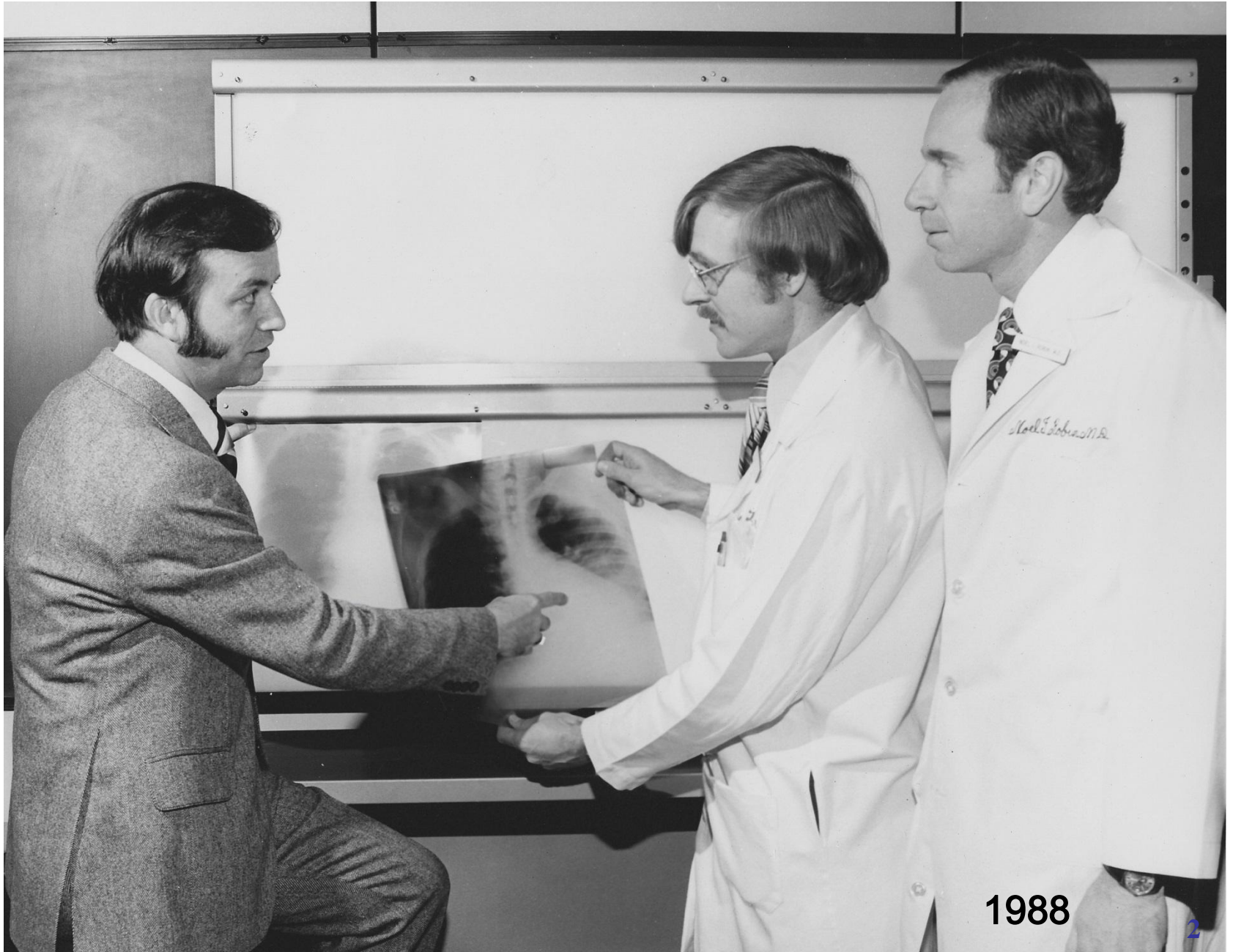




Michael F. Parry, M.D.

Thomas J. Bradsell Chair of Infectious Diseases, Stamford Hospital
Professor of Clinical Medicine, Columbia University P&S

April 2017



1988

THE CRISIS IN ANTIBIOTIC RESISTANCE

Science 257: 1064, 1992.

Dr. Harold C. Neu

The synthesis of large numbers of antibiotics over the past three decades has caused complacency about the threat of bacterial resistance. Bacteria have become resistant to antimicrobial agents as a result of chromosomal changes or the exchange of genetic material via plasmids and transposons. *Streptococcus pneumoniae*, *Streptococcus pyogenes*, and staphylococci, organisms that cause respiratory and cutaneous infections, and members of the *Enterobacteriaceae* and *Pseudomonas* families, organisms that cause diarrhea, urinary infection, and sepsis, are now resistant to virtually all of the older antibiotics. The extensive use of antibiotics in the community and hospitals has fueled this crisis. *Mechanisms such as antibiotic control programs, better hygiene, and synthesis of agents with improved antimicrobial activity need to be adopted in order to limit bacterial resistance.*

BAD BUGS, NO DRUGS

As Antibiotic Discovery Stagnates ...
A Public Health Crisis Brews



A 'slow catastrophe' unfolds as the golden age of antibiotics comes to an end

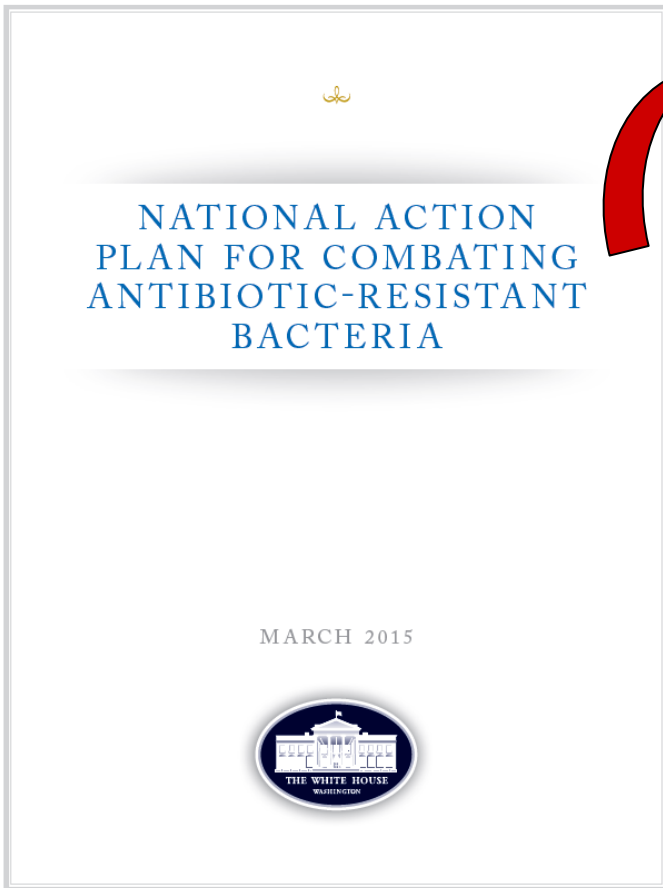


Research scientist Rosslyn Mayback was part of the team that identified a strain of *E. coli* bacteria with a gene that could spread antibiotic resistance. (Walter Reed Army Institute of Research)

By **Melissa Healy**

JULY 11, 2016, 10:05 AM | REPORTING FROM BETHESDA, MD.

In early April, experts at a military lab outside Washington intensified their search for evidence that a dangerous new biological threat had penetrated the nation's borders.



Prepublication Requirements

The Joint Commission has approved the following revisions for prepublication. While revised requirements are published in the semiannual updates to the print manuals (as well as in the online E-dition®), accredited organizations and paid subscribers can also view them in the monthly periodical *The Joint Commission Perspectives*®. To begin your subscription, call 877-223-6866 or visit <http://www.jcinc.com>.



New Antimicrobial Stewardship Standard

APPLICABLE TO HOSPITALS AND CRITICAL ACCESS HOSPITALS

Effective January 1, 2017

Medication Management (MM)

Standard MM.09.01.01

The [critical access] hospital has an antimicrobial stewardship program based on current scientific literature.

Elements of Performance for MM.09.01.01

1. Leaders establish antimicrobial stewardship as an organizational priority. (See also LD.01.03.01, EP 5)

Note: Examples of leadership commitment to an antimicrobial stewardship program are as follows:

- Accountability documents
- Budget plans

Note: An example of an educational tool that can be used for patients and families includes the Centers for Disease Control and Prevention's Get Smart document, "Viruses or Bacteria—What's got you sick?" at <http://www.cdc.gov/getsmart/community/downloads/getsmart-chart.pdf>.

4. The [critical access] hospital has an antimicrobial stewardship multidisciplinary team that includes the following members, when available in the setting:

- Infectious disease physician
- Infection preventionist(s)
- Pharmacist(s)
- Practitioner

Note 1: Part-time or consultant staff are acceptable as members of the antimicrobial stewardship multidisciplinary team.

Note 2: Telehealth staff are acceptable as members of antimicrobial stewardship multidisciplinary team.

Proposed CMS rule on infection control and inappropriate antibiotic use

Today, the Centers for Medicare and Medicaid Services (CMS) proposed new standards to advance healthcare quality and equity in our nation's hospitals. In a proposed rule open for public comment, CMS recommends strengthening Conditions of Participation (CoPs) related to infection prevention and antibiotic prescribing in U.S. hospitals and critical-access hospitals (CAHs).

The rule includes provisions for preventing healthcare-associated infections, stopping spread of antibiotic-resistant germs and reducing inappropriate antibiotic prescribing. Hospitals and CAHs would be required to have and demonstrate adherence to facility-wide infection prevention and control programs, as well as antibiotic stewardship programs.

The proposed rule builds on the Department of Health and Human Services (HHS) quality initiatives, including the [National Quality Strategy](#), the Centers for Disease Control's [Antibiotic Resistance Solutions Initiative](#) and the [Partnership for Patients](#).



National Antibiotic Resistance Trends 2016

Multidrug-resistant organisms -- **MDROs**

ESCAPE pathogens

- ***E***nterococcus (**VRE**)
- ***S***taphylococcus aureus (**MRSA** and **VISA**)
- ***C***arbapenem-resistant Enterobacteriaceae (**CRE** – KPC, NDM-1, etc)
- ***A***cinetobacter (MDR strains)
- ***P***seudomonas (Fluoroquinolone resistant)
- ***E***xtended spectrum beta-lactamase producing GNR (**ESBL** positive *E. coli*, *Klebsiella*, *Enterobacter*)
- plus *Clostridium difficile* (**C diff**)

Impact of Antibiotic Resistance

What happens if the patient gets infected with an MDRO?

| Organism | Increased risk of <u>death</u> (OR) | Attributable LOS (days) | Attributable cost |
|---|--|--------------------------------|--------------------------|
| MRSA bacteremia | 1.9 | 2.2 | \$6,916 |
| MRSA surgical infection | 3.4 | 2.6 | \$13,901 |
| VRE infection | 2.1 | 6.2 | \$12,766 |
| Resistant <i>Pseudomonas</i> infection | 3.0 | 5.7 | \$11,981 |
| Resistant <i>Enterobacter</i> infection | 5.0 | 9 | \$29,379 |

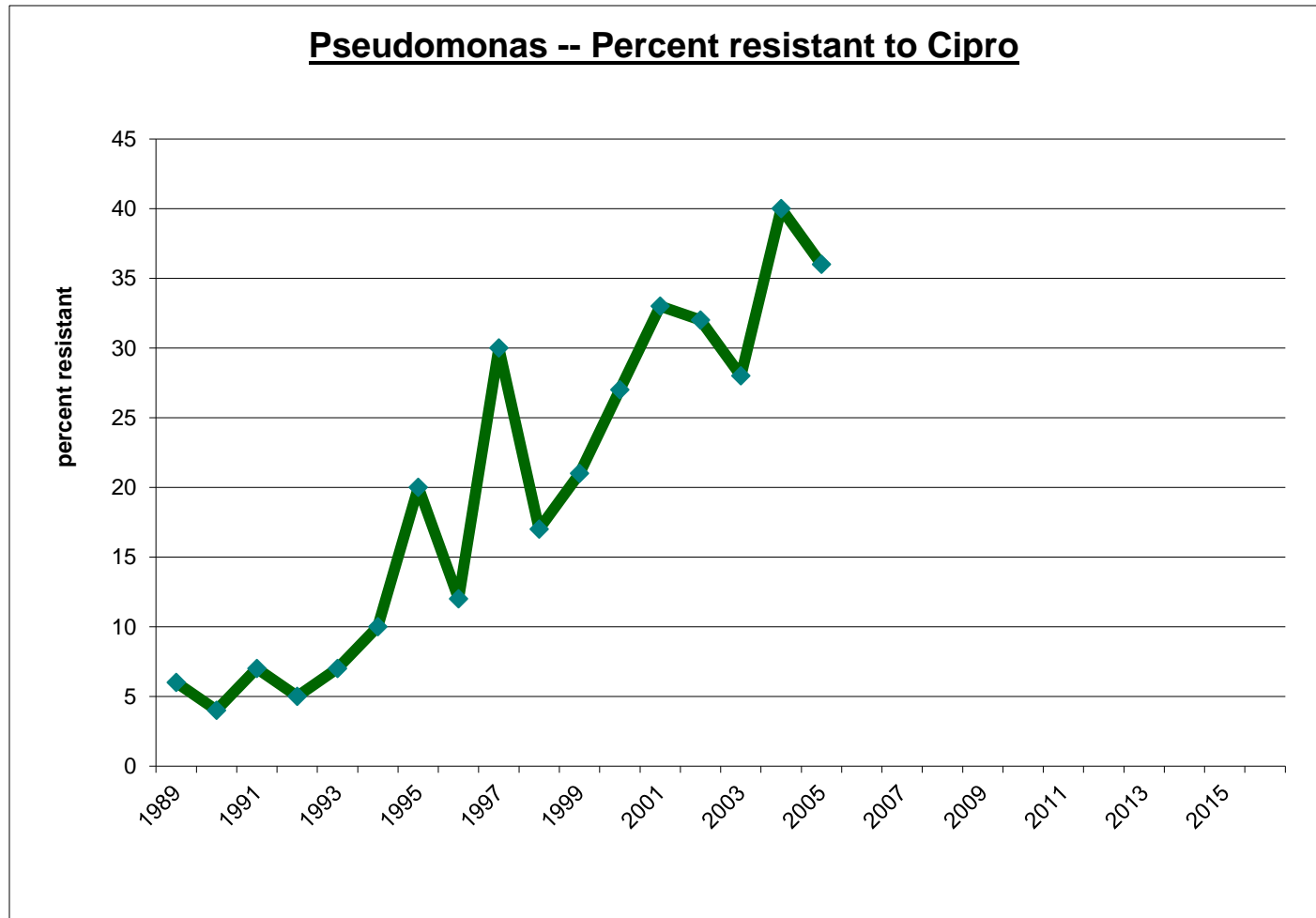
Prevalence of Antimicrobial Use in US Acute Care Hospitals, May-September 2011

Shelley S. Magill, MD, PhD; Jonathan R. Edwards, MStat; Zintars G. Beldavs, MS; Ghinwa Dumyati, MD; Sarah J. Janelle, MPH; Marion A. Kainer, MBBS, MPH; Ruth Lynfield, MD; Joelle Nadle, MPH; Melinda M. Neuhauser, PharmD, MPH; Susan M. Ray, MD; Katherine Richards, MPH; Richard Rodriguez, MPH; Deborah L. Thompson, MD, MSPH; Scott K. Fridkin, MD; for the Emerging Infections Program Healthcare-Associated Infections and Antimicrobial Use Prevalence Survey Team

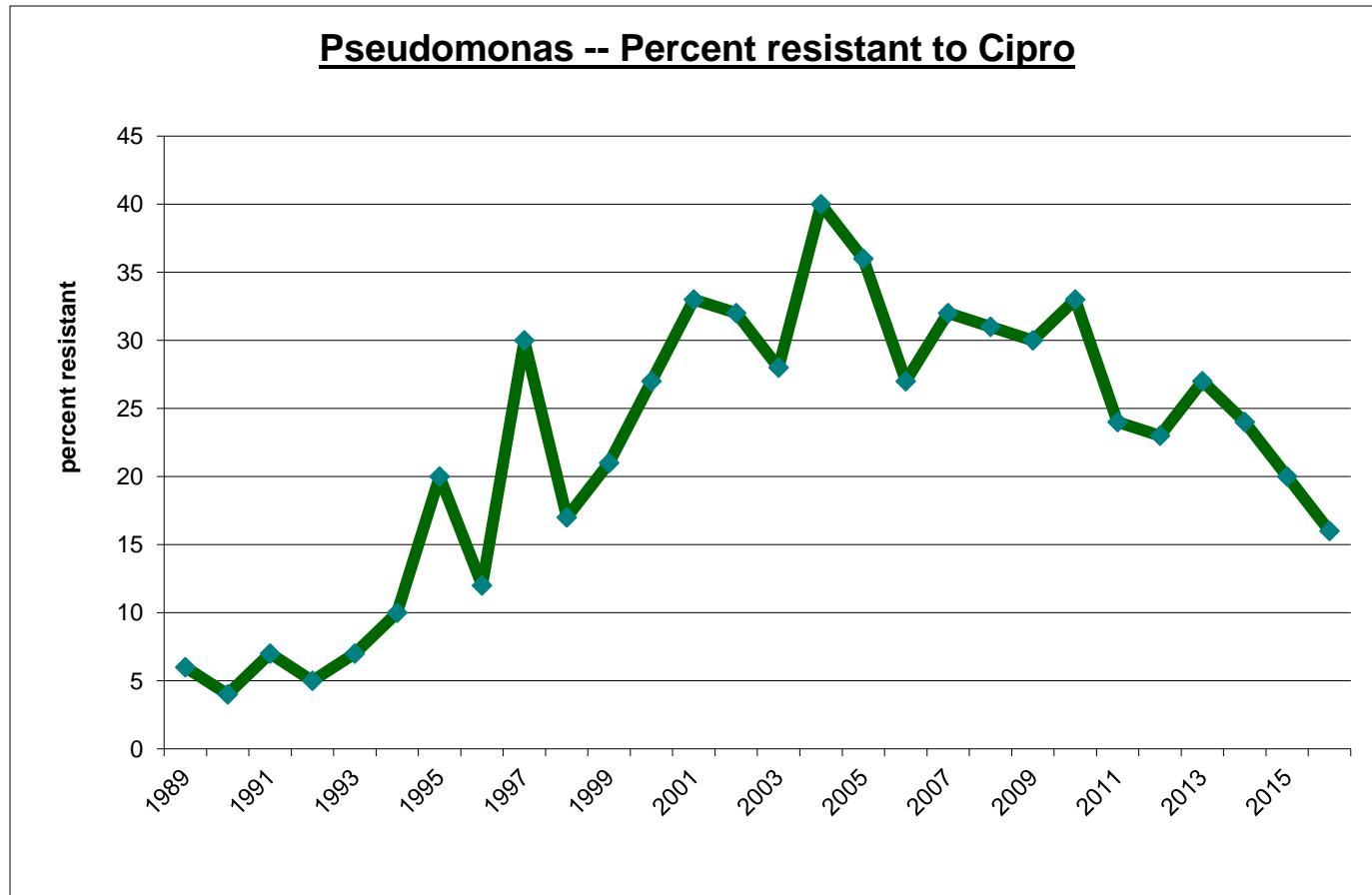
IMPORTANCE Inappropriate antimicrobial drug use is associated with adverse events in hospitalized patients and contributes to the emergence and spread of resistant pathogens. Targeting effective interventions to improve antimicrobial use in the acute care setting requires understanding hospital prescribing practices.

RESULTS Of 11 282 patients in 183 hospitals, 5635 (49.9%; 95% CI, 49.0%-50.9%) were administered at least 1 antimicrobial drug; 77.5% (95% CI, 76.6%-78.3%) of antimicrobial drugs were used to treat infections, most commonly involving the lower respiratory tract, urinary tract, or skin and soft tissues, whereas 12.2% (95% CI, 11.5%-12.8%) were given for surgical and 5.9% (95% CI, 5.5%-6.4%) for medical prophylaxis. Of 7641 drugs to treat infections, the most common were parenteral vancomycin (1103, 14.4%; 95% CI, 13.7%-15.2%), ceftriaxone (825, 10.8%; 95% CI, 10.1%-11.5%), piperacillin-tazobactam (788, 10.3%; 95% CI, 9.6%-11.0%), and levofloxacin (694, 9.1%; 95% CI, 8.5%-9.7%). Most drugs administered to treat infections were given for community-onset infections (69.0%; 95% CI, 68.0%-70.1%) and to patients outside critical care units (81.6%; 95% CI, 80.4%-82.7%). The 4 most common treatment antimicrobial drugs overall were also the most common drugs used for both community-onset and health care facility-onset infections and for infections in patients in critical care and noncritical care locations.

Fluoroquinolone resistance in Pseudomonas (ciprofloxacin)

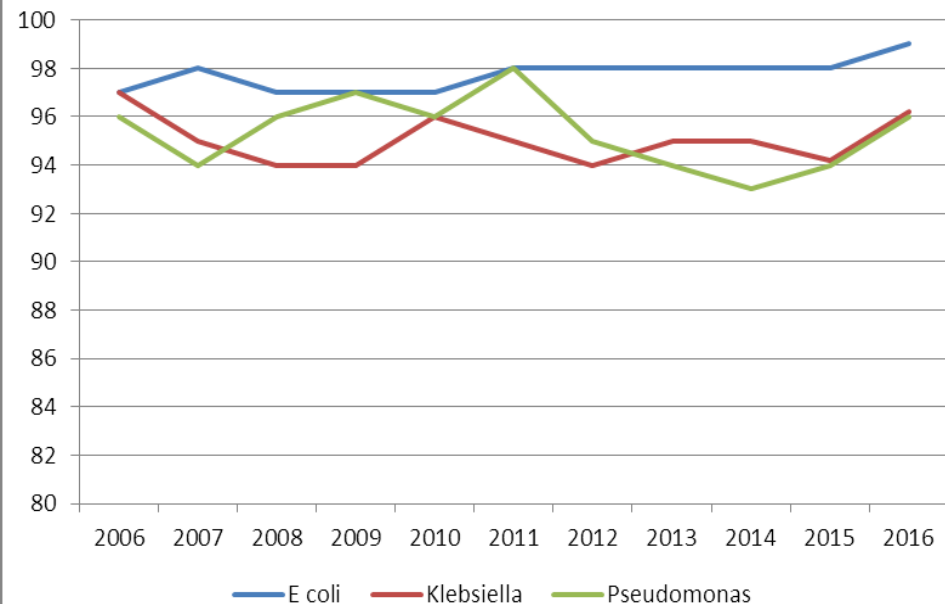


Fluoroquinolone resistance in Pseudomonas (ciprofloxacin)

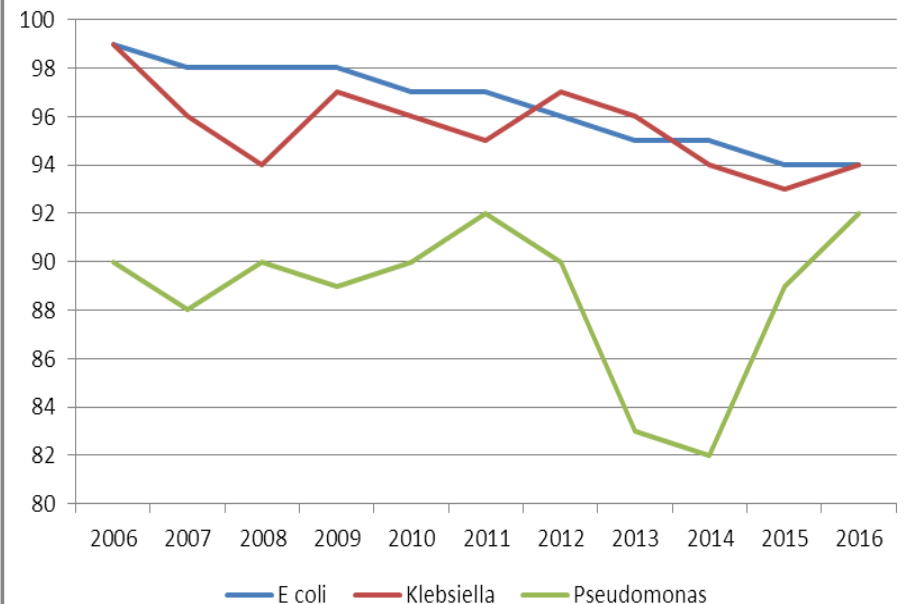


Are our work-horse agents eroding in value due to emerging resistance?

Pip/Tazo Susceptibility Past Decade



Cefepime Susceptibility Past Decade



A Nasty Bug Breaks Out

Drug-resistant staph bacteria now stalk even students

By Lindsay Lyon

The trouble started in May, with a fever and what felt like a lump in her throat. Within days, 12-year-old Spence had a temperature of 102 degrees and was fighting for her life in a hospital, nearly 85 miles from her home. There, doctors told her she had contracted methicillin-resistant *Staphylococcus aureus*, a bacteria expected to live. Immune to antibiotics, the MRSA in her bloodstream reached seventh grade, but only after several operations and in intensive care.

Hunt for the bacteria in the community. In Virginia, health officials are trying to close 21 schools in other states.



Surviving the New KILLER BUG

A nasty, drug-resistant staph infection—is racing across the U.S. usually seen in hospitals—

WHAT YOU CAN DO

Wash your hands frequently with soap and water for at least 20 seconds. Avoid touching your face, especially your nose, mouth, and eyes. Do not share personal items like towels, razors, or clothing. Clean and disinfect surfaces that you touch frequently. If you have a wound, cover it with a bandage and change it regularly. Avoid swimming pools, hot tubs, and saunas. If you are sick, stay home and avoid public places. If you have a fever, sore throat, or skin infection, see a doctor immediately.



The first sign can be a sore throat, a fever, or a skin infection. Sometimes spider bites or scratches become red, tender, or painful abscesses. Wholesome cases like Hui's are rare, but suspicious should get mention. It's frightening side effect: common staphylococci are now pervasive to all antibiotics. Spores can survive for months, even years, in the environment.

To Catch a Deadly Germ

By BETSY McCaughey
Published: November 14, 2006

WHAT kills more than five million people every year? Hospital infections.

- WORLD
- U.S.
- N.Y. / REGION
- BUSINESS
- TECHNOLOGY
- SCIENCE
- HEALTH
- SPORTS
- OPINION

N.Y. / Region

- EDITORIALS
- COLUMNISTS
- CONTRIBUTORS
- LETTERS
- OPINION

Dead Student Had Infection, Officials Say

By WINNIE HU and SARAH KERSHAW
Published: October 26, 2007

New York City health officials said yesterday that a Brooklyn middle school student who died on Oct. 14 had become infected with a drug-resistant strain of bacteria that is primarily spread in hospital settings.

The health officials, who said they were investigating the circumstances of the student's death, were unable to confirm whether the student contracted the infection at the school. The school is located in Canarsie. The school officials said that school officials had decided to close it.

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A11
Wednesday • October 31 • 2007

The ADVOCATE
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Stamford student has staph infection

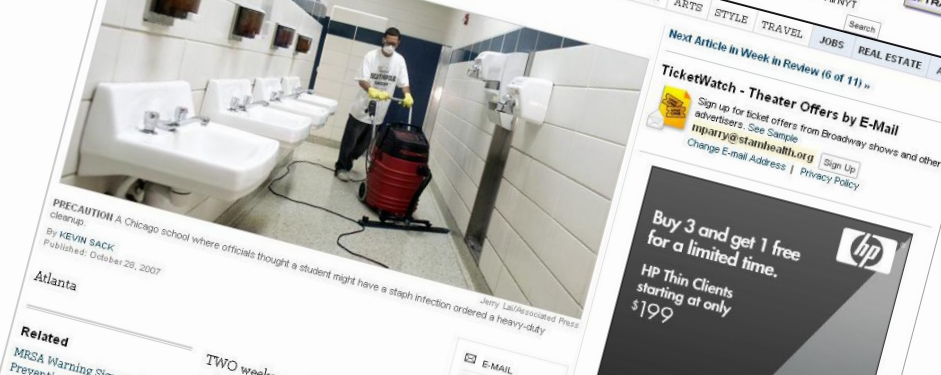
Officials: Northeast school disinfected
By Natasha Lee
STAMFORD — Health and school officials confirmed yesterday that a student at Northeast Elementary School was being treated for drug-resistant staph infection. The school was disinfected Monday evening after officials learned of the case, schools spokeswoman Sarah Arnold said. Students attended class yesterday. The surfaces were washed down thoroughly overnight to

prepare for a safe opening," Arnold said. Principal Ehan Margolis could not be reached for comment. Stamford Hospital notified health and school officials Monday after the student's culture tested positive, said Anne Fountain, a spokeswoman for the Stamford Health Department. The student was taken to the hospital over the weekend after exhibiting symptoms, Fountain said. Methicillin-resistant staphylococcus aureus, MRSA, is a form of bacteria that looks like a boil or pimple and causes open wounds. It is resistant to penicillin-based antibiotics but is treatable with other drugs. The staph infection is common and spread through skin contact or an infected open wound. The state Department of Public Health reported 880 MRSA cases in Connecticut last year, up from 114 in 2001. The child is being treated with antibiotics and will return to school once a doctor approves, Fountain said. According to newspaper reports, the mother of the Brooklyn boy, who died Oct. 14, filed a \$25 million lawsuit yesterday against the New York City Health and Hospital Corp. Fountain said it's hard to track the number of cases in Stamford because doctors are not required to report them.

“We do see a lot of MRSA cases over the years, but there have been some very serious cases in the media lately that have really put it on the forefront,” she said. Residents should not panic, she said. Two weeks ago, the released

Week in Review

A (Sometimes) Deadly Scourge



PRECAUTION A Chicago school where officials thought a student might have a staph infection ordered a heavy-duty cleanup.
By KEVIN SACK
Published: October 28, 2007
Atlanta

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- Related
- MRSA Warning Signs and Preventive Measures
- Two weeks ago, the released

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“Community-acquired” MRSA

- 1988: first appearance of sporadic cases
- 1993-1995: University of Chicago Children’s Hospital -
 - 25-fold increase in CA-MRSA
 - Different sensitivity pattern noted in some
 - Cellulitis and abscesses
- 1999: Minnesota and North Dakota – 4 pediatric deaths
- 2002–2003: clusters of cases in athletes, IVDU’s, gay men
- 2004–2007 prevalent in many communities



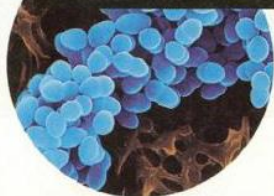
Clusters of CA-MRSA in athletes

risk factors

- Football, rugby, wrestling
- Towel and soap sharing
- Turf burns, other sites of abrasion
- Body shaving
- Suboptimal hygiene in players, trainers
- BMI (e.g. linemen)
- Prior antibiotic use
- Poor maintenance of equipment (e.g. whirlpools)
- Relatively little nasal carriage

Surviving the New

KILLER



BUG

A nasty, drug-resistant staph infection—the kind usually seen in hospitals—is racing across the U.S.

By CHRISTINE GORMAN

JEWAUN SMITH, A 9-YEAR-OLD BOY FROM Chicago, is lucky to be alive. A scrape on his left knee that he picked up riding his bike last October turned into a runaway infection that spread in a matter of days through the rest of his body, leaving his lungs riddled with holes. Jewaun managed to survive, but what worries doctors most about his near-death experience is that it's not an isolated case. The bacteria that infected his knee has become resistant to the most common antibiotics and is on the march across the U.S. It has spread rapidly through parts of California, Texas, Illinois and Alaska and is beginning to show up in Pennsylvania and New York.

"This bug has gone from 0 to 60, not in five seconds but in about five years," says Elizabeth Bancroft, a medical epidemiologist at the Los Angeles County Department of Health Services. "It spreads by contact, so if it gets into any community that's fairly close-knit, that's all it needs to be passed."

This is not bird flu or SARS or even the "flesh-eating bacteria" of tabloid fame. But it

is every bit as dangerous, even if it goes by an uncommonly ungainly name: community-acquired methicillin-resistant *Staphylococcus aureus* (MRSA).

Never heard of it? Neither have most doctors. But major new health threats don't usually announce themselves with press releases. A quarter of a century ago, the world learned about the AIDS epidemic because a health bureaucrat noticed an uptick in prescriptions for treatment of a rare pneumonia. In 1912—more than a half-century before the Surgeon General's report—a New York physician chronicled "a decided increase" in lung cancer, which was considered rare at the time, and suggested that cigarettes might be the cause.

Which helps explain why infectious-disease specialists in the U.S. are so alarmed by the new killer bug. "We're out here waving our arms, trying to get everyone's attention," says Dr. Robert Daum, director of the University of Chicago's pediatric infectious-disease program, who was one of the first to call attention to the rapid spread of MRSA, back in 1998. "People talk about bird flu, but this is here now."

Hospital workers know all about drug-

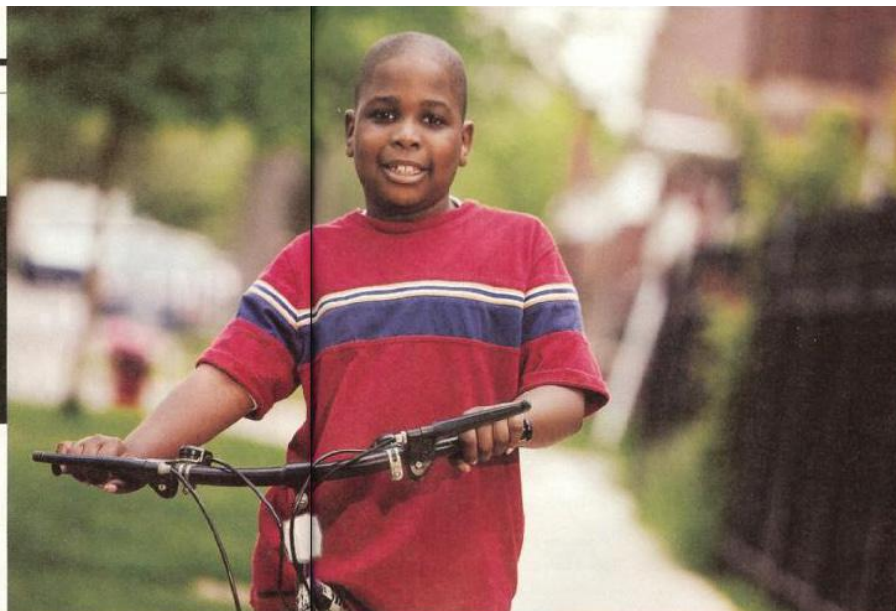


PHOTO: BOB BULL

resistant bacteria. Several strains have been making the rounds of the biggest hospitals for the past 15 years or so, often posing a greater risk for patients than the condition they were admitted for. But until the late 1990s, epidemiologists assumed that the problem was restricted to large hospitals and nursing homes.

The MRSA strains turning up in the community at large are related to but different from the ones found in medical institutions. The hospital variety usually requires intervention with powerful intravenous antibiotics and is pretty hard to catch. By contrast, the new strains of MRSA respond to a broader range of antibiotics but spread much more easily among otherwise healthy folks. The bugs can be picked up on playgrounds, in gyms and in meeting rooms, carried on anything from a shared towel to a poorly laundered necktie.

One of the difficulties in tracking MRSA is that doctors rarely check for it. The standard test usually takes a couple of days, and hardly any doctors do it anymore because everyone assumes that most skin infections



▲ ALL BETTER NOW
Jewaun was riding a bike last fall near his Chicago home when he got the scrape that caused all the trouble

◀ IN THE HOSPITAL
By the time Jewaun was admitted, the infection had spread throughout his body, leaving his lungs riddled with holes

respond to the usual antibiotics. "HMOs aren't going to be paying for you to do a culture on what they consider to be a [common] skin lesion," Bancroft says.

The ubiquity of staph bacteria adds to the problem. The germs are part of the usual microscopic landscape of your outer and inner skin, including the mucus linings of the nose. Most of those bacteria

don't cause illness, and in fact their presence is a good thing, since they can crowd out more dangerous pathogens. But every once in a while, the good guys take a beating, and one of the bad guys, like MRSA, takes hold, colonizing the skin.

Even when that happens, it doesn't necessarily signal an emergency. The skin, after all, is an effective barrier against many kinds

of threats. But anytime you get a break in that barrier—even a tiny cut—there's a chance some bacteria will get inside and infect the wound. What makes MRSA germs particularly dangerous is that they excrete a potent toxin that attacks the skin, causing an abscess that's often mistaken for a spider bite. Normally, the body can wall that area off. But if the infection spreads, treatment with antibiotics may be called for.

And that's the problem. Doctors have grown used to prescribing antibiotics like oxacillin or cephalexin in that situation. It's not clear if that long-standing habit helped the bugs grow resistant in the first place. But what is abundantly clear is that those standard treatments are no longer effective.

There's another factor that makes the community-based MRSA so dangerous, one that has been revealed only recently by genetic analysis. In addition to their normal chromosomal DNA, staph and other bacteria like to mix and match genetic information by exchanging short strips of DNA called cassettes. Some of those cassettes carry genetic instructions to do two things at once: confer antibiotic resistance and make the host even more susceptible to infection. "MRSA is where resistance and virulence converge," says Daum.

What epidemiologists still can't explain, however, is how that particular bug manages to get around to so many cities and towns yet has left others relatively unscathed—at least so far. Cases of the new MRSA strain have only just started cropping up in New York City, for example. "We've been waiting for this to happen," says Dr. Betsy Herold of Mt. Sinai. "Now, we're in a unique position to watch it unfold and to find out why it's happening."

Meanwhile, there are things you can do to protect yourself (*see box*). To prevent more bugs from developing resistance, it's important to remember that not all skin infections need antibiotic treatment, even MRSA. "A garden-variety infection is still a garden-variety infection," says Dr. Philip Graham at New York-Presbyterian's Children's Hospital in New York City. "If your cuts and scrapes are acting like they always do, don't worry."

If, however, you or a loved one is running a high fever, has a lot of redness or shows signs that an abscess is forming, you need to get to a doctor right away. "It never hurts for a patient to say something like, 'Could this be an MRSA infection?'" says Dr. Jack Edwards, chief of infectious disease at Harbor-UCLA Medical Center in Los Angeles. It could make all the difference in the world. —Reported by Wendy Cole/Chicago and Dan Cray/Los Angeles

WHAT YOU CAN DO

Try to avoid cuts and scrapes as much as possible. Wear gloves to protect your hands while gardening, doing repair work or tinkering in the garage.

Thoroughly clean even superficial wounds with soap and water. Do not use hydrogen peroxide. Cover wounds with a clean, dry bandage.

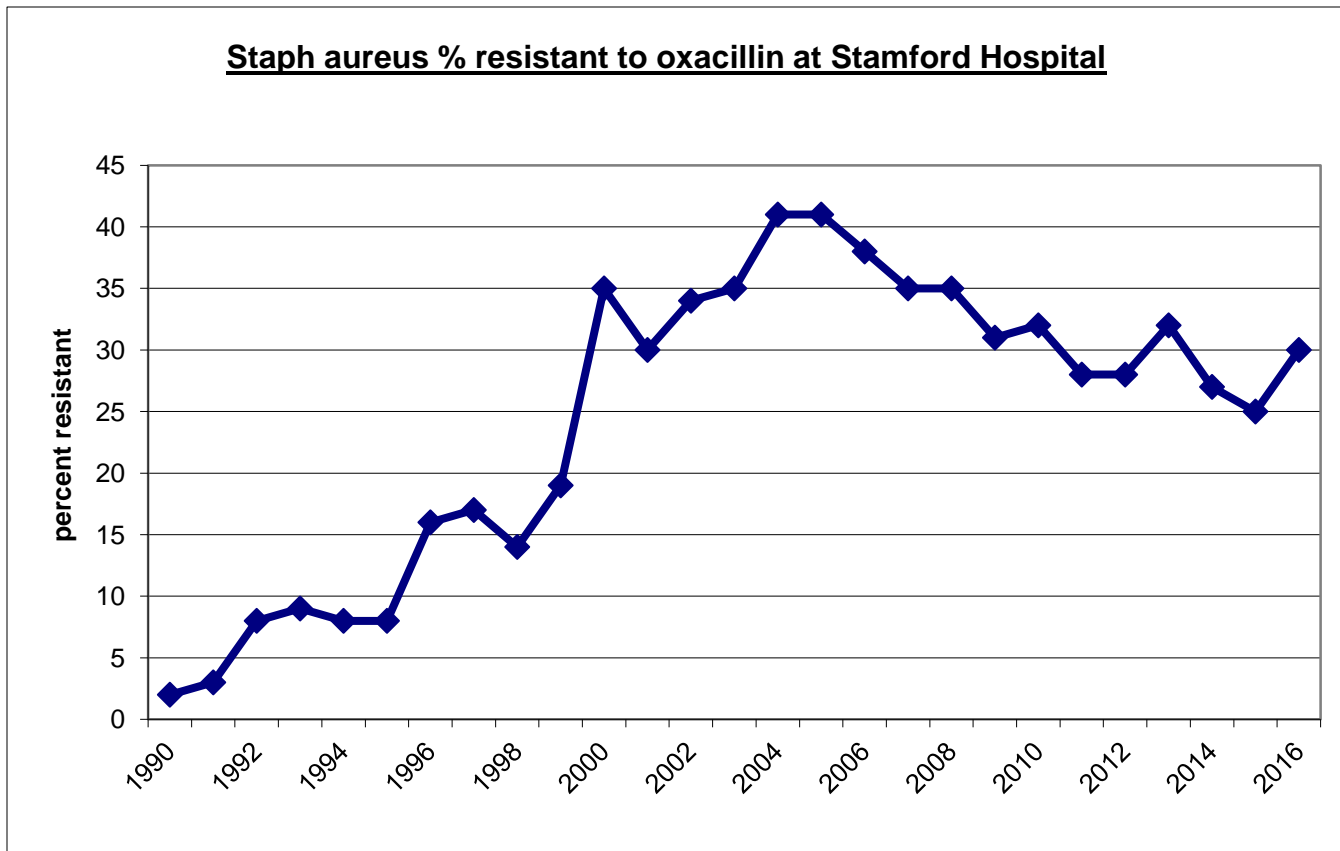
Wash your hands regularly and insist that any clinician examining you or a loved one do so too. Soap disrupts many parts of the germ at once, making resistance difficult.

Don't share towels or other linens. Make sure that all laundry is properly washed at 120°F or higher (unless a low-temperature detergent is used) and dried at 180°F.

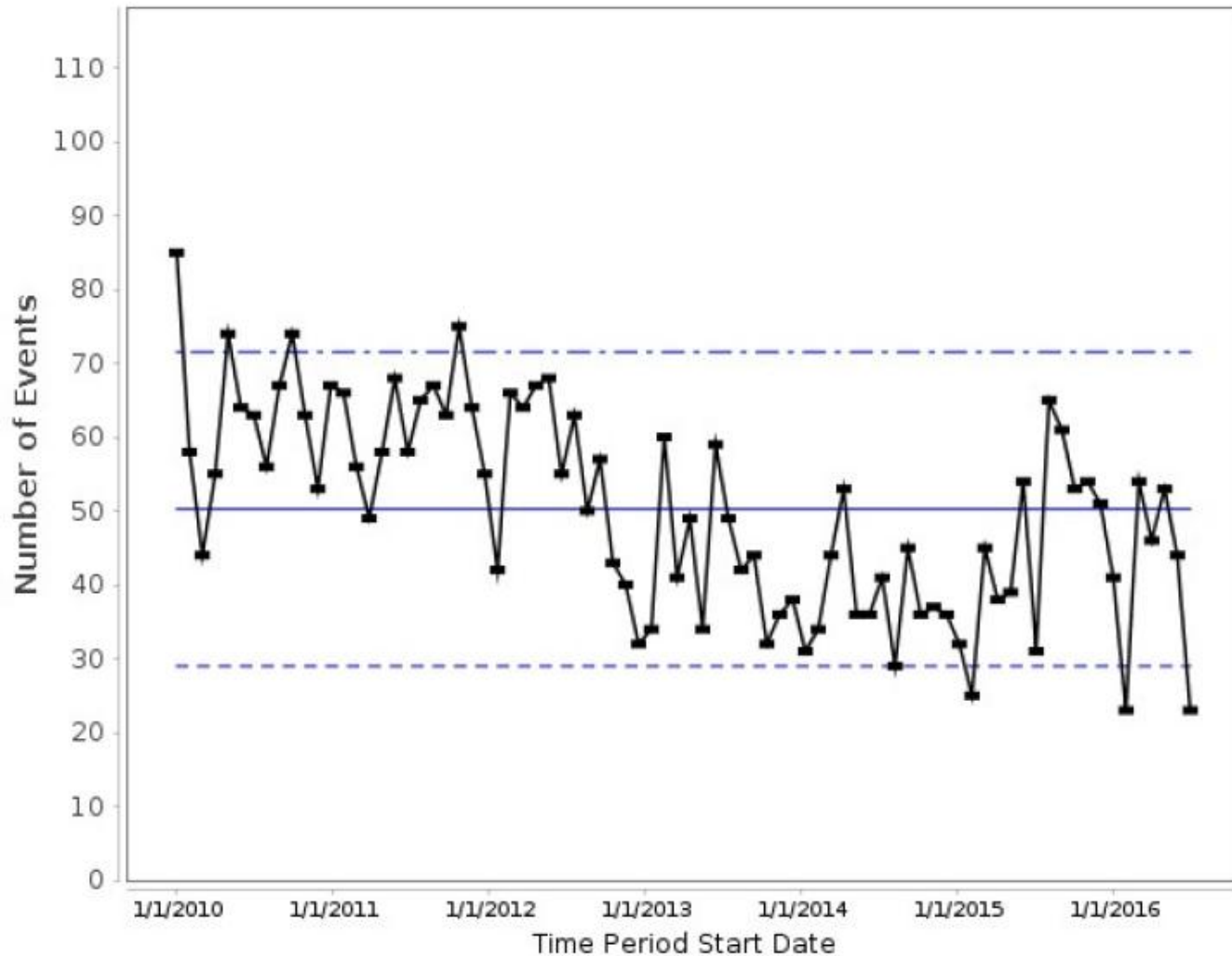
How should we control MRSA?

- Hand sanitation!
- Isolation of proven / suspect MRSA
- Pre-emptive screening for MRSA
 - Nursing home admissions
 - Transfer from other acute care institutions
 - Admissions from WCC's
- Routine barrier precautions (CCU)
- Antibiotic controls

Emergence of MRSA over 20 years Stamford Hospital Microbiology Lab data (community and hospital strains)



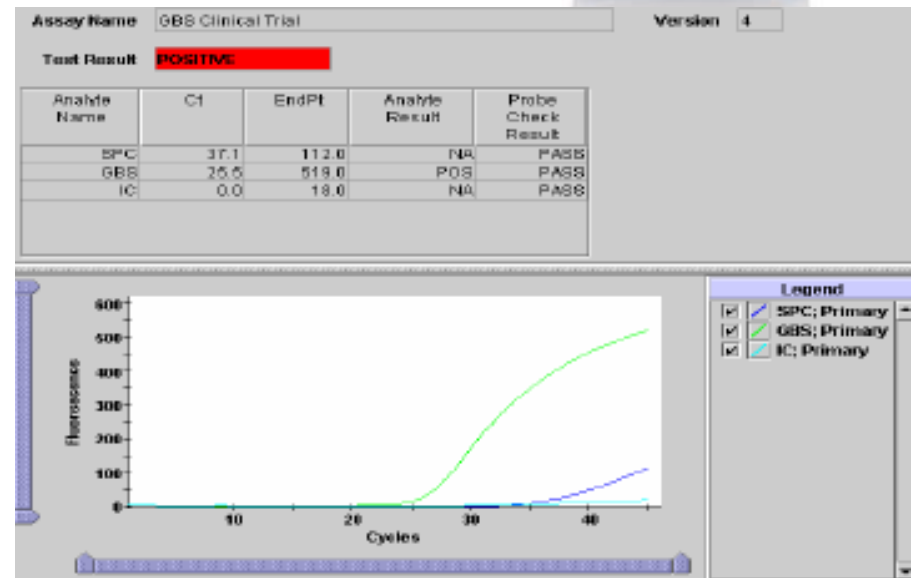
Stamford MRSA Prevalence is Declining



Stamford Hospital Screening Program for MRSA



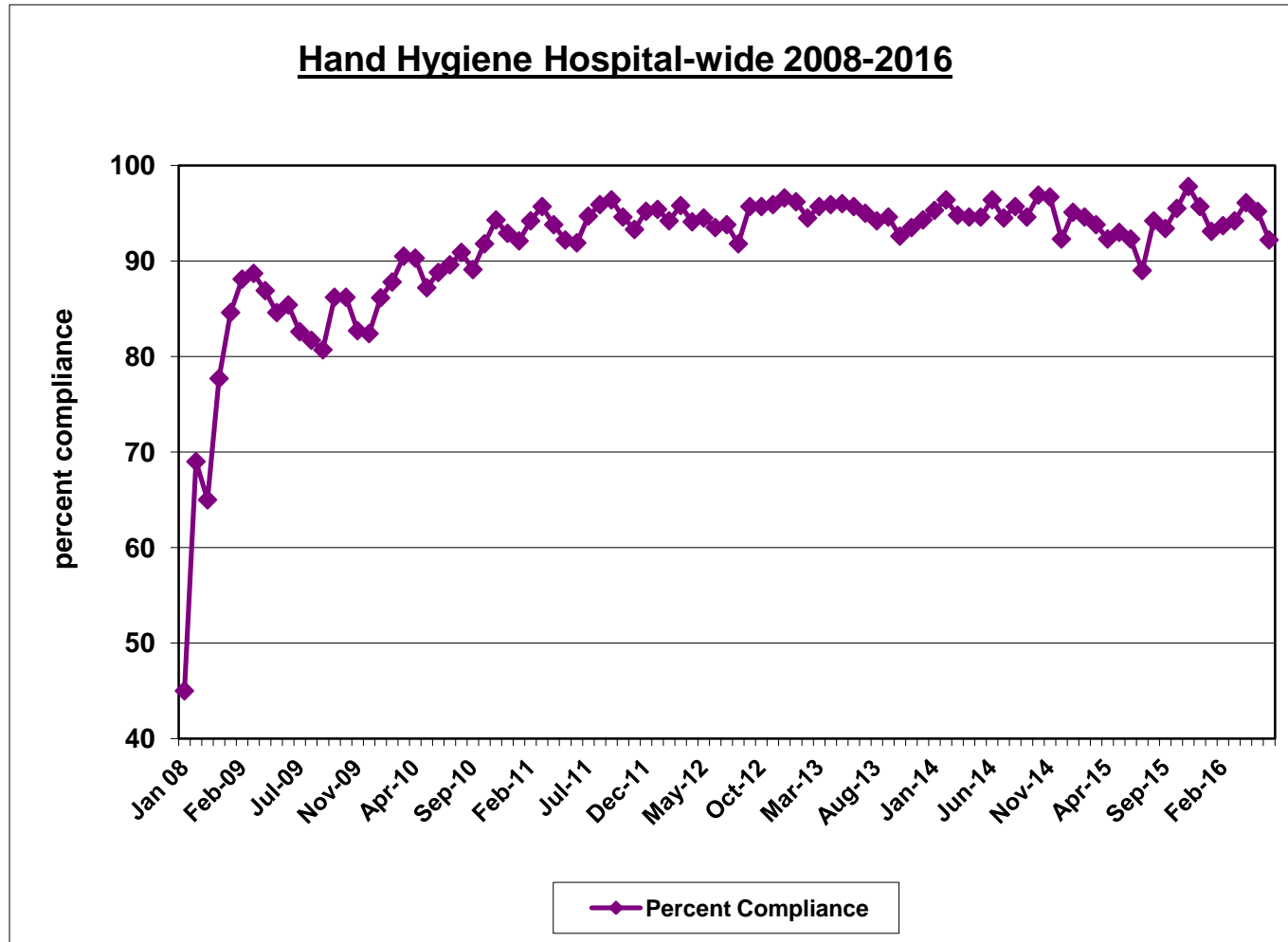
- Populations at high risk for screening protocol
 - Nursing home patients
 - Acute care transfers
 - WCC patients
 - ICU admissions
 - SCU admissions
 - Hemodialysis patients
- Preop
 - TJR, Spines, Cardiac
- Methodology
 - PCR (GeneXpert)



Hand hygiene



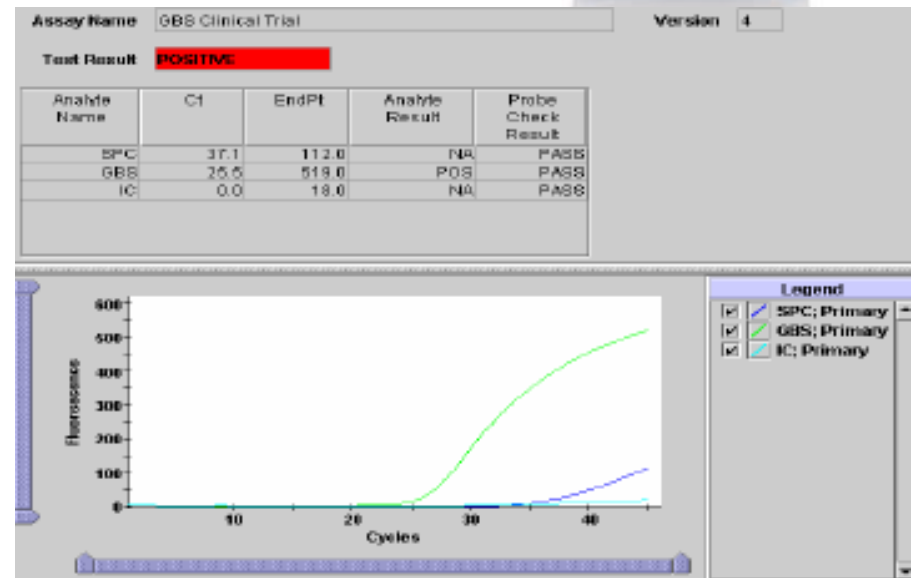
Hand Hygiene Stamford Hospital



Stamford Hospital Screening Program for MRSA



- Populations at high risk for screening protocol
 - Nursing home patients
 - Acute care transfers
 - WCC patients
 - ICU admissions
 - SCU admissions
 - Hemodialysis patients
- Preop
 - TJR, Spines, Cardiac
- Methodology
 - PCR (GeneXpert)



CONTACT PRECAUTIONS



+



+



VISITORS -- Report to Nurses' Station for instructions before entering room

HANDS – Wash BEFORE and AFTER patient contact

GOWNS and GLOVES – must be worn by all entering the room

UPON LEAVING the room, remove gloves and gown. Wash your hands after leaving the room

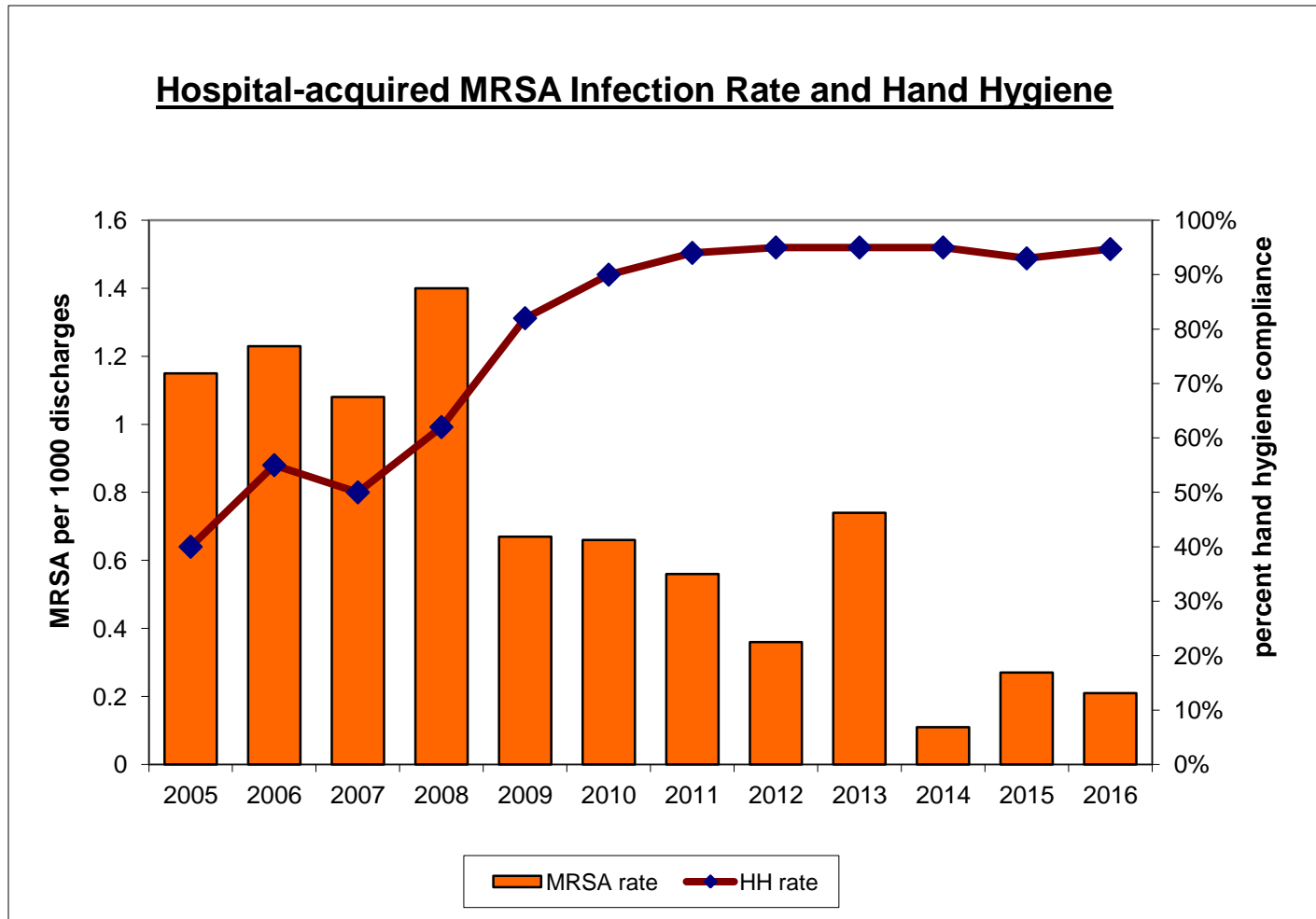
VISITANTES -- Reportense a la Estación de las Enfermeras para recibir instrucciones antes de entrar

MANOS – Hay que lavarse las manos ANTES y DESPUES de contacto con el paciente

BATAS y GUANTES – se deben poner al entrar en la habitación

ANTES DE SALIR de la habitación, quítese los guantes y las batas. Lavese las manos después de salir

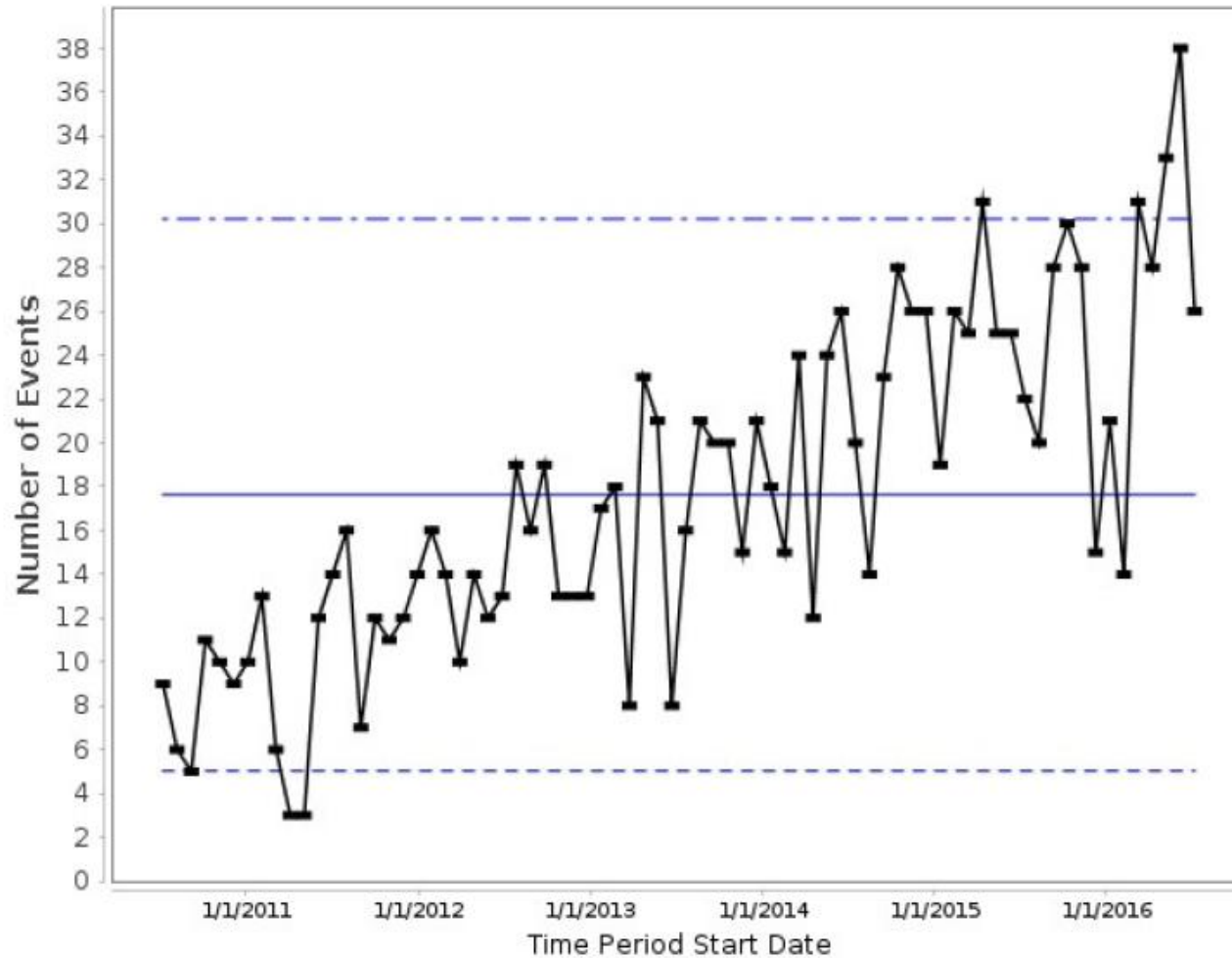
Hospital-acquired MRSA Infections Stamford Hospital Overall



Extended Spectrum Beta-lactamases (**ESBL**)

- Confer resistance to all cephalosporins and penicillins
 - Gram negative bacilli (E coli, Klebsiella, etc)
 - 700 different profiles
- Prevalence of ESBLs is unappreciated
 - Laboratories fail to detect ESBL in 25% of instances depending on the type of enzyme present (Tenover, CDC, 2009)
- Chronic intestinal carriage
- High rate of treatment failure
- Inpatient and community prevalence

ESBL-positive isolates at Stamford



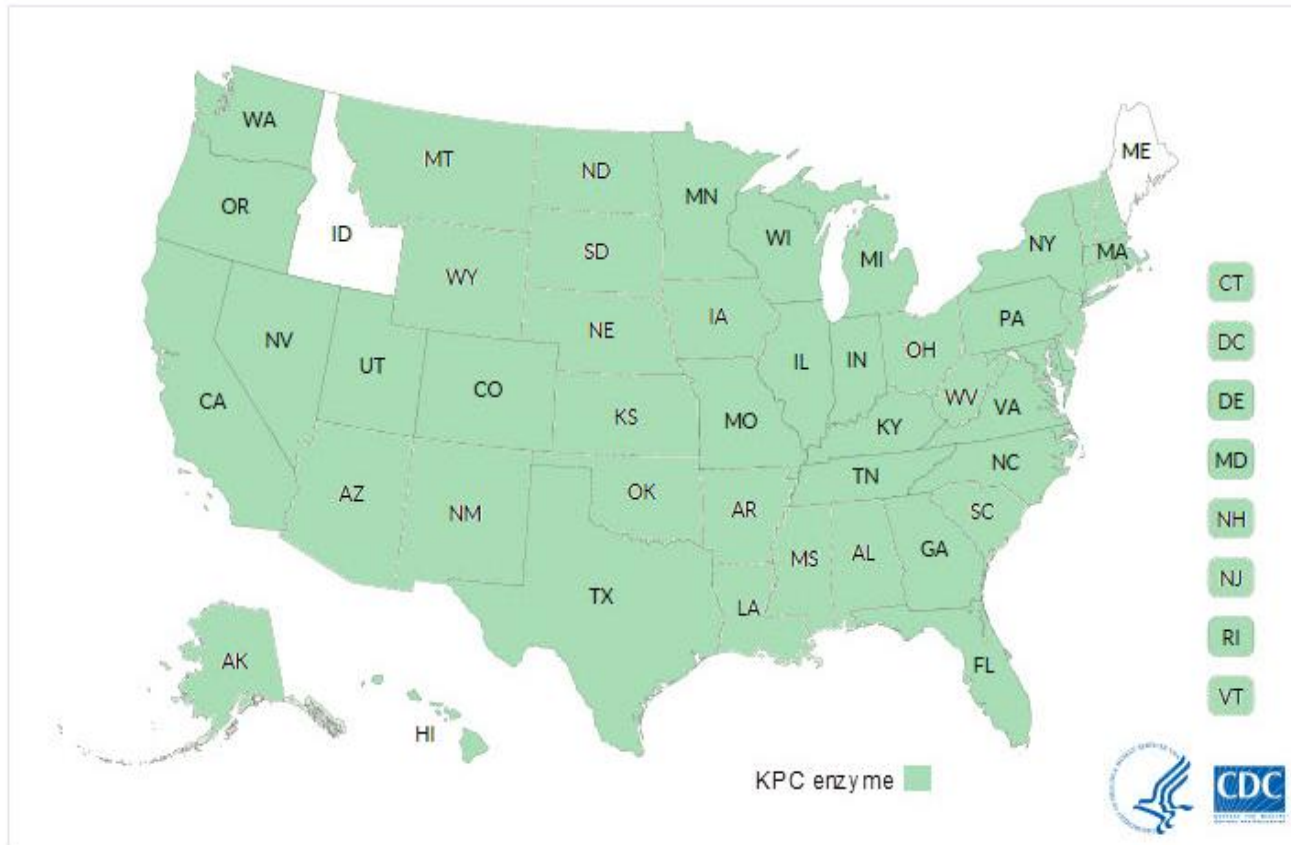
Outpatient urine culture

| Procedure | Result | Verified |
|--|--|------------------------|
| URINE CULTURE Final | | Verified 07/27/15-0835 |
| Source: URINE CLEAN CATCH MIDSTREAM SEE M29565 FROM 07/23/15. | | |
| | This organism exhibits extended spectrum beta lactamase (**ESBL**) activity. In vitro susceptibility testing may be unreliable. Consider Infectious Diseases consultation. | |
| Organism | ESCHERICHIA COLI **ESBL** | |
| Colony Count: | >100,000 COL./CC. | |
| | E.COLI ** | |
| | MIC | RX |
| | ----- | --- |
| TRIMET/SULFA | >2/38 | R |
| AMPICILLIN | >16 | R* |
| CEFAZOLIN | >16 | R* |
| CIPROFLOXACIN | >2 | R |
| GENTAMICIN | >8 | R |
| NITROFURANTOIN | <=32 | S |
| TETRACYCLINE | >8 | R |

Emergence of Carbapenem-resistant *Enterobacteriaceae* (CRE)

- Carbapenems have remained effective against most of the *Enterobacteriaceae*, including ESBL producing strains.
- CRE (KPC most common)
 - Appeared 1996; 2690 cases in NYS, 50% hospital acquired in 2014
 - Klebsiella, E. coli, Enterobacter and others
 - Confer resistance to all β -lactams including extended-spectrum cephalosporins and carbapenems
 - Usually co-resistant to multiple other agents
 - Multiple enzyme profiles (KPC, NDM, VIM, OXA, others)
 - High mortality due to co-morbidities and lack of effective treatment
 - **Plasmid mediated**

Patients with KPC-producing *Carbapenem-resistant Enterobacteriaceae* (CRE) reported to the Centers for Disease Control and Prevention (CDC) as of January 2017, by state



[^ Top of Page](#)



SPEC : 16:M0031627R

PATIENT: [REDACTED]

Procedure

Result

[FLUID CULTURE] Preliminary (continued)

Verified 08/04/16-1228

Method: *MAN* Perf Site: *TSH*

3. KLEBSIELLA PNEUMONIAE **KPC** MSCAN GRAM NEG MIC45 Ent: 08/04-1228 GOCAMPO

| Target | Route | Dose | RX | AB | Cost | M.I.C. | IQ | NP |
|----------------|-------|------|----|------|------|--------|----|----|
| TRIMET/SULFA | | | R | | | >2/38 | | |
| AMOXAC/CLAVUL | | | R | | | >16/8 | | NP |
| AMPICILLIN | | | R | | | >16 | | |
| AMP/SUL | | | R | | | >16/8 | | |
| AZTREONAM | | | R | | | >16 | | NP |
| CEFAZOLIN | | | R | | | >16 | | |
| CEFOTAXIME | | | R | | | >32 | | NP |
| CEFOXITIN | | | R | | | >16 | | NP |
| CEFTAZIDIME | | | R | | | >16 | | NP |
| CEFTRIAZONE | | | R | | | >32 | | NP |
| CEFEPIME | | | R | | | >16 | | NP |
| CEFUROXIME | | | R | | | >16 | | |
| CIPROFLOXACIN | | | R | | | >2 | | |
| ERTAPENEM | | | R | | | >1 | | NP |
| GENTAMICIN | | | I | | | 8 | | |
| CEFOTA/CLAV | | | R | | | >4 | | NP |
| CEFTAZ/CLAV | | | R | | | >2 | | NP |
| CFTE SCREEN | | | | ESBL | | >1 | | NP |
| IMIPENEM | | | R | | | >8 | | NP |
| LEVOFLOXACIN | | | R | | | >4 | | NP |
| MEROPENEM | | | R | | | >8 | | NP |
| NITROFURANTOIN | | | R | | | >64 | | NP |
| PIPERACILLIN | | | R | | | >64 | | |
| TETRACYCLINE | | | R | | | >8 | | |
| TICAR/K CLAV | | | R | | | >64 | | NP |
| TIGECYCLINE | | | R | | | >4 | | |
| TOBRAMYCIN | | | R | | | >8 | | NP |
| AMIKACIN | | | I | | | 32 | | NP |
| PIP/TAZO | | | R | | | >64 | | |

> [FLUID CULTURE] Preliminary (changed)

Verified 08/02/16-1506

Method: *MAN* Perf Site: *TSH*

Ent: 08/02-1506 GOCAMPO, Ver: 08/02-1506 GOCAMPO

Source: PERITONEAL FLUI

BAP

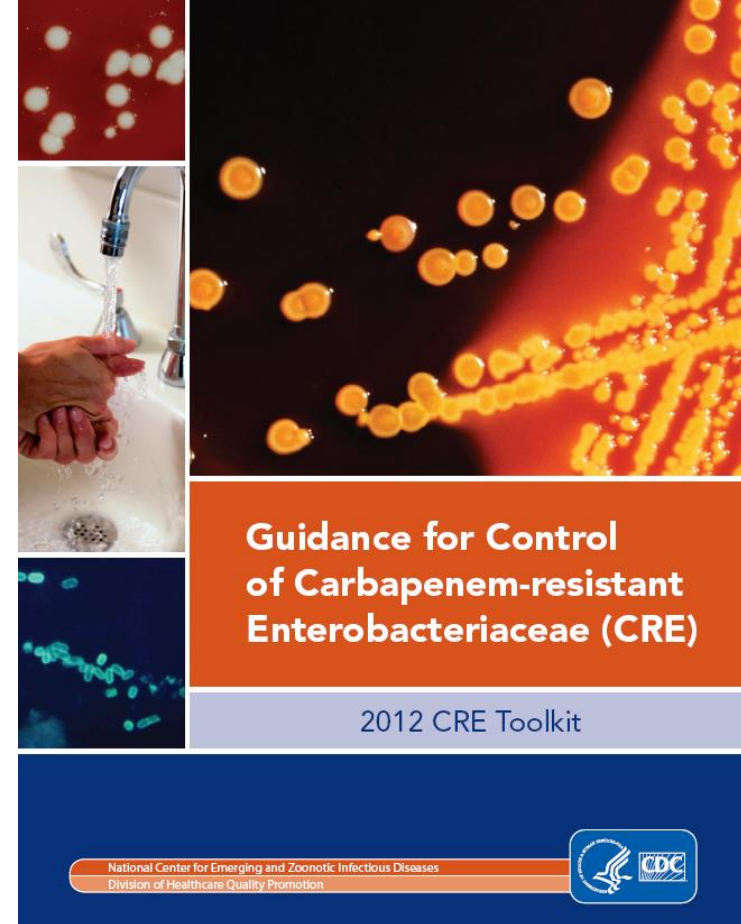
GNR #2^

CNA

#3^ #4^ #5^

CDC Action Plan for CRE Control

- Surveillance
- HCW education
- Laboratory detection
 - lab education
- Mandatory Reporting
- Strict isolation / contact tracing / screening
- Antibiotic stewardship
- Limited options for treatment
 - colistin, ceftazidime + avibactam (Avycaz), fosfomycin



Highly resistant MCR-1 'superbug' found in US for first time

Filed Under: [MCR-1](#); [Antimicrobial Resistance](#)

Jim Wappes | Editorial Director | CIDRAP News | May 26, 2016

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Bacteria carrying the very worrisome MCR-1 resistance gene—which makes the last-line antibiotic colistin useless against them—have been found in human and animal samples for the first time in the United States, according to a report today in *Antimicrobial Agents and Chemotherapy* and a statement by federal health officials.

A Chinese team first described the MCR-1 gene last November, after finding it in pigs, pork, and humans. Since then scientists in several countries have found the gene, sometimes alongside other resistance genes, after examining their sample collections. The gene can be transferred to other organisms, compounding the concern.

Today's findings involve a 49-year-old woman whose urine contained *Escherichia coli* harboring the MCR-1 gene and an *E coli* isolate from a pig intestine that also contained the colistin-resistance gene.

MCR-1 in urine sample

The woman sought care at a Pennsylvania clinic for symptoms of a urinary tract infection 1 month ago



FDA, Michael J. Ermarth / Flickr cc

Infection Prevention Escalation

MRSA, VRE, ESBL

CRE

Basic

Infection Control

- Hand Hygiene
- Contact precautions

Intensive

Infection Control

- Hand Hygiene
- Contact precautions
- Cohort patients and staff
- Screening cultures of patient contacts
- Save cultures
- Report to DPH

Antibiotic Resistance is frequently associated with Hospital-acquired Infections



The image is a screenshot of a Fox News website article. At the top, there is a dark blue navigation bar with the Fox News logo and a search bar. Below the navigation bar, there is a large yellow rectangular placeholder. The article is categorized under 'HEALTH' and has a main headline: '2 deaths possibly linked to 'superbug' at UCLA hospital after 7 infected, 179 exposed'. Below the headline, there is a sub-headline: 'Superbug may be linked to 2 deaths at UCLA hospital'. The article text begins with 'UCLA reported Wednesday that nearly 180 patients were exposed to a potentially deadly "superbug" on contaminated medical instruments that infected seven patients and may have contributed to two deaths.' and continues with 'A total of 179 patients at Ronald Reagan UCLA Medical Center were exposed to antibiotic-resistant carbapenem-resistant Enterobacteriaceae, or CRE...'. There are social media sharing icons for Facebook, Twitter, and Email, along with a print icon. A large yellow rectangular placeholder is also present on the right side of the article content.

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HEALTH

2 deaths possibly linked to 'superbug' at UCLA hospital after 7 infected, 179 exposed

Published February 19, 2015 • FoxNews.com

797 1356

NOW PLAYING

Superbug may be linked to 2 deaths at UCLA hospital

UCLA reported Wednesday that nearly 180 patients were exposed to a potentially deadly "superbug" on contaminated medical instruments that infected seven patients and may have contributed to two deaths.

A total of 179 patients at Ronald Reagan UCLA Medical Center were exposed to antibiotic-resistant carbapenem-resistant Enterobacteriaceae, or CRE...

Hospital-acquired infections (HAI)

- Often due to drug-resistant pathogens
- High patient mortality (up to 20% of HAI) and morbidity
- High costs
 - Attributable direct care (\$30-45 billion)
 - Indirect costs (LOS, lost business, isolation)
 - Liability costs
- Infection Prevention = Expense Prevention
- Preventable (“zero infections”)
- Public interest
 - Federal initiatives and reimbursement penalties
 - Mandatory reporting of infections
 - National reporting requirements (CMS)
 - *Public perception of poor quality of care*

Hospital-acquired infection = Medical Mistake

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The Sunday ADVOCATE

\$1.50 \$1 IN SELECT AREAS SUNDAY, AUGUST 9, 2009 SERVING THE COMMUNITY SINCE 1829

Tax hike blocking budget

Battle waged over effects of increase

By Ken Dixon
STAFF WRITER

HARTFORD — For a solution to the state budget impasse, lawmakers — and the voters who elect them — are arguing whether a couple earning \$800,000 a year should pay another \$20 a week in income taxes for the benefits of living in Connecticut.

In a nutshell, it's the obstacle that's on the verge of giving Connecticut

Top rates

- Connecticut: 5 percent
- New Jersey: 10.75 percent, a temporary one-year raise over the current top rate of 8.97 percent
- Rhode Island: 9.9 percent
- Vermont: 9.5 percent
- New York: 8.97 percent
- North Carolina: 7.75 percent
- California: 10.55 percent

A SPECIAL REPORT
ON PATIENT SAFETY

Dead by mistake



CONTRIBUTED PHOTOS

An estimated 98,000 people die each year in the U.S. of preventable medical errors. Each photo represents a

One-bin program takes off

Recycling up 47 percent in system's first month

By Magdalene Perez
STAFF WRITER

STAMFORD — The city saved \$15,000 on waste-hauling costs in the first month of a new recycling program that allows residents to recycle more materials with less effort, city officials said.

Under the new single-stream program, which took effect July 1, residents who use city recycling no longer have to separate paper from other recyclable materials. They also can recycle a much wider range of materials, including paperboard, such as egg cartons and cereal or tissue boxes; milk cartons and juice boxes; plastics coded 1 through 7; plastic bags, waxed paper or cardboard; and na-

The city picked up 623.5 tons of recycling in July 2009 compared with 423.5 tons in July 2008, said Alex Tergis, chief of the Public

What is antibiotic stewardship?

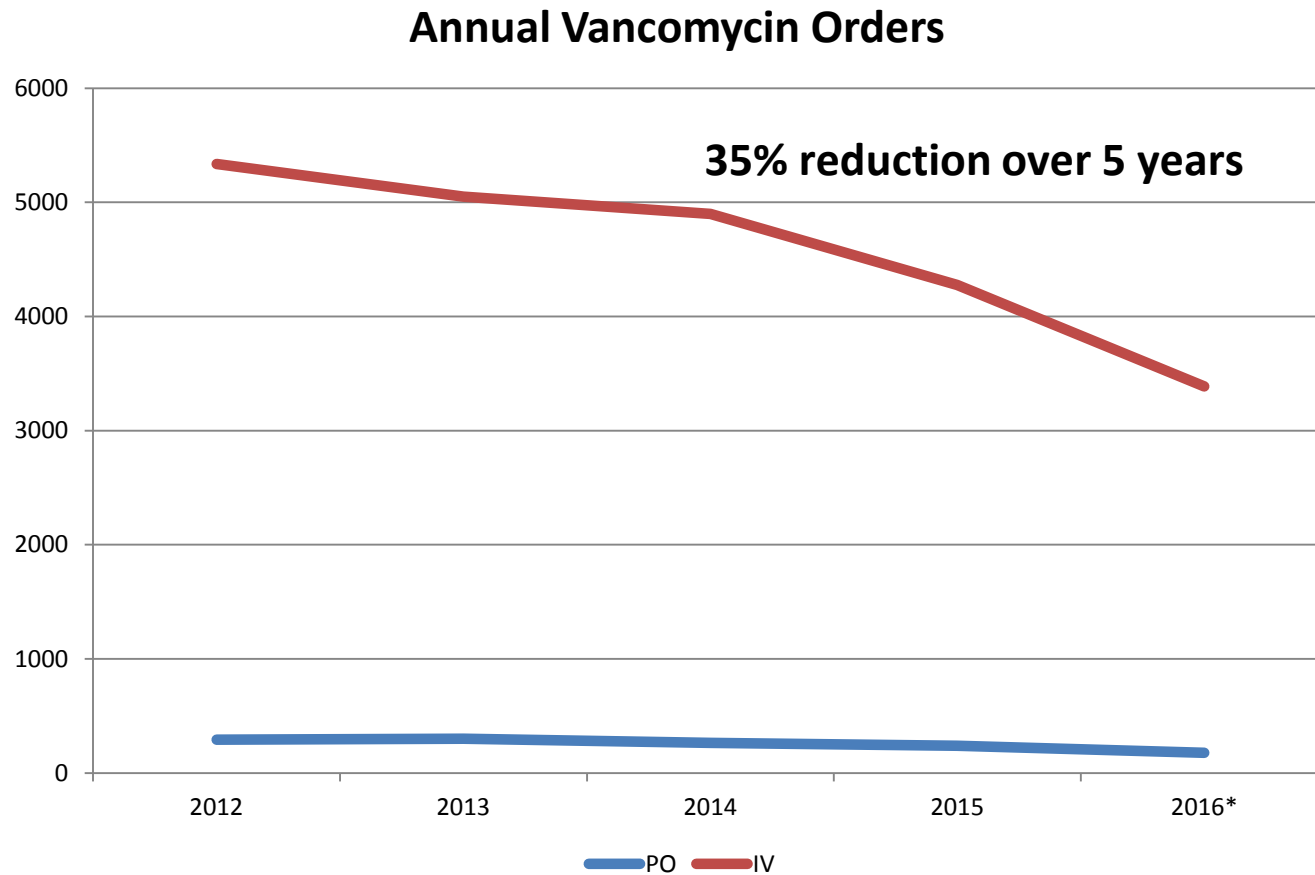
Antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobial agents, improves patient outcomes, reduces microbial resistance, reduces cost, and decreases the spread of infections caused by multidrug-resistant organisms.

Stamford Hospital

Antibiotic Stewardship Program

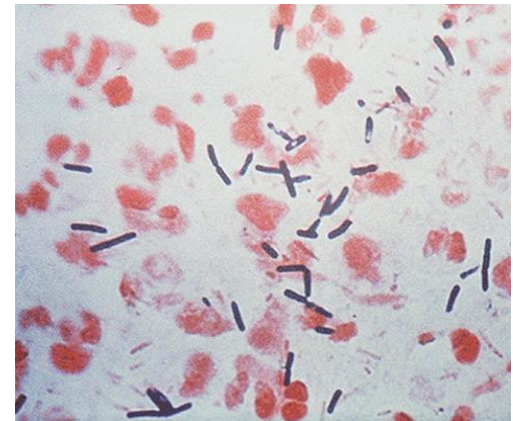
- Formulary restrictions
- Prescribing limitations / ID approval required by drug / dose
- Preprinted orders / pathways (e.g. CAP, febrile neutropenia)
- Antibiotic prophylaxis standards
- IV to PO program (pharmacy based)
- Renal dosing (pharmacy based)
- Antibiogram review
- Restricted susceptibility reporting (cascade system thru micro lab)
- Daily Blood culture monitoring for appropriateness of Rx
- Drug:Bug Mismatch detection in micro lab
- De-escalation program in ICU – “antibiotic time-out”
- Education for correct duration of rx
- Monitoring MDRO for determining formulary changes and guideline changes
- Spot Drug Use Evaluations (DUEs)
- Escalation of rapid molecular diagnostics
- Increased emphasis on using biomarkers (e.g. procalcitonin)

Vancomycin Usage Reduction Program



The most dramatic complication of excess antibiotic use is *Clostridium difficile* infection

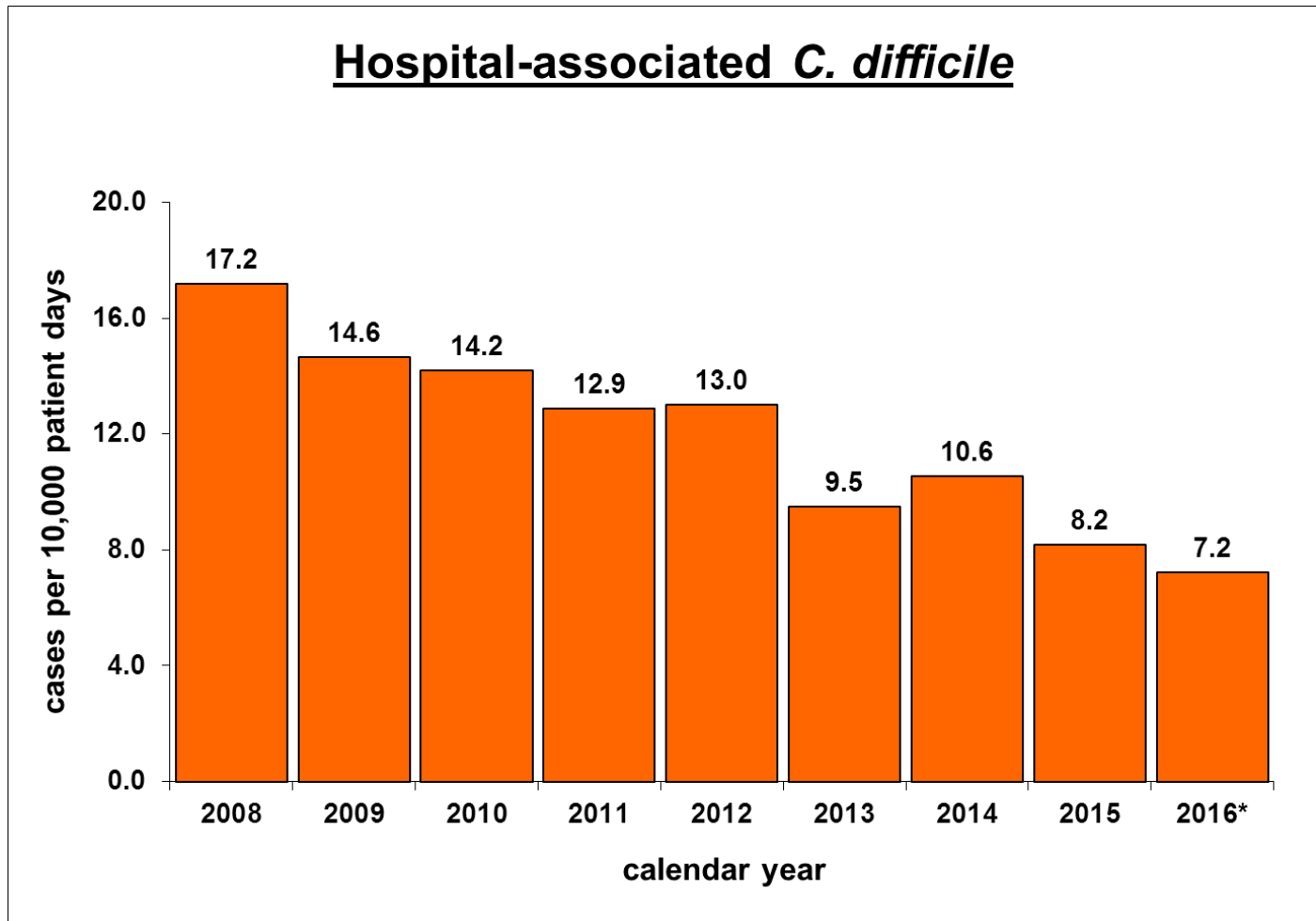
- $\geq 95\%$ CDI pts have received antibiotic therapy
 - Fluoroquinolones > cephalosporins > penicillins
 - Role of PPIs
- Environmental contamination by *C. difficile* is common (spores are difficult to eradicate)
- Personnel carry *C. difficile* on their hands
- Asymptomatic patients carry *C. difficile*
 - 3-6% community carriage
- Patients regularly acquire *C. difficile* in health care facilities



Difficulties in controlling the spread of *C. difficile*

- Difficulty preventing infection in high risk settings – “incident density” pressure – carriers + ill
- High community prevalence
- Antibiotic use and overuse (*stewardship program*)
- Prolonged fecal and skin carriage (*isolation for duration of hospitalization*)
- Frequent recurrence (*longer treatment courses, fidaxomicin, fecal transplant*)
- Persistence of spores in the environment (*bleach or peracetic acid for disinfection; UV light disinfection*)

Stamford Hospital-acquired C difficile



Superbugs in the Headlines

- ***Klebsiella pneumoniae* carbapenemase (KPC)**
- **New Delhi Metallo-beta-lactamase-1 (NDM-1)**
- **Oxacillinase-48 (OXA-48 and OXA-48-like)**
- **Verona Integron-Encoded Metallo-beta-lactamase (VIM)**
- **Novel Carbapenemases**
- **Plasmid-mediated Colistin Resistance (*mcr* -1, *mcr*-2)**

