

***Perioperative Antimicrobial Resistance
and Infection Control***

The Bugs are Winning, Not the Rats

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Disclaimer

I have no conflicts of interest



**I don't speak for
any commercial
group**

**My research is
not currently
supported by
any
commercial
vendor**

I am not an ID doc!

Lecture goals

Case management review of

- **Our role in preventing periop infection**
- **Touch on life threatening infection**
 - **Dr. Wischmeyer will focus on treatment guidelines for this on Friday**
- **Antimicrobial resistance in US hospitals, ORs/ICUs**
 - Review [CDC.gov/drugresistance/healthcare](https://www.cdc.gov/drugresistance/healthcare) website guidelines to preventing perioperative infection

How did the CRASH 2007 planning committee pick me to give this talk?

- A. I know some really smart ID guys**
- B. I work in a busy tertiary care ICU & ORs & frequently see pts with antimicrobial resistance**
- C. Organizers needed a tall, bearded, & balding guy concerned about ab resistance, pts & his health**
- D. All of the above**

Why does this topic matter?

- **Infectious diseases**
 - **#3 cause of death in U.S.**
 - **#2 worldwide**
- **Hospital acquired infections major cause of morbidity & mortality**
 - **We are part of problem/solution**
 - **Periop infection control & elimination increasingly our responsibility**
- **Public is watching & acting**

Key Take Away Points

- **Wash hands before entering the room or starting a case, performing an invasive procedure, frequently thereafter & between all pts!**
- **Use good technique for CVC placement/procedures**
- **Timely & appropriate ab prophylaxis & use**
- **Maintain periop eu- thermia, glycemia, volemia as able**
- **Avoid hypoperfusion or hypoxia**
- **Antimicrobial resistance a BIG problem**
 - **Sepsis #1 cause of death in med-surg ICUs**

54 y/o 6', 72kg male anesthesiologist presents for a right hemicolectomy

- **Active till fatigued over past 3 - 6 mo**
- **Well controlled HTN on ACEI**
- **Near obstructing colon ca on CT**
 - **Sadly skipped his screening colonoscopy**
 - **Hct - 29, microcytic & hypochromic, FBS - 114, lytes - NI**
 - **ECG - WNL**

Mauermann WJ, Nemergut EC. The anesthesiologist's role in the prevention of surgical site infections. *Anesthesiology* 2006; 105:413-21

- **Surgical site infection (SSI)**
 - **Varies by operation (open vs. closed), surgeon, institution**
 - **Pt has own unique risk factors**
 - **He is anemic, works in an environment with resistance**
 - **2nd most common nosocomial infection**
 - **Account for 17% of hospital acquired infections**
 - **↑ hospital & ICU LOS**
 - **↑ cost**

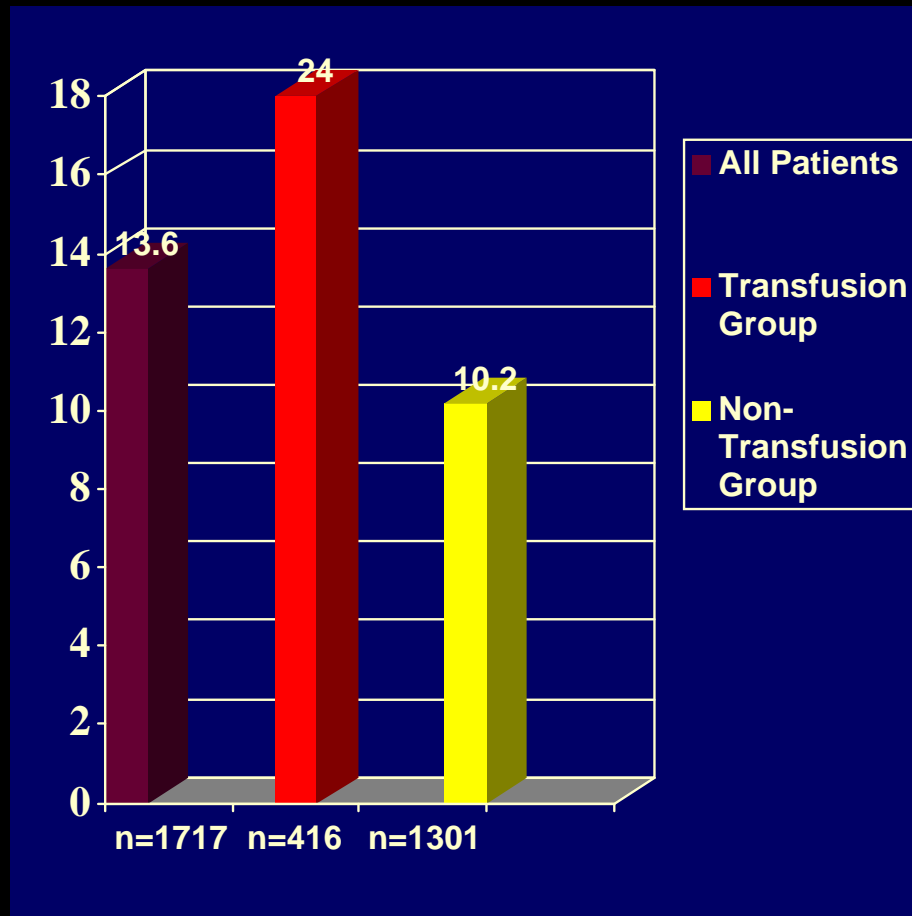
Six Preventive Factors

- **Judicious & properly timed antibiotics**
 - What should we give?
 - Why? When? How often? How long?
 - Say he is allergic to PCN?
 - Kefzol safe? Other?
- **Avoid hypothermia**
 - Easier to avoid than treat
 - Keep > 36° C
 - Best data from colon & abd surg pts
- **Maintain normoxia or hyperoxia**

Preventive Factors

- **Maintain good glucose control**
 - What is a reasonable level
 - Is it the same for all pts?
- **Careful fluid management**
 - Euvolemia, avoid hypovolemia
- **Minimize transfusions**
 - What is a reasonable transfusion trigger?
 - Is it the same for every patient?
 - When do you transfuse?
 - Do you use leukoreduced or poor cells?
 - Alternatives to Tx?

The Impact of PRBCS on Mortality Rates in ICU



**Taylor R, et al. *Crit Care Med* 2002;
30: 2249-54 (retrospective)**

&

**Taylor RBC txs & nosocomial
infections in critically ill pts. *Crit
Care Med* 2006;34:2302-8
(prospective)**

The Impact of packed RBCs (pRBCs) on Mortality Rates in ICU

- **pRBC transfusion is associated with ↑ nosocomial infection in critically ill pts**
 - Association continues to exist when adjusted for severity of illness & age.
- **Mortality rates are significantly ↑ in transfused critically ill pts**
- **Potential to lower this with leukopoor cells or leukoreduction**

***How BIG is the Problem
of Resistant Infection?***

***So Big that even the
lay press writes
about it regularly***



PEOPLE

Deadly Medicine

Killer microbes that threaten tens of thousands of lives lurk in the unlikeliest of places: the hospital



GERMS

Fortune

The killer bug

Staphylococcus aureus,
whose name translates
into English as "golden
bunch of grapes"

So Big

- **Regulators such as JCAHO & governmental agencies are very concerned about it**
 - **AND our role in it & response to it**
- **P4P**

PERSPECTIVE

N Engl J Med Volume 353:225-227

July 21, 2005

Number 3

Infection-Control Report Cards — Securing Patient Safety

Robert A. Weinstein, M.D., Jane D. Siegel, M.D., and P.J. Brennan, M.D.

This is the wave of the future!

This is how we will be benchmarked & tracked.

May impact your livelihood through P4P or Pay for Results!



Campaign to Prevent Antimicrobial Resistance

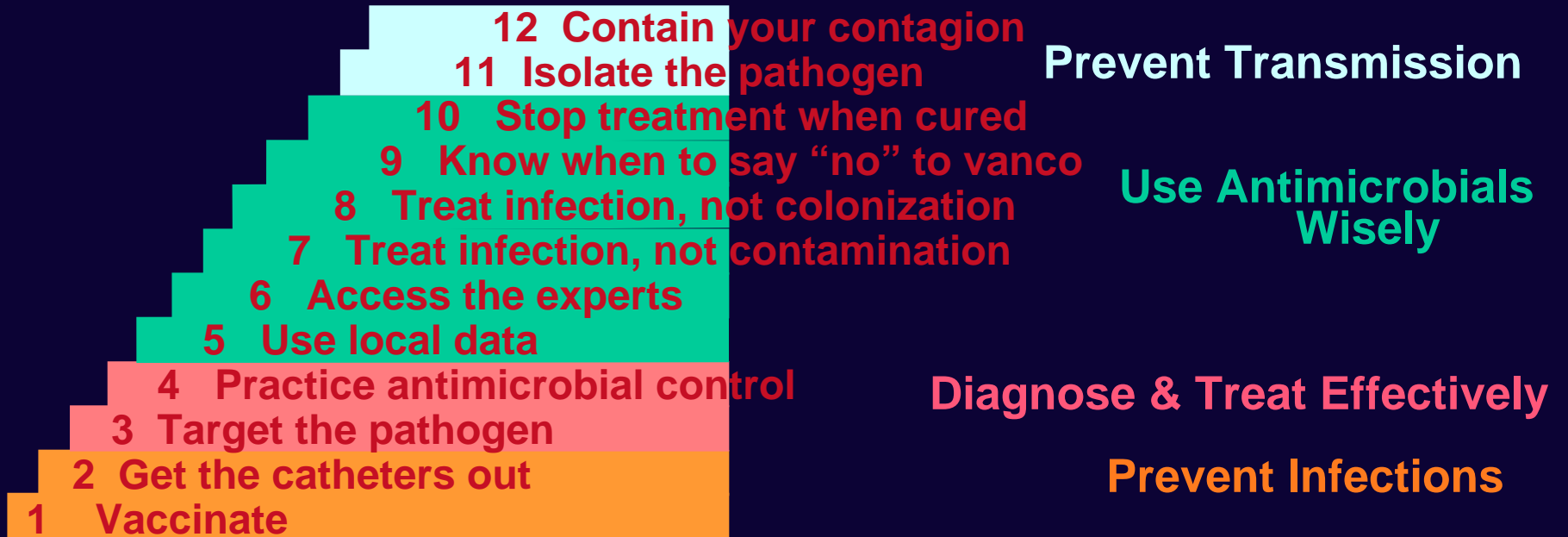
Centers for Disease Control and Prevention
National Center for Infectious Diseases
Division of Healthcare Quality Promotion

Clinicians hold the solution!

➤ Go to: CDC.gov/drugresistance/healthcare



CDC 12 Step Program to Prevent Antimicrobial Resistance: Hospitalized Adults





Prevention is Primary!

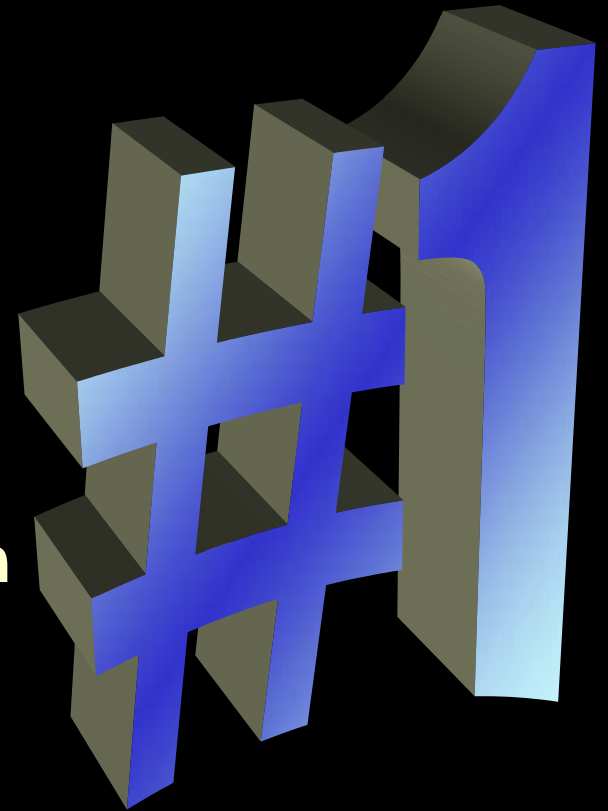
Protect patients.....

Protect healthcare personnel.....

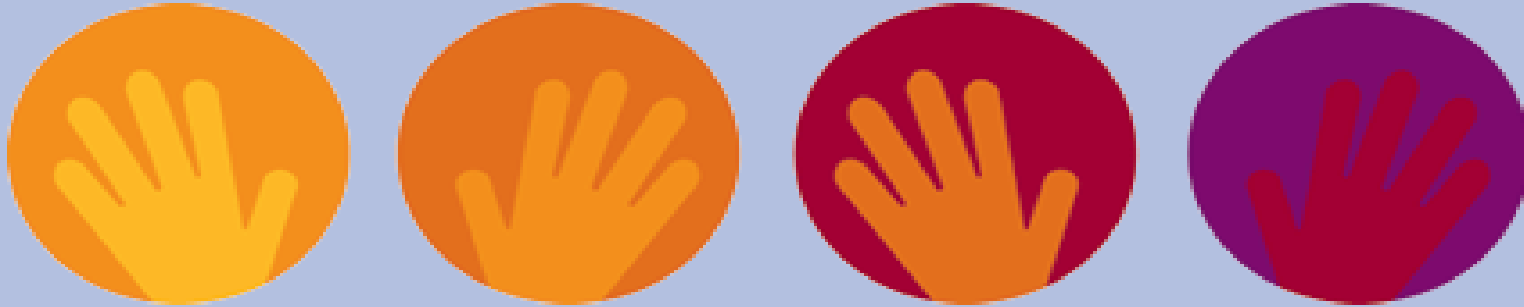
Promote quality healthcare!

Division of Healthcare Quality Promotion

National Center for Infections Diseases



CELEBRATE HAND HYGIENE WEEK



<http://www.cdc.gov/MMWR/preview/mmwrhtml/rr5116a1.htm>

**Only 50% of healthcare workers wash hands between
pts**

Hand flora may be transient or resident

#1 cause of healthcare associated infection

Glove don't eliminate need for hand hygiene

Soiled hands wash with soap & water first

Use alcohol-based as needed

**[Don't work for bacterial spores (*C. difficile*), some non-envelope
viruses, or protozoan oocytes]**

65 y/o presents with partially treated periodontal infection

- **Febrile, lethargic, in shock**
- **Has neck abscess extending into pleural & pericardial space**
- **3/3 + cultures for MRSA, thank goodness not VSRA, but still methicillin resistant**
- **Yikes, what do we do?**
 - **Source control - surgical drainage - OR stat**
 - **Trial of vancomycin & addition of a 2nd drug**
 - **Linezolid or Daptomycin or other**
 - **Surveillance & follow up cultures**

MRSA/VISA/VRSA

- **Varies from institution to institution**
- **MRSA widespread**
- **VISA increasingly common**
- **VRSA first reported to CDC, summer 2002**
- **Linezolid, Daptomycin, Tigacycline, & Synercid treatment for resistant *Staph aureus*, literally the *Grapes of Wrath***
 - **Reports of resistance to Linezolid & Synercid!**

Source Control

“If the doctor in opening an abscess, shall kill the patient, his hands shall be cut off.”

**Code of Hammurabi
King of Babylon,
Former Chief ID, UW
18th century BC**



Septic Shock & Resistance

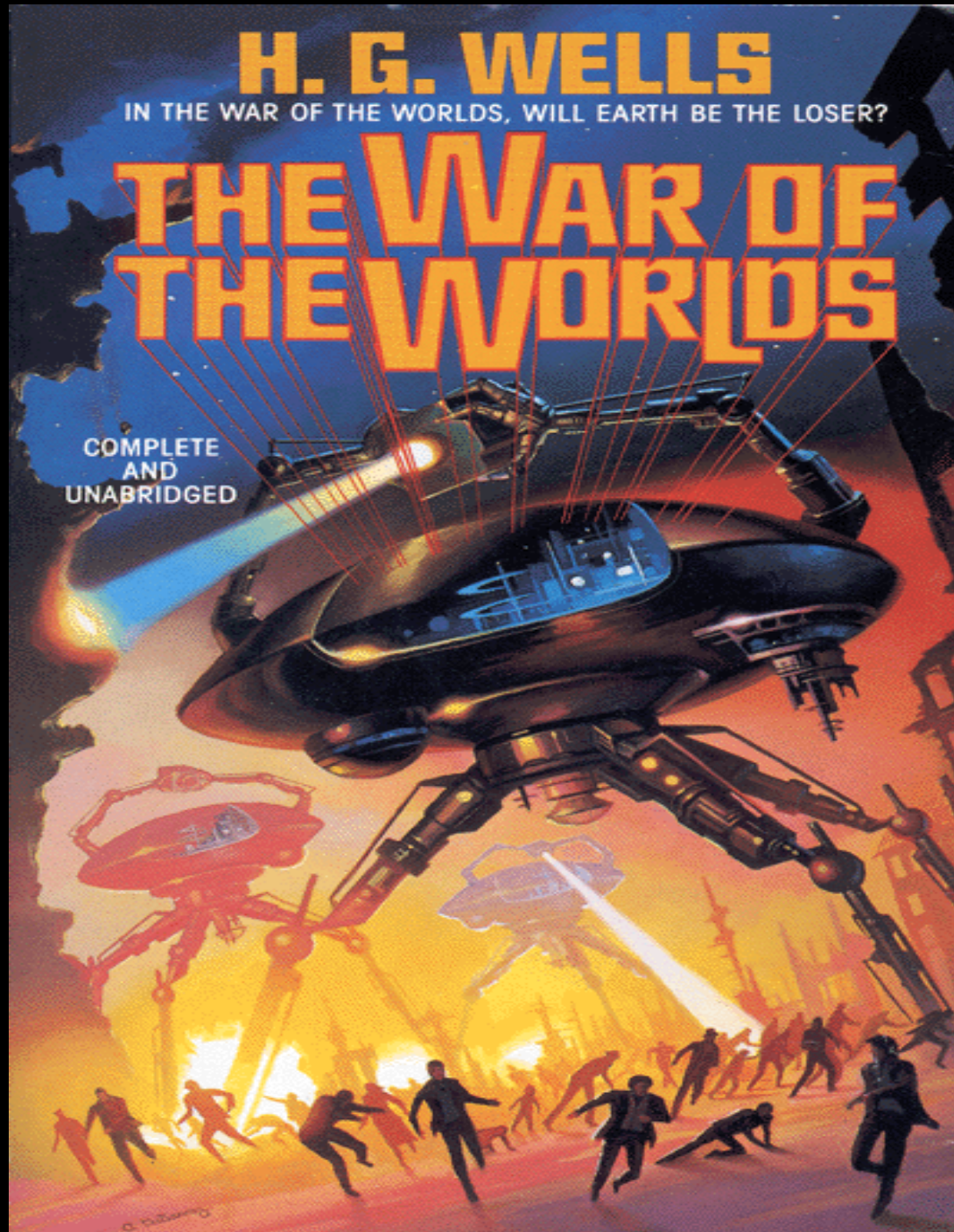
The Ultimate Report

“Dead! Slain by the putrefactive & diseased bacteria against which their systems were unprepared; slain as the red weed was being slain; slain, after all man’s devices had failed, by the humblest things that God, in his wisdom, has put upon this earth.”

Anyone know the source?

Could this be us?

Influenza, MRSA, VRE, GNR, XDR TB, other!



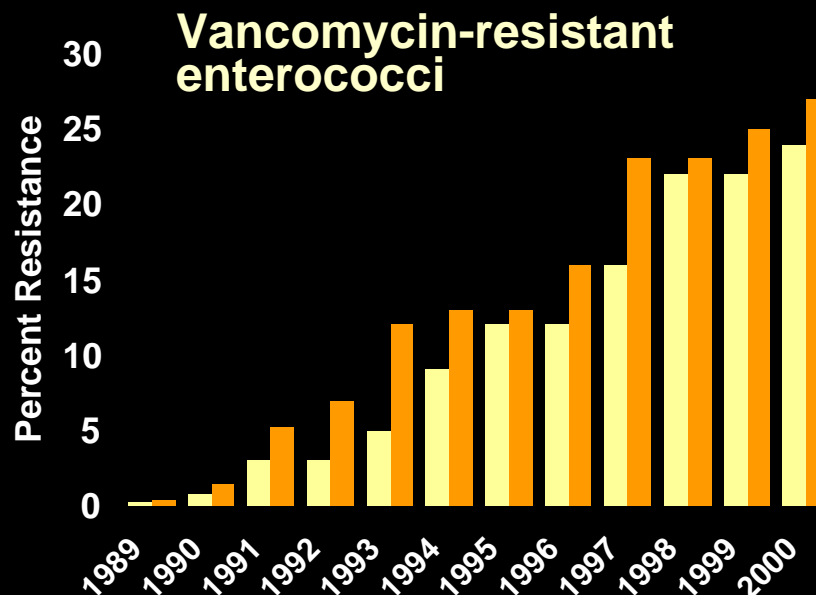
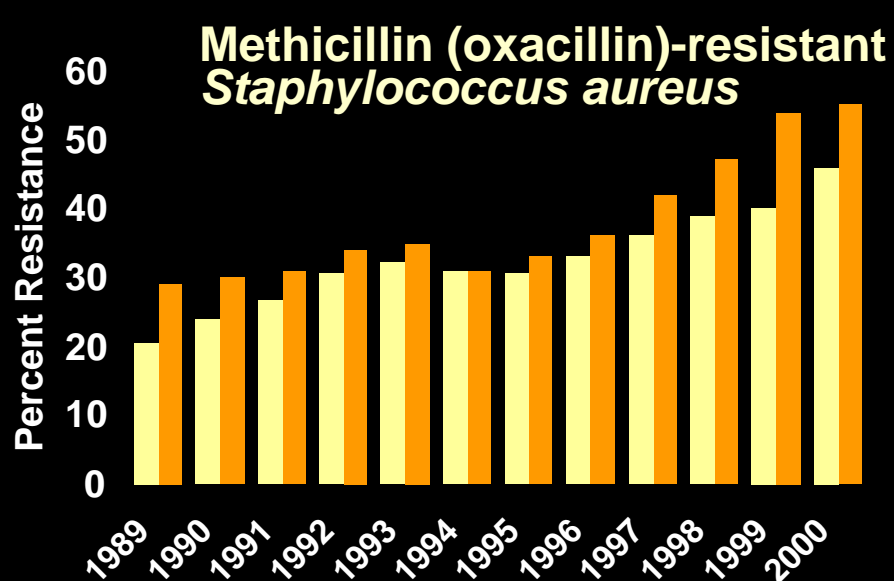
Severe Sepsis Epidemiology*

- **750,000 cases/year**
 - 3 cases/ 1000
 - 2.26 cases per 100 hospital discharges
 - #1 cause ALI/ARDS**
- **51% required ICU**
- **17% required ventilator**
- **100 fold ↑ with age**
- **Mortality 28%**
- **215,000 deaths/year**
 - 500-1,000 deaths/day
- **Cost**
 - \$16.7 billion annually
 - \$22,100 per case
- **↑ 1.5% incidence/year**
- **↑ antibiotic resistance**

* Russell JA. Management of sepsis. *NEJM* 2006; 355:1699-1713

** Incidence of ALI/ARDS *NEJM* 10/20/2005

Antimicrobial Resistance among Pathogens Causing Hospital-Onset Infections - GRAM Positives



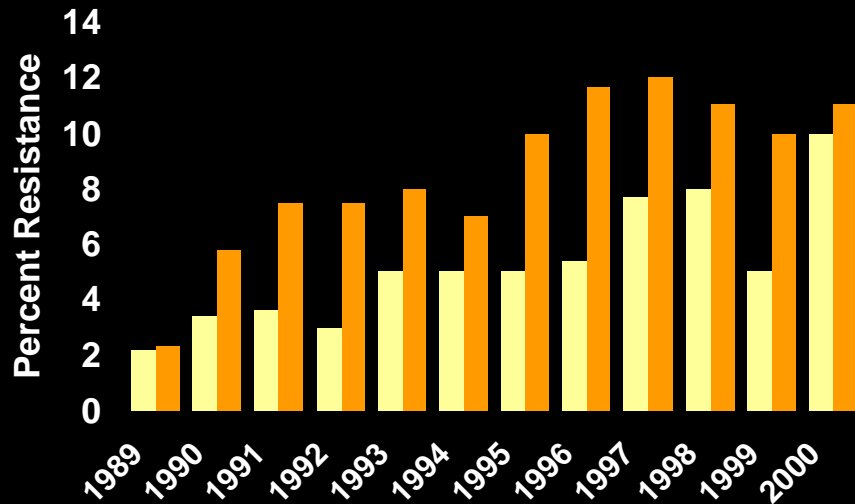
■ Non-Intensive Care Unit Patients
 ■ Intensive Care Unit Patients

Source: National Nosocomial Infections Surveillance (NNIS) System

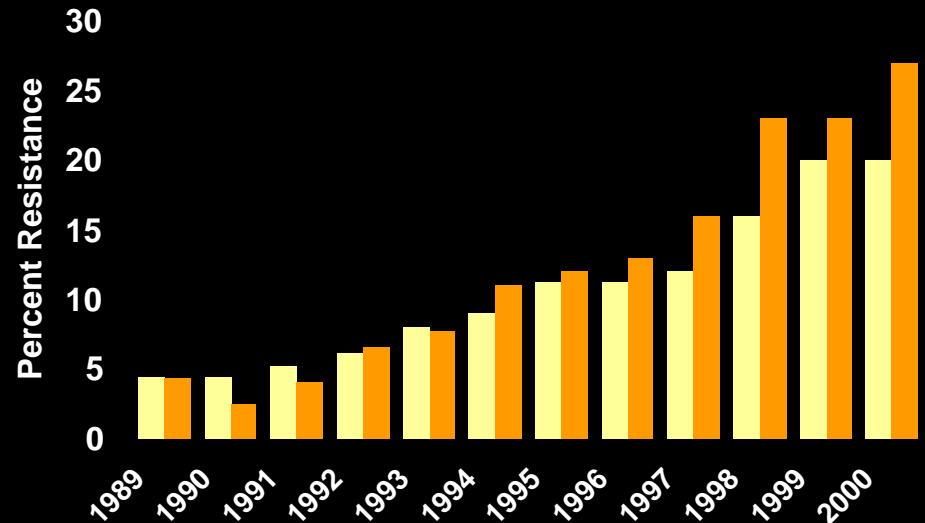
Am J Infect Control. 2003 Dec;31(8):481-98

Antimicrobial Resistance among Pathogens Causing Hospital-Onset Infections GNRs

3rd generation cephalosporin-resistant *Klebsiella pneumoniae*



Fluoroquinolone-resistant *Pseudomonas aeruginosa*



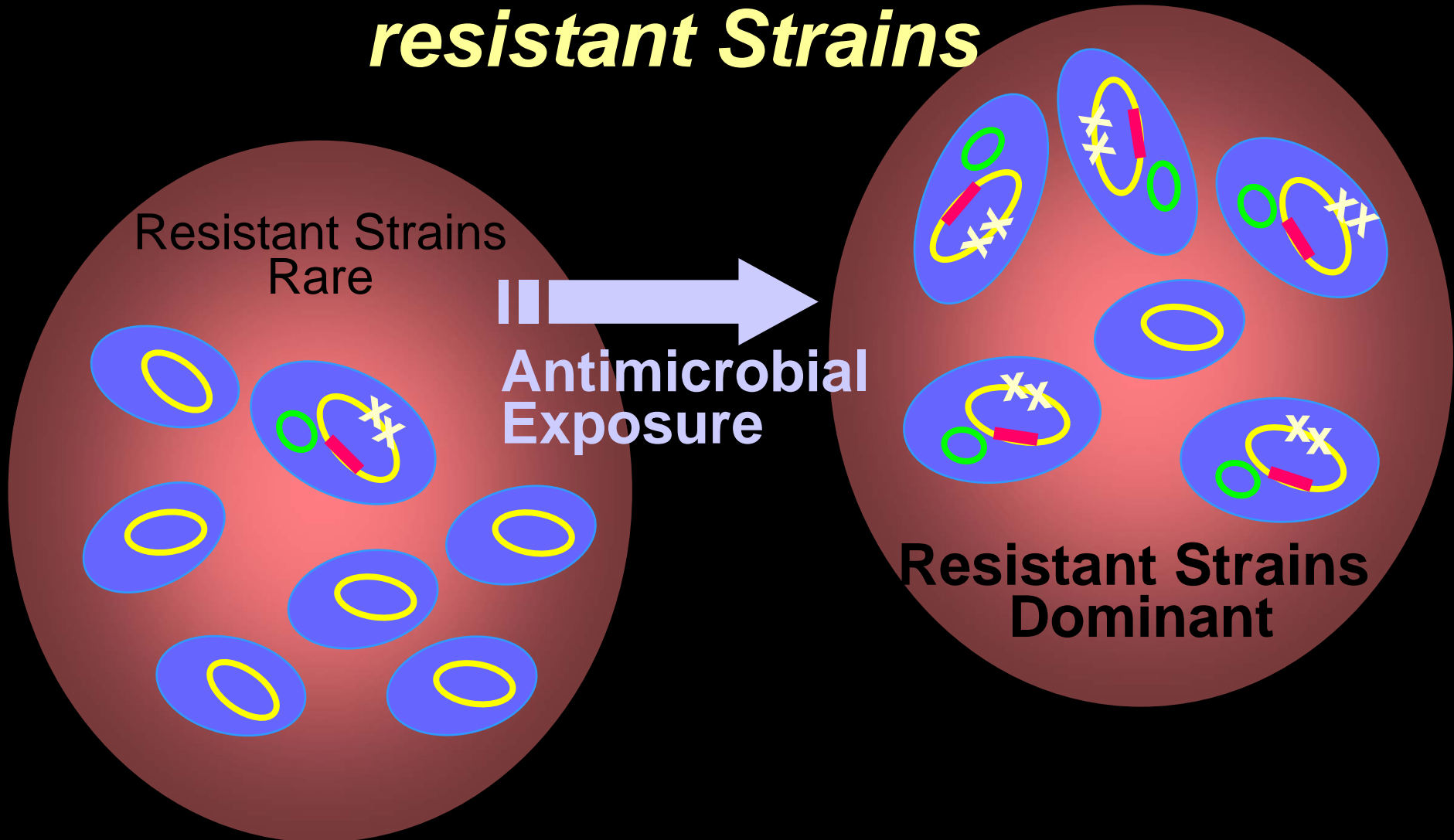
■ Non-Intensive Care Unit Patients
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Selection for antimicrobial resistant Strains



Influence of Antibiotic-Resistant Organisms on OR/ICU Patient Outcome

- **Mortality ↑**
 - For infection with resistant organisms compared with no infection
 - For infection with resistant organisms compared with infection with sensitive organisms
 - If resistance this increases the likelihood of inadequate therapy
- **Prolongs length of stay**
 - ICU & hospital
 - Prolongs mechanical ventilation, other therapies
 - Greater incidence of tracheostomy

Influence of antibiotic-resistant organisms on ICU patient outcome

- **More costly therapy**
 - **More expensive antibiotics, multiple antibiotics, prolonged duration of antibiotic Rx**
- **Overuse of specific antibiotics may diminish efficacy for other organisms in other pts, necessitating more costly alternatives**
- **Need for more costly management**
 - **Isolation & associated expense:**
 - **Private room, gowns, gloves, negative pressure ventilation, cleaning of utensils and medical equipment**
- **Delay in return to functional status**

Antimicrobial Resistance More Common in Patients With.....

- **Prolonged ICU stay**
- **Prior therapy with antibiotics**
- **Increasing severity of illness**
- **Older age**
 - Think of the nursing home patient
- **Therapy with invasive devices**
 - Central venous catheters
 - Tracheal intubation
 - Foley catheters

Why is resistance developing?

- **Dummies when it comes to infection control & antibiotic use!**
 - **Excess antibiotic pressure, poor infection control & isolation techniques!**
- **Bugs smarter than we give them credit!**
- **Slower development of newer, effective drugs!**
- **Mutant strains of bugs selected & then can share their DNA across cultures!**

Antimicrobial resistance develops to bacteria, fungi & viruses

- **More frequent in the critically ill, where...**
 - **Abs with higher resistance potential used**
 - **Immunosuppressed pts**
 - **Older pts with multiple problems**
 - **Bad practices**
 - **Poor ab selection**
 - **Inadequate ab dosing & improper duration**
 - **Excessive & prolonged ab empiric use**
 - **Fail to adjust regimen even when bugs are known**

Antimicrobial resistance

- **Develops with some specific agents, but not always related to class of drug**
 - **Resistance to ceftazidime vs. ceftriaxone with some GNR infections**
 - **Therefore test for a specific drug within a class**
 - **Wiener, J, et al. *JAMA* 1999; 281:517-523.**
 - **Ostrosky & Eliopoulos. *J Intens Care Med* 1999; 14:59-73**

Intrinsic vs. Acquired Resistance

- **Intrinsic resistance is an attribute of a particular species**
 - **Species may lack Ab target or possess natural barriers to Ab function**
 - **Examples**
 - **Vanco resistant GNR do not allow the drug to penetrate the outer cell membrane**
 - **Natural PBPs in *Enterococci* result in resistance to cephalosporins**

Acquired Resistance is the Big Problem

- **This reflects a true change in the genetic composition of a bacterium so that a once effective drug is no longer active**
 - **Various degrees of resistance ranging in spectrum from development of tolerance with need for greater dosing to frank resistance**
 - **Acquired resistance is the KEY PROBLEM!**

Bugs

- **Adapt quickly**
- **Chromosomal, plasmid, & transposon mediated vertical intra-species & horizontal interspecies transmission of resistant genes**
- **Can alter some of these developments by changing practices**

What to do about resistance?

- **Maintain a high index of suspicion for patients at ↑↑ risk**
 - Institutionalized
 - Immunosuppressed
 - Recurrently infected
 - Patients on high anti-microbial pressure

Means to limit resistance

- **Control dose & duration of drugs**
 - Use sufficient dose of antimicrobial
 - Administer the antimicrobial for appropriate & sufficient duration
 - Avoid excess empiric use of antimicrobial agents for
 - Any fever
 - Any patient with leukocytosis
 - Pts who remain culture/source negative, but febrile
 - Contaminated cultures
- **Restrict formulary**
- **Rotate antimicrobials**
- **Did I mention, wash your hands?**

