Multi-Drug Resistant Organisms

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Health Watch USA

Somerset Community College
March 13, 2018

Multi-Drug Resistant Organisms

Bacteria which are resistant to three or more classes of antibiotics

- Aminoglycosides (gentamycin, tobramycin),
- β-lactams (cephalosporins, penicillin, methicillin),
- Carbapenems,
- Fluoroquinolones (ciprofloxacillin, levofloxacin) and
- Tetracyclines

Lecture Topics

- **Incidence & Cost of MDRO Infections**
- **Antibiotic Overutilization**
- **Agricultural Usage of Antibiotics**
- **Types of Organisms**
  - -- MRSA
    - -- Incidence
    - -- Prevention
  - -- C. Diff
    - -- Incidence
    - -- Prevention
  - -- CRE
    - -- Incidence
    - -- Prevention
- Facility and Health Department Coordination

Each year in the **United States**, at least 2 million people become infected with bacteria that are resistant to antibiotics and **at least 23,000 people die each year as a direct result of these infections**.

-- Association for Professionals in Infection Control and Epidemiology
http://cqrcengage.com/apic/antibioticresistance

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Incidence & Cost

- These infections will transform healthcare and not in a good way. Once treatable disease will become death sentences.
  - Patients Needing Organ Transplantation.
  - Chemotherapy for Cancer.
  - Immunosuppression for Autoimmune Disease & Asthma.
  - Immunocompromised Patients Such as Diabetics.
  - Even Surgeries Will Have Much Greater Risk of Complications.

Cost of Antibiotic Resistant Infections

- March 2009: "…the overall annual direct medical costs of HAI to U.S. hospitals ranges from ….. $35.7 billion to $45 billion (after adjusting to 2007 dollars using the CPI for inpatient hospital services).

The Direct Medical costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. Author – R. Douglas Scott II, Economist Division of Healthcare Quality Promotion National Center for Preparedness, Detection, and Control of Infectious Diseases Coordinating Center for Infectious Diseases Centers for Disease Control and Prevention March 2009 https://www.cdc.gov/hai/pdfs/hai/scott_costpaper.pdf

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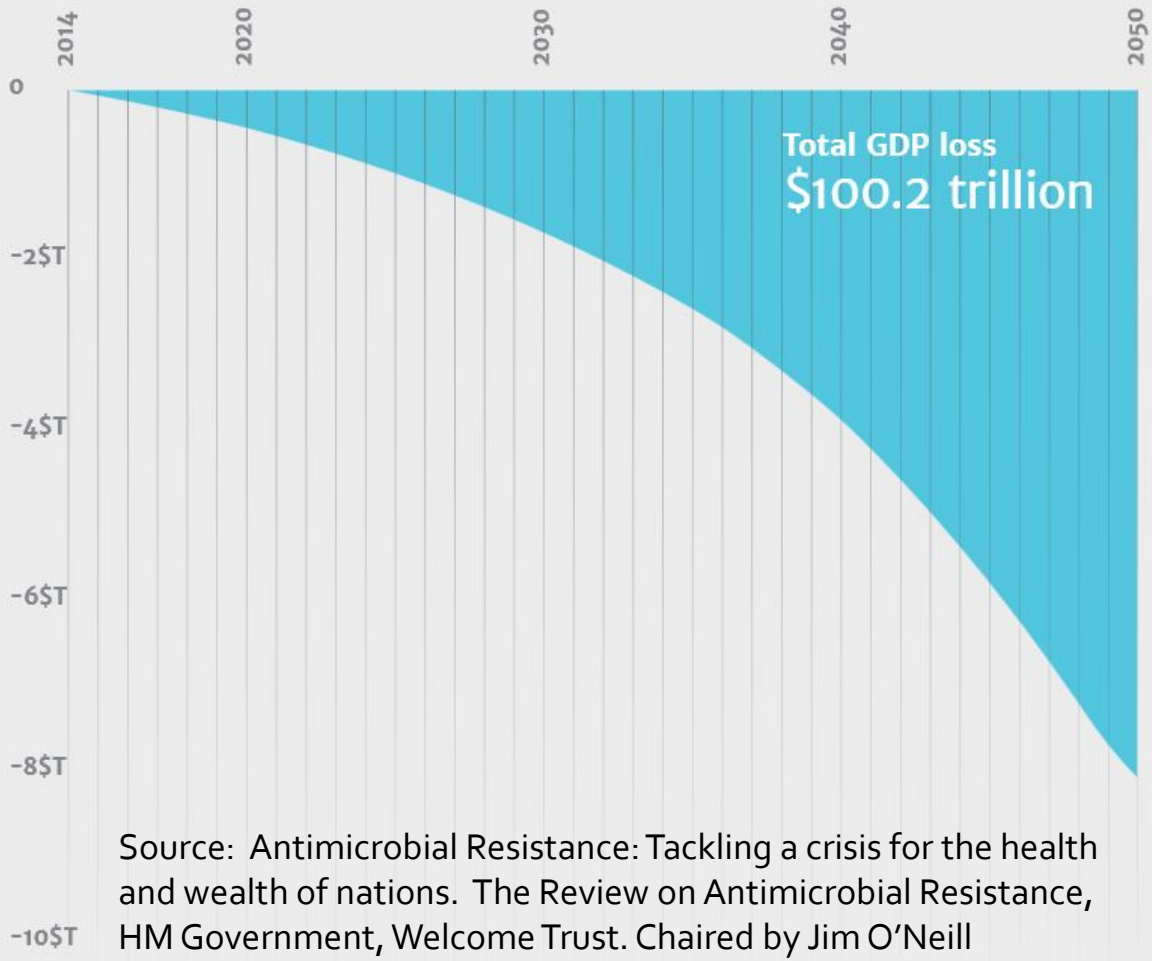
"For countries in the OECD, the cumulative (multi-year) loss of economic output by 2050 will amount to between USD 20 and 35 trillion"



Source: Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations. The Review on Antimicrobial Resistance, HM Government, Welcome Trust. Chaired by Jim O'Neill

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Incidence & Cost

- The damaging effects of antimicrobial resistance (AMR) are already manifesting themselves across the world. Antimicrobial-resistant infections currently claim at least **50,000 lives each year across Europe and the US alone**, with many hundreds of thousands more dying in other areas of the world. But reliable estimates of the true burden are scarce.

Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations. HM Government, Welcome Trust. The Review on Antimicrobial Resistance, Chaired by Jim O'Neill. Dec. 2014
https://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf

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Nursing Homes - HAI

A large proportion of Healthcare Associated Infections (HAI) are Drug Resistant.

- "…there are between 1.6 and 3.8 million HAIs [health care-acquired infections] in nursing homes every year. Annually, these infections result in an estimated 150,000 hospitalizations, 388,000 deaths, and between $673 million and $2 billion dollars in additional healthcare costs (Castle, et al. Nursing home deficiency citations for infection control, American Journal of Infection Control, May 2011; 39, 4)."

Proposed CMS Nursing Home Regulations: Docket ID: CMS-2015-0083.
Agency: Centers for Medicare Medicaid Services (CMS)

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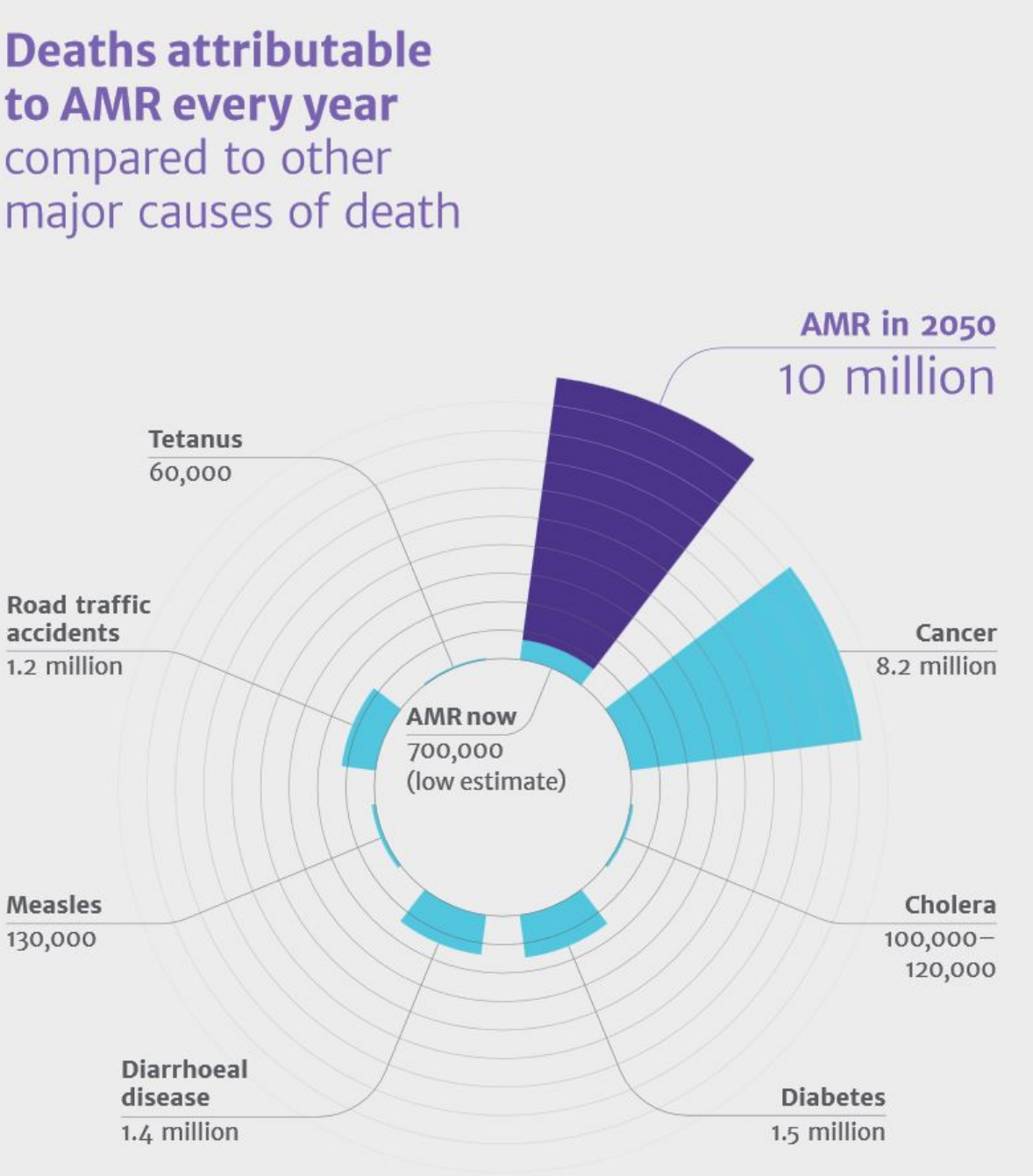

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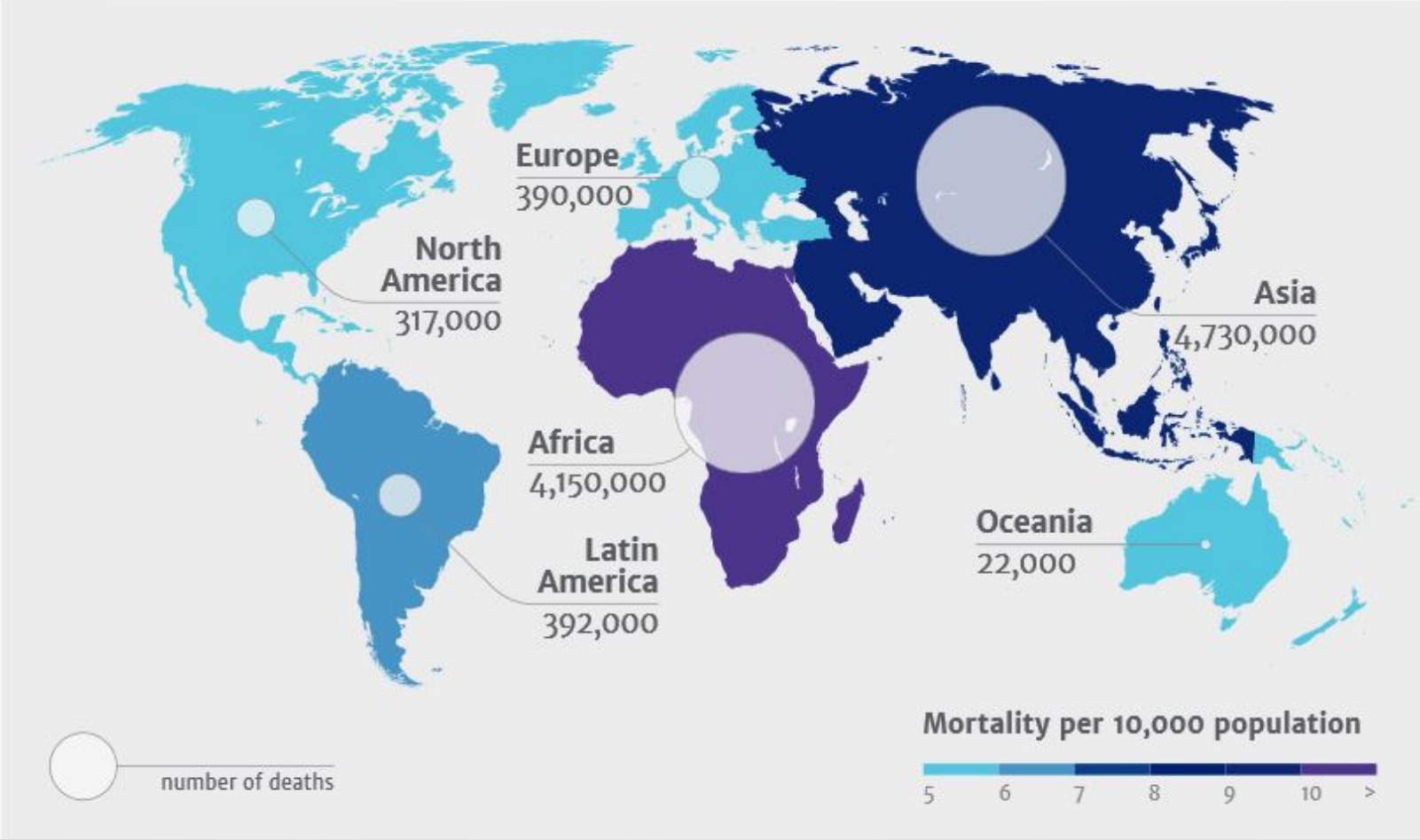
Yearly Deaths to AMR by 2050



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Antibiotic Overutilization

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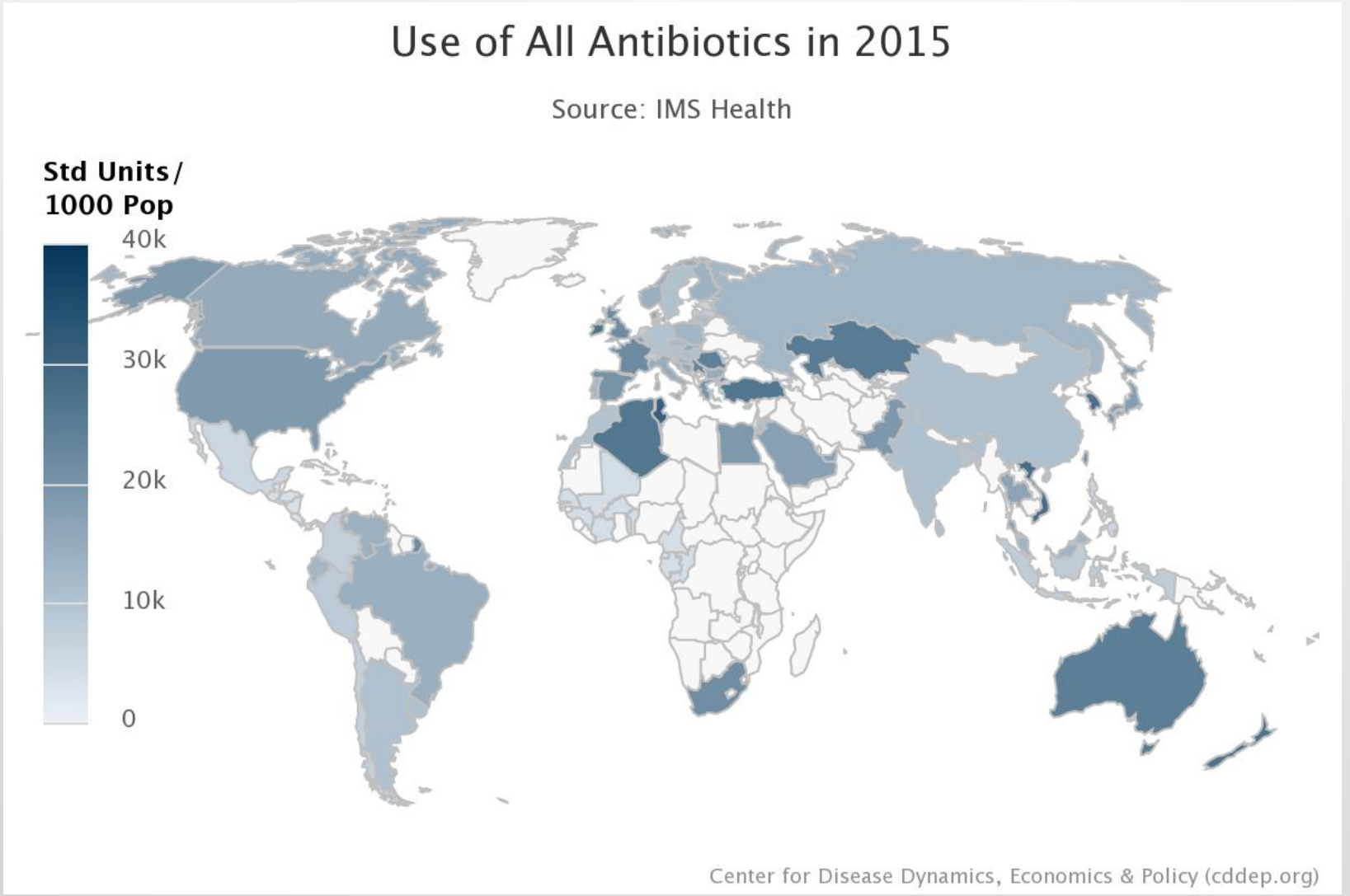
Antibiotic Usage – United States



The Center For Disease Dynamics, Economics & Policy (CDDEP): https://resistancemap.cddep.org/AntibioticUse.php

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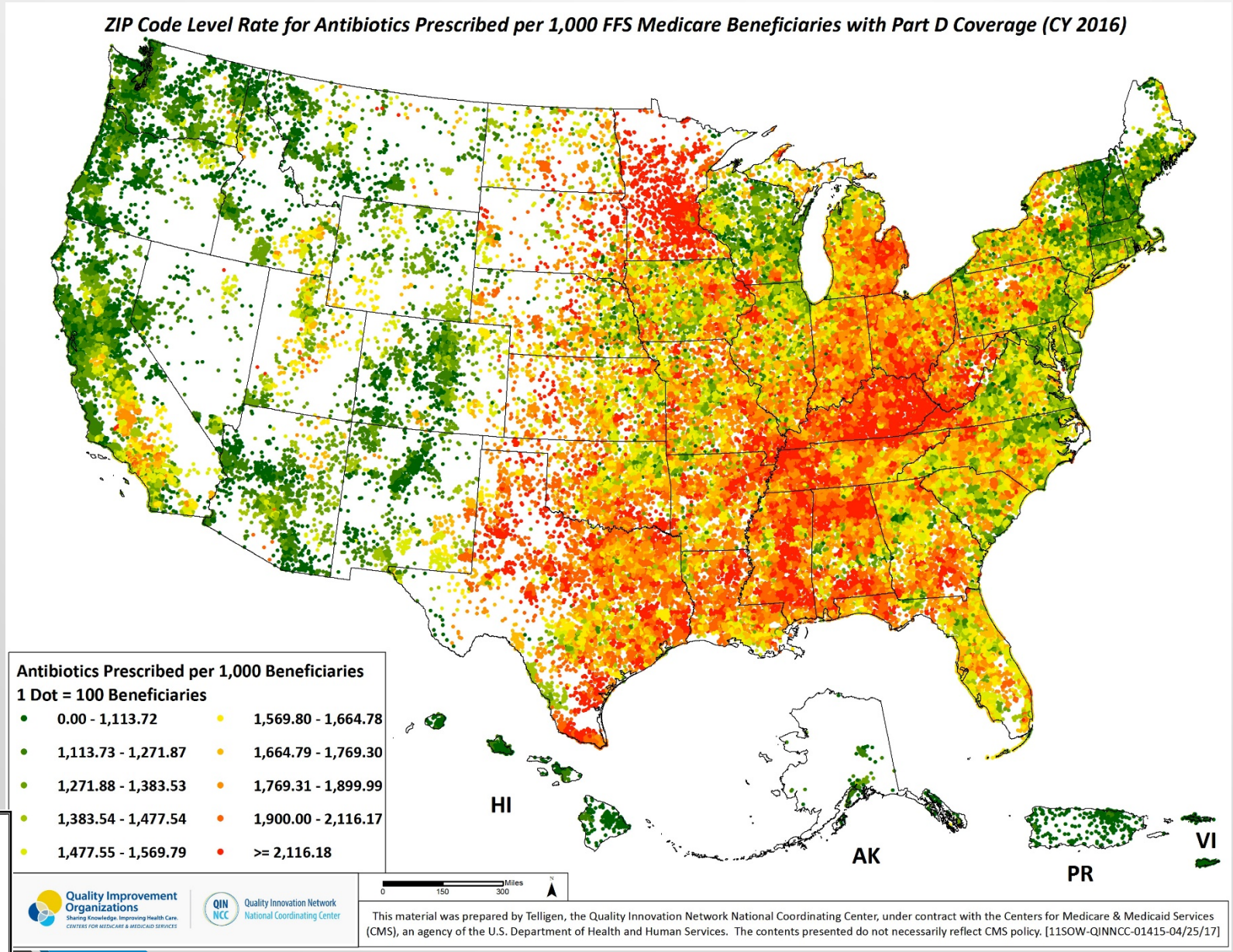
Antibiotic Usage – United States



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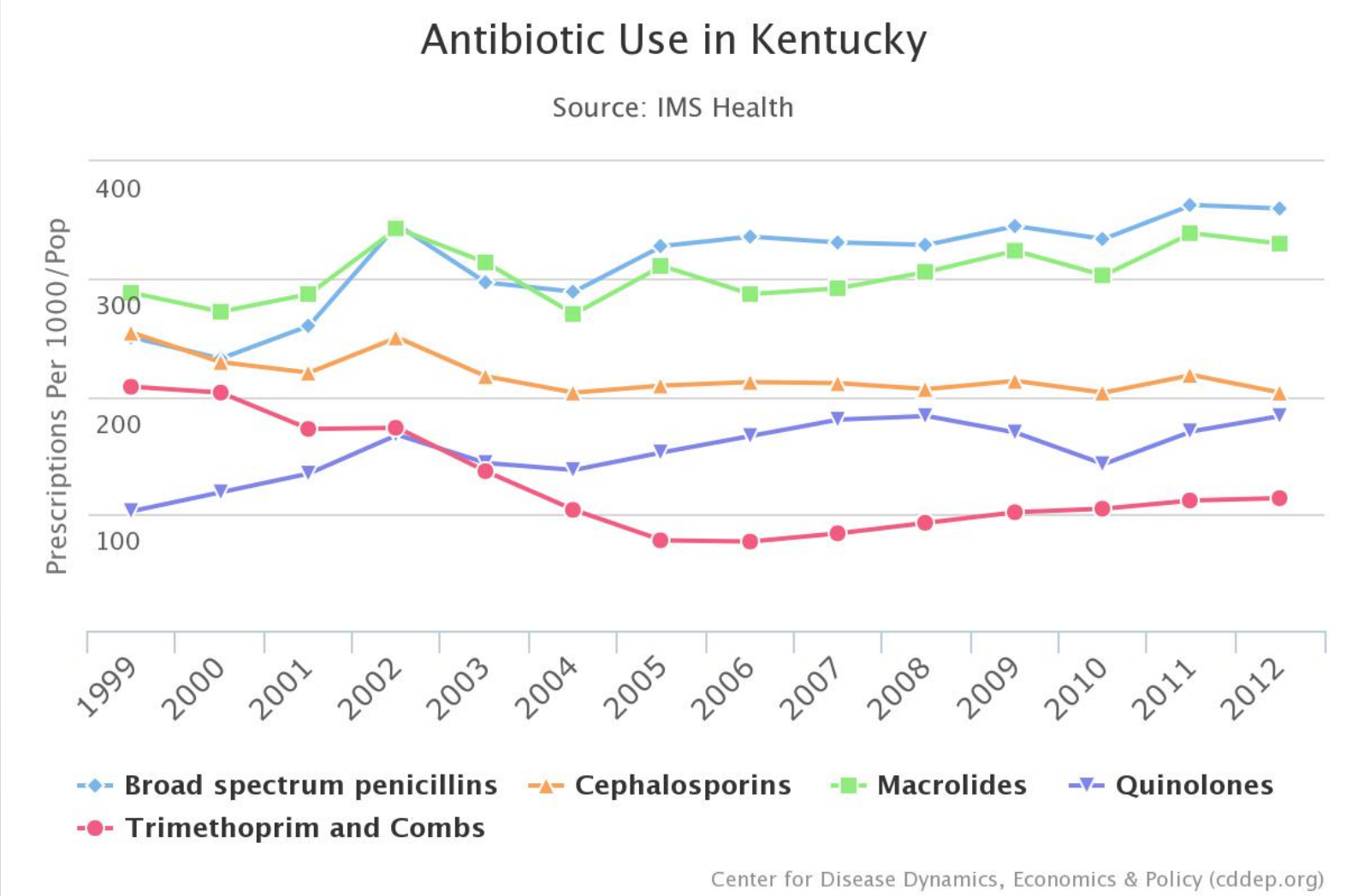
Antibiotic Usage – Kentucky



The Center For Disease Dynamics, Economics & Policy
https://resistancemap.cddep.org/CountryPageSub.php?countryId=38&country=United+States

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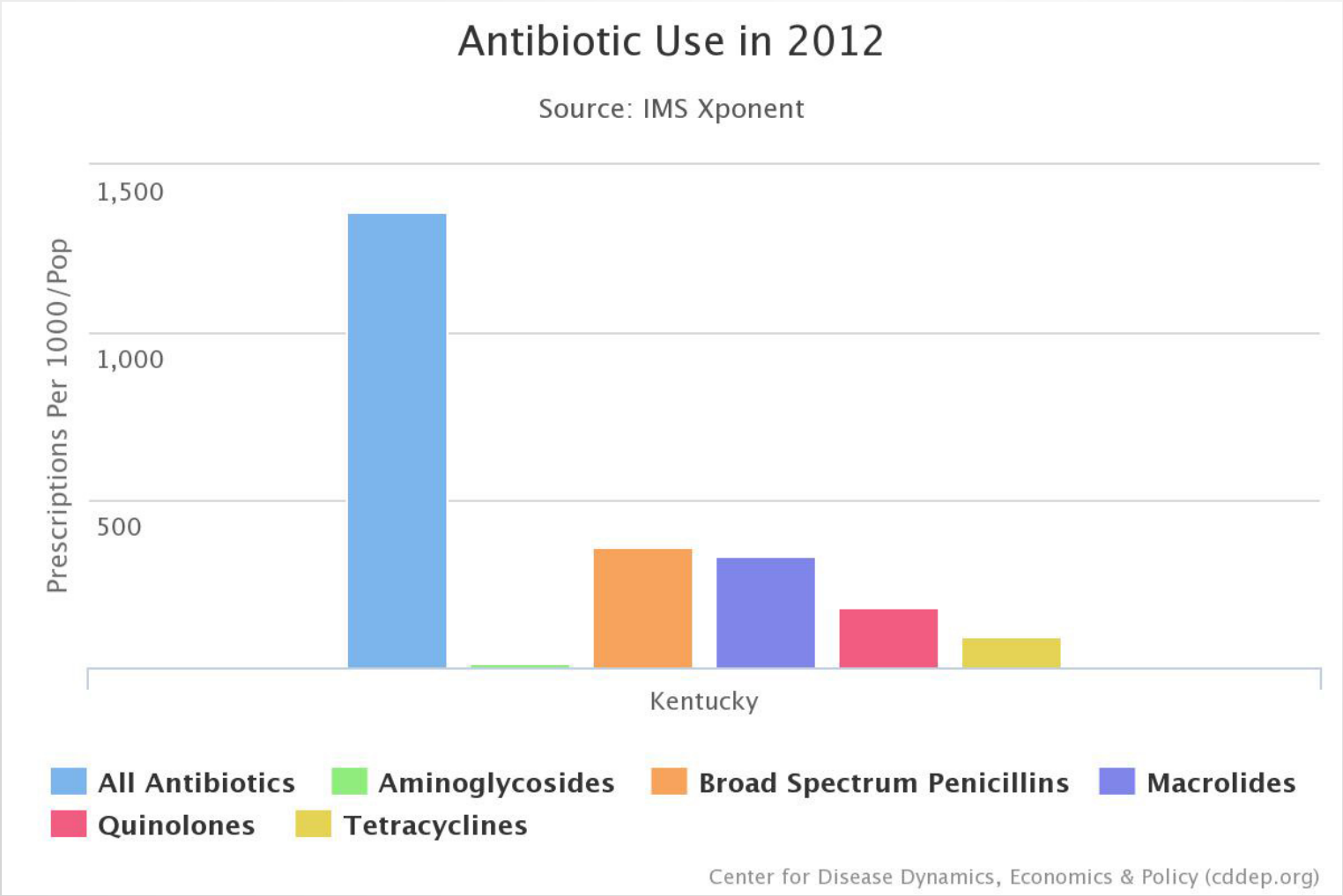
Antibiotic Usage - Kentucky



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Colistin, The last line of Defense

Same mechanism of resistance:

1) Polymyxin B
2) Polymyxin D (Colistin)

Agricultural Usage of Antibiotics

Agriculture Usage of Antibiotics

70% of antibiotics used in the United States are Used in Agriculture.

- **95% are used in the food and water of animals.**
- **Approximately 96% are sold over the counter.**

Antibiotics and Animal Agriculture: A Primer. Why are antibiotics used in animal agriculture, and what can be done to ensure their appropriate use? A fact sheet from the PEW charitable trusts. Jan. 2017 http://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2016/12/antibiotics-and-animal-agriculture-a-primer

U.S. Food and Drug Administration, 2014 Summary Report on Antimicrobials Sold or Distributed for Use in Food-Producing Animals (2015), http://www.fda.gov/downloads/ForIndustry/UserFees/AnimalDrugUserFeeActADUFA/UCM476258.pdf .

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Agriculture – MDRO Spread

Importance in Human Infections.

- Spread to the environment.
- On food processed, for example chicken chicken contaminated with *Salmonella* and/or *Campylobacter*.
- Mounting evidence of direct spread of MDROs from animals to humans. However, the percentage of human infections caused by this source has not been determined.

Consumer Union: The Overuse of Antibiotics in Food Animals Threatens Public Health. http://consumersunion.org/news/the-overuse-of-antibiotics-in-food-animals-threatens-public-health-2/

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Common Multi-Drug Resistant Organisms

Epidemiology and Control Are Different Depending Upon the Organism

- **Methicillin-resistant Staphylococcus aureus (MRSA)**
  -- Administration and Hospital Staff Dependent. Environmental Staff & Nursing.
- **Clostridium difficile (C. Diff.)**
  -- Physician Dependent, Antibiotic Stewardship can prevent activation.
  -- Screening has also been found to be beneficial.
- **Carbapenem-resistant Enterobacteriaceae (CRE)**
  -- Screening all contacts in both hospital and community. Coordinated approach with Health Dept. of Paramount Importance.

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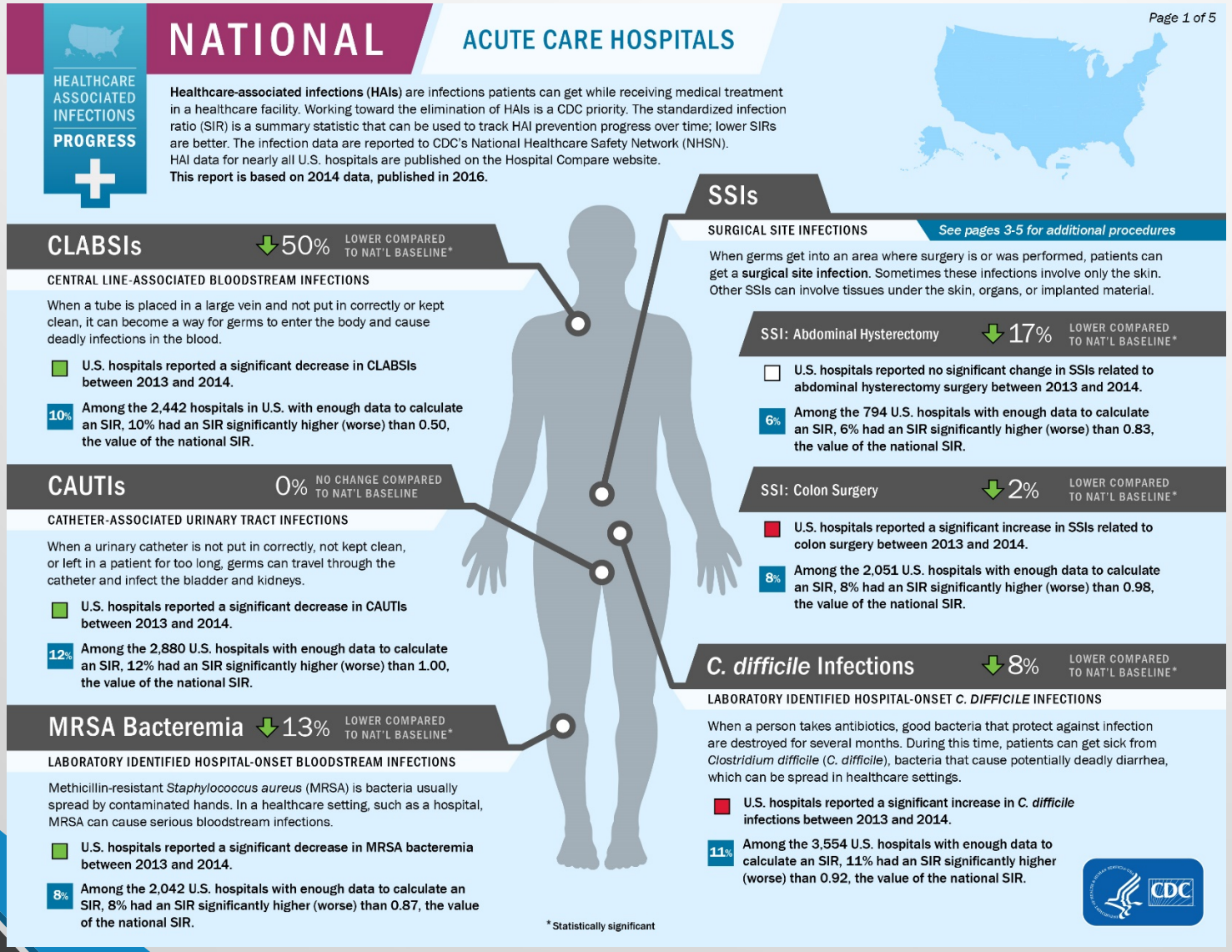
Epidemiology and Control Are Different Depending Upon the Organism



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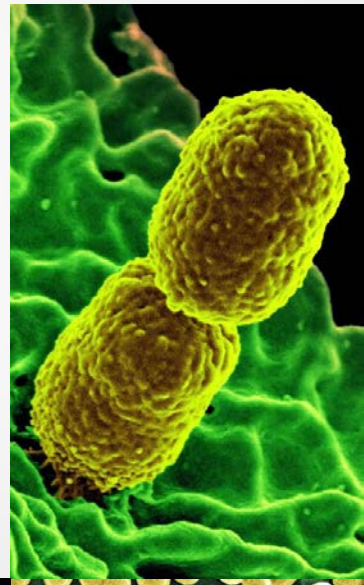
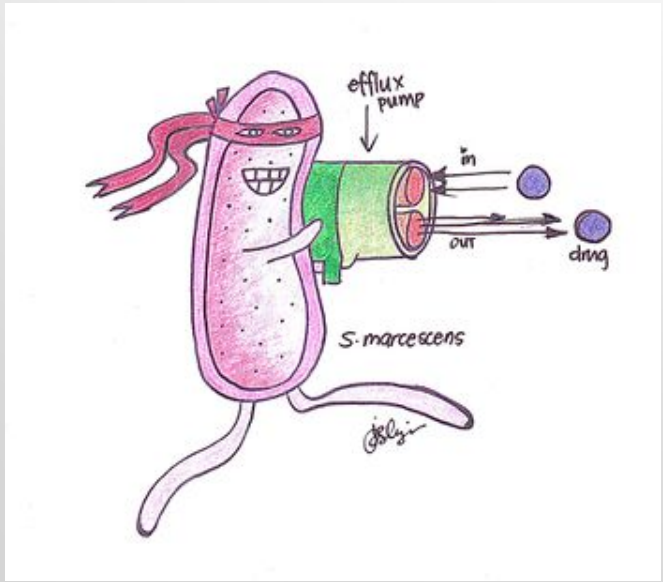
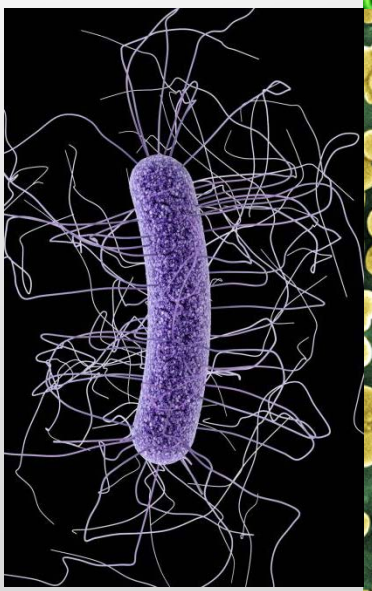
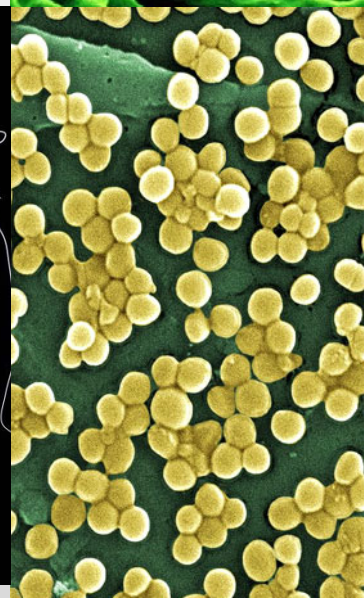
Mechanisms of Resistance

- Produces Enzyme To Breakdown Antibiotics.
- Multi-Drug Efflux Pumps
- Wall Barriers to Penetration.









Methicillin-resistant Staphylococcus aureus (*MRSA*)

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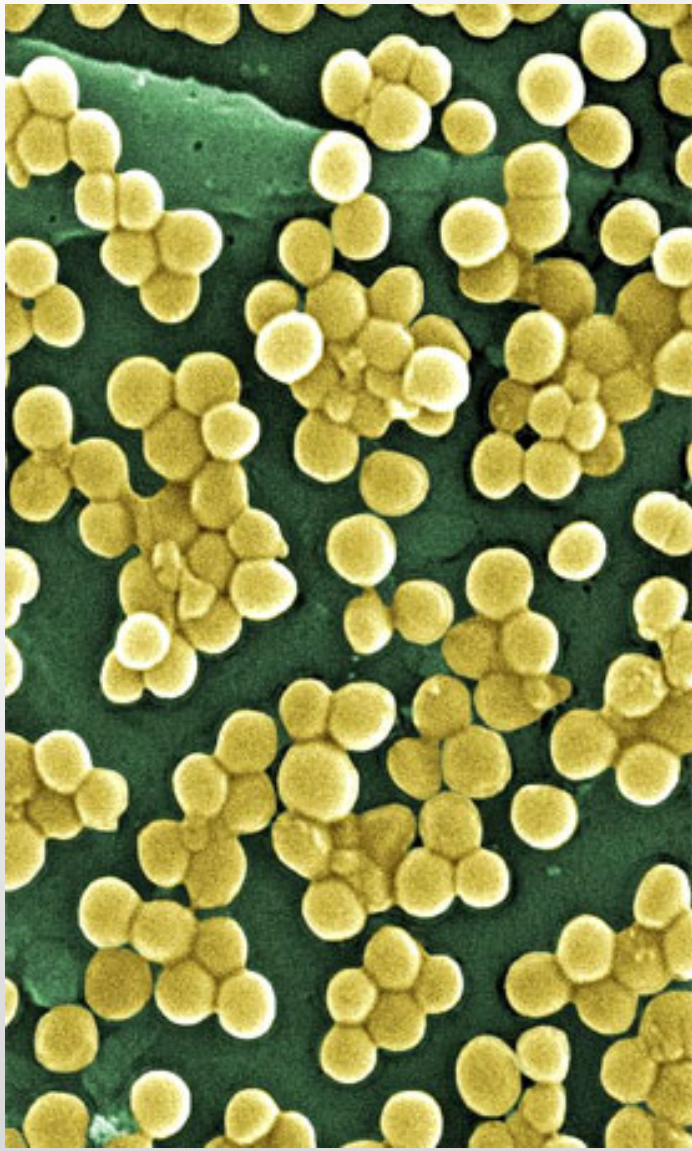
MRSA in The United States

- MRSA causes all too common skin and soft tissue infection.



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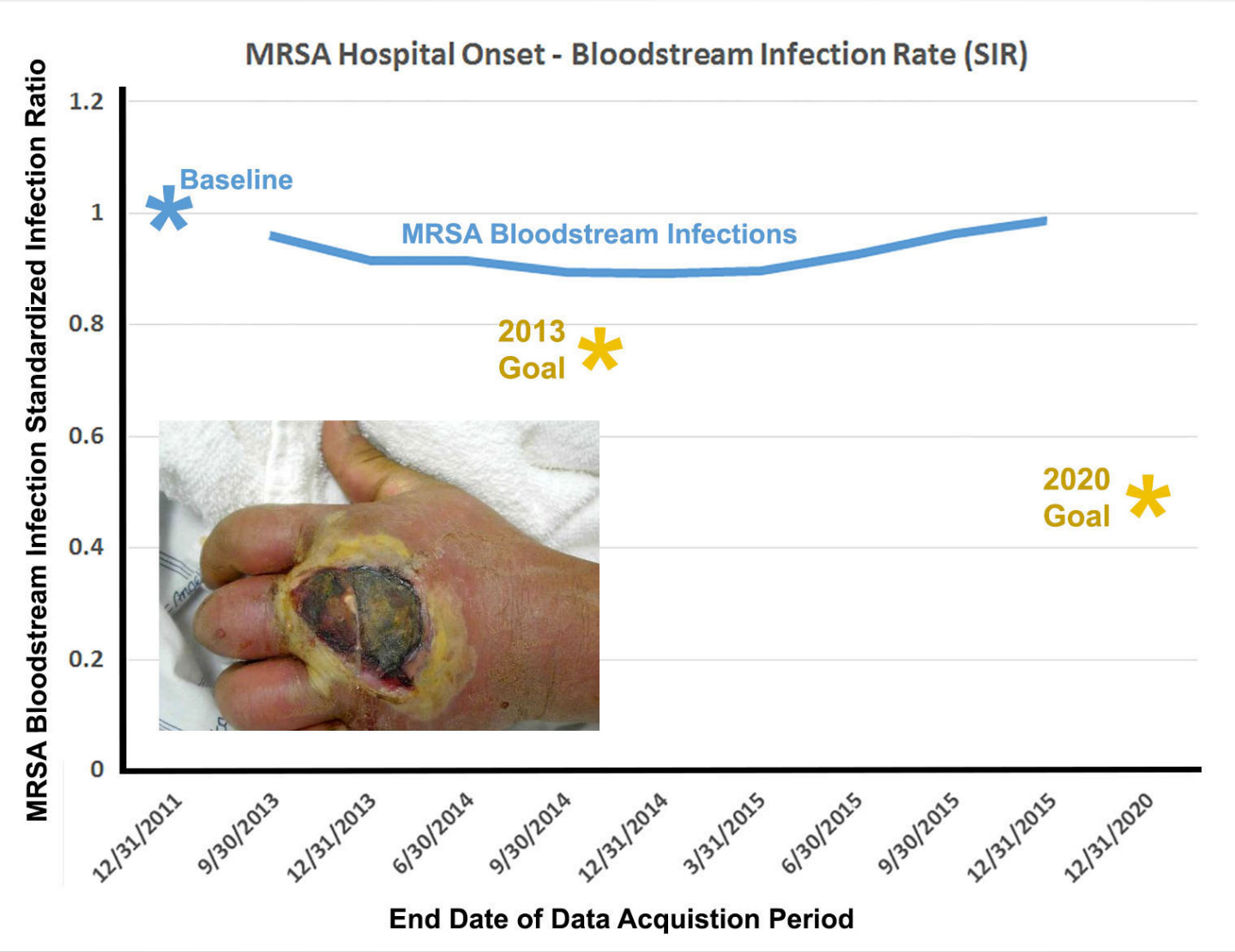
MRSA in The United States



Kavanagh KT, et. al. The incidence of MRSA infections in the United States. Is a more comprehensive tracking system needed? Antimicrobial Resistance and Infection Control. April 7, 2017.

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MRSA in Kentucky – CDC - HAI

KENTUCKY

ACUTE CARE HOSPITALS

Healthcare-associated infections (HAIs) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAIs is a CDC priority. The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time; lower SIRs are better. The infection data are reported to CDC's National Healthcare Safety Network (NHSN). HAI data for nearly all U.S. hospitals are published on the Hospital Compare website.
This report is based on 2014 data, published in 2016.

MRSA Bacteremia ↑ 25% HIGHER COMPARED TO NAT'L BASELINE*

LABORATORY IDENTIFIED HOSPITAL-ONSET BLOODSTREAM INFECTIONS

Methicillin-resistant *Staphylococcus aureus* (MRSA) is bacteria usually spread by contaminated hands. In a healthcare setting, such as a hospital, MRSA can cause serious bloodstream infections.

☐ Kentucky hospitals reported no significant change in MRSA bacteremia between 2013 and 2014.

18% Among the 34 hospitals in Kentucky with enough data to calculate an SIR, 18% had an SIR significantly higher (worse) than 0.87, the value of the national SIR.

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MRSA in Kentucky – NHSN - HAI

State Rankings MRSA Bloodstream Infections – Hospital Associated

Ranking	State	Measure Name	Measure ID	SIR Score
44	NV	MRSA	HAI_5_SIR	1.115
45	KY	MRSA	HAI_5_SIR	1.173
46	DC	MRSA	HAI_5_SIR	1.183
47	WV	MRSA	HAI_5_SIR	1.199
48	OK	MRSA	HAI_5_SIR	1.254
49	AR	MRSA	HAI_5_SIR	1.264
50	TN	MRSA	HAI_5_SIR	1.267
51	LA	MRSA	HAI_5_SIR	1.385

NHSN Data for Acquisition Dates: 4/1/2016 3/31/2017

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MRSA in Kentucky – NHSN - HAI

KY Hospital Rankings MRSA Bloodstream Infections – HAI

- 27 of 92 hospitals had calculated SIR Scores.
- One hospital was statistically better than the National Benchmark (NB).
- Four hospitals were statistically worse than the National Benchmark (NB).

Rank	Hospital			Measure ID	SIR Score	
4	BAPTIST HEALTH LOUISVILLE	LOUISVILLE	MRSA	HAI_5_SIR	0.268	Better Than NB
18	UNIVERSITY OF KENTUCKY HOSPITAL	LEXINGTON	MRSA	HAI_5_SIR	1.378	Worse than NB
20	NORTON HOSPITAL / NORTON HEALTHCARE PAVILION / NOR	LOUISVILLE	MRSA	HAI_5_SIR	1.639	Worse than NB
21	UNIVERSITY OF LOUISVILLE HOSPITAL	LOUISVILLE	MRSA	HAI_5_SIR	1.703	Worse than NB
26	LAKE CUMBERLAND REGIONAL HOSPITAL	SOMERSET	MRSA	HAI_5_SIR	2.541	Worse than NB

NHSN Data for Acquisition Dates: 4/1/2016 3/31/2017

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Will The Epidemic Reverse

- Denmark Experience – In Beginning Easier To Reverse

"The frequency of MRSA rose to 15% in the years 1967 through 1971 but decreased to 0.2% in 1984. Since 1984, only 0.2% of the Danish S aureus population has been MRSA, and imported MRSA strains have been prevented from spreading. "

Rosdahl VT, Knudsen AM. The decline of methicillin resistance among Danish Staphylococcus aureus strains. Infect Control Hosp Epidemiol. 1991 Feb;12(2):83-8.

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MRSA Prevention

Two Methodologies are in Use

- Surveillance and Screening
- Unit or Facility Wide Daily Bathing with Chlorhexidine

Reuters News Service: "In 2009, the federal government launched a campaign to reduce bloodstream infections by the notorious superbug methicillin-resistant *Staphylococcus aureus* (MRSA) in hospital patients 25 percent by 2013. That failed. The new goal: Halve infection rates by 2020. "

Nelson DJ, McNeill R. Money from infection-control industry muddies research into beating back superbugs Reuters News Service. Apr. 7, 2017. http://www.reuters.com/investigates/special-report/usa-superbugs-research/

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MRSA Prevention

Surveillance and Screening

- The U.S. Veterans Administration
- The United Kingdom

MRSA Prevention - VA

- The VA has also seen a dramatic reduction in MRSA infections in 127 reporting acute care hospitals. From October 2007 to October 2015, healthcare-associated **MRSA infection rates dropped 87.0% in ICUs and 80.1% in non-ICU patient areas**, achieving an incidence of 0.147 and 0.090 infections per 1,000 patient days, respectively. In long term care facilities the VA reports MRSA infection reductions of 49.4% from July 2009 to September 2015.12

Kavanagh KT, Abusalem S, Calderon LE. The incidence of MRSA infections in the United States. Is a more comprehensive tracking system needed? Antimicrobial Resistance and Infection Control. April 7, 2017. 6:34 DOI: 10.1186/s13756-017-0193-0
https://aricjournal.biomedcentral.com/articles/10.1186/s13756-017-0193-0

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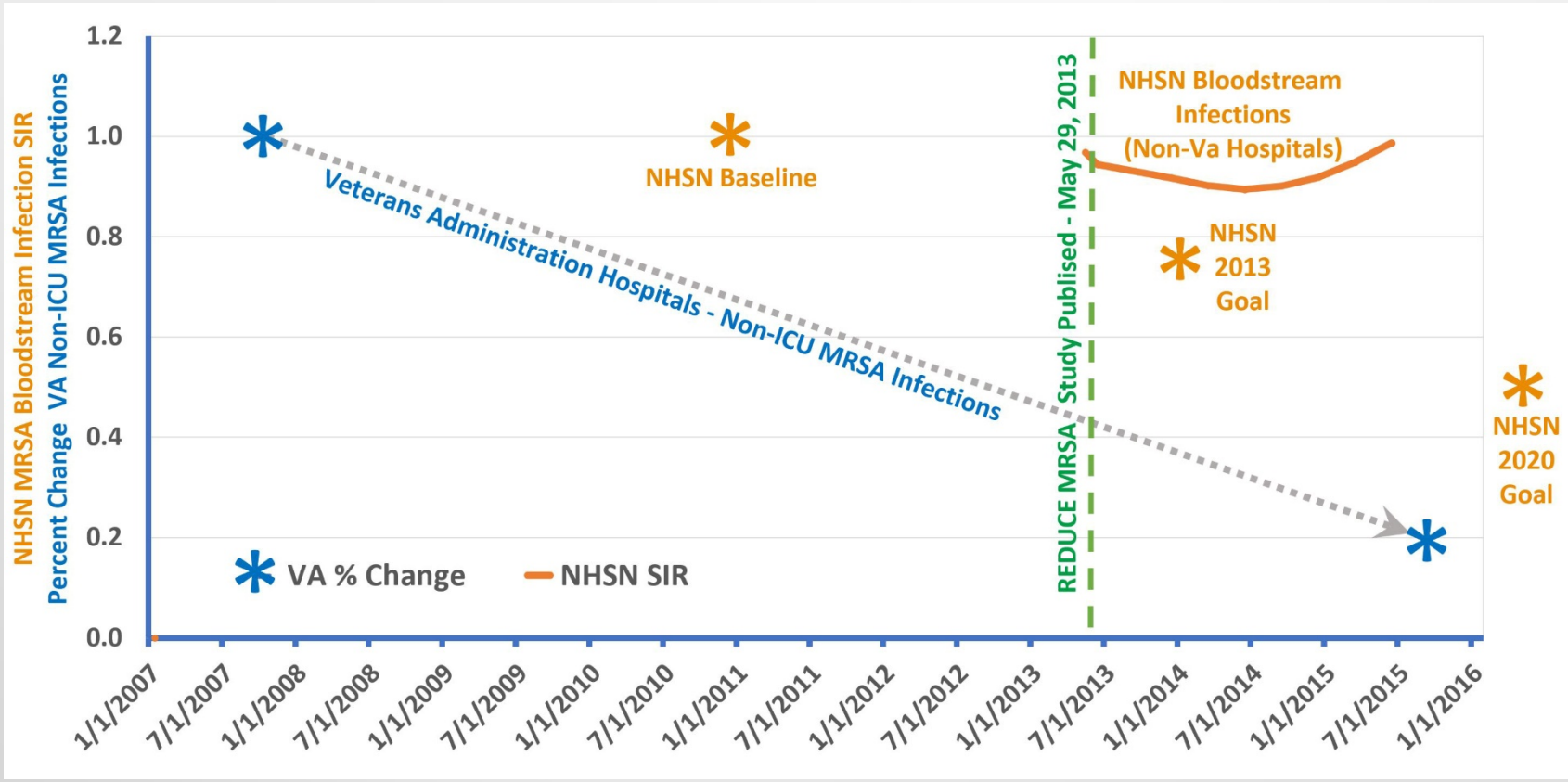
MRSA Prevention - VA



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https://aricjournal.biomedcentral.com/articles/10.1186/s13756-017-0193-0

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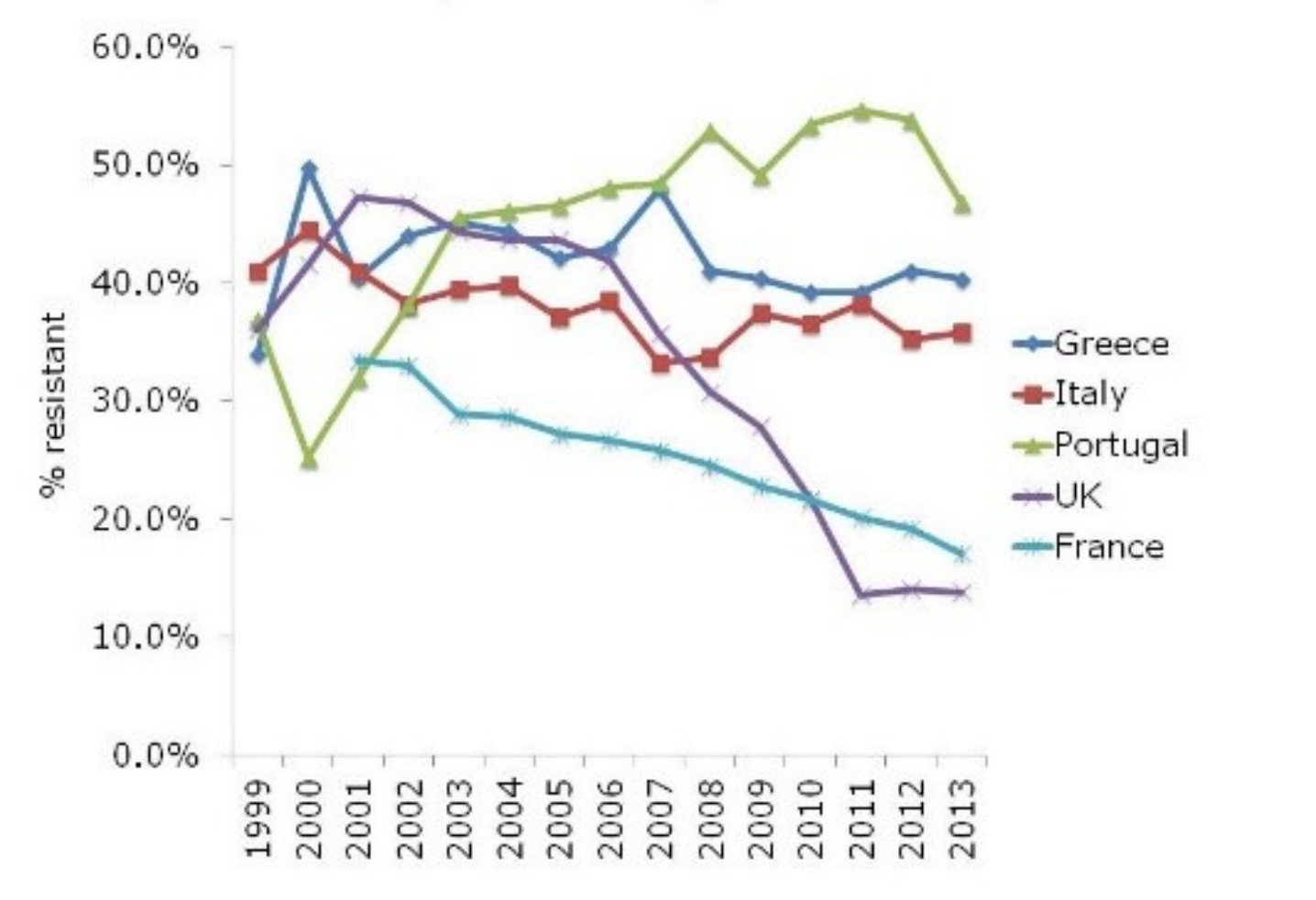
MRSA Prevention – United Kingdom

Even a Large Scale Epidemic Can Be Reversed.

The English Experience



Otter J. The English MRSA Miracle. Micro Blog. Your window to the world of healthcare microbiology and epidemiology; by Jon Otter and Saber Yezli \Mar. 8, 2015 from https://reflectionsipc.com/2015/03/03/the-english-mrsa-miracle/

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MRSA Prevention – United Kingdom

Screening of High Risk Patients

- All elective surgical patients
- All emergency admissions
- Critical care (including intensive care and high-dependency units)
- Pre-operative patients in certain surgical specialties
- Emergency orthopaedic and trauma admissions
- Renal medicine
- All patients previously known to be MRSA positive
- Oncology/chemotherapy inpatients
- Patients admitted from high-risk settings

Screening for Meticillin-resistant Staphylococcus aureus (MRSA) colonisation: A strategy for NHS trusts: a summary of best practice. 2006 (Archived Jan 23, 2013) http://webarchive.nationalarchives.gov.uk/20130123191323/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_063187.pdf

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MRSA Prevention – United Kingdom

- 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 (either at pre-admission clinics for elective admissions or immediately on admission for emergency admissions).

Screening for Meticillin-resistant Staphylococcus aureus (MRSA) colonisation: A strategy for NHS trusts: a summary of best practice. 2006 (Archived Jan 23, 2013) http://webarchive.nationalarchives.gov.uk/20130123191323/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_063187.pdf

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MRSA - Chlorohexidine Bathing

Popularized by the Reduce MRSA Study.
Research Integrity Questions Regarding:

- **Spinning of Data**
- **Changing of Metrics**
- **Use of Surrogate Endpoints**

Huang SS, Septimus E, Kleinman K, et al. Targeted versus universal decolonization to prevent ICU infection. *N Engl J Med.* 2013; **368**(24):2255-65. doi: 10.1056/NEJMoa1207290. Epub 2013 May 29

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Spinning of Data – REDUCE MRSA Study

- Abstract: "In routine ICU practice, universal decolonization was more effective than targeted decolonization or screening and isolation in reducing rates of MRSA clinical isolates and bloodstream infection from any pathogen."
- But "any pathogen" refers to a composite category which was added after the trial completion date (registered on clinical trials.gov) and whose effects were largely based on Yeast and Consensual Bacteria.

Huang SS, Septimus E, Kleinman K, et al. Targeted versus universal decolonization to prevent ICU infection. *N Engl J Med.* 2013; **368**(24):2255-65. doi: 10.1056/NEJMoa1207290. Epub 2013 May 29

Chlorhexidine – Health Watch USA

- Kavanagh KT, Saman DM, Yu Y. A Perspective on How the United States Fell behind Northern Europe in the Battle against Methicillin-Resistant Staphylococcus aureus. Antimicrob Agents Chemother. 2013 Dec;57(12):5789-91. doi: 10.1128/AAC.01839-13. Epub 2013 Oct 7. PMID: 24100502 http://aac.asm.org/content/57/12/5789.long

- Kavanagh KT, Calderon LE, Saman DM, Abusalem SK. The use of surveillance and preventative measures for methicillin-resistant staphylococcus aureus infections in surgical patients. Antimicrob Resist Infect Control. 2014 May 14;3:18. eCollection 2014. PMID: 24847437 http://www.aricjournal.com/content/3/1/18

- Kavanagh KT, Calderon LE and Saman DM Viewpoint: a response to "Screening and isolation to control methicillin-resistant Staphylococcus aureus: sense, nonsense, and evidence" Antimicrobial Resistance and Infection Control 2015, 4:4 (5 February 2015) http://www.aricjournal.com/content/4/1/4

- Kavanagh KT, Tower SS, Saman DM. A perspective on the principles of integrity in infectious disease research. Journal of Patient Safety. Published Online Mar. 24, 2016. PMID 27010326 http://journals.lww.com/journalpatientsafety/Fulltext/2016/06000/A_Perspective_on_the_Principles_of_Integrity_in.1.aspx

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MRSA - Chlorhexidine Bathing

Cleaning Up

Money from infection-control industry muddies research into beating back superbugs

By Deborah J. Nelson and Ryan McNeill | **Filed** April 7, 2017, 1 p.m. GMT

Reuters News Service: "Since then, Sage has provided funding and millions of dollars in wipes for studies by Weinstein and his colleagues. And in that time, Weinstein and his colleagues have published 11 articles on six trials that endorse daily washing of patients with Sage's patented wipes — an "off-label" use, as the U.S. Food and Drug Administration (FDA) has approved the wipes only for cleaning patients before surgery."

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MRSA - Chlorhexidine Bathing

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Reuters News Service: "....a $1 million donation from the family foundation of Sage's founder, Vincent W. Foglia. The money was earmarked for research by the senior scientist on the study, Dr Robert A. Weinstein, an infectious-disease specialist at Rush.."

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MRSA - Chlorhexidine Bathing

Chlorhexidine reduces MRSA, VRE in patients with devices

October 7, 2017

Helio Infectious Disease News: "We found that, in general units outside the ICU, **only** patients with central lines and other medical devices derived a benefit from chlorhexidine bathing, researcher Susan S. Huang, MD, MPH,."

Oct. 7, 2017: https://www.healio.com/infectious-disease/mrsa/news/online/{91bded5c-d4c7-426d-97f7-b42169472618}/daily-chlorhexidine-does-not-reduce-mrsa-vre-in-lower-risk-patients

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BUSINESS

UCI doctor's plan to stop superbugs is widely used. didn't work

By MELODY PETERSEN MAY 16, 2017 | 6:00 AM

LA Times: "Dr. Susan Huang, the hospital's infection control expert, had a plan. The strategy — which she had promoted so successfully that most U.S. hospitals now use it — included bathing all infants in the ICU with a powerful disinfectant, and swabbing inside their noses with an antibiotic. But this time, the plan failed.."

Peterson M. LA Times May 16, 2017
http://www.latimes.com/business/la-fi-uci-infant-outbreak-20170515-story.html

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MRSA - Chlorhexidine Bathing

May be fueling the epidemic of CRE by stimulation of Multi-Drug Efflux Pumps

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Clostridium difficile (C. Diff)

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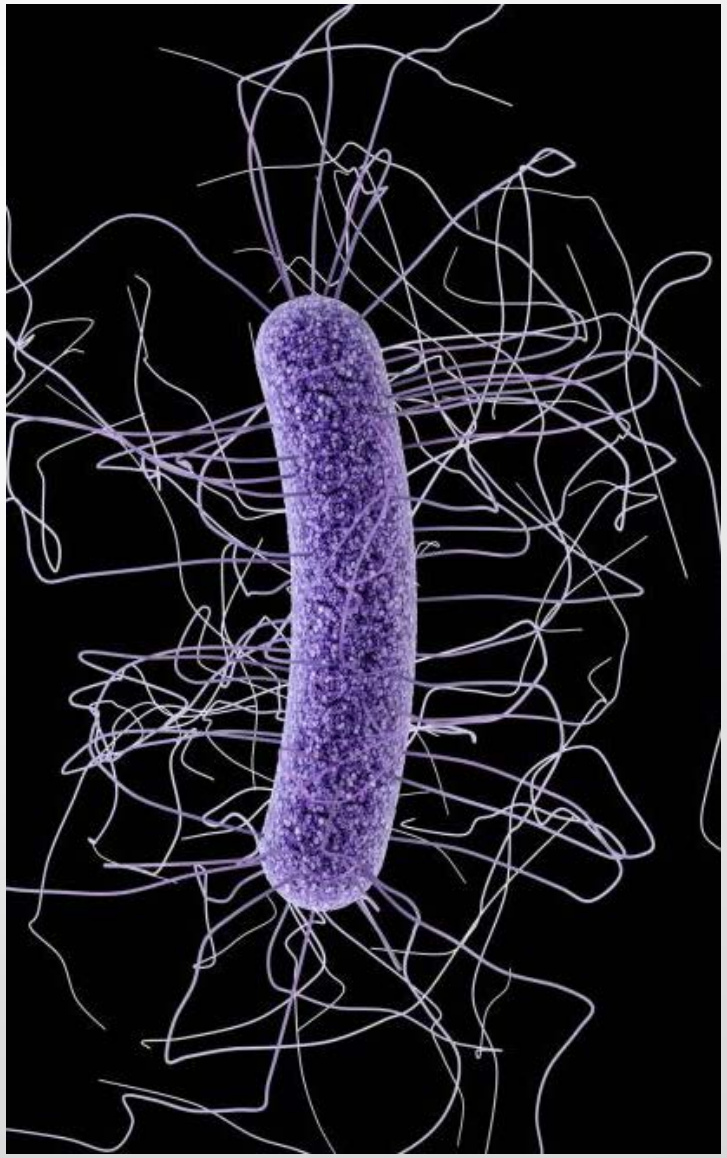
Clostridium difficile

- C. Diff can cause a severe and life threatening GI infection.
- Forms Spores – Very hard to treat and infections return 20% of the time.
- 95% of infections are linked to medical care (hospitals 25%, nursing homes, outpatient care 75%).



https://www.cdc.gov/HAI/organisms/cdiff/Cdiff_infect.html
https://www.cdc.gov/hai/organisms/cdiff/cdiff-patient.html

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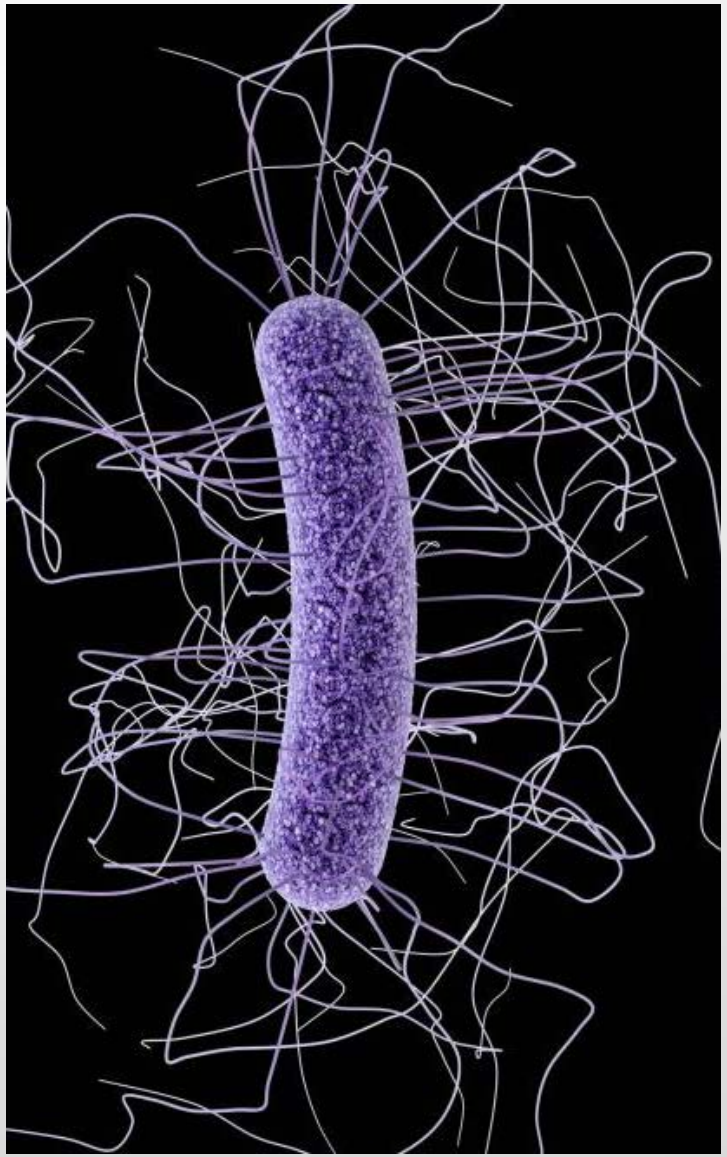
Clostridium difficile

- *C. difficile* – was estimated to cause almost half a million infections in the United States in 2011, and 29,000 died within 30 days of the initial diagnosis.
- Cost estimated to be 1 billion dollars annually.
- Rates increased 4X between 2000 and 2007. NOT GOING DOWN



https://www.cdc.gov/HAI/organisms/cdiff/Cdiff_infect.html
https://www.cdc.gov/hai/organisms/cdiff/cdiff-patient.html

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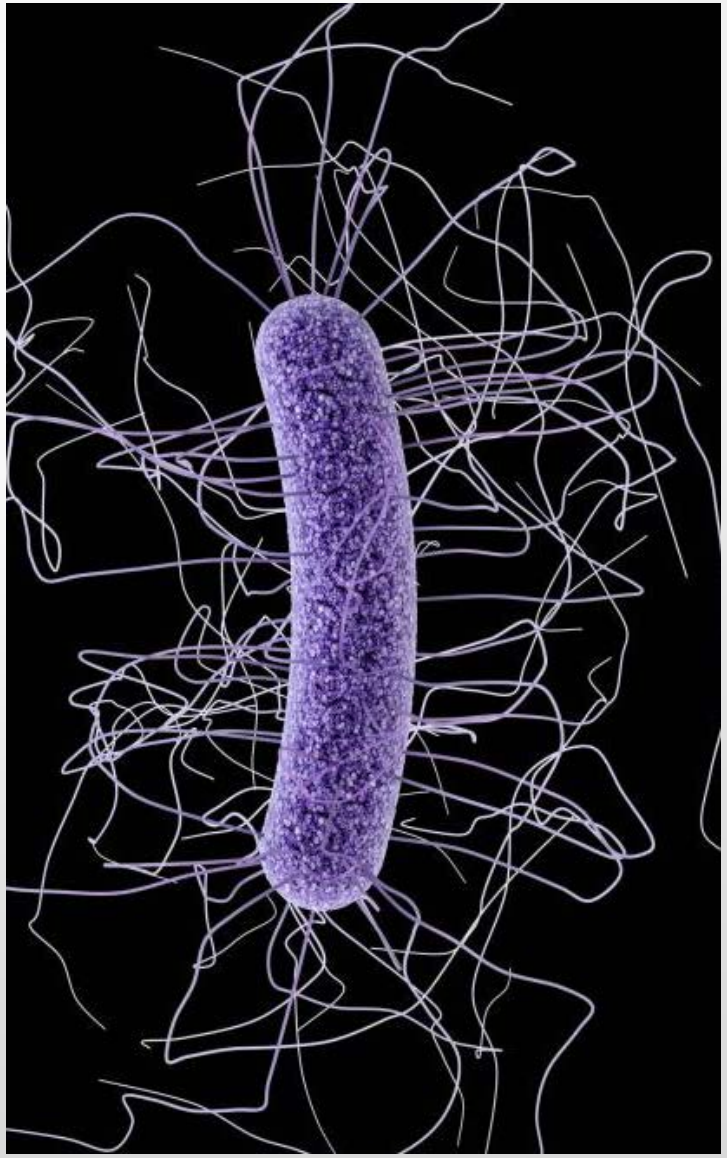
Clostridium difficile – PA Hospitals

- In FY 2017, 17,495 admissions for CDI—relatively steady since FY 2008. 20% developed the condition in the hospital.
- Mortality Declining. "In-hospital mortality dropped 42% (from 9.7% to 5.7%
- Readmission rates dropped 14%, from 32.9% to 28.2%."
- Patients admitted with CDI had a 5% mortality. Acquired CDI in the hospital was associated with a 8.5 mortality.



Ref: PHC4
http://www.phc4.org/reports/researchbriefs/cdi/17/nr030118.htm

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Clostridium difficile in KY– CDC - HAI

KENTUCKY

ACUTE CARE HOSPITALS

Healthcare-associated infections (HAIs) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAIs is a CDC priority. The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time; lower SIRs are better. The infection data are reported to CDC's National Healthcare Safety Network (NHSN). HAI data for nearly all U.S. hospitals are published on the Hospital Compare website.
This report is based on 2014 data, published in 2016.

C. difficile Infections

8% LOWER COMPARED TO NAT'L BASELINE*

LABORATORY IDENTIFIED HOSPITAL-ONSET *C. DIFFICILE* INFECTIONS

When a person takes antibiotics, good bacteria that protect against infection are destroyed for several months. During this time, patients can get sick from *Clostridium difficile* (*C. difficile*), bacteria that cause potentially deadly diarrhea, which can be spread in healthcare settings.

☐ **Kentucky hospitals reported no significant change in *C. difficile* infections between 2013 and 2014.**

14% **Among the 69 hospitals in Kentucky with enough data to calculate an SIR, 14% had an SIR significantly higher (worse) than 0.92, the value of the national SIR.**

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DEPARTMENT OF HEALTH & HUMAN SERVICES · USA
CDC

Clostridium difficile in KY – NHSN - HAI

State Rankings Clostridium Difficile Infections – Hospital Associated

Ranking	State	Measure Name	Measure ID	SIR Score
1	AL	C. Difficile	HAI_6_SIR	0.623
2	ME	C. Difficile	HAI_6_SIR	0.68
3	ID	C. Difficile	HAI_6_SIR	0.692
4	MS	C. Difficile	HAI_6_SIR	0.718
5	FL	C. Difficile	HAI_6_SIR	0.769
6	SC	C. Difficile	HAI_6_SIR	0.77
7	HI	C. Difficile	HAI_6_SIR	0.779
8	AR	C. Difficile	HAI_6_SIR	0.786
9	KY	C. Difficile	HAI_6_SIR	0.799

NHSN Data for Acquisition Dates: 4/1/2016 3/31/2017

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Clostridium difficile in KY– NHSN - HAI

Rank	Hospital			Measure ID	SIR Score	
1	WHITESBURG ARH HOSPITAL	WHITESBURG	C. Diff	HAI_6_SIR	0	Better than NB
8	GREENVIEW REGIONAL HOSPITAL	BOWLING GREEN	C. Diff	HAI_6_SIR	0.149	Better than NB
11	METHODIST HOSPITAL	HENDERSON	C. Diff	HAI_6_SIR	0.289	Better than NB
12	HAZARD ARH REGIONAL MEDICAL CENTER	HAZARD	C. Diff	HAI_6_SIR	0.291	Better than NB
14	HIGHLANDS REGIONAL MEDICAL CENTER	PRESTONSBURG	C. Diff	HAI_6_SIR	0.332	Better than NB
16	HARDIN MEMORIAL HOSPITAL	ELIZABETHTOWN	C. Diff	HAI_6_SIR	0.453	Better than NB
17	BAPTIST HEALTH PADUCAH	PADUCAH	C. Diff	HAI_6_SIR	0.467	Better than NB
19	OUR LADY OF BELLEFONTE HOSPITAL	ASHLAND	C. Diff	HAI_6_SIR	0.473	Better than NB
21	OWENSBORO HEALTH REGIONAL HOSPITAL	OWENSBORO	C. Diff	HAI_6_SIR	0.503	Better than NB
24	LOURDES HOSPITAL	PADUCAH	C. Diff	HAI_6_SIR	0.536	Better than NB
26	BAPTIST HEALTH MADISONVILLE	MADISONVILLE	C. Diff	HAI_6_SIR	0.611	Better than NB
28	KING'S DAUGHTERS' MEDICAL CENTER	ASHLAND	C. Diff	HAI_6_SIR	0.639	Better than NB
29	THE MEDICAL CENTER AT BOWLING GREEN	BOWLING GREEN	C. Diff	HAI_6_SIR	0.652	Better than NB
30	UNIVERSITY OF KENTUCKY HOSPITAL	LEXINGTON	C. Diff	HAI_6_SIR	0.766	Better than NB
31	ST ELIZABETH MEDICAL CENTER NORTH	EDGEWOOD	C. Diff	HAI_6_SIR	0.77	Better than NB
57	EPHRAIM MCDOWELL REGIONAL MED. CTR.	DANVILLE	C. Diff	HAI_6_SIR	1.482	Worse than NB
59	OWENSBORO HEALTH MUHLENBERG COMMUNITY HOSPITAL	GREENVILLE	C. Diff	HAI_6_SIR	2.722	Worse than NB
60	FLAGET MEMORIAL HOSPITAL	BARDSTOWN	C. Diff	HAI_6_SIR	3.529	Worse than NB

- 60 of 92 hospitals had calculated SIR Scores.
- 15 hospitals was statistically better than the National Benchmark.
- 3 hospitals were statistically worse than the National Benchmark.

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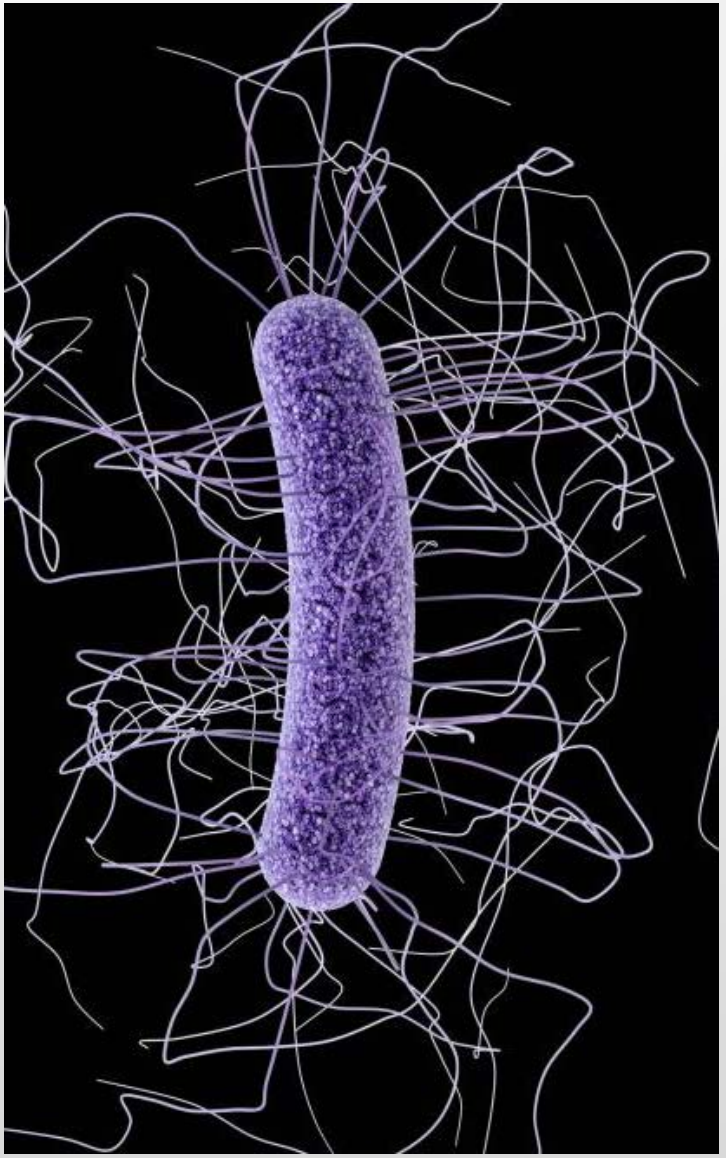
NHSN Data for Acquisition Dates: 4/1/2016 3/31/2017

Antibiotic Overutilzation

- **Fluoroquinolones**

FDA: "The U.S. Food and Drug Administration is advising that the serious side effects associated with fluoroquinolone antibacterial drugs generally outweigh the benefits for patients with acute sinusitis, acute bronchitis, and uncomplicated urinary tract infections who have other treatment options. For patients with these conditions, fluoroquinolones should be reserved for those who do not have alternative treatment options." July 26, 2016.

https://www.fda.gov/Drugs/DrugSafety/ucm500143.htm



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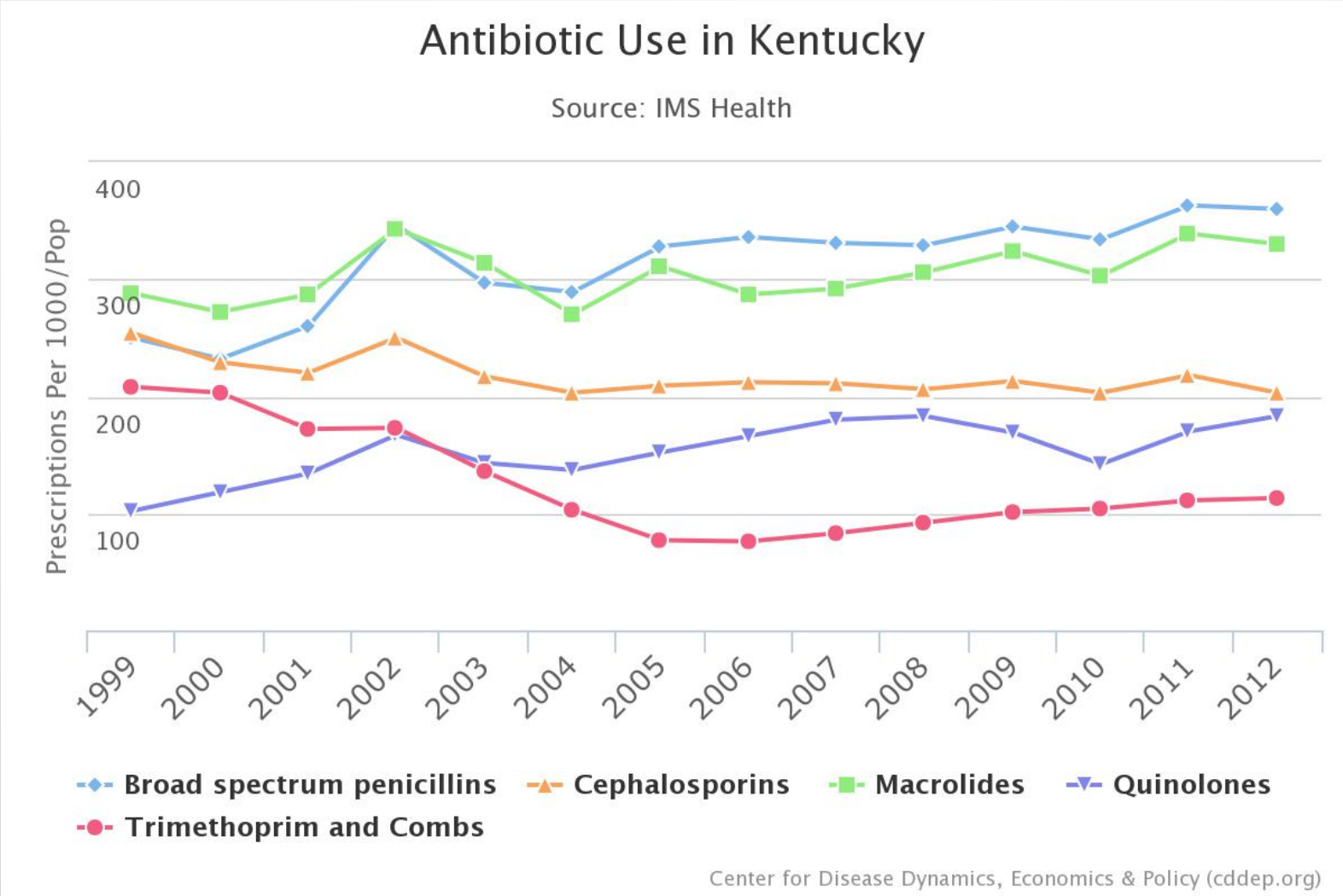
Antibiotic Usage – Kentucky



The Center For Disease Dynamics, Economics & Policy
https://resistancemap.cddep.org/CountryPageSub.php?countryId=38&country=United+States

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Carbapenem-resistant Enterobacteriaceae (*CRE*)

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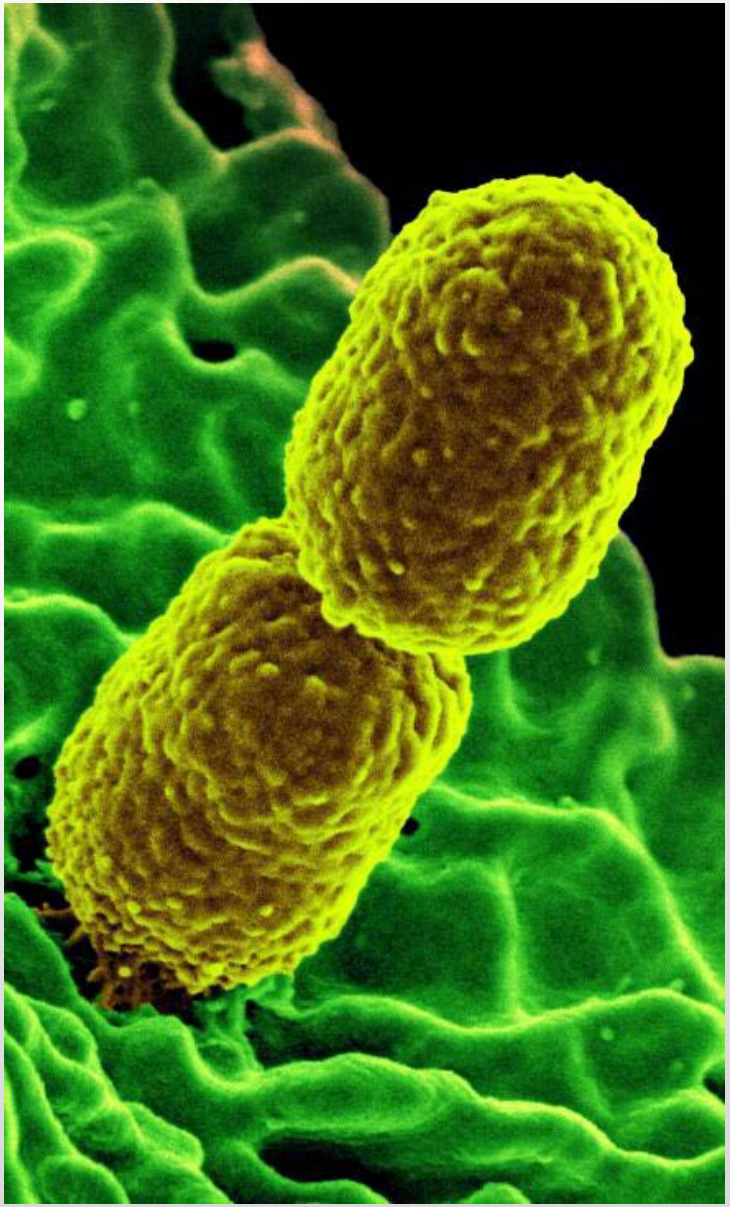
Carbapenem-resistant Enterobacteriaceae

- Severe GI Infections with a 50% fatality rate if enters the blood.
- Colistin – Very toxic antibiotic is the last line of defense.
- However, becoming resistant to this antibiotic.

Ref: CDC



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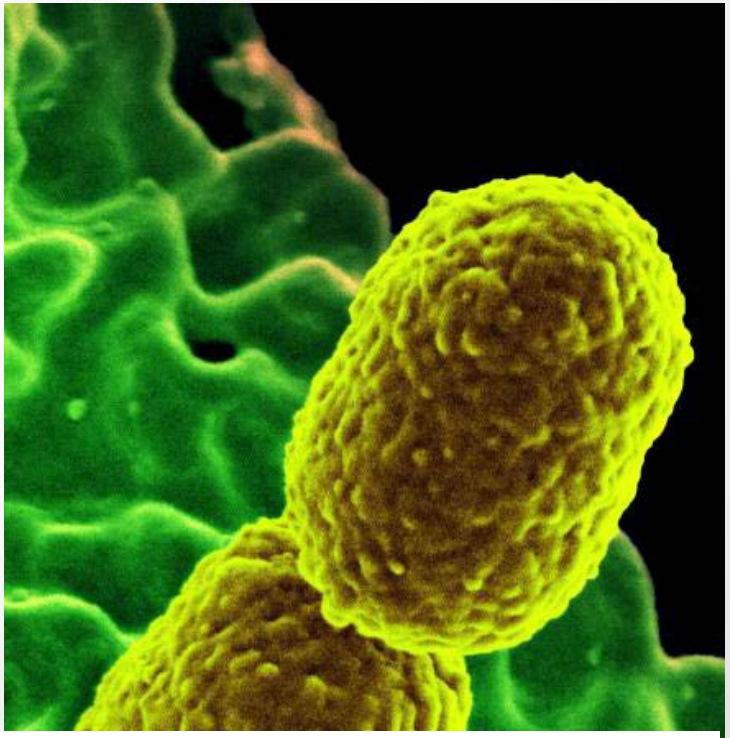
Carbapenem-resistant Enterobacteriaceae

- There is no National Reporting System
- Possible to reduce CRE infections by 70% over 5 years if facilities coordinate to protect patients – CDC.



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Antibiotic-resistant germs cause more than **2 million** illnesses and at least 23,000 deaths each year in the US.

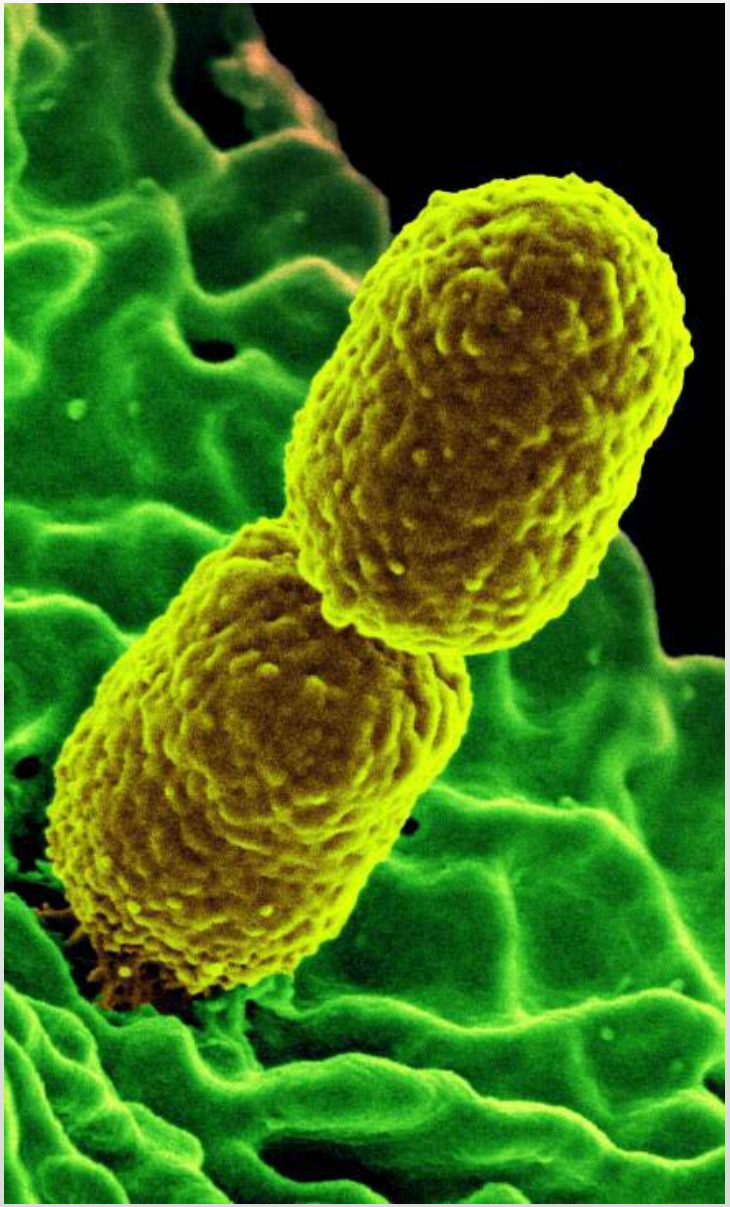
Up to **70%** fewer patients will get CRE over 5 years if facilities coordinate to protect patients.

Preventing infections and improving antibiotic prescribing could save **37,000** lives from drug-resistant infections over 5 years.

CRE - Prevention

Carbapenem-Resistant *Enterobacteriaceae* (CRE) Control and Prevention Toolkit

"Each institution will need to carefully choose among the available screening methodologies to support their active surveillance program, and lack of ability to implement molecular testing should not otherwise prevent pursuit of aggressive CRE control efforts using existing culture techniques."



Ref: Carbapenem-Resistant Enterobacteriaceae (CRE) Control and Prevention Toolkit. - AHRQ
http://www.ahrq.gov/cretoolkit

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Facility Guidance for Control of Carbapenem-resistant *Enterobacteriaceae* (CRE)

November 2015 Update - CRE Toolkit

- Identification of all epidemiologically related contacts (screening).
- Contact Isolation for carriers and those with infections.

Screening is used to identify unrecognized CRE colonization as clinical cultures alone will identify only a fraction of all patients with CRE. Generally, this testing has involved stool, rectal, or peri-rectal cultures and sometimes cultures of skin sites, wounds or urine (if a urinary catheter is present).

When available, patients colonized or infected with any CP-CRE or any non-CP-CRE judged to be epidemiologically important should be housed in single patient rooms. In addition, consideration

Point prevalence surveys might be an effective way for facilities to rapidly evaluate the prevalence of CRE in particular wards/ units and is usually conducted by screening all patients present on the unit. This

CRE are nightmare bacteria

CRE in 2002 to 2012: "During the first six months of 2012 4.6% of hospitals reported one or more infections. 3.9% in short stay hospitals and 17.8% long term facilities.[2] CRE Klebsiella cultures positive for CRE increased from 0.1% to 4.5% between 2002 and 2010.[4]

Vital Signs: Carbapenem-Resistant Enterobacteriaceae. MMWR Morbidity and Mortality Weekly Report. March 5, 2013. Vol. 62
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6209a3.htm?s_cid=mm6209a3_w
CDC News Release. Tuesday, March 5th, 2013.
http://www.cdc.gov/media/releases/2013/p0305_deadly_bacteria.html
Braykov NP, Eber MR, Klein EY, Morgan DJ, Laxminarayan R. Trends in resistance to carbapenems and third-generation cephalosporins among clinical isolates of Klebsiella pneumoniae in the United States, 1999-2010. Infect Control Hosp Epidemiol. 2013 Mar;34(3):259-68. doi: 10.1086/669523. Epub 2013 Jan 23.
http://www.ncbi.nlm.nih.gov/pubmed/23388360

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CRE in 2001 to 2013

- "Nationally, the CDC issued warnings last year about CRE, saying the bacteria spread from one medical facility in 2001 to numerous facilities in 46 states in 2013. CDC Director Tom Frieden said, "Our strongest antibiotics don't work, and patients are left with potentially untreatable infections."

Unger L. Doctors fear growing hospital superbug. Courier Journal. Aug. 5, 2014. https://www.courier-journal.com/story/life/wellness/health/2014/08/04/doctors-fear-growing-hospital-superbug/13569933/

USA Health Watch

CRE Outbreak in Louisville, KY - 2013

Kindred had 40 CRE cases

Written by Laura Ungar The Courier-Journal
Apr. 16

courier-journal.com

- "Kavanagh said it's important that outbreaks be made public, partly because patients often go from one health care location to another "This is a huge problem," he said. "It's not something one hospital can control. In Kentucky, health care sites must report "outbreaks" of greater-than-expected numbers of cases, leaving it to them to interpret what that means. But Kavanagh and state Rep. Tom Burch, D-Louisville, are calling for a new rule that hospitals report all CRE cases to the state. Burch says he plans to introduce a bill on mandatory public reporting in next year's General Assembly."

Ungar L. Kindred had 40 CRE cases. Courier Journal, April 16, 2013.

USA Health Watch

CRE in 2012 to 2013

- Study finds an incidence of 2.93 CRE cases per 100,000 people over a two year period. Equates to 4500 People a Year. Data acquisition dates 2012-2013.

Guh AY, Bulens SN, Mu Y, Jacob JT, et al. Epidemiology of Carbapenem-Resistant Enterobacteriaceae in 7 US Communities, 2012-2013. JAMA. 2015 Oct 5:1479-1487. doi: 10.1001/jama.2015.12480. [Epub ahead of print]

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CRE in 2014 - Kentucky

Table 2. In-State Healthcare Facilities Reporting Cases of Infection or Colonization with Emerging Pathogens of Public Health Importance, by Organism--Kentucky, 2014

Organism	Hospital	Long Term Care Facility	Outpatient Facility	Other
Carbapenem-resistant Enterobacteriaceae (*Escherichia coli*)	5	0	0	0
Carbapenem-resistant Enterobacteriaceae (*Klebsiella pneumoniae*)	13	1	0	1
Carbapenem-resistant Enterobacteriaceae (other spp.)	12	1	0	0
Cephalosporin-resistant *Klebsiella*	1	0	0	0
Methicillin-resistant *Staphylococcus aureus*	5	2	6	1
Multi-drug resistant *Acinetobacter*	4	1	0	0
Vancomycin-resistant *Enterococcus*	2	2	0	0
Other MDRO	9	3	0	2

This table shows the number and type of facilities that have voluntarily reported cases of infection or colonization with certain pathogens of public health importance. Because hospitals may have reported more than one type of case, the columns do not necessarily sum to the total number of hospitals reporting. These voluntary reports are sometimes made by the facility that identifies the pathogen and may not reflect where the infection or colonization was acquired, since it may have been present on admission.

Kentucky Deptartment for Public Health

USA Health Watch

CRE in 2016 – HARP-DC

Healthcare Antibiotic Resistance Prevalence—DC (HARP-DC)

Participating Facilities

The George Washington University Hospital – UHS Universal Health

BridgePoint Hospital

Children's National

MedStar National Rehabilitation Network

MedStar Washington Hospital Center

MedStar Georgetown University Hospital

Sibley Memorial Hospital – Johns Hopkins Medicine

Providence Hospital

UMC United Medical Center

HUH Howard University Hospital

Acute Care:

- Children's National Medical Center
- George Washington University Hospital
- Howard University Hospital
- MedStar Georgetown University Hospital
- MedStar Washington Hospital Center
- Sibley Hospital
- United Medical Center
- Providence Hospital

Transitions Healthcare

Sub-Acute Care:

- BridgePoint Hospital Hadley
- BridgePoint Hadley Skilled Nursing Facility
- Transitions Healthcare Capitol City
- United Medical Center – Skilled Nursing Facility
- BridgePoint Hospital Capitol Hill
- BridgePoint Capitol Hill Skilled Nursing Facility
- National Rehabilitation Hospital
- Providence Skilled Nursing Facility

Study Partners

DCHA District of Columbia Hospital Association

OpGen

DOH Department of Health – Promote. Prevent. Protect.

CRE in 2016 HARP-DC

Measure	Number
Patients targeted	2216
Exemptions (clinical, mental, language)	412
Unavailable to consent	279
Patients approached	1503
Patients who consented and were sampled	1036 (69%)
Incomplete tests	15*
Completed tests	1021
CRE Prevalence (52 positives)	**5.1%**
CRO Prevalence (65 positives)	**6.4%**

* = Incomplete tests: 14 tests not performed, lost media; 1 test indeterminate

Facility Type	CRE	
	n	% positive
Acute care	35	4.8
Sub-acute care	17	5.7
Total	52	5.1

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Dangerous CRE Outbreak In Kentucky.

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 65 / No. 7
February 26, 2016

Verona Integron-Encoded Metallo-Beta-Lactamase–Producing Carbapenem-Resistant Enterobacteriaceae in a Neonatal and Adult Intensive Care Unit — Kentucky, 2015

Anna Q. Yaffee, MD[1,2]; Lynn Roser, MSN[2]; Kimberly Daniels[2]; Kraig Humbaugh, MD[2]; Robert Brawley, MD[2]; Douglas Thoroughman, PhD[2,3]; Andrea Flinchum, MPH[2]

Health Department Working With Healthcare Facilities

- A rare form of resistance found in 8 patients, in 4 different types of bacteria, in two different wards.
- Demonstrates that the transmission of resistance between different types of bacteria is clinically important.
- No patient developed an infection.

USA Health Watch

Dangerous CRE Outbreak In Kentucky.

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 65 / No. 7
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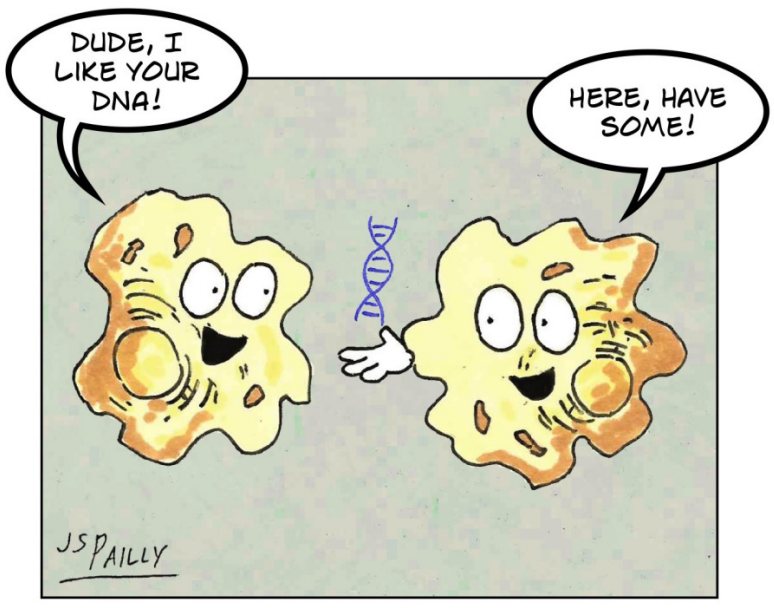

Bacterial Conjugation

Health Department Working With Healthcare Facilities

- A rare form of resistance found in 8 patients, in 4 different types of bacteria, in two different wards.
- Demonstrates that the transmission of resistance between different types of bacteria is clinically important.
- No patient developed an infection.

USA Health Watch

Dangerous CRE Outbreak In Kentucky.

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 66 / Nos. 51 & 52
January 5, 2018

We hear about it over a year later.

Investigation of Carbapenemase-Producing Carbapenem-Resistant Enterobacteriaceae Among Patients at a Community Hospital — Kentucky, 2016

Sae-Rom Chae, MD[1,2]; Anna Q. Yaffee, MD[1,3]; Mark K. Weng, MD[1,4]; D. Cal Ham, MD[4]; Kimberly Daniels[3]; Amanda B. Wilburn, MPH[3]; Kimberly A. Porter, PhD[3,5]; Andrea H. Flinchum, MPH[3]; Sandra Boyd[4]; Alicia Shams, MPH[4]; Maroya S. Walters, PhD[4]; Alexander Kallen, MD[4]

"On August 11, 2016, two Klebsiella pneumoniae carbapenemase (KPC)–producing CP-CRE isolates from clinical cultures were reported from patients hospitalized at a rural, community hospital in Kentucky; CRE had not been identified previously at this facility. During the next 4 months, an additional 21 CRE isolates were identified from facility patients, resulting in a total of 23 isolates, including 17 K. pneumoniae, five Escherichia coli, and one Enterobacter cloacae isolate. Seventeen (74%) of these isolates were identified through patient screening cultures; the rest were from clinical cultures."

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Coordinated Approach To Prevention

Kentucky – MDRO Reporting Regulation

Healthcare associated infection surveillance KAR 902.20

- **Defines an Outbreak**

  "HAI Outbreak" means

  (a) The occurrence of two (2) or more HAIs that are epidemiologically linked or connected by person, place, or time; or

  (b) A single case of an HAI not commonly diagnosed such as a postsurgical group A Streptococcus infection or healthcare-associated Legionella infection.

- **Covers All Types of Facilities**

  ""Health facility" means:

  (a) A facility licensed under 902 KAR Chapter 20 and required by the Centers for Medicare and Medicaid Services (CMS) to report an HAI event or healthcare personnel influenza vaccination information to CMS using the National Healthcare Safety Network; or

  (b) A facility licensed under KRS Chapter 216B."

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Kentucky – MDRO Reporting Regulation

Healthcare associated infection surveillance KAR 902.20

- Following diseases shall be electronically reported to the Kentucky Department for Public within five (5) business days:
  - (a) Vancomycin-intermediate Staphylococcus aureus (VISA),
  - (b) Vancomycin-resistant Staphylococcus aureus (VRSA)
  - (c) Methicillin-resistant Staphylococcus aureus (MRSA)
  - (d) Vancomycin-resistant Enterococcus species (VRE)
  - (e) Clostridium difficile (C. difficile) identified from a positive laboratory test result for a C. difficile toxin A or B,
  - (f) Carbapenem-resistant Enterobacteriaceae (CRE)
  - (g) Extended–spectrum beta-lactamase Gram negative organisms (ESBL);
  - (h) Multidrug-resistant – Acinetobacter - Non-susceptibility (resistant or intermediate) to at least one (1) agent in at least three (3) antimicrobial classes.

USA Health Watch

KHN
KAISER HEALTH NEWS

Lack Of Cooperation Among Health Facilities Mars Antibiotic Resistance Fight, CDC Says

By **Jordan Rau** | August 4, 2015

- **No single facility or facility type can solve this problem. It takes a coordinated approach.**

USA Health Watch

CDC: What Is Needed

- Independent Approach – Not Enough
- Coordinated Approach – What is Needed.

  Facilities and public health authorities share information and implement shared infection control actions to stop spread of germs from facility to facility.

Vital Signs. Aug. 4, 2015 Center for Disease Control and Prevention

USA Health Watch

Facilities work together to protect patients.

Common Approach *(Not enough)*

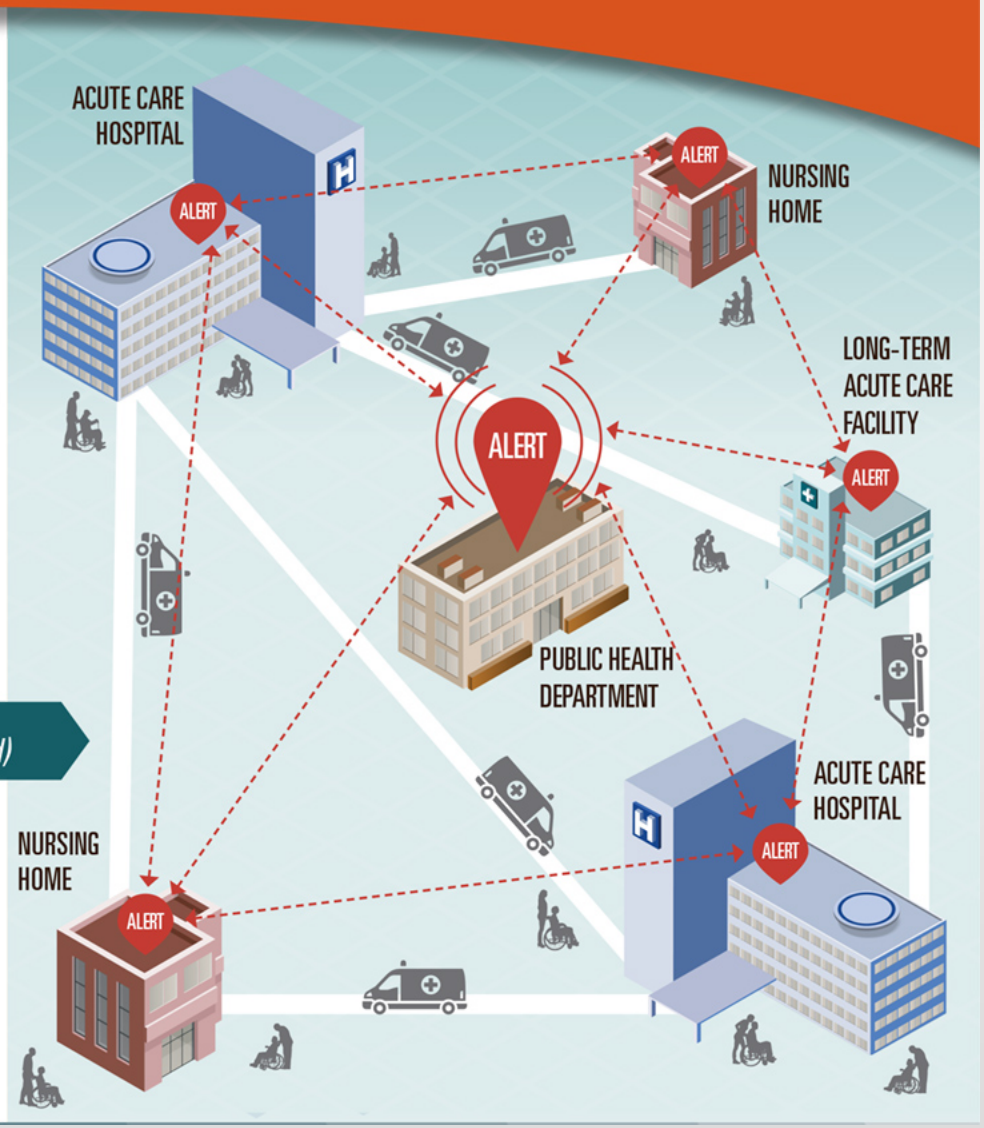
- Patients can be transferred back and forth from facilities for treatment without all the communication and necessary infection control actions in place.

Independent Efforts *(Still not enough)*

- Some facilities work independently to enhance infection control but are not often alerted to antibiotic-resistant or *C. difficile* germs coming from other facilities or outbreaks in the area.
- Lack of shared information from other facilities means that necessary infection control actions are not always taken and germs are spread to other patients.

Coordinated Approach *(Needed)*

- Public health departments track and **alert** health care facilities to antibiotic-resistant or *C. difficile* germs coming from other facilities and outbreaks in the area.
- Facilities and public health authorities share information and implement shared infection control actions to stop spread of germs from facility to facility.



Vital Signs. Aug. 4, 2015 Center for Disease Control and Prevention

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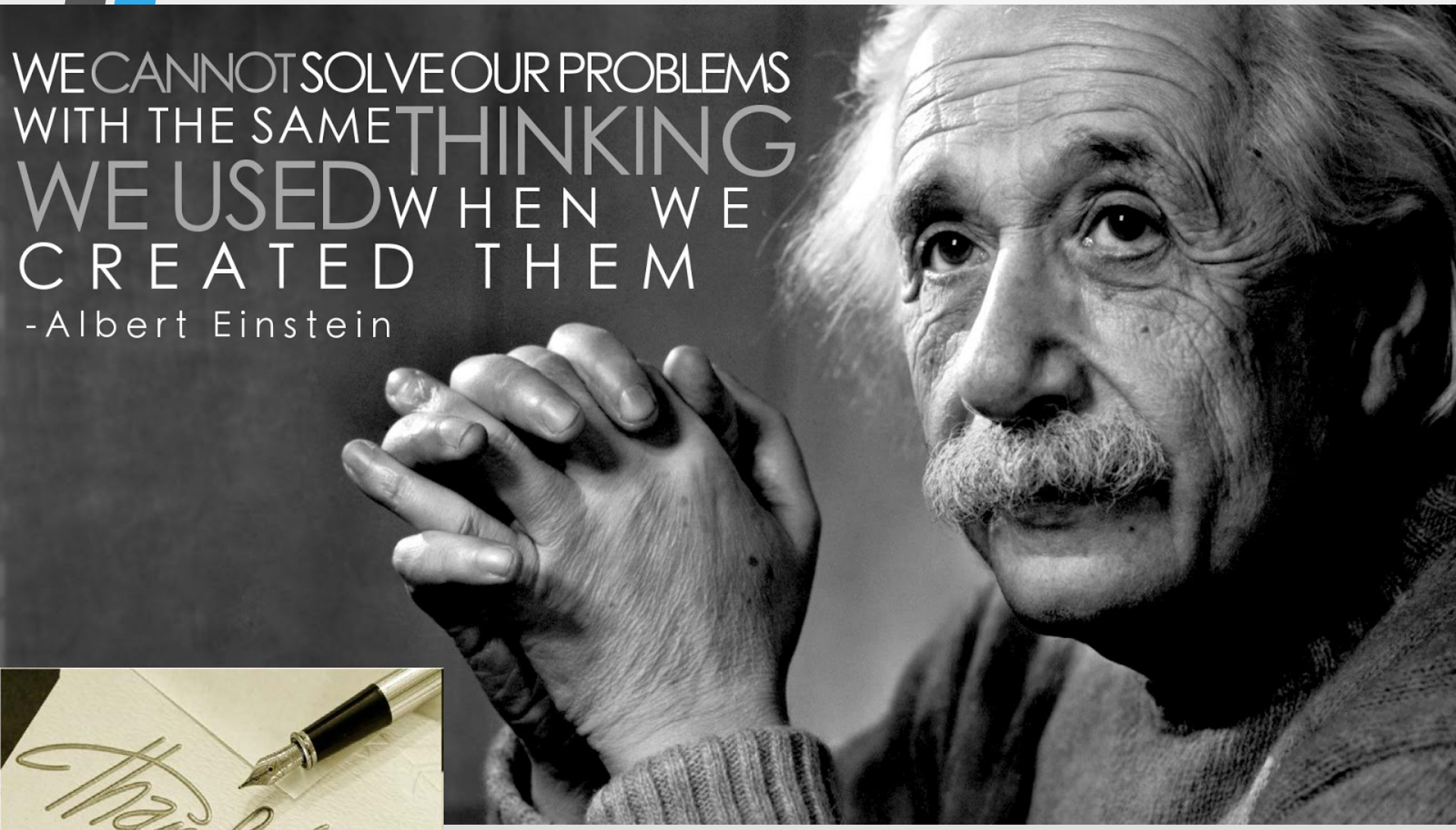

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