

The U.S. National Antimicrobial Resistance Monitoring System (NARMS)

**Julian Grass, MPH
and
Byron Douglas**

**CDC Health Information Innovation Consortium Forum
November 10, 2015**

National Center for Emerging and Zoonotic Infectious Diseases
Division of Foodborne, Waterborne, and Environmental Diseases



Objectives

- ❑ **Antibiotic resistance**
- ❑ **Overview of NARMS**
- ❑ **NARMS Now: Human Data**
 - Background
 - Live demonstration
 - Results
- ❑ **Potential enhancements**
- ❑ **Opportunities for reuse**
- ❑ **Lessons learned**

Antibiotic Resistance



- ❑ **One of the most serious health threats today**
 - Worldwide problem
 - Impacts human and animal health

- ❑ **Undermines our ability to fight infectious diseases and manage infections in patients treated for other conditions**

- ❑ **Studies have estimated that each year in the U.S. resistance costs**
 - \$20 billion in excess direct health care costs
 - As much as \$35 billion for lost productivity

Antibiotic Resistance

❑ Human medical use

- Inappropriate antibiotic use
- Drugs should only be used to manage infections

❑ Animal use

- Resistant bacteria can be transmitted to humans through the food supply.
- Resistant bacteria can cause infections in humans.
- Resistant infections can cause adverse health consequences for humans.



Estimates of Illnesses and Deaths from Resistant Gut Infections

Pathogen	Antibiotic	Percent Resistant	Resistant Infections (per year)	Deaths from Resistant Infections (per year)
<i>Campylobacter</i>	Ciprofloxacin or azithromycin	24%	310,000	28
Non-typhoidal Salmonella	Ceftriaxone or ciprofloxacin* or ≥5 classes of antibiotics	8%	100,000	38
<i>Salmonella Typhi</i>	Ciprofloxacin*	67%	3,800	<5
<i>Shigella</i>	Ciprofloxacin or azithromycin	6%	27,000	<5
Total			440,800	66-70

*Resistance or partial resistance

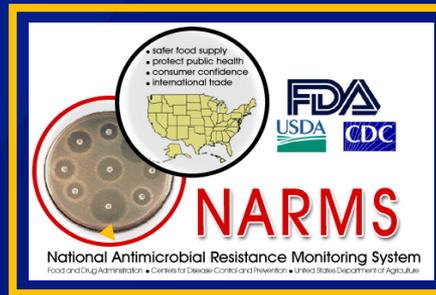
National Antimicrobial Resistance Monitoring System (NARMS)

Humans

CDC/NCEZID



Isolate Source:
54 Health Departments
(1996)



Animals

USDA/FSIS, ARS



Isolate Source:
USDA/FSIS
(1997)

Retail Meats

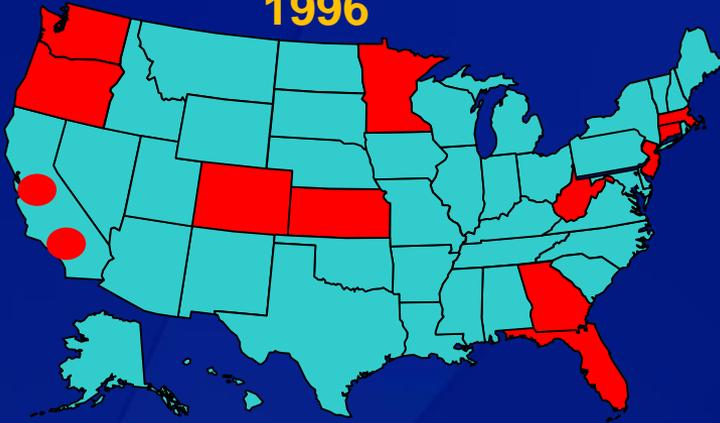
FDA/CVM



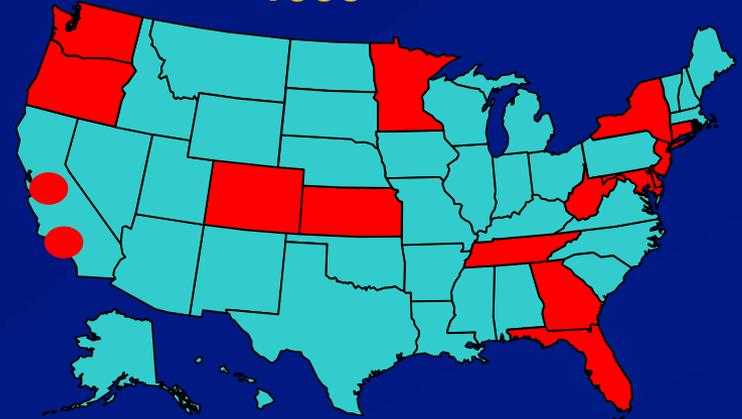
Isolate Source:
14 sites
(2002)

NARMS Human Isolate Sampling

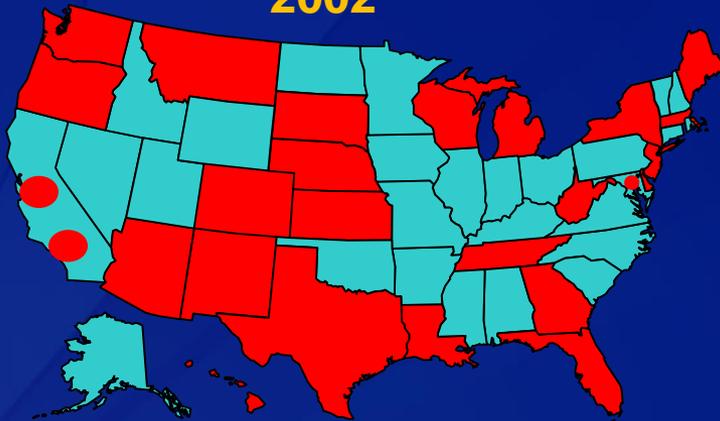
1996



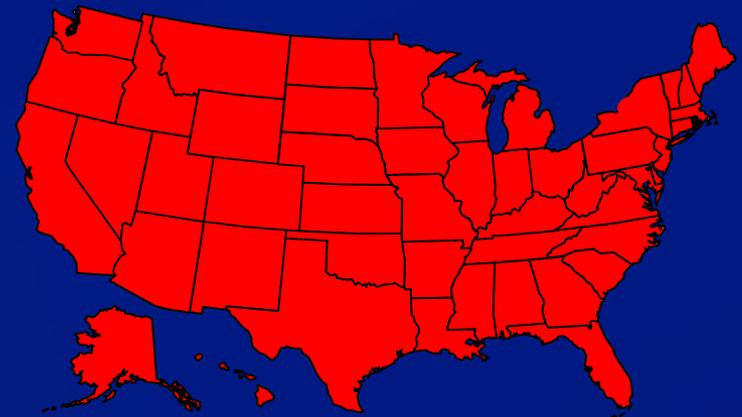
1999



2002



2003: 54 sites



 NARMS sites

All 50 states and 4 metropolitan areas

CDC-NARMS Pathogen Testing (Humans)

Pathogen	Start Year	States	Current Sample
Non-typhoidal <i>Salmonella</i>	1996	All	Every 20 th isolate
<i>E. coli</i> O157:H7	1996	All	Every 20 th isolate
<i>Shigella</i>	1999	All	Every 20 th isolate
<i>Salmonella</i> Typhi	1999	All	All
<i>Vibrio</i> (other than <i>V. cholerae</i>)	2009	All	All
<i>Campylobacter</i>	1997	10 sites (FoodNet)	Varies from all to every 5 th isolate

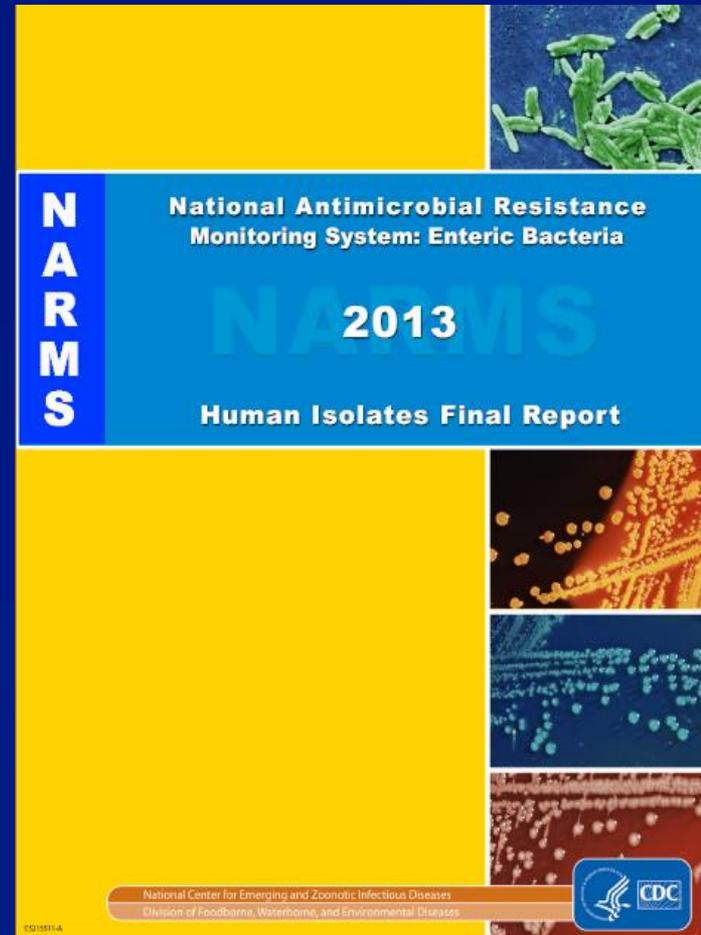
* Approximately 5,000 isolates tested per year



NARMS Annual Report for Human Data

- ❑ **Detailed technical report**
 - 100 pages and more than 50 tables
- ❑ **Individual antibiotics and multi-drug resistant**
- ❑ **Percent of isolates that are resistant for past 10 years**
- ❑ **Summary and highlights**

www.cdc.gov/narms



NARMS Now: Human Data

NARMS Now: Human Data

CDC

Welcome to NARMS Now, an interactive tool from CDC that contains human antibiotic resistance data from the National Antimicrobial Resistance and Monitoring System (NARMS). NARMS Now makes it easier and quicker to find out how antibiotic resistance for four bacteria transmitted commonly through food—*Campylobacter*, *E. coli*, *Salmonella*, and *Shigella*—has changed over the past two decades. Get started by filling in the search options below or scroll down the page to download NARMS data.

Select a view: [Dashboard](#) [Tabular](#)

Search Options

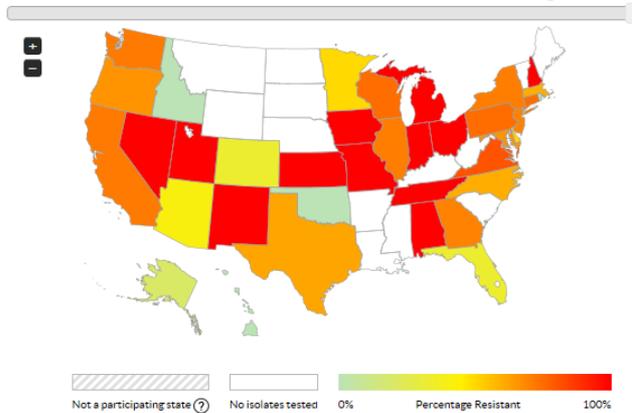
Bacteria: Serotype: Antibiotic: From: To: States:

Resistance By State

Display:

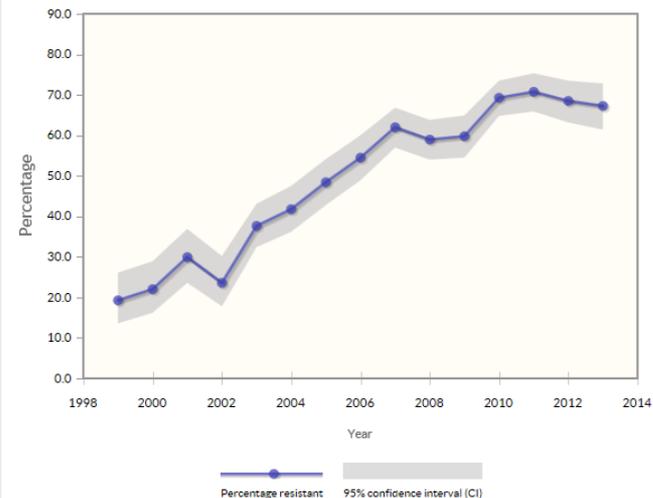
2013

Set your search above, then press play to see changes in resistance over time



Resistance by Year

Display:



Live as of August 19th, 2015

NARMS Now: Human Data

- ❑ Track changes in antibiotics commonly used to treat foodborne infections**
- ❑ Display geographic variation of resistance**
- ❑ Show trends in antibiotic resistance by state or national level**
- ❑ Download 18 years of antibiotic resistance data for humans**

Live Demonstration of NARMS Now: Human Data

<http://wwwn.cdc.gov/narmsnow/>

CDC Media Announcement

Safe Healthcare

Home

Posts by Category +

Posts by Month +

About This Site +



Get Email Updates

To receive email updates about this page, enter your email address:

What's this?

Submit

“NARMS Now: Human Data” paints national picture of antibiotic resistance in foodborne bacteria

Posted on August 27, 2015 by CDC's Safe Healthcare Blog



Author: [CDC Division of Foodborne, Waterborne, and Environmental Diseases \(DFWED\)](#)

Wondering how antibiotic resistance in foodborne bacteria has changed over time? You're in luck. With CDC's new interactive tool, [NARMS Now: Human Data](#), you can view trends in antibiotic resistance over the past two decades for four bacteria transmitted commonly through food: *Campylobacter*, *E. coli*O157, *Salmonella*, and *Shigella*.

Antibiotics have been prescribed by doctors for the past 70 years to treat patients who have infections, and they have greatly reduced sickness and deaths since the 1940s. However, some bacteria have adapted to antibiotics, making drugs less effective. Injudicious use of antibiotics in humans and animals has made this problem worse.

Why should we care? Each year in the United States, about 2 million illnesses and 23,000 deaths are caused by antibiotic-resistant bacteria. Antibiotic-resistant infections from foodborne bacteria cause about 440,000 of those illnesses. These infections can be severe, difficult to treat, and expensive.

NARMS Now: Human Data shows what is happening with some resistant infections state by state and across the country. The interactive program contains human antibiotic resistance data from the National Antimicrobial Resistance Monitoring System (NARMS), which is a partnership among CDC, the [Food and Drug Administration \(FDA\)](#), the [U.S. Department of Agriculture \(USDA\)](#), and state and local health departments. NARMS tracks information about antibiotic resistance in foodborne bacteria from three sources: humans (CDC), retail meats (FDA), and food animals (USDA).

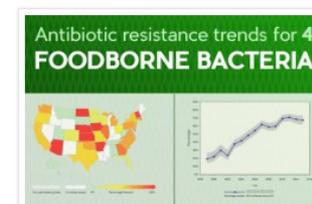
With NARMS Now: Human Data, you can search by type of bacteria, name of antibiotic, year (1996-2013), and geographic region. Results are displayed on interactive maps and graphs or in tables. You also can download your search or all program data to your desktop or device.

NARMS Now: Human Data can be used to:

- **Monitor trends in resistance:** Investigators are using NARMS data to help figure out why antibiotic resistance has increased in a type of *Salmonella*, I 4,[5],12,:1-, which has emerged recently in the United



Infographic: See how antibiotic resistance can spread from food animals to people.



Social Media

facebook [Sign Up](#)

Timeline Photos

Back to Album CDC's Photos CDC's Page Previous Next

Antibiotic resistance trends for 4 FOODBORNE BACTERIA

NARMS Now: Human Data www.cdc.gov/NARMSNow

CDC

Want to see how antibiotic resistance in people sickened by *Campylobacter*, *E. coli* O157, *Salmonella*, and *Shigella* has changed over two decades in your state? Check out CDC's new NARMS Now: Human Data resource, from the National Antimicrobial Resistance Monitoring System. <http://www.cdc.gov/NARMSNow>

Album: Timeline Photos Shared with: Public Open Photo Viewer Download

LinkedIn

Centers for Disease Control and Prevention Want to see how antibiotic resistance in people sickened by *Campylobacter*, *E. coli* O157, *Salmonella*, and *Shigella* has changed over two decades in your state? Check out CDC's new NARMS Now: Human Data resource, from the National Antimicrobial ... more

Antibiotic resistance trends for 4 FOODBORNE BACTERIA

NARMS Now: Human Data www.cdc.gov/NARMSNow

Like (179) · Comment (5) · Share · 27 days ago

Heather Rubino, Salwa Rashid +177

See previous comments

Matthew Standland I love the way that this data is organized by state, year, organism, and drug resistance. It was interesting for me to see some discrepancy among the states concerning resistance. For example, Nevada's high resistance of non-typhoidal *Salmonella* to streptomycin and Florida's high resistance of *shigella* to ampicillin. 24 days ago

Josh Boston Really cool data here! I work with a ton of labs over at the CDC and have provided a ton of the products they use to get this info! If anyone over there is looking to lower their error bars, reduce their variance, and make their data more reproducible, lets connect and I'll be glad to get you the same results! 21 days ago

Add a comment...

Dr. Tom Frieden @DrFriedenCDC Follow

See NARMS Now: Human Data for 18 yrs of #antibiotic resistance data on 4 foodborne bacteria ow.ly/RAGG1

Antibiotic resistance trends for 4 FOODBORNE BACTERIA

NARMS Now: Human Data www.cdc.gov/NARMSNow

RETWEETS 14 FAVORITES 9

3:31 PM - 31 Aug 2015

News Articles

TIME Solutions That Matter

HEALTH PUBLIC HEALTH

This Technology Tracks Antibiotic Resistance In Food

Alexandra Sifferlin @acsifferlin Aug 20, 2015

Federal officials have created a new public database that tracks superbugs

On Wednesday, the U.S. Centers for Disease Control and Prevention (CDC) rolled out a new interactive tool




[This Technology Tracks Antibiotic Resistance In Food](#)

[Watch How Researchers Are Ensuring the Future of America's Livestock](#)

[See How Kids Are Getting 3D-printed Hands for Free](#)

TECH INSIDER SCIENCE

Superbugs are creeping into our food supply and quietly wreaking havoc

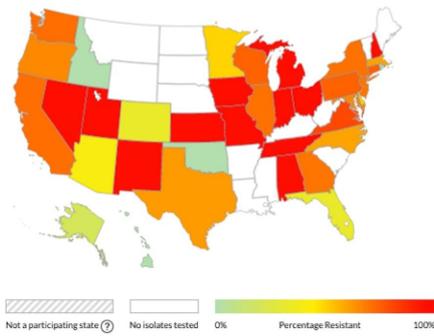
Julia Calderone
Aug. 19, 2015, 4:14 PM 173

FACEBOOK LINKEDIN TWITTER EMAIL PRINT

Many of us have had a brush with food poisoning. The rumble in your stomach after eating that questionable leftover pad Thai is unmistakable and can leave you helplessly on your couch for days.

Foodborne illnesses in the US are extremely common.

The Centers for Disease control (CDC) estimates that each year, 1 in 6 Americans are sickened by contaminated food and beverages. This adds up to about **48 million people per year**, 128,000 of whom are hospitalized, and 3,000 of whom



Percentage of Salmonella typhi resistant to antibiotic nalidixic acid per state in 2013.

NARMS/CDC

Food Poisoning Bulletin

Home About Contact Report an Illness Food Safety Recalls Outbreaks News Search this website ... Search

You are here: Home / Food Safety / NARMS Now Interactive Tool Launched by CDC

NARMS Now Interactive Tool Launched by CDC

August 23, 2015 by Linda Larsen

NARMS Now, which is part of the National Strategy for Combating Antibiotic-Resistant Bacteria (CARB) and the President's Open Government Initiative has been released to the public. NARMS reports present aggregated data, but this new system is the entire collection of the government's enteric bacterial isolates collected over the past 18 years.

latest+news

- Shigellosis Strikes Lubbock TX Schools and Daycares
- What Caused E. coli Contamination in High Hill Ranch Apple Juice?
- Consumer Advisory Issued for Uncle John's Apple Cider for E. coli
- Bio-Sphere Brand Sprouted

NEWS TECH SPACE HUMAN EARTH HISTORY ANIMALS AI

BIOTECHNOLOGY

New CDC Online Tool Tracks Superbugs

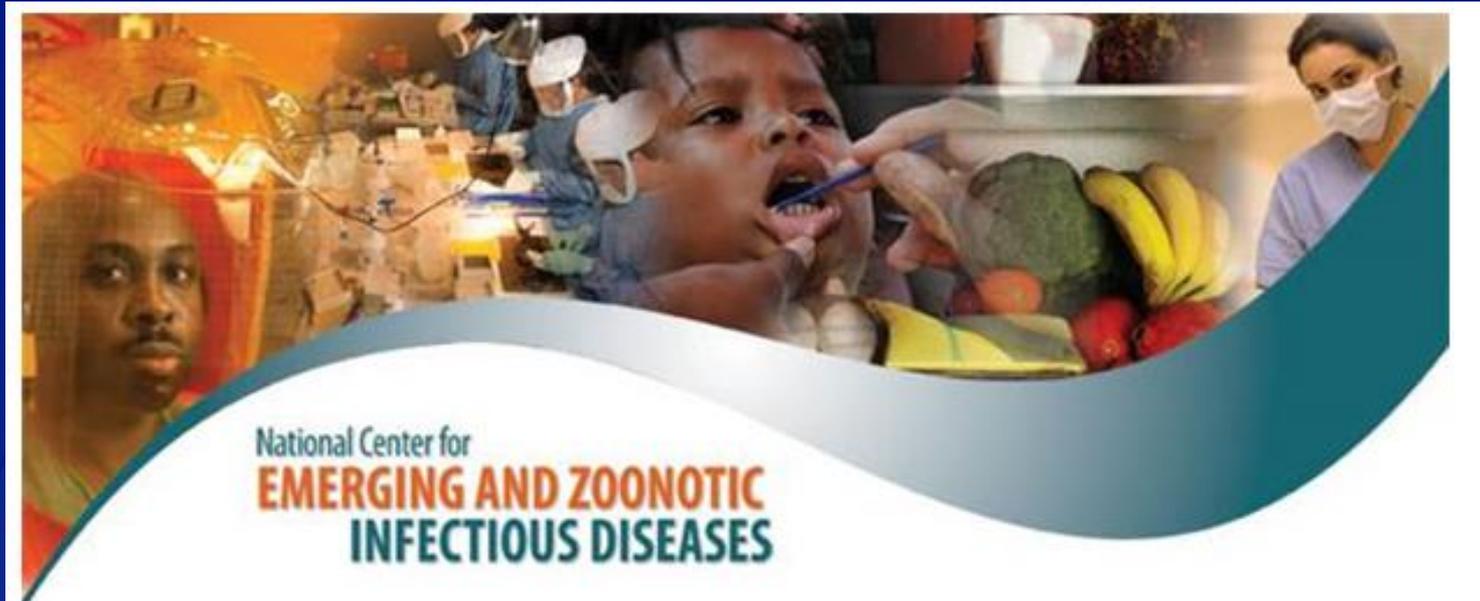
AUG 20, 2015 03:45 PM ET // BY GLENN MCDONALD



[VIEW RELATED GALLERY >](#)

Color-enhanced scanning electron micrograph showing Salmonella Typhimurium (red) invading cultured human cells.

2015 NCEZID Director's Recognition Award



NARMS Now Web Traffic

Cumulative Daily Unique Visits to **NARMS Now: Human Data**, August 19 - October 30



- ❑ **Over 4,500 visits in the first three days**
- ❑ **12,079 total visits as of October 30, 2015**

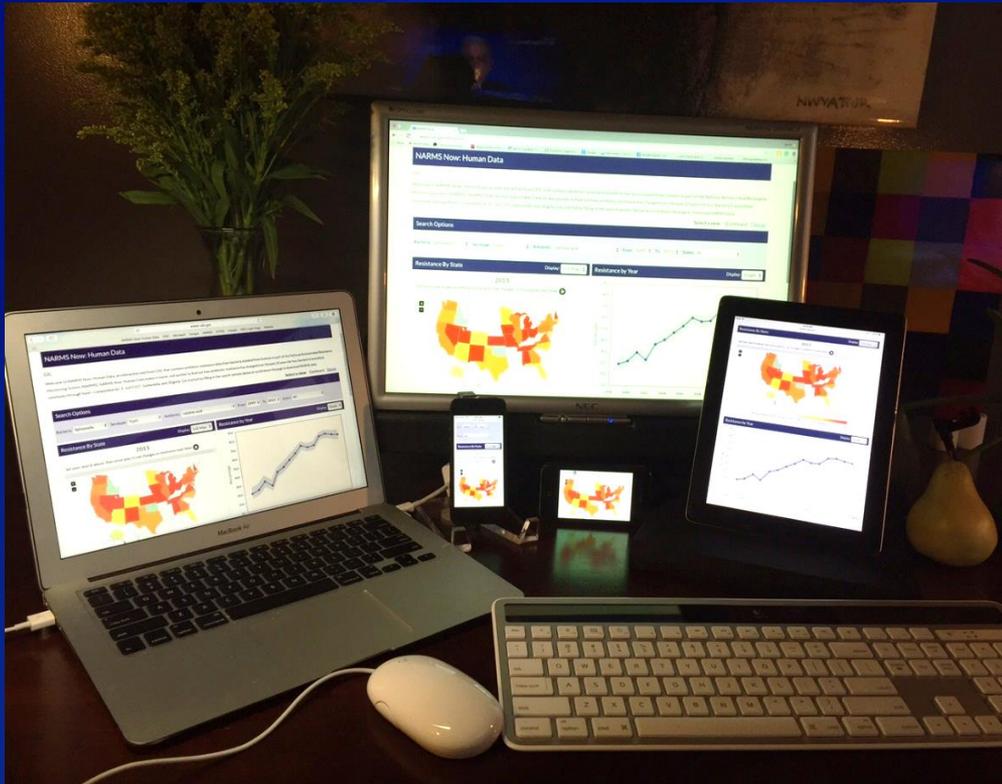
NARMS Now Visits* by Country



* Visits within 7 days prior September 17

☐ Total of 35 different countries have visited NARMS
Now within the week ending 9/17/2015

NARMS Now Visits by Device



Device	Number of visits
PC / Mac	10,432
Mobile Devices	1,647
Android devices	456
Blackberry	3
iPad/iPhone	1,120
Windows phone	22
Other/Unknown	46

*Data as of 10/30/2015

NARMS Now Data Downloads by Pathogen

Download

-  [Download data related to your search](#)
-  [Download all NARMS data](#)
-  [Data dictionary](#)

Note: Downloadable isolate-level data are not available from all states.
Data current as of **October 21, 2015**.

Pathogen	Number of Downloads
<i>Campylobacter</i>	11
<i>E. coli</i> O157	13
<i>Salmonella</i>	178
<i>Shigella</i>	16
All Pathogens	276
Total Downloads	494

*Data as of 10/30/2015

Potential Enhancements

□ Data enhancements

- Upload data on a more frequent basis
- Add whole genome sequence data
- Add data from additional sites to download feature

□ Dashboard enhancements

- Add multidrug resistant patterns to queries
- Query additional non-typhoidal *Salmonella* serotypes
- Ability to select data for multiple states or U.S. Census regions
- Display cumulative counts over time via map
- Ability to download figures from dashboard as PDF

Opportunities for Reuse

❑ Interested partners

- USDA NARMS
- CDC FoodNet

❑ Other CDC programs with similar data tools

- CDC Food Tool
- NCHHSTP Atlas
- CDC FluView

Lessons Learned

- ❑ **Early involvement of key partners**
 - Usability expert
 - Security officials
 - State partners
 - CDC leadership
 - Communication specialists
- ❑ **Routine collaboration between IT specialists and subject matter experts**
- ❑ **Iterative development was beneficial**
- ❑ **Portability of data in common files**
- ❑ **Intuitive variable names**
- ❑ **Patience**

Thank You



For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

National Center for Emerging and Zoonotic Infectious Diseases
Division of Foodborne, Waterborne, and Environmental Diseases

