



Looking for the Bad Bugs in Wisconsin



David Warshauer, PhD, D(ABMM)

Deputy Director, Communicable Diseases

Wisconsin State Laboratory of Hygiene



Using a Proven Model for Antimicrobial Resistance Surveillance

CDC

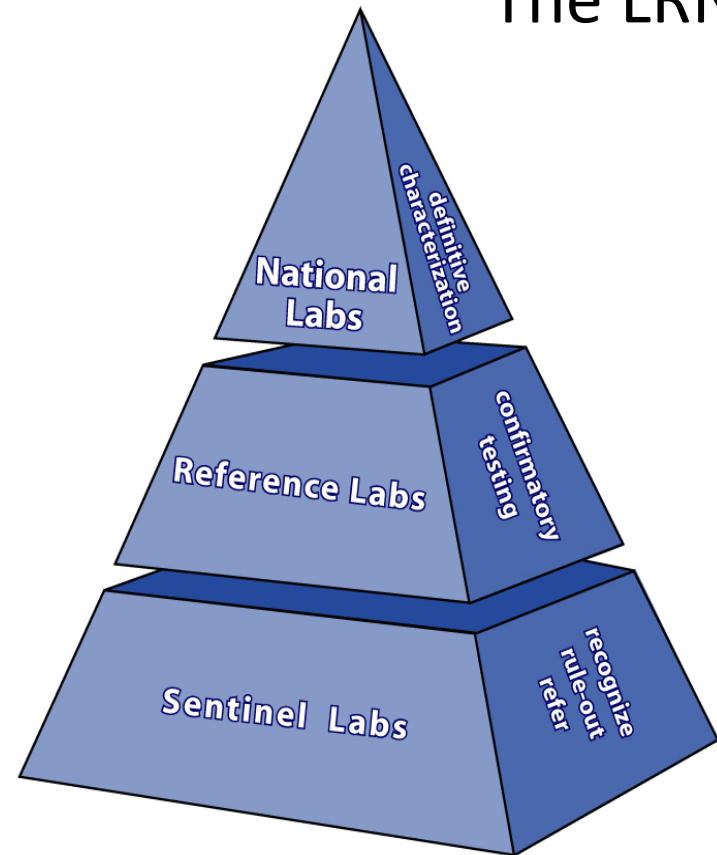


Public Health Laboratories



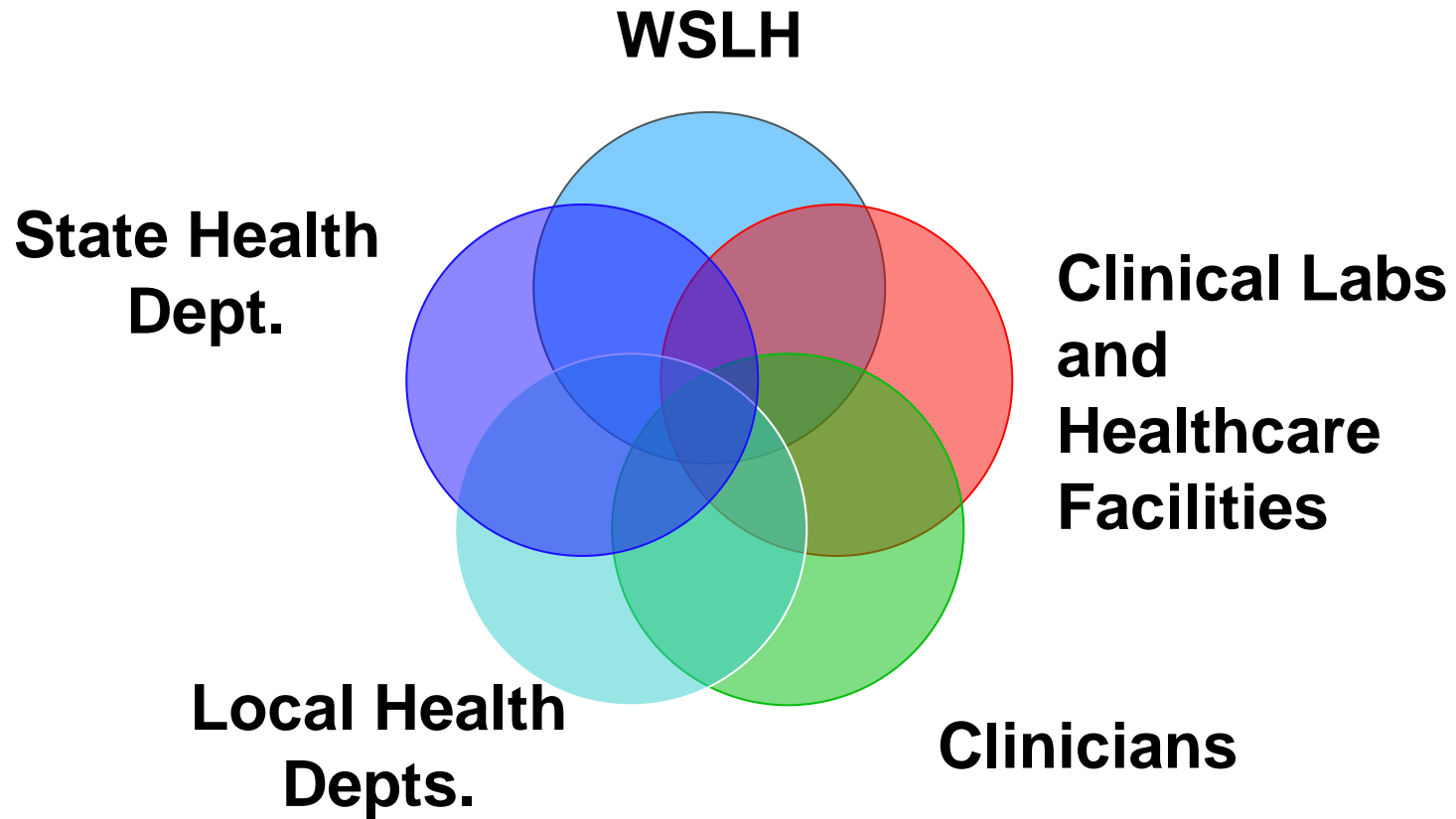
Clinical Laboratories
Commercial Laboratories
Research Laboratories

The LRN



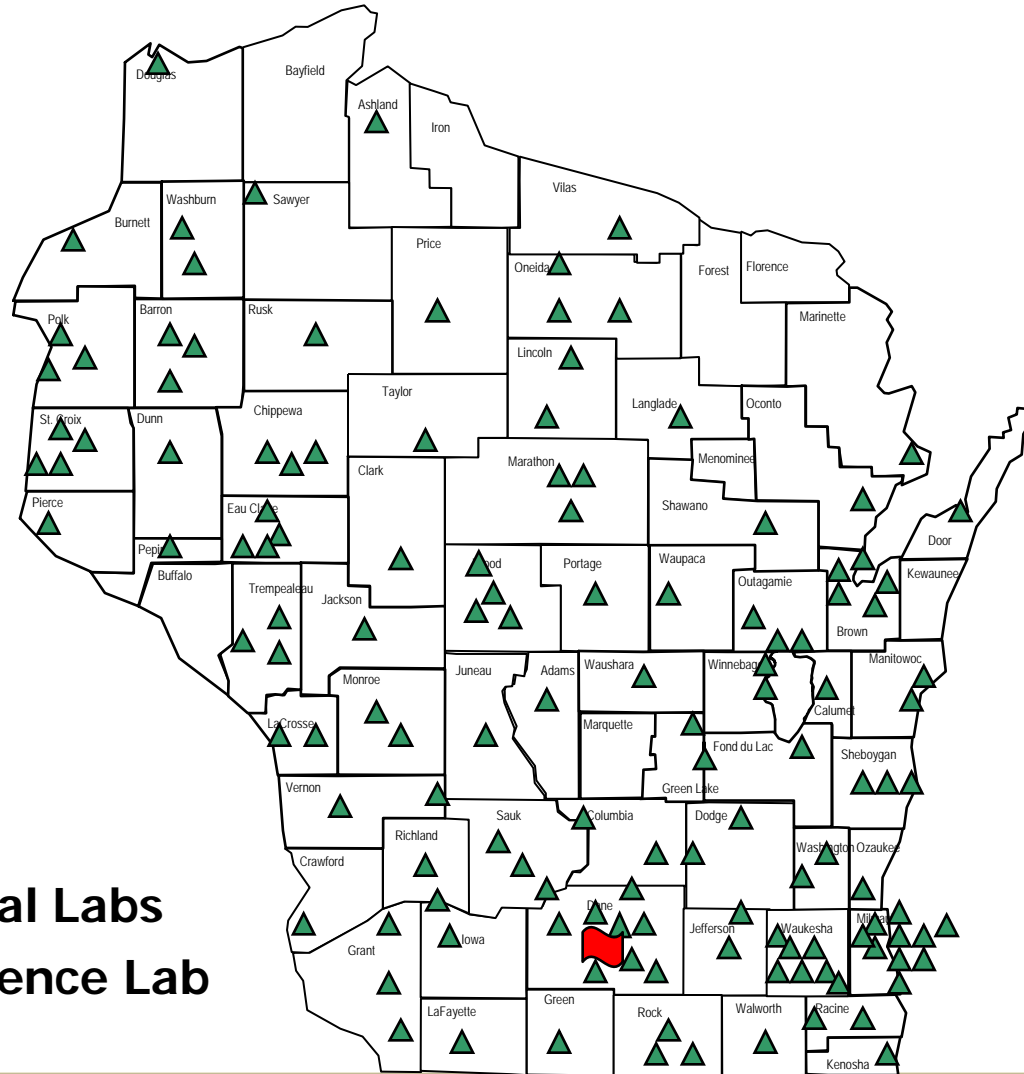




Traditional *State* Partners in Public Health



The Wisconsin Clinical Laboratory Network

An "all-hazards" Network



 **WCLN Clinical Labs**
 **WCLN Reference Lab**



Role of Clinical Laboratories

- Submission of isolates
 - Voluntary
- Submission of AST results
- Reporting to public health



<http://www.gru.edu/alliedhealth/mlirs/images/cls-program.jpg>



Wisconsin Antimicrobial Resistance Surveillance

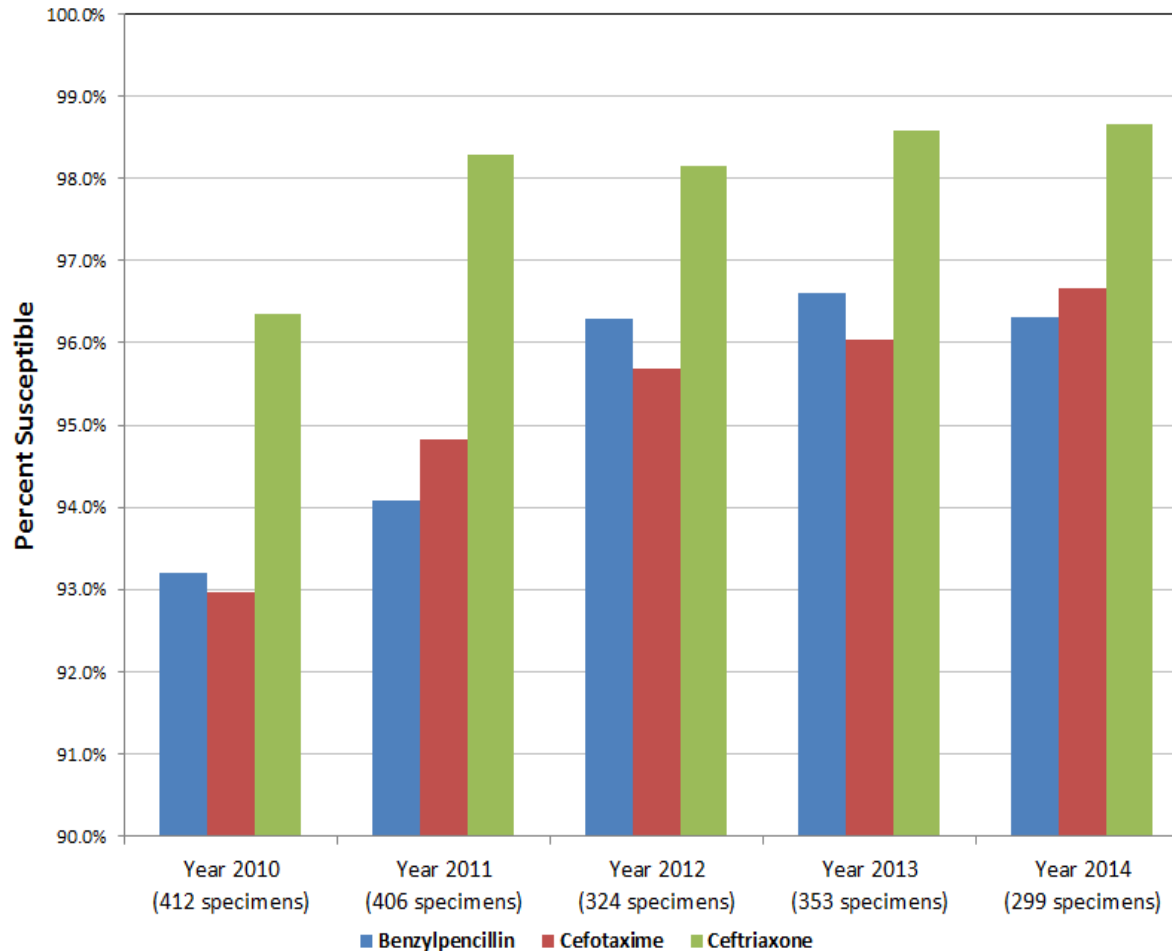
▪ NARMS

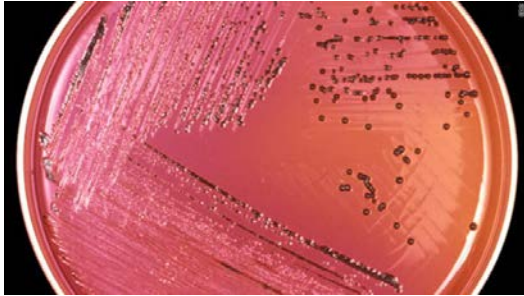
- Salmonella
- E. coli O157
- Shigella
- Listeria
- Vibrio

▪ WSLH

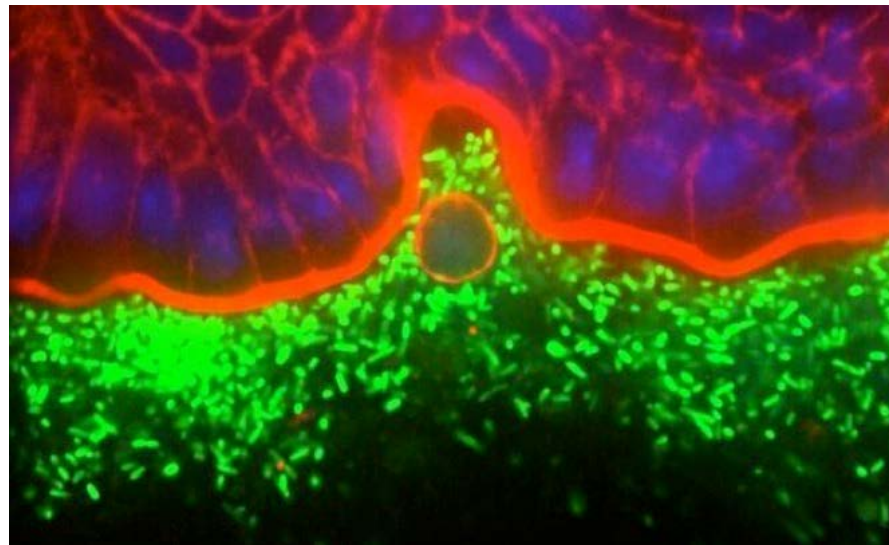
- Salmonella
- S. pneumoniae
- Milwaukee City Lab/GISP
 - Neisseria gonorrhoeae
- State Antibigram
 - Clinical Lab Data

Streptococcus Pneumoniae Susceptibilities 2010-2014 (Non-Meningitis Breakpoints)





Salmonella Antibiotic Resistance Surveillance





Wisconsin Surveillance

Non-typhoidal *Salmonella* isolates tested for antibiotic susceptibility at WSLH, 2003-2012

Serotype	Number of isolates tested by year									
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Enteritidis	128	151	245	8	8	11	5	11	7	9
Typhimurium	134	181	192	161	173	136	96	115	88	106
Newport	106	81	82	66	60	54	49	53	56	53
Heidelberg	14	19	33	16	24	33	9	11	16	14
I 4,[5],12:i:-	0	0	34	42	86	35	16	28	34	52
Other	310	400	341	341	384	323	295	334	340	357
All serotypes	692	832	927	634	735	592	470	552	541	591



Findings

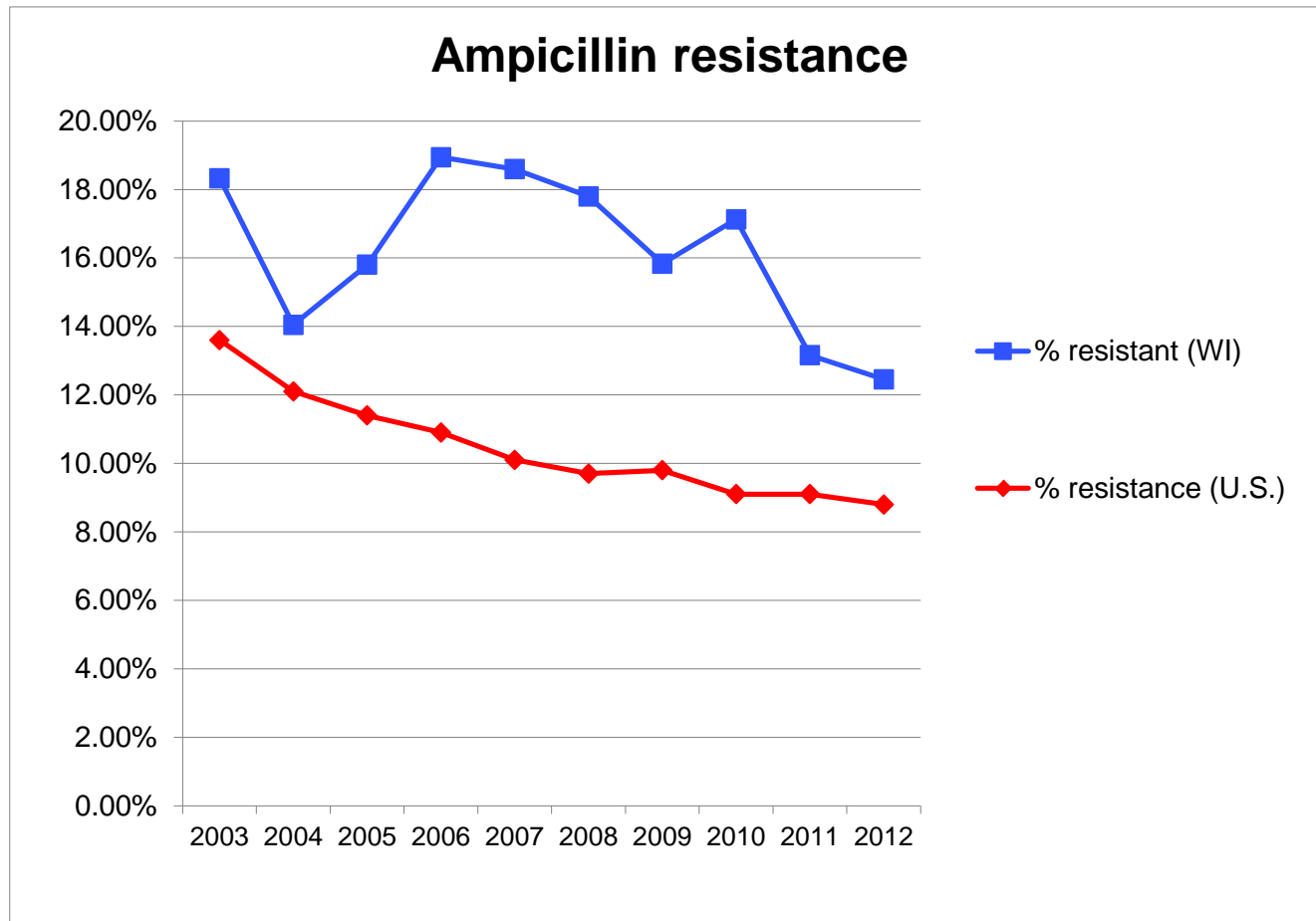
Number and percent of all non-typhoidal *Salmonella* isolates from Wisconsin and U.S. that are resistant to individual antibiotics, from all years (2003-2012) combined

Antibiotic	Wisconsin (N=6566)		U.S. (N=21589)		p-value
	n	%	n	%	
Gentamicin	194	3.0%	336	1.6%	<0.05
Kanamycin	360	5.5%	529	2.5%	<0.05
Streptomycin	2046	31.2%	2234	10.3%	<0.05
Amoxicillin-clavulanic acid	780	11.9%	713	3.3%	<0.05
Ceftriaxone	414	6.3%	690	3.2%	<0.05
Ampicillin	1071	16.3%	2236	10.4%	<0.05
Ciprofloxacin	12	0.2%	46	0.2%	0.32
Nalidixic Acid	172	2.6%	456	2.1%	<0.05
Cefoxitin	524	8.0%	669	3.1%	<0.05
Sulfisoxazole	1521	23.2%	2369	11.0%	<0.05
Trimethoprim-sulfamethoxazole	159	2.4%	341	1.6%	<0.05
Chloramphenicol	763	11.6%	1361	6.3%	<0.05
Tetracycline	1348	20.5%	2727	12.6%	<0.05



Findings

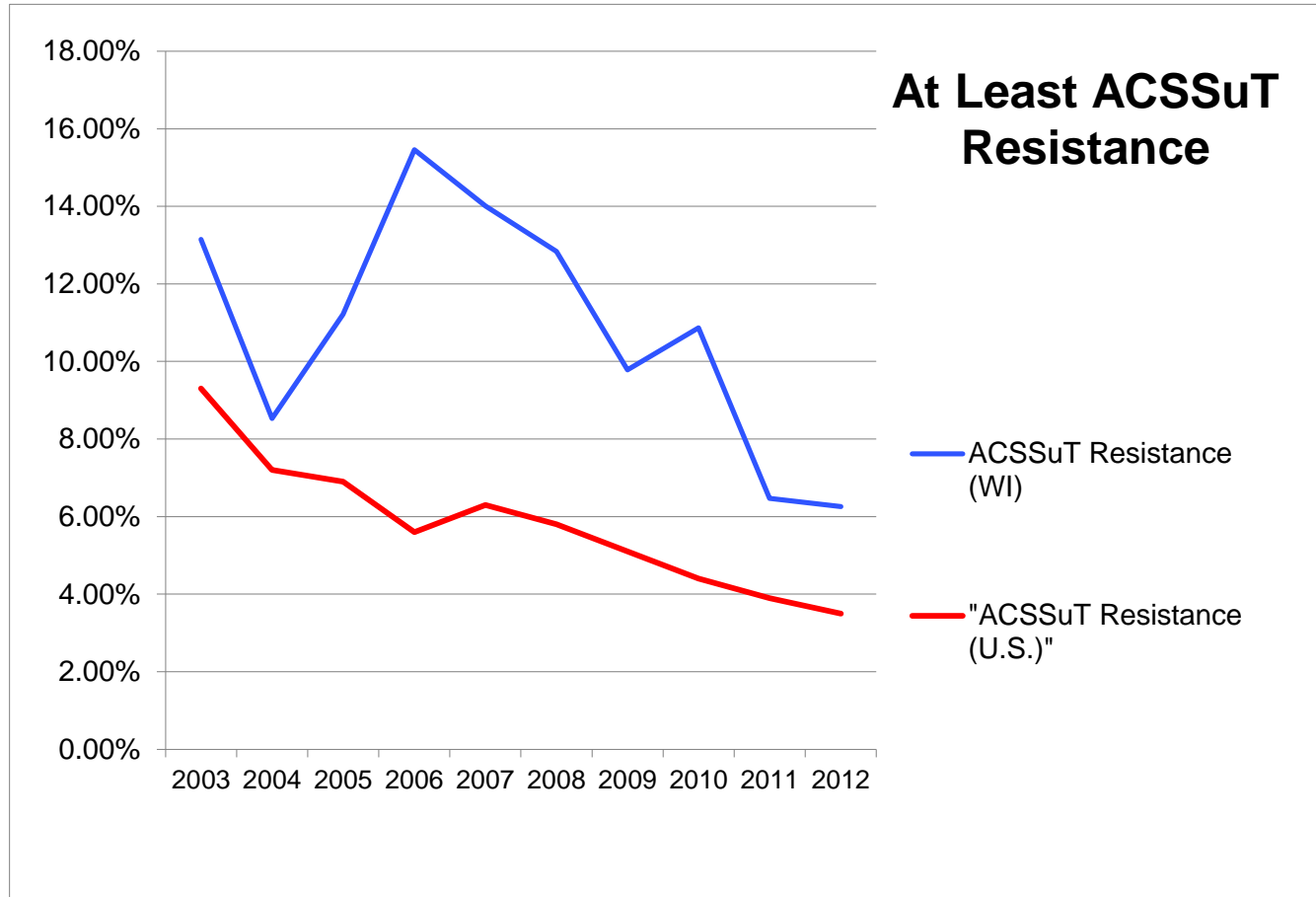
Trends in resistance to individual antibiotics





Findings

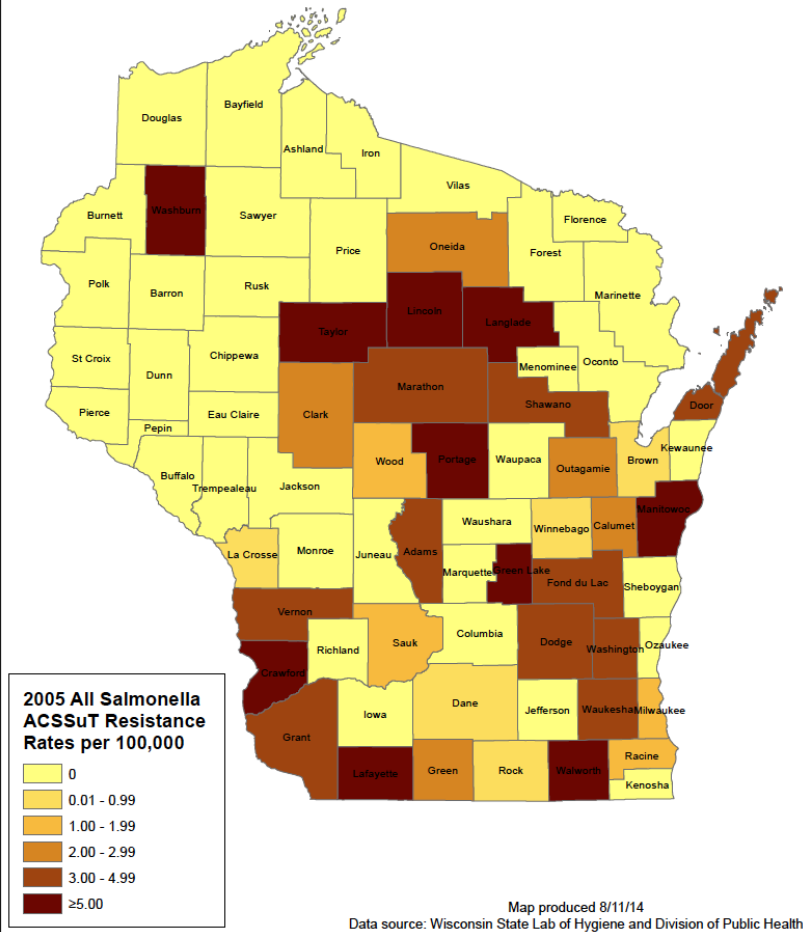
Trends in resistance to combinations of antibiotics



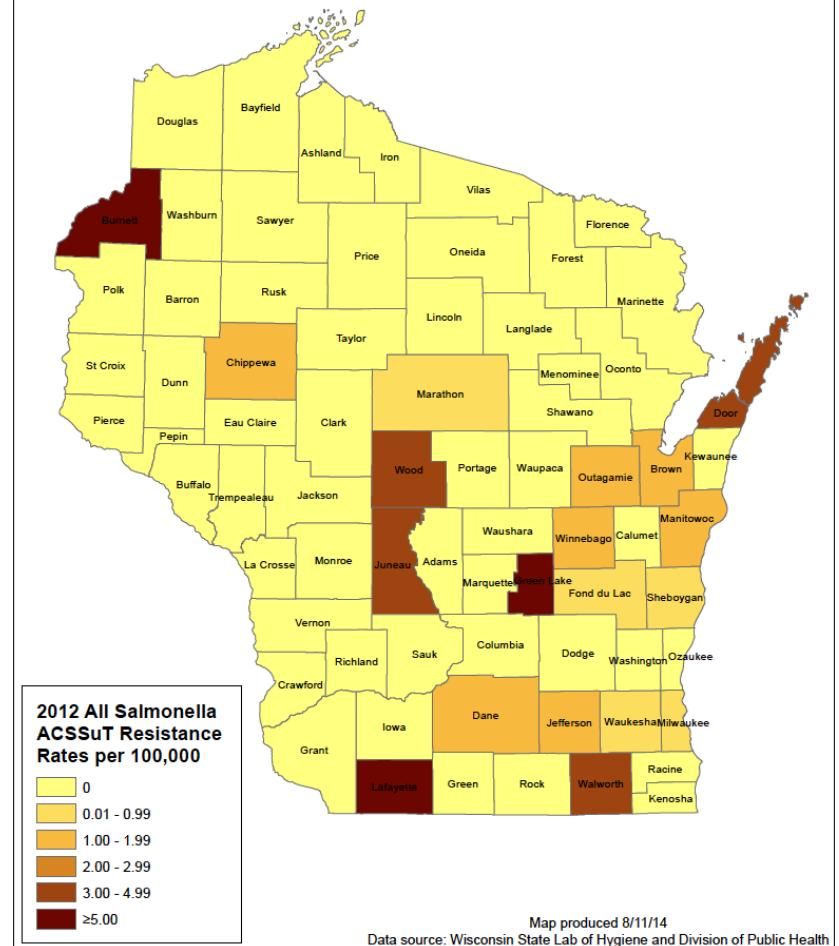


Comparison of ACSSuT resistance rates by county over time

All Salmonella Serotypes ACSSuT Resistance Rates: 2005



All Salmonella Serotypes ACSSuT Resistance Rates: 2012





Observations

Resistance rates to nearly all tested antibiotics in WI and U.S. have decreased over the studied time period

WI isolates are generally more resistant than national averages



CRE Surveillance

Hospital Based



Laboratory Based



The Bacteria Bowl



CRE

Hospital-Based Surveillance in Wisconsin

- Reporting became mandatory during Dec 2011
- Hospital **inpatient**-based
- Requires use of the National Healthcare Safety Network (NHSN) for reporting
- Purposes
 - Identify areas of high CRE prevalence
 - Identify “high risk” facilities
 - Assess healthcare-associated transmission



CRE

Surveillance in Wisconsin

N = 137 hospitals

Hospitals required to report cases of CRE among inpatients

- 71 acute care
- 58 critical access
- 2 children's
- 6 long-term acute care



CRE

Surveillance in Wisconsin

2014 NHSN definition

Any *E. coli* or *Klebsiella* spp. non-susceptible to imipenem, meropenem, or doripenem, by standard susceptibility testing methods or by a positive result for any method FDA-approved for carbapenemase detection from specific specimen sources. Includes clinical isolates from hospital inpatients.



Wisconsin 2014 Hospital-based CRE Data

Measure	n= 26 patients
Proportion of males	13/26 (50%)
Median age (range), years	65 (32–94)
Carbapenemase (KPC) positive	10/26 (38%)
Specimen source	n= 38 specimens
Urine	23 (60%)
Blood, other sterile sites	7 (18%)
Other (sputum, wound, SST)	5 (13%)
<i>Klebsiella</i> spp.	30 (79%)
Hospital onset (specimen collected on or after day 4 of admission)	15 (39%)



CRE

Wisconsin 2014 Hospital-based CRE Data

Findings:

The southeastern public health region has a relatively high prevalence of CRE.

- One “high risk” facility has been identified.
- At least three probable incidents of healthcare-associated transmission have been identified.



Laboratory-Based Surveillance





Isolate Criteria for CRE Surveillance

- Enterobacteriaceae nonsusceptible to carbapenems
 - Imipenem, Meropenem, doripenem, or ertapenem
 - Excluding *Proteus* spp., *Providencia* spp., and *Morganella morganii*



TYPES OF CARBAPENEMASES

Enzyme Type	Ambler Class	Activity Spectrum	Organism(s)
KPC (1-10) (plasmid)	A	All β -lactams	Enterobacteriaceae <i>Ps. aeruginosa</i>
SME <i>S. marcescens</i> enzyme	A	Carbapenems and aztreonam, but not 3 rd /4 th Gen cephalosporins	<i>S. marcescens</i> , not plasmid Associated.
NMC-A, IMI MNC = <u>N</u> ot <u>m</u> etallo <u>c</u> arbapenemase IMI = IMI hydrolyzing B-lactamase	A	Same as for SME	<i>Enterobacter</i> spp.
GES GES= <u>G</u> uiana <u>e</u> xtended <u>s</u> pectrum (plasmid)	A	Imipenem and 3 rd /4 th cephalosporins	<i>Ps. Aeruginosa</i> and Enterobacteriaceae
IMI, VIM, NDM-1 VIM = <u>V</u> erona <u>I</u> ntegron encoded <u>M</u> BL) NDM-1 = New Delhi metallo β lactamase	B (metallo- β -lactamases)	All β -lactams; can test susceptible to aztreonam (NDM-1 variable AZT resistance)	<i>Pseudomonas</i> spp. <i>Acinetobacter</i> spp. Enterobacteriaceae
OXA (Oxacillin hydrolyzing)	D	Weakly active against carbapenems	<i>A. baumannii</i> , <i>P. Aeruginosa</i> , and rare Enterobacteriaceae

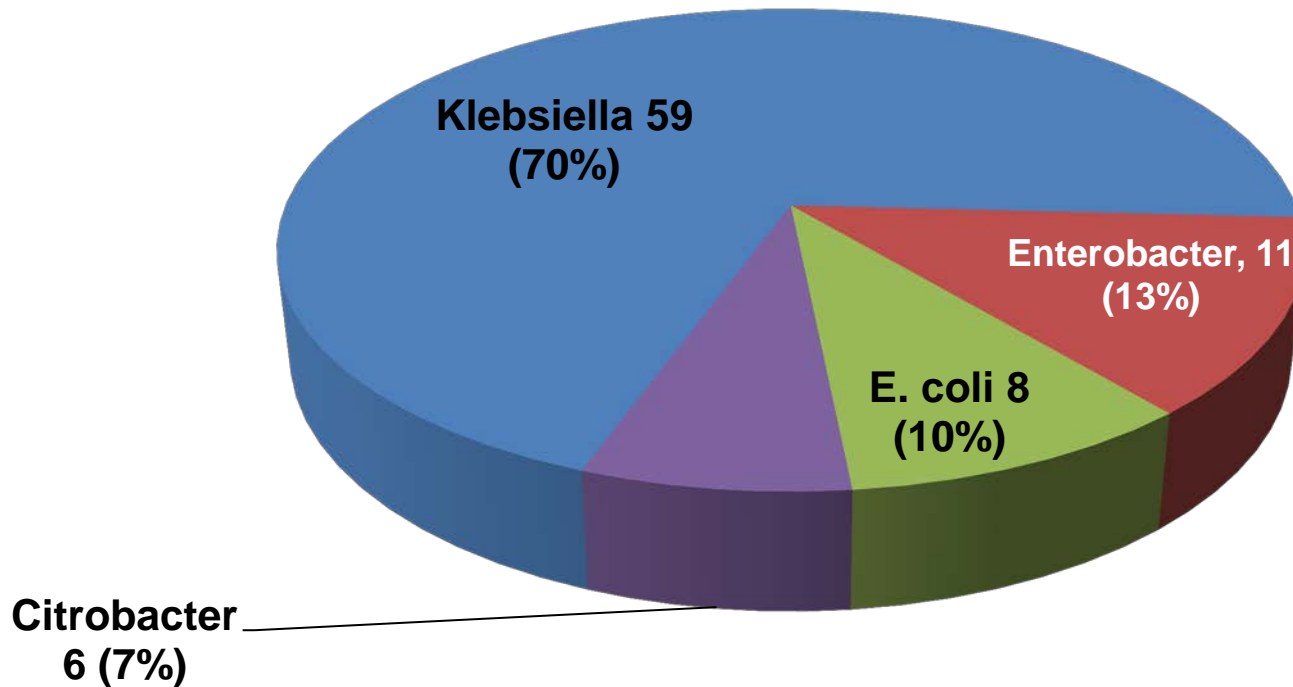


January 2010 to July 2014 CRE Surveillance

- Of 316 isolates tested for KPC, 84 positive (27%)
 - Most cases sporadic, but clusters were detected by PFGE and epidemiological linkage
- Of 196 isolates tested for NDM-1, 6 were positive (3%)
 - 5 cases were part of tightly linked epidemiological cluster
 - Index case had medical treatment on Indian subcontinent

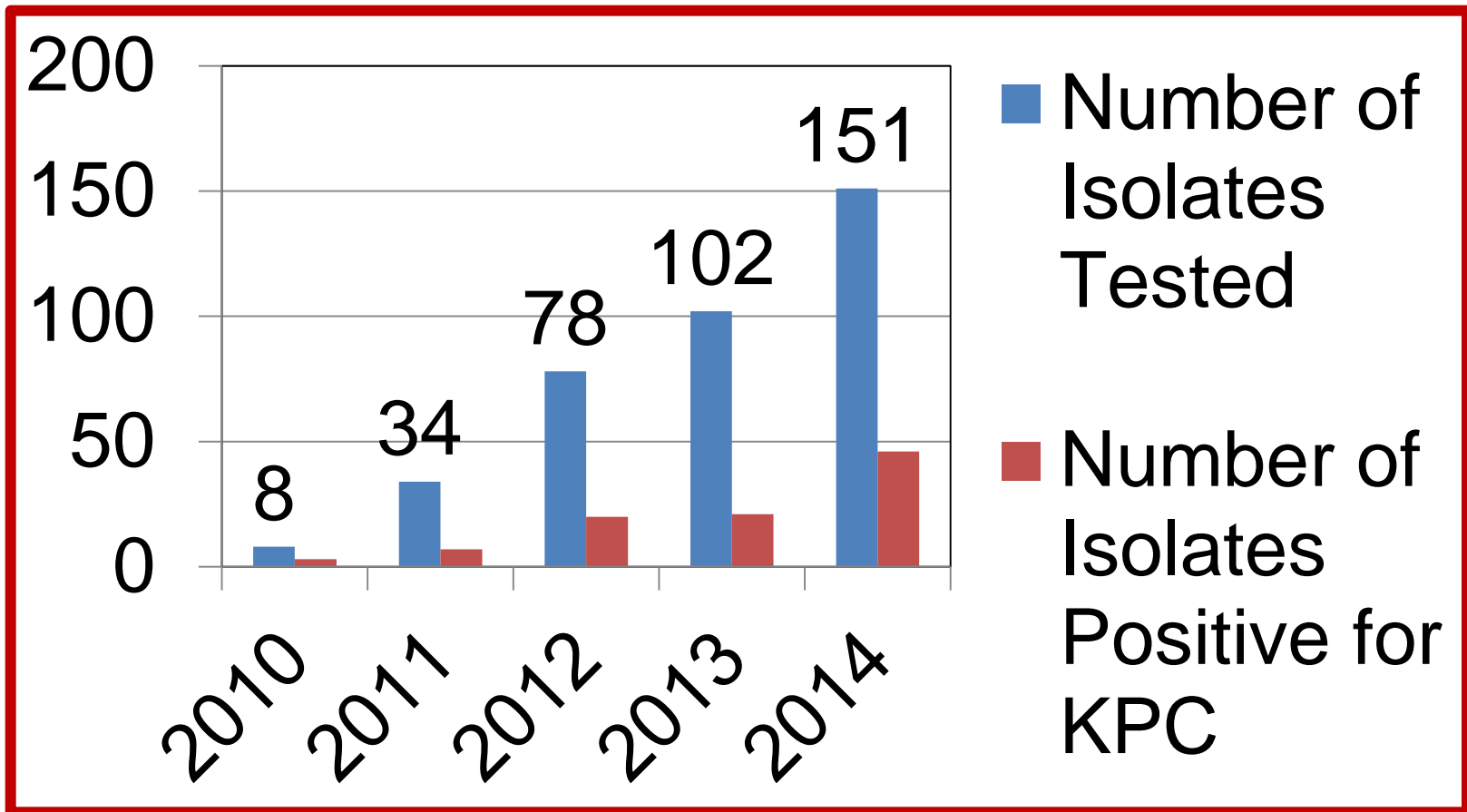


January 2010 to July 2014 CRE Surveillance Positive for KPC





CRE Laboratory Surveillance





Conclusion

- Increasing antimicrobial resistance requires enhanced surveillance
- Antimicrobial resistance surveillance requires a strong clinical laboratory network
- Surveillance must include many partners: state and local public health, healthcare facilities, infection preventionists, and clinicians
- Surveillance requires funding



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