Emerging and Zoonotic Infectious Diseases

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New Health Official Orientation

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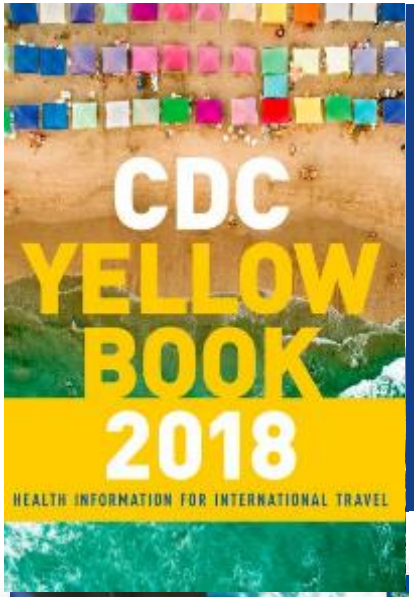
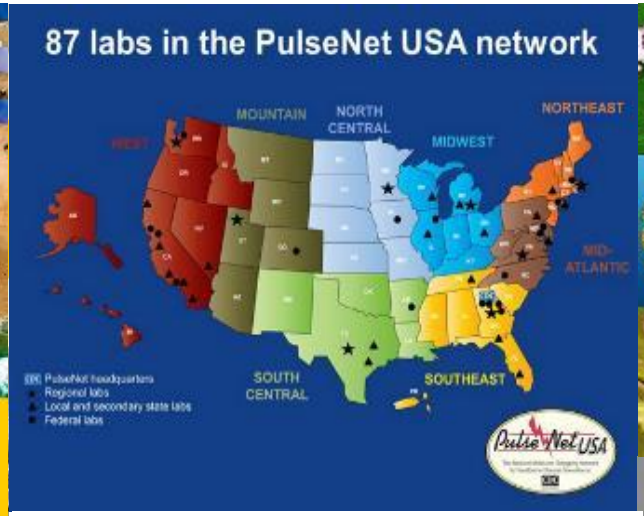
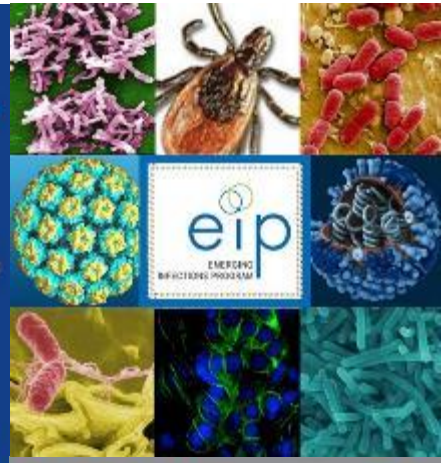
NCEZID: Protecting People from Infectious Disease

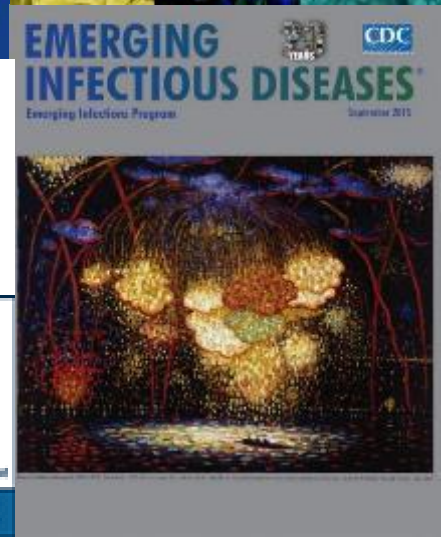
- Foodborne, waterborne, and fungal illnesses
- Vector-borne diseases -- spread by mosquitoes, ticks, and fleas
- Healthcare-associated infections
- Antibiotic-resistant infections
- Illnesses that affect immigrants, migrants, refugees, and travelers
- Deadly diseases like anthrax and Ebola
- Advanced Molecular Detection

Signature Programs









NHSN
National Healthcare Safety Network

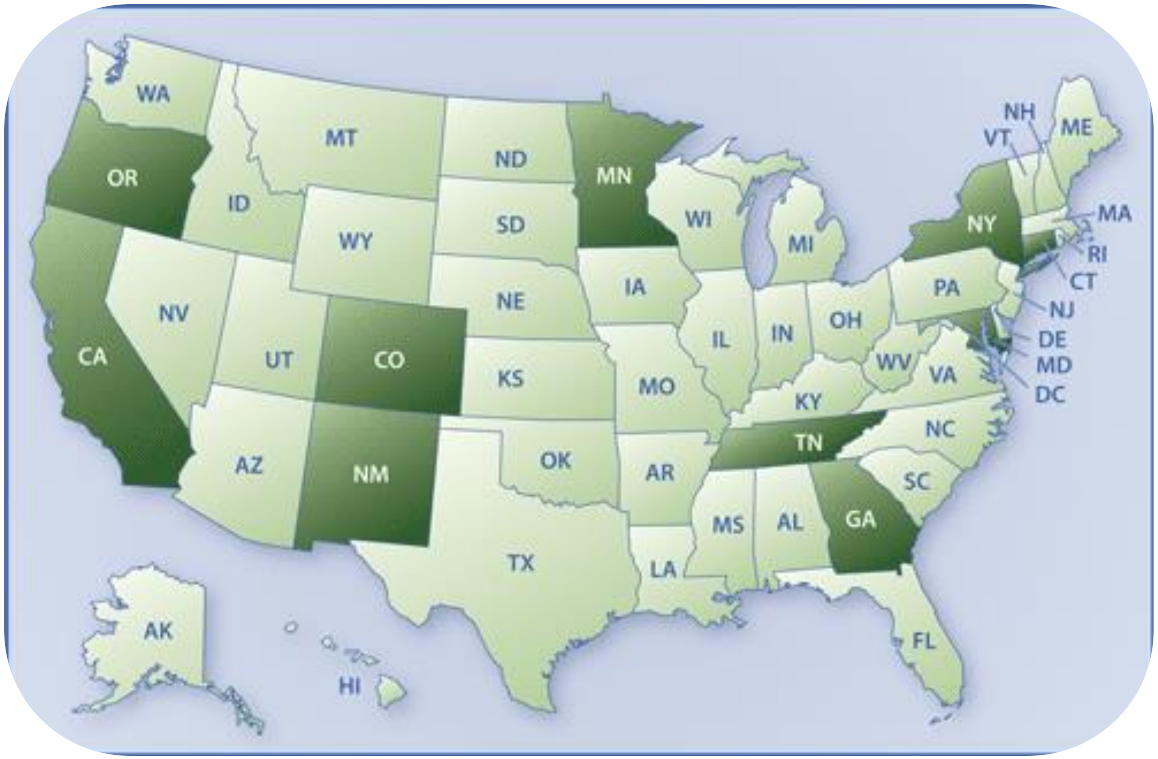
LRN
LABORATORY RESPONSE NETWORK

Strengthening State and Local Capacity

Epidemiology and Laboratory Capacity Grants

- ELC: CDC's national funding strategy for combatting domestic infectious disease threats
  - *Strengthen* epidemiological capacity
  - *Enhance* laboratory capacity
  - *Improve* health information systems
- Support to 64 health departments in states, large cities and territories for >20 infectious disease programs (e.g., flu, foodborne, healthcare-associated infections)

Emerging Infections Program (EIP)



- Network of 10 state health departments and university partners
- Translates gold-standard surveillance into policy and public health practice
- Examples:
  - Active Bacterial Core surveillance (ABCs)
  - FoodNet
  - Influenza activities
  - HAI and antimicrobial resistance

Responding to Outbreaks in the United States

- NCEZID works with states to investigate many infectious disease outbreaks each year
- Example of 2017 multistate outbreak investigation:
  - Worked with states using PulseNet to identify a fast-moving outbreak of Shiga toxin-producing *Escherichia coli* O157:H7 infections, mostly in children
  - Identified source within 8 days: soy nut butter
  - Company quickly recalled all varieties of its soy nut butter products.
  - As of March 30: 29 cases (12 hospitalizations, no deaths) in 12 states

Image of soy nut butter

Other examples of NCEZID assisting states in investigations since December 2016

- **Kentucky:** CRE (carbapenem-resistant *Enterobacteriaceae*) infections
- **New York:** Possible ongoing transmission of *Candida auris* in healthcare facilities
- **Iowa:** Bacteria-contaminated organ preservation fluid
- **Wisconsin, Illinois:** Seoul virus infection linked to pet rat-breeding facilities
- **Arizona:** Zoonotic spread of leptospirosis from dogs to people
- **Arkansas:** Increased number of laboratory reports for Lyme disease
- **Alaska:** Invasive group A *Streptococcus* infection among homeless people

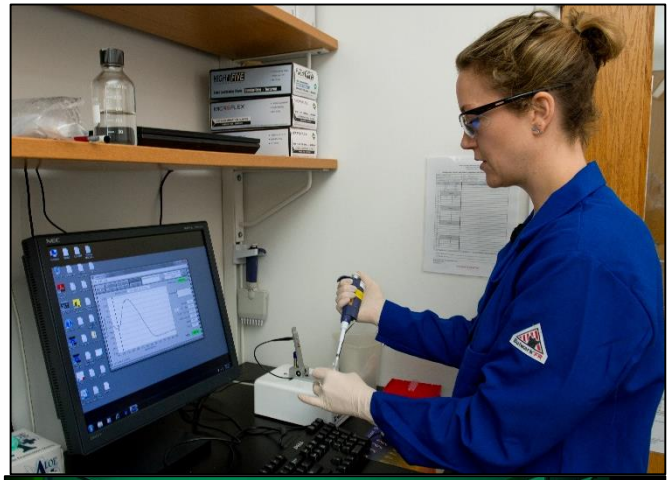
Responding to US Outbreaks: Domestic Zika Response

- 14 months into most complex CDC response ever
- Key objective is to support state and local jurisdictions in Zika prevention, including $184M in awards
- Improve laboratory diagnostics
- Monitor pregnant women with Zika infection and their babies
- Implement robust vector surveillance and control programs

NCEZID Laboratories – A Critical Public Health Resource

NCEZID manages a broad array of specialized labs and nationwide lab networks. Examples:

- PulseNet: US lab network that detects foodborne disease outbreaks, prevents 270,000 illnesses each year
- Laboratory Response Network: Responds quickly to biological threats and other public health emergencies
- Infectious Disease Pathology Lab: Conducts specialized studies of human tissues and diseases of unknown origin
- Biotech Core Facility: Provides advanced sequencing and other technology support
- High-Containment Lab: Conducts research on BSL-4 pathogens (e.g., Ebola)

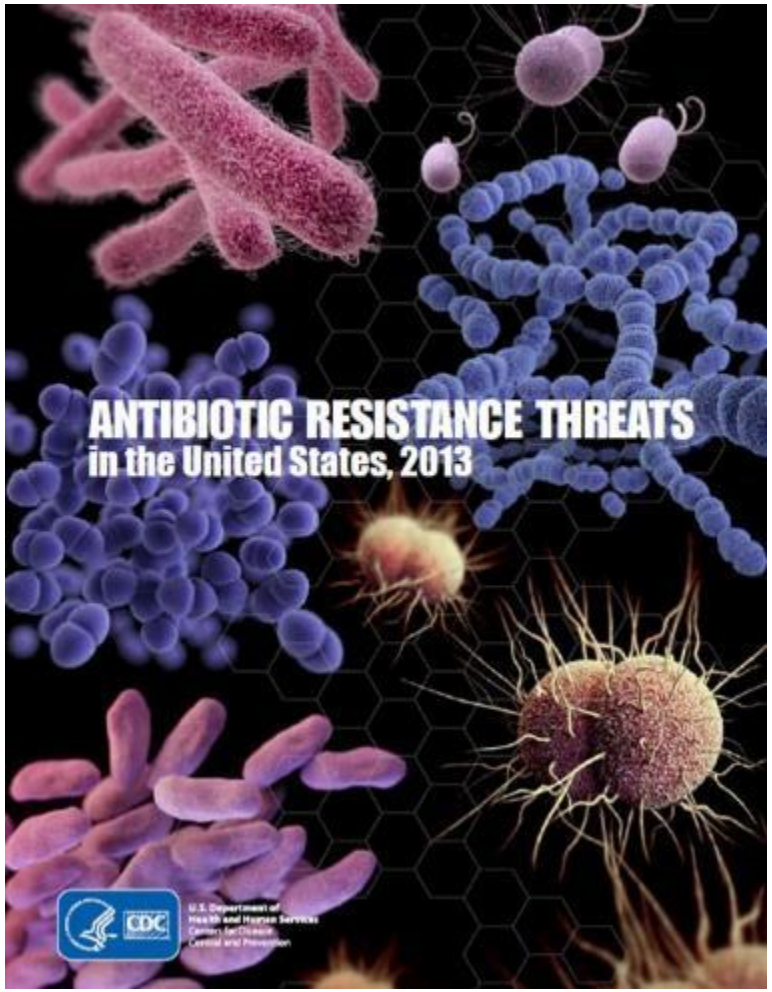


MicrobeNet: Improving Patient Outcomes by Helping Laboratories Match Test Results

- Online database with information on more than 2,400 rare disease-causing microbes
  - Genetic sequence information
  - Biochemical characterization (what enzymes and nutrients does the pathogen use)
  - Morphological characterization (how does the pathogen grow: size, shape, and color of colonies)
  - Antibiotic resistance profiles
- Allows public health and clinical laboratories anywhere in the world to match results from their diagnostic tests against CDC's unique collection of pathogens

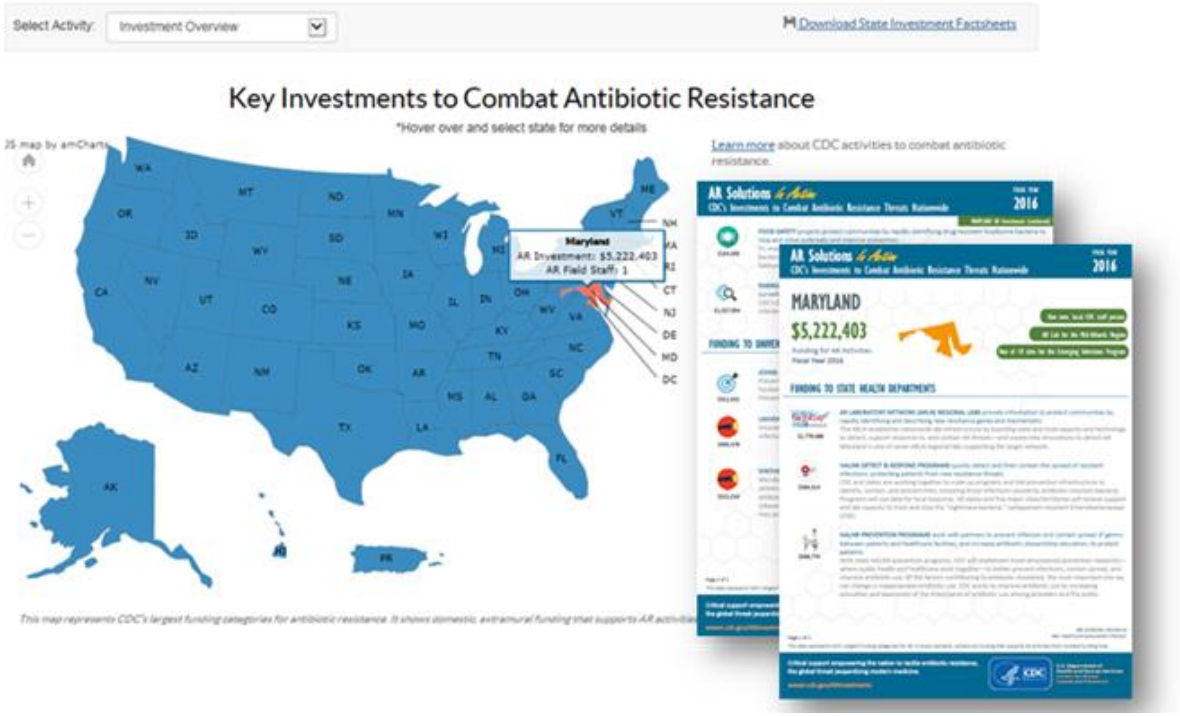
Antibiotic Resistance: An Emerging Threat

- Sickens **>2 million** people and kills at least **23,000** people each year
- **>$20 billion** each year in healthcare costs
- Threatens modern medicine – if we lose antibiotics, we lose the ability to treat patients with sepsis and cancer, provide organ transplants and save victims of burns and trauma
- Need to act now or even drugs of last resort will soon be ineffective



CDC Investments to Combat Antibiotic Resistance (AR)

- CDC investments with partners are intended to transform how the US fights AR and slows resistance at all levels
- $160M in FY 2016 AR investments to Detect, Respond, Contain, Prevent and Innovate
- AR Laboratory Network
- Support provided to every state. In Jan 2017 CDC launched interactive AR investment map: https://wwwn.cdc.gov/arinvestments



Championing Innovation: Advanced Molecular Detection

Advanced Molecular Detection (AMD):

- Established by Congress in FY2014
- $30 million per year
- Innovation and modernization program

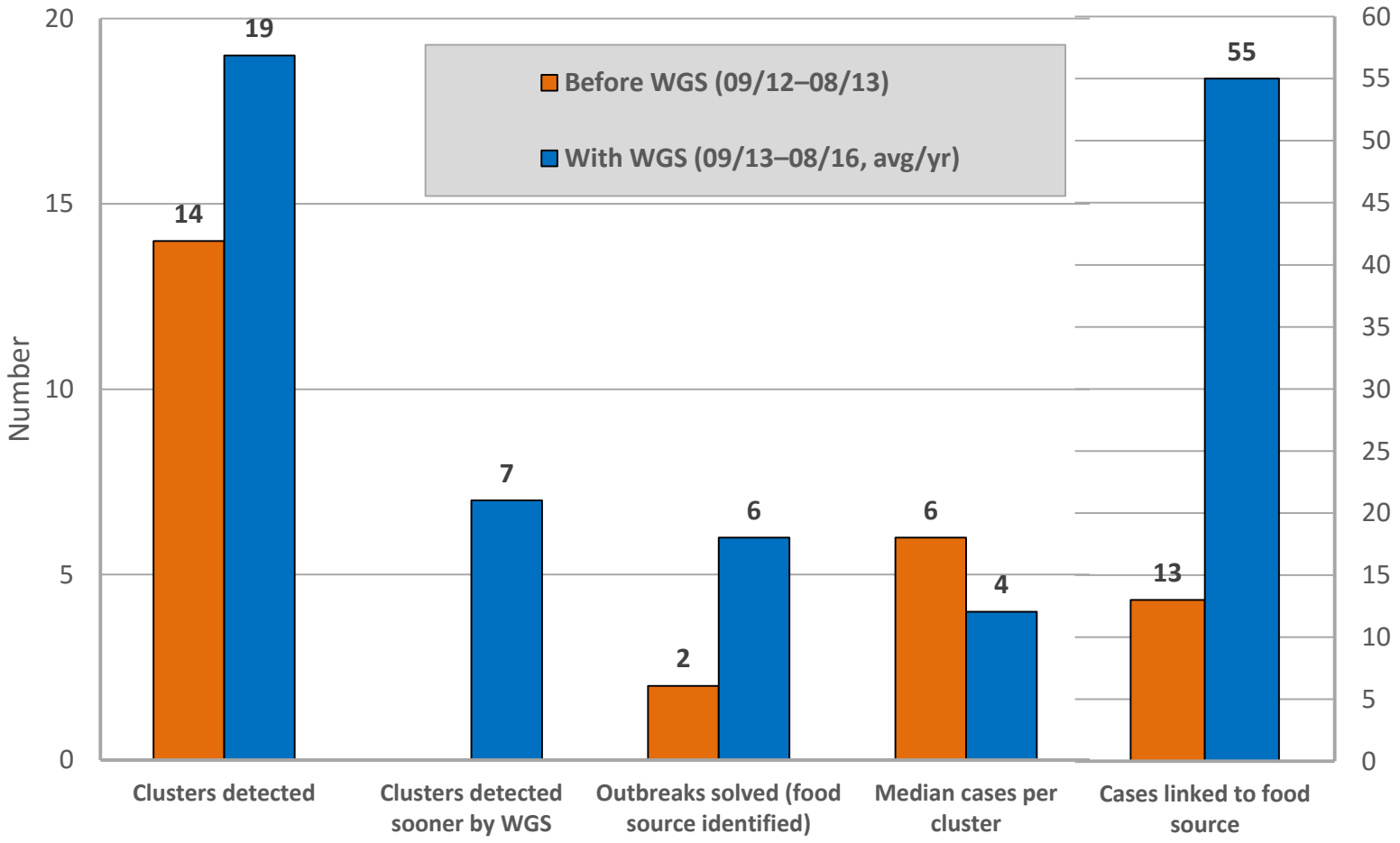
AMD combines:

- Traditional epidemiology
- Genomic sequencing
- Bioinformatics

Examples of AMD in Action:

- Zika virus diagnostic development
- HIV outbreak in Indiana
- Influenza monitoring for vaccine development
- Emergence of *Candida auris* strains

U.S. Listeria Outbreaks, Before and After AMD



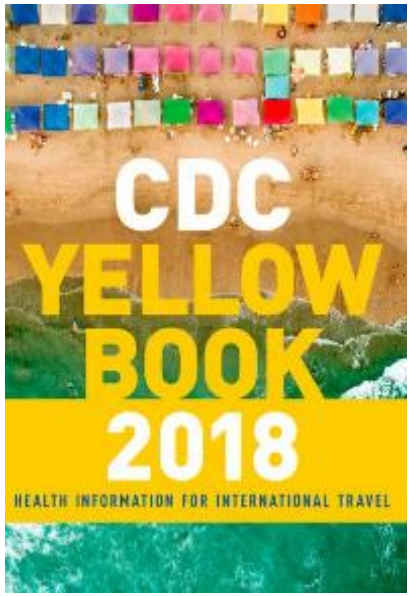
Source: Jackson BR. Clin Infect Dis 2016;63:380-6; and CDC/OID/NCEZID/DFWED

Examples of AMD Successes and Impact

Bacterial Foodborne Illness	Expanding PulseNet whole genome sequencing (WGS) to *E. coli, Shigella, Campylobacter, Salmonella*, others
Tuberculosis	WGS of all 10,000 U.S. TB isolates to identify locally acquired cases and better understand transmission; rapid inference of drug susceptibility
Influenza	Change to "sequencing-first" approach has revolutionized how influenza viruses are characterized
Antibiotic Resistance	Better understanding of emergence of antibiotic-resistant organisms such as CRE and *C. auris*
Zika and other mosquito-borne viruses	Methods developed under AMD to monitor Dengue and Chikungunya viruses in the Americas were used to rapidly develop a molecular Zika virus assay early in the outbreak
Hepatitis C virus	Special methods developed, validated and now being rolled out to state health departments for monitoring HCV transmission and detecting outbreaks
Legionella	WGS now being used to better understand the 96% of *Legionella* cases that are sporadic

Protecting Against Importation of Infectious Diseases

- Quarantine Stations at 20 U.S. Ports of Entry
- Final Rule for Control of Communicable Diseases became effective March 21
  - Improves CDC's ability to protect against introduction and spread of communicable diseases
- Travelers' Health - U.S. residents traveling abroad
- Immigrant, refugee, and migrant health – guidelines, screen/treat, track diseases



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