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Antibiotic Resistance in Texas

Jennifer A. Shuford, MD, MPH
Infectious Disease Medical Officer
Department of State Health Services

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Overview of Antibiotic Resistance

Antibiotic Resistance Timeline

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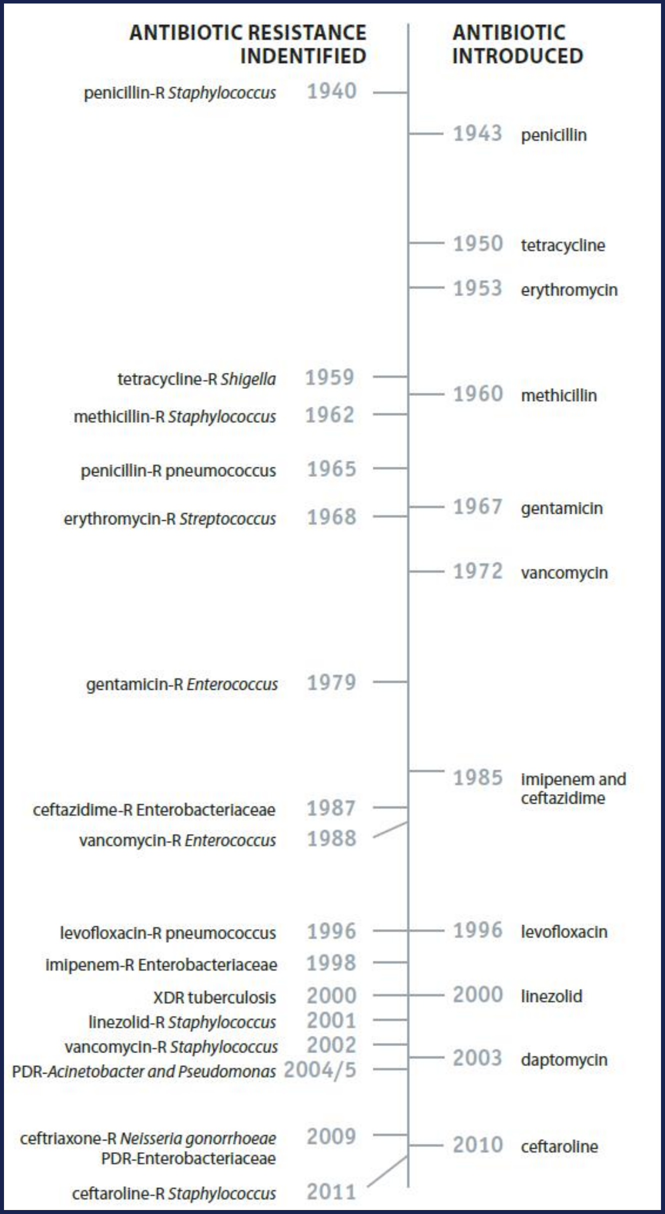


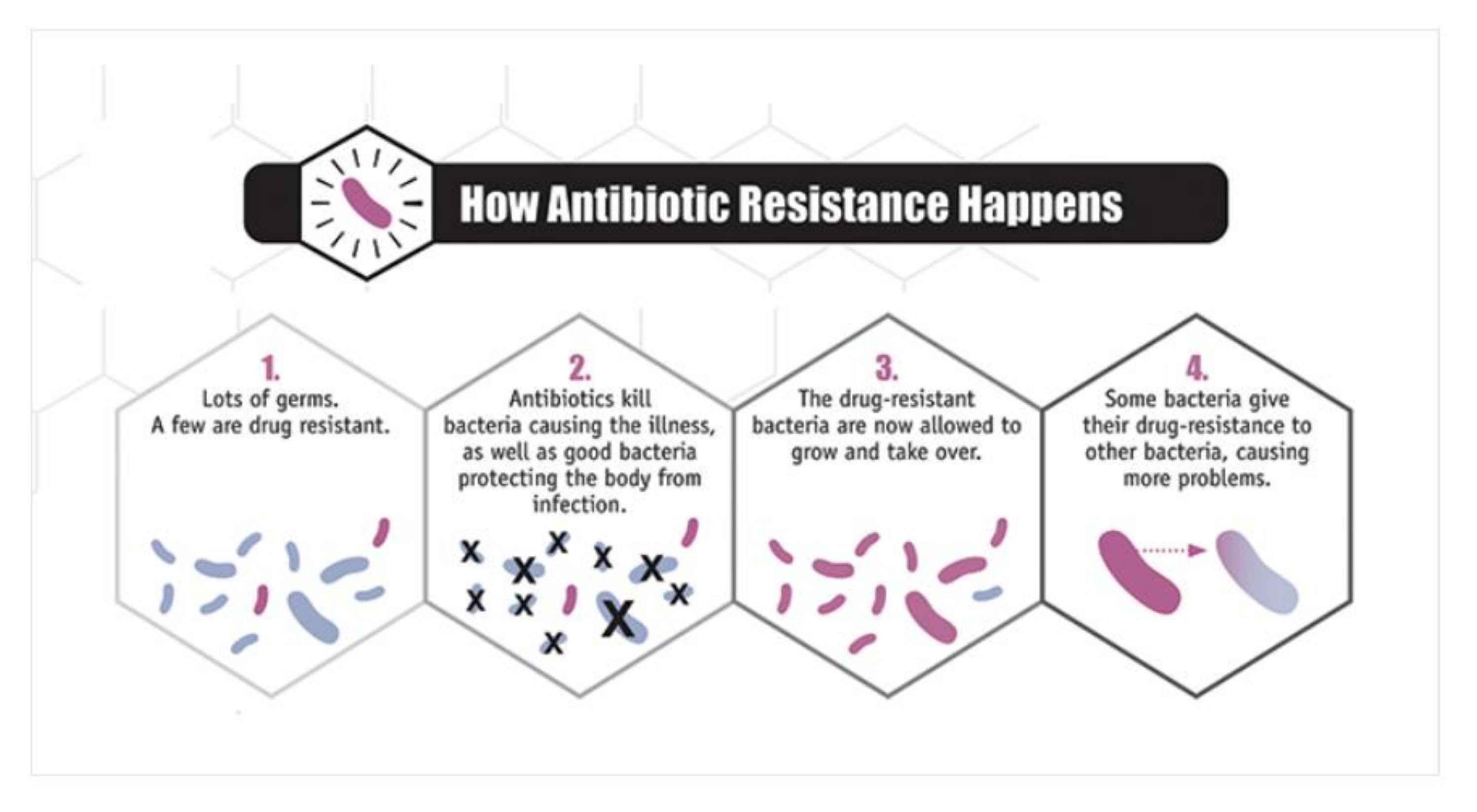
Available at: https://www.cdc.gov/drugresistance/about.html
Accessed: January 8, 2018.

Antibiotic Use

- Antibiotics have saved countless lives since sulfa was introduced in the 1930s
- Overuse of antibiotics is now common
  - ~30-50% of antibiotic use is unnecessary or inappropriate

Available at: https://www.cdc.gov/antibiotic-use/healthcare/index.html. Accessed January 8, 2018.

Development of Resistance



Available at: https://www.cdc.gov/drugresistance/about.html. Accessed January 8, 2018.

Development of Resistance

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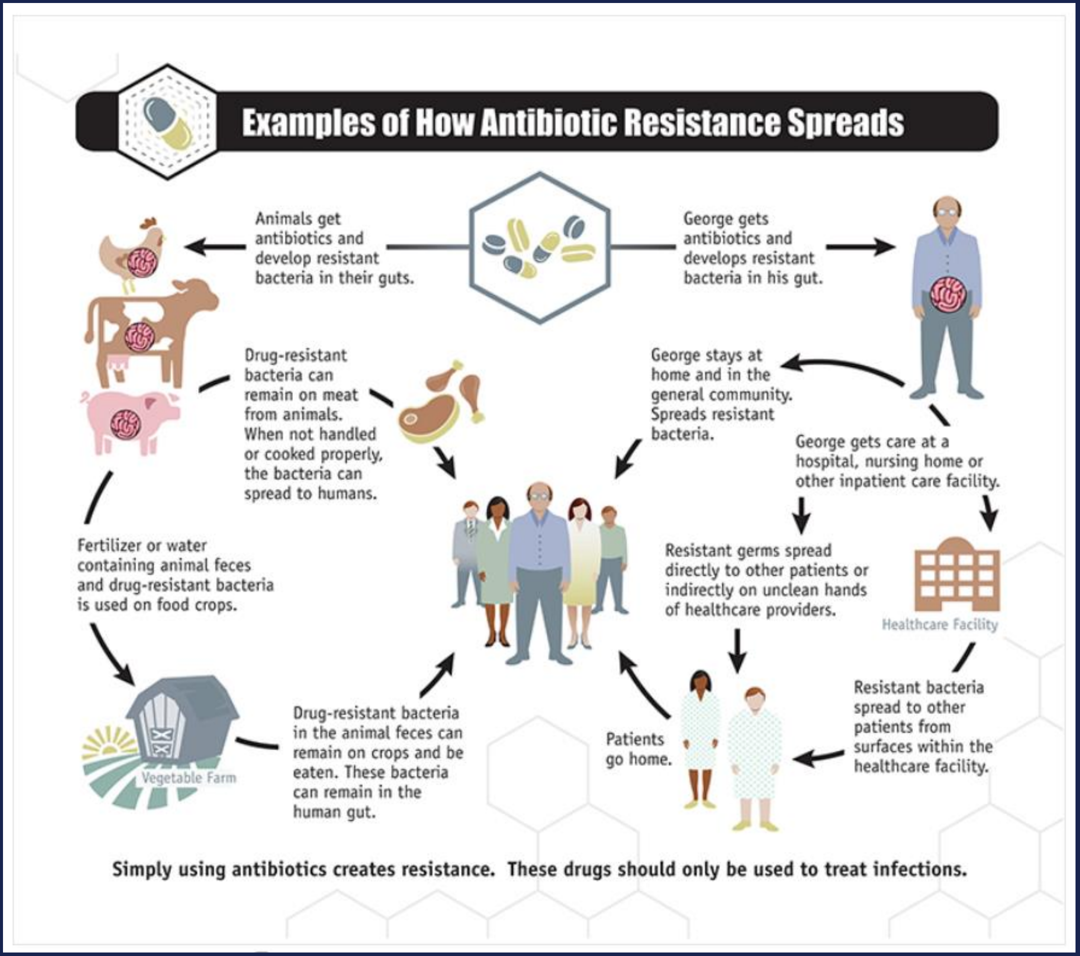
- Many organisms are now resistant to multiple different antibiotics
  - These are termed MDROs, also known as “nightmare bacteria”
- Organisms may become resistant to all antibiotics
  - Sometimes called “pan-resistant”
- Threaten to return us to a time without any antibiotics
- Use of antibiotics is the most important factor in rising prevalence of resistant organisms around the world

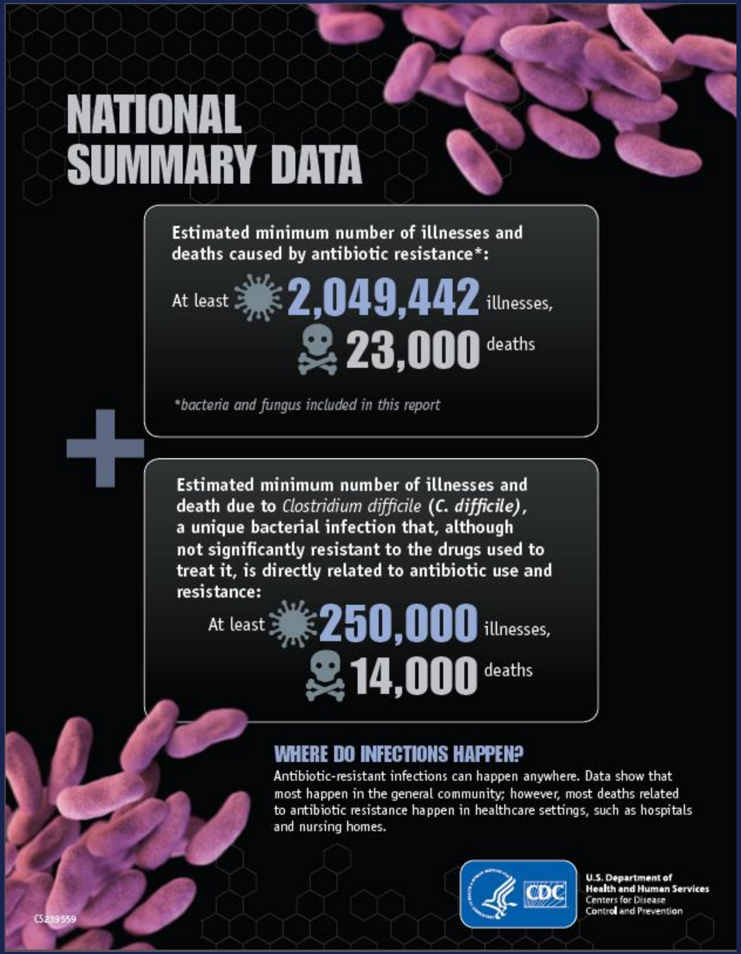
Available at: www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf#page=11. Accessed January 9, 2018.

Spread of Resistance



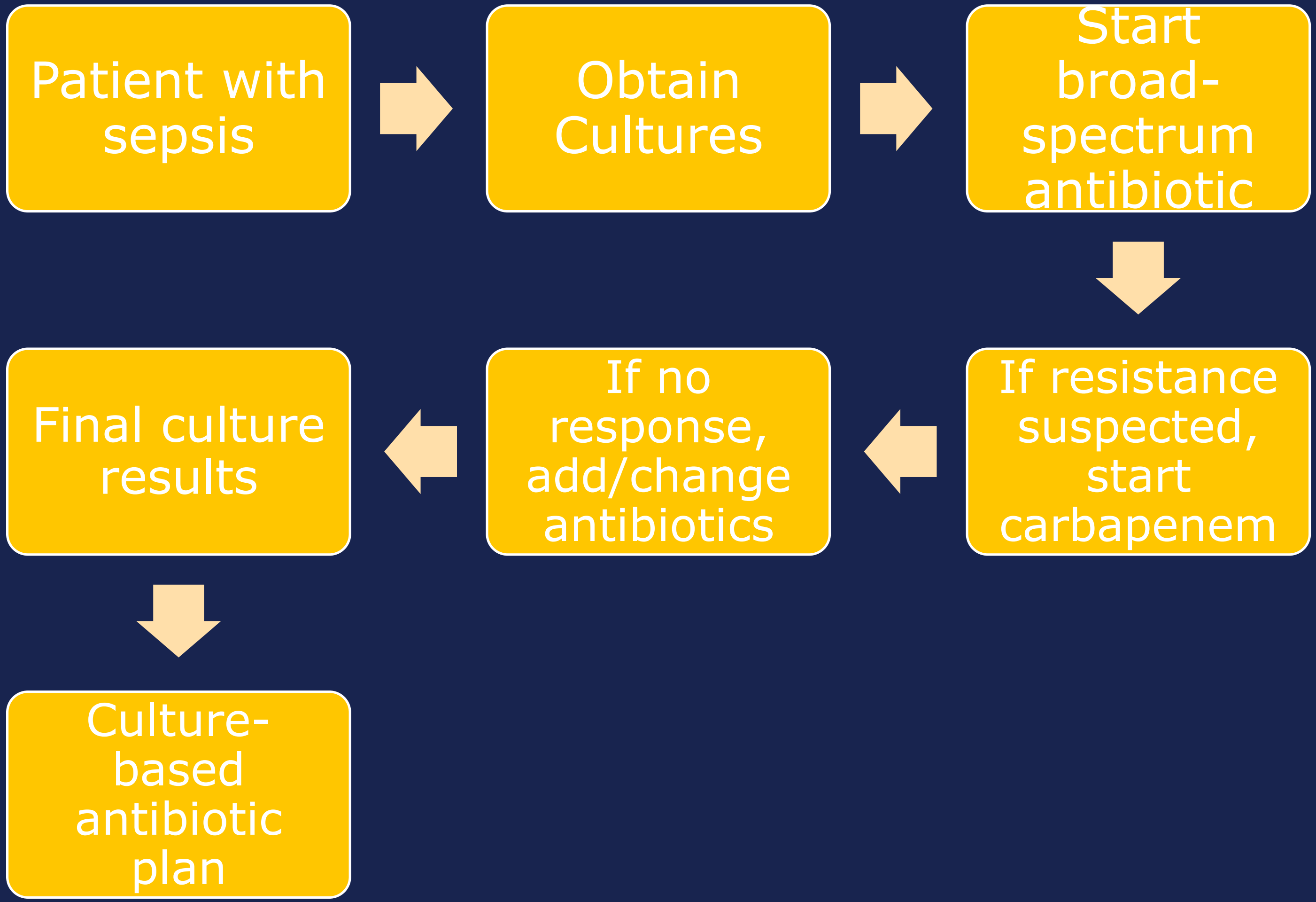
Available at: https://www.cdc.gov/drugresistance/about.html. Accessed January 8, 2018.

Cost of Resistance

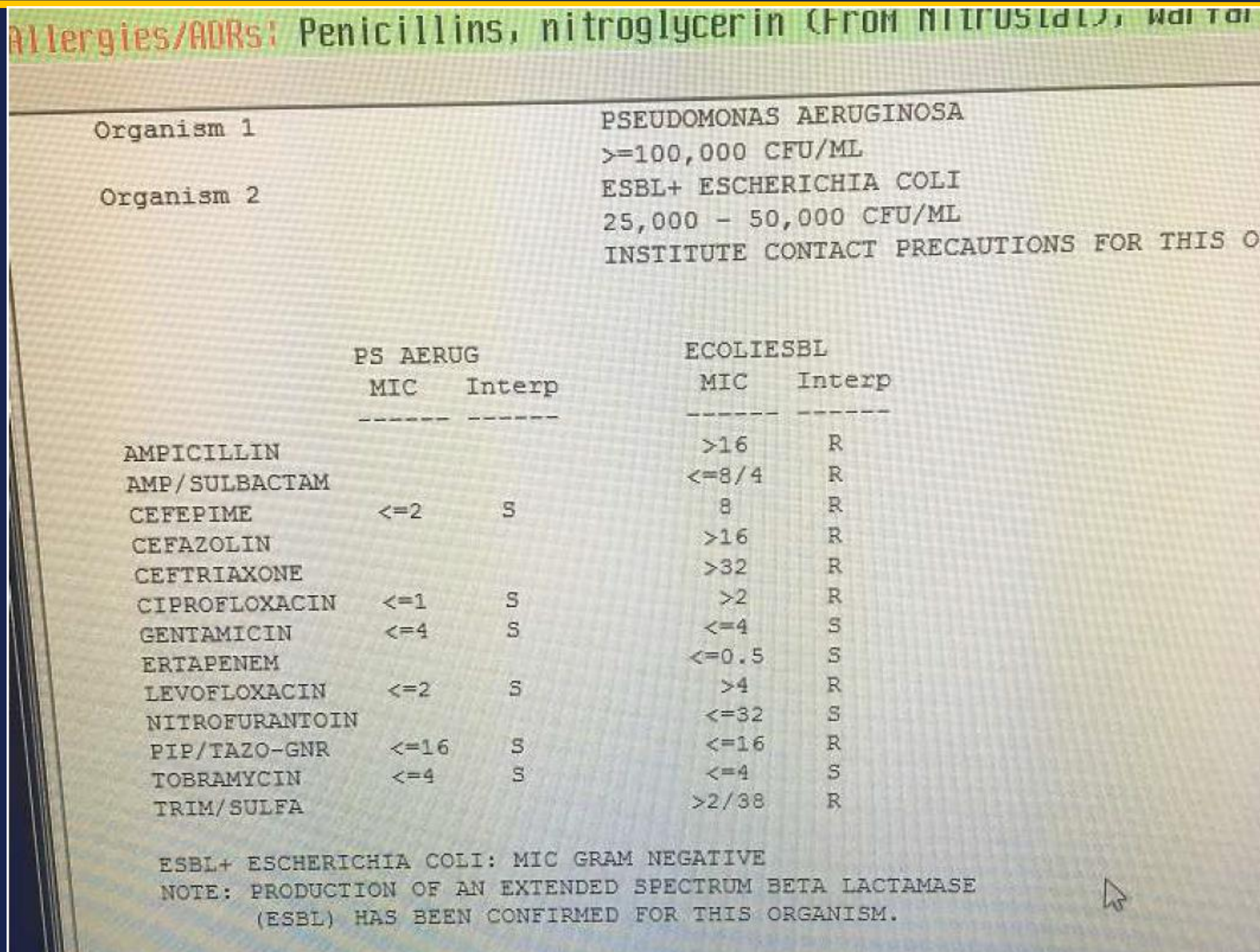


Available at: https://www.cdc.gov/drugresistance/pdf/3-2013-508.pdf. Accessed January 9, 2018.

Progression of Antibiotic Treatment



Antibiotic Resistance-Susceptibility Profile



Allergies/ADRs: Penicillins, nitroglycerin (From Nitrostat), warfar

Organism 1	PSEUDOMONAS AERUGINOSA >=100,000 CFU/ML
Organism 2	ESBL+ ESCHERICHIA COLI 25,000 - 50,000 CFU/ML INSTITUTE CONTACT PRECAUTIONS FOR THIS OR

	PS AERUG		ECOLIESBL	
	MIC	Interp	MIC	Interp
AMPICILLIN			>16	R
AMP/SULBACTAM			<=8/4	R
CEFEPIME	<=2	S	8	R
CEFAZOLIN			>16	R
CEFTRIAXONE			>32	R
CIPROFLOXACIN	<=1	S	>2	R
GENTAMICIN	<=4	S	<=4	S
ERTAPENEM			<=0.5	S
LEVOFLOXACIN	<=2	S	>4	R
NITROFURANTOIN			<=32	S
PIP/TAZO-GNR	<=16	S	<=16	R
TOBRAMYCIN	<=4	S	<=4	S
TRIM/SULFA			>2/38	R

ESBL+ ESCHERICHIA COLI: MIC GRAM NEGATIVE
NOTE: PRODUCTION OF AN EXTENDED SPECTRUM BETA LACTAMASE
(ESBL) HAS BEEN CONFIRMED FOR THIS ORGANISM.

Antibiotic Resistance- KPC-producing *K. pneumoniae*

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Antibiotic	Interpret.
Amikacin	I
Amox/clav	R
Ampicillin	R
Aztreonam	R
Cefazolin	R
Cefotaxime	R
Cefotetan	R
Cefoxitin	R
Ceftazidime	R
Ceftriaxone	R
Cefepime	R
Chloramphenicol	R

Antibiotic	Interpret.
Ciprofloxicin	R
Ertapenem	R
Gentamicin	R
Imipenem	R
Meropenem	R
Pip/tazo	R
Tobramycin	R
Trimeth/Sulfa	R
Polymixin B	MIC >4mg/l
Colistin	MIC >4mg/l
Tigecycline	S

Cost of Resistance

- Antibiotic-resistant infections are complex
  - Longer hospital stays[1]
  - Increased mortality[1]
  - Increased hospital costs[2]
- Est costs of antibiotic-resistant infections[3]
  - $20 billion per yr in excess direct healthcare costs
  - $35 billion per yr in additional societal costs

1. Raymond DP, et al. 2003. Crit Care Med.
2. Dicks KV, et al. 2017. Infect Control Hosp Epidemiol.
3. CDC. 2013. Available at: https://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf#page=11. Accessed January 9, 2018.

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Interventions to Decrease Antibiotic Resistance

Fighting Antibiotic Resistance

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FIGHTING BACK AGAINST ANTIBIOTIC RESISTANCE

Four Core Actions to Prevent Antibiotic Resistance

1 PREVENTING INFECTIONS, PREVENTING THE SPREAD OF RESISTANCE

Avoiding infections in the first place reduces the amount of antibiotics that have to be used and reduces the likelihood that resistance will develop during therapy. There are many ways that drug-resistant infections can be prevented: immunization, safe food preparation, handwashing, and using antibiotics as directed and only when necessary. In addition, preventing infections also prevents the spread of resistant bacteria.

2 TRACKING

CDC gathers data on antibiotic-resistant infections, causes of infections and whether there are particular reasons (risk factors) that caused some people to get a resistant infection. With that information, experts can develop specific strategies to prevent those infections and prevent the resistant bacteria from spreading.

3 IMPROVING ANTIBIOTIC PRESCRIBING/STEWARDSHIP

Perhaps the single most important action needed to greatly slow down the development and spread of antibiotic-resistant infections is to change the way antibiotics are used. Up to half of antibiotic use in humans and much of antibiotic use in animals is unnecessary and inappropriate and makes everyone less safe. Stopping even some of the inappropriate and unnecessary use of antibiotics in people and animals would help greatly in slowing down the spread of resistant bacteria. This commitment to always use antibiotics appropriately and safely—only when they are needed to treat disease, and to choose the right antibiotics and to administer them in the right way in every case—is known as antibiotic stewardship.

4 DEVELOPING NEW DRUGS AND DIAGNOSTIC TESTS

Because antibiotic resistance occurs as part of a natural process in which bacteria evolve, it can be slowed but not stopped. Therefore, we will always need new antibiotics to keep up with resistant bacteria as well as new diagnostic tests to track the development of resistance.

Available at: https://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf#page=11. Accessed January 9, 2018.

Texas Response-Surveillance

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- Mandatory reporting of certain resistant bacteria
  - Carbapenem-resistant Enterobacteriaceae
  - Multidrug-resistant *Acinetobacter* spp.
- Voluntary reporting/submission of additional resistant bacteria
  - Submitted to ARLN labs
  - Including carbapenem-resistant *P. aeruginosa*, carbapenemase-producing *Acinetobacter baumanii*, and ESBL-producing organisms

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Antibiotic Resistance Testing

Grace Kubin, Ph.D.
Laboratory Services Section Director
Department of State Health Services

CDC Antibiotic Resistance Laboratory Network (ARLN)

Purpose: Establish 7 regional laboratories with comprehensive testing capacity for CDC's "urgent" or "serious" threats.

- Goal #1: Enhance outbreak detection and response support
- Goal #2: Create a surveillance system to detect resistance mechanisms
- Goal #3: Produce real-time, actionable data to prevent and combat current and future AR threats

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CDC ARLN

- All regional labs will perform Core Testing for their region, including:
  - Molecular testing to detect colonization of carbapenem-resistant Enterobacteriaceae (CRE).
  - Detection of new and emerging threats, mcr-1, and ability to detect changes to known threats, *Neisseria gonorrhoeae*.
  - Isolates may be used for the CDC and FDA AR Isolate Bank and WGS projects.
  - Fungal susceptibility of *Candida* species to identify emerging resistance.
  - Identification and colonization screening to detect and help prevent spread of *Candida auris* (*C. auris*).

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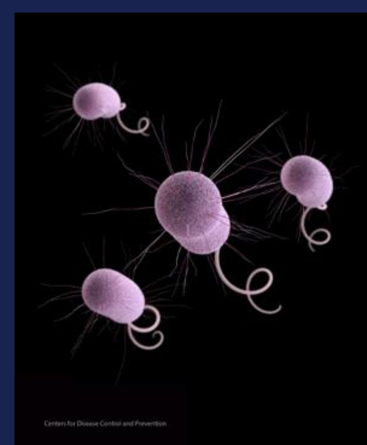
Colonization Testing

Culture from a patient, not previously known to be colonized by the target organism

- Facilities should consider screening patient contacts to identify transmission
- Consider screening any roommates of the index patient for the duration of their stay



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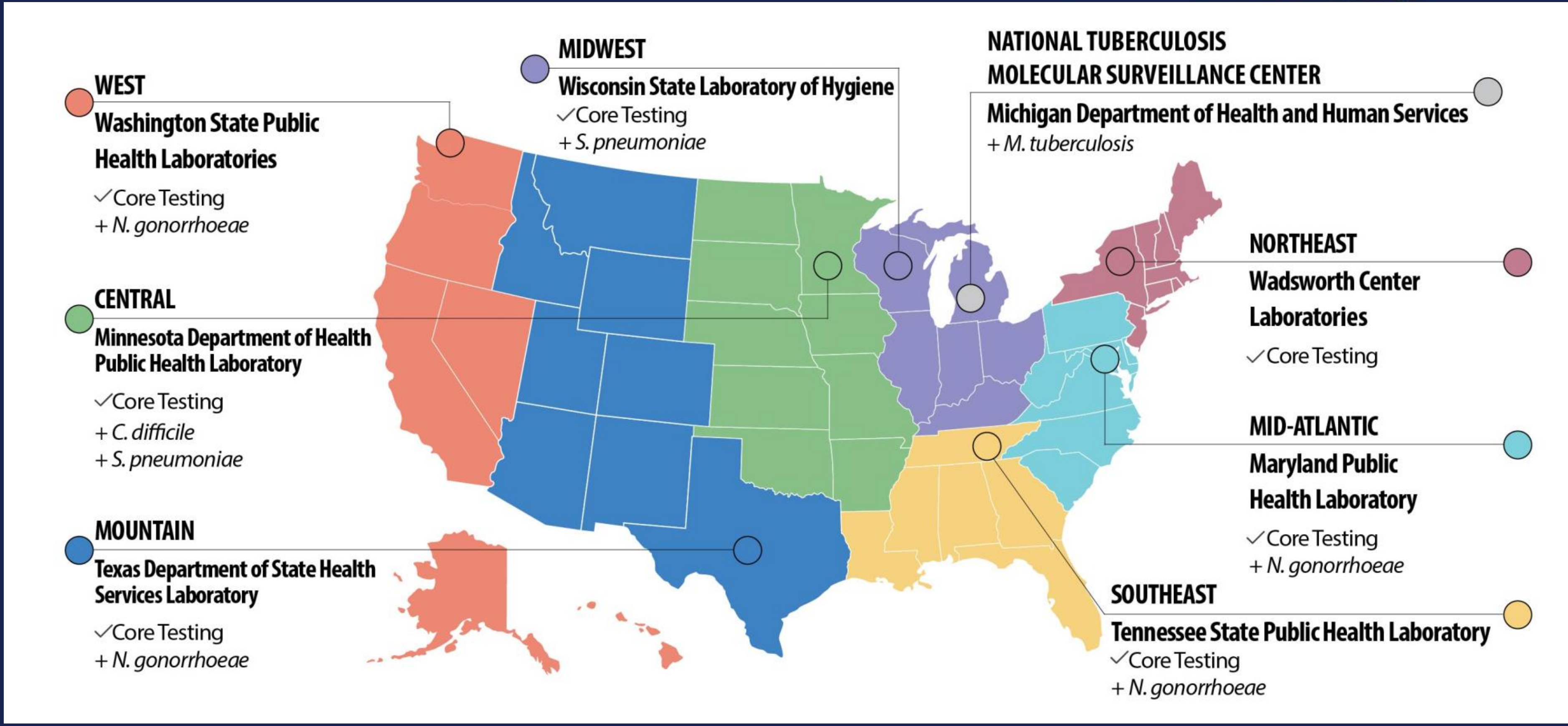
CDC ARLN



WEST
Washington State Public Health Laboratories
✓Core Testing
+ N. gonorrhoeae
CENTRAL
Minnesota Department of Health Public Health Laboratory
✓Core Testing
+ C. difficile
+ S. pneumoniae
MOUNTAIN
Texas Department of State Health Services Laboratory
✓Core Testing
+ N. gonorrhoeae
MIDWEST
Wisconsin State Laboratory of Hygiene
✓Core Testing
+ S. pneumoniae
NATIONAL TUBERCULOSIS MOLECULAR SURVEILLANCE CENTER
Michigan Department of Health and Human Services
+ M. tuberculosis
NORTHEAST
Wadsworth Center Laboratories
✓Core Testing
MID-ATLANTIC
Maryland Public Health Laboratory
✓Core Testing
+ N. gonorrhoeae
SOUTHEAST
Tennessee State Public Health Laboratory
✓Core Testing
+ N. gonorrhoeae

ARLN Workflow

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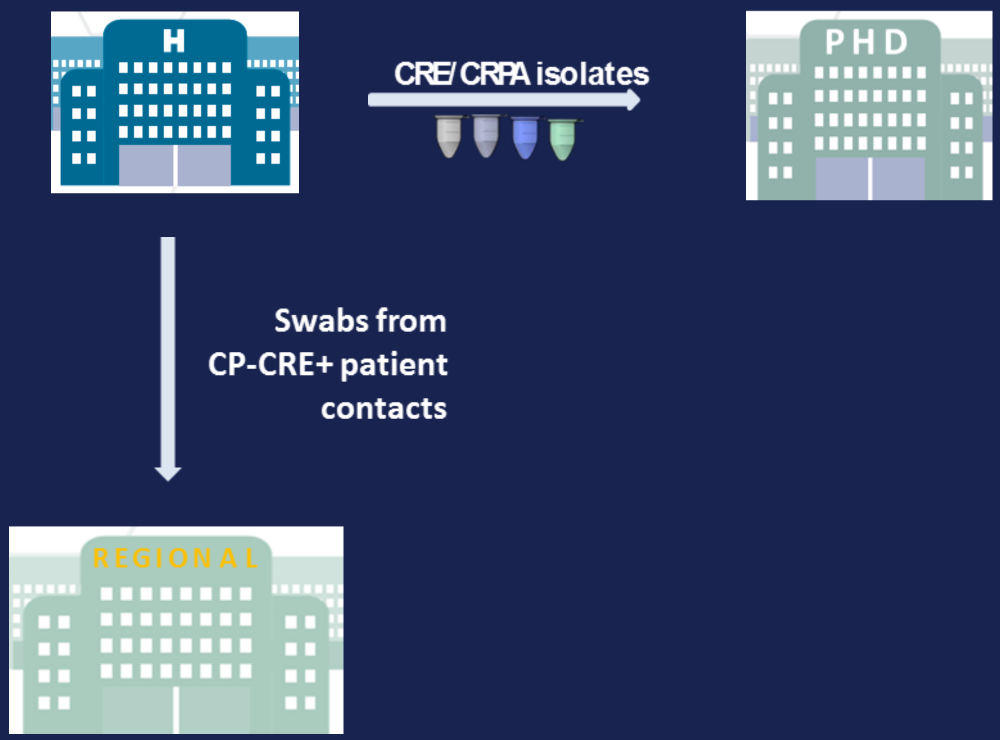

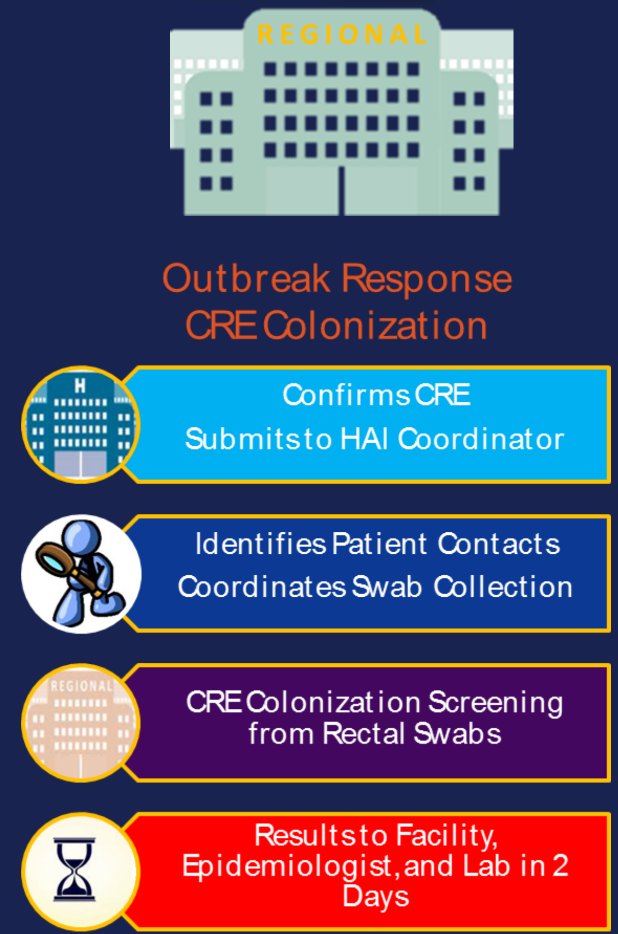

Texas ARLN Laboratory

- Texas capacity is 2,000 colonization swabs and 2,000 isolates per year.
- Implemented all 1st year testing in May.
  - Tested 678 samples in total through Dec.
  - Majority of CP-CRE isolates are KPC
  - June – 1st IMP+ *Pseudomonas aeruginosa*
  - Other mechanisms of resistance: OXA-48 and VIM
- Next testing to implement: Candida

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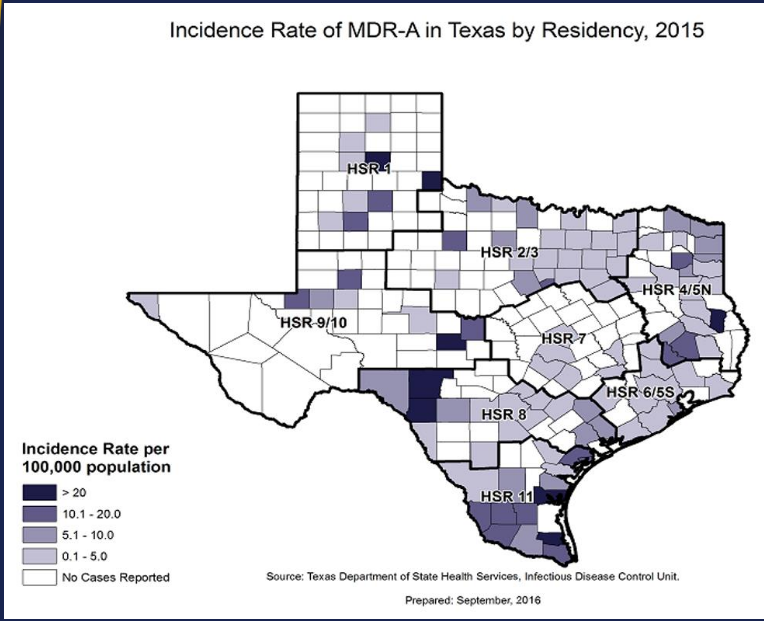
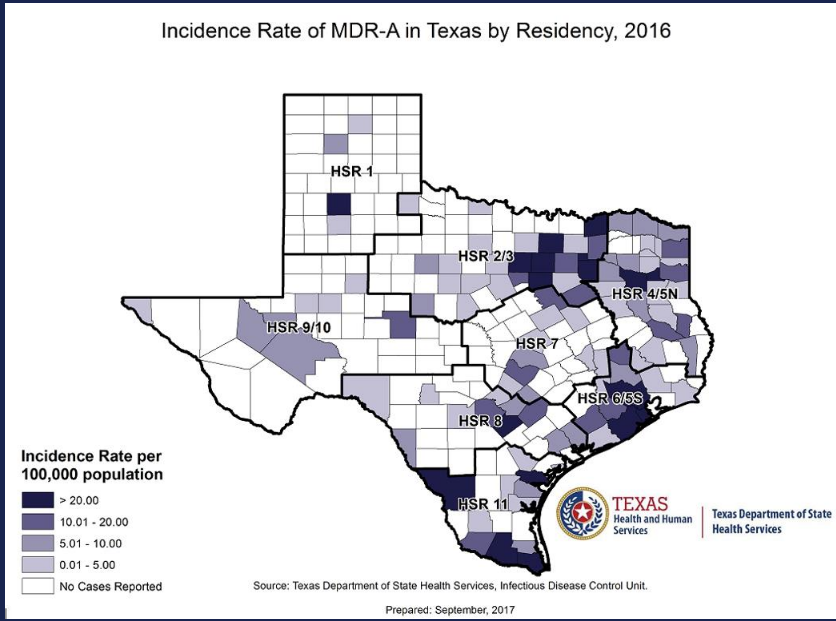
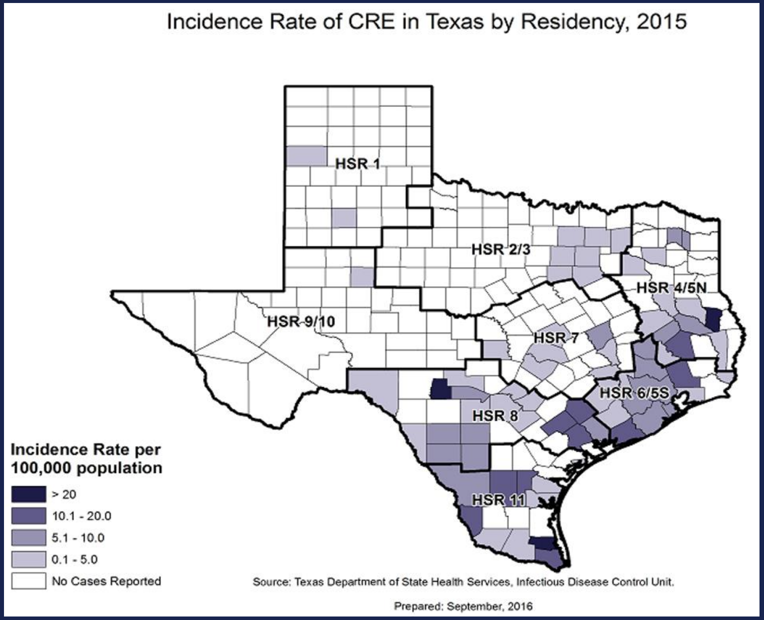
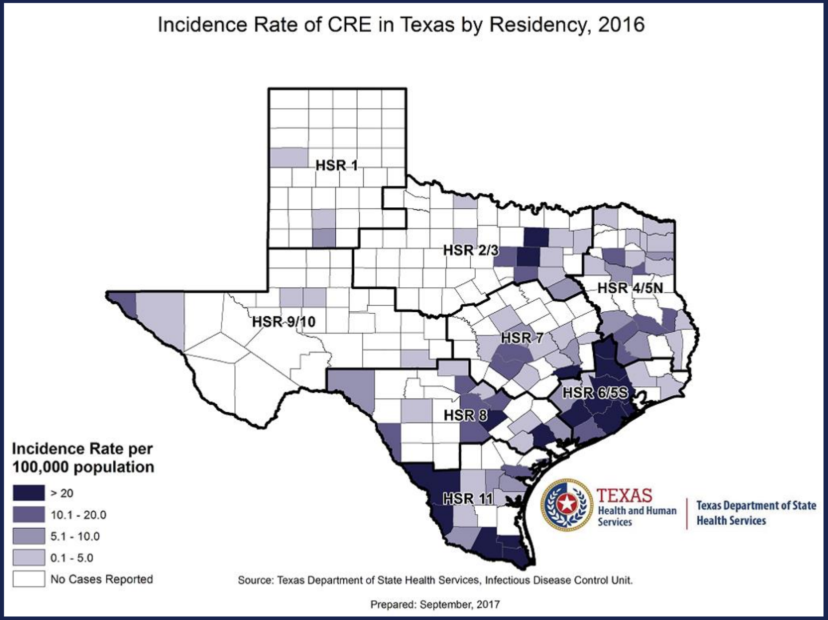
Surveillance Findings





Surveillance Findings





Surveillance Findings

- Total of 48 mechanisms of resistance identified in Texas June 2017 to date
  - MCR-1 in *E.coli*
  - VIM in *P. aeruginosa*
  - IMP in *P. aeruginosa*
  - NDM in *E. coli*
  - OXA-48 in *E. coli*
  - KPC in *K. pneumonia* (pan-resistant)
- Other unknown mechanisms being identified are being sent to CDC
  - IMP variants

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Texas Response- Outbreaks

- DSHS HAI epidemiologists assist/lead MDRO outbreak investigations in healthcare facilities
  - Respond to MDRO clusters in healthcare facilities to help contain transmission
- Other activities
  - Promote isolate submission for mechanism of resistance testing and possible characterization
  - Conduct point prevalence studies to detect colonization based on tiered response approach
  - Coordinate with local health department(s), DSHS Laboratory and CDC
  - Conduct prospective surveillance activities once initial AR threat has been mitigated

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HAI Epidemiologists

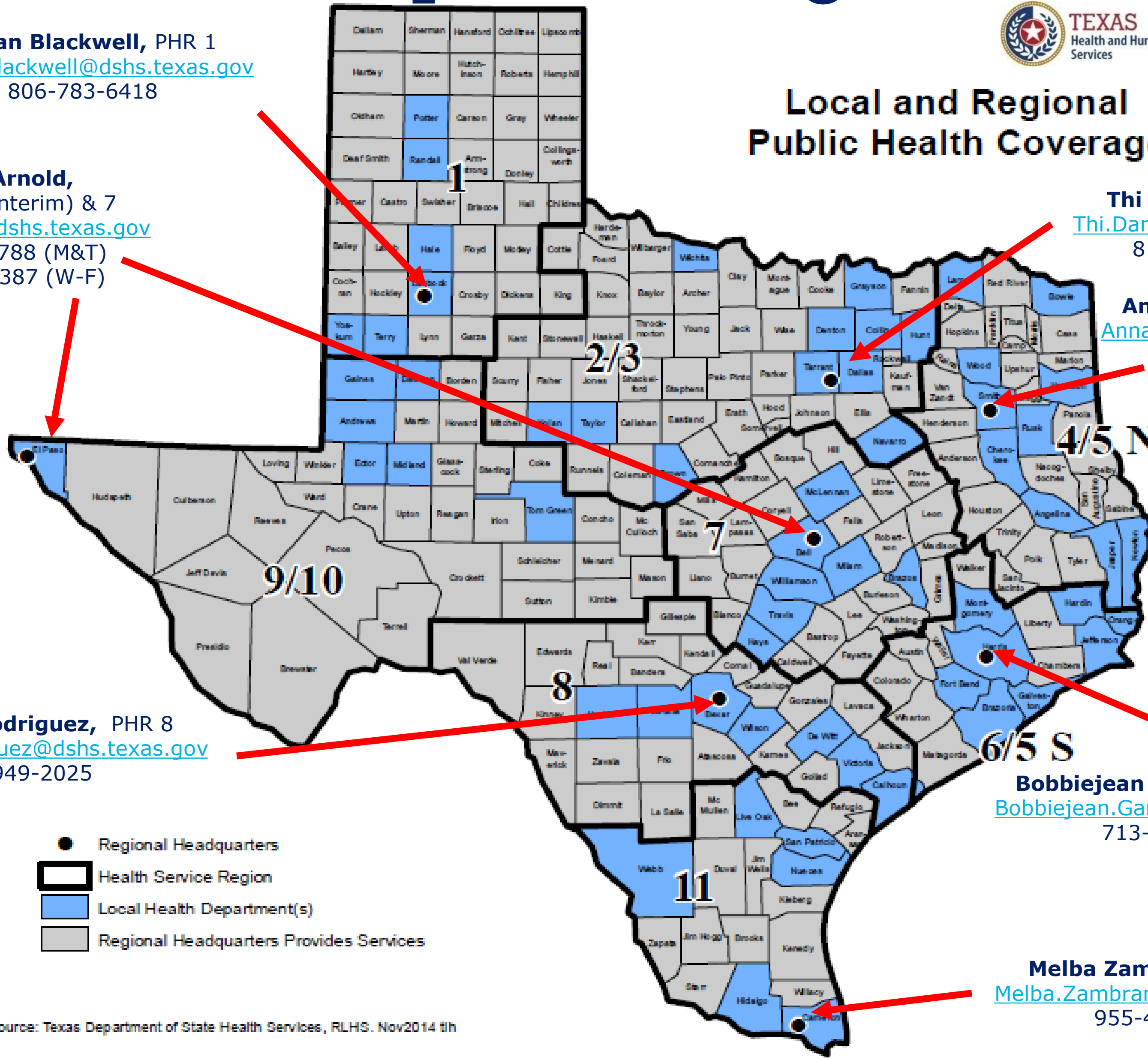
Local and Regional Public Health Coverage

Gillian Blackwell, PHR 1
Gillian.Blackwell@dshs.texas.gov
806-783-6418

Sandi Arnold,
PHR 9/10 (interim) & 7
Sandi.Arnold@dshs.texas.gov
254-771-6788 (M&T)
254-750-9387 (W-F)

Thi Dang, PHR 2/3
Thi.Dang@dshs.texas.gov
817-264-4500

Annie Nutt, PHR 4/5N
Anna.Nutt@dshs.texas.gov
903-533-5317



Gretchen Rodriguez, PHR 8
Gretchen.Rodriguez@dshs.texas.gov
210-949-2025

Bobbiejean Garcia, PHR 6/5S
Bobbiejean.Garcia@dshs.texas.gov
713-767-3404

Melba Zambrano, PHR 11
Melba.Zambrano@dshs.texas.gov
955-444-3208

Texas Response-Antibiotic Stewardship

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- Inappropriate use of antibiotics is a primary factor in increasing prevalence of drug resistance
- Antibiotic stewardship (AS) is an important part of slowing the progression of antibiotic resistance
- AS refers to the use of the optimal antibiotic at the right dose for the right period of time
  - This usually requires a system of protocols and people in place, all committed to achieving good outcomes
- AS expert Dr. Michael Fischer recently added to DSHS staff

Texas Response-Antibiotic Stewardship

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- AS Expert tasks
  - Direct AS initiatives and serve as SME on core elements of an AS program in various healthcare settings
    - acute, long-term care, outpatient, others
  - Promote facility participation in AS collaborations
  - Create a strategic plan outlining the role of public health related to antibiotic stewardship
  - Coordinate training opportunities using resource materials from the CDC

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Thank you!

Jennifer A. Shuford, MD, MPH

Infectious Disease Medical Officer

Department of State Health Services

jennifer.shuford@dshs.texas.gov