
Results from the California Antibiogram Project, 2008 - 2010

CDPH HAI Program
January 22 and 23, 2013

Rationale for Statewide Monitoring of Antimicrobial Resistance

- Monitor susceptibility trends
- Raise awareness of resistance problems
- Identify opportunities to reduce inappropriate antimicrobial use
- Measure success of recommendations and interventions designed to combat resistance
- Identify opportunities to develop better tests to detect and characterize drug-resistant organisms

Rationale for Statewide Monitoring of Antimicrobial Resistance

- Be prepared for introduction of new resistant organisms that may be associated with institutional and community outbreaks and individual cases of severe illness
- Develop recommendations to assist local health departments in the control and spread of drug-resistant organisms

Background

- Aggregated cumulative antibiograms are feasible, inexpensive, relatively rapid and relatively accurate
- In 2011, CDPH re-launched the California Antibiogram Project (CAbP) collecting cumulative antibiograms from hospital laboratories
 - Aimed at:
 - ✓ Characterizing adherence to Clinical and Laboratory Standards Institute (CLSI) guidelines
 - ✓ Determining antibiotic susceptibility trends in hospitals

Background

- Specific organism-antimicrobial combinations
 - Organisms with a large number of isolates tested in most laboratories
 - Public health relevance

Methods

- Laboratories were surveyed using online voluntary questionnaire from July – October 2011
 - Data from 2008, 2009, and 2010
- Susceptibility data represents all isolates – including blood, urine, and wound
- Susceptibility data was aggregated
 - Percent isolates susceptible calculated

Methods: Percent change calculation

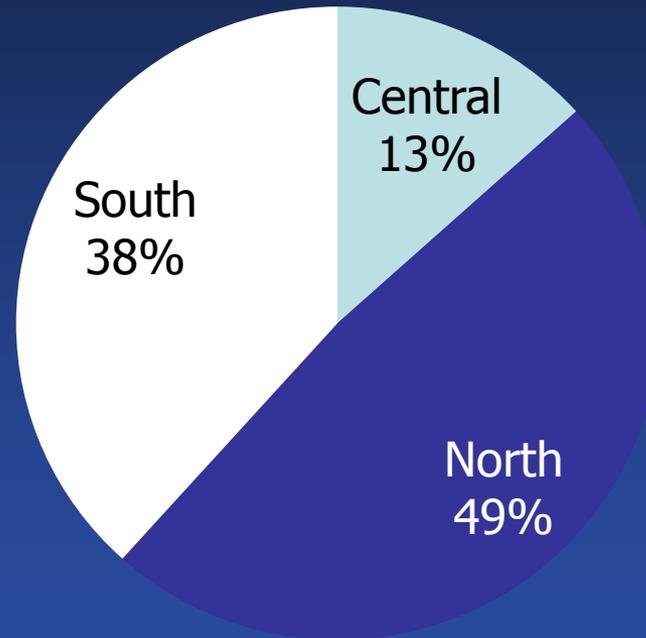
- Used 2008 data as baseline
- Percent change defined as the percent difference between the percent isolates susceptible in 2008 (baseline) and the percent susceptible in 2010, divided by the percent isolates susceptible in 2008 (baseline)
 - Standardizes percent difference
- Percent change of 5% or more considered substantial

Results: Sample size

- 59 participating laboratories
 - Representing 85 hospitals
- 73% (42 laboratories) completed the 2008-2010 survey in less than an hour

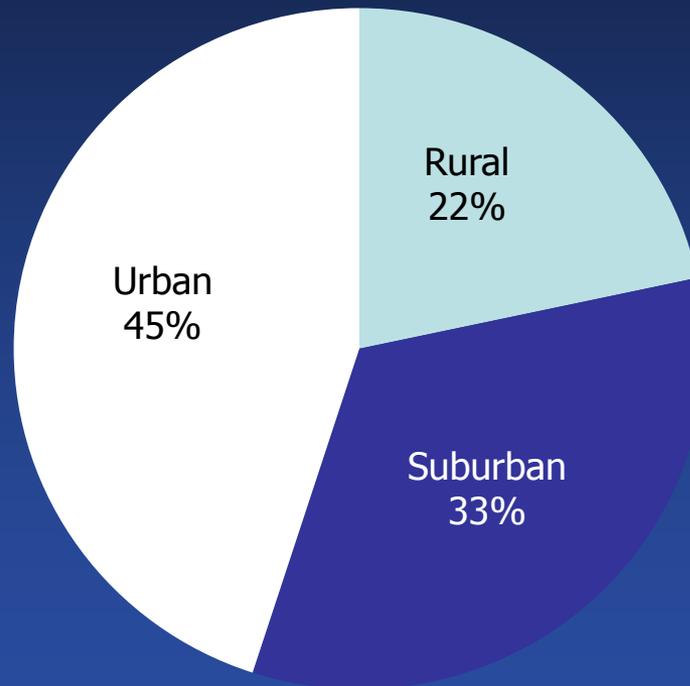
Results: Sample Demographics (1)

In what region of California is your hospital?



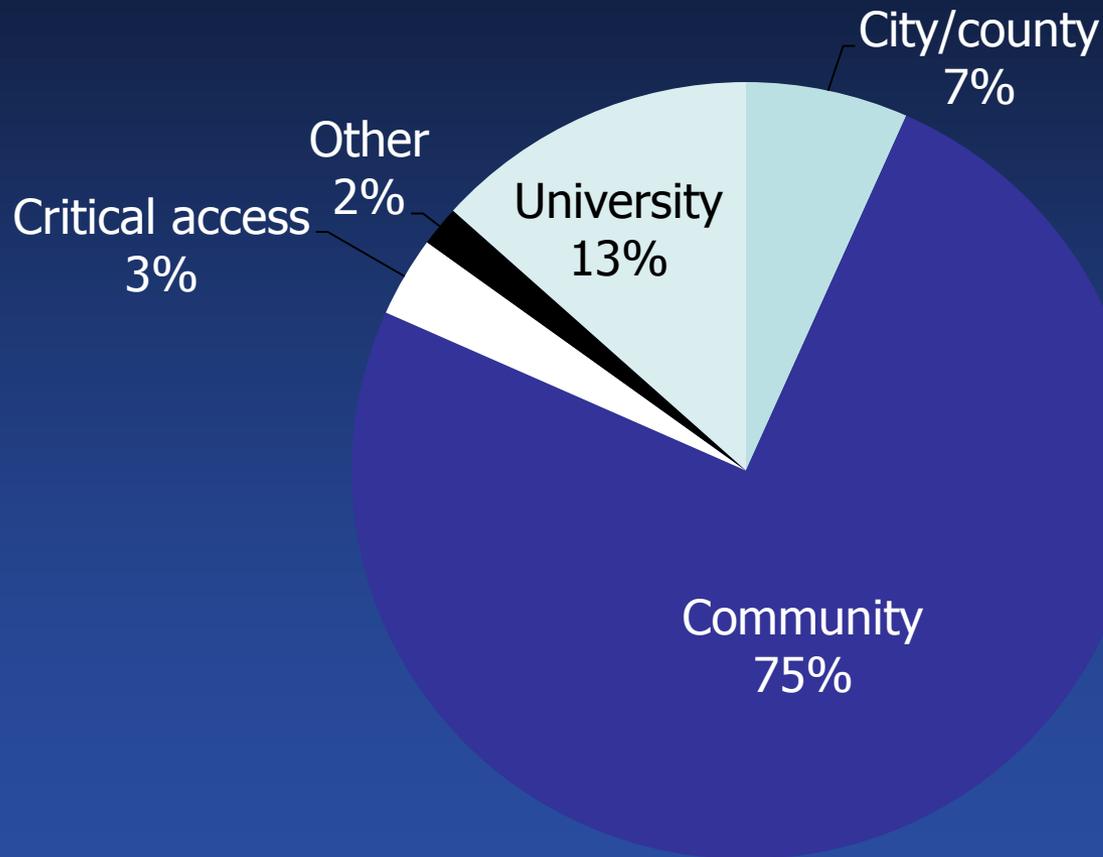
Results: Sample Demographics (2)

How would you describe the area in which this hospital is located?



Results: Type of hospitals

How would you best describe this hospital?



Results: AntibioGrams and Antimicrobial Stewardship

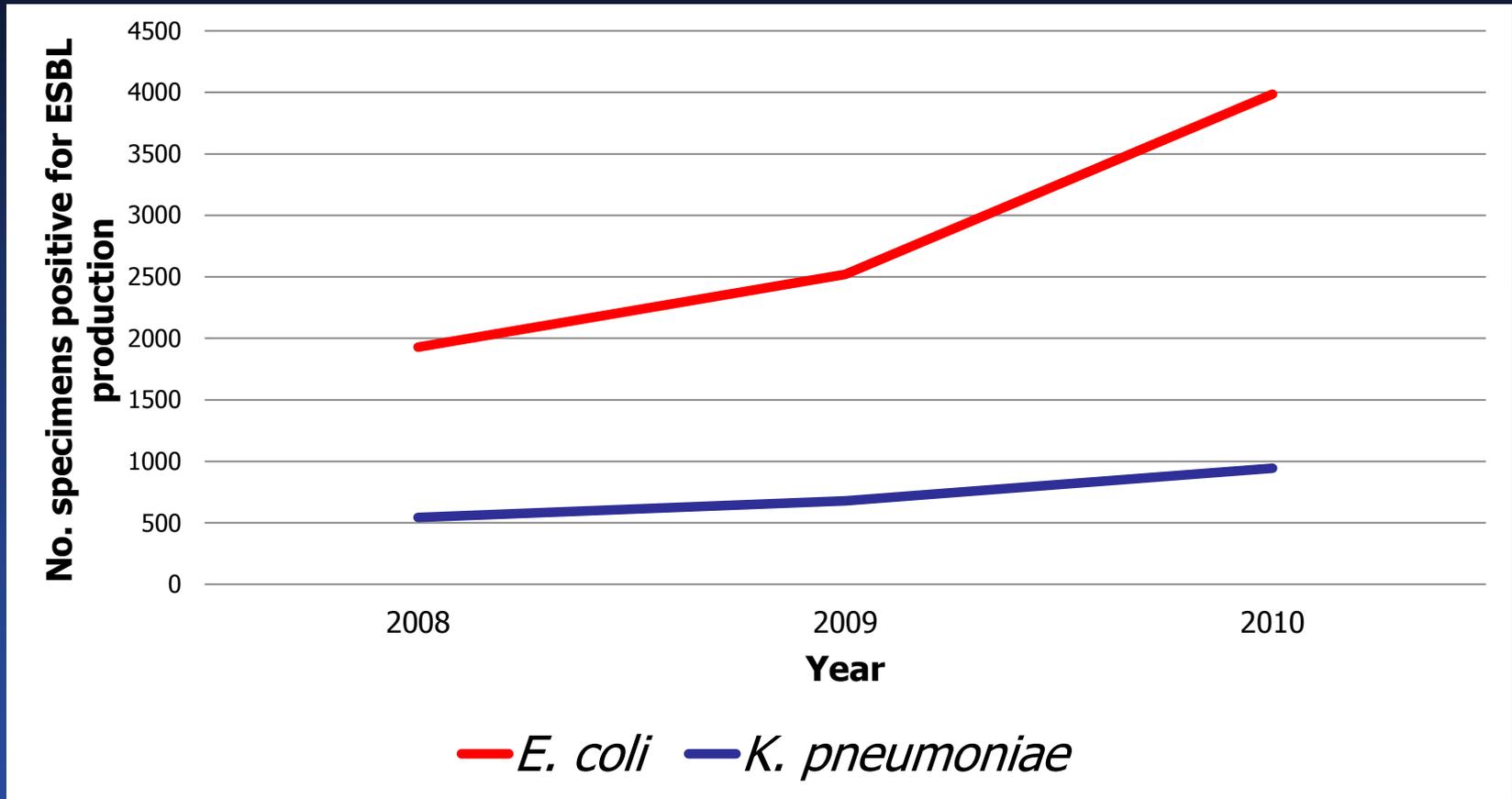
- 93% produce annual antibiograms
 - 95% eliminate duplicates
- 73% have an antimicrobial stewardship program (ASP) in place
 - 33 of 43 hospital laboratories developed ASPs following the 2008 mandate

Results: Microbiology practice

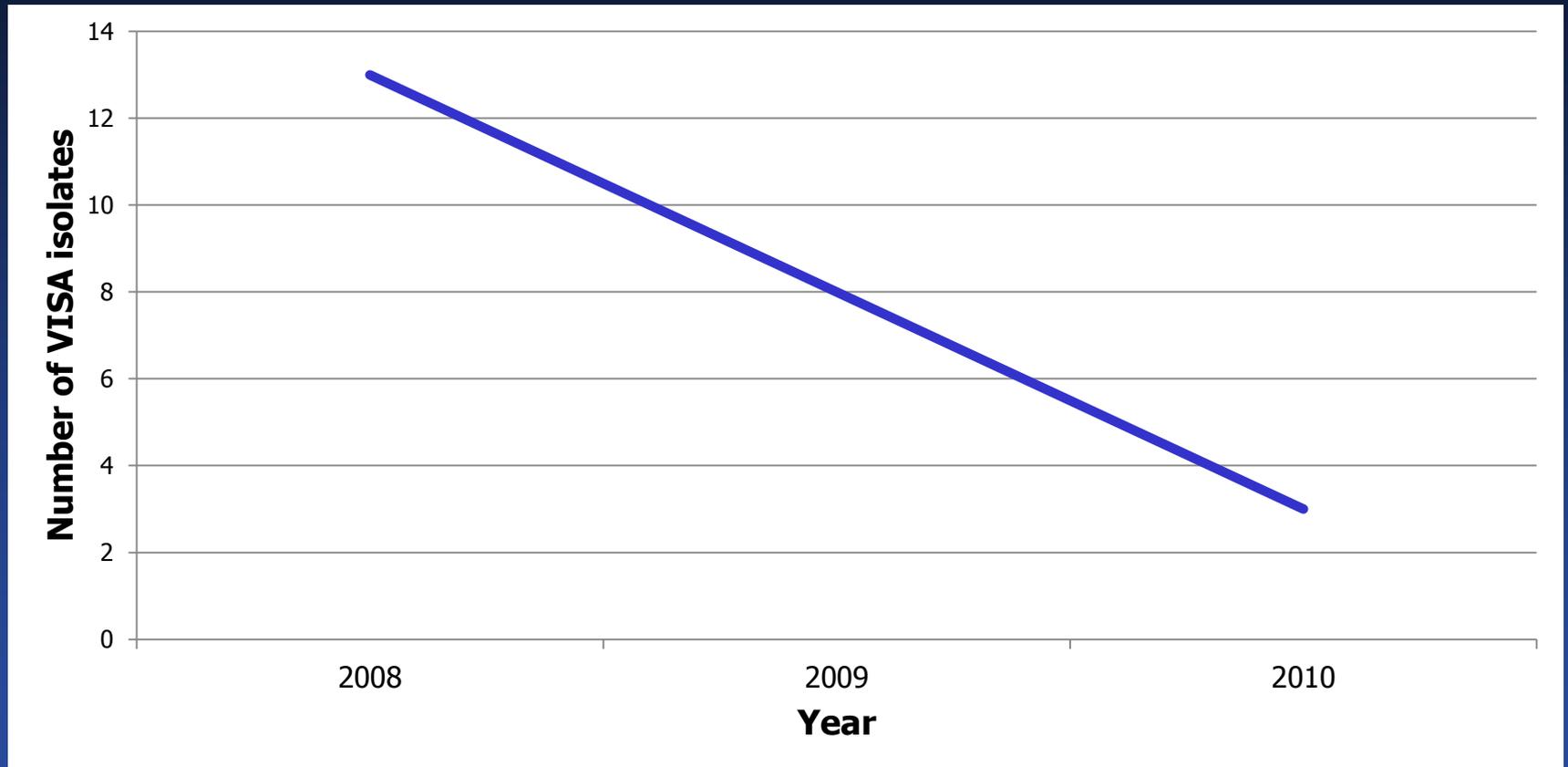
- 20.3% of labs have implemented the revised 2010 CLSI breakpoints for cefotaxime/ceftriaxone and *Enterobacteriaceae*
- 30.5% labs have implemented the revised 2010 CLSI breakpoints for doripenem/ imipenem/ meropenem and *Enterobacteriaceae*

Results: Aggregated susceptibility data by organism-antimicrobial combination

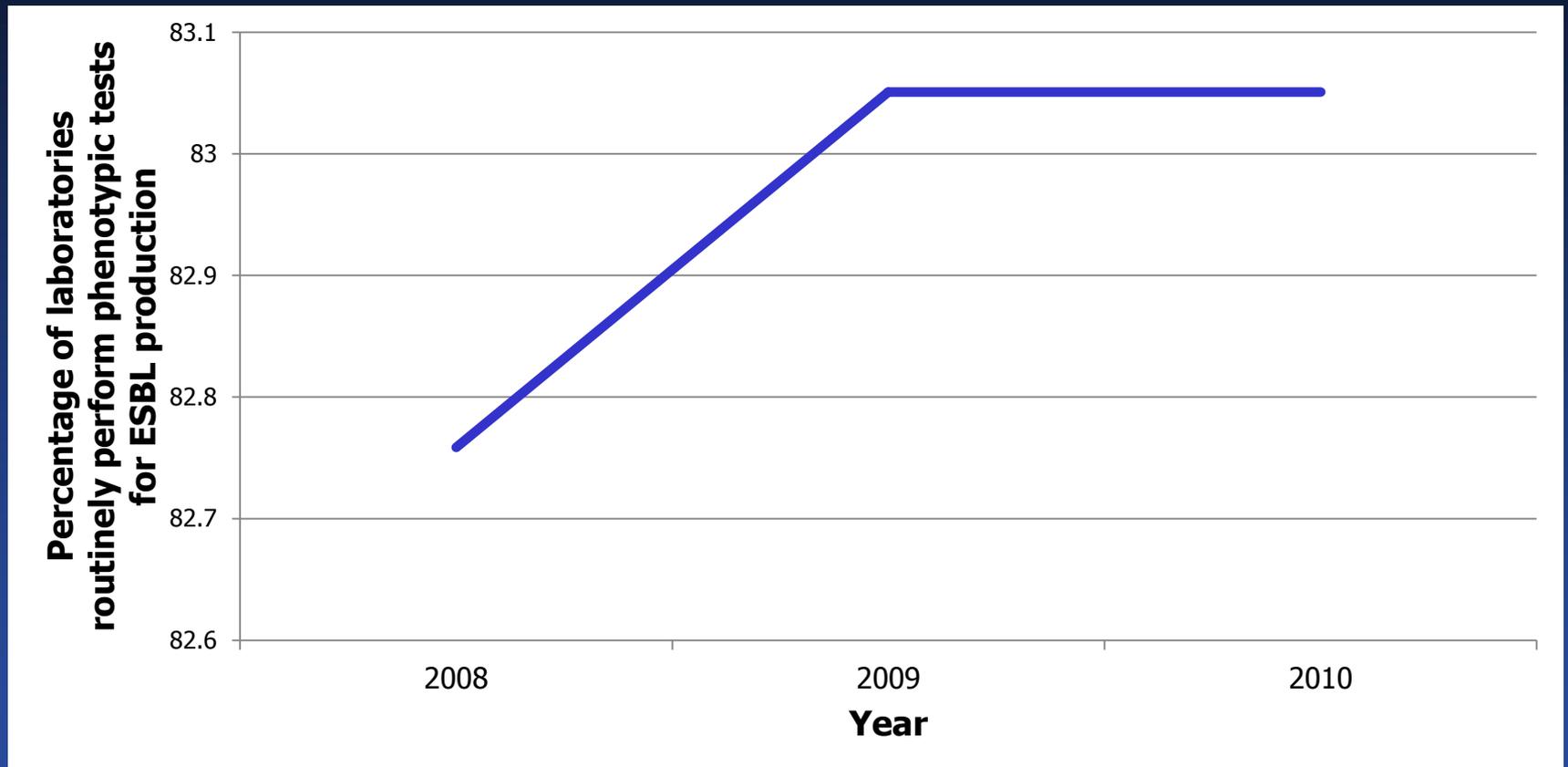
Number of extended-spectrum Beta-lactamase (ESBL) producing *Escherichia coli* and *Klebsiella pneumoniae* isolates per year



Number of vancomycin-intermediate *Staphylococcus aureus* (VISA, minimum inhibitory concentration 4-8mcg/ml) isolates (one/patient) by year



Percentage of laboratory routinely perform phenotypic tests (eg. Double-disk diffusion or other method) for ESBL production on all *Klebsiella pneumoniae* that are suspicious for ESBL production



Update on CRE

- MDL at CDPH (in collaboration with CDC) has been involved with confirmatory testing of CRE resistance phenotypes
- No clear mechanism at this point for confirming CRE testing at MDL

Enterobacter cloacae to ceftazidime

Year	No. isolates tested	No. isolates susceptible	Percent isolates susceptible
2008	5,402	3,810	70.5%
2009	5,907	4,294	72.7%
2010	5,563	4,333	77.9%

Change from 2008 to 2010: increased susceptibility 10.4%

Resistance of *Enterobacter cloacae* to ceftazidime

- Similar to previous national trends
 - ICU patients only
 - ✓ Resistance decreased from 36% (1993-1995) to 11.7% (2002-2004)

Lockhart, S, et al. Antimicrobial Resistance among Gram-Negative Bacilli Causing Infections in Intensive Care Unit Patients in the United States between 1993 and 2004. 2007. J Clin Microbiol 45(10):3352-3359.

Staphylococcus aureus to oxacillin

Year	No. isolates tested	No. isolates susceptible	Percent isolates susceptible
2008	68,878	35,592	51.7%
2009	67,623	36,686	54.3%
2010	63,079	35,260	55.9%

Change from 2008 to 2010: increased susceptibility 8.2%

Resistance of *Staphylococcus aureus* to oxacillin

- 2007 CAbP found percent susceptibility of 50%, following 2008-2010 trend
- Similar to national trends
 - NHSN report (2006-2007)
 - ✓ Oxacillin resistance ranged from 49.2 to 64.2% depending on infection type
 - ✓ Only for specimens causing device-related or procedure-associated HAIs reported to NHSN

Pseudomonas aeruginosa to imipenem/meropenem/doripenem

Year	No. isolates tested	No. isolates susceptible	Percent isolates susceptible
2008	18,030	14,380	79.8%
2009	17,917	15,517	86.6%
2010	17,879	15,408	86.2%

Change from 2008 to 2010: increased susceptibility 8.1%

Resistance of *Pseudomonas aeruginosa* to imipenem/meropenem/doripenem

- Similar to national trends
 - NHSN report (2006-2007)
 - ✓ Imipenem/ meropenem resistance ranged from 11.8 to 26.4% depending on infection type

Pseudomonas aeruginosa to amikacin

Year	No. isolates tested	No. isolates susceptible	Percent isolates susceptible
2008	18,030	13,316	73.9%
2009	17,917	14,749	82.3%
2010	17,879	14,383	80.4%

Change from 2008 to 2010: increased susceptibility 8.9%

Resistance of *Pseudomonas aeruginosa* to amikacin

- Higher than national reports
 - NHSN report (2006-2007)
 - ✓ Amikacin resistance ranged from 2.0 to 7.9% depending on infection type
- International trends
 - Documented high rates of resistance in Latin America (30.5%) and Europe (13.7%)

Poole, K. Aminoglycoside Resistance in *Pseudomonas aeruginosa*. 2005. *Antimicrob. Agents Chemotherapy* 49:2479-2487.

Pseudomonas aeruginosa to cefepime/ceftazidime

Year	No. isolates tested	No. isolates susceptible	Percent isolates susceptible
2008	18,030	14,100	78.2%
2009	17,917	14,891	83.1%
2010	17,879	15,127	84.6%

Change from 2008 to 2010: increased susceptibility 8.2%

Resistance of *Pseudomonas aeruginosa* to cefepime/ceftazidime

- Higher than national reports
 - NHSN report (2006-2007)
 - ✓ Cefepime-*only* resistance ranged from 5.7 to 12.6% depending on infection type
- Resistance to cefepime associated with prior use of an extended-spectrum cephalosporin, extended-spectrum penicillin, or fluoroquinolone
- Associated with higher mortality
 - Mortality rate for participants with cefepime-resistant *P. aeruginosa* was 20.2% (43/213)
 - Mortality rate for participants with cefepime-susceptible *P. aeruginosa* was 13.2%

Akhabue, E, et al. 2011. Cefepime-Resistant *Pseudomonas aeruginosa*. *EID* 17(6).



Acinetobacter baumannii to imipenem/meropenem/doripenem

Year	No. isolates tested	No. isolates susceptible	Percent isolates susceptible
2008	2,023	1,207	59.7%
2009	1,917	1,130	59.0%
2010	1,649	846	51.3%

Change from 2008 to 2010: decreased susceptibility 14.0%

Acinetobacter - carbapenem resistance

- Several mechanisms of resistance
- NHSN report:
 - Carbapenem resistance ranged from 26 – 37%
- Method of transmission
 - Associated with contaminated skin, body fluids, equipment, environment

Acinetobacter - carbapenem resistance prevention and control

- Hand hygiene
- Contact precautions
- Environmental cleaning
- Antimicrobial stewardship
 - Formulary restriction
 - Prior approval
- Resources
 - APIC, Guide to the Elimination of Multidrug-resistant *Acinetobacter baumannii* Transmission in Healthcare Settings, 2010
 - CDC, Guidance for Control of Infections with Carbapenem-Resistant or Carbapenemase-Producing *Enterobacteriaceae* in Acute Care Facilities, 2009
 - CDC, Guidance for Control of Carbapenem-resistance *Enterobacteriaceae* (CRE), 2012 CRE Toolkit
<http://www.cdc.gov/hai/pdfs/cre/CRE-guidance-508.pdf>

Results: Organism-antimicrobial combinations that changed less than 5%, Gram negative bacteria

- *Klebsiella* spp. to ceftriaxone/cefotaxime increased 1.0%.
- *Klebsiella* spp. to imipenem/meropenem/doripenem increased 0.9%.
- *Escherichia coli* to ceftriaxone/cefotaxime decreased 0.7%.
- *Escherichia coli* to ciprofloxacin/levofloxacin decreased 1.5%.
- *Enterobacter cloacae* to imipenem/meropenem/doripenem increased 2.2%.
- *Enterobacter cloacae* to ciprofloxacin/levofloxacin increased 3.6%.
- *Enterobacter cloacae* to cefepime increased 1.3%.
- *Pseudomonas aeruginosa* to ciprofloxacin/levofloxacin increased 3.3%.
- *Pseudomonas aeruginosa* to gentamicin/tobramycin decreased 4.1%.
- *Pseudomonas aeruginosa* to piperacillin/tazobactam increased 1.9%.



Results: Organism-antimicrobial combinations that changed less than 5%, Gram positive bacteria

- *Enterococcus* spp. to vancomycin decreased 4.6%.
- *Staphylococcus aureus* to clindamycin increased 1.5%.
- *Staphylococcus aureus* to tetracycline/doxycycline/minocycline decreased 2.0%.
- *Staphylococcus aureus* to trimethoprim-sulfamethoxazole increased 2.2%.
- *Staphylococcus aureus* to rifampin decreased 0.5%.

Limitations

- Resistance identified in population served by individual hospital may not reflect resistance in surrounding areas
- Does not allow evaluation by age or other variables of interest such as race or gender
- Lack of patient- and case- specific data eliminates opportunity for more in-depth analyses

Limitations

- Not all laboratories reported susceptibilities to all drugs
- Inpatient and outpatient isolates were not reported separately
- Few LTCFs participated
- Given number of laboratories that participated unable to do more subset analyses (acute care vs. tertiary care, etc.)
 - Data may not represent susceptibility patterns throughout California

CAbP Website

<http://www.cdph.ca.gov/programs/hai/Pages/CaliforniaAntibiogramProject.aspx>

CAbP 2008-2010:

<http://www.cdph.ca.gov/programs/hai/Pages/CaliforniaAnnualAntibiograms.aspx>

How to Utilize CAbP Data

- Compare local antibiograms to aggregate antibiogram
 - Understand how local susceptibility patterns differ
 - Help target specific organism-antimicrobial combinations
- Continue to utilize local antibiograms to answer specific questions:
 - How to modify clinical guidelines to develop institutional-based guidelines
 - Which antimicrobials to focus ASPs at your institution

Changes to the 2011 CAbP Survey

- Link:
 - <https://www.surveymonkey.com/s/CAAntibiogramProject2011>
 - <http://www.cdph.ca.gov/programs/hai/Documents/CAAntibiogramSurvey2011.pdf>
- Retained format and most questions
 - Hospital demographics, creation of local antibiogram, microbiology practice, CLSI breakpoints, same drug-organism combinations
- Minor changes to SurveyMonkey format
 - Fields altered for better data quality
- Now asking for total number of isolates tested for ESBL production (*E. coli* and *K. pneumoniae*)

Changes to 2011 CAbP Survey (1)

***20. If polymerase chain reaction (PCR) was performed for carbapenemases on *Klebsiella pneumoniae* and other Enterobacteriaceae, how many isolates were tested and how many were found positive (one/patient) in 2011?**

Number of
Enterobacteriaceae isolates
tested by PCR

Number of
Enterobacteriaceae isolates
found positive by PCR

***21. If this hospital performed phenotypic tests (eg. double-disk diffusion) for extended-spectrum Beta-lactamase (ESBL) production on *Escherichia coli* and *Klebsiella pneumoniae* that were suspicious for ESBL production, please enter number tested and number positive in 2011 below.**

E. coli isolates suspicious for
ESBL tested

E. coli ESBL isolates
positive

K. pneumoniae isolates
suspicious for ESBL tested

K. pneumoniae ESBL
isolates positive

Changes to 2011 CAbP Survey (2)

California Antibioqram Project 2011

Enterococcus spp. in 2011

If your hospital did not collect information on a particular isolate, please put "N/A" in the corresponding textbox. All isolates (blood, urine, wound) should be reported together and not separated.

All susceptibility data collected through this survey should represent INPATIENT data from general acute care hospitals only. This does not include reference laboratories unless they service general acute care hospitals. If a laboratory services two acute care hospitals, we would prefer filling out one survey per hospital.

*24. For Enterococcus spp. in 2011 enter:

Total number of isolates tested

Total number of isolates susceptible to Vancomycin

25. For Enterococcus spp., what was the primary testing methodology used?

- Manual broth dilution
- Automated broth dilution
- Disk diffusion

26. How many acute care hospitals are included in these data?

27. Indicate the reporting period for these data:

From: MM / DD / YYYY
To: MM / DD / YYYY



Conclusions

- Low adherence to revised CLSI breakpoints
- From 2008 to 2010, the susceptibility of *Acinetobacter baumannii* to imipenem/meropenem/doripenem decreased by 14%
- 5 combinations improved susceptibility (8-10%)
- 15 combinations changed <5%
- 2011 CAbP Survey has minor changes from prior tool

Research Collaborations

- Harvard and Princeton studying the economics of antibiotic resistance
 - Using CAbP data to study the social and economic correlates of antibiotic resistance
 - Only statistical descriptions and trends will be reported as research results
 - No identifying information on hospitals, labs, or personnel will be shared beyond the researchers on this team



Questions?

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