

# Building Health Surveillance Capacity for Illnesses and Outbreaks Associated with Harmful Algal Blooms

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National Center for Emerging and Zoonotic Infectious Diseases

Division of Foodborne, Waterborne, and Environmental Diseases



# Objectives

- ❑ **Describe the national surveillance system for waterborne disease outbreaks**
- ❑ **Characterize harmful algal bloom-associated outbreaks reported to CDC through 2010**
- ❑ **Describe efforts to improve public health surveillance capacity for harmful algal blooms (outbreaks, events, individual cases) in the Great Lakes region**

# Waterborne Disease and Outbreak Surveillance System (WBDOSS)

- ❑ **Primary source of national data about the scope and effects of waterborne disease outbreaks among persons in the United States**
- ❑ **Initiated in 1971 for drinking water outbreaks by:**
  - **The Centers for Disease Control and Prevention (CDC)**
  - **The Environmental Protection Agency (EPA)**
  - **The Council of State and Territorial Epidemiologists (CSTE)**
- ❑ **Recreational water-associated outbreaks reported since 1978**



# Outbreak Definition

- ❑ **≥2 persons epidemiologically linked by time, exposure to water, and characteristics of illness.**
  
- ❑ **Includes exposure to**
  - **Infectious pathogens transmitted by ingesting, inhaling aerosols of, or having contact with contaminated water**
  - **Chemicals/Toxins in the water or chemicals/toxins that volatilize from water e.g., harmful algal blooms**

# Routes of Transmission

**Ingestion**



**Contact**  
(dermal, ear,  
eye, wound,  
urinary tract)

**Inhalation**

**Nasal**

# Waterborne Pathogens and Chemicals Affect Many Systems

**Neurologic infections**  
*Echovirus, Naegleria fowleri*

**Eye infections & irritation**  
*Acanthamoeba keratitis, Adenoviruses*

**Ear infections**  
*Pseudomonas*

**Respiratory infections & irritation**  
*Legionella, non-tuberculus mycobacteria, chemicals*

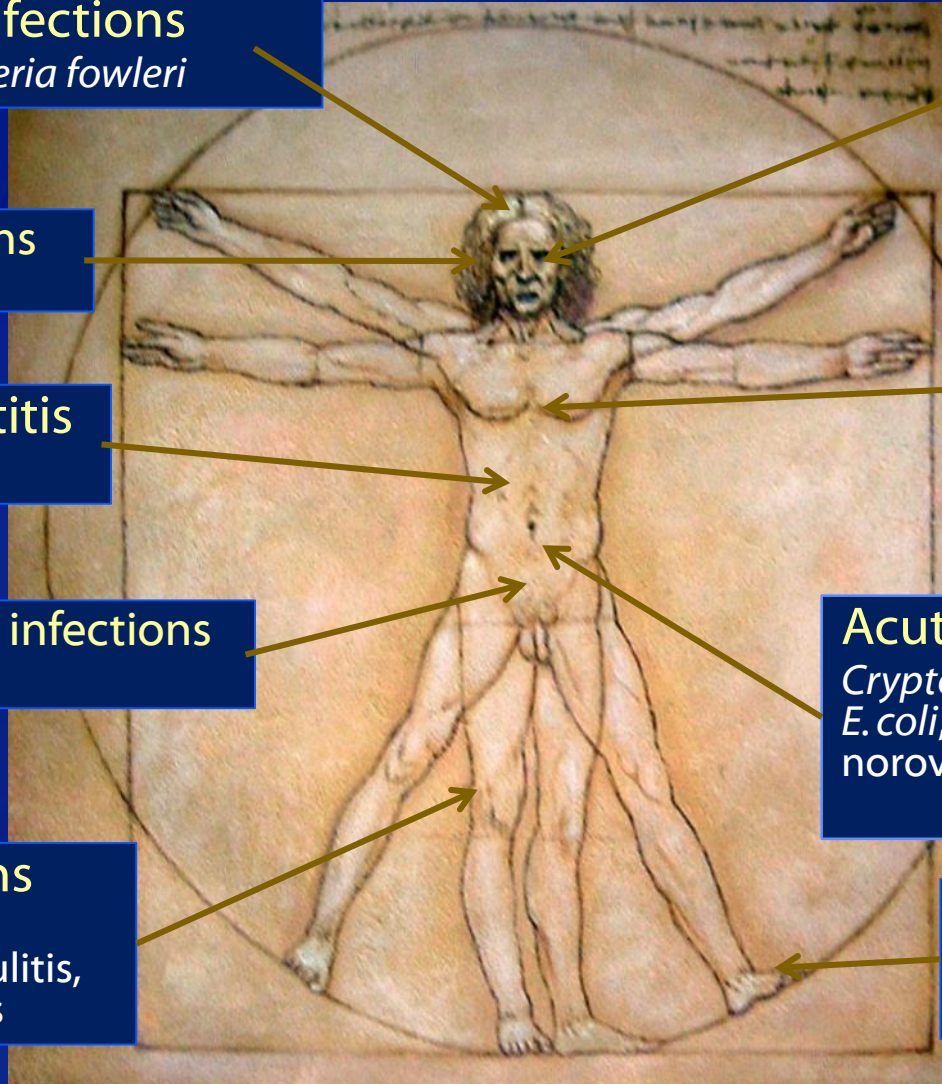
**Hepatitis**  
HAV

**Acute gastroenteritis**  
*Cryptosporidium, toxigenic E. coli, Giardia, Shigella, norovirus, chemicals*

**Urinary tract infections**  
*Pseudomonas*

**Skin infections**  
*Pseudomonas dermatitis/folliculitis, fungal infections*

**Wound infections**  
*Vibrio, Aeromonas, Pseudomonas*





# Outbreak Reporting

## Surveillance System Attributes

- ❑ Voluntary reporting by health departments
- ❑ Outbreaks are nationally notifiable (since 2010)
- ❑ Passive surveillance (no active search for outbreaks)
- ❑ Paper-based from 1971-2008
- ❑ Electronic reporting since 2009 via the National Outbreak Reporting System (NORS)



WBDOS: <http://www.cdc.gov/healthywater/surveillance/index.html>

NORS: <http://www.cdc.gov/nors>

# Electronic Outbreak Reporting

**NORS is used to report**

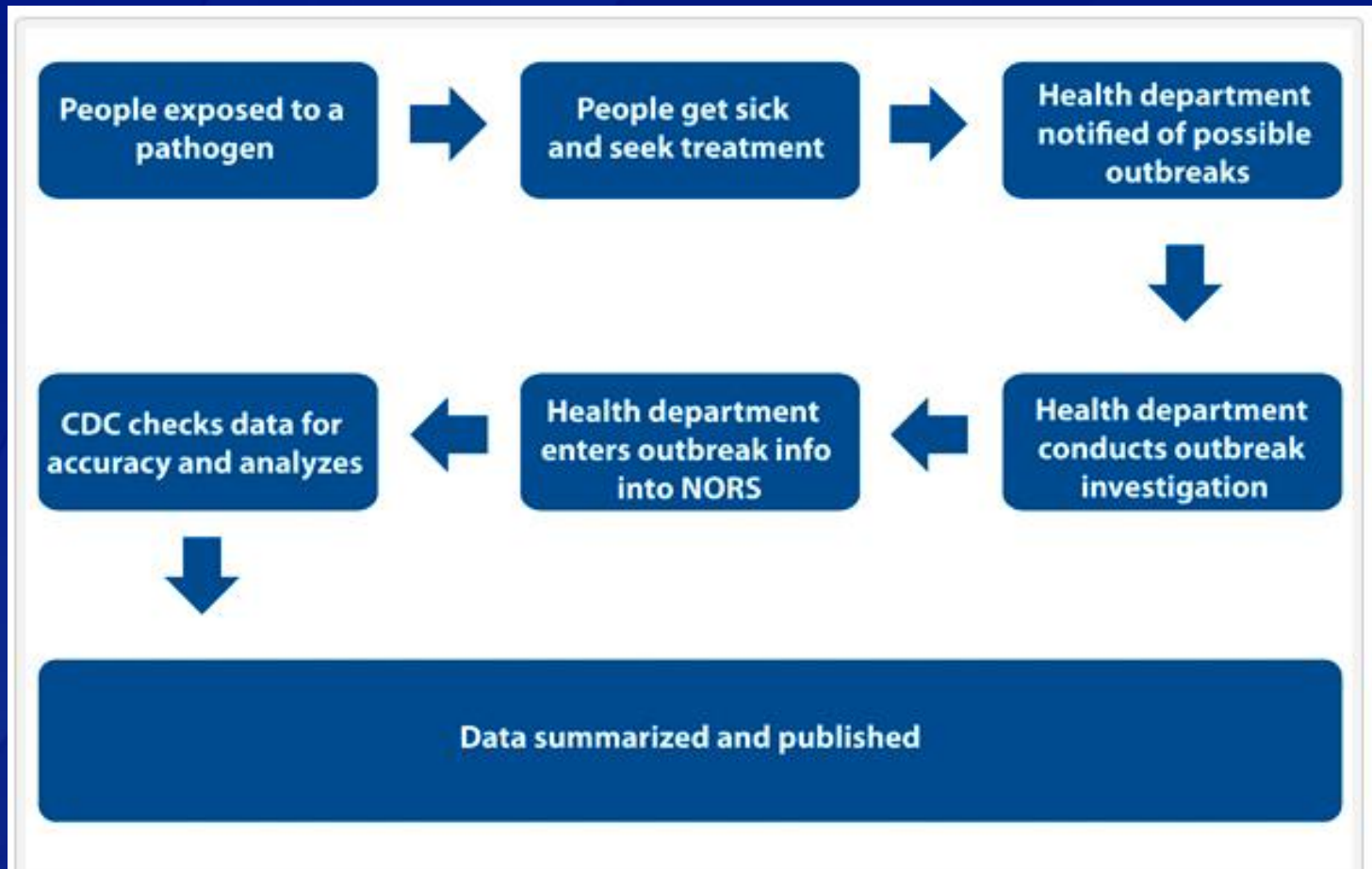
- ❑ Outbreaks associated with water**
- ❑ Enteric outbreaks associated with
  - ❑ Food**
  - ❑ Animal contact**
  - ❑ Person-to-person transmission**
  - ❑ Environmental contamination**
  - ❑ Other enteric illness outbreaks****



**More information: <http://www.cdc.gov/nors>**



# Outbreak Reporting Process

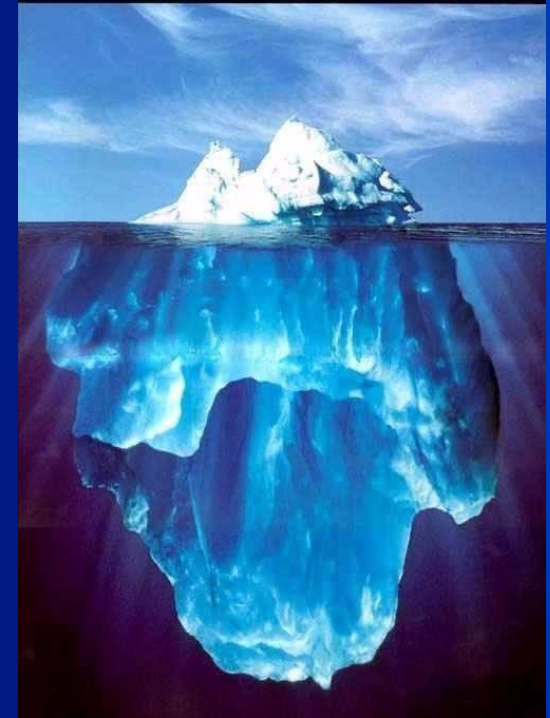


# Waterborne Disease Investigations and Reports: Quality AS WELL AS Quantity



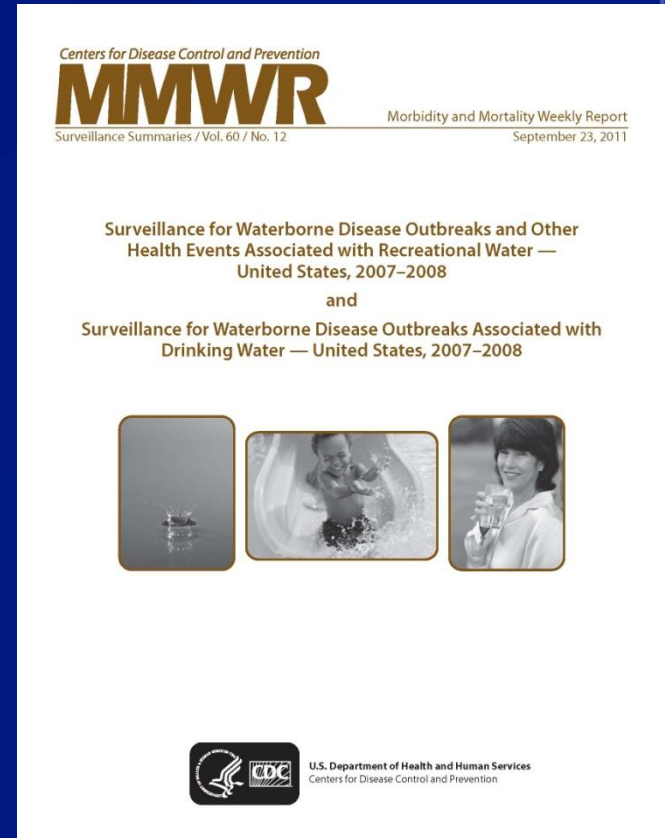
## Understanding the Data: Limitations

- Inconsistent or incomplete data
- Passive surveillance
- Not all outbreaks detected, investigated, reported
- No reliable estimates of the number of undetected outbreaks
- Data do not include cases of endemic waterborne disease
- Not an indicator of magnitude of disease



# Outbreak Data Uses

- ❑ Surveillance summary reports (<http://www.cdc.gov/healthywater/surveillance/rec-water-surveillance-reports.html>)
- ❑ Other publications, data, and statistics
- ❑ Development and support of programs, health promotion, policies. e.g., Healthy Swimming Program, Model Aquatic Health Code, trends in outbreaks involving public water systems provided support for the EPA Ground Water Rule (2006)



# Algal Bloom-Associated Outbreaks Reported to WBD OSS Prior to 2009 (n=5)\*

## ❑ Hawaii, August 1981

- *Microcoleus lyngbyaceus*, skin symptoms in 14 persons, ocean setting

## ❑ New Hampshire, August 2001

- *Oscillatoria* suspected, gastrointestinal symptoms in 42 persons, lake in a state park

## ❑ Nebraska, August 2004

- Microcystin, respiratory and skin symptoms in 20 persons, lake setting
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## ❑ Florida, July 2007\*\*

- *Karenia brevis*, respiratory symptoms in 15 persons, ocean setting

\*Summary data available at <http://www.cdc.gov/healthywater/statistics/wbdoss/surveillance.html>

\*\*CDC. Illness associated with red tide—Nassau County, Florida, 2007. MMWR 2008;57:717–20.

# **Algal Bloom-associated Outbreaks Reported to CDC, 2009-2010**

- ❑ 11 outbreaks**
- ❑ Person**
  - 61 cases, 2 hospitalizations, 0 reported deaths**
  - 38 (66%)  $\leq$ 19 years of age**
- ❑ Place**
  - Fresh water**
  - New York, Ohio, Washington**
- ❑ Time**
  - June–August , 2009-2010**

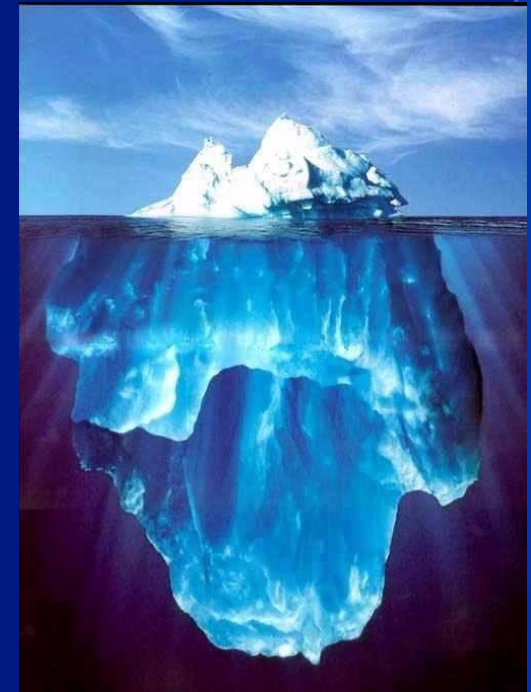
## **Algal Bloom-associated Outbreaks reported to CDC, 2009-2010 cont.**

- ❑ **8 outbreak investigations included detection of toxins**
  - **Microcystins, anatoxin-a, saxitoxin, cylindrospermopsin**
- ❑ **2 outbreak investigations revealed potential association with fish or dog deaths or bird illness**
- ❑ **Health effects**
  - **Dermatologic, gastrointestinal, respiratory, and neurologic**



## Tip of the Iceberg

- ❑ **Swimming-related illnesses underreported**
  - ❑ **National Epidemiologic and Environmental Assessment of Recreational Water (NEEAR Water) study** → 54,250 beachgoers
  - ❑ **Swimmers had higher incidence (unadjusted  $\chi^2$ ) of illness (gastrointestinal, respiratory, ear, rash)**
  - ❑ **No associated outbreaks reported**
- ❑ **Emerging issue: drinking water outbreaks**
- ❑ **Difficult to link illnesses to harmful algal blooms**



# Building Capacity for Surveillance



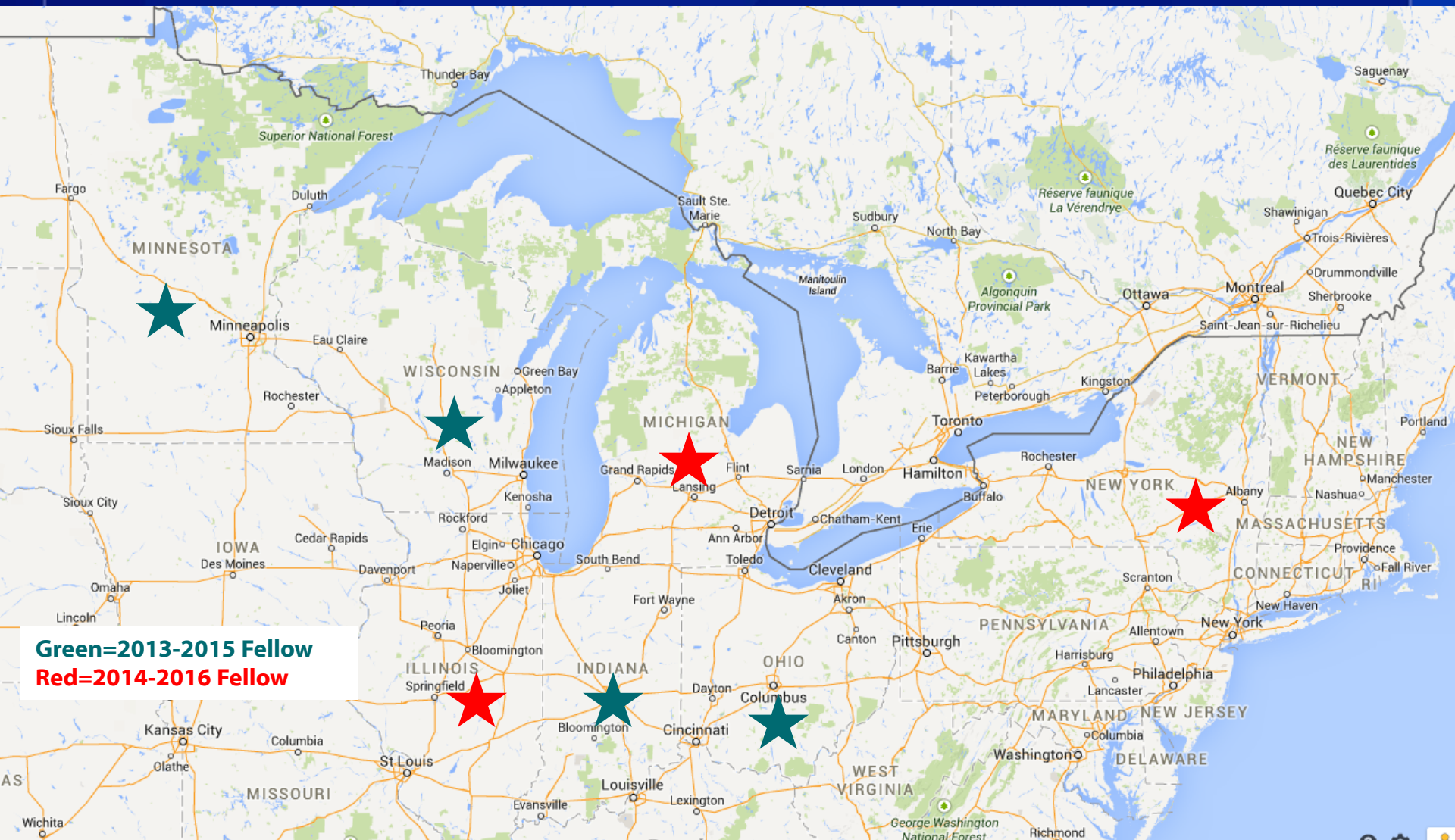
- ❑ **CDC funded in 2013-2014 by the Great Lakes Restoration Initiative to expand surveillance capacity for waterborne disease in Great Lakes (8 states)**
- ❑ **Harmful algal blooms (HABs) and ambient waters**
- ❑ **Great Lakes Activities**
  - **Build Great Lakes state surveillance capacity and communication network**
  - **Build regional capacity through state and federal partnerships, data and information sharing**
  - **Build harmful algal bloom reporting system within NORS**

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# Great Lakes Waterborne Disease Epidemiology Fellows (N=7)





# Select CSTE Fellow Activities to Improve HAB Surveillance Capacity

## Understanding the Problem

- ❑ Evaluating state HAB surveillance capabilities
- ❑ Initiating or expanding HAB health surveillance systems
- ❑ Participating in electronic HAB reporting system development
- ❑ Studying exposure and illness associations

## Educating to Improve Detection and Prevention

- ❑ Health professional reference materials, training presentations, website content, social media

## Improving Public Health and Emergency Response

- ❑ Outbreak investigation/ response activities
- ❑ Human and animal illness investigations

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# Harmful Algal Bloom-related Illness Surveillance System (HABISS)

## □ Data

- Temporally and geographically related
- Focus on “One Health, One Environment”
  - Human health
  - Animal health
  - Environmental characteristics

## □ Goals

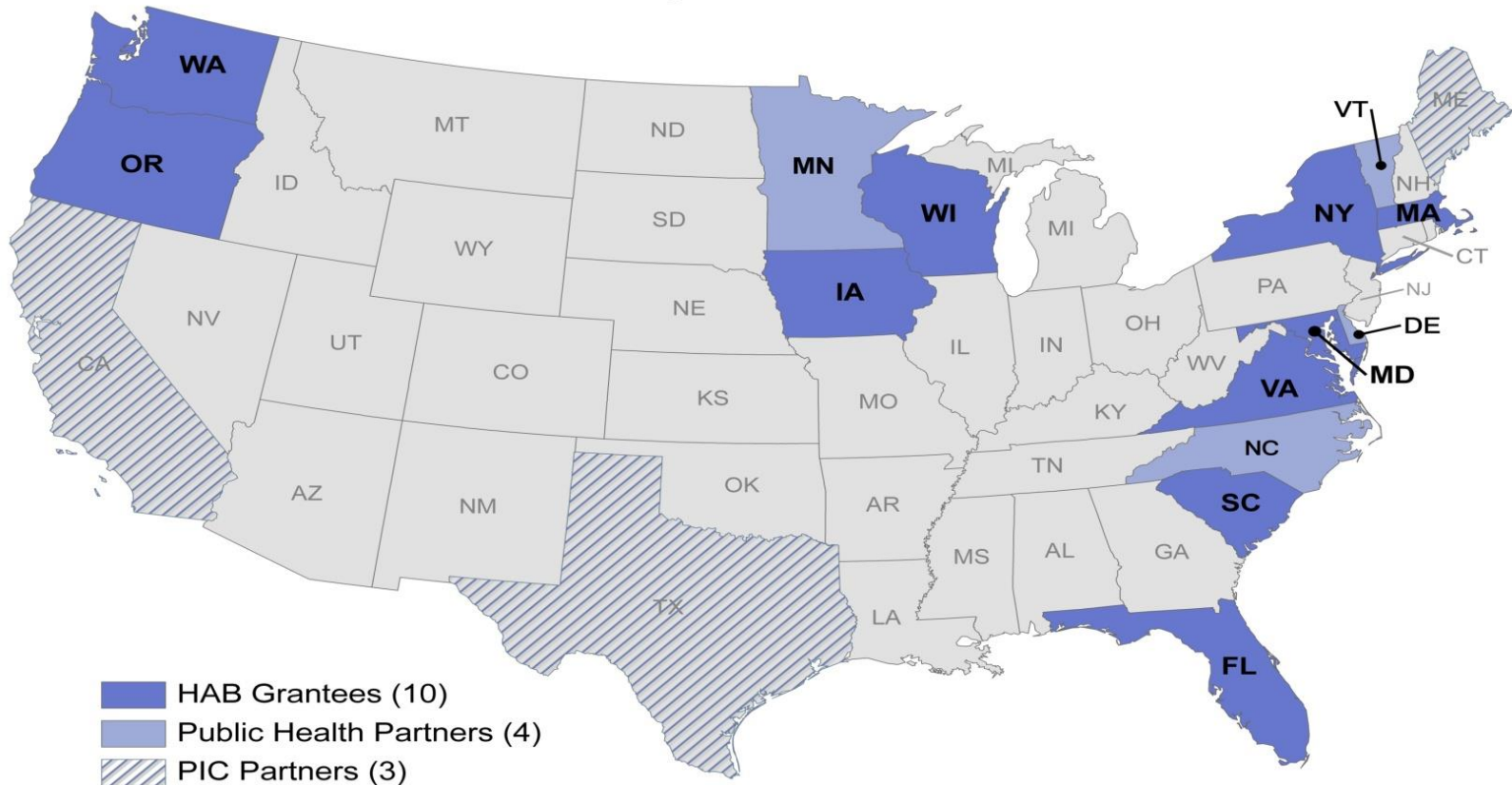
- Detection, mitigation, prevention
- *Link cases of illness with the environmental event*

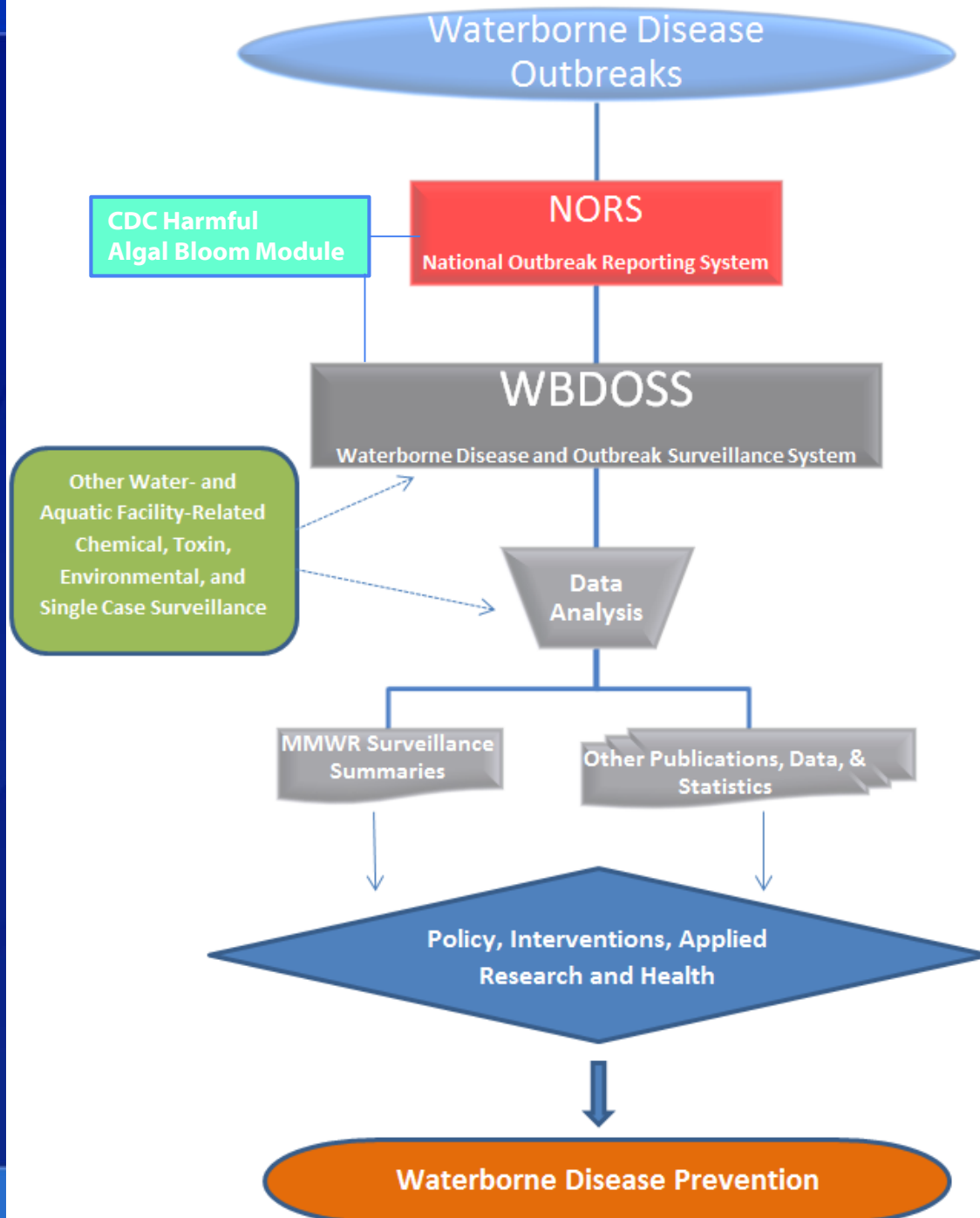




# HABISS Data Sources

FY 2009 Harmful Algal Bloom Grantees and Partners





# **Harmful Algal Blooms: Surveillance Objectives**

- ❑ Human and animal illnesses and outbreaks associated with harmful algal blooms:
  - Identify and characterize illnesses/outbreaks**
  - Refine case definitions****
- ❑ Understand whether harmful algal bloom events are changing in frequency or geographic distribution over time.**
- ❑ Link public health surveillance data to other national health data and environmental data systems.**
- ❑ Inform public health policy and illness prevention efforts**

# Harmful Algal Bloom Reports

HAB Report

Event and Environmental  
Report (Form)

Hum

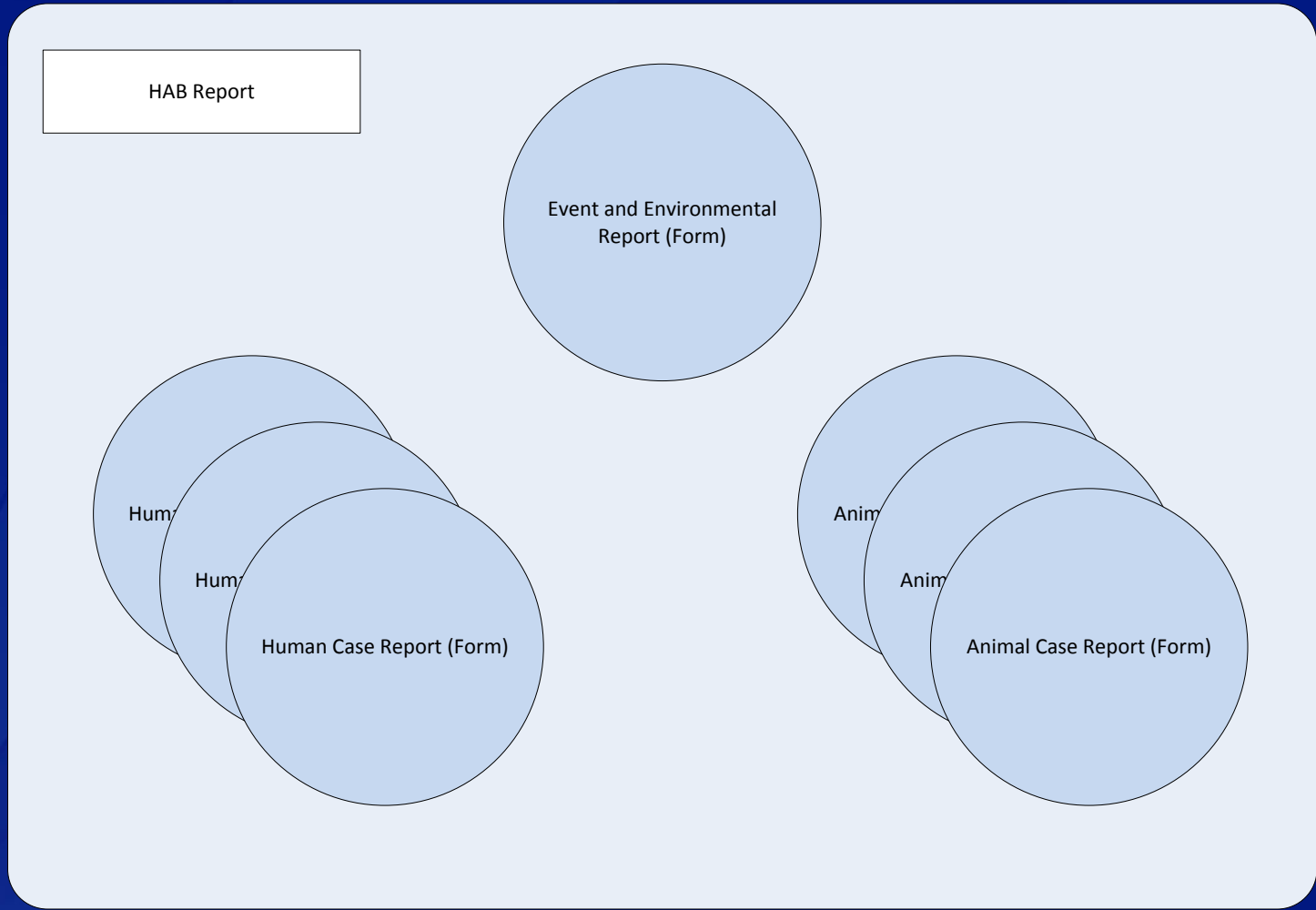
Hum

Human Case Report (Form)

Anim

Anim

Animal Case Report (Form)



# Harmful Algal Bloom Surveillance Collaboration

- ❑ **Current working group includes:**
  - ❑ **Former HABISS surveillance states, Great Lakes states**
    - ❑ **FL, IL, IN, IA, KS, MD, MA, MI, MN, NY, OH, OR, SC, VA, WA, WI**
  - ❑ **Federal and other interested organizations**
    - ❑ **CDC, EPA, NPS, NOAA, EPA, USGS**
    - ❑ **IJC**
- ❑ **IT developers and NORS program staff**
- ❑ **Focus on state and federal needs and capacity to report**

# Harmful Algal Bloom Draft Surveillance Materials



- ❑ **Data forms**
  - ❑ **HAB environmental data report**
  - ❑ **HAB animal illness case report**
  - ❑ **HAB human illness case report**
  
- ❑ **Definitions/Reporting criteria**
  - ❑ **HAB events**
  - ❑ **HAB illnesses**

# Progress Toward Developing a HAB Reporting Module





# Acknowledgments

## □ Public Health Partners

- Local,
- State, DC
- Territorial
- Freely Associated States

## □ CDC

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- Sarah Collier
- Michele Hlavsa
- Amy Kahler
- Jonathan Yoder

## □ EPA

- Betsy Hilborn
- Tim Wade

## □ GLRI Federal Partners

## □ HAB Working Group

- FL, IL, IN, IA, KS, MD, MA, MI, MN, NY, OH, OR, SC, VA, WA, WI
- CDC, EPA, USGS, NPS, NOAA, IJC

# Capacity: If you build it...



# 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

Visit: [www.cdc.gov](http://www.cdc.gov) | Contact CDC at: 1-800-CDC-INFO or [www.cdc.gov/info](http://www.cdc.gov/info)

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.

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# Questions?

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