Operations and Innovation in Homeland Security Biosurveillance

Use of Novel Data and Information for Early Warning and Shared Situational Awareness

Steve Bennett, Ph.D.
Director
National Biosurveillance Integration Center

Office of Health Affairs
Department of Homeland Security
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Agenda

1. Why national biosurveillance integration?
2. How does NBIC do biosurveillance integration?
3. Current and planned pilot projects

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Why National Biosurveillance Integration?

- Acute, emergent biological events can be caused by
  - Biological agents
  - Chemical agents
  - Radiological agents
  - Environmental conditions
- Impacting
  - Human health
  - Animal health
  - Agriculture
  - Environment, ecology, and water

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National Biosurveillance Integration

- National Biosurveillance Integration Center (NBIC)
  - Housed in the Department of Homeland Security
  - Coordinates comprehensive national biosurveillance and situational awareness
  - Collaborates with the interagency community to acquire, integrate, analyze, and disseminate information pertaining to emerging biological events and their impact on US interests in order to:
    - Provide indications and warnings to NBIS partners
    - Provide situational awareness to NBIS partners

- National Biosurveillance Integration System (NBIS)
  - Federal interagency community providing national biosurveillance and situational awareness
  - Provides the collective framework to acquire, integrate, analyze, and disseminate information pertaining to emerging biological events and their impact on US interests

National Biosurveillance Integration System (NBIS)

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NBIC Vision and Mission

Strategic Vision

Advance the safety, security, and resilience of the Nation by leading an integrated biosurveillance effort that facilitates early warning and shared situational awareness of biological events.

Mission

Enable early warning and shared situational awareness of acute biological events and support better decisions through rapid identification, characterization, localization, and tracking.

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Strategic Vision

Advance the safety, security, and resilience of the Nation by leading an integrated biosurveillance effort that facilitates early warning and shared situational awareness of biological events.

Mission

Enable early warning and shared situational awareness of acute biological events and support better decisions through rapid identification, characterization, localization, and tracking.

Strategic Goals

1. Build and maintain enduring processes to support interagency collaboration and operations through the NBIS.

2. Enhance federal government ability to rapidly identify, characterize, localize, and track a biological event of national concern.

3. Enhance federal government ability to disseminate alerts and other information to partners

4. Mature and strengthen NBIC into a world-class biosurveillance analysis and integration organization

Objectives

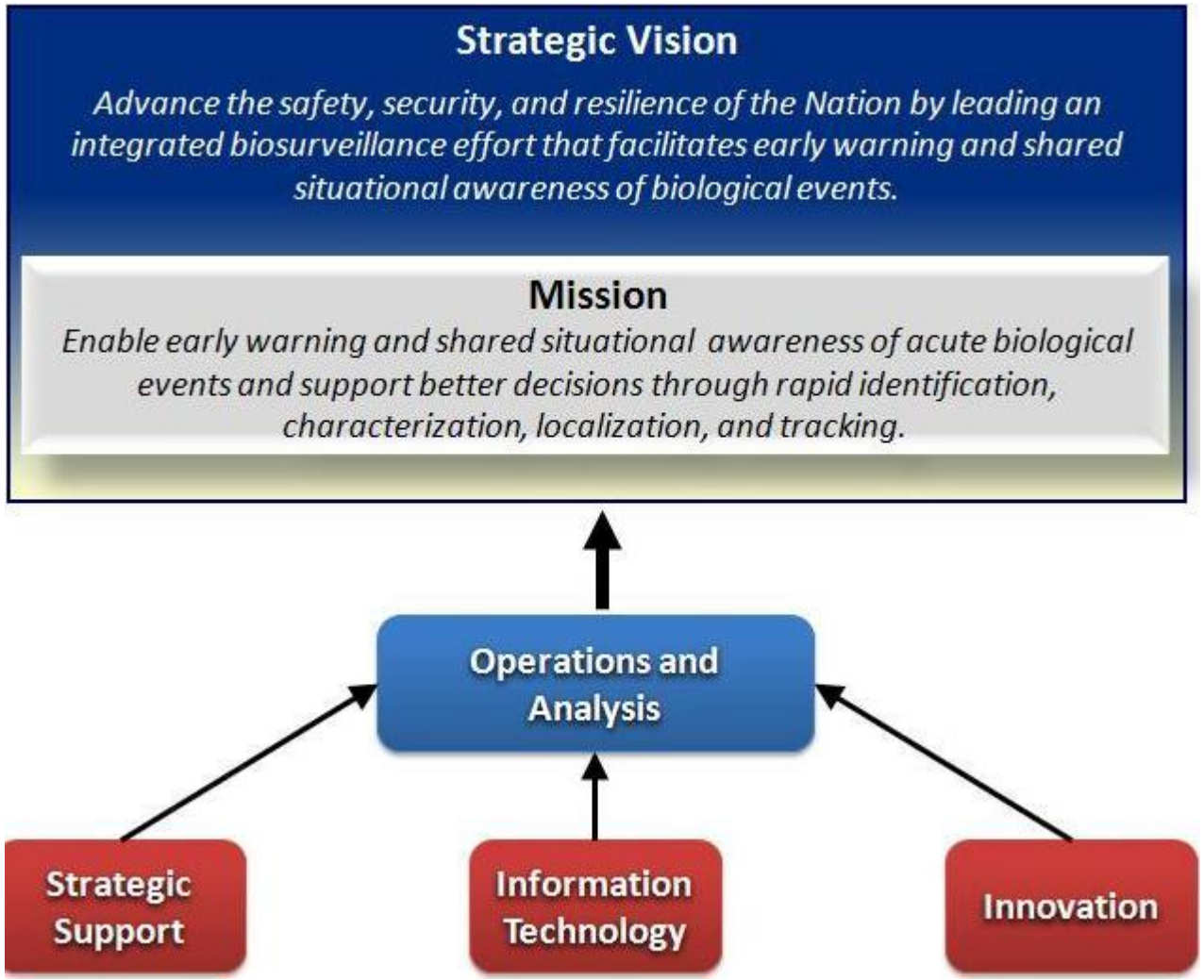
- **1.1 Maintain interagency working group**
- **1.2 Continue to Evolve Concept of Operations with NBIS Partners**
- **1.3 Provide the Infrastructure for integration of systems and partners**
- **1.4 Provide technical assistance to contributing partners**

- **2.1 Consolidate information from available relevant surveillance systems maintained by NBIS partners**
- **2.2 Seek state, local and private sector info to enhance coverage of critical gaps**
- **2.3 Incorporate an IT system that uses the best available tools to identify, characterize, localize, and track biological events of national concern**

- **3.1 Establish method for real-time communication and 24 hour support to the NOC**
- **3.2 Implement and execute information sharing with intelligence entities**

- **4.1 Recruit, develop, and retain, multi-disciplinary federal analytic staff to develop and operate the NBIC**
- **4.2 Recruit technical expertise bio-specific data analysis and interpretation**
- **4.3 Support the growth and development through training opportunities**
- **4.4 Innovate new ways to leverage existing data, models, and partner relationships**

NBIC Vision and Mission



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NBIC Biosurveillance
Operations & Analysis

1

24 / 7 Biosurveillance

- NOC OHA Desk
- NBIC Operations
- BCON database
- On-call NBIC Analysts

2

Review / Integrate

- Analysts review and curate biosurveillance information
- Classified information monitoring

3

- **IN-SPIRE** information visualization

- Biosurveillance Common Operating Network (BCON)
- Interagency inputs
- HHS SOC
- Wildfire
- Epi-X
- BioWatch
- NOC OHA Desk

4

Collaboration / Information Sharing

Daily Analyst Review Meeting

Collaboration / Information Sharing

Weekly Interagency Biosurveillance Call conducted on *Wednesday*

Formal / Informal RFIs sent to NBIS Partners and integrated to BCOP reports

5

Information Sharing / Dissemination

Publish **BCOP reports** to portals

- Federal
- State and Local

6

Reporting / Monitoring List sent by NOC OHA Desk to Federal/State/Local Partners

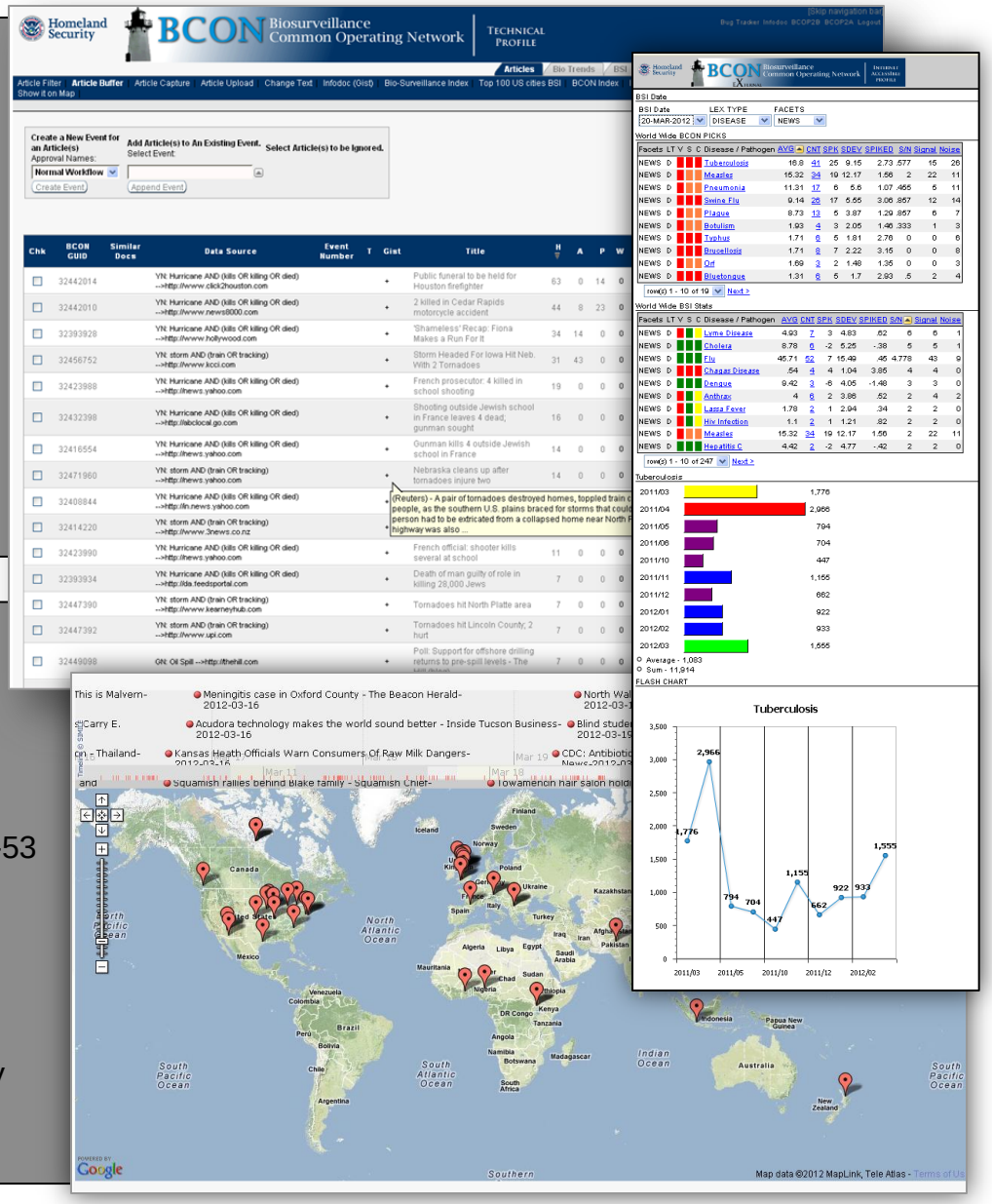
Biosurveillance Common Operating Network (BCON)

System Status Overview

- 6,749,086 maintained published content factors:
  Includes:
  Social Media =4,388,794
  Open Source =2,360,292
- 24,000+ Sources
- 16k+ Articles per day
- 2 Minute acquisition frequency
- Over 30 integrated subsystems
- 8k+ taxonomy terms
- 6k+ search terms

Capabilities

- National and Worldwide Situational Awareness
- Natural Language Processing
- GIST reporting
- Geo-Temporal Visualization
- Documented Information categorization tracking and scoring by public health domain according to PL110-53
- Graphical Analytics and Data Visualization
- Real-time Crowdsourcing / Social Networking
- Information Sharing
- Automatic Infodoc generation
- Intelligent Event Detection
- Biosurveillance Statistical Index Reporting Capability
- Event tracking and SME collaboration capability
- Independent taxonomy management



NBIC Products

	Federal		State/Local	
	Users	Agencies	Users	States
BCOP[1]	579	17	168	50
Monitoring List	577	17	74	50
Weekly Call	192	17	-------	-------
NBIS Protocol	164	15	-------	-------
BCON-X	46	5	-------	-------
RSS Feeds[2]	No registration required			

[1] Biosurveillance Common Operating Picture

[2] Biosurveillance Common Operating Network (BCON) RSS feeds:
- Centers for Disease Control and Prevention (CDC)
- National Collaborative for Bio-Preparedness (NCB-Prepared)

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BSV Dysfunction*

- Analysts scan multiple disparate data sources manually
- Analysts interprets data for importance – no analytics connected to the data
- Analysts collaborates with others
- Through collaboration and discussion, confirms/denies signal
- Produces report
- Product goes out
- ***Stuff out way too late for decision makers to make use of it***

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***Adapted from J. Paragas, 8/27/12**

Pilot Initiatives Beginning/Continuing in FY12

Food Pilot #1

- Potential Initiatives include:
- Understand barriers and identify solutions for sharing and integrating private sector information
- Consider utility of recall data (self directed), returned product data, and supply input intelligence
- Enhance coding of food , national guidelines, training/calls to poison control center, apply refined analytics to a food safety help line call center that scales nationally

Potential Contributors:

- 5 International food companies
- Safe Food international
- Center for Science in the Public interest
- North Carolina, South Carolina, West Virginia
- SAS
- Association for Poison Control Centers

NCB-P Pilot

- Establish a National model for bio-preparedness and demonstrate an operational system that can be adopted by our State and local partners and integrated with NBIC
- Identify and adopt lessons learned, models, and analytical tools for NBIC improvement

Partners:

- DHS (OHA, FEMA, USSS)
- HHS
- USDA Project (In development),
- NC OEMS, CPC, NC DPH, SC OEMS, WV EMS
- *Performers: UNC, SAS, NC State, IBM, ESRI*

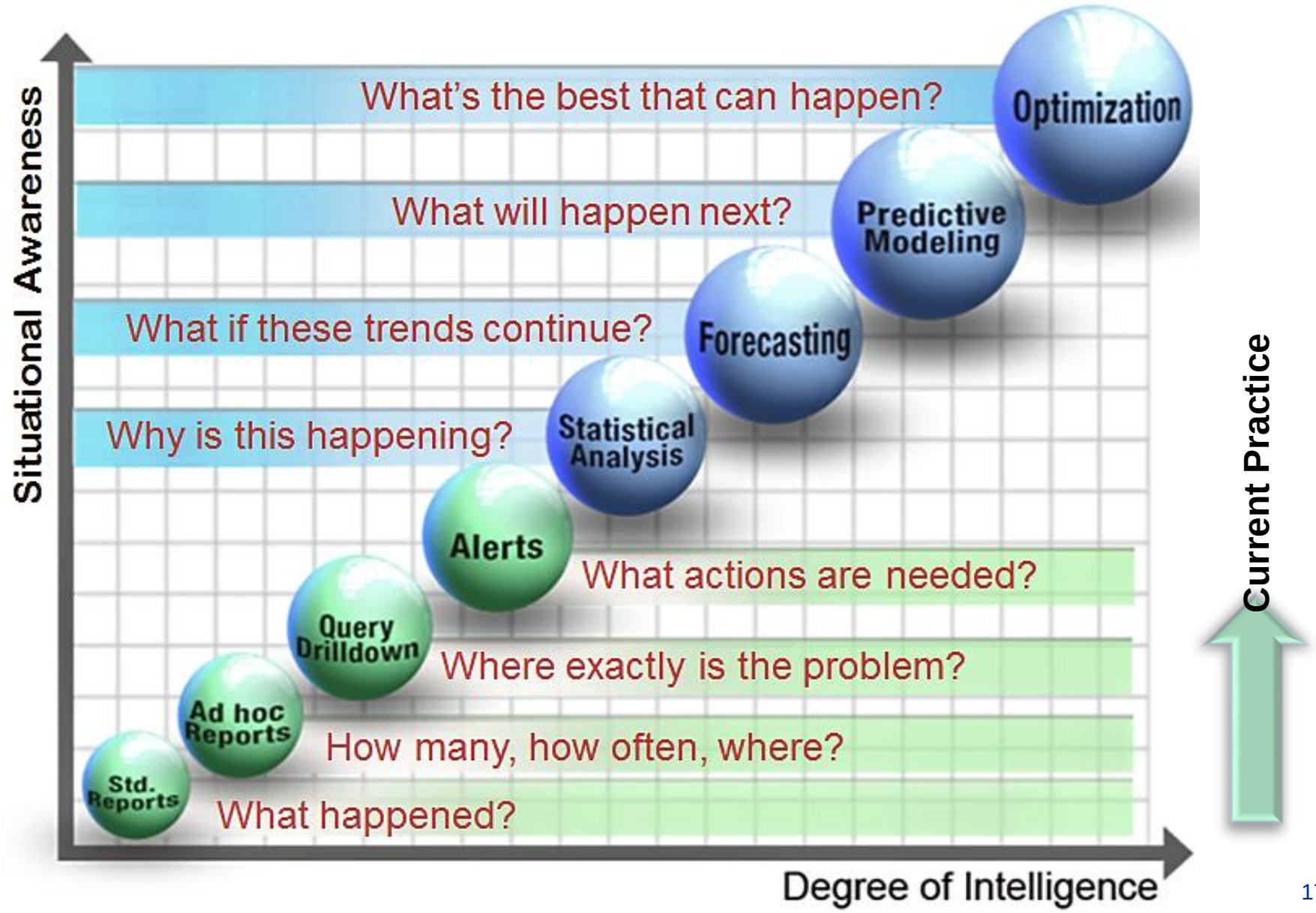
Social Media Pilot

- Determine if social media can provide earlier advance warning or better characterization of an ongoing event
- Test and evaluate analytic tools and compare performance to known social media provider such as Google Flu

Potential Partners:

- DHS S&T
- DOD

Analytics: Reactive vs. Proactive



Social Media pilot

Much attention has been given lately to the purported ability of Social Media to provide (A) early warning, and/or (B) ongoing situational awareness/event characterization during a biological event of national concern.

Hypotheses for the pilot:

1. To what extent can existing ontologies/taxonomies related to potential biological events of national concern be used successfully in analysis of Social Media data to accomplish (A) or (B) above (or both)?

2. Can machine learning approaches be used to automatically generate ontologies/taxonomies that accomplishes either (A) or (B) above (or both)?

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Social Media pilot

Hypotheses (cont'd):

3. How well do approaches generated in (1) and (2) perform in comparison to current open-source approaches (e.g. ARGUS, NCMI, BCON, Google Flu, etc.)

4. Validation of Social Media-based alerts: does monitoring of social media provide predictive capabilities or early detection of a biological event as compared to current, real biodata from which alerts are generated (pre-hospital data, NCB-P, FSIS, CDC, PCC) to determine predictive/early alert capacity?

Social Media pilot

Hypotheses (cont'd):

5. It is possible that Social Media data analysis alone may not significantly improve early warning or ongoing event characterization on its own. What are the possibilities for synergistic improvements when different data and approaches are combined together? Are there enhanced capabilities when combined with other data and information?

6. Can Social Media analytics be shown to be 'operationalizable' within the Center? Can it be summarized and synthesized in a manner useful for biosurveillance analysts?

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NBIS Directed Pilot Under Evaluation for FY13

- Pilot will be directed and executed by a Sub-Working Group of the NBIS Interagency Working Group and led by a NBIS partner
  - Goal – providing real direction and guidance responsibilities to our partners and maintaining our promise of shared, participatory governance and true interagency collaboration
- By the end of FY12, the NIWG Sub-Working Group will determine and prioritize current biosurveillance gaps across the interagency and select the highest priority gap to address in the FY13 interagency directed pilot
- Recent DHS House Appropriations Bill
  - Included an increase of 5M above the request to sustain existing biosurveillance activities and to expand the diversification of bio-surveillance capabilities through new pilots that shall be awarded on a competitive basis.

National Collaborative for Bio-Preparedness Pilot

Project Goal

The ultimate goal of the pilot is establish a National model for biopreparedness that can be adopted by our State and local partners and integrated with NBIC and NBIS.

Questions Answered:

- ***Do EMS, ED, and other novel data sets provide opportunities for enhanced early warning capabilities?***
- ***Can advanced analytics be applied to data sets to enhance early warning capabilities?***
- How can information on early detection of health threats be shared between NCB-Prepared and DHS?
- Has NCB demonstrated useful state-wide integrated biosurveillance?
- Are NCB-P data sets and analytic approaches be nationalized?
- Has NCB-NBIC demonstrated the ability to effectively share state level biosurveillance information with national level biosurveillance information?

Partners:

- DHS (OHA, FEMA, USSS)
- HHS,
- USDA Project (In development),
- NC OEMS, CPC, NC DPH, SC OEMS, WV EMS

Performers: UNC, SAS, NC State, IBM, ESRI

Planned Deliverable/Milestone	Core Disciplines			
	Collaboration	Information Sharing and Integration	Analysis	User-Defined Reporting
1. Laboratory Operational Demonstration • Establish Trusted Third Party (TTP) to protect data providers and combined multiple feeds of data • On-board additional data sources [poison control, EMS, national food safety data, veterinary data, etc] • Established information sharing requirements from individuals to federal agencies • Demonstrate the use of 5 predictive analytics tools on existing data • Conduct signal testing to validate sensitivity and specificity on the user community	✓	✓	✓	✓
2. Test Operational Pilot Capability	✓	✓	✓	✓
3. Identify and adopt lessons learned, models, and analytical tools for NBIC improvement	✓	✓	✓	✓

Early Warning Requires Integration of Many Data Sets

Incident





Data Generated by the Incident

Clinical Specificity over Time

- Social Network
- 911 Data
- Poison Data
- Org Data
- Food Alerts
- EMS Data
- Animal Data
- ED Data
- Lab Data
- Hospital Data
- Practice Data
- Vital Statistics
- Discharge Data

Situational Awareness with Analytics

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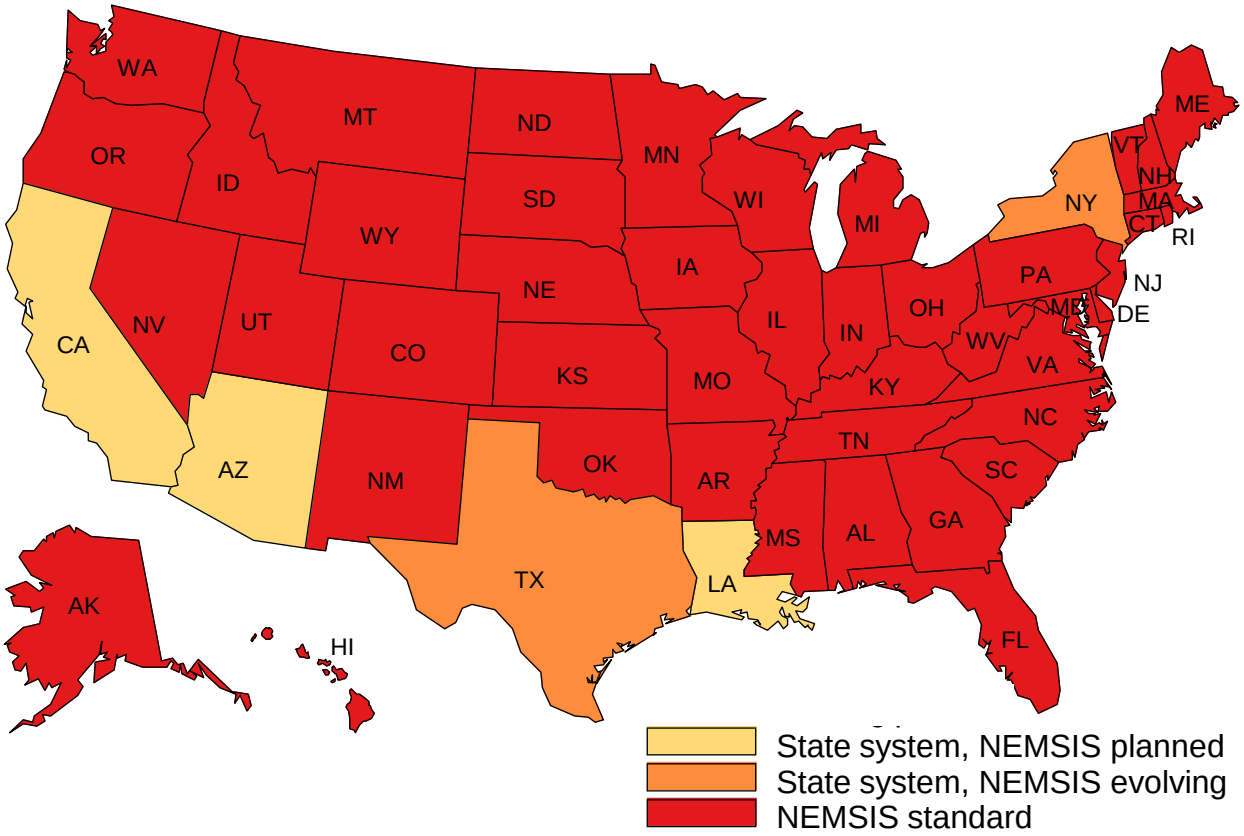
Currently Unutilized Data Set #1: EMS Reporting



NEMSIS = National Emergency Medical Services Information System

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Currently Under-Utilized Data Set #2: Poison Control Centers

57 Poison Centers across the nation use a common data format

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Currently Unutilized Data Set #3: Veterinary Clinics

802 veterinary clinics nationwide using the same EMR system

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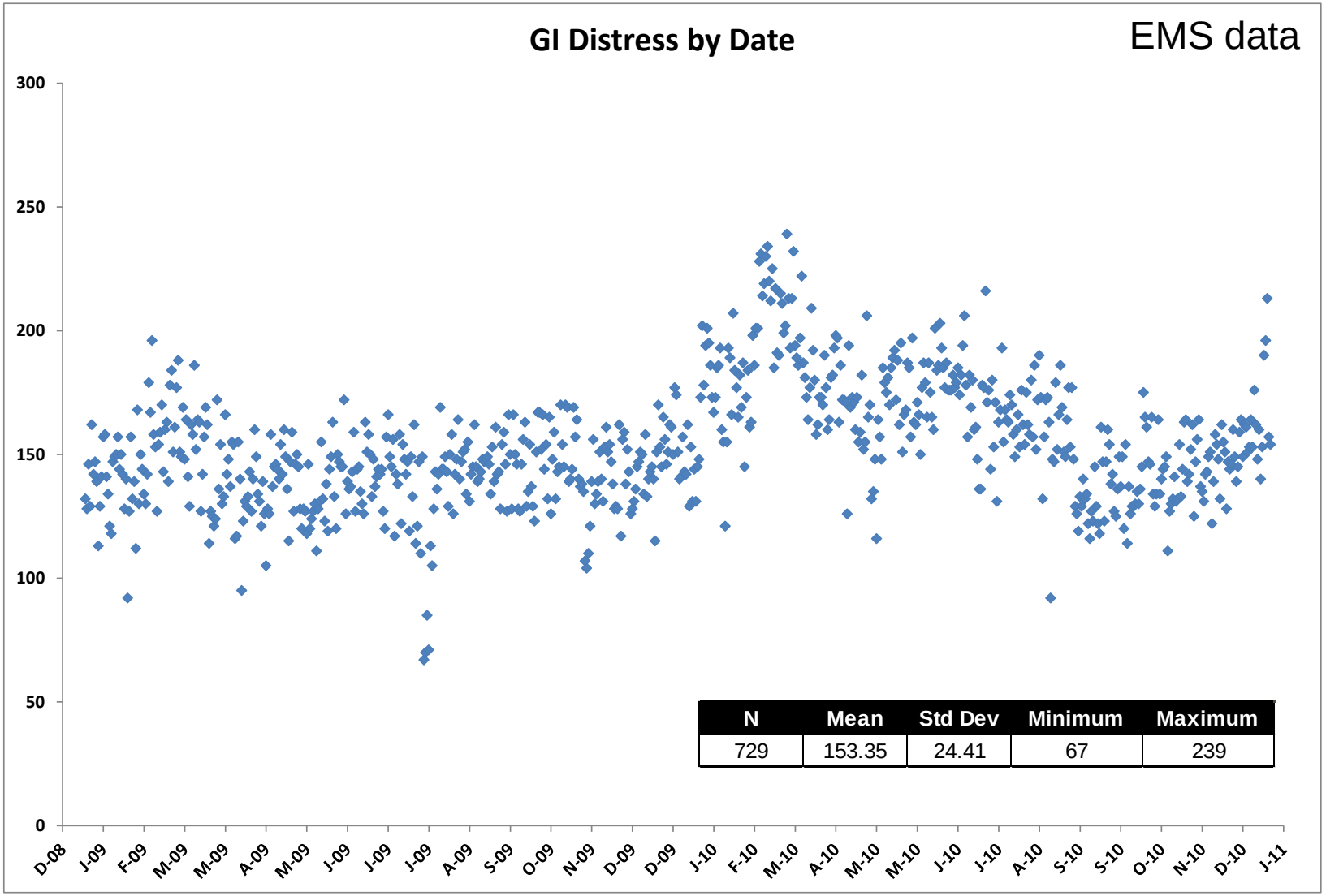
Piloting Advanced Analytics: GI Distress data from 2009 and 2010



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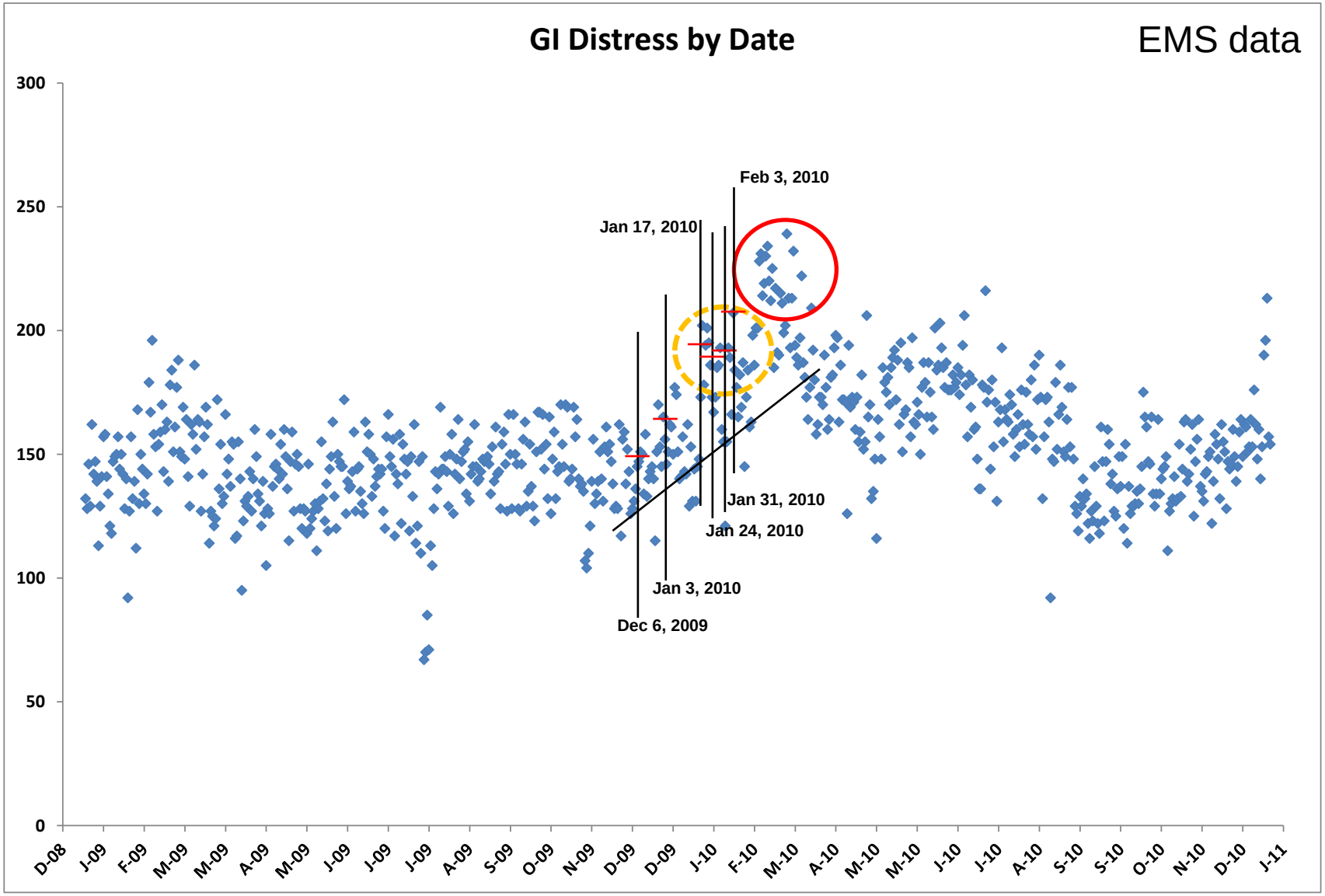


Event Detection: Media Reporting Later than EMS and other Data Sources

Durham retirement community quarantined for norovirus outbreak

February 13, 2010

DURHAM, N.C. — A Durham retirement community was put under quarantine after leaders there said norovirus sickened approximately 80 residents and 50 employees this week.

The origin of the virus hasn't been determined, DeWitt said.

Dewitt said Croasdaile Village hasn't seen an incident like this in the 11 years it has been open. The retirement community has approximately 630 residents and and 300 employees. It offers individual-living, assisted-living and skilled-nursing facilities.

The norovirus is a gastrointestinal disease that often breaks out in closed communities such as hospitals and cruise ships.

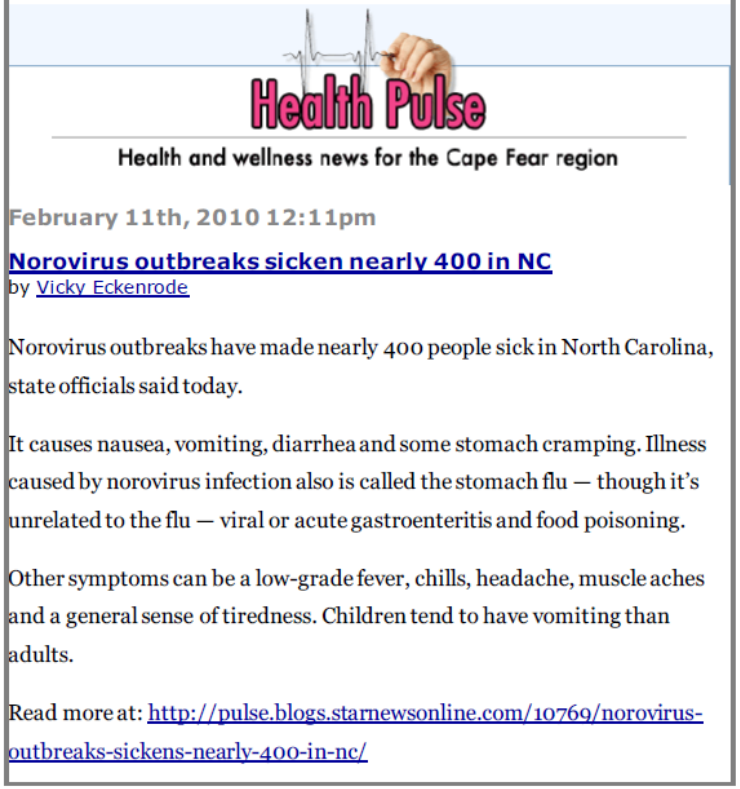
Read more at: http://www.wral.com/news/news_briefs/story/7030374/

Virus Hits Hundreds Across Carolinas

February 24, 2010

Health officials say a powerful stomach bug circulating around the Carolinas is the norovirus, which is similar to the stomach flu.

Read more at: http://www.wsoctv.com/news/22662447/detail.html



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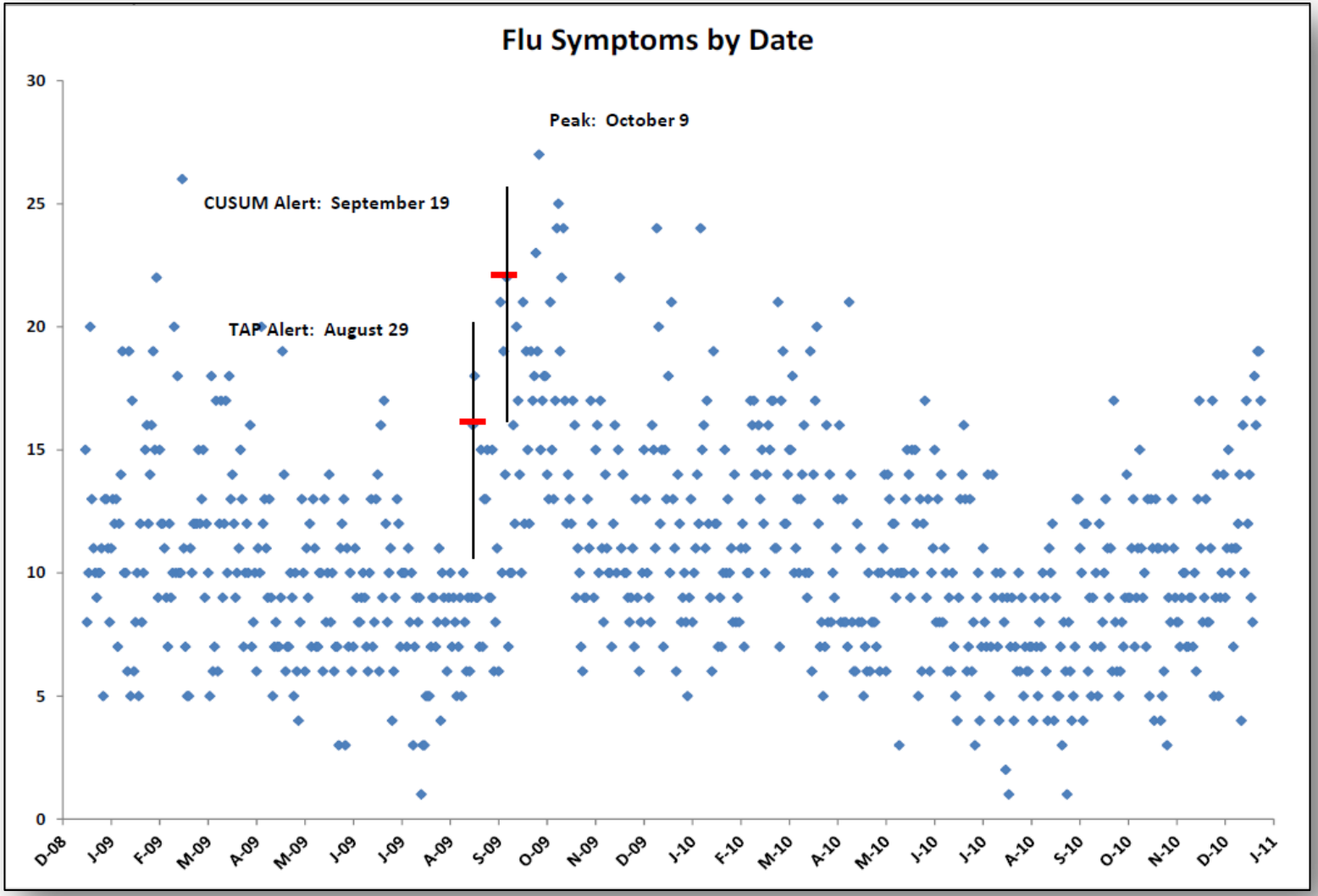
Piloting Advanced Analytics: EMS Flu data from 2009 and 2010; CUSUM and TAP Analysis



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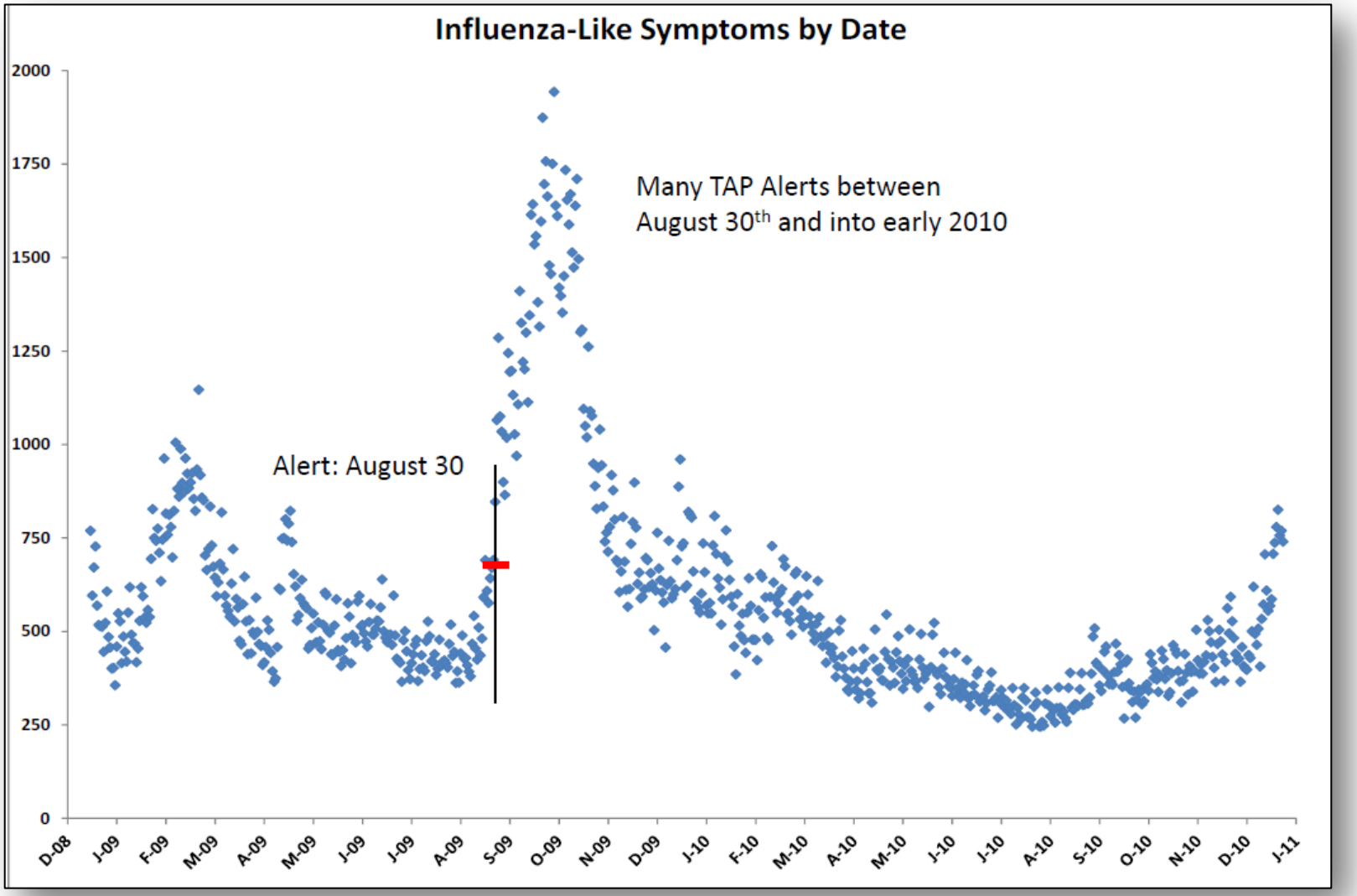

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Contact Information

- NBIC:
  - NBICOHA@hq.dhs.gov
  - 202-282-8597
- Dr. Steve Bennett, NBIC Director
  - Steve.Bennett@hq.dhs.gov
  - 202-254-6362
- Dr. Teresa Quitugua, NBIC Deputy Director
  - Teresa.Quitugua@hq.dhs.gov
  - 202-254-2217

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