

PREVENTION OF METHICILLIN- RESISTANT STAPHYLOCOCCUS AUREUS

Size of the Problem and Mechanisms of Control

Bluegrass Community Health Coalition
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The information in this presentation is the express opinion of Kevin T Kavanagh

Healthcare Associated Infections

Many Healthcare Associated Infections are Multi-Resistant Drug Organisms

- ▣ Affects 1 in 25 Hospitalized Patients
- ▣ Top 10 Cause of Death in the United States

<http://www.ahrq.gov/news/newsletters/research-activities/aug11/0811RA3.html>

Nationally, deaths from HAIs equal more than one Boeing 767 crashing every day.



Healthcare Associated Infections

- In the USA -- HAIs just in Hospitals cost 30 Billion Dollars Annually.
- In Kentucky - - An annual cost of almost 400 million dollars & almost 1400 lives lost from 23,000 HAIs.

HAIs a System Wide Problem

Type of Facility	Number in Kentucky
Long Term Care Facilities	307
Hospitals (Not Critical Access)	94
Critical Access Hospitals	29
Surgery Centers	31
Dialysis Centers	57

Acute care facilities comprise less than 20% of the facilities in Kentucky.

One Facility Can Affect Rates In Another Facility (Nursing Homes or Hospitals)

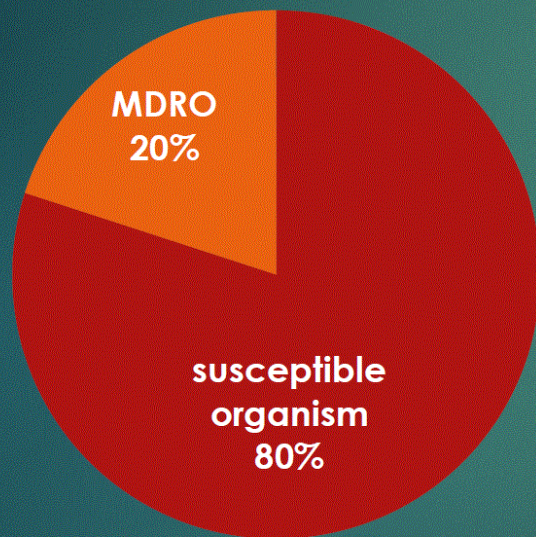
- ▣ “...the transmission dynamics of nosocomial pathogens, especially of multiple antibiotic-resistant bacteria, is not exclusively amenable to single-hospital infection prevention measures.” Int J Med Microbiol 2013 PMID: 23499307
<http://www.ncbi.nlm.nih.gov/pubmed/23499307>
- ▣ “Our simulation demonstrated that each hospital's decision to test for MRSA and implement contact isolation procedures could affect the MRSA prevalence in all other hospitals.” Health Affairs 2012 PMID: 23048111
<http://www.ncbi.nlm.nih.gov/pubmed/23048111>

Ciccolini M1, Donker T, Köck R, Mielke M, Hendrix R, Jurke A, Rahamat-Langendoen J, Becker K, Niesters HG, Grundmann H, Friedrich AW. Infection prevention in a connected world: the case for a regional approach. Int J Med Microbiol. 2013 Aug;303(6-7):380-7. doi: 10.1016/j.ijmm.2013.02.003. Epub 2013 Mar 13.

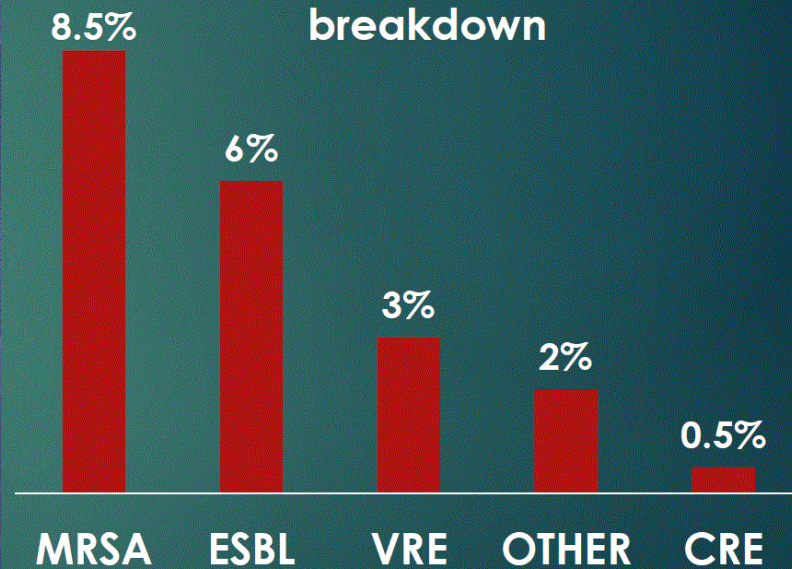
Lee BY, Bartsch SM, Wong KF, Yilmaz SL, Avery TR, Singh A, Song Y, Kim DS, Brown ST, Potter MA, Platt R, Huang SS. Simulation shows hospitals that cooperate on infection control obtain better results than hospitals acting alone. Health Aff (Millwood). 2012 Oct;31(10):2295-303. doi: 10.1377/hlthaff.2011.0992.

MDROs Significance & HAIs

► Account for 20% of HAIs



20% MDRO
breakdown



- MDRO - Defined as non-susceptibility to at least one agent in three or more antimicrobial categories

From the CDDEP – HW USA Presentation, Samanth Gandra, March 16, 2014

MDROs Significance & HAIs

Most common HAI Bacteria – CDC Mar. 26, 2014:

- ▣ C. difficile (12%),
- ▣ Staphylococcus aureus, including MRSA (11%),
- ▣ Klebsiella (10%),
- ▣ E. coli (9%),
- ▣ Enterococcus (9%), and
- ▣ Pseudomonas (7%).

Klebsiella and E. coli are members of the Enterobacteriaceae bacteria family, which has become increasingly resistant to last-resort antibiotics known as carbapenems.

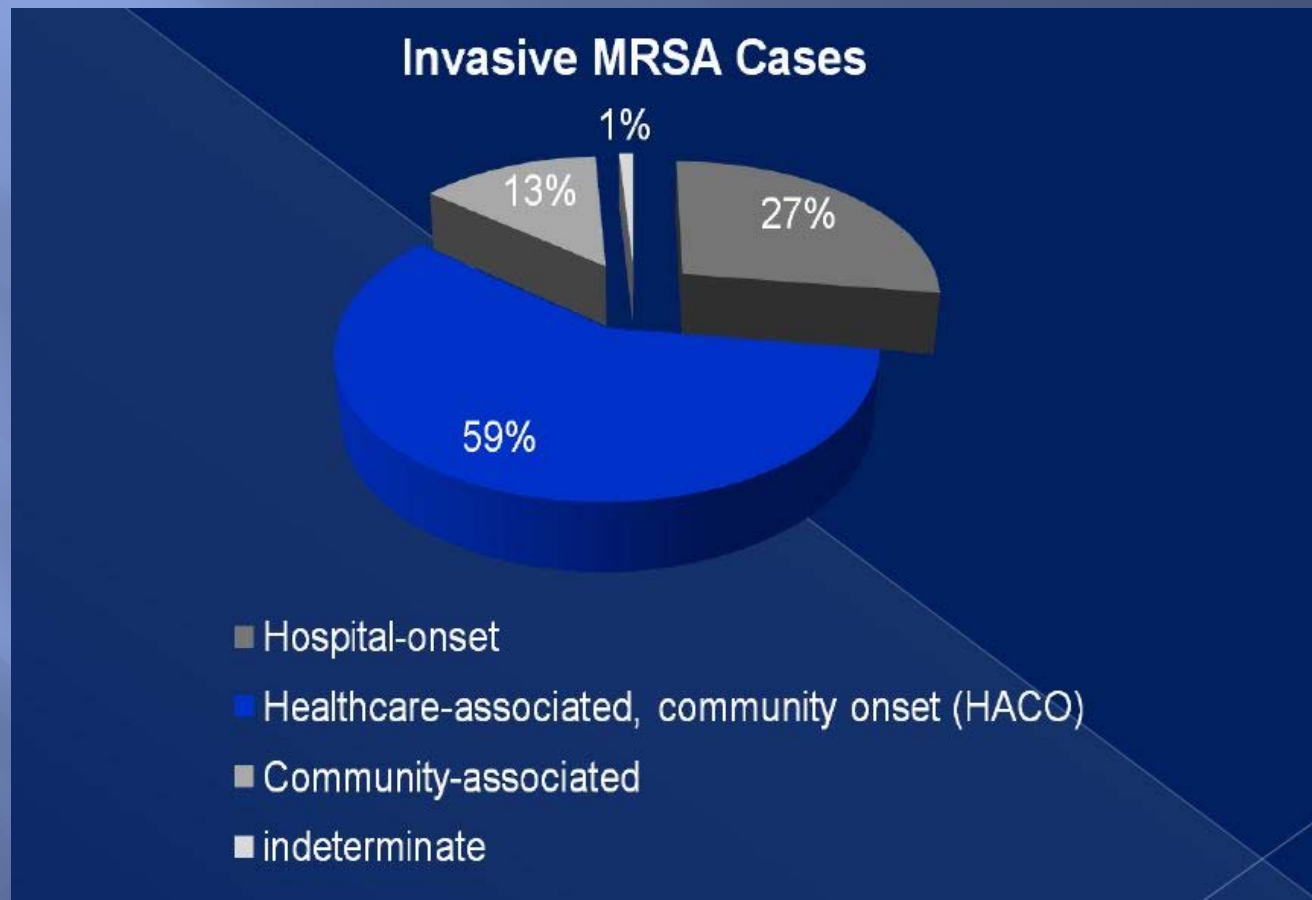
MDROs Significance

- Infections from MDROs have twice the mortality rate as other Healthcare Associated Infections (HAIs)
- The percentage of these infections is growing.

MDROs Significance

- Thus, if left unchecked has the potential of doubling the mortality rate for HAI.

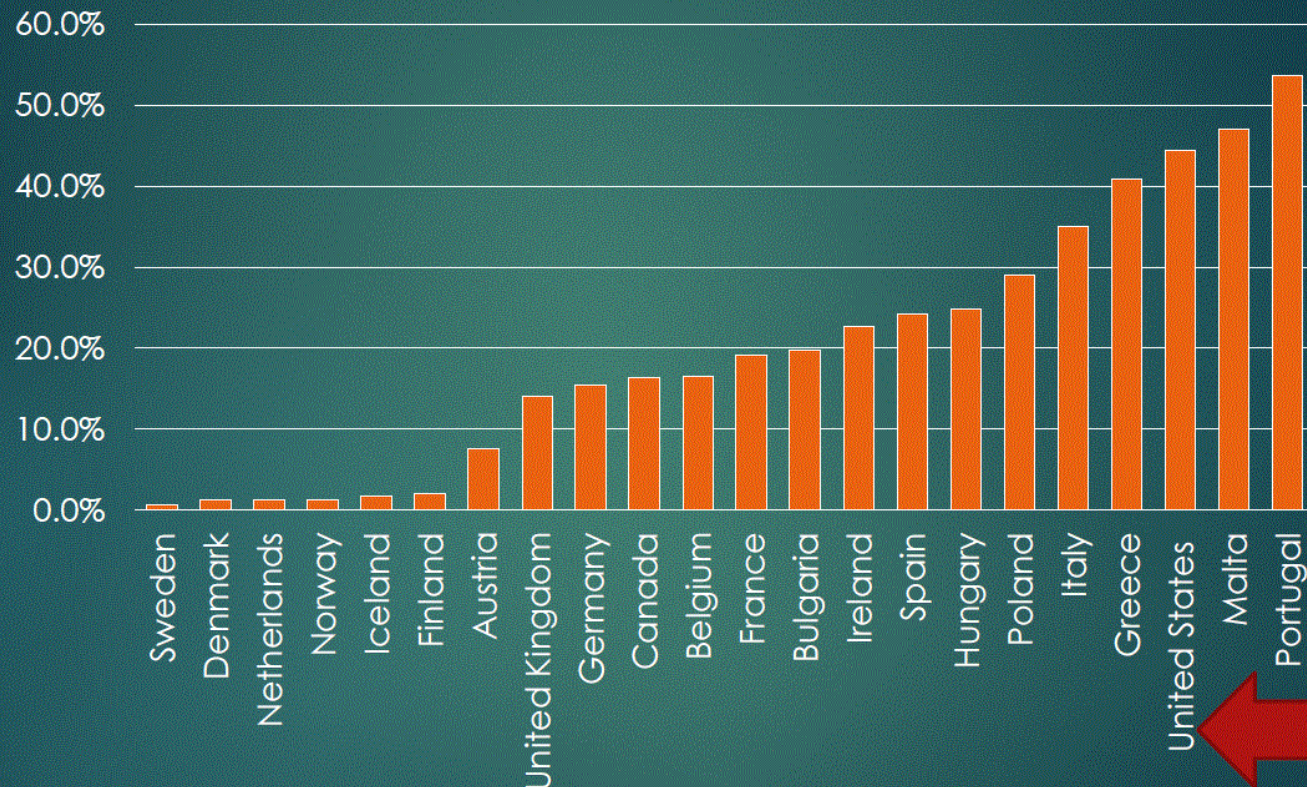
MRSA – How Are We Doing



Remember 85% of MRSA infections are Healthcare Associated.
HP2020 HAI Webinar - Aug. 16, 2011

Methicillin-Resistant Staphylococcus Aureus - MRSA

Proportion of MRSA among *S. aureus* blood isolates in Europe and North America- 2012



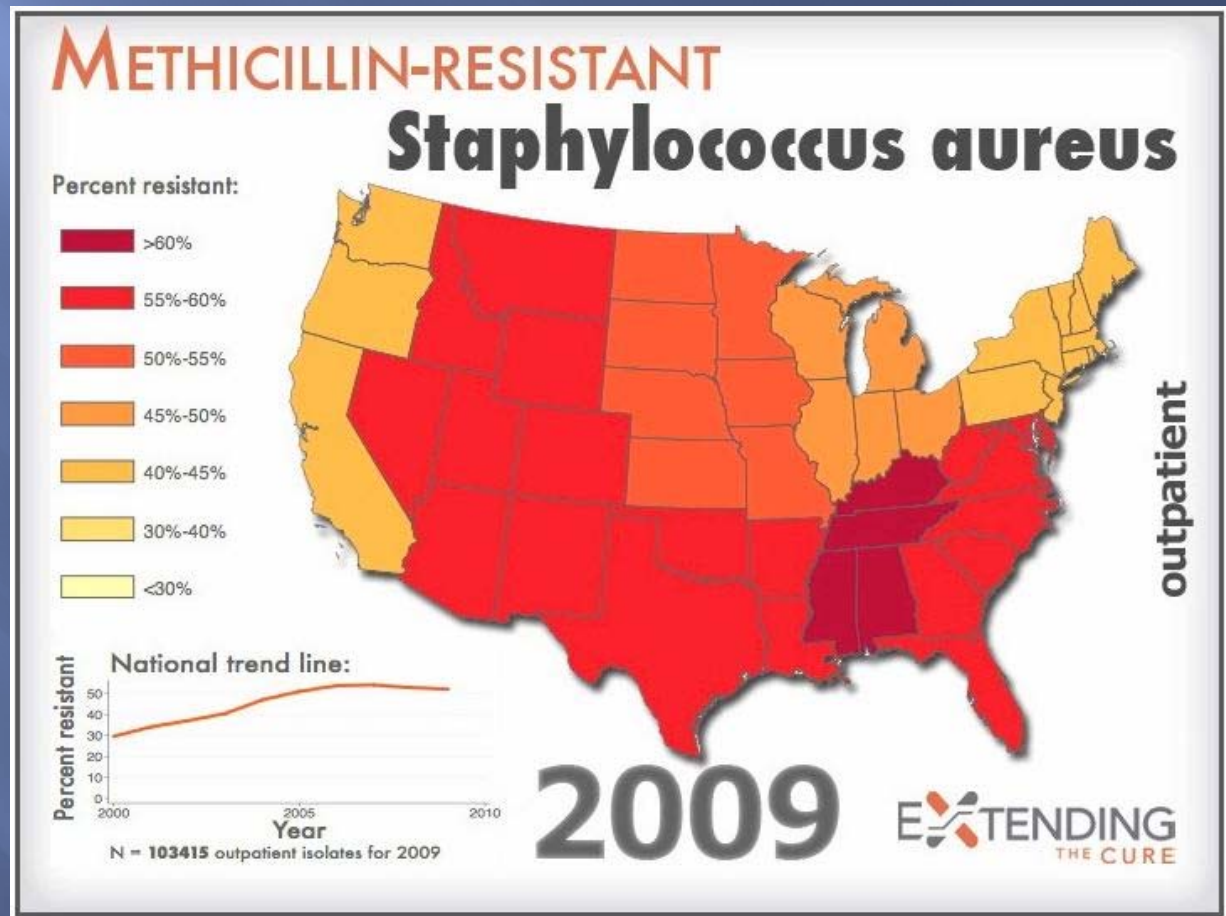
From the CDDEP – HW USA Presentation, Samanth Gandra, March 16, 2014

Methicillin-Resistant Staphylococcus Aureus - MRSA

In Northern Europe –
Less than 5% of Staph
Cultures are MRSA
Positive.

In the United States
– 50% of Staph
Cultures
are MRSA Positive.

In the Region Kentucky
Resides – Almost 70%
of Staph Cultures are
MRSA Positive.



MRSA – How Are We Doing

Data conflicting on meeting goals – No Uniform Reporting System:

- ▣ Emerging Infections Program (EIP) (JAMA, 2010, 2013) – Yes
{Overall 21% decrease, Hospital Onset a 46% decrease}
- ▣ Healthcare Cost and Utilization Project (H-Cup Data) (USA Today, Dec 2013) – No
{460,000 Hospitalizations involving MRSA, 23,000 Deaths}
- ▣ University Healthsystem Consortium (UHC) (ICHE, 2013) – No
“The number of hospital admissions for any MRSA infection per 1,000 hospital admissions overall increased during 2003–2008”
- ▣ NHSN (Dept. HHS, 2014) – No
{Data from 1/1/2013 to 3/31/2013: SIR is 1.05, Base Data 2010 }
- ▣ Pediatric Survey (Pediatrics, 2013) – No
“there were no significant reductions in health care-associated MRSA infections in children.”

MRSA – Reporting Requirements

- MRSA is reported for bloodstream infections (lab event).
 - The picture to the right would not be reportable.



MRSA Infection Reduction

Reduction In MRSA Infections (Interventions which use surveillance)	No Effect on MRSA Infections (Interventions which do not use surveillance)
Robiseck A, et al. Ann Intern Med 2008. Mar. 18, 148(6): 409-18	Harbarth S. et al. JAMA. 2008, Mar. 12; 299(10):1149-57
Rodríguez-Baño J, et al. Infect Control Hosp Epidemiol. 2010 Aug;31(8):786-95	Huskins WC, et al. NEJM. Apr. 2011; 364; 1407-1428.
Jain R, et al., NEJM. Apr. 2011; 364: 1419-1430	Huang SS, et al. NEJM. June 2013; 368:2255-2265
Lee AS, et al. BMJ Open. 2013; 3: e00312	
Almost 40 other studies.	

Reduction Associated With Surveillance

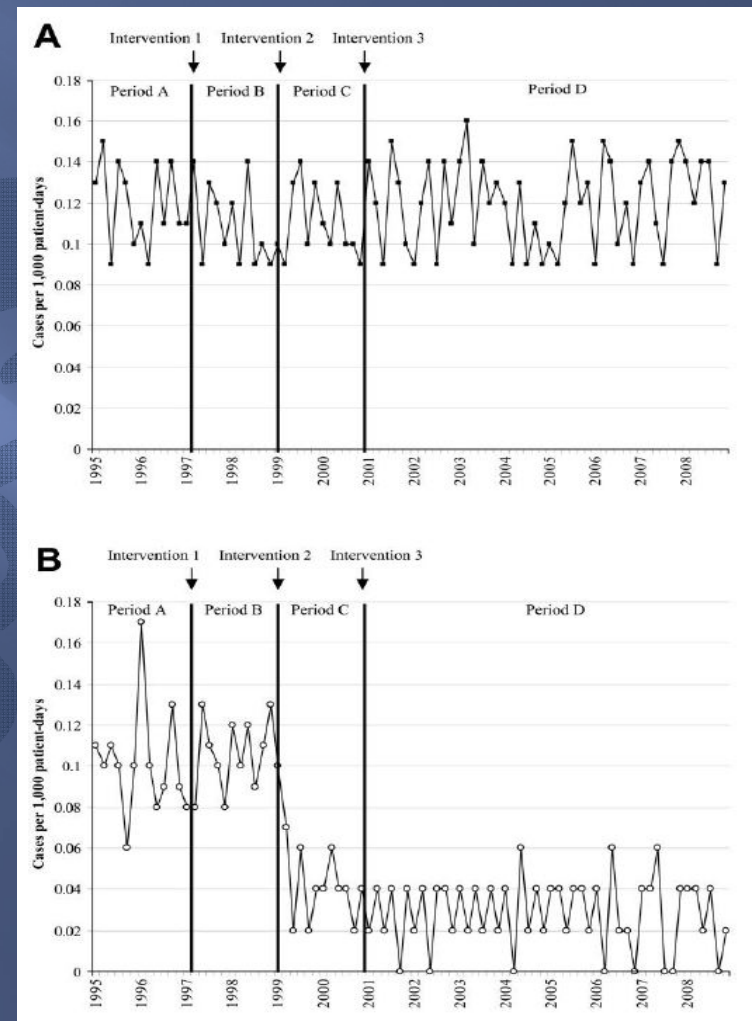


MRSA: Robiseck A, et al.

- Well Controlled Study. MRSA decreased by:
 - 36.2% from baseline to ICU Surveillance.
 - 69.6% from baseline to Universal Surveillance.

MRSA: Rodriguez-Bano, et al.

- To the right is a drop in MRSA bacteremia observed by Rodriguez-Bano, et al. (Period C represents the time period when active MRSA surveillance in patients and healthcare workers were performed in units where there was MRSA transmission. A: Shows no decrease in MSSA bacteremia, B: is the decrease found in MRSA Bacteria.



MRSA: The VA Experience

- VA Nursing Homes – 36% decrease in MRSA.
- Lexington VA Hospital – 95% decrease in MRSA.
- VA Study – Jain, NEJM, Apr. 14, 2011
 - Decrease of 45% in non-ICU Patients.
 - Decrease of 62% in ICU Patients.

MRSA: Lee, et al.

- “In clean surgery wards, strategy 2 (MRSA screening, contact precautions and decolonisation) was associated with decreasing rates of MRSA clinical cultures (15% monthly decrease, aIRR 0.85, 95% CI 0.74 to 0.97) and MRSA infections (17% monthly decrease, aIRR 0.83, 95% CI 0.69 to 0.99).” Intervention phase ran for 12 months, equating to a 86% to 89% decrease.
- “... no evidence that enhanced HH promotion was effective.”

MRSA: Lee, et al.

- “In surgical wards with relatively low MRSA prevalence, a combination of enhanced standard and MRSA-specific infection control approaches was required to reduce MRSA rates. Implementation of single interventions was not effective, except in clean surgery wards where MRSA screening coupled with contact precautions and decolonisation was associated with significant reductions in MRSA clinical culture and infection rates.”

No Reduction Associated With Surveillance



MRSA: Harbarth, et al.

- Prior to surgery over half of the known MRSA carriers were not given antibiotics effective against MRSA and because of delays and emergency intervention, 31% of the carriers were identified as MRSA carriers only after surgery.
- Of the patients who developed a MRSA infection and were known carriers prior to surgery, only 66% received prophylaxis against MRSA and almost 60% did not receive optimal decolonization of MRSA prior to surgery.
- This study effectively negated Lee, et al. Harbarth, S. was the corresponding author of this study.

MRSA: Huskins, et al.

- ▣ “... when contact precautions were specified, gloves were used for a median of 82% of contacts, gowns for 77% of contacts, and hand hygiene after 69% of contacts,”
- ▣ Admission cultures took 5 days to get back.

MRSA: Huang, et al.

- ▣ “Changes in important metrics: According to www.clinicaltrials.gov, 6 months after the study completion date, the registry’s records for the study were updated by adding a measure for all-pathogen bloodstream infections and eliminating the measures for central line- associated bloodstream infections and MRSA urinary cultures.”
- ▣ “The all-pathogen bloodstream infection (primarily skin commensal organisms) and nosocomial MRSA clinical culture measures showed a statistically significant improvement over the control.
- ▣ MRSA bacteremia reduction was not significant.”

MRSA: Huang, et al.

- ▣ Derde et al. (Lancet, 2014), also observed a significant decrease in MRSA acquisitions with improved hand hygiene and unit-wide chlorhexidine decolonization protocols.
There was not a significant decrease in vancomycin-resistant Enterococcus or Enterobacteriaceae acquisitions .
- ▣ There is also concern regarding the promotion of bacterial resistance. Disturbingly, Derde et al. reported a 13% to 14% incidence of MRSA resistance to chlorhexidine.
- ▣ Combined low-level mupirocin and chlorhexidine resistance significantly increases the risk of persistent MRSA carriage after decolonization therapy. Institutions with widespread use of these agents should monitor for resistance and loss of clinical effectiveness. (Lee AS, Clin Infect Dis. 2011)

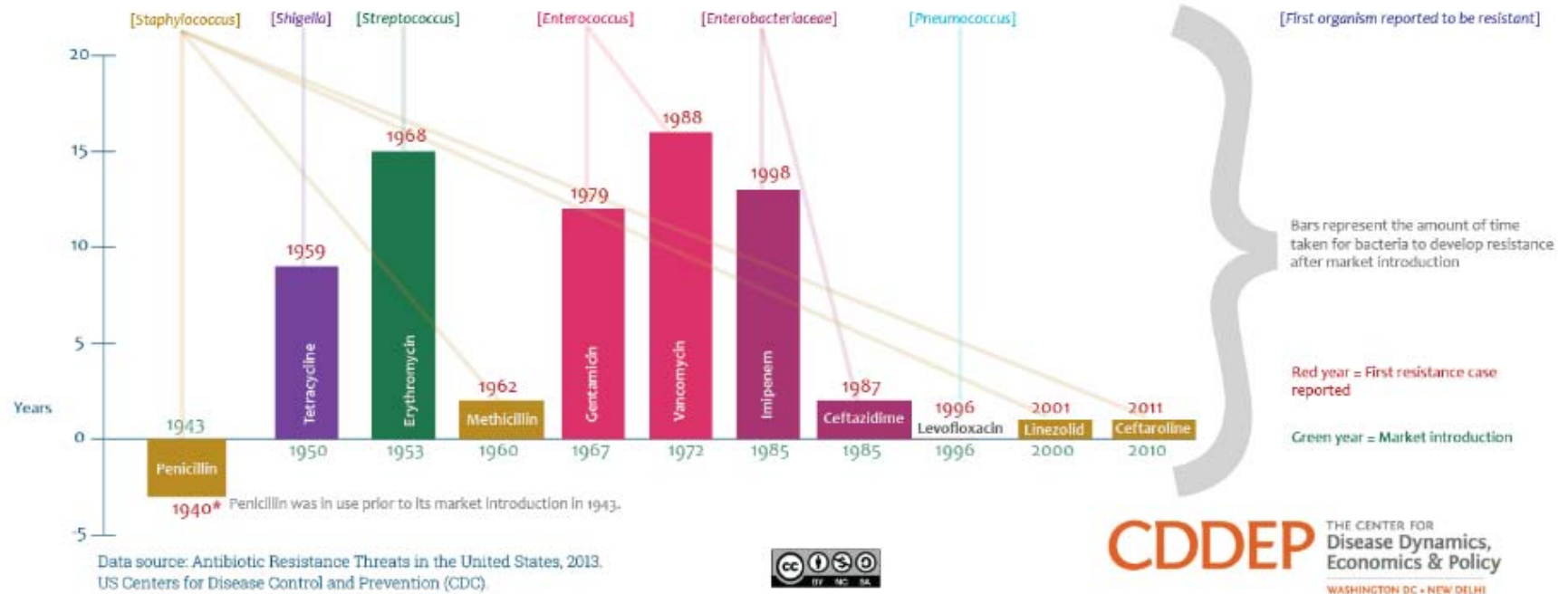
Chlorhexidine Resistance

- The recent observation that MRSA strains carrying the antiseptic resistance genes *qacA/B* can be clinically resistant to chlorhexidine raises a note of caution against its unfettered use. The dissemination of chlorhexidine-resistant MRSA would have implications for the decolonization of individual patients and for preventing transmission.

Edgeworth JD. Has decolonization played a central role in the decline in UK methicillin-resistant *Staphylococcus aureus* transmission? A focus on evidence from intensive care. *J Antimicrob Chemother.* 2011 Apr;66 Suppl 2:ii41-7. doi: 10.1093/jac/dkq325. Epub 2010 Sep 18.

Chlorhexidine Resistance

First reported cases of bacterial resistance against key antibiotics



Preop MRSA Surveillance

- Harbarth S. et al. JAMA. 2008, Mar. 12; 299(10):1149-57 Found no effect but serious flaws.
- Lee AS, et al. BMJ Open. 2013; 3: e00312 Was a well controlled multi-national study which found a beneficial effect. Harbarth, S was the corresponding author of this study.
- Multiple other studies most of which did not control for secular trends also found a beneficial effect.

Preop MRSA Surveillance

- MRSA Carriers Have a Higher Risk for Developing MRSA Infections.
- Screening determines the length of preoperative decolonization. (One vs. five days of chlorhexidine.)
- Type of Antibiotic Used Pre-Op May Depend Upon Carrier State.

UK - National Health Service

The United Kingdom's National Health Service's best practices include MRSA screening of:

- Orthopaedics, cardiothoracic and neurosurgical patients;
- Emergency orthopaedic and trauma admissions;
- Critical care admissions;
- All elective surgical patients;
- Previous MRSA carriers;
- Oncology/chemotherapy patients;
- Renal patients;
- Patients admitted from high risks settings such as nursing homes and care homes and;
- All emergency admissions.

http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_063187.pdf

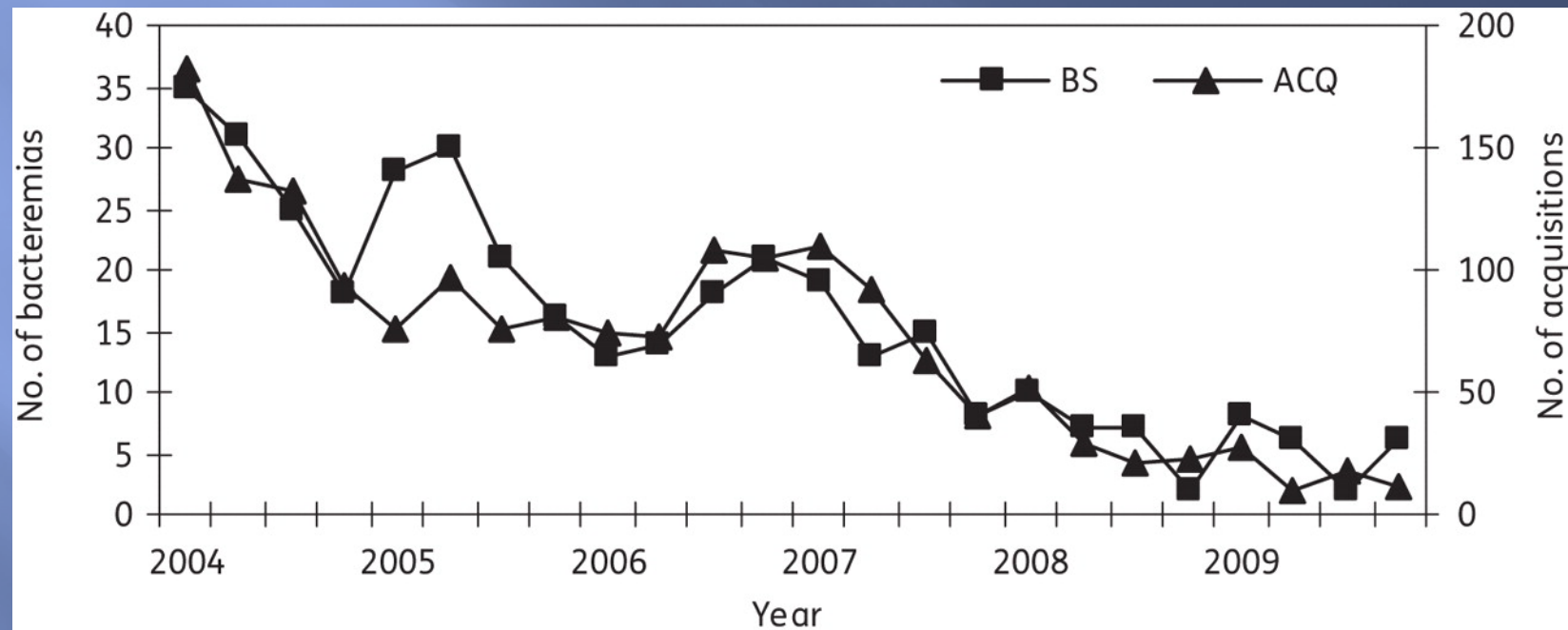
UK - National Health Service

“... the logical conclusion of risk factor assessments and the results of modelling studies is that the most appropriate approach to the reduction in MRSA carriage in the population, and resultant MRSA infections, is the universal screening of all admissions to hospital.”

Screening for Methicillin-resistant Staphylococcus aureus (MRSA) colonization.
A strategy for NHS trusts: summary of best practices.

http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_063187.pdf

Comparison between trend reductions in MRSA bacteraemias and MRSA acquisitions at a single UK hospital.



Edgeworth J D J. Antimicrob. Chemother. 2011;66:ii41-ii47

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