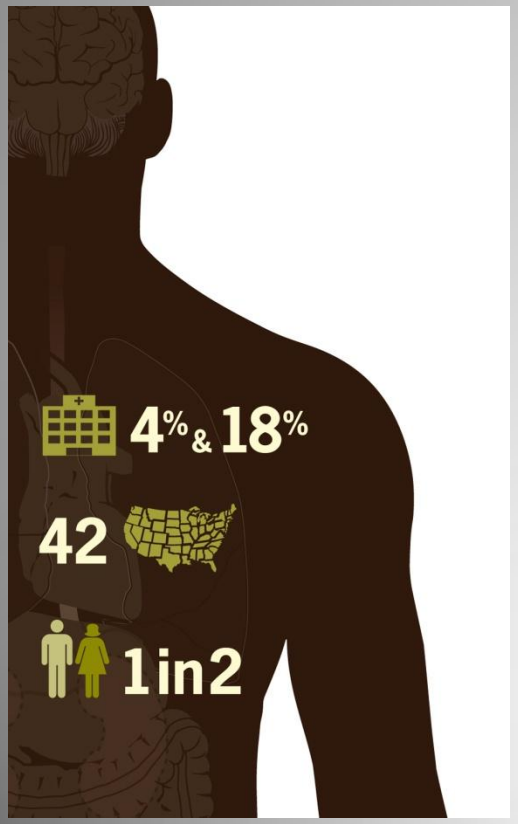
Carbapenem-Resistant Enterobacteriaceae

Andrea Flinchum MPH, BSN, CIC
HAI Coordinator/KDPH

May 7, 2013



Carbapenem-Resistant Enterobacteriaceae (CRE)

Kentucky Public Health
Prevent. Promote. Protect.

Enterobacteriaceae

- **Normal human gut flora & environmental organisms**
- **More than 70 species**
- **Range of human infections:**
  - UTI
  - Wound infections
  - pneumonia
  - bacteremia

- **Important cause of healthcare- and community-associated infections**
  - Some of the most common organisms encountered in clinical laboratories

Pathogens Reported to National Healthcare Safety Network (NHSN) 2009-2010

	Overall percentage	CLABSI	CAUTI	VAP	SSI
E					
K					
P. aeruginosa	8% (5)	4%	11%	17%	6%
Enterobacter spp.	5% (8)	5%	4%	9%	4%

These three groups of organisms make up about 25% of organisms reported to NHSN Device and Procedure module

Sievert D, et al. Infect Control Hosp Epidemiol 2013; 34: 1-14

Enterobacteriaceae

- **Antibiotic resistance has been a concern for decades**
  - β-lactamases
  - Extended-spectrum β-lactamases
- **Carbapenems**
  - Imipenem, meropenem, doripenem, ertapepnem
- **Resistance before 2000, combination of mechanisms**
  - 1986-1990 in NNIS 2.3% of *Enterobacter* NS to imipenem

ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, Apr. 2001, p. 1151–1161 Vol. 45, No. 4
0066-4804/01/$04.00+0 DOI: 10.1128/AAC.45.4.1151–1161.2001

Novel Carbapenem-Hydrolyzing β-Lactamase, KPC-1, from a Carbapenem-Resistant Strain of *Klebsiella pneumoniae*

HESNA YIGIT,[1] ANNE MARIE QUEENAN,[2] GREGORY J. ANDERSON,[1]
ANTONIO DOMENECH-SANCHEZ,[3] JAMES W. BIDDLE,[1] CHRISTINE D. STEWARD,[1]
SEBASTIAN ALBERTI,[4] KAREN BUSH,[2] AND FRED C. TENOVER[1]*

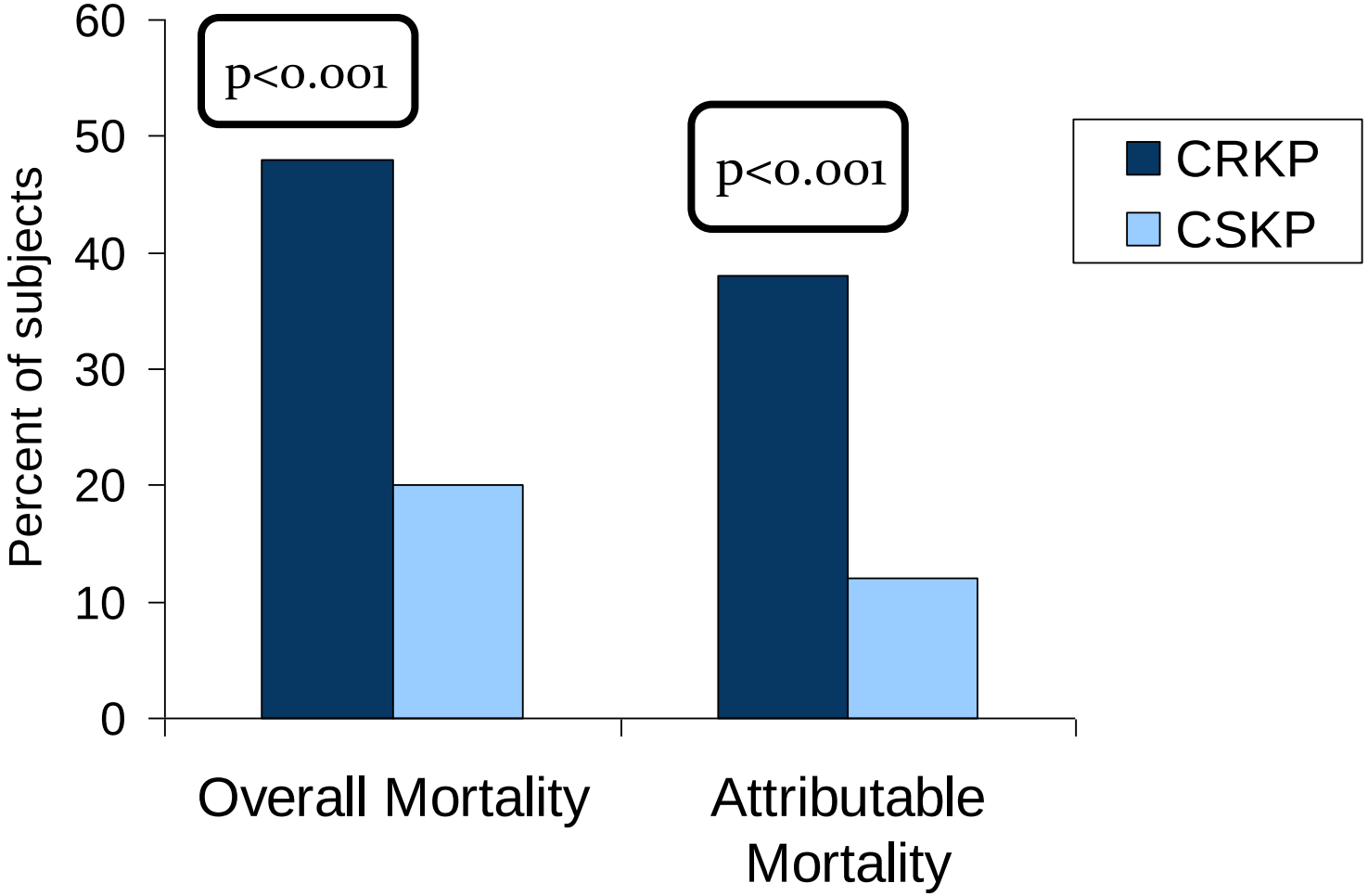
- Isolate collected in 1996 during an ICU surveillance project from NC
- Class A β-lactamase

Change in CRE incidence, 2001-2011

	National Nosocomial infection Surveillance system, Number (%) of isolates			National Healthcare Safety Network, Number (%) of isolates		
	2001			2011		
Organism	Isolates	Tested	Non-susceptible	Isolates	Tested	Non-susceptible
Klebsiella pneumoniae and *oxytoca*	654	253 (38.7)	4 (1.6)	1,902	1,312 (70.0)	136 (10.4)
E. coli	1,424	421 (29.6)	4 (1.0)	3,626	2,348 (64.8)	24 (1.0)
Enterobacter aerogenes and *cloacae*	553	288 (52.1)	4 (1.4)	1,045	728 (69.7)	26 (3.6)
Total	2,631	962 (36.6)	12 (1.2)	6,573	4,388 (66.8)	186 (4.2)

Why are CRE Clinically and Epidemiologically Important?

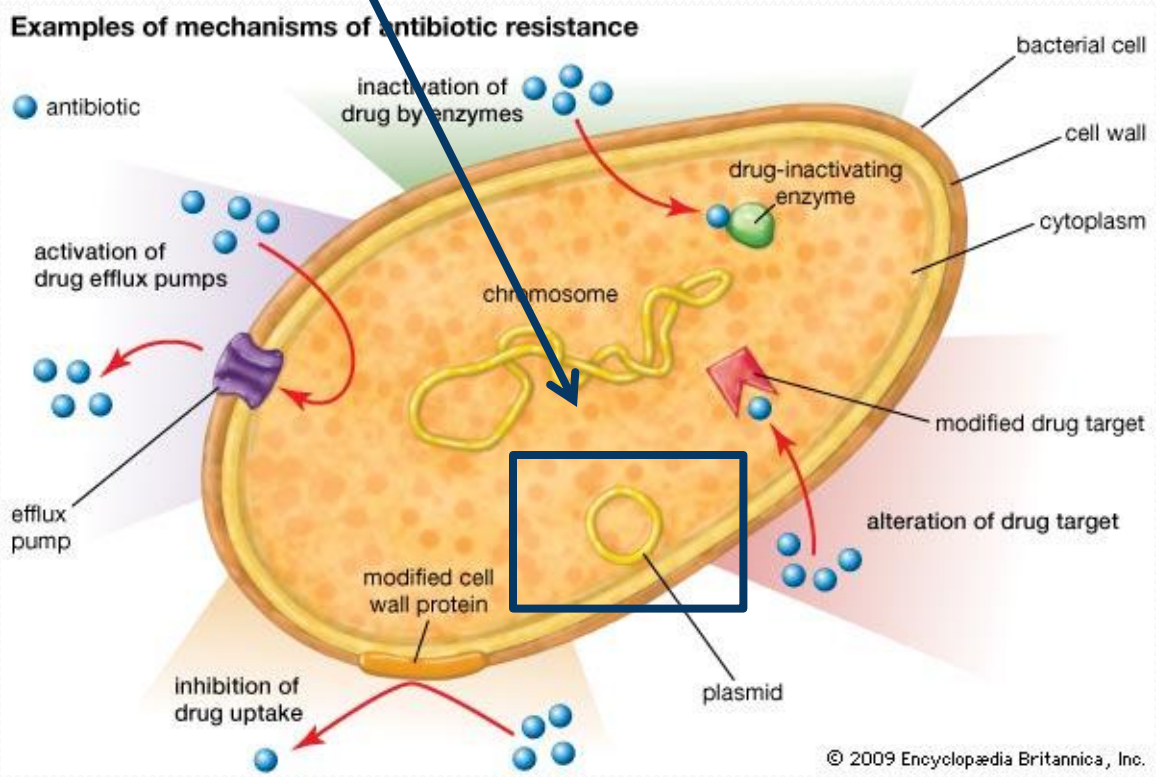
- Cause infections associated with high mortality rates



Patel et al. Infect Control Hosp Epidemiol 2008;29:1099-1106

Why are CRE Clinically and Epidemiologically Important?

- Resistance is highly transmissible
  - Between organisms – plasmids
  - Between patients



How CRE Take Over

1. Lots of germs, 1 or 2 are CRE

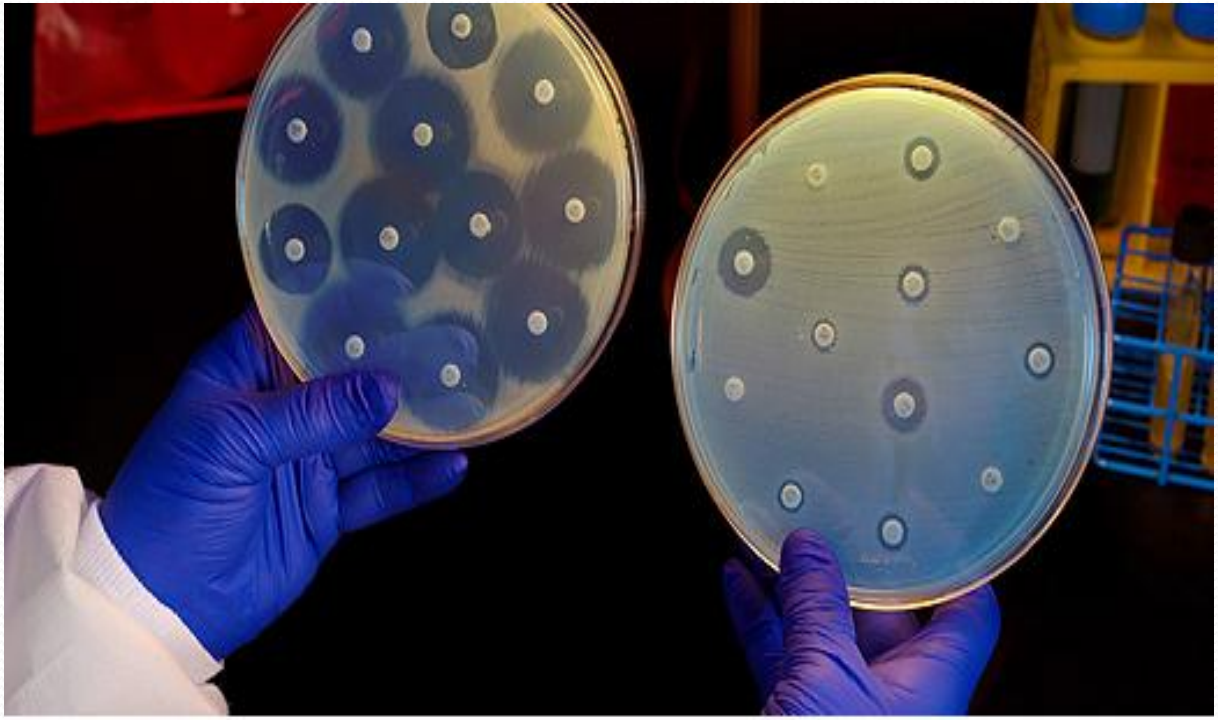
2. Antibiotics kill off good germs

3. CRE grow

4. CRE share genetic defenses to make other bacteria resistant

Why are CRE Clinically and Epidemiologically Important?

- Treatment options are limited
- Pan-resistant strains identified, could be decades before new agents are available to treat



Why are CRE Clinically and Epidemiologically Important?

- **Potential for spread into the community**
  - *E. coli* common cause of community infection

Isozumi R et al. EID 2012: 1383-4

Kumarasamy K Lancet ID 2010;

Walsh TR Lancet ID 2011:355-362

Lewis JS, et al. Poster Presentation, 49th ICAAC 2009, San Francisco

Tangden T et al. AAC 2010: 3564-3568

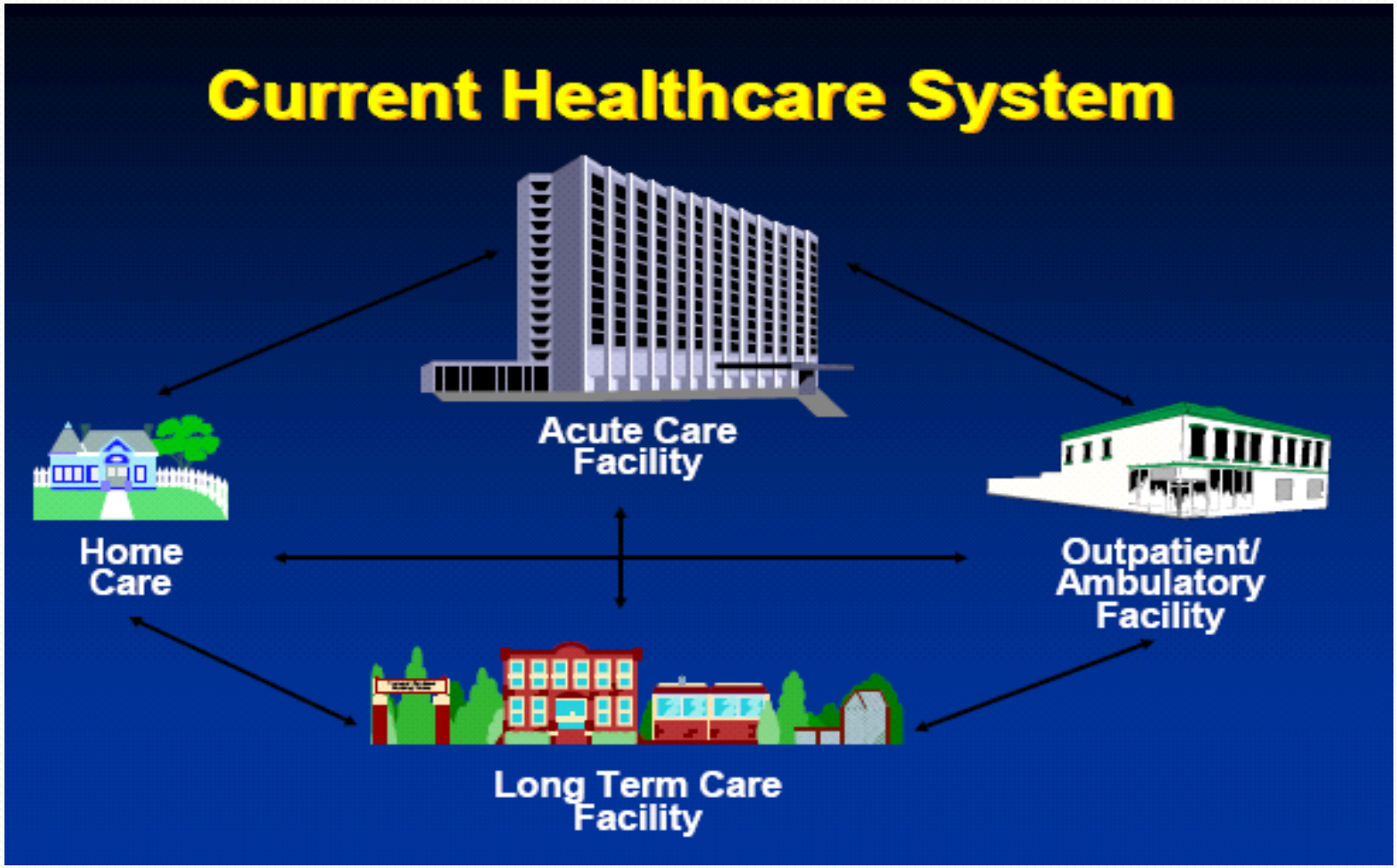
Why are CRE Clinically and Epidemiologically Important?

In most areas in the U.S. this organism appears to infrequently identified

Facilities Reporting at least One CRE (CAUTI or CLABSI) to NHSN, First Half of 2012

Facility characteristic	Number of facilities with CRE from a CAUTI or CLABSI (2012)	Total facilities performing CAUTI or CLABSI surveillance (2012)	(%)
All acute care hospitals	181	3,918	(4.6)
Short-stay acute hospital	145	3,716	(3.9)
Long-term acute care hospital	36	202	(17.8)

CRE Occur in All Settings



Inter-Facility Transmission of MDROs (Including CRE)

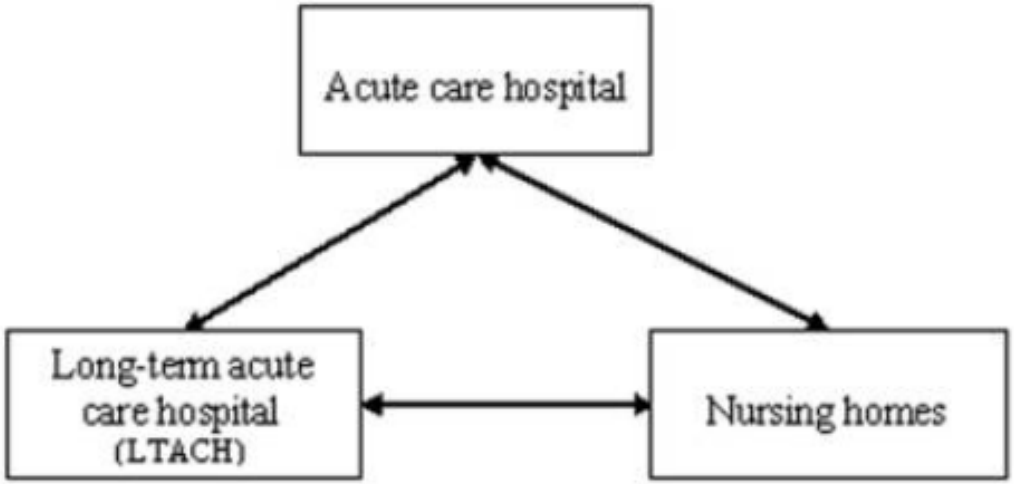
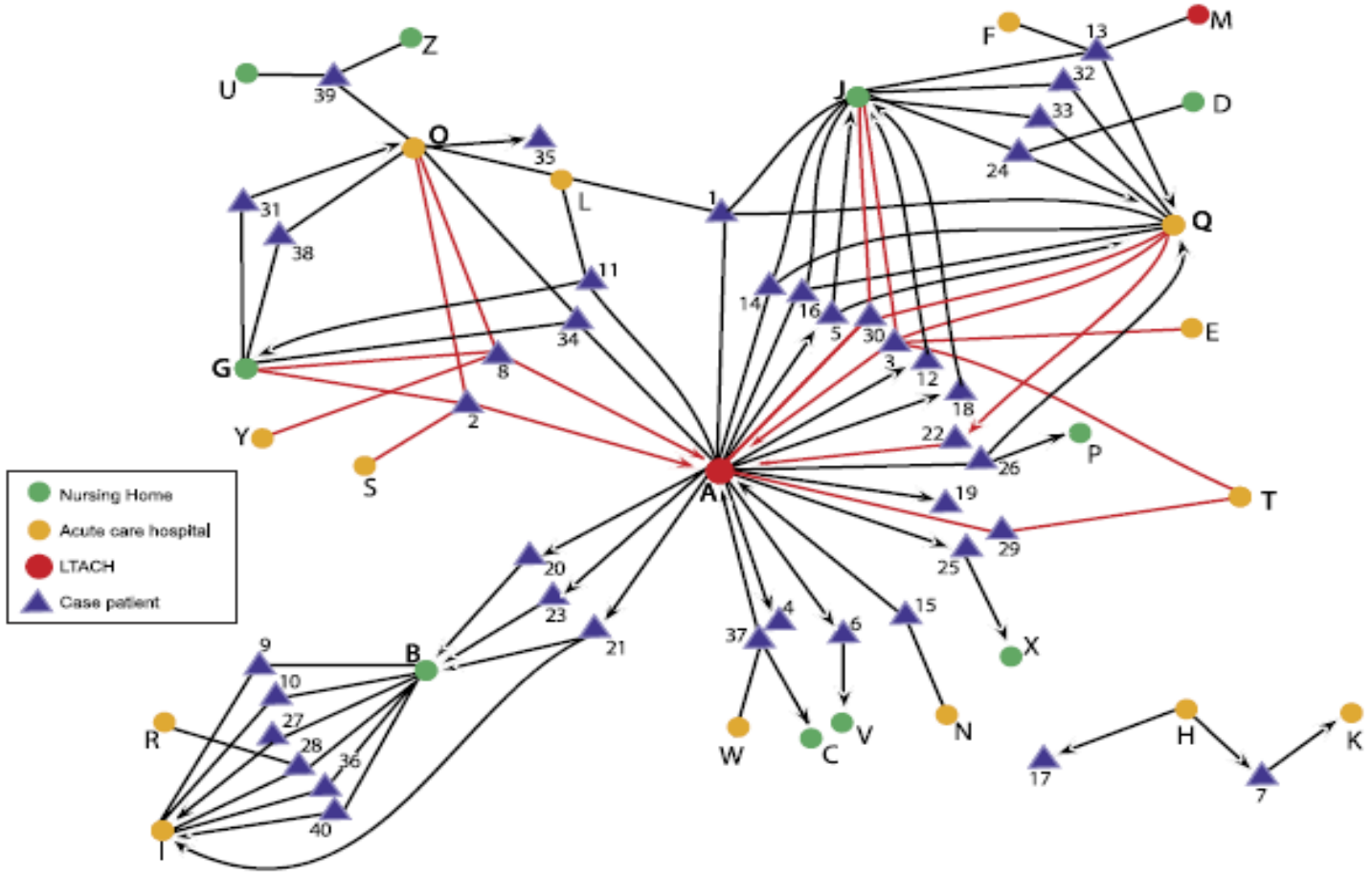


Figure 3. Patient flow among regional health care facilities. Outbreaks of infection with multidrug-resistant organisms have been found to follow the flow of colonized patients across institutions.

Munoz-Price SL. Clin Infect Dis 2009;49:438-43



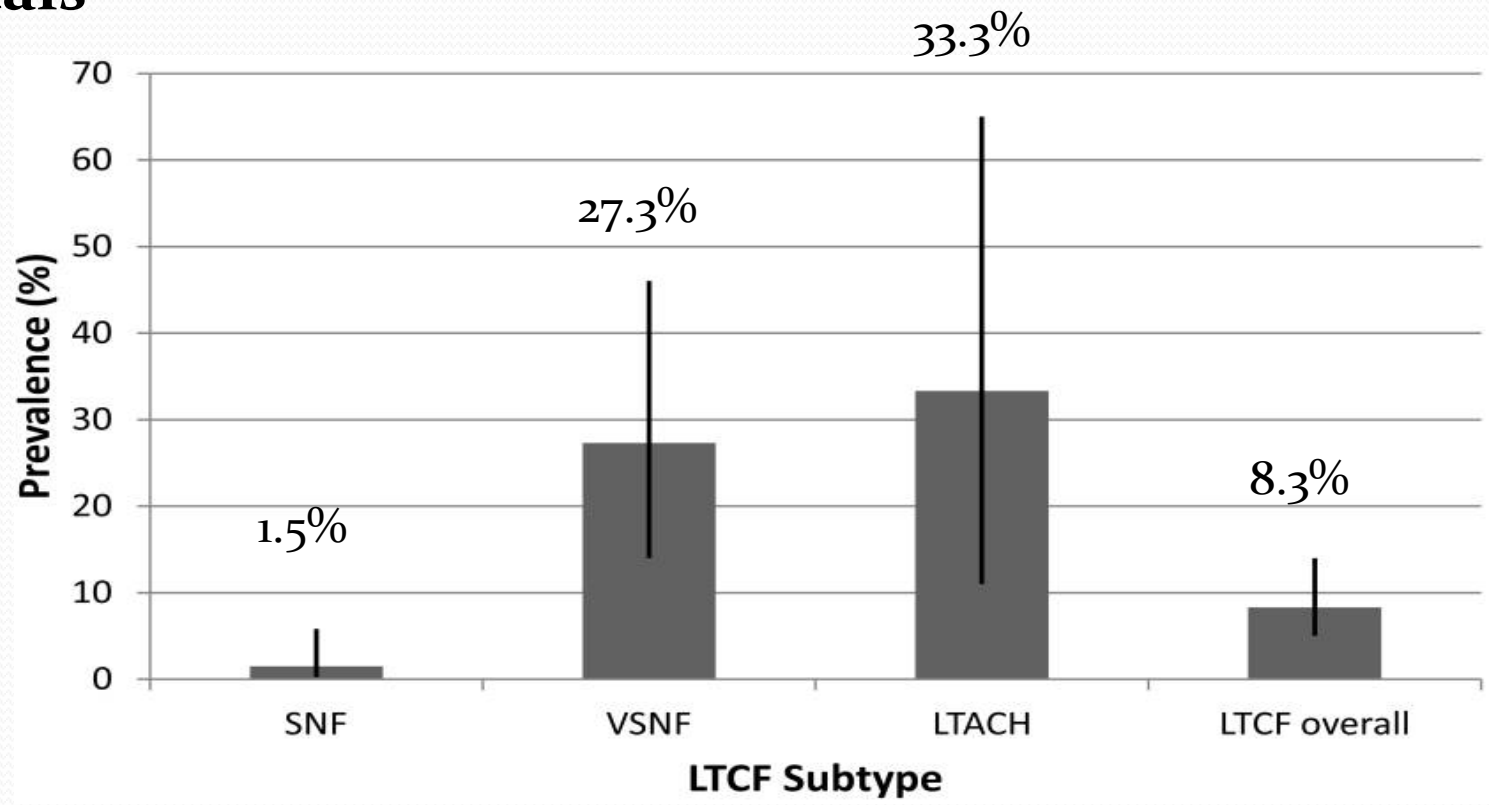
KPC outbreak in Chicago, 2008

- **Of 40 KPC patients, only 4 definitively acquired KPC in acute care hospital**
- **Most (60%) linked to 1 LTACH**

Won et al. Clin Infect Dis 2011; 53:532-540

CRE Prevalence in LTCF: By Type

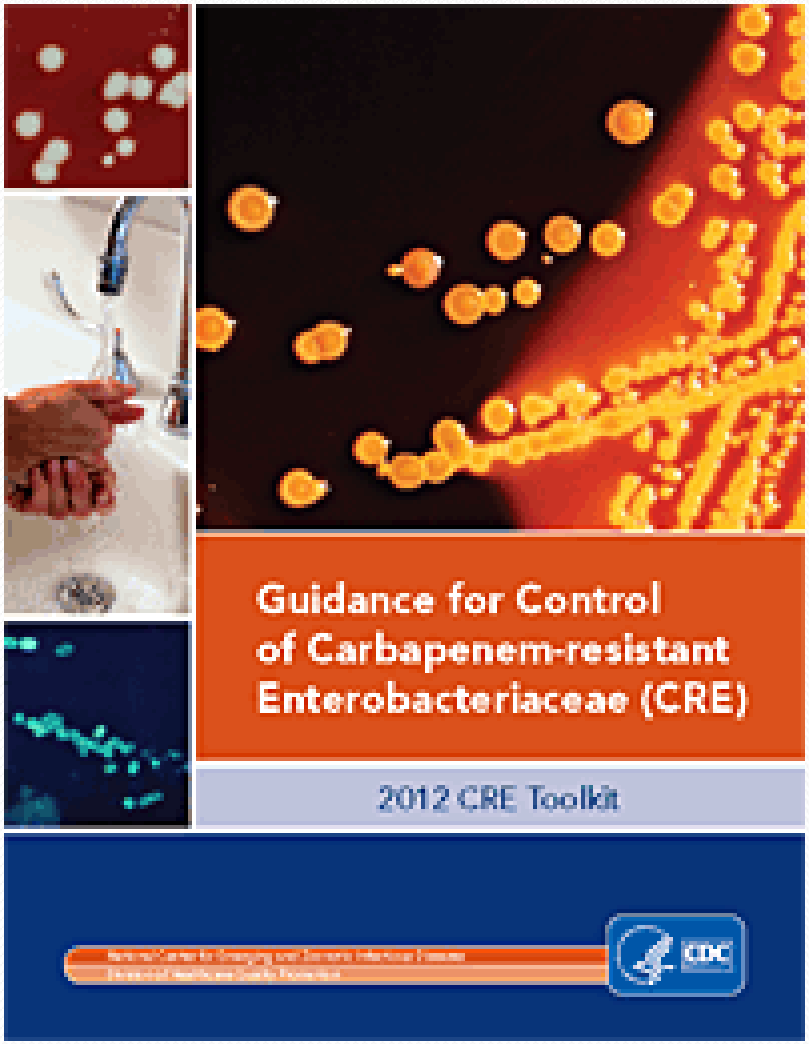
Prevalence of CRE Carriage at admission to 4 acute care hospitals



0% from those admitted to the community

Prabaker K et al. ICHE 2012; 33:1193-1199

CRE Toolkit



http://www.cdc.gov/hai/organisms/cre/cre-toolkit/

Interventions

- Core
  - Hand hygiene
  - Contact Precautions
  - HCP education
  - Minimizing device use
  - Patient and Staff cohorting
  - Laboratory notification
  - Antimicrobial stewardship
  - CRE Screening

Contact Precautions

- CP for patients colonized or infected with CRE
- Systems in place to identify patients at readmission
- Education of HCP about use and rationale behind CP
- Adherence monitoring
- Consideration of pre-emptive CP in patients transferred from high-risk settings

Contact Precautions in Long-Term Care

- **CP could be modified in these settings:**
  - CP should be used for residents with CRE who are at higher risk for transmission
    - Dependent upon HCP for their activities of daily living
    - Ventilator-dependent
    - Incontinent of stool
    - Wounds with drainage that is difficult to control
  - For other residents the requirement for Contact Precautions might be relaxed
  - Standard Precautions should still be observed

Patient and Staff Cohorting

- CRE patients in single rooms (when available)
- Cohorting (even when in single rooms)
- Staff cohorting
- Preference for single rooms should be given to patients at highest risk for transmission such as patients with incontinence, medical devices, or wounds with uncontrolled drainage

CRE Screening

- Used to identify unrecognized CRE colonization among contacts of CRE patients
- Stool, rectal, peri-rectal
- Link to laboratory protocol http://www.cdc.gov/ncidod/dhqp/pdf/ar/Klebsiella_or_E.coli.pdf
- Applicable to both acute and long-term care settings

CRE Screening

- **Description of types**
  - Screening of epidemiologically linked patients
    - Roommates
    - Patients who shared primary HCP
  - **Point prevalence survey**
    - Rapid assessment of CRE Prevalence on particular wards/units
    - Might be useful if lab review identifies one or more previously unrecognized CRE patient on a particular unit

Regional Approach to CRE prevention

Surveillance and Definitions

- **Facilities/Regions should have an awareness of the prevalence of CRE in their Facility/Region**
  - Could concentrate on *Klebsiella* and *E. coli*
  - Could concentrate on those NOT SENSITIVE to a Carbapenem OR add RESISTANT to a third-generation cephalosporin to the definition to increase specificity
    - Ceftiaxone, cefotaxime, ceftazidime
- **No easy way right now to check for carbapenemases**
  - Many smaller laboratories lack the more sophisticated testing necessary to identify this type of resistance

Things to ask and do when receiving reports of Carbapenem-resistant Enterobacteriaceae infection or colonization in healthcare facilities

- Collect details about the event using the KDPH MDRO EVENT REPORTING FORM
- Determine whether an outbreak in occurring
- Ensure the reporting facility is taking appropriate control measures
- Provide additional educational materials and resources
- Any questions, call 502-564-3261 ext. 4248

Summary

- **Carbapenem-resistance among Enterobacteriaceae appears to be increasing**
  - Appears to be driven primarily by the emergence of carbapenemases
- **Has the potential to spread widely**
  - Healthcare and community settings
- **Most areas in a position to act to slow emergence**
- **A regional approach to MDRO prevention is required**
  - Public health well-positioned to facilitate and support regional prevention efforts

Resources

- http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6124a3.htm
- http://www.cdc.gov/features/vitalsigns/hai/cre/
- (http://www.cdc.gov/ncidod/dhqp/gl_isolation.html)
- http://www.cdc.gov/handhygiene/
- http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm
- http://www.cdc.gov/ncidod/dhqp/pdf/ar/Klebsiella_or_E.coli.pdf
- http://www.cdc.gov/media/dpk/2013/dpk-vs-hai.html

Kentucky Public Health
Prevent. Promote. Protect.

HAI Prevention Program

- **Andrea Flinchum, BSN, MPH, CIC**
  Andrea.flinchum@ky.gov
- **Colleen Bradley, RN**
  Colleen.bradley@ky.gov
- **Fontaine Sands, DrPH, MSN, CIC**
  Fontaine.sands@ky.gov
- **Matthew Groenewold, PhD, MSPH**
  Matthew.groenewold@ky.gov
- **Jared Powell, BA**
  Jared.powell@ky.gov

Kentucky Public Health

Prevent. Promote. Protect.

Special Thanks

Alexander Kallen, MD, MPH

Medical Epidemiologist and Outbreak Response Coordinator

Division of Healthcare Quality Promotion

Centers for Disease Control and Prevention

Questions