Epidemiology of Antimicrobial Resistance in the Community: Implications for Control

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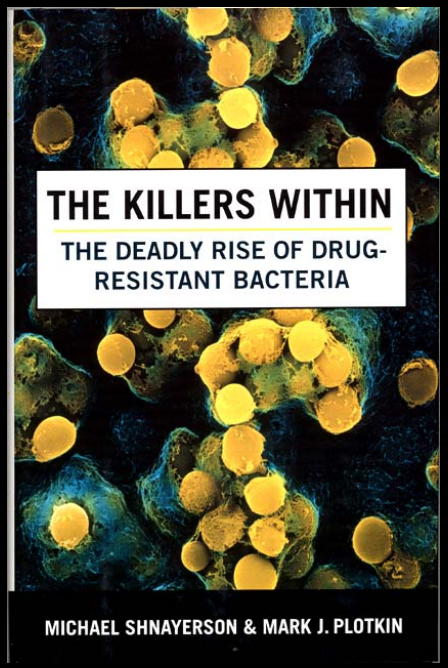
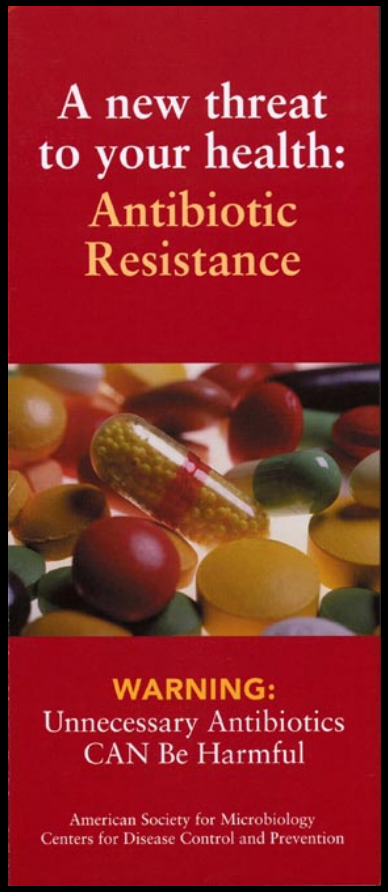
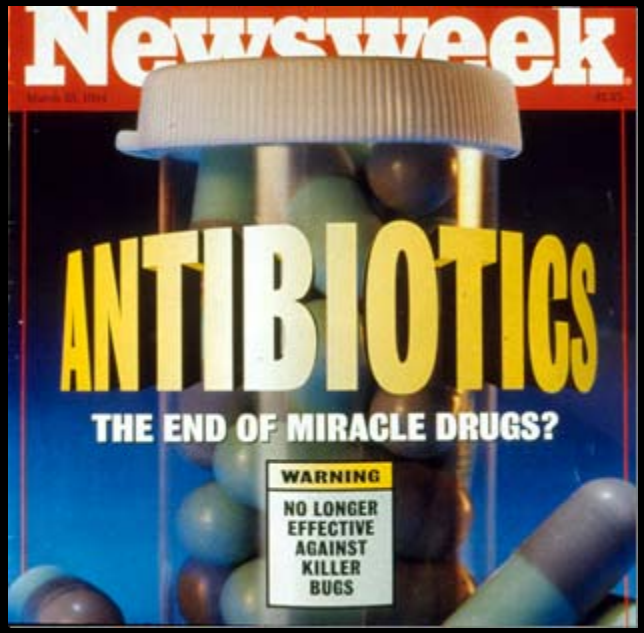
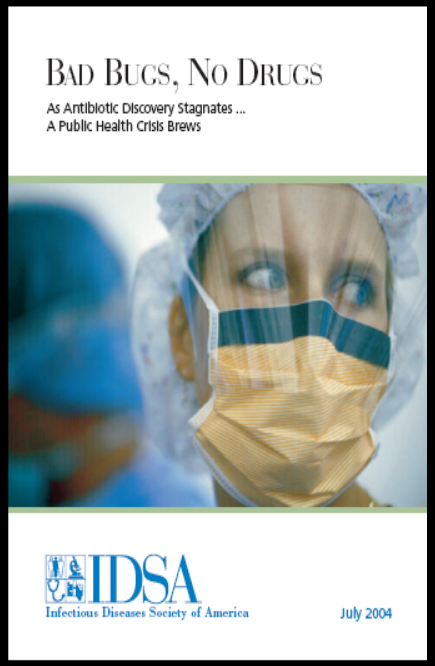

THE KILLERS WITHIN
THE DEADLY RISE OF DRUG-RESISTANT BACTERIA
MICHAEL SHNAYERSON & MARK J. PLOTKIN


A new threat to your health:
Antibiotic Resistance
WARNING:
Unnecessary Antibiotics CAN Be Harmful
American Society for Microbiology
Centers for Disease Control and Prevention

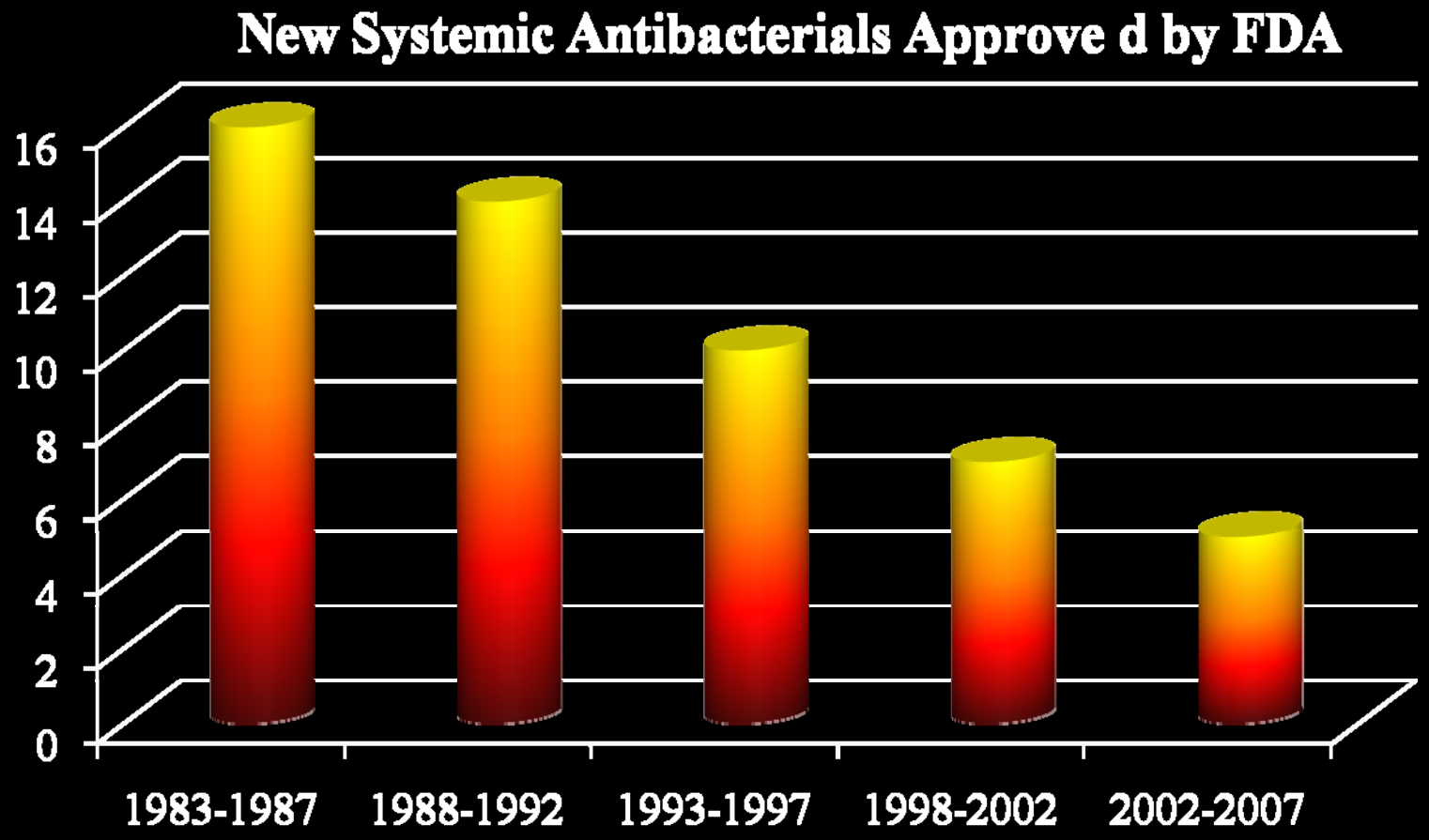

Newsweek
ANTIBIOTICS
THE END OF MIRACLE DRUGS?
WARNING
NO LONGER EFFECTIVE AGAINST KILLER BUGS

Bad Bugs, No Drugs



- IDSA Antimicrobial Availability Task Force
  - CID 2006; 42:657
- "High Priority" Pathogens
  - high attributable mortality and morbidity, unique virulence or resistance factors, few candidates in late-stage pipeline
  - Gram positive: VRE, MRSA
  - Gram negative: *Acinetobacter* spp, *Pseudomonas aeruginosa*, ESBL producers

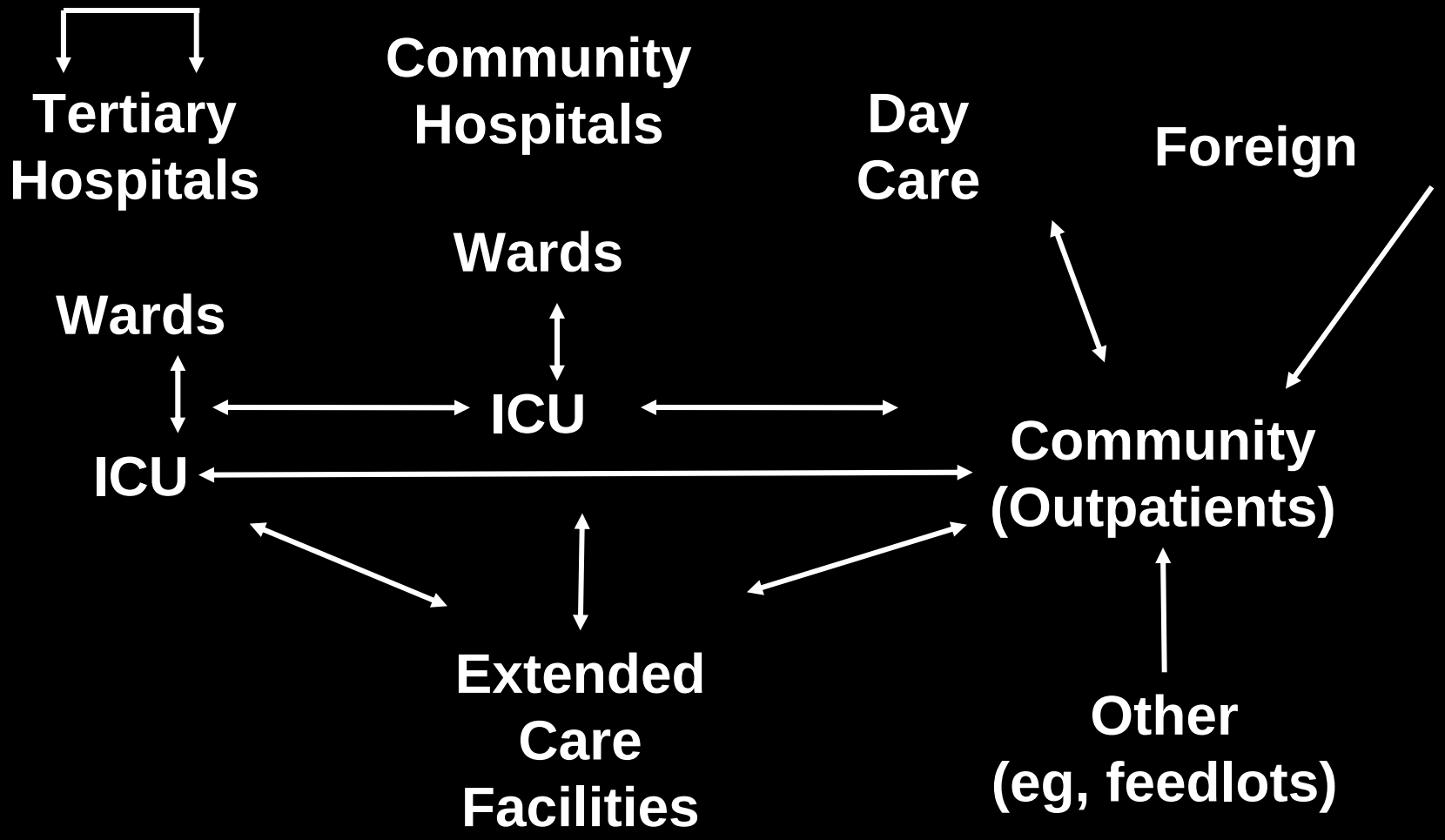
The Pipeline of New Antibiotics Is Drying Up



Spellberg et al. CID 2008;46:155-64

Bad Bugs, No Drugs 2004 idsociety.org

Dynamics of Bacterial Resistance

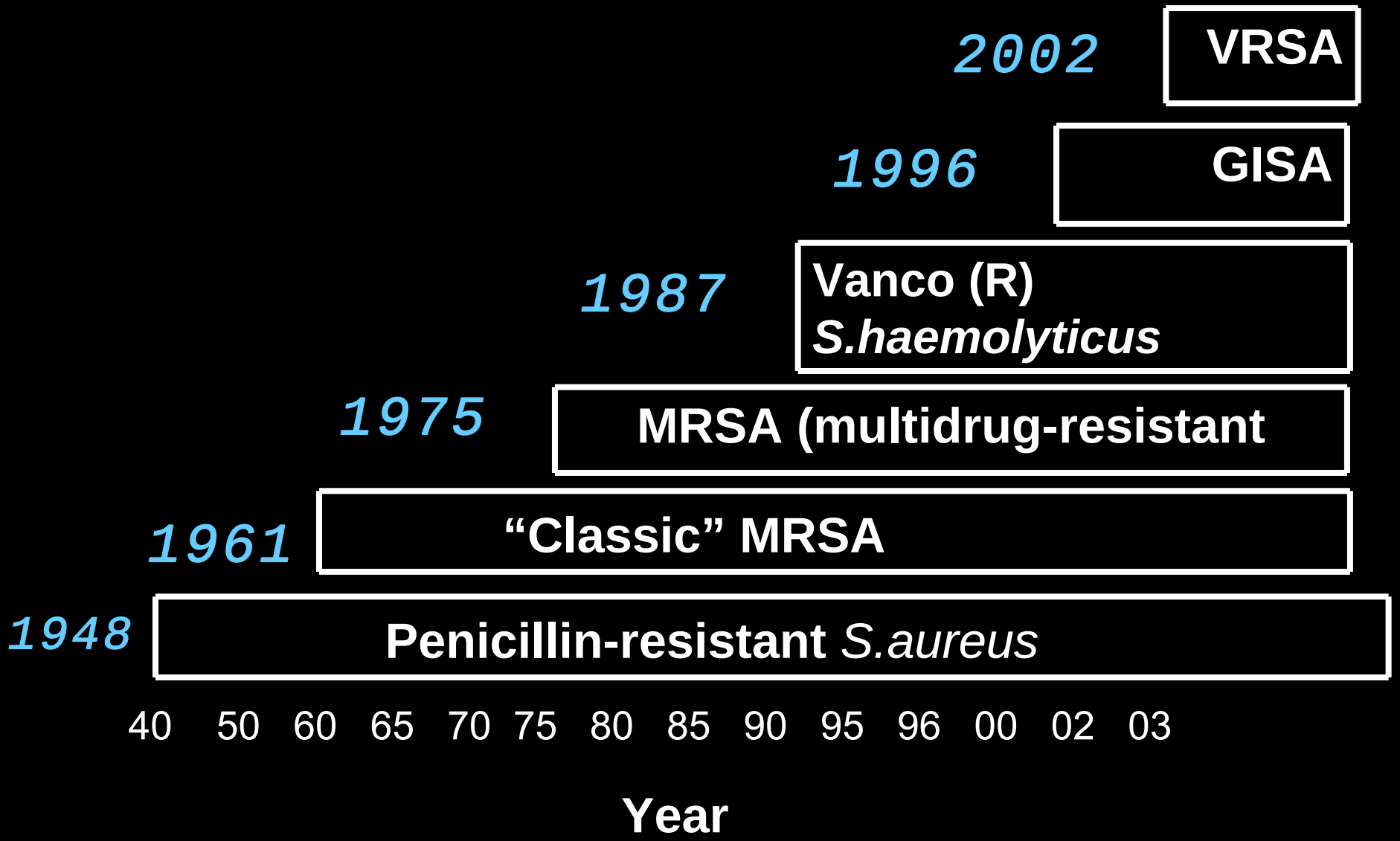


Modified from: Murray. *J Infect Dis*. 1991.

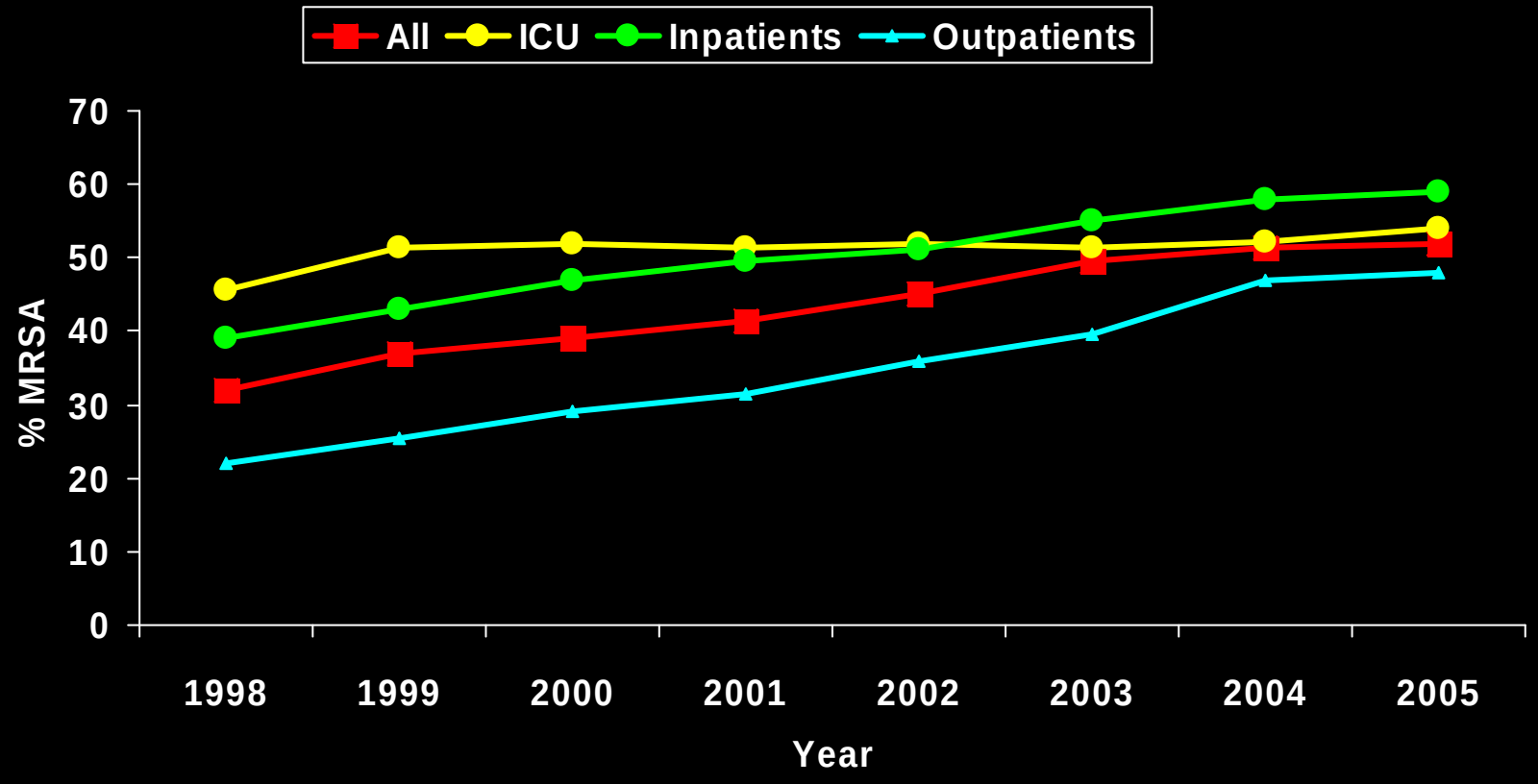
Antimicrobial Resistance in Community Pathogens

- Staphylococcus aureus
- Streptococcus pneumoniae
- Enterococcus
- ESBL MDR : Klebsiella and E. coli, and other GNB
- Salmonella
- Neisseria gonorrhea
- TB: MDR XDR

Staphylococci Acquired Resistance



MRSA Trends by Patient Location



Styers D et al. *Ann Clin Microbiol Antimicrob.* 2006;5:2.

MRSA Infections Among Patients Presenting to the Emergency Department: Isolates from SSTI

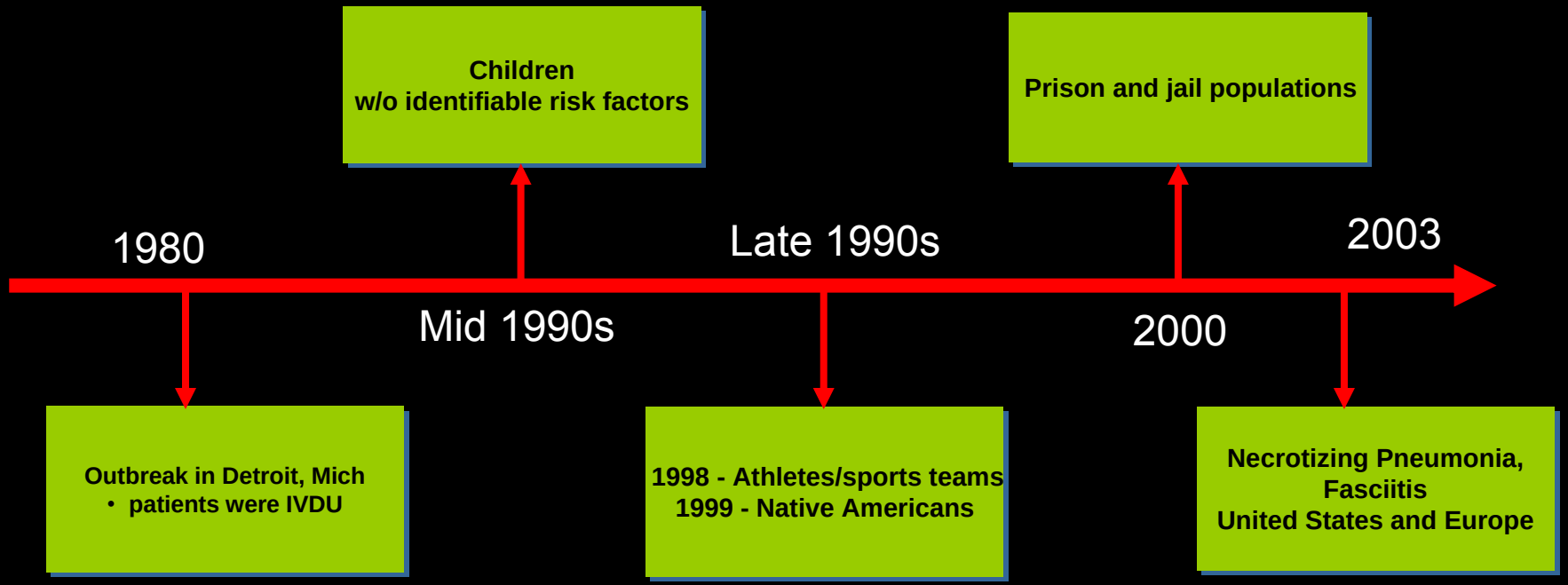
Site	No. of Patients Enrolled (N=422)	MRSA (N=249)†	MSSA (N=71)
Albuquerque	42	25 (60)	10 (24)
Atlanta	32	23 (72)	4 (12)
Charlotte, N.C.	25	17 (68)	0
Kansas City, Mo.	58	43 (74)	6 (10)
Los Angeles	47	24 (51)	6 (13)
Minneapolis	28	11 (39)	4 (14)
New Orleans	69	46 (67)	11 (16)
New York	20	3 (15)	8 (40)
Philadelphia	58	32 (55)	12 (21)
Phoenix, Ariz.	30	18 (60)	8 (27)
Portland, Oreg.	13	7 (54)	2 (15)

Moran et al., NEJM 2006:355;666-74

CA-MRSA prevalence in Midwest USA 27% in 2005 (Davis SL et al., JCM 2007:45;1705-11); 2007 is 56%

Community-Associated MRSA

CA-MRSA outbreaks over the past 2-3 decades, including skin endocarditis and pneumonia.



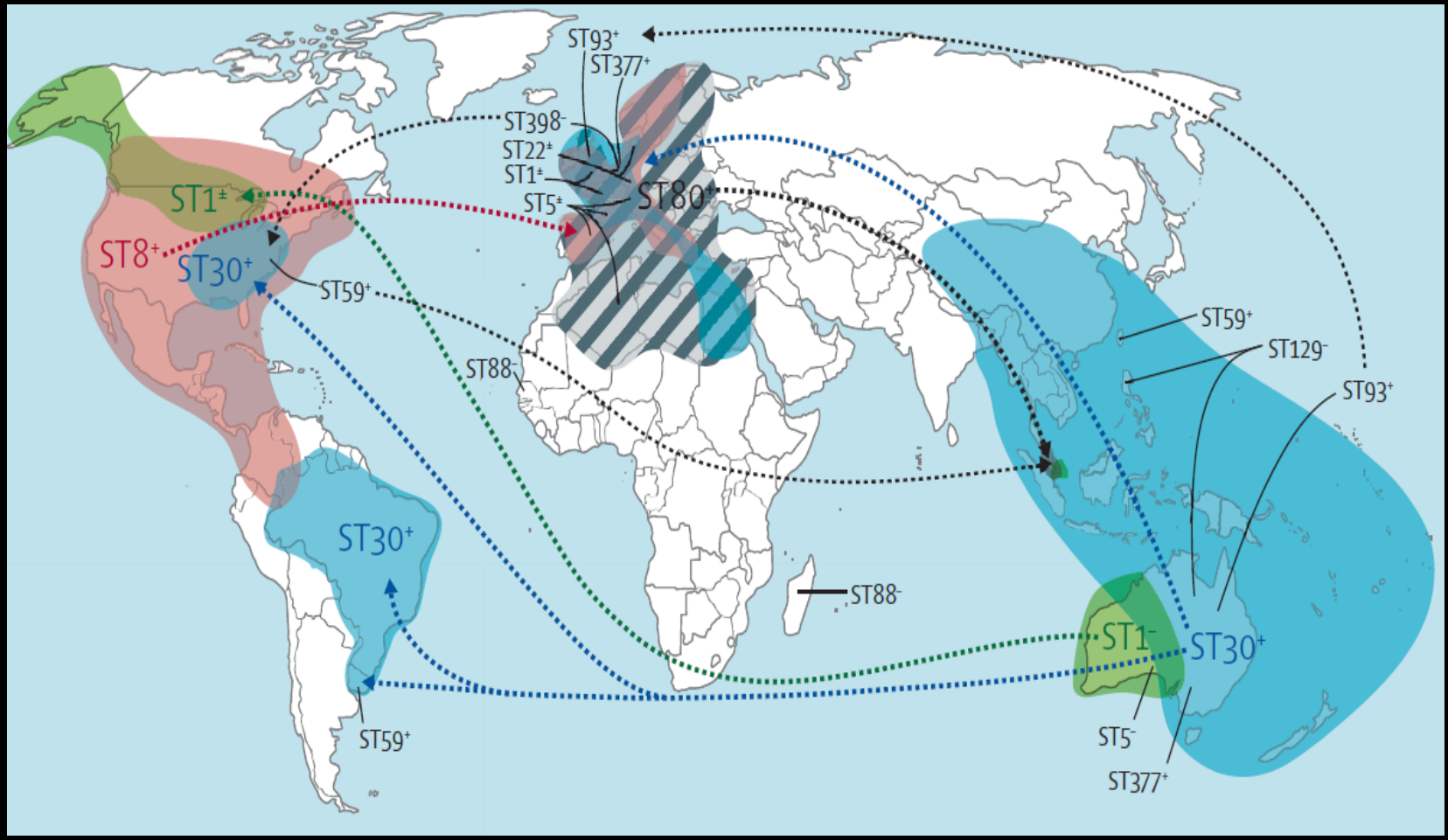
IVDU=intravenous drug users.

Naimi TS et al. *JAMA.* 2003;290:2976-2984.
Zetola N et al. *Lancet Infect Dis*. 2005;5:275-286.
Levine DP, Zervos MJ. Rev Inf Dis 1986;8:374-97.
CDC. *Morb Mortal Wkly Rep.* 2003;52:793-795.

Groom AV et al. *JAMA.* 2001;286:1201-1205.
Saravolatz LD, Markowtiz N et al Ann Intern Med 1982;96;11-16.
CDC. *Morb Mortal Wkly Rep.* 2001;50:919-922.

Gillet Y et al. *Lancet.* 2002;359:753-759.
CDC. *Morb Mortal Wkly Rep*. 1999;48:707-710.
Haque et al IJAA 2007

Geographic spread of MRSA



DeLeo F et al Lancet 2010;375:1557-1568

Early Reports of CA-MRSA

Populations at Risk

- Daycare, children
- Jail/prison residence
- MSM
- Competitive sports
- Alaskan native populations
- Institutionalized (e.g.homeless shelter)
- Military
- Pacific Islanders
- Tattoo administration
- Health club attendance
- Farmers, farm workers, meat

CA-MRSA: Risk Factors

Table 4. Frequency of Characteristics Potentially Related to Infection among 575 Patients with Confirmed Community-Associated MRSA Disease, 2001–2002.*

Potential Risk Factor	No. of Patients (%)
Any visit to a physician's office in past yr	357 (62)
Receipt of any antimicrobial agents in past yr	224 (39)
Chronic noninfectious skin disease	190 (33)
Stayed >2 wk in non–health care high-risk setting in past 5 yr†	10 (2)
Health care–related employment in past 5 yr	69 (12)
Health care provider or direct care	23 (4)
Health care–delivery support services	26 (5)
Other type of health care	46 (8)
Acute care or skilled-nursing facility	30 (5)
Clinic or ambulatory care facility	12 (2)
Crowded household (>1 person/bedroom)‡	121 (51)
≥1 Household member ≤2 yr old	132 (23)
≥1 Household member >60 yr old	109 (19)
≥1 Household member with established risk factor for MRSA infection	92 (16)
Job in the health care setting	69 (12)
Attendance at day care§	52 (9)
History of MRSA infection	35 (6)
Receipt of home care services	17 (3)

Fridkin SK et al., NEJM 2005;352:1436-44

CA-MRSA Household Transmission

- 236 households (case patients) and 712 household contacts
- 69 days after onset of symptoms, 13% of case patients and 12% of household contacts had MRSA nasal colonization
- Household contacts that shared bath balms/lotions/ointments more likely to be colonized, those using antibacterial soaps less likely to be colonized

Nerby JM et al Ped Infect Dis J 2011 May 25 [Epub ahead of print]

CA-MRSA in Professional Football Players: 2003

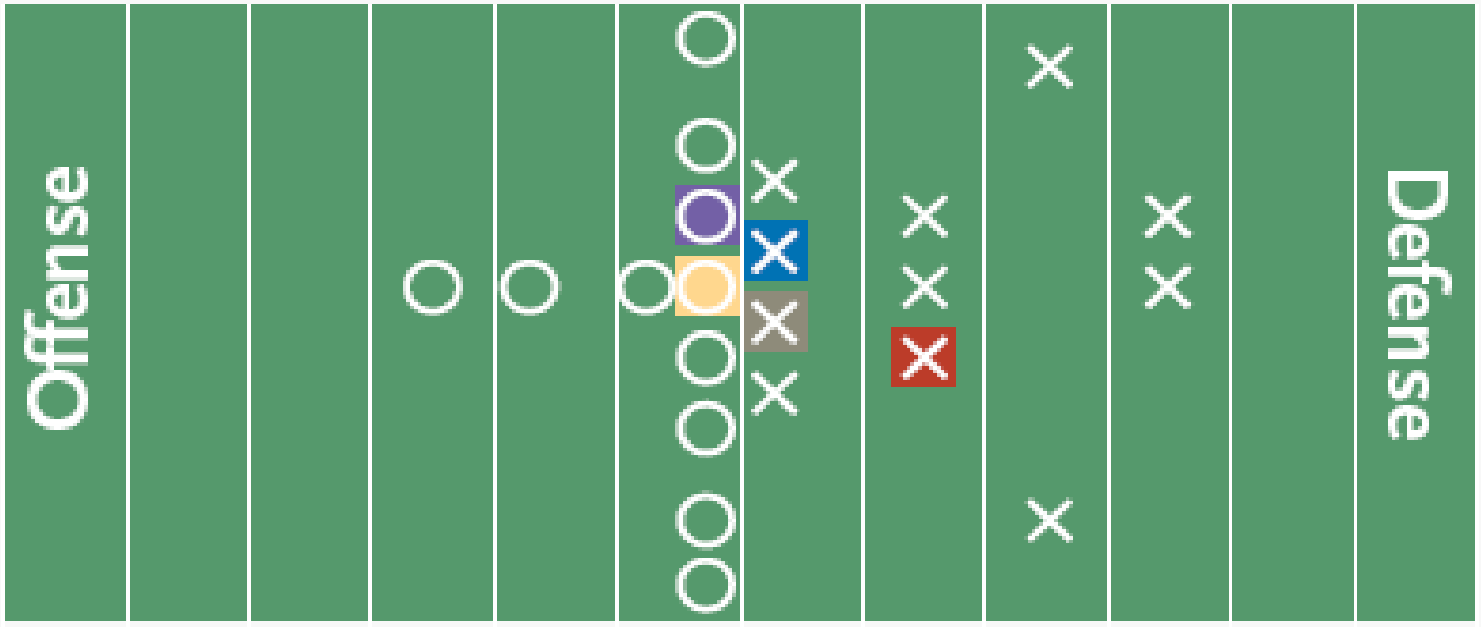


Figure 1. Epidemic-Curve Graph (Top) and Field Position Diagram (Bottom) of Cases of MRSA Infection among St. Louis Rams Professional Football Players in 2003.

Each box on the epidemic-curve graph and field diagram represents an MRSA infection; different colors designate different players; boxes of the same color thus represent recurrent infections. On the field diagram, X represents a defensive-player position and O an offensive-player position.

Kazakova SV et al., NEJM 2005;352:468-75

MRSA Skin Lesions

carbuncle

abscess

folliculitis

CA-MRSA Skin uSSTI

Necrotizing Pneumonia and Fasciitis due to CA-MRSA

- Of 843 MRSA 14 with necrotizing fasciitis (43% IVDA, 21% hepatitis C, 7% HIV)

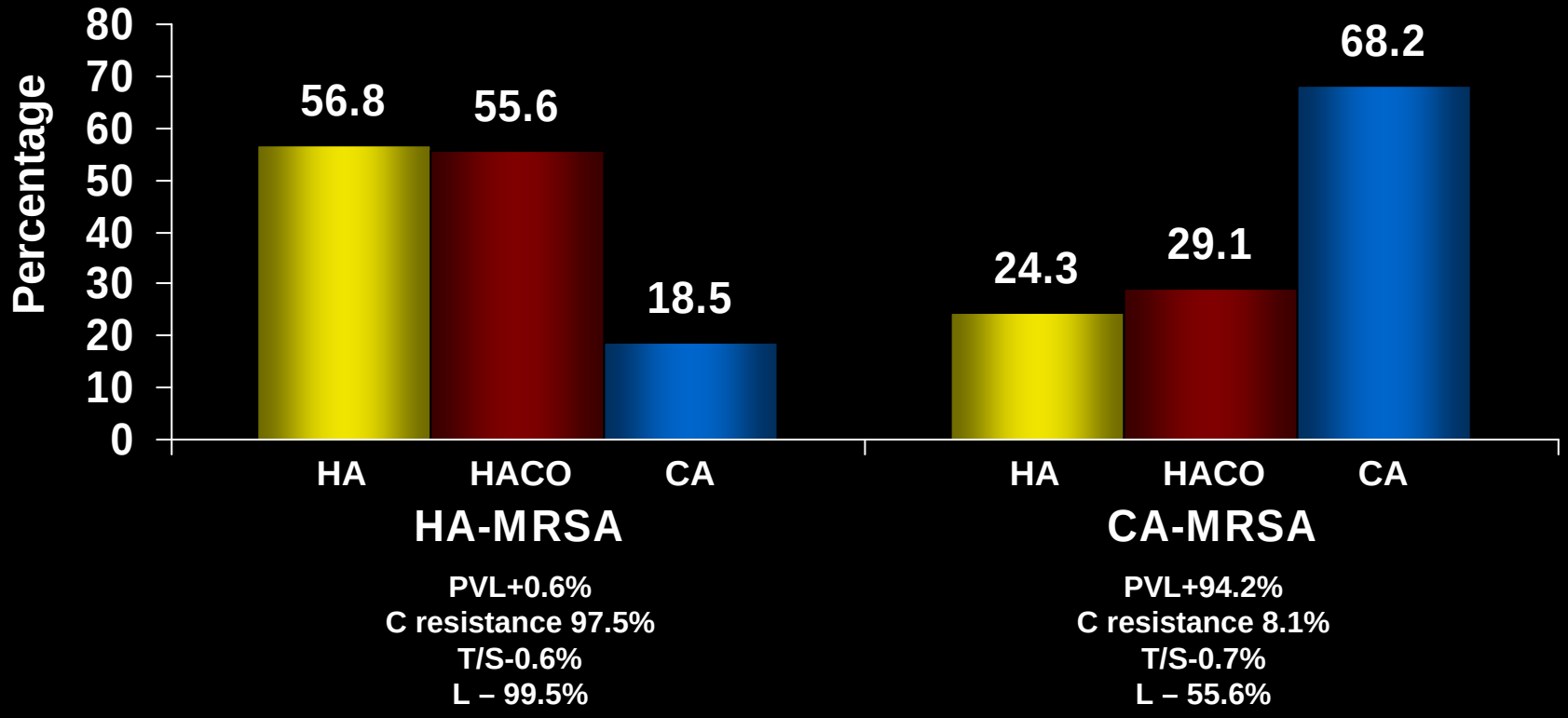
  No death, but prolonged hospital, ICU stay (all USA300, PVL positive strains)
- Increase in case reports of necrotizing pneumonia with death, most post influenza. Persistent bacteremia with vancomycin; optimal therapy not yet defined, but earlier recognition needed

Miller et al., NEJM 2005;352:1445-53

Micek ST, Chest 2005;128:2732-8

Gerasymchuk L, Zervos M, Carpenter C. IDCP 2005;13:1-2

HA-MRSA and CA-MRSA Now Overlap in Hospitals and in the Community



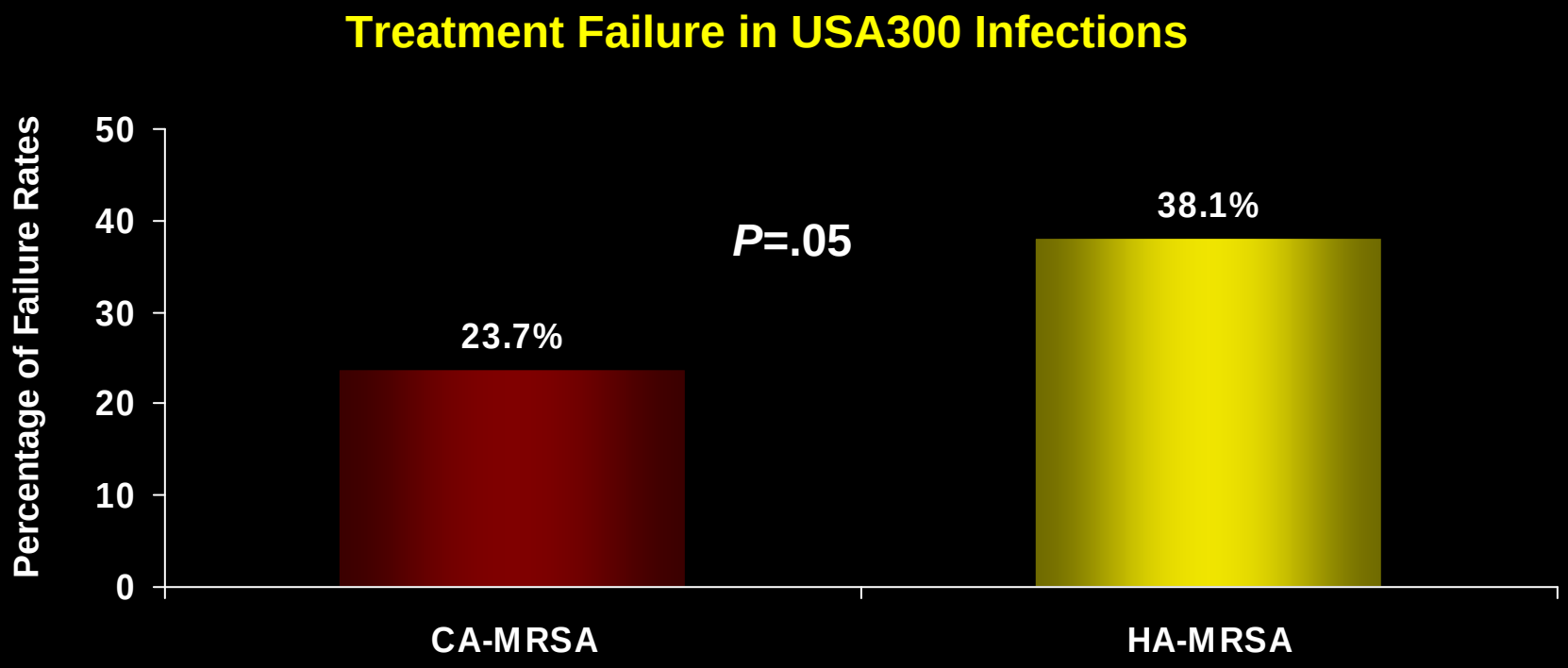
The distinction in onset of HA-MRSA and CA-MRSA is becoming blurred

HA, hospital associated; HACO, health care–associated community onset; CA, community associated; PVL, Panton-Valentine leukocidin; C, clindamycin; T/S, trimethoprim/sulfamethoxazole; L, levofloxacin.

CDC. ABCs report, 2006. http:/www.cdc.gov/abcs/survreports/mrsa06.htm. Accessed August 19, 2009.

Failure Rates Are Higher for USA300 Causing HA-MRSA vs CA-MRSA

Significantly more treatment failure with health care–associated infections



Sixty of 160 patients had cSSTI; 65 had uncomplicated SSTI, 13 pneumonia, 12 bacteremia, 9 osteomyelitis, and 1 had an infected device.

cSSTI, complicated skin and soft tissue infections.

Moore CL et al. *Int J Antimicrob Agents*. 2009;34(2):148-155.

Staphylococcus aureus Resistant to Vancomycin: 'The Perfect Storm'

- First clinical isolate in 2002 resistant to vancomycin
- VRSA isolated from a swab catheter site from a Michigan resident age 40 with DM, peripheral vascular disease, CRF, multiple foot ulcers, long-term vancomycin. Also isolated VRE faecalis;both *S. aureus* and *E. faecalis* contain vanA gene
- 2nd isolate from PA, third isolate from NY LTCF 4th-10th isolates from MI, 11th isolate from Delaware
- Failure to be detected by routine automated susceptibility testing
- VR *E. faecalis* contains pAM830 closely related to the Inc18 family of broad host range plasmids
- SA hyper susceptible to gene transfer having deficiency in restriction modification (RM) pathway, and pSK41 plasmid

MMWR;2002;51:585-567;MMWR 2004:53:322; Flannigan S., et al AAC 2003:47;3954-9; Sung J et al., AAC 2007:51;2189-91; Sievert D. et al CID 2008:46;668

VRSA: Why Southeastern Michigan

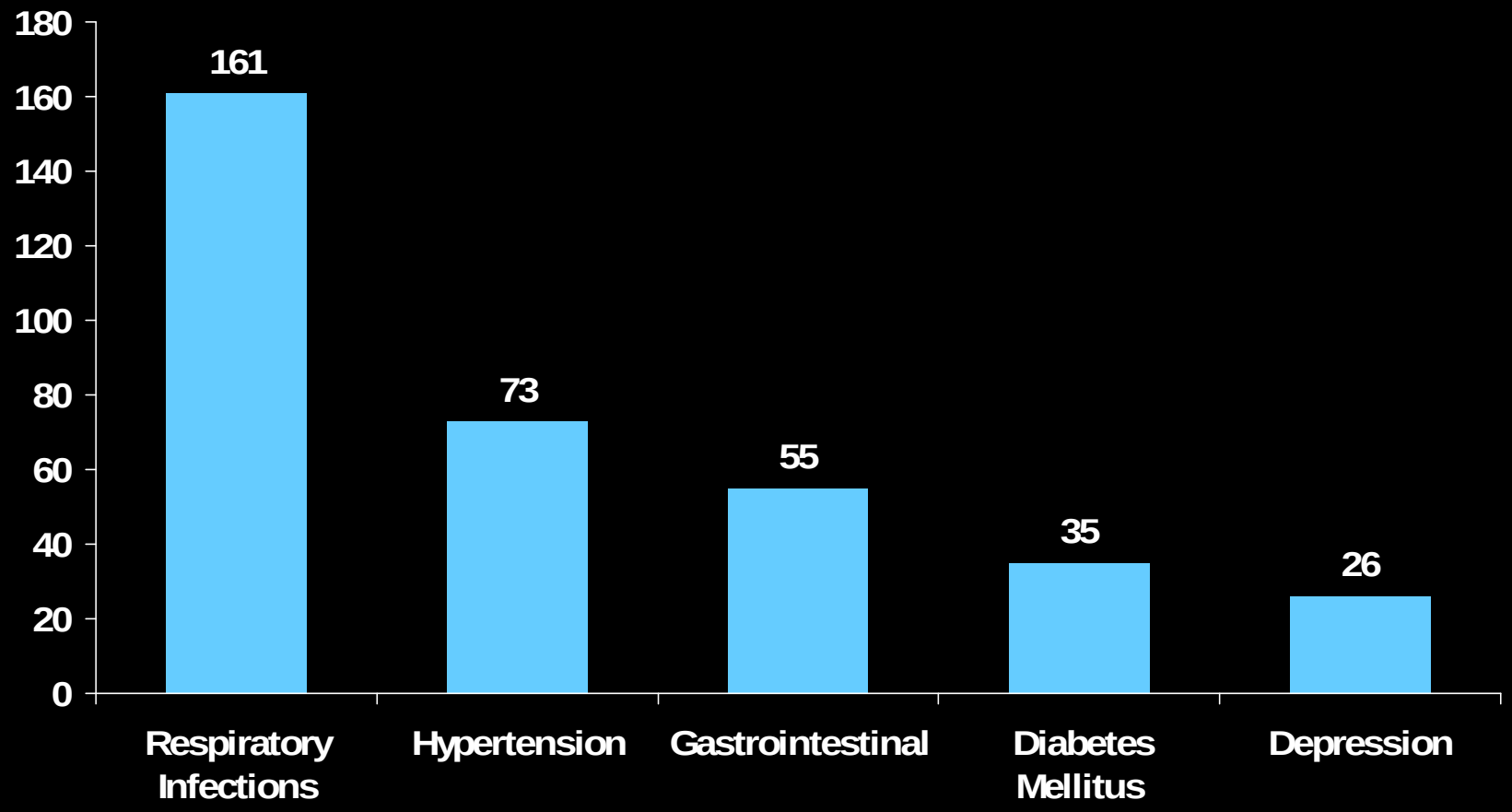
- High prevalence of MRSA for years
- High proportion of patients with diabetes (8th in nation), ESRD (9th in nation)
- High prevalence of VRE for years including 11 percent of *E. faecalis* in SE Michigan are vancomycin resistant
- High use of vancomycin: duration too long, dose inadequate
- Unknown factors: e.g. unique strain of VRE or MRSA (Detroit MRSA or VRE), other patient factors, infection control, or reservoirs or mechanisms for development

VRSA: Michigan Summary

- Cases residing in SE Michigan 100%
- Chronic underlying conditions 100%
  - Diabetes 71%
  - ESRD 40%
  - Osteomyelitis 57%
  - Chronic extremity ulcer 85%
- Extremity ulcers 85%
- Wound clinic 100%

Sievert D. et al CID 2008:46;668

Respiratory Infections:The Most Common Reason for Physician Visit



RTI: Leading reason for antibiotic use and misuse

Antibiotics: RTIs/all uses

- Adults: 75%
- Pediatrics: 88%

Resistance: S. pneumoniae

- Penicillin resistance: 16%, macrolide: 35 %
- Trends: increased 1990-00; now stable to decreased

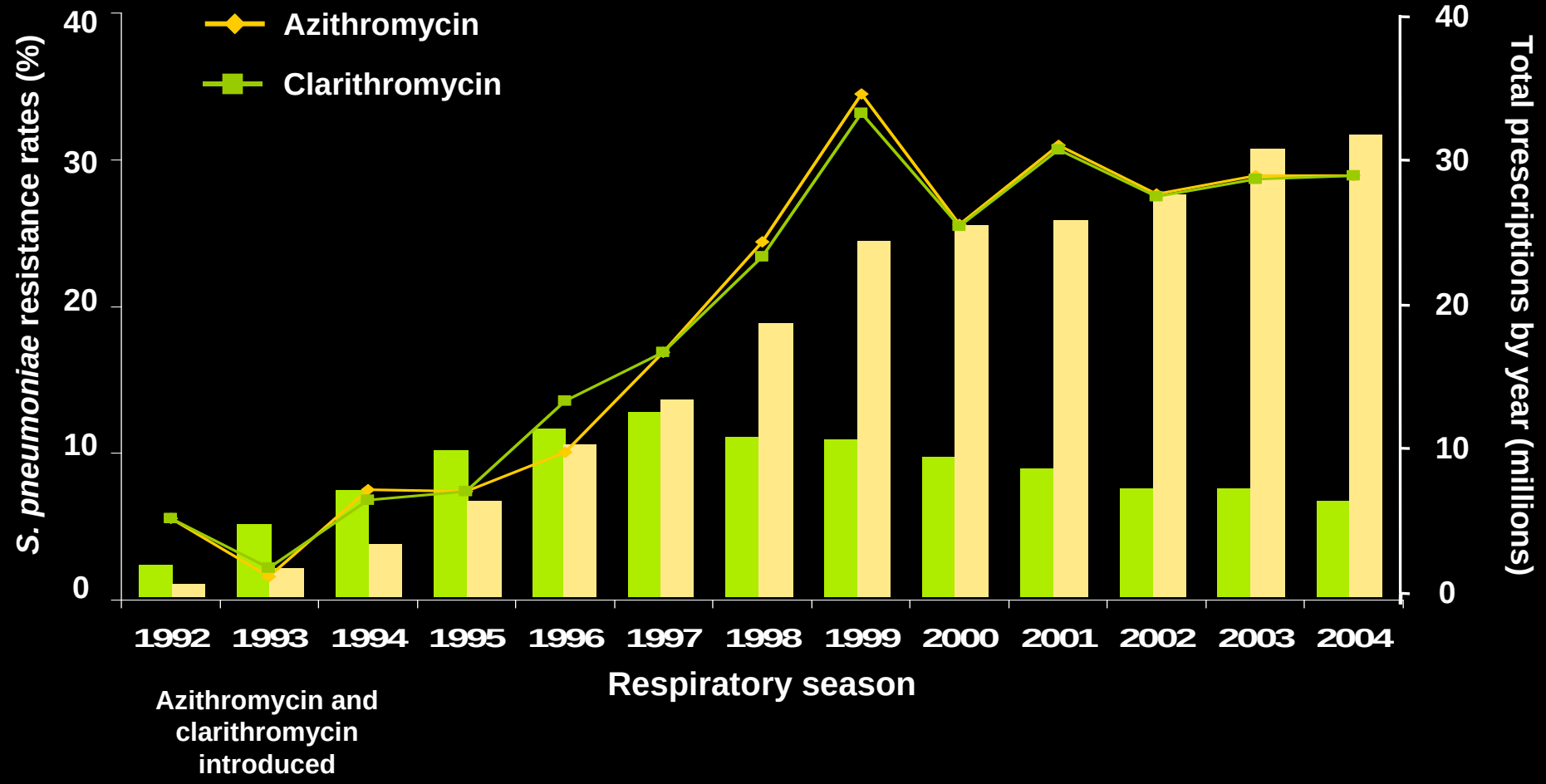
Conditions: Pneumonia, Otitis, pharyngitis, bronchitis, AECB and sinusitis

PENICILLIN-RESISTANT PNEUMOCOCCUS

Risk factors for resistance

- Age <6 yrs
- Day care centers
- Previous antibiotic use
- Immunocompromised patients
- Serotype 6A, 6B, 9V, 14, 19F, 19A, 23F

Emergence of *In Vitro Streptococcus pneumoniae* Resistance Following Introduction of Azithromycin and Clarithromycin [1,2]



1. Alexander Project 1992–2000. www.alexandernetwork.com; 2. PROTEKT US Study Report 2001–2004).

IDSA-ATS CONSENSUS REPORT GUIDELINES

Outpatient: macrolide, fluoroquinolone (with expanded coverage vs. *S. pneumoniae second choice)*or doxycycline

In-hospital-general medical ward, non-ICU management:

Preferred antimicrobials

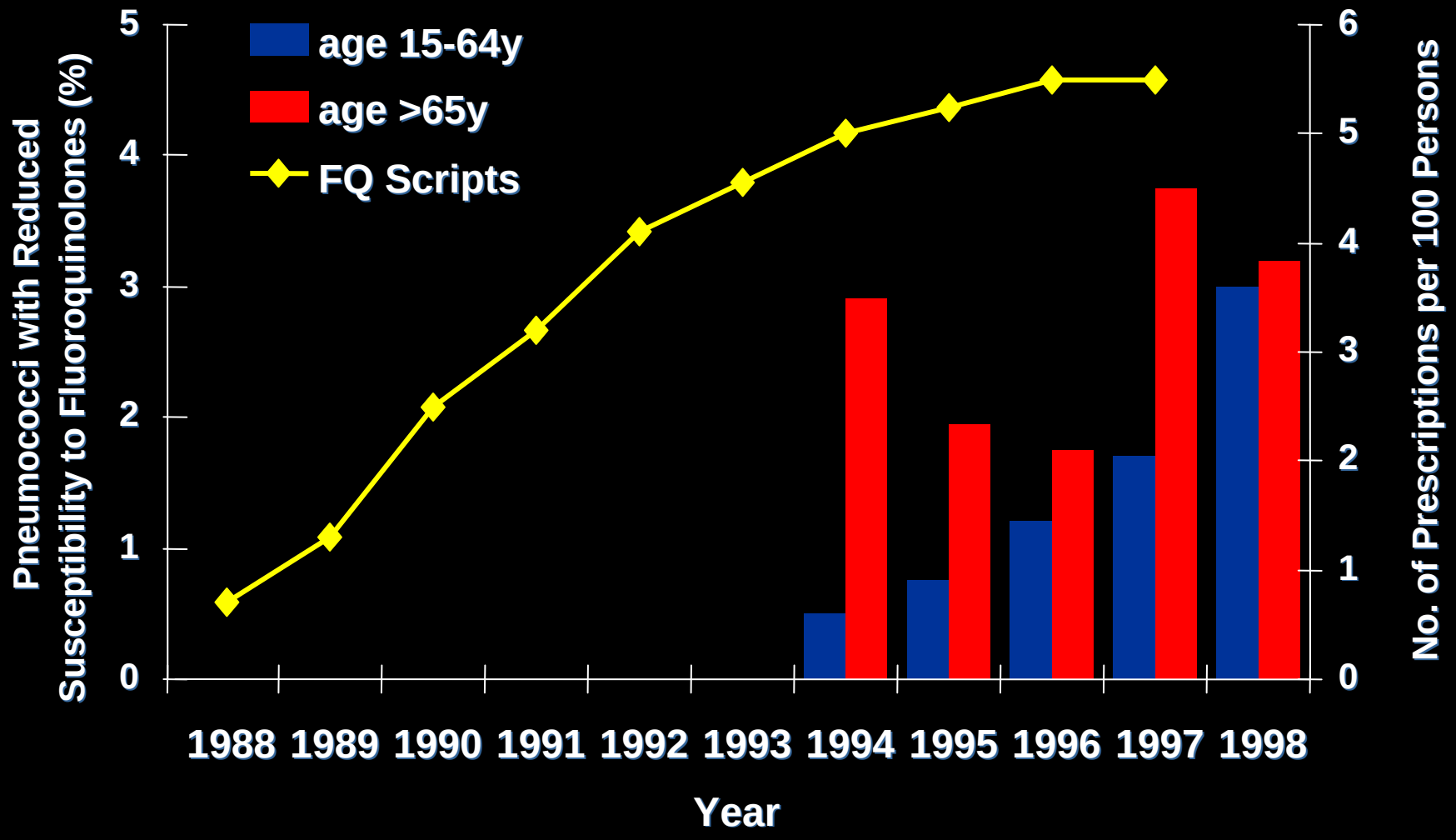
- Beta-lactam with a macrolide OR an intravenous fluoroquinolone

In-hospital intensive care unit management:

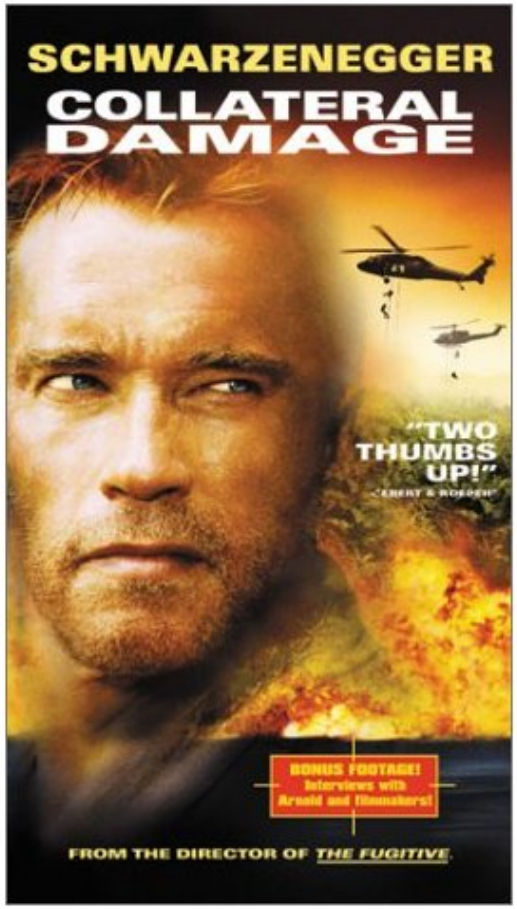
- Same as in-hospital unless pseudomonas or MRSA is a concern

Clin Infect Dis 2007;44:27-72

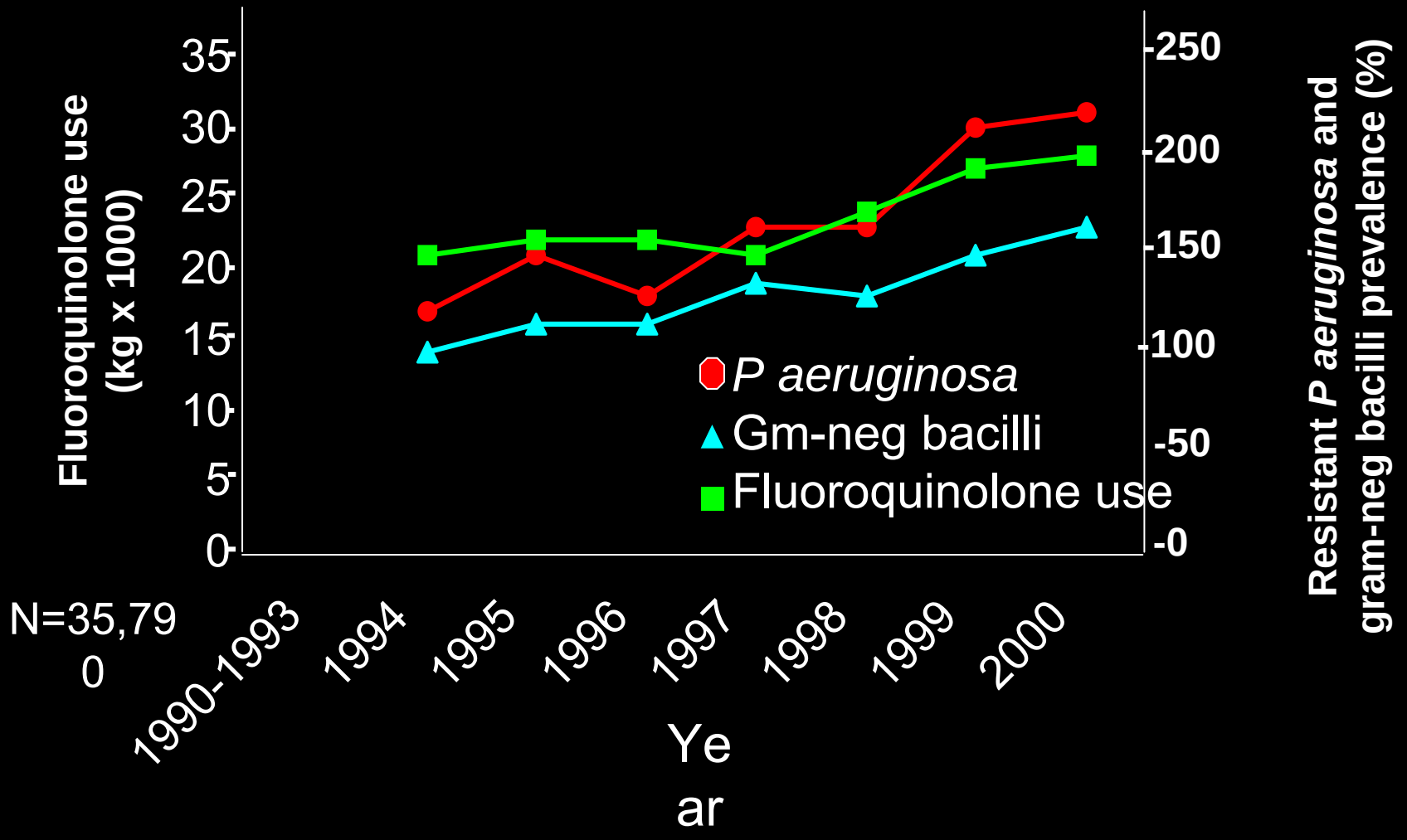
Fluoroquinolone Prescriptions and Emergence of Pneumococcal Resistance in Canada



Chen *et al. NEJM.* 1999;341:233-9

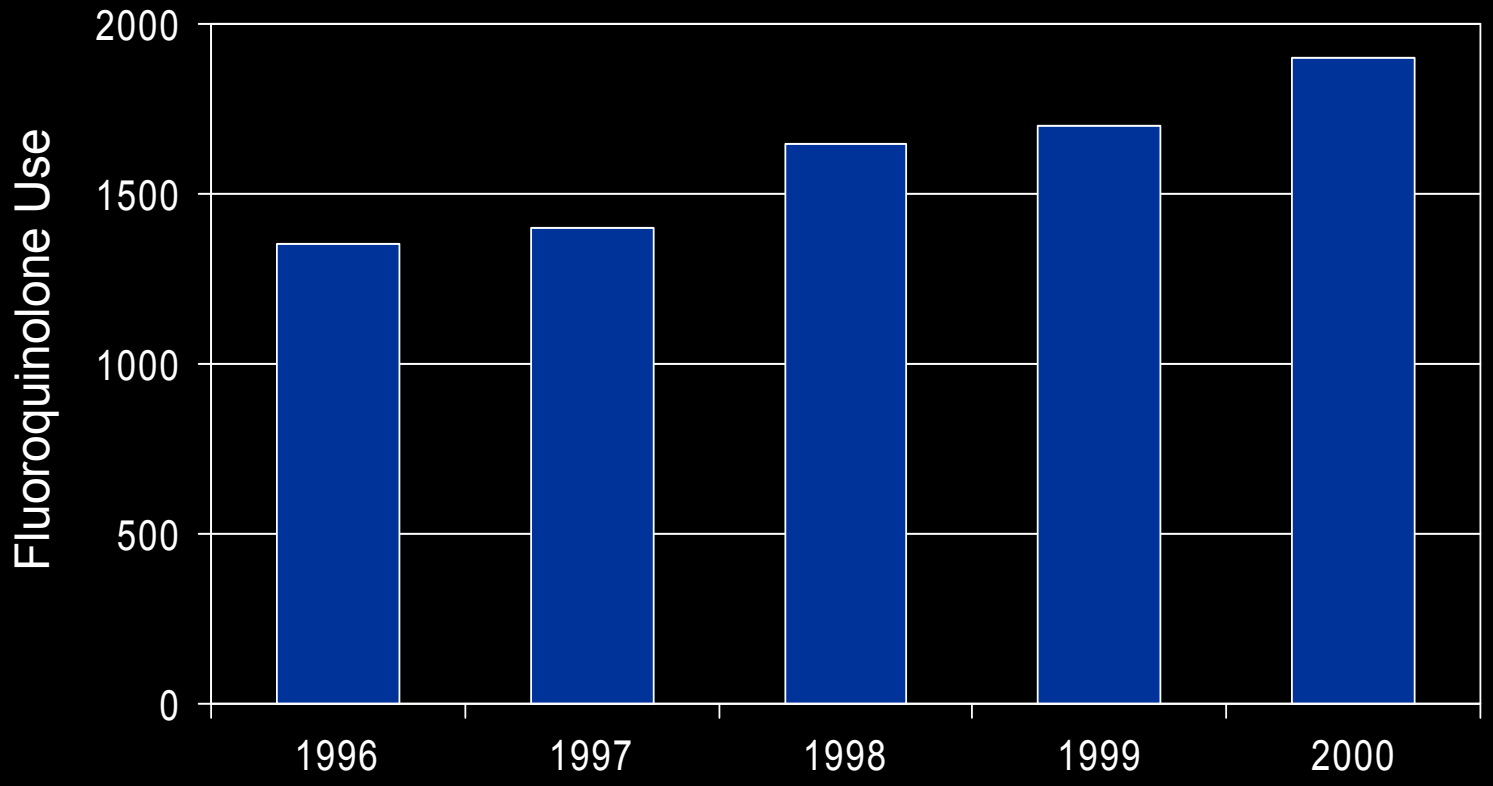

SCHWARZENEGGER
COLLATERAL DAMAGE
"TWO THUMBS UP!"
BONUS FOOTAGE!
Interviews with
Arnold and filmmakers!
FROM THE DIRECTOR OF THE FUGITIVE

Fluoroquinolone Use and Resistance Rates of Gram-negative Bacilli



Neuhauser, et al. *JAMA*. 2003;289:885-8.

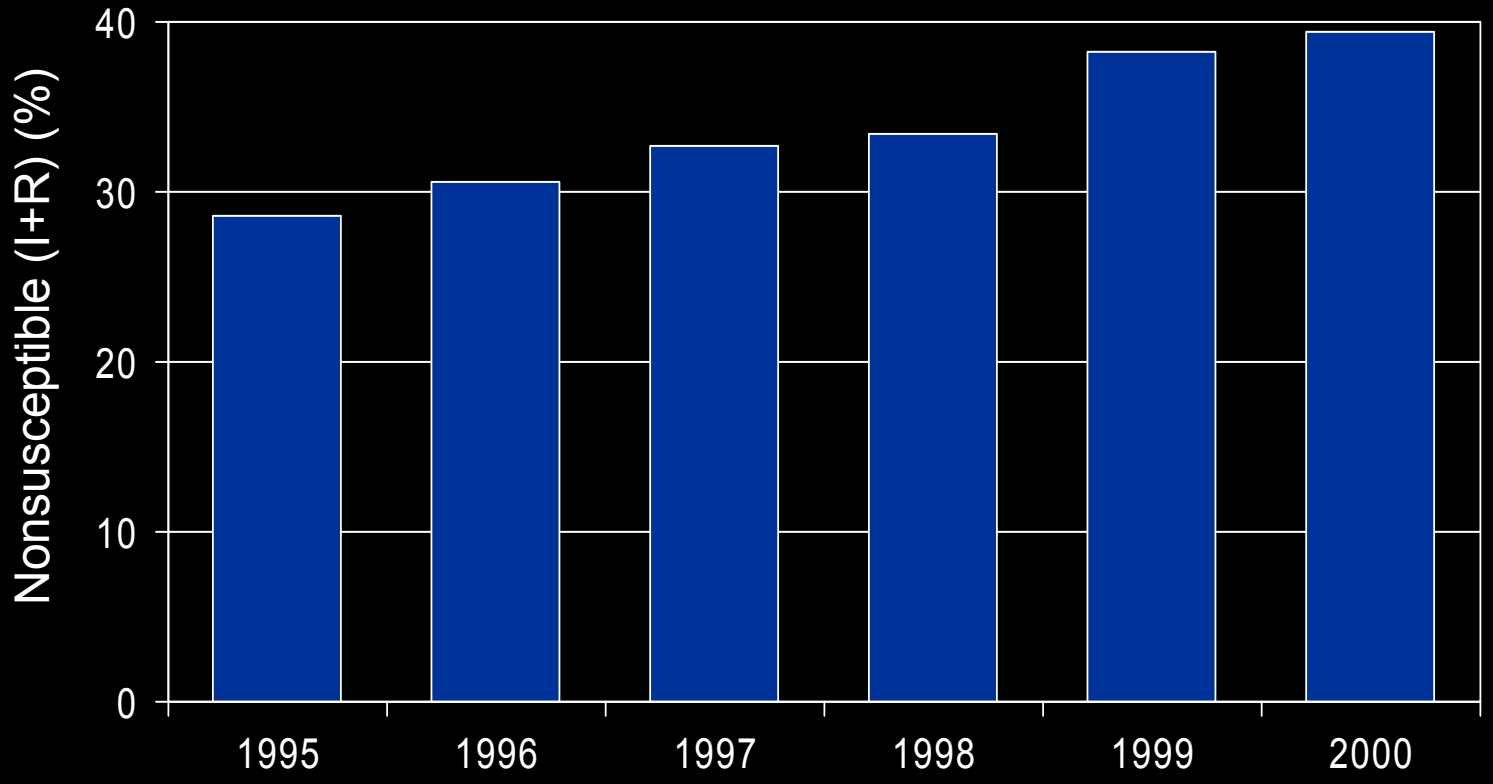
CHANGE IN FLUOROQUINOLONE USE IN 10 US HOSPITALS



Over a 5-year period, fluoroquinolone use increased by more than 40%

Zervos et al CID 2003:37;1643

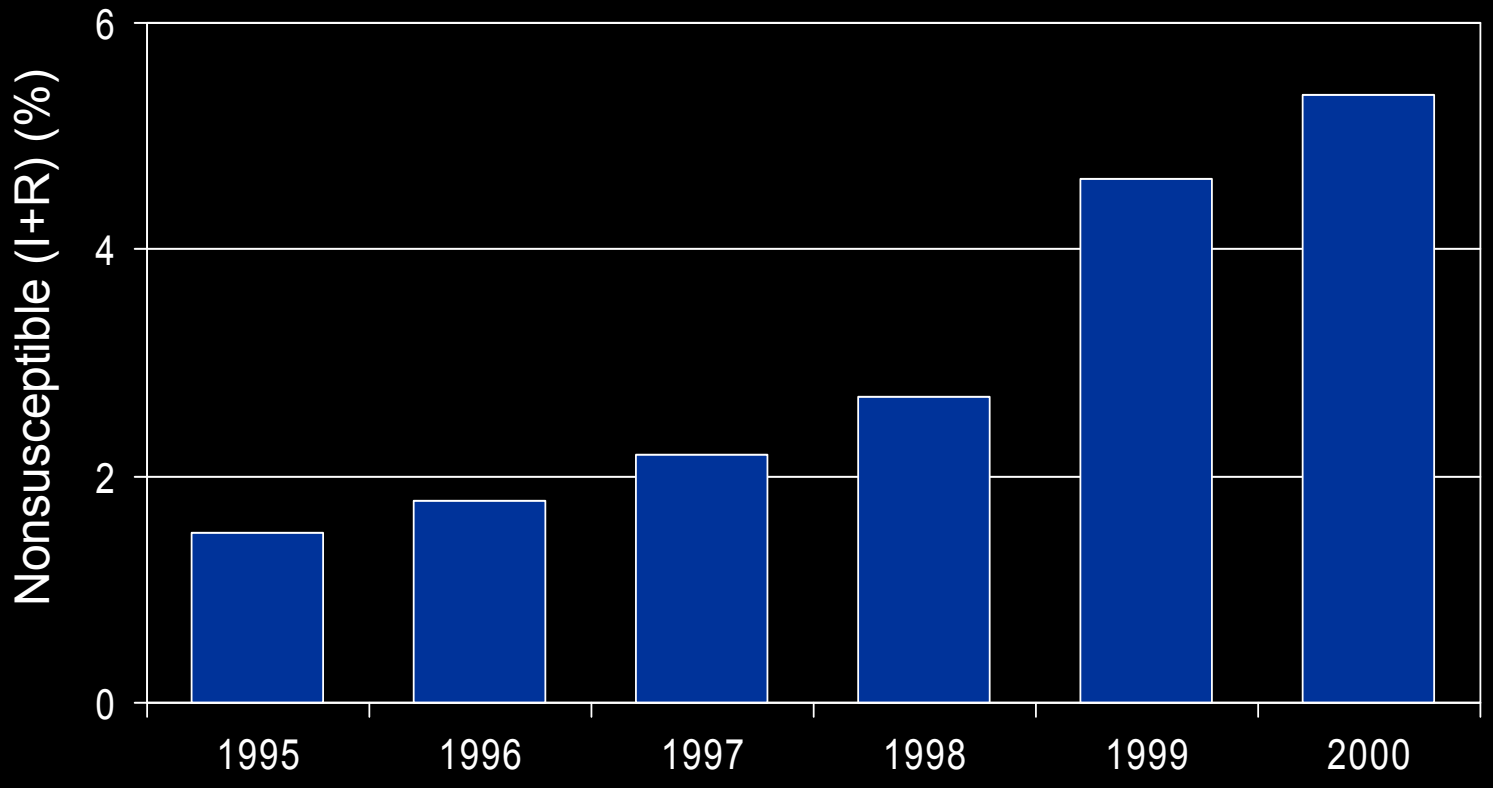
CHANGE IN *P AERUGINOSA* NONSUSCEPTIBILITY TO FLUOROQUINOLONES IN 10 US HOSPITALS



Over a 6-year period, the rate of nonsusceptibility (I+R) to fluoroquinolones among *P aeruginosa* increased by 38%

Zervos et al CID 2003:37;1643

CHANGE IN *E COLI* NONSUSCEPTIBILITY TO FLUOROQUINOLONES IN 10 US HOSPITALS



As fluoroquinolone use increased over time, pathogen susceptibility to fluoroquinolones decreased. Over a 6-year period, the rate of nonsusceptibility (I+R) to fluoroquinolones among *E coli* increased by more than 250%

Zervos et al CID 2003:37;1643

Enterococcal Infection

- Spectrum of disease:
  - Urinary tract infection
  - Bacteremia
  - Endocarditis
  - Wound infection, intraabdominal and pelvic infection*
- Important nosocomial pathogen

*Present in polymicrobial milieu

Arias CA and Murray BE. In: Mandell GL, Bennett JE, and Dolin R, eds. *Principles and Practice of Infectious Diseases*. 7th ed. Philadelphia, Pa: Churchill Livingstone; 2010 ed:2643-53.

Epidemiology of VRE

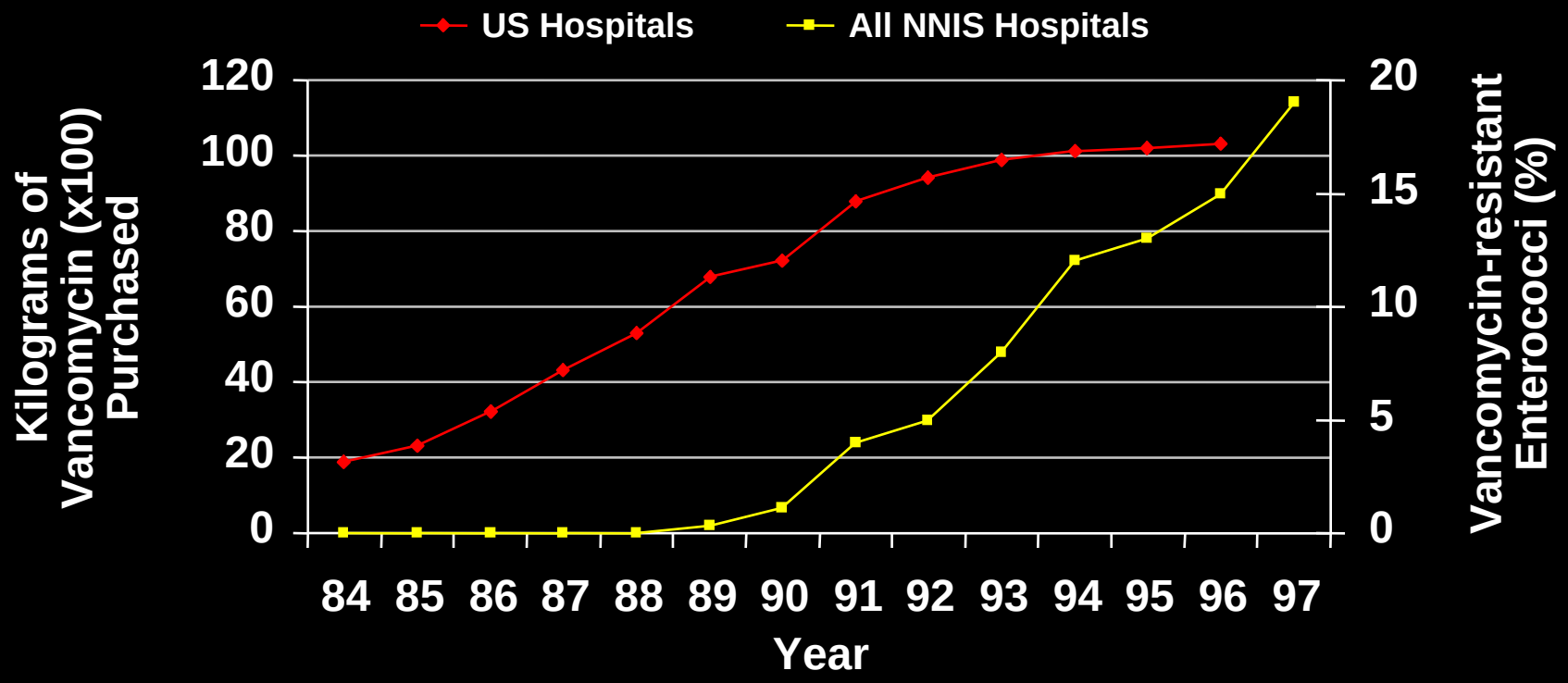
- VRE colonize then infect ill, immunosuppressed patients
- GI tract is the most important reservoir
- VRE contaminate the patients environment
- Risk factors include prolonged stay, prior cephalosporin, antianaerobic agents, and vancomycin use, close proximity, nursing home admission and “colonization pressure.”
- The epidemiology is complex and multifactorial
- *E faecalis* epidemiology is similar to *E.faecium*

CID 2002; 34:441

Ann Intern Med; 2001; 135:484

J Antimicrob Chemo 2004;53:626-30

Use of Vancomycin in US, and VRE at NNIS* Hospitals



*National Nosocomial Infections Surveillance System (CDC).

Kirst, et al. *Antimicrob Agents Chemother.* 1998.

Epidemiology of Glycopeptide Resistance in Enterococci:Europe vs USA

- First reports of VRE in Europe in 1988
- Numerous studies show vancomycin resistant enterococci common in food, food animals and sewage
- VRE found in healthy humans in the community, spread between animals and farmers shown
- Farms using more avoparcin had higher resistance rates

Wegener H., et al Emerg Infect Dis 1999;5:329-35;.Shoutin MA, et al Lancet 1997;349:1258; van den Braak et al Lancet 1997;350:146-7.

Animal Origin for Antimicrobial Resistant Enterococci

- Molecular characterization of gentamicin-resistant enterococci in the United States: Evidence of spread from animals to humans through food.
- Quinupristin-dalfopristin resistance in *Enterococcus faecium* isolates from humans, farm animals, and grocery store meat in the United States.
- VRE found in swine from three Michigan counties
- Human and Swine Hosts Share Vancomycin-Resistant *Enterococcus faecium* CC17, CC5, and *Enterococcus faecalis* CC2 Clonal Clusters Harboring Tn1546 on Indistinguishable Plasmids , across 2 continents

J Clin Micro 2010 Nov;48(11):4156-60

J Clin Micro 2003;41:1109-1113

J Clin Micro 2006;44:3361-5

J Clin Micro 2011;49;925-

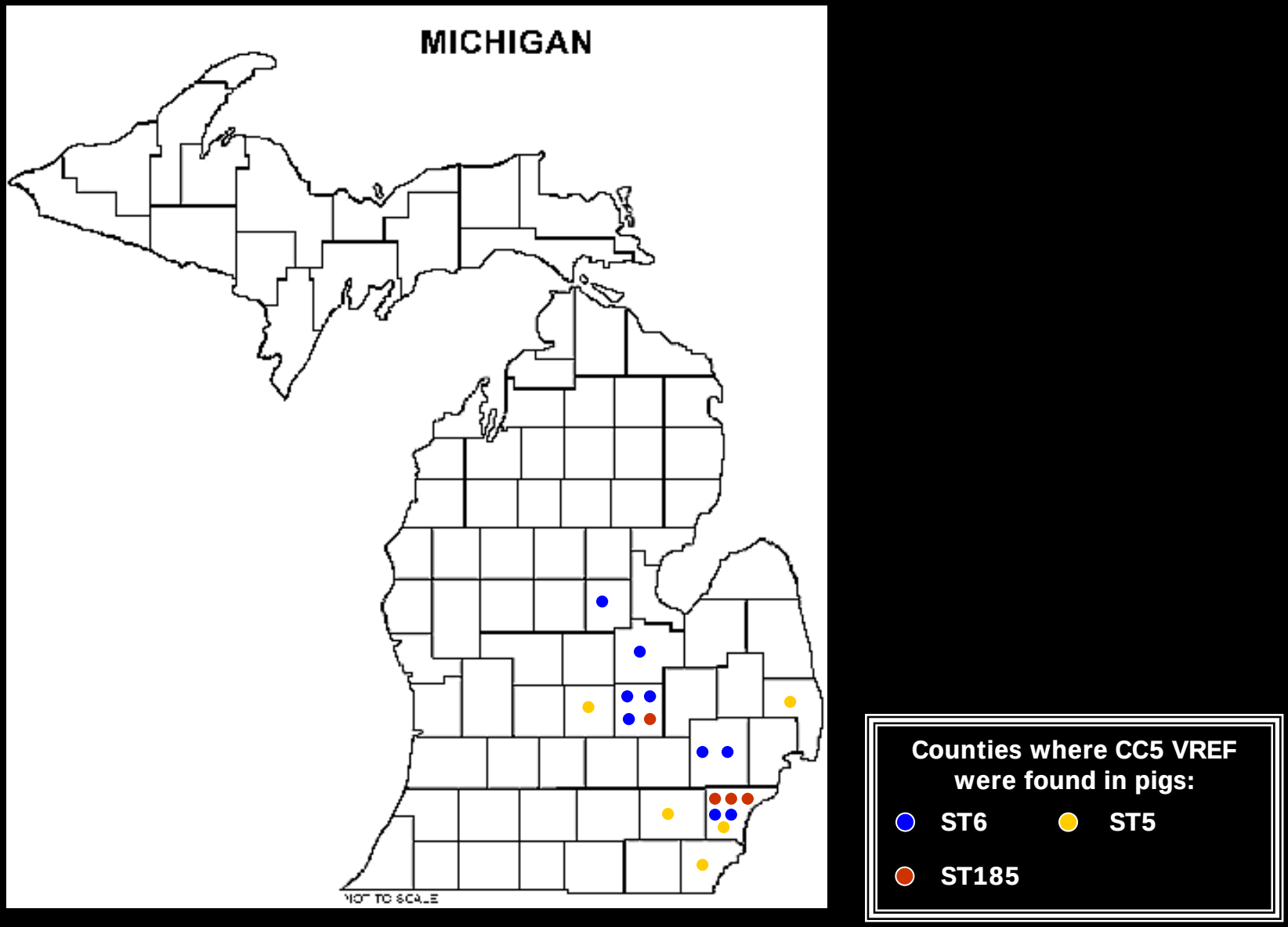


Figure 1. Michigan counties with swine cultures positive for CC5 VanA *E. faecium*

Main β-lactamase Threats

- Extended-spectrum β-lactamases
- Amp C
- Carbapenemases

Livermore DM. *Clin Microbiol Rev*. 1995;8:557-84; Paterson, et al. *Clin Infect Dis.* 2000;30:473–8.

Resistance in Community GNB Pathogens

- Reports on community onset, ESBL-producing *E. coli* infections started to emerge in the late 1990s and early 2000s.
- Initially identified mostly from European countries, community-acquired ESBL-producing *E. coli* infections have now been reported from all populated continents.
- In a population-based study conducted in Canada between 2000 and 2002, the incidence of ESBL-producing *E. coli* infections was 5.5 cases per 100,000 population per year, 71% of which was community-onset.
- While earlier data suggested that CTX-M-14 was most commonly associated with community-acquired infections , more recent data indicate that a large part of this global epidemic is driven by a particular clone of *E. coli* that produces CTX-M-15 MLST sequence type 131

Coque TM et al Emerg Infect Dis 2008;14:195-200;Pitout JD et al., J Clin Micro 2005;43:2844-9;Pitout JD et al., Clin Infet Dis 2004;38:1736-41

Resistance in Community GNB Pathogens

- Several studies have pointed out overseas travel, especially to the Indian subcontinent where the rate of CTX-M-15 production among *E. coli* is estimated to be very high , as a major risk factor for acquisition.
- Food animals, in particular poultry, are known to be sometimes contaminated with ESBL-producing *E. coli* and speculated to be one source.
- First E. coli Isolate Resistant to Amikacin and Nine Other Antimicrobial Subclasses, NARMS, 2004-2006 , suggesting food source
- High carriage rates of ESBL-producing *E. coli* by family members.
- While CTX-M-type ESBLs are most frequently encountered in *E. coli*, they have now spread to *K. pneumoniae* and other enterobacterial species worldwide.

Krueger A et al., Foodborne Path Dis 2011;2:329-32;Carattoli A Clin Microbiol Infect 2008;14 supp 1:117-23;Laupland KB et al., J Infect Dis 2008;57:441-8;Rodriguez-Bano J et al J Clin Microbiol 2004;42:1089-94

New Delhi metallo-B-lactamase 1 (aka NDM1)

- Carbapenemase first isolated in India, reported in 2010
- Are carried on plasmids so are transmissible to a variety of bacteria (enterobacteriaciae)
- Is a pan resistant strain
- Surveillance should be strict as spread to UK and other countries reported

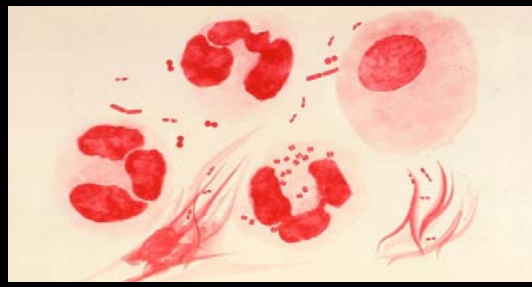
Kumarasamy KK et al Lancet Infect Dis 2010;10597-602

BLOOD CULTURE

REPORT STATUS	Final 07/27/2010
SUSCEPTIBILITY	
ORGANISM	Aerobic bottle Pseudomonas aeruginosa
METHOD	MIC Vitek
CEFEPIME	>=64 Resistant
CIPROFLOXACIN	>=4 Resistant
GENTAMICIN	>=16 Resistant
IMIPENEM	>=16 Resistant
PIP/TAZO	>=128 Resistant
TOBRAMYCIN	>=16 Resistant
SUSCEPTIBILITY	
ORGANISM	Aerobic bottle Pseudomonas aeruginosa
METHOD	KB (Kirby Bauer)
AMIKACIN	Resistant
SUSCEPTIBILITY	
ORGANISM	Aerobic bottle Pseudomonas aeruginosa
METHOD	MIC E Test
COLISTIN	8 Resistant
DORIPENEM	>32 Non susceptible

HOME> HEALTH>ABC NEWS ONCALL+ WELLNESS CENTER

Super Gonorrhea: Scientists Discover Antibiotic-Resistant STD



Scientists have discovered a new strain of gonorrhea in Japan that is resistant to available treatments.

The discovery, announced by Unemo at the International Society for Sexually Transmitted Disease Research meeting in Quebec City, Canada,
.
It is still too early to assess if this new strain has become widespread. This report points out that antibiotic resistance is occurring not only in hospitals, but out in the community.

And while the strain was discovered in Kyoto, Japan, antibiotic-resistant bacteria don't need a passport.

GC Resistance

- A survey of 26 cities found that fluoroquinolone-resistant disease accounted for 6.7 percent of gonorrhea cases among heterosexual men, compared with about 0.6 percent of cases in 2001. Among gay men, drug-resistant strains accounted for 38 percent of gonorrhea cases in the first half of 2006
- A July 8, 2011, report from the U.S. Centers for Disease Control and Prevention urged doctors to be on the lookout for gonorrhea resistant to cephalosporins, and to report cases promptly.

MMWR July 8, 2011

http://www.cdc.gov/std/treatment/2010

GC Cephalosporin Resistance US

- Using — MICs ≥ 0.25 µg/mL for cefixime, and ≥ 0.125 µg/mL for ceftriaxone between 2000 and 2010:
- **Cefixime:** elevated MICs rose from 0.2 percent to 1.4 percent.
- **Ceftriaxone:** elevated MICs increased from 0.1 percent to 0.3 percent.
- Were most prominent in samples collected in the western United States, and among gay and bisexual men:
- **Western regions:** For cefixime, rose from zero percent in 2000 to 3.3 percent in 2010, in Hawaii (from 0 to 7.7 percent) and California (from 0 to 4.5 percent).
- **MSM:** For cefixime, the proportion of isolates with elevated MICs rose from zero to 4 percent between 2000 and 2010; for ceftriaxone, the proportion of isolates with elevated MICs rose from zero to 0.9 percent.

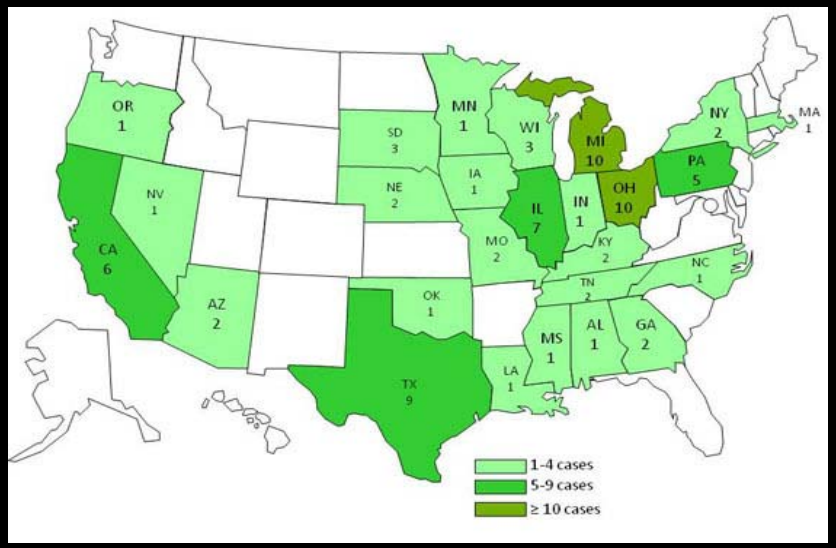
MMWR July 8,2011

GC Management and Response

- **Healthcare Providers**:
- • Promptly treat all patients according to CDC's Treatment Guidelines
- • Obtain cultures to test for decreased susceptibility from patients with suspected or documented treatment failures
- • Report any suspected treatment failure to local or state public health officials within 24 hours, helping to ensure that any future resistance is recognized early
- **Health Departments and Laboratories —** maintain culture capacity, develop local response plans and notify the agency of treatment failures.
- **Public and Private Partners —** CDC urges scientists and drug development sponsors to prioritize the identification of effective new antibiotic treatments for gonorrhea.

July 8, 2011 issue of CDC's *Morbidity and Mortality Weekly Report*
http://www.cdc.gov/std/treatment/2010

Multistate Outbreaks of Human *Salmonella*



August 3,2011 S Heidelberg linked to ground turkey

As of 23 Aug 2011, a total of 65 individuals infected with an outbreak strain of _S._ Altona have been reported from 20 states

Isolates showing increasing antimicrobial resistance to commonly used agents for some of these infections

Resistance in salmonella felt to be due to use of antimicrobial agents in animals as human to human transmission of strains does not occur, food is source of infection

http://www.cdc.gov/salmonella/

“Antibiotic Pressure”

- In a population of 300 million, each year in the US, 160 million prescriptions for antibiotics are written: 30 prescriptions or 4.1kg (9 lbs) per 100 persons per year.
- 22.7 million kg (25,000 tons) of antibiotics are prescribed, about 50% for people and 50-70% for animals .
- Estimates are that up to 50% of antibiotics are inappropriate

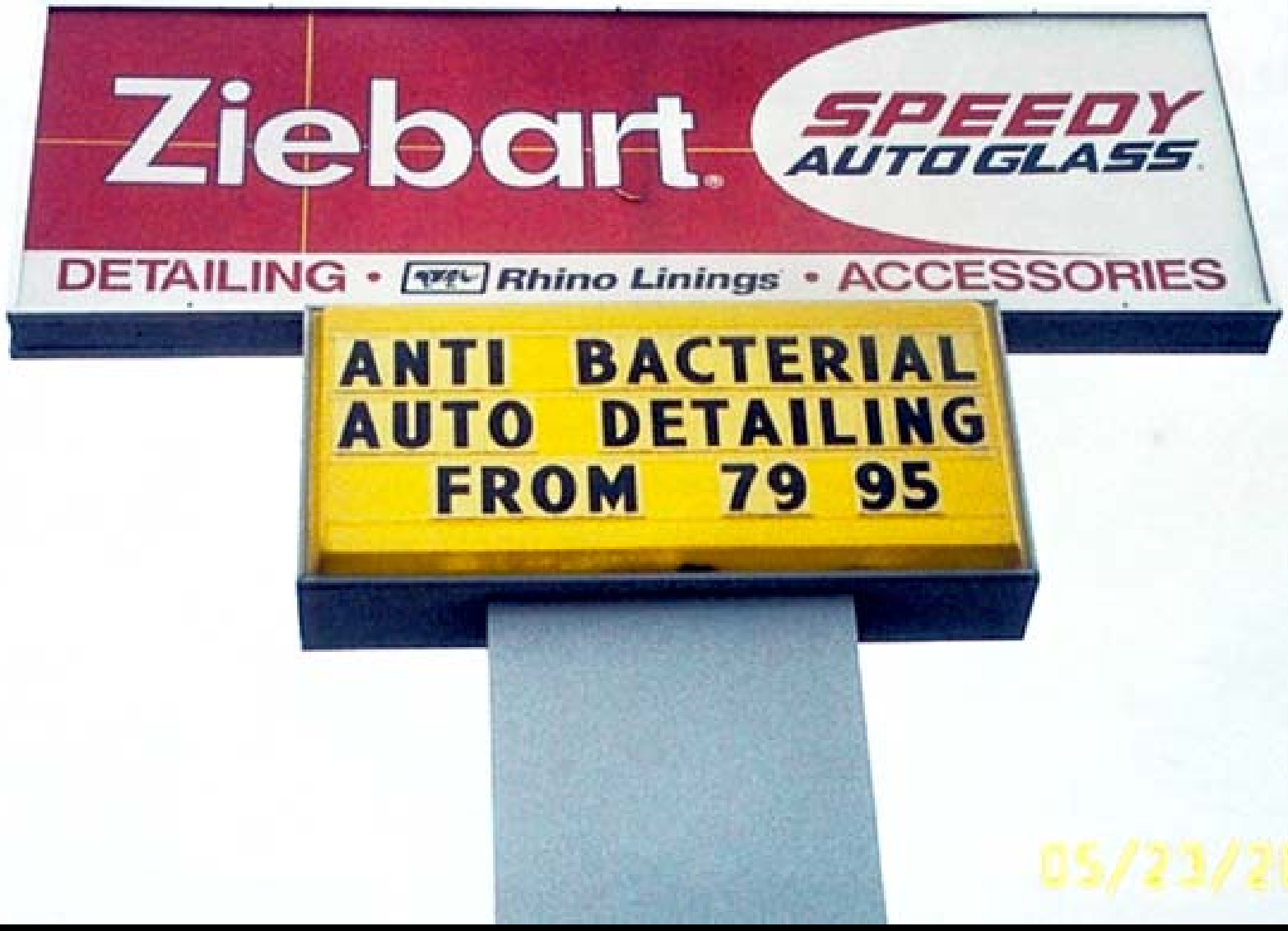
Wenzel R and Edmond M., NEJM 2000;343:1961

Playing Chicken With Our Antibiotics

Overtreatment is creating dangerously resistant germs

As much as 80% of the antibiotics used in the U.S. are used in agriculture

Illustration for TIME by Roberto Parada


Ziebart
SPEEDY AUTO GLASS
DETAILING • Rhino Linings • ACCESSORIES
ANTI BACTERIAL
AUTO DETAILING
FROM 79 95
05/23/2002

RESISTANCE: Problem and Solutions

Defining the Problem:

- Increasing Abx – resistance
- Dry pipeline

Solutions:

- Better diagnostics
- Antibiotic discipline
- Assuring compliance
- Antibiotic Stewardship
- The Netherlands
- Role of Guidelines
- Abx selection

ROLE OF GUIDELINES

Source: Federal, Plans, Professional Societies, Experts etc.

Validity: "Evidence based"

Dissemination: most infection indications have national and local guidelines

Clout: Medicare (CMS)
Audits
Public exposure
Pay-for-performance

Concern: are more problems created e.g CMS rules and CAP

Control of Antimicrobial use and Resistance

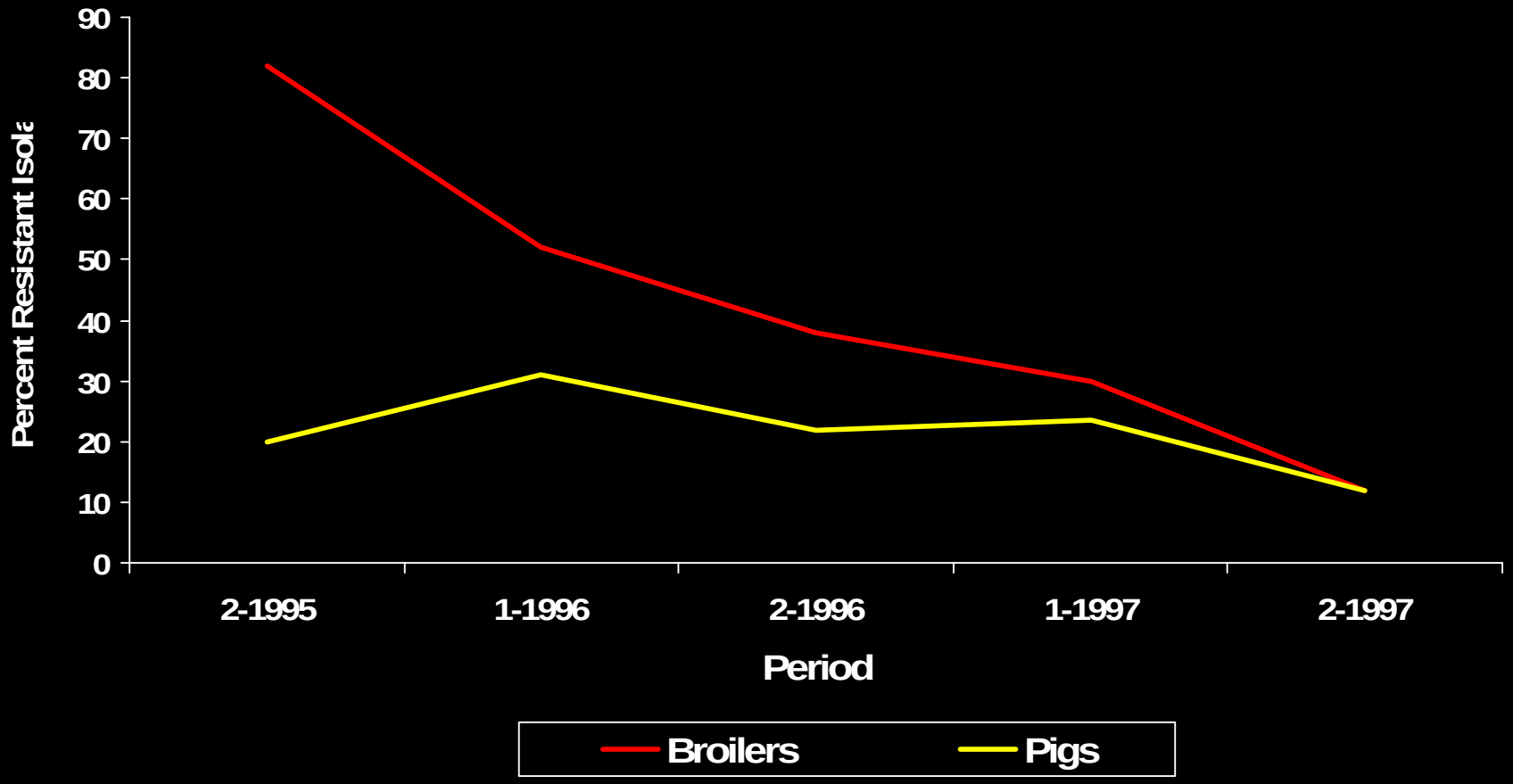
- In response to an increase in macrolide resistance in group A strep in Finland, policies for use were changed. Macrolide consumption decreased from 2.4 daily doses/1000 inhabitants/day in 1991to 1.38 in 1992 (p=0.007). Resistance decreased from 16.5% in 1992 to 8.6% in 1996 (Seppala et al NEJM 1997;227;441-6)
- Studies done in Hungary and Iceland suggest decreasing penicillin use nation-wide associated with a decrease in resistance (Nowack R. Science 1994;264;364 and Stephenson J JAMA 1996;275:175)
- Studies in Denmark show growth promoting antibiotics can be eliminated with a decrease in resistance and without compromising feed productivity (DANMAP 2007)

Resistance in Enterococci in Relation to Antimicrobial Use In Animals: Denmark kg of Agent Used

Group	Agent	1992	1994	1996	1997
Bacitracin	Bacitracin	5,657	13,689	8,399	8,544
Glycopeptide	Avoparcin	17,210	24,117	0	0
Macrolides	Tylosin	26,980	37,111	68,350	62,009
Strept	Virginiamycin	15,537	2,801	5,055	10,644

Source: DANMAP 1998

Resistance To Avoparcin Among *Enterococcus faecium* From Boilers And Pigs Trends Between 2nd Half of 1995 To 2nd Half of 1997



THE NETHERLANDS

Use: Lowest in European Union

Resistance: Lowest in EU

- *S. pneumoniae* pen resist < 2%
- MRSA: "Search and destroy"
- *P. aeruginosa* < 2% ceftaz, cefepime, cipro, tobra

Method: Culture, antibiotic restriction

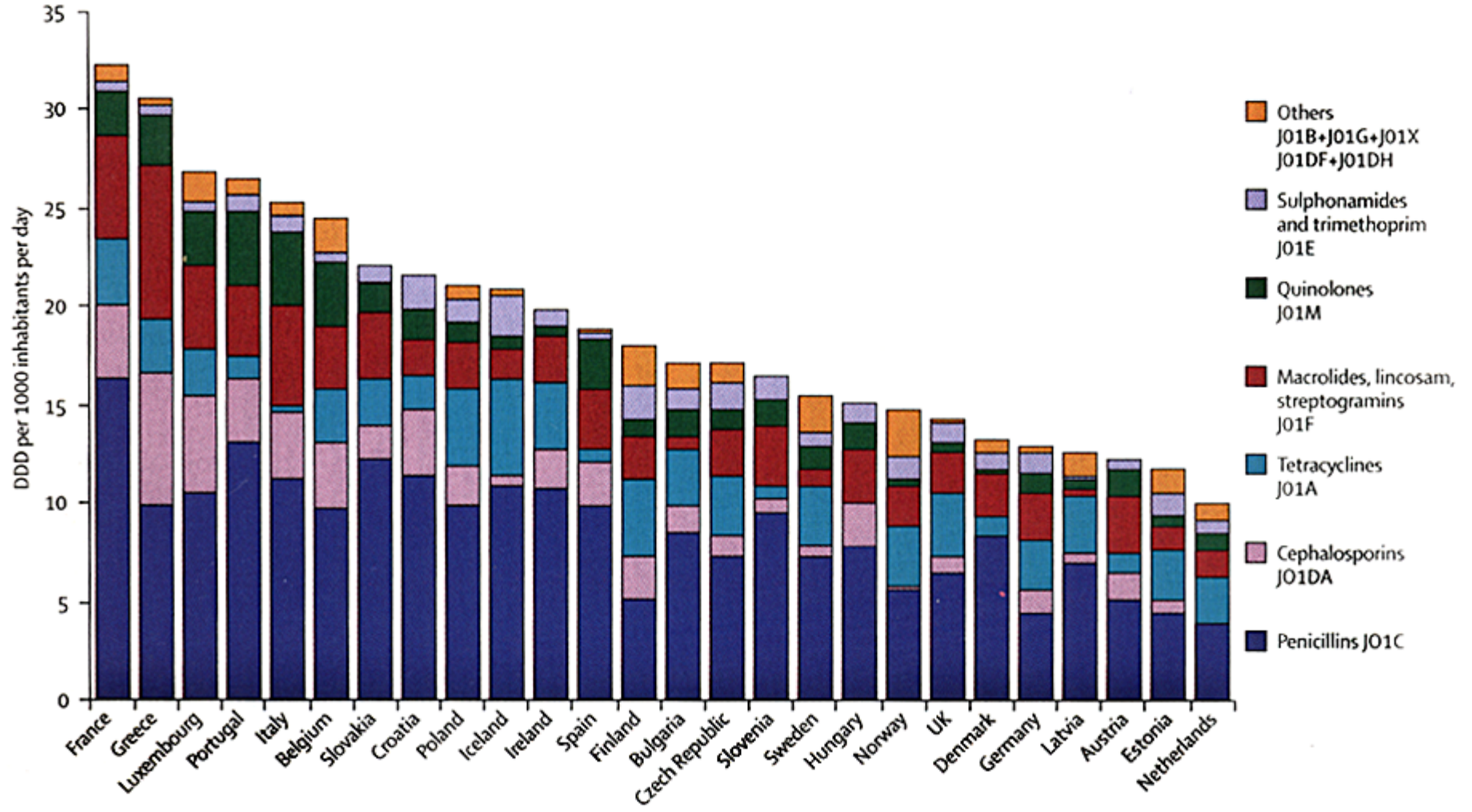
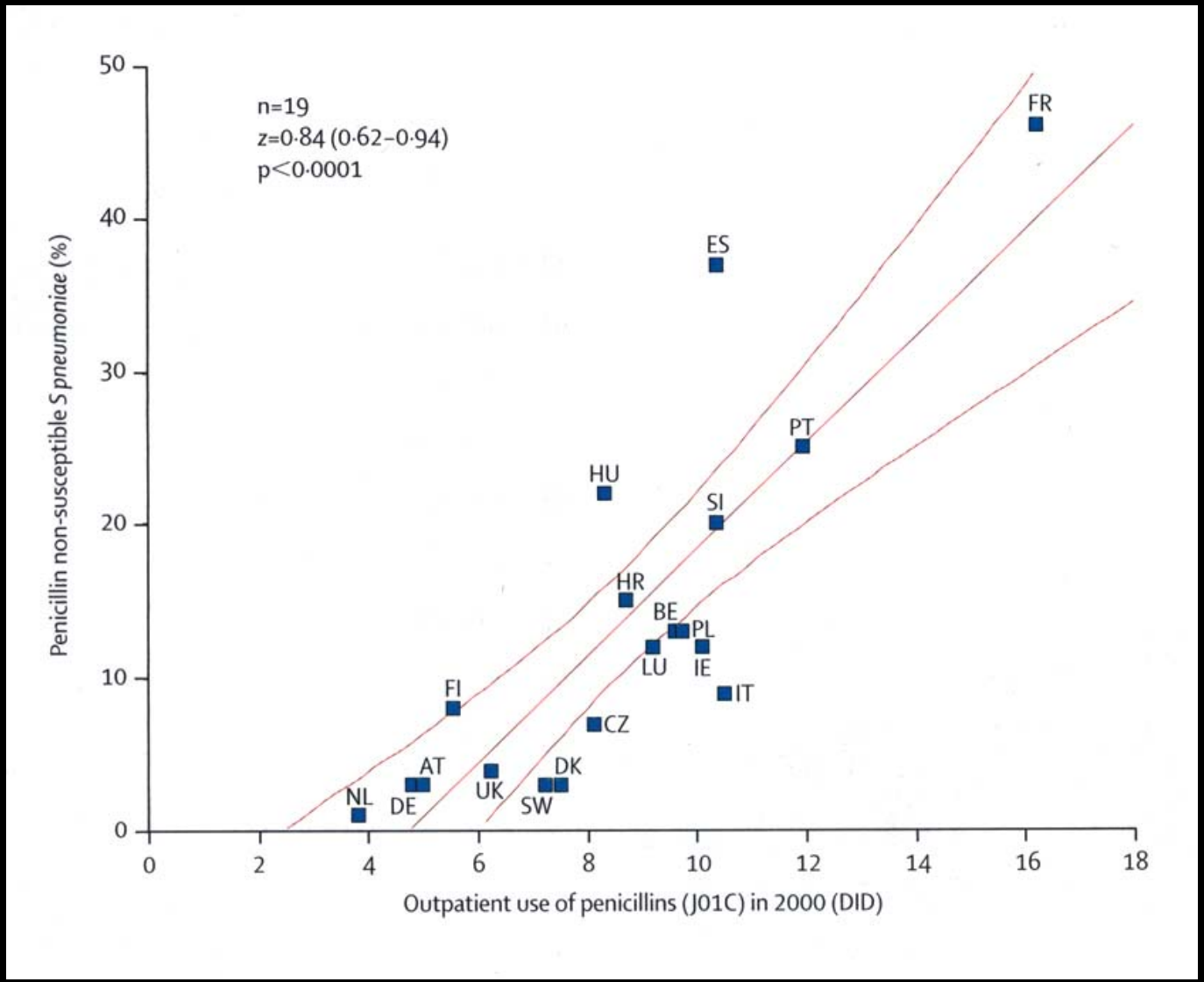


Figure 1: Total outpatient antibiotic use in 26 European countries in 2002

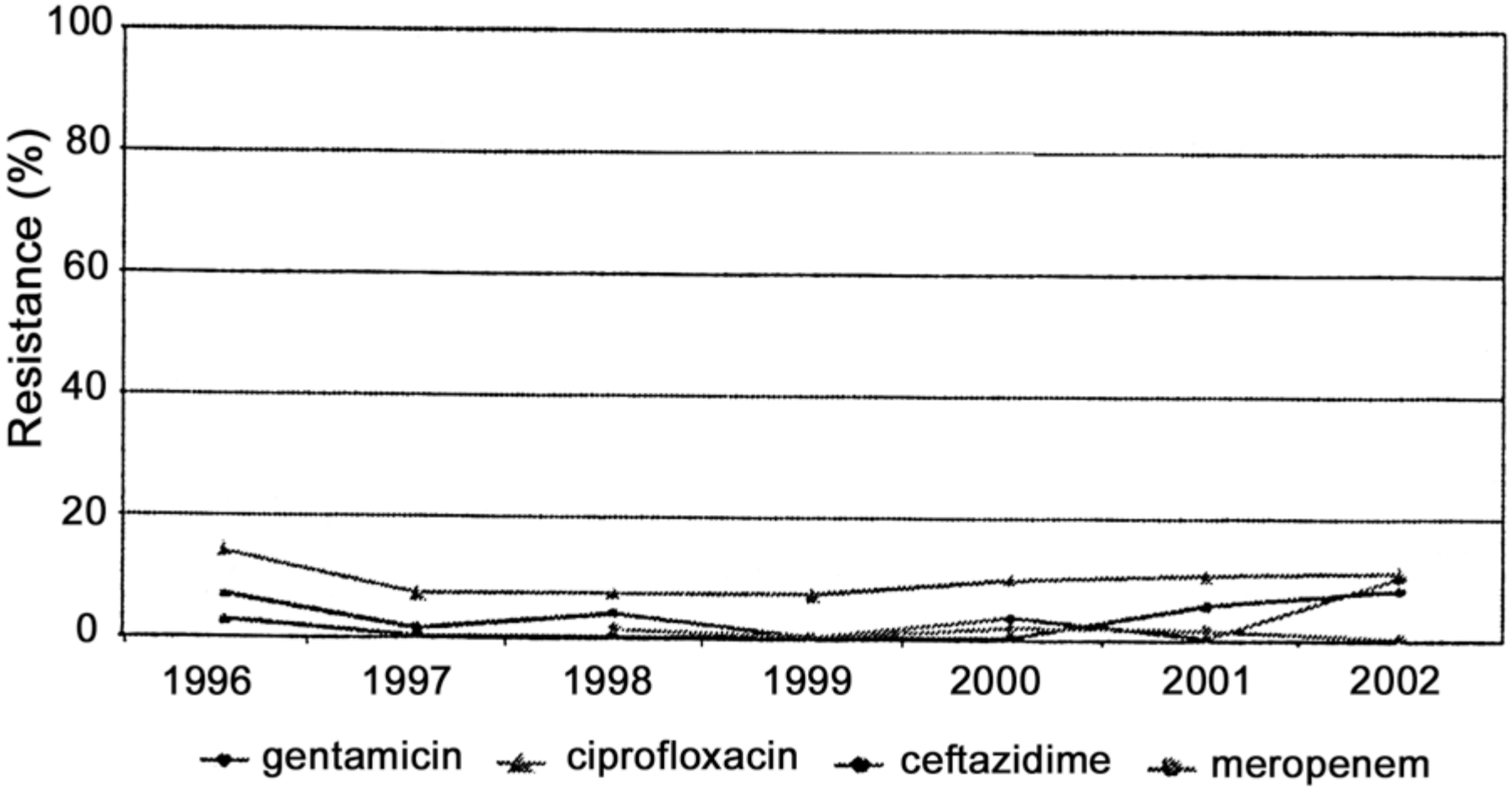
www.swab.nl

www.rivm.nl/earss/



www.swab.nl
www.rivm.nl/earss/

Pseudomonas aeruginosa - Intensive Care Units



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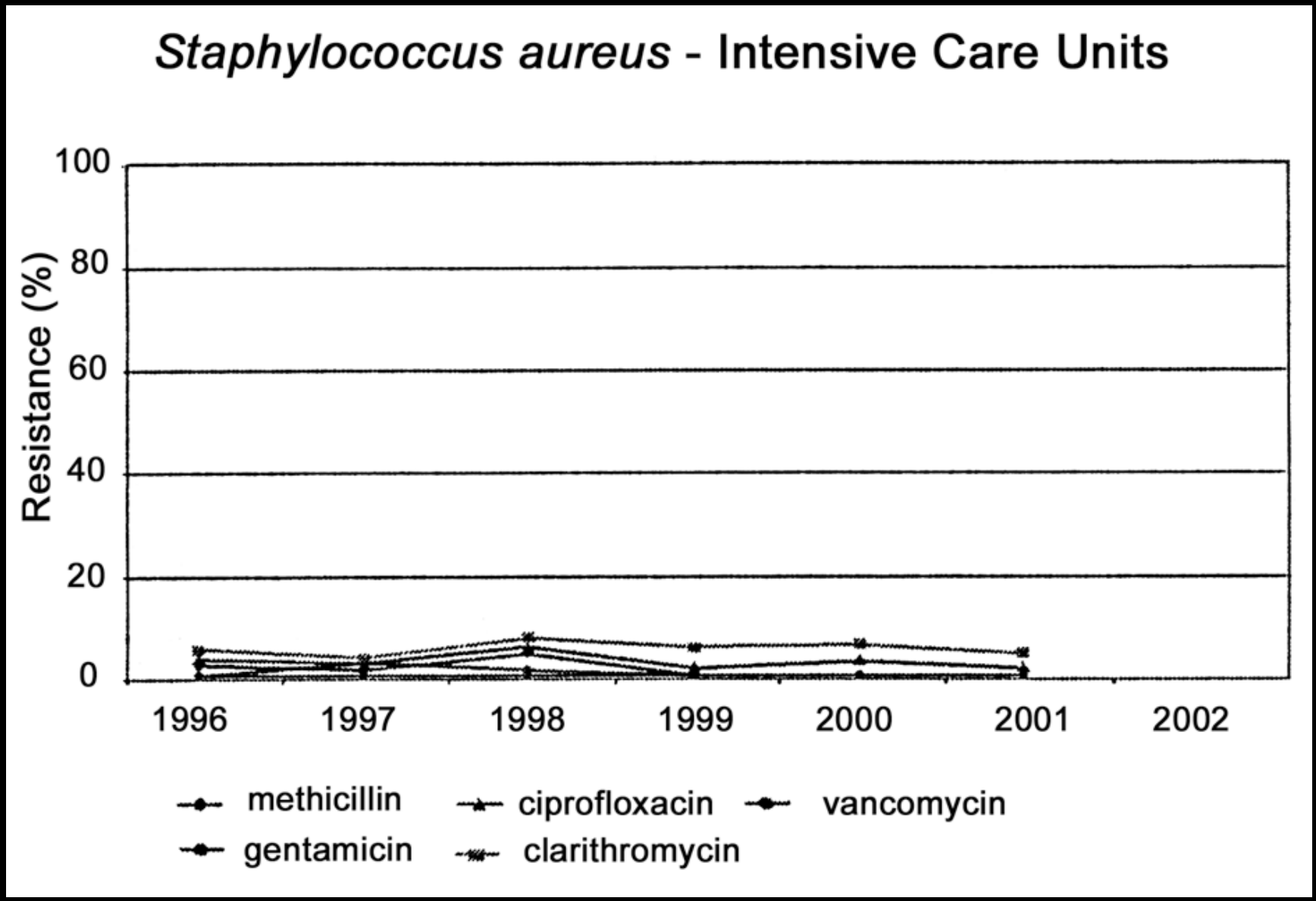
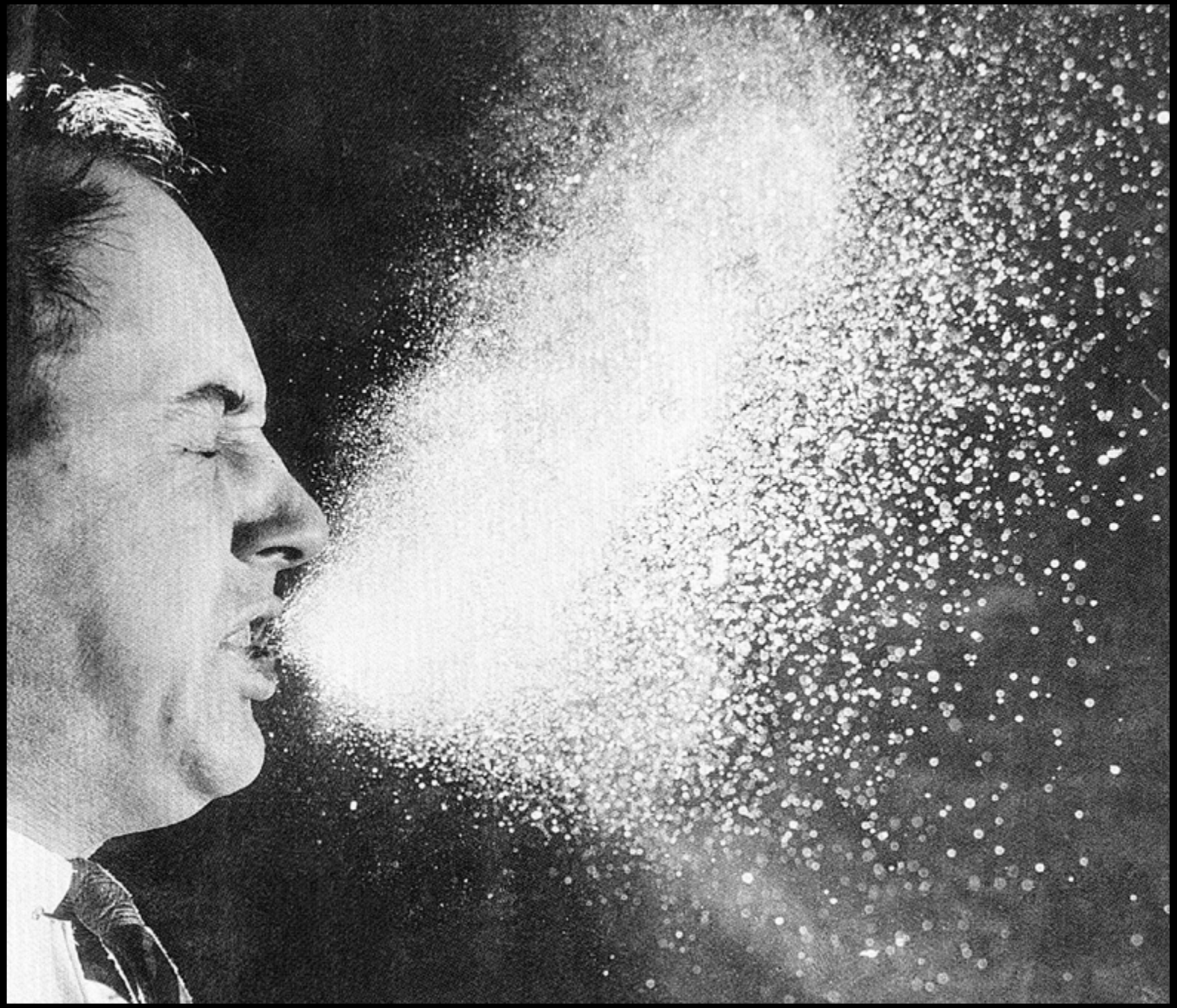


www.swab.nl
www.rivm.nl/earss/

PREVENTION OF RTIs

Strategy	Result
Pneumovax	Prevents pneumococcal bacteremia
Prevar (for peds)	Prevents pneumococcal pneumonia in parents
Influenza vaccine	Reduces antibiotic use for RTIs
Smoking cessation	Reduces AECB and pneumococcal bacteremia etc.
3 foot rule	Reduce transmission of viral URIs



THE NETHERLANDS: RTIs

Upper respiratory tract infections

- Discourage consumers
- Physicians who prescribe Abx for URIs are viewed badly

Pneumonia: Doxycycline

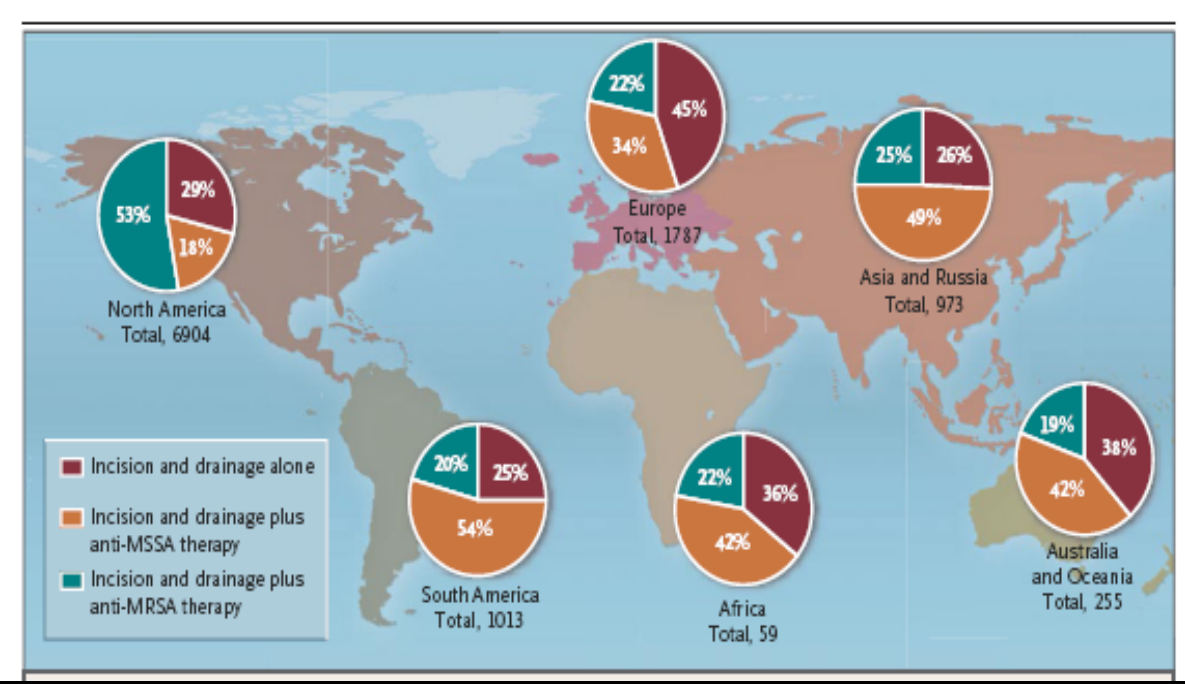

Snort. Sniffle. Sneeze.
No Antibiotics Please.
Treat colds and flu with care.
Talk to your doctor.
As a parent, you want to help your child feel better. But antibiotics aren't always the answer. They don't fight the viruses that cause colds and flu. What will? Fluids and plenty of rest are best. Talk to your doctor. Find out when antibiotics work – and when they don't. The best care is the right care.
For more information, please call 1-888-246-2675 or visit www.cdc.gov/getsmart.
GET SMART
Know When Antibiotics Work
CDC
FDA

Reduce Risk Factors for CA-MRSA (the 6 c's)

- Crowding: correctional facilities, daycare, households
- Contact: MSM, sports, correctional facilities
- Cleanliness: deficient hygiene practices
- Compromised skin integrity: skin cuts and abrasions (sports teams, military)
- Contaminated items: sharing of personal items (towels, razor, health club)
- Colonization: search and destroy strategy?

Begier EM et al CID 2004;39:1446, CDC JAMA 2002: 287;181, Kazakova SV et al., NEJM 2005: 352;468, Davis SL et al JCM 2007:45;1705-11;Bartels MD et al Clin Microbiol Infect 2010;16:78-83

Management of uSSTI: Poll



11,205 participants from 124 countries

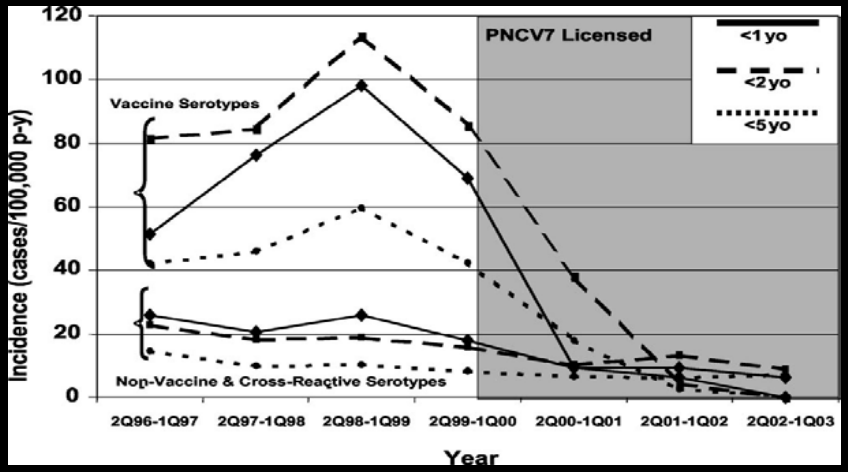
Hammond SP and Baden LR., NEJM 2008;10.1056/mcide0806337 e20

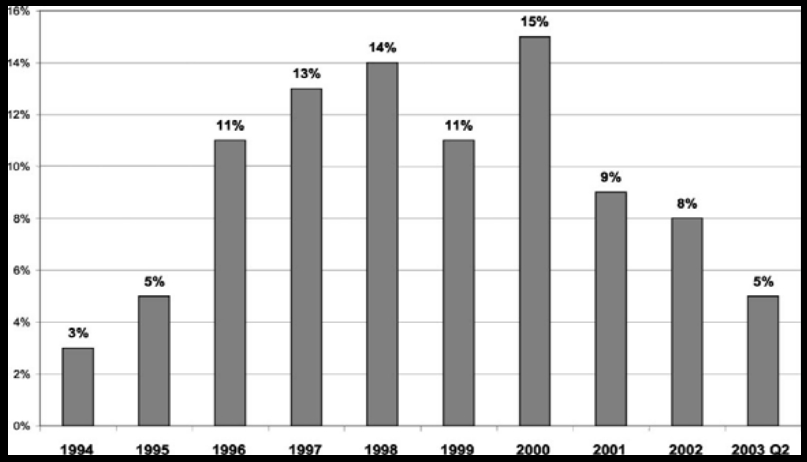
Decline in Invasive Pneumococcal Disease after Vaccine Introduction

- Early 2000, conjugate vaccine licensed for children
- Invasive disease rate dropped from 24.3 to 17.3 cases/100,000 in one year
- Rate of disease caused by strains not sensitive to penicillin dropped by 35% (adults and children)

Whitney et al NEJM 2003:348;1737

Decline in Pneumococcal Invasive Disease and Penicillin Resistance Kaiser Permanente Northern California 157,471 Children





Black S et al Ped Infect Dis J 2004;23:485-9

SHEA/IDSA/IHI Guidelines to Control Hospital Infections

- Monitor bacterial resistance and antibiotic usage
- Control use of antibiotics, modify host risks
- Adopt CDC recommendations for isolation precautions
- IHI: hand hygiene, decontamination of equipment, surveillance, bundles
- Monitor effectiveness by measuring outcomes

Note: The status quo is not working. Many unanswered questions remain about best methods for control

Shlaes DM et al. *Clin Infect Dis.* 1997;25:584-599.

www. IHI. org

Antimicrobial Stewardship

- Formulary control
- Selective susceptibility reporting
- Guidelines for use
- Drug rep restrictions-academic detailing
- Criteria monitored anti-infective
- Restricted anti-infective
- Antibiotic order form: stop orders
- Pharmacy substitution or switch
- Computerized decision support
- Pharmacy, ID review, provider feedback

Stewardship: http://henry.hfhs.org/body.cfm?id=8788
Antibiograms: http://henry.hfhs.org/body_depts.cfm?id=6944
CID 2007;44:159-77

Antibiotic Stewardship Programs in Ambulatory Pediatric Populations

General education	6 outpt	all improved prescribing
Dynamic education	2 outpt	2 decreased antibiotic use
Parent education	4 outpt	2 decreased antibiotic use

Patel SJ et al Ped Infect Dis J 2007;26:531

Antimicrobial Optimization is the answer: It's a delicate balance…

Questions?