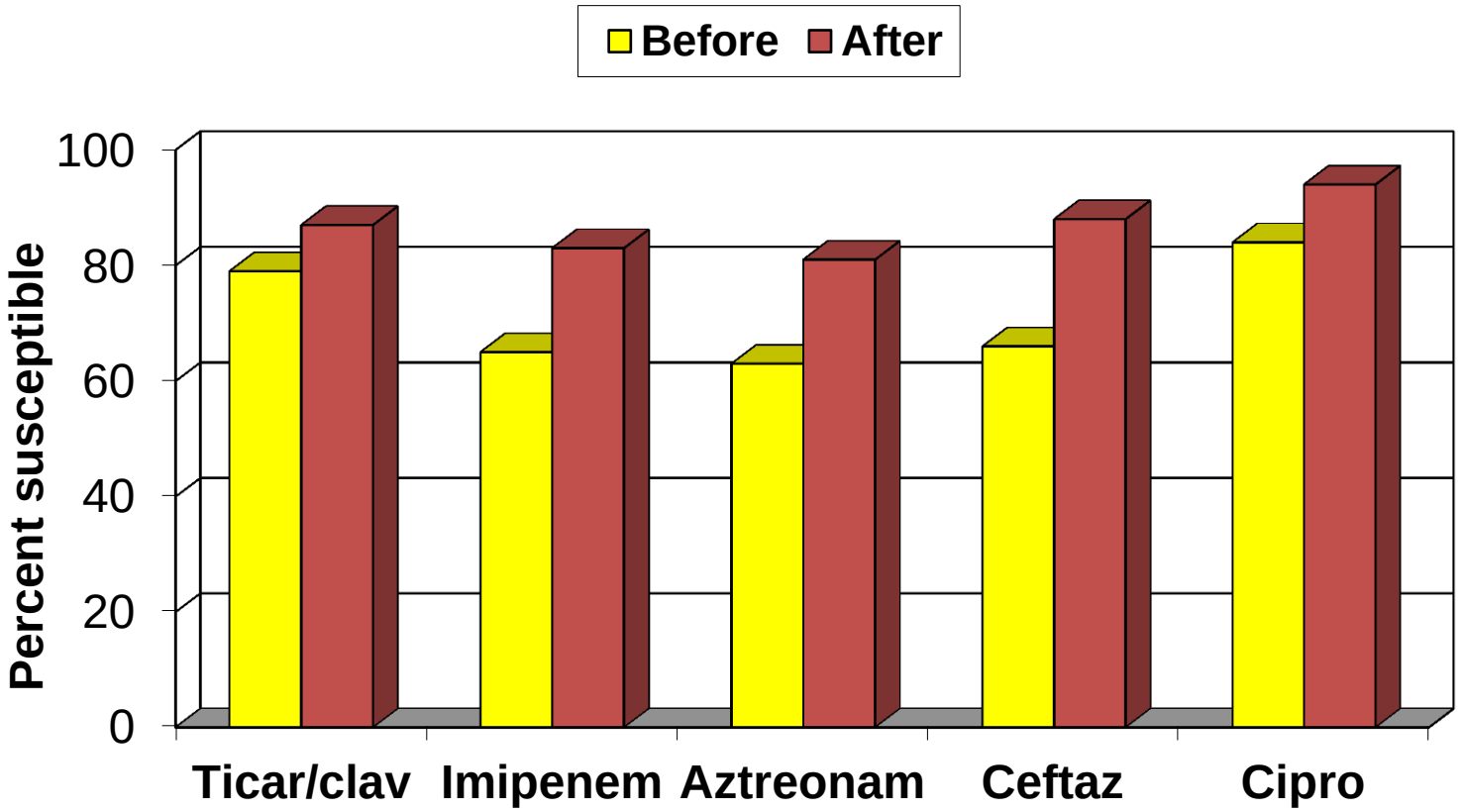


	Cipro	Standard
Antibiotic duration	3 days	10 days
LOS ICU	9 days	15 days
Antibiotic resistance/ superinfection	14%	38%

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

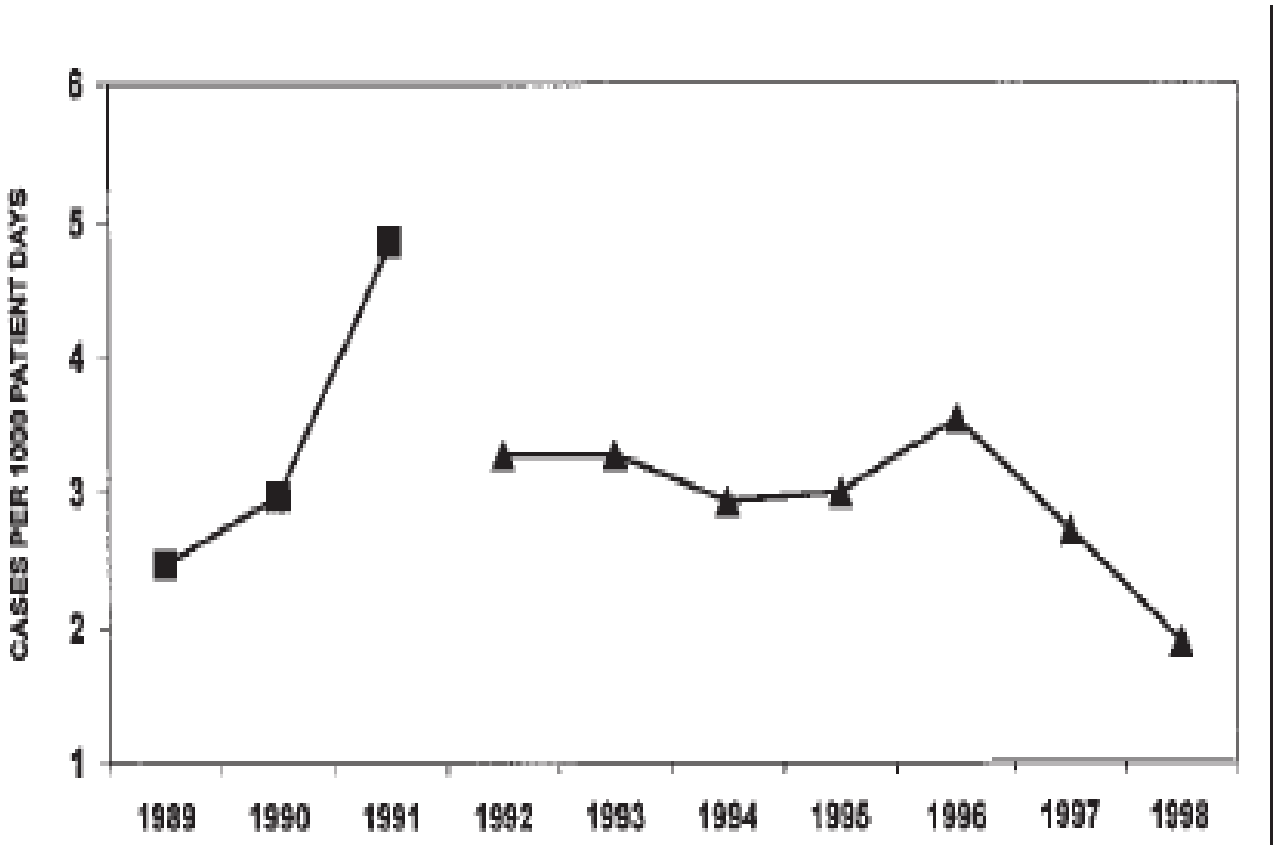
P. aeruginosa Susceptibilities Before and After Implementation of Antibiotic Restrictions



P<0.01 for all increases

Clinical Infect Dis 1997;25:230

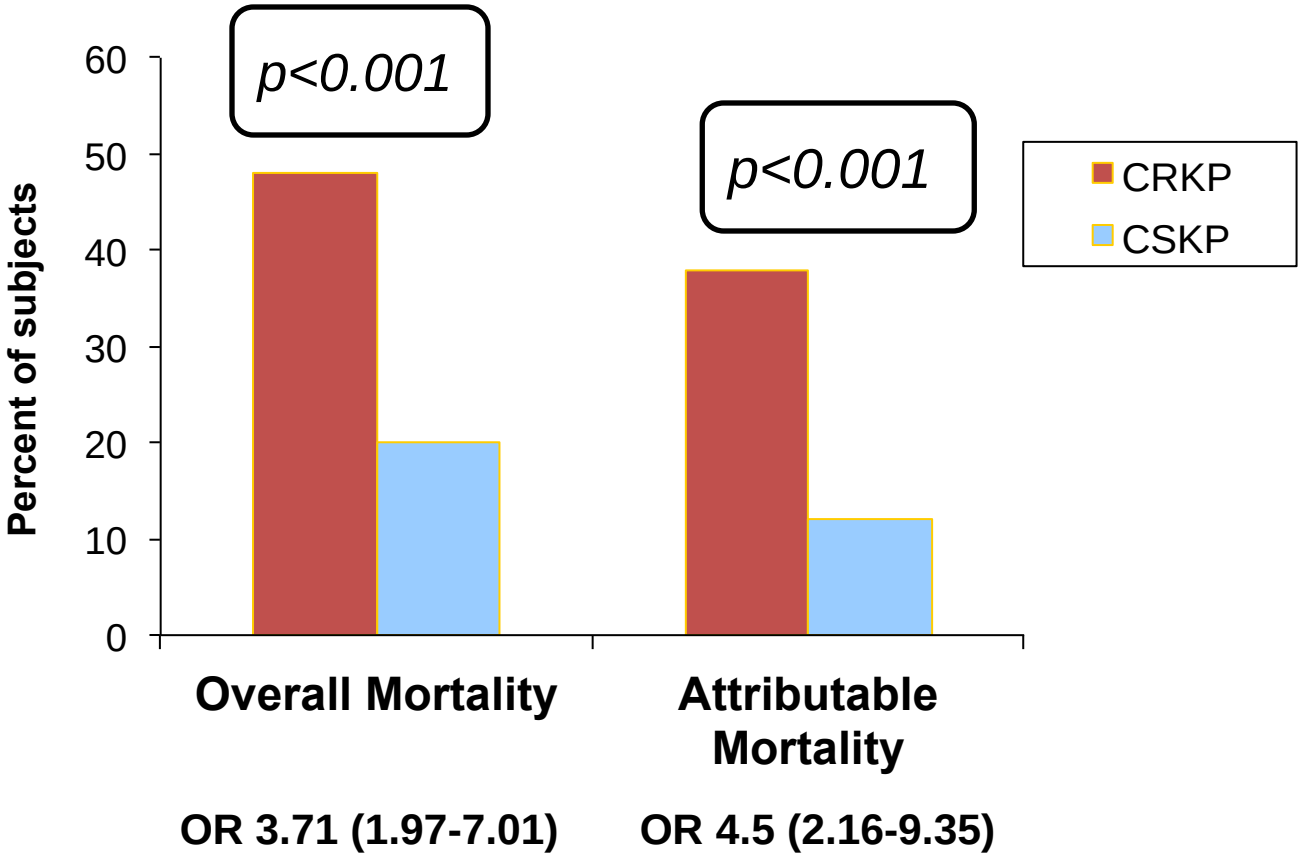
Impact of Improving Antibiotic Use on Rates of Resistant Enterobacteriaceae



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

Antibiotic resistance increases mortality

Mortality associated with Carbapenem-resistant (CR) vs. Susceptible (CS) *Klebsiella pneumoniae*



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).

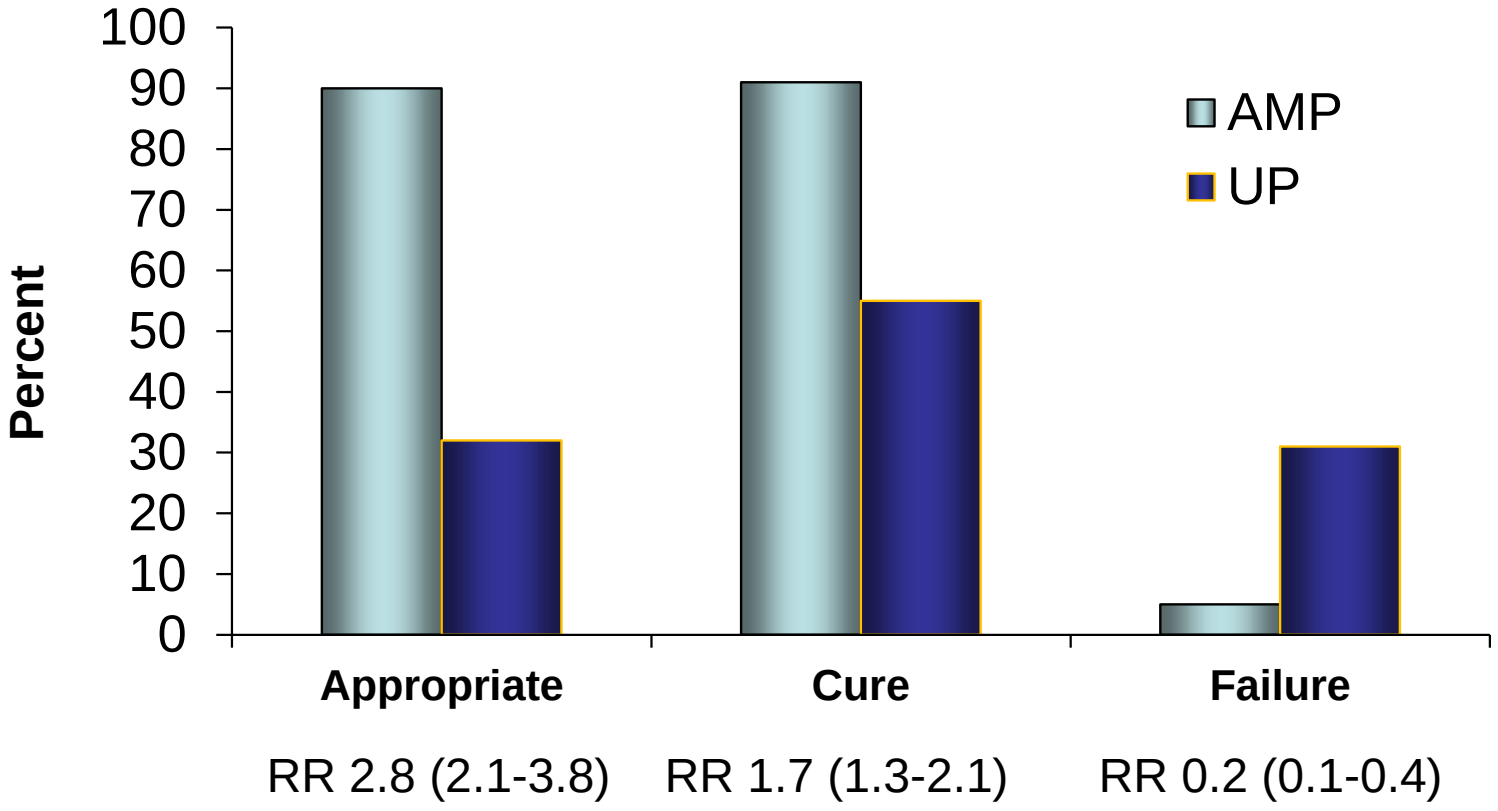
Antibiotic misuse adversely impacts patients - adverse events

- In 2008, there were 142,000 visits to emergency departments for adverse events attributed to antibiotics.[1]
- National estimates for in-patient adverse events are not available, but there are many reports of serious adverse events, aside from CDI, from in-patient antibiotic use.

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

Improving Antibiotic Use Improves Infection Cure Rates

Clinical outcomes better with antimicrobial management program



AMP = Antibiotic Management Program
UP = Usual Practice

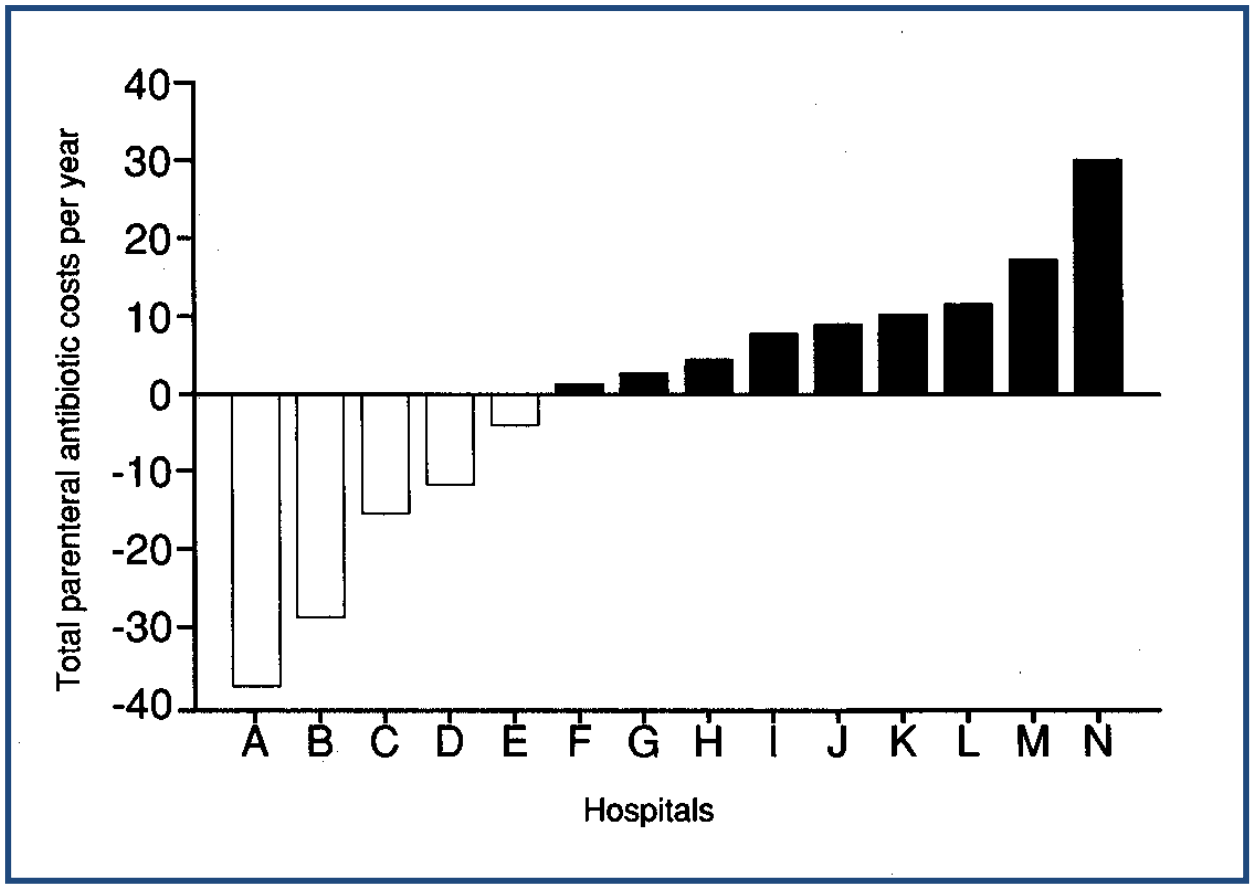
Fishman N. *Am J Med.* 2006;119:S53.

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
- 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

CORE Components of a Hospital Antimicrobial Stewardship Program

- The foundation of an ASP are 2 core, proactive strategies

1. Prospective audit with intervention and feedback
2. Formulary restriction and preauthorization

Other Components of an Antimicrobial Stewardship Program

- Standardized order sets and clinical pathways that foster evidence-based prescribing
- Antimicrobial order forms
- De-escalation of therapy
  - Review C&S results
  - On-going review of therapy
- Dose optimization
  - Right dose
  - Right route of administration
  - Renal dose adjustment
- IV to oral dose conversion
- Outpatient antimicrobial therapy

KGH Antimicrobial Stewardship Program Activities

- Targeted antimicrobial approvals
- Post-prescribing review and follow-up
  - Broad-to-Narrow spectrum change
  - IV-to-Oral conversion
  - Duration
  - Discharge and OPAT
- Surveillance of antibiotic utilization and resistance patterns
- General antimicrobial therapy review

	Intervention	Outcomes
1.	Antibiotic Approvals	Improved appropriateness of broad-spectrum antibiotic requests
		Decreased duration of broad-spectrum antibiotic therapy
2.	Post-prescribing Review and Follow up	Increased IV to PO Conversions
		Reduction in antibiotic duration of therapy
		Reduction in redundant antimicrobial therapy
		Improved dosing according to antimicrobial pharmacokinetics and pharmacodynamics
		Increased de-escalation and streamlining according to culture results and clinical condition
3.	Surveillance of Antibiotic Utilization and Resistance	Decrease in inappropriate antibiotic utilization
		Decrease or stabilization in prevalence of antibiotic resistant organisms causing infections
4.	Targeted antimicrobial surveillance	Decreased in targeted antimicrobial use by Defined Daily Doses (DDD) per 10,000 patient days coupled with
		Improvement or no reduction in global patient outcomes

Benefits of an ASP

From an Infection Prevention & Control perspective

1. Track and reduce antimicrobial resistance
2. Encourage appropriate treatment patterns
   - The right antibiotic, for the right duration, for the right infection
3. Develops a collaborative practice between MDs, Pharmacists, Microbiology, Nursing and Patient Safety advocates to optimize patient outcomes
4. Education Catalyst

Benefits of an ASP

Hospital Pharmacists Perspective:

1. Allows needed FOCUS on a drug class
2. Need to assure appropriate medication management and safety
3. Assist with educational efforts
4. Assist with formulary standardization
5. Control costs

Pitfalls of ASP

- Lack of institutional and physician buy-in
  - Backlash
  - Obstructionism
- Complexity
- Resource allocation
  - Information management
  - “Foot soldiers”
  - ID expertise
- Maintenance

Antibiotic Stewardship – Summing Up

- Arrived at KGH August 7, 2012
- Accreditation standard
- Will help us to improve patient safety and quality of care
- Complement IPAC goals to reduce
  - Incidence of CDI
  - Antibiotic resistance rates
- Reduce costs attributable to drug acquisition, length of stay, CDI and MDROs

"Don't forget to take a handful of our complimentary antibiotics on your way out."