Antibiotic Resistance in Texas

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Department of State Health Services
Overview of Antibiotic Resistance
Antibiotic Resistance Timeline

Available at: https://www.cdc.gov/drugresistance/about.html
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

Development of Resistance

How Antibiotic Resistance Happens

1. Lots of germs. A few are drug resistant.
2. Antibiotics kill bacteria causing the illness, as well as good bacteria protecting the body from infection.
3. The drug-resistant bacteria are now allowed to grow and take over.
4. Some bacteria give their drug-resistance to other bacteria, causing more problems.

Development of Resistance

- 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

Spread of Resistance

Examples of How Antibiotic Resistance Spreads

Animals get antibiotics and develop resistant bacteria in their guts.

Drug-resistant bacteria can remain on meat from animals. When not handled or cooked properly, the bacteria can spread to humans.

Fertilizer or water containing animal feces and drug-resistant bacteria is used on food crops.

Drug-resistant bacteria in the animal feces can remain on crops and be eaten. These bacteria can remain in the human gut.

Simply using antibiotics creates resistance. These drugs should only be used to treat infections.

George gets antibiotics and develops resistant bacteria in his gut.

George stays at home and in the general community. Spreads resistant bacteria.

George gets care at a hospital, nursing home or other inpatient care facility.

Resistant germs spread directly to other patients or indirectly on unclean hands of healthcare providers.

Resistant bacteria spread to other patients from surfaces within the healthcare facility.

Patients go home.

Available at:
Cost of Resistance

NATIONAL SUMMARY DATA

Estimated minimum number of illnesses and deaths caused by antibiotic resistance*:

At least 2,049,442 illnesses, 23,000 deaths

* bacteria and fungus included in this report

Estimated minimum number of illnesses and death due to *Clostridium difficile* (C. difficile), a unique bacterial infection that, although not significantly resistant to the drugs used to treat it, is directly related to antibiotic use and resistance:

At least 250,000 illnesses, 14,000 deaths

WHERE DO INFECTIONS HAPPEN?

Antibiotic-resistant infections can happen anywhere. Data show that most happen in the general community; however, most deaths related to antibiotic resistance happen in healthcare settings, such as hospitals and nursing homes.

Progression of Antibiotic Treatment

1. **Patient with sepsis**
2. **Obtain Cultures**
3. **Start broad-spectrum antibiotic**
   - If resistance suspected, start carbapenem
4. **If no response, add/change antibiotics**
5. **Final culture results**
6. **Culture-based antibiotic plan**
Antibiotic Resistance-Susceptibility Profile

<table>
<thead>
<tr>
<th>Organism 1</th>
<th>PSEUDOMONAS AERUGINOSA</th>
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<tbody>
<tr>
<td></td>
<td>&gt;=100,000 CFU/ML</td>
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<tr>
<td>Organism 2</td>
<td>ESBL+ ESCHERICHIA COLI</td>
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<td>25,000 - 50,000 CFU/ML</td>
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INSTITUTE CONTACT PRECAUTIONS FOR THIS ORGANISM.

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<thead>
<tr>
<th>PS AERUG</th>
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<tbody>
<tr>
<td>MIC</td>
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<tr>
<td>Interp</td>
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<tr>
<th>AMPICILLIN</th>
<th>ECOLESBL</th>
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<table>
<thead>
<tr>
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<table>
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<tr>
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<tr>
<td>ERTAPENEM</td>
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</table>

| LEVOFLOXACIN | <=2 | S |
| NITROFURANTOIN | <=32 | S |
| PIP/TAZO-GNR | <=16 | S |
| TOBRAMYCIN   | <=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*

<table>
<thead>
<tr>
<th>Antibiotic</th>
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<th>Interpret.</th>
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<td>Tigecycline</td>
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<tr>
<td>Chloramphenicol</td>
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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

Interventions to Decrease Antibiotic Resistance
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.

• 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
Antibiotic Resistance Testing

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

Swabs from CP-CRE+ patient contacts

Texas Department of State Health Services

Outbreak Response CRE Colonization

- Confirms CRE
- Submit to HAI Coordinator
- Identifies Patient Contacts
- Coordinates Swab Collection
- CRE Colonization Screening from Rectal Swabs
- Results to Facility, Epidemiologist, and Lab in 2 Days

3/6/2018
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
Surveillance Findings

Incidence Rate of MDR-A in Texas by Residency, 2015

Incidence Rate of MDR-A in Texas by Residency, 2016

Source: Texas Department of State Health Services, Infectious Disease Control Unit.
Prepared: September, 2016
Surveillance Findings

Incidence Rate of CRE in Texas by Residency, 2015

Incidence Rate per 100,000 population
- > 20
- 10.1 - 20.0
- 5.1 - 10.0
- 0.1 - 5.0
- No Cases Reported

Source: Texas Department of State Health Services, Infectious Disease Control Unit
Prepared: September, 2016

Incidence Rate of CRE in Texas by Residency, 2016

Incidence Rate per 100,000 population
- > 20
- 10.1 - 20.0
- 5.1 - 10.0
- 0.1 - 5.0
- No Cases Reported

Source: Texas Department of State Health Services, Infectious Disease Control Unit
Prepared: September, 2017
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
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
HAI Epidemiologists

Gillian Blackwell, PHR 1
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Texas Response—Antibiotic Stewardship

• 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
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
Thank you!

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