

Discovering the New Frontier of Syndromic Surveillance: A Meaningful Use Dialogue on the BioSense 2.0 Implementation

ISDS March 2012 Meaningful Use webinar series
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Taha A. Kass-Hout, MD, MS

Director

Director, Division of Informatics Solutions and Operations
Public Health Surveillance and Informatics Program Office
Centers for Disease Control & Prevention (CDC)

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BioSense 2.0

- ❑ **Provides timely nationwide and regional picture for all hazards health-related events (including bioterrorism)**
- ❑ **Supports national, state, and local responses to those events**

Scope

Data Source: Data captured by health information system and sent to a public health authority defines the scope of this recommendation.

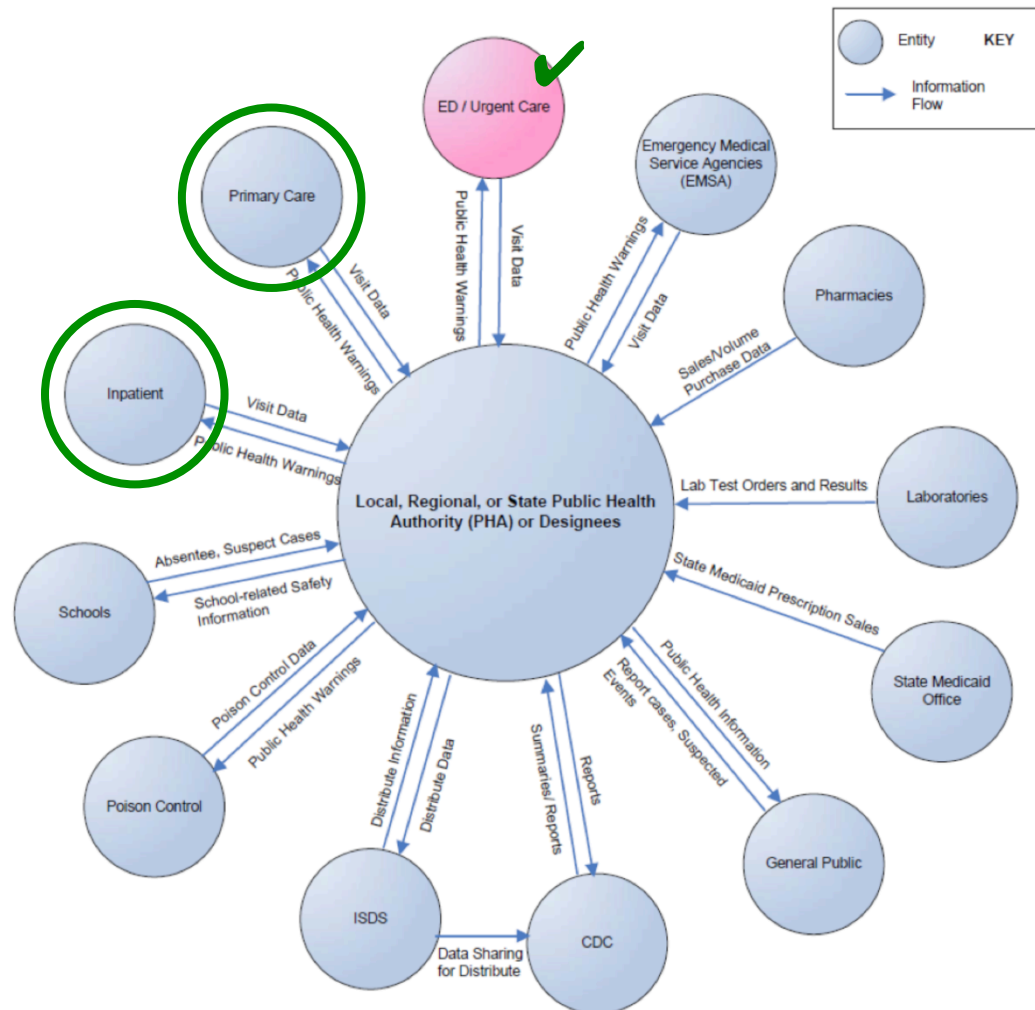
Progress to Date: **Emergency department (ED), urgent care (UC) patient visits, Inpatient care, and Ambulatory care (EP's)**

Surveillance Goal: Assessment of community and population health for **all-hazards** defines the scope of this recommendation.

Message and Vocabulary

Standards: Standards that support current and continued PHSS improvements, while maintaining consistency with those **standards required by the CMS EHR Reimbursement Program** define the scope of this recommendation

Public Health Syndromic Surveillance Context Diagram



October 2011

33 Elements

3 Core Business Processes

17 Core

16 Optional

Performing
Syndrome-based
Surveillance

Establishing
New Data
Source

Monitoring
Data
Quality

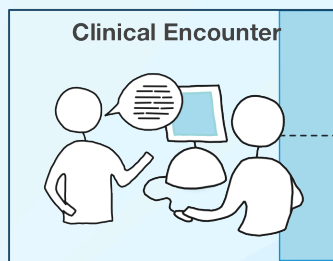


Encounter
Data



Public Health
Prevent. Promote. Protect.

**Health Information
Exchange**



Clinical Encounter



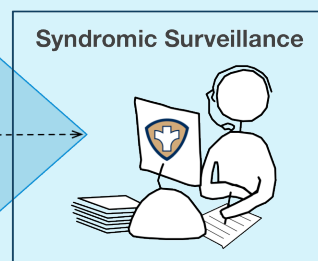
**EHR
Technology**



Message



**Public
Health IT**



Syndromic Surveillance

NOW AVAILABLE

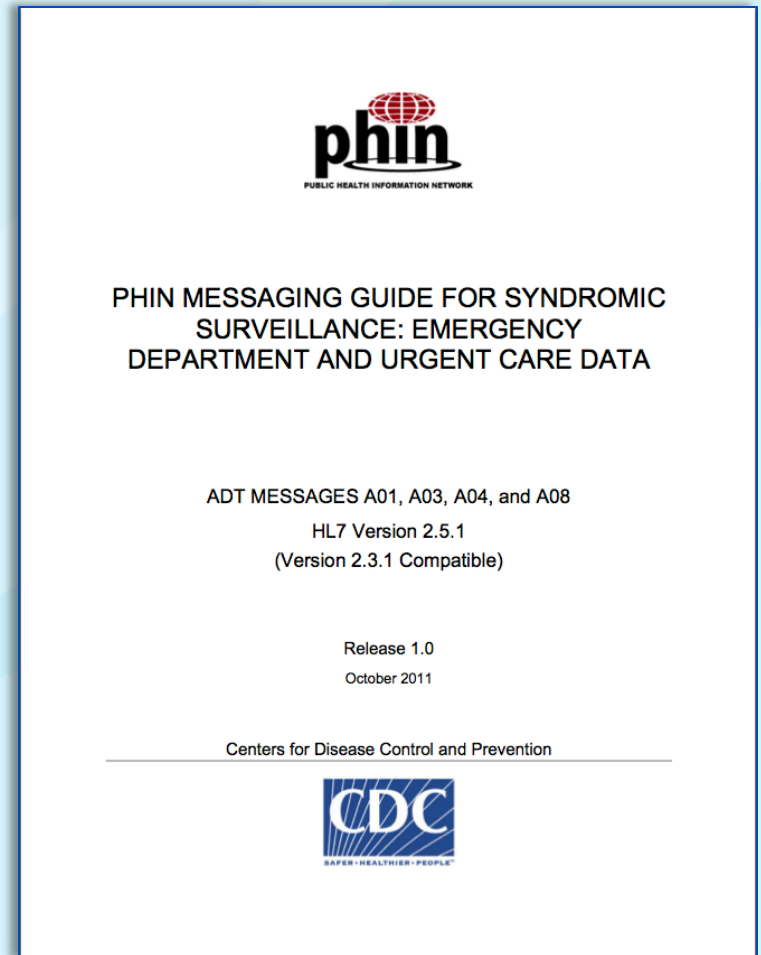
PHIN Guide for SS: Emergency Department & Urgent Care Data, Release 1.0

Revised and improved

- Based on feedback through Federal Registry post 5/11-6/11
- Better suit the intent of Meaningful Use policy
- Added FAQ to address specific issues and needs for clarification

Highlight changes

- **Data Elements of Interest – Usage**
 - 17 required (R or RE)
 - 16 optional (O)
- **Data Elements of Interest – Vocabulary**
 - Treatment Facility ID
 - Race, Ethnicity, Gender
- **Extended data elements**
 - Increased guidance
- **Business rules**
 - Transmission and updating



BioSense 2.0 Value for State and Local

Four primary services

Catcher's Mitt (Jurisdiction's Locker)

- Provides for securely receiving (multiple channels), storing, and processing high volumes of data for jurisdictions at no cost to them
- Meaningful-Use ready

Data Conversion

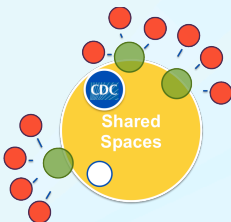
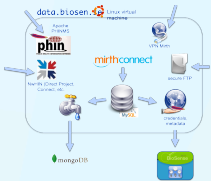
- Can receive all data forms and formats, including HL7 (2.3.1. or 2.5.1) or CDA, and convert them to any format an individual health department uses

Analytics

- Compatible environment for the users' requested analytic tools (CUSUM, Change Point Analysis, etc.) and offers other tools (ESSENCE, the R statistical package, EpiInfo, phpMyAdmin, etc.)

Collaboration (Shared Space, including Public-Access Option)

- Allows for ad-hoc or continual data sharing among jurisdictions, with full jurisdictional control, and based on data use agreements initiated by the jurisdiction and signed with ASTHO



BioSense 1.0 Value in Sharping MUse

- ☐ **Data elements prioritization**
- ☐ **Gulf Oil Spill**
- ☐ **HAI Surveillance**
- ☐ **Influenza Comorbidity**
- ☐ **Post-disaster response surveillance**
- ☐ **Oral health study**
- ☐ **Suicide ideation/attempt study**
- ☐ **Routine surveillance**

Data Elements Prioritization for MUse Recommendations

- ❑ Found patient chief complaint of self-reported fever was more readily available in ED records than measured temperature
- ❑ Majority of patients with an elevated temperature recorded also self-reported fever
- ❑ Due to its currently limited availability, we conclude that measured temperature is likely to add little value to self-reported fever in syndromic surveillance for febrile illness using ED records

Measured Temperature (T)	Self-Reported Fever (F)				Total	
	Yes (F+)		No (F-)			
	N	%	N	%	N	%
> 38 °C (T+)	58,997	2.73	39,628	1.84	98,625	4.57
<= 38 °C (T+)	100,700	4.67	1,958,873	90.76	2,059,573	95.43
Total	159,697	7.40	1,998,501	92.60	2,158,198	100.00

Gulf Oil Spill – All Hazards Surveillance

□ The BioSense Program:

- Monitored 21 health conditions in the coastal region of the 5 Gulf States using Department of Defense (DoD), Veteran's Affairs (VA), and non-federal facility data.

Sub-syndromes		
Abdominal pain	Dyspnea	Respiratory failure
Allergy	Food poisoning	RSV
Alteration of consciousness	Headache	Shock
Asthma	Hemoptysis	Syncope and collapse
Bronchitis and bronchiolitis	Intestinal infections, ill-defined	Upper respiratory infection
Cardiac dysrhythmias	Jaundice	Visual impairment
Coma	Malaise and fatigue	
Convulsions	Migraine	Syndromes
COPD	Myalgia	Botulism-like
Cough	Nausea and vomiting	Gastrointestinal
Cyanosis and hypoxemia	Pleurisy	Neurological
Death	Pneumonia and lung abscess	Respiratory
Diarrhea	Pregnancy complications	Severe illness or death
Dizziness	Rash	
		Patient visit volume

Gulf Oil Spill – Mental Health Surveillance

- ❑ **Implemented a separate mental health surveillance activity by creating syndromes using ICD-9-CM codes**
 - Depression
 - Anxiety
 - Stress
 - Substance abuse
 - Suicide

Gulf Oil Spill – Collaboration

BioSense Enhanced Surveillance for Oil Spill: Florida, 05/07/2010

Background: The BioSense Program is monitoring healthcare activity in facilities located in states potentially affected by the oil spill in the Gulf of Mexico (Florida, Alabama, Mississippi, Louisiana, and Texas).

Methods¹

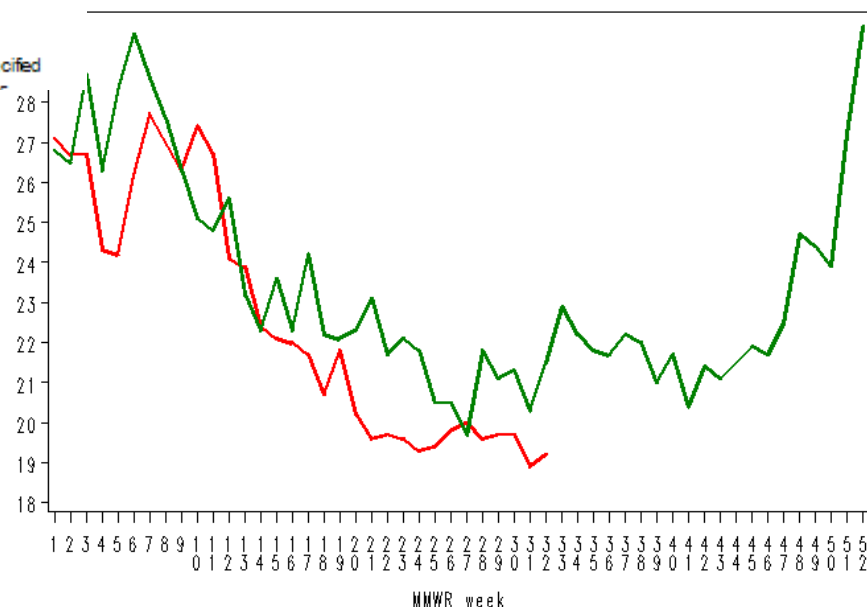
- Health conditions monitored are listed in the table in the following reports. Mapping definitions for the conditions are available upon request. Conditions monitored can be added/deleted as needed.
- Facilities, data types, and lag time:
 - Veterans Affairs (VA) and Department of Defense (DoD) facilities provide final diagnoses data (ICD-9-CM codes) from patient visits in outpatient facilities; there is a 2-5 day lag time between the time of the visit and the time the data are available in BioSense.
- Facilities in the coastal region of each state were selected for surveillance (see map, additional facilities can be added upon request). For Florida, this includes:
 - 16 / 23 DoD facilities
 - 22 / 48 VA facilities
- Reports include aggregated counts of visits and rates meeting the definitions of the specified health conditions on the specified day for each facility type (VA, DoD). A baseline rate is

6.6	186	22146	8.4
0	5	22146	0.2
25	710	22146	32.1
6.6	130	22146	5.9
2.6	132	22146	6
0	8	22146	0.4
14.5	243	22146	11
3.9	97	22146	4.4
0	71	22146	3.2
0	2	22146	0.1
0	6	22146	0.3
1.3	70	22146	3.2

facilities in LA, MS, AL, FL (N= 34)

Syndrome=Respiratory

PL0T 2010 2009



Clostridium difficile

- ❑ **Determine the feasibility of using BioSense laboratory data for surveillance on a disease of public health importance**
- ❑ **Apply surveillance definitions and calculate overall and facility rates of disease based on definitions created by the *C. difficile* Surveillance Working Group**

Clostridium difficile

- ❑ Identified positive *C. difficile* toxin assays and cultures in laboratory data sent to BioSense from January 1, 2007 through June 30, 2008
- ❑ Merged laboratory data with Admission, Discharge, Transfer (ADT) data to determine healthcare setting, patient demographics, and previous healthcare exposures
- ❑ De-duplicated data; earliest report kept for each unique patient

Text Reports

EIA positive for **C.difficile** toxin

POSITIVE FOR **C.DIFFICILE** TOXINS A AND/OR B CALLED TO, READ BACK AND
CONFIRMED BY KM 03/07/08 1330 BY CAM FINAL 03/07/2008

C. diff Toxin B SPECIMEN DESCRIPTION STOOL COMMENTS NONE TEST RESULT
POSITIVE FOR CLOSTRIDIUM DIFFICILE TOXIN B REPORT STATUS FINAL
03192007

Soft stool: Positive for **Clostridium difficile** toxin

***** MICROBIOLOGY ***** C. DIFFICILE TOXIN A & B EIA @ ACC#: COLL D/T:
12/31/07 1800 ----- FINAL REPORT ----- 02JAN08 **CLOSTRIDIUM**
DIFFICILE TOXIN A & B POSITIVE .END OF REPORT

SP 2020 01 RAPID MICROBIOLOGY TESTS ----- PROCEDURE: **CLOSTRIDIUM**
DIFF TOXIN A/B @ COLLECTED: 03/18/08 0945 SOURCE: STOOL
RECEIVED: 03/18/08 1552 STARTED: 03/18/08 1603 -----FINAL REPORT-----
FINAL REPORT 03/18/08 1954 POSITIVE for **C. difficile** Toxin A
and/or Toxin B @ = CLOS DIFF TXN A

Text Reports – Negative

C.difficile toxins are **absent** or below the limit of detection

NEGATIVE FOR C.DIFFICILE TOXINS A AND/OR B FINAL 05/24/2008

***** MICROBIOLOGY ***** C. DIFFICILE TOXIN A & B EIA @ ACC#:02-xxxxx
COLL D/T:06/18/08 0630 ----- FINAL REPORT ----- 18JUN08
CLOSTRIDIUM DIFFICILE TOXIN A & B **NOT DETECTED**

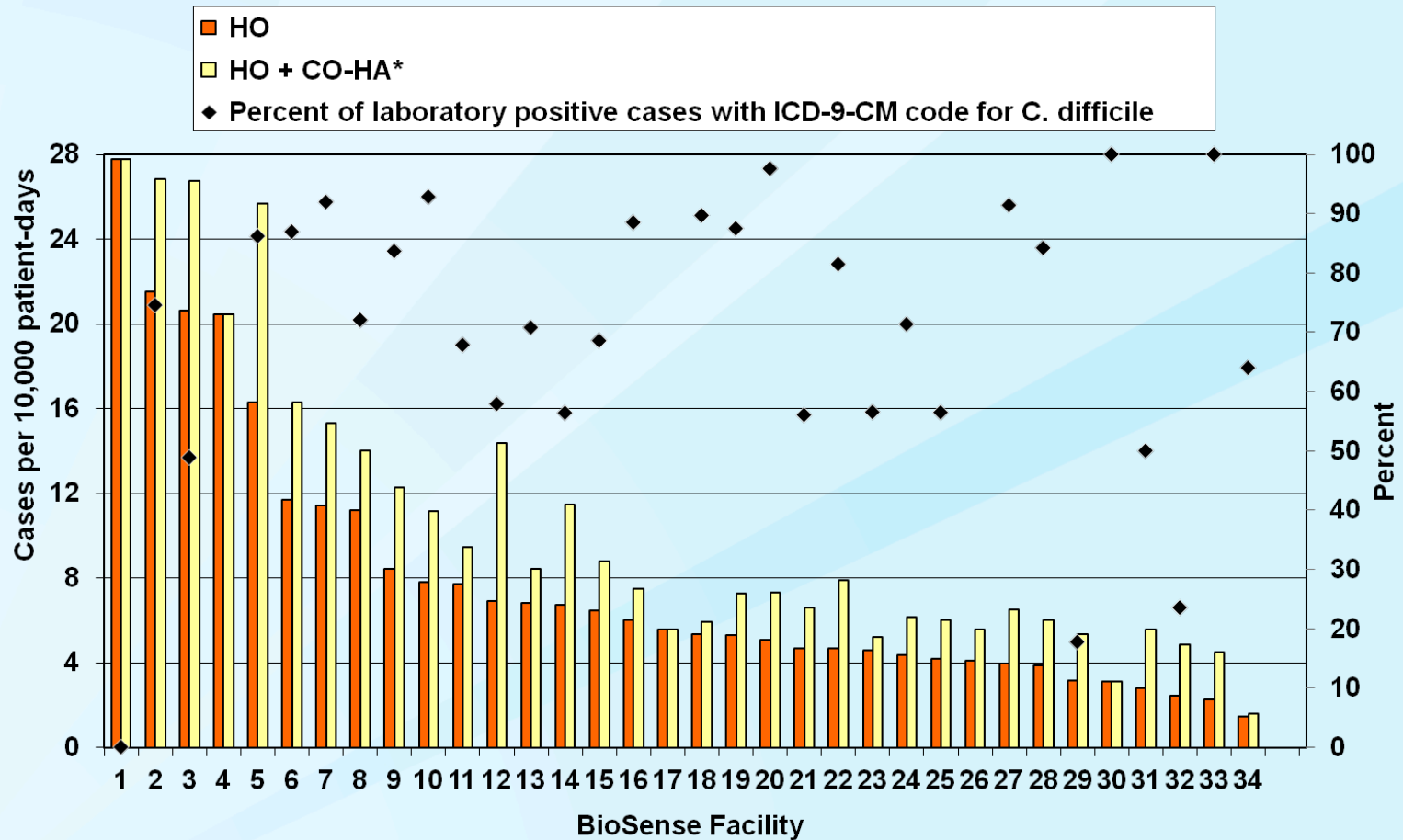
Clostridium difficile toxin A and/or B **not present**.

No Clostridium difficile toxin detected.

C. diff Toxin EIA SPECIMEN DESCRIPTION STOOL COMMENTS NONE TEST
RESULT **CANCELLED** REQUEST CANCELLED. THIS TEST EXCEEDED REPLICA
LIMIT. SPECIMEN WILL BE HELD 24 HOURS. CALL LAB AT xxx-xxx-xxxx IF
NECESSARY. REPORT STATUS FINAL

***** MICROBIOLOGY ***** C. DIFFICILE TOXIN A & B EIA @ ACC#:xx-xxxxxx
COLL D/T:01/05/07 1040 ----- FINAL REPORT ----- 06JAN07
SPECIMEN REJECTED. Testing for C. difficile toxins will only be performed on one
specimen within a 24 hour timeframe. Patient account has been credited for this test.

Results



Comparing BioSense to Other Studies

	BioSense	Kutty et al. ¹⁷	Dubberke et al. ²²	Sohn et al. ²³	Cambell et al. ²⁵	Chang et al. ^{24*}
Hospital-onset Proportion	47.0%	42.2%	8.9	8.7	6.4-7.9	
Rate per 10,000 patient-days	7.8	1.4 – 16.8	3.9 – 15.8			
Facility rate range per 10,000 patient-days	1.5 – 27.8					
Hospital-onset + Community-onset – Hospital-associated Rate per 10,000 patient-days	10.5	3.0 – 19.0		10.5		
Facility rate range per 10,000 patient-days	1.6 – 27.8					
Community-onset proportion	53.0%	57.8%				
Community-onset - Hospital-associated proportion	30.8%	15.6%				64.0%

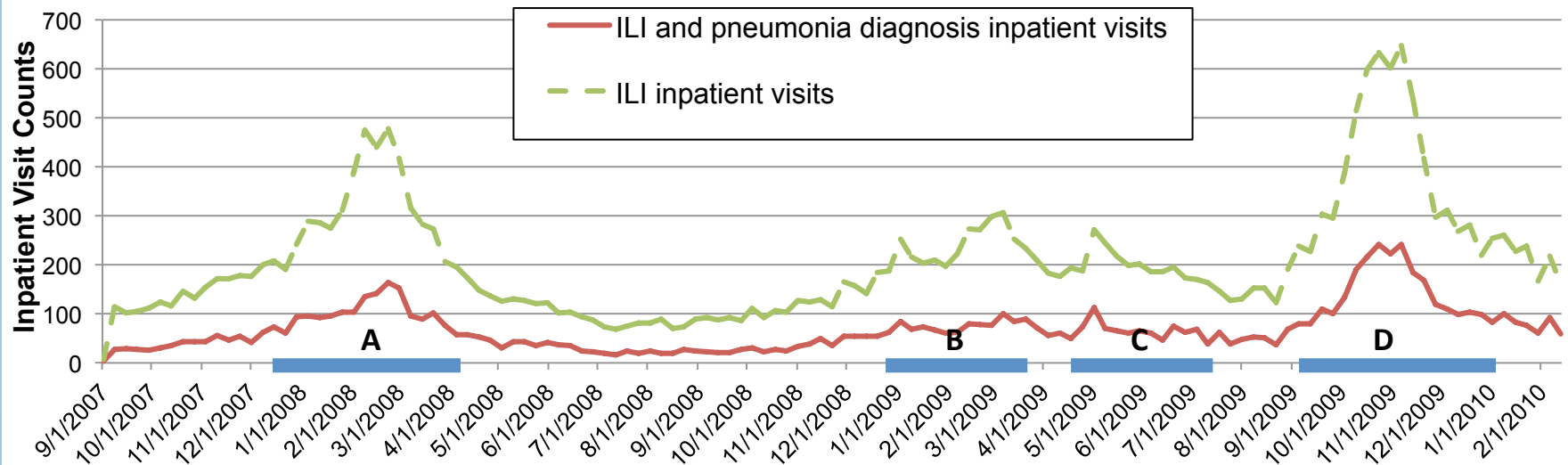
Pneumonia among hospitalized patients with Influenza-like Illness

- ❑ Track secular trends in ILI and pneumonia**
- ❑ Identify risk factors for pneumonia in patients hospitalized with ILI**
- ❑ Identify bloodstream infections among patients with ILI and pneumonia**
- ❑ Study the use of influenza antiviral medications in hospitalized ILI patients**

Pneumonia among hospitalized patients with Influenza-like Illness

- ❑ **Identified hospitalized patients meeting our case definition of ILI**
- ❑ **Identified pneumonia and other underlying conditions using ICD-9-CM codes**
- ❑ **Merged administrative data with clinical laboratory and pharmacy data to identify patients with bloodstream infections and those receiving influenza antiviral treatment**

Hospitalized patients with ILI and ILI plus pneumonia, BioSense, September 2007 - February 2010 (26,987 hospitalizations)



Underlying conditions associated with a pneumonia diagnosis stratified by age group and controlling for influenza epidemic period among hospitalized patients with ILI

	0-17 years N=9,095	18-49 years N=7,435	50-64 years 4,625	65+ years 5,804
	OR (95% CI) ^b	OR (95% CI) ^b	OR (95% CI) ^b	OR (95% CI) ^b
Underlying conditions				
Asthma	1.7 (1.5, 1.9)	1.1 (1.0, 1.3)	1.1 (0.9, 1.3)	1.0 (0.9, 1.2)
Malignancy	0.4 (0.2, 0.8)	0.9 (0.7, 1.2)	0.8 (0.7, 1.0)	1.0 (0.9, 1.1)
Cardiac disease	1.2 (1.0, 1.5)	1.4 (1.2, 1.5)	1.1 (1.0, 1.3)	1.1 (1.0, 1.2)
COPD ^c	Not applicable	2.1 (1.6, 2.7)	1.2 (1.1, 1.5)	1.4 (1.2, 1.6)
Diabetes	0.9 (0.5, 1.7)	1.0 (0.8, 1.1)	0.9 (0.8, 1.0)	0.8 (0.7, 0.9)
Hemoglobinopathies	0.8 (0.6, 1.0)	0.8 (0.7, 1.0)	1.0 (0.7, 1.3)	1.0 (0.8, 1.3)
Immunosuppressive disorder	1.0 (0.8, 1.3)	1.4 (1.2, 1.6)	1.5 (1.2, 1.9)	1.4 (1.0, 1.9)
Neuromuscular disease	1.9 (1.5, 2.3)	1.4 (1.1, 1.9)	1.0 (0.7, 1.3)	1.1 (0.9, 1.4)
Obesity	1.5 (0.9, 2.4)	1.3 (1.1, 1.5)	1.0 (0.8, 1.2)	0.9 (0.7, 1.1)
Renal disease	1.1 (0.7, 1.7)	0.9 (0.7, 1.1)	1.0 (0.8, 1.2)	1.0 (0.9, 1.2)
Any condition above ^d	1.5 (1.3, 1.6)	1.0 (0.9, 1.1)	1.2 (1.0, 1.4)	1.0 (0.9, 1.2)

Microbiology Data on Bloodstream Infections

8,979 visits with pneumonia



3,242 (36.1%) visits with potential laboratory data



2,993 (33.3%) had a lab result



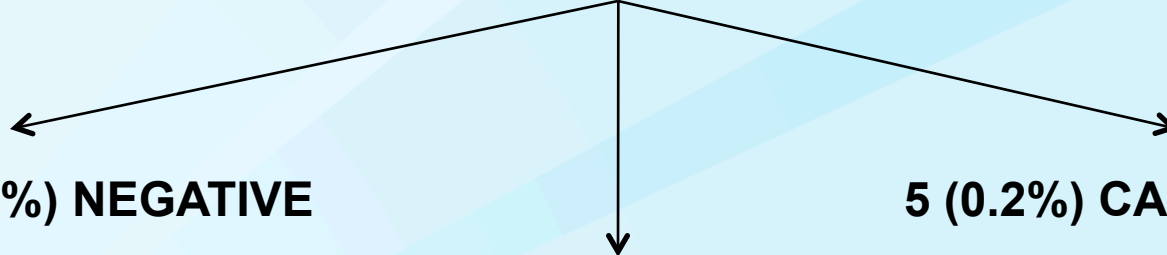
2,956 (32.9%) had a LOINC^a code



2,240 (24.9%) had LOINC code for blood culture (600-7)



2,212 (24.6%) had "Final" results and LOINC code for blood culture



1,930 (87.3%) NEGATIVE

5 (0.2%) CANCELLED test

277 (12.5%) POSITIVE



107 (4.8%) True bloodstream infection

Microbiology Blood Culture Results

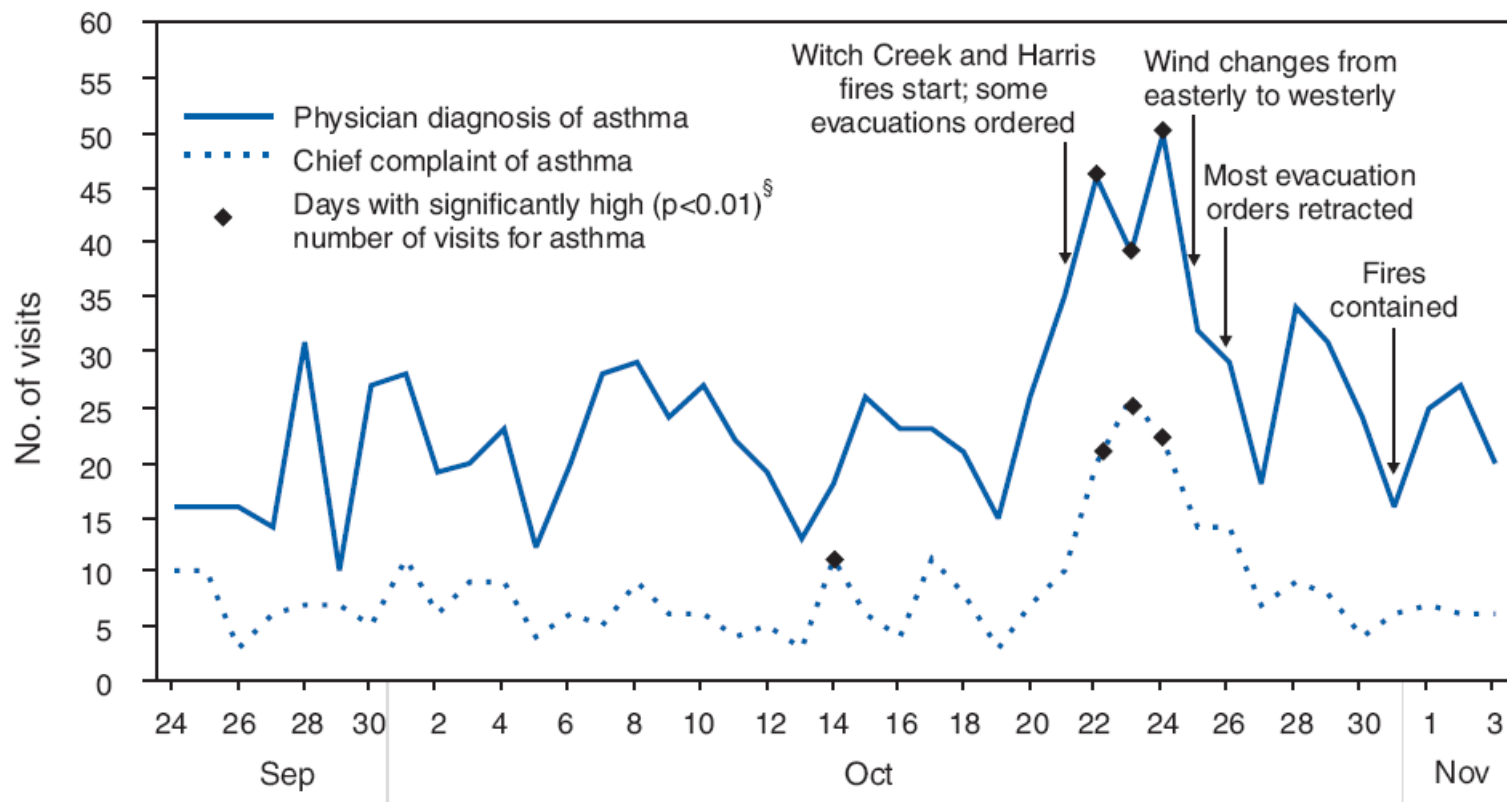
Pathogens	Count (%) N=110 (107 unique patients)
<i>Streptococcus pneumoniae</i>	41 (37.3)
<i>Staphylococcus aureus</i>	24 (21.8)
<i>Escherichia coli</i>	12 (10.9)
<i>Candida</i> spp.	10 (9.1)
<i>Klebsiella pneumonia</i>	8 (7.3)
beta-hemolytic streptococci ^f	6 (5.5)
<i>Pseudomonas aeruginosa</i>	5 (4.6)
<i>Bacteroides</i> spp.	2 (1.8)
<i>Enterobacter cloacae</i>	2 (1.8)

Influenza Antiviral Treatment for Hospitalized Patients with ILI

	No Influenza Epidemic	2007-2008 Seasonal Influenza	2008-2009 Seasonal Influenza	2009 Pandemic H1N1 Spring Wave	2009 Pandemic H1N1 Fall Wave	All Count (%)
Admissions with pneumonia	n=1,515	n=743	n=384	n=359	n=1,182	N=4,183
Antiviral treatment	128 (8.5)	127 (17.1)	10 (2.6)	65 (18.1)	650 (55.0)	980 (23.4)
Admissions without pneumonia	n=3,053	n=1,408	n=747	n=753	n=1,803	N=7,764
Antiviral treatment	105 (3.4)	175 (12.4)	24 (3.2)	90 (12.0)	659 (36.6)	1,053(13.6)

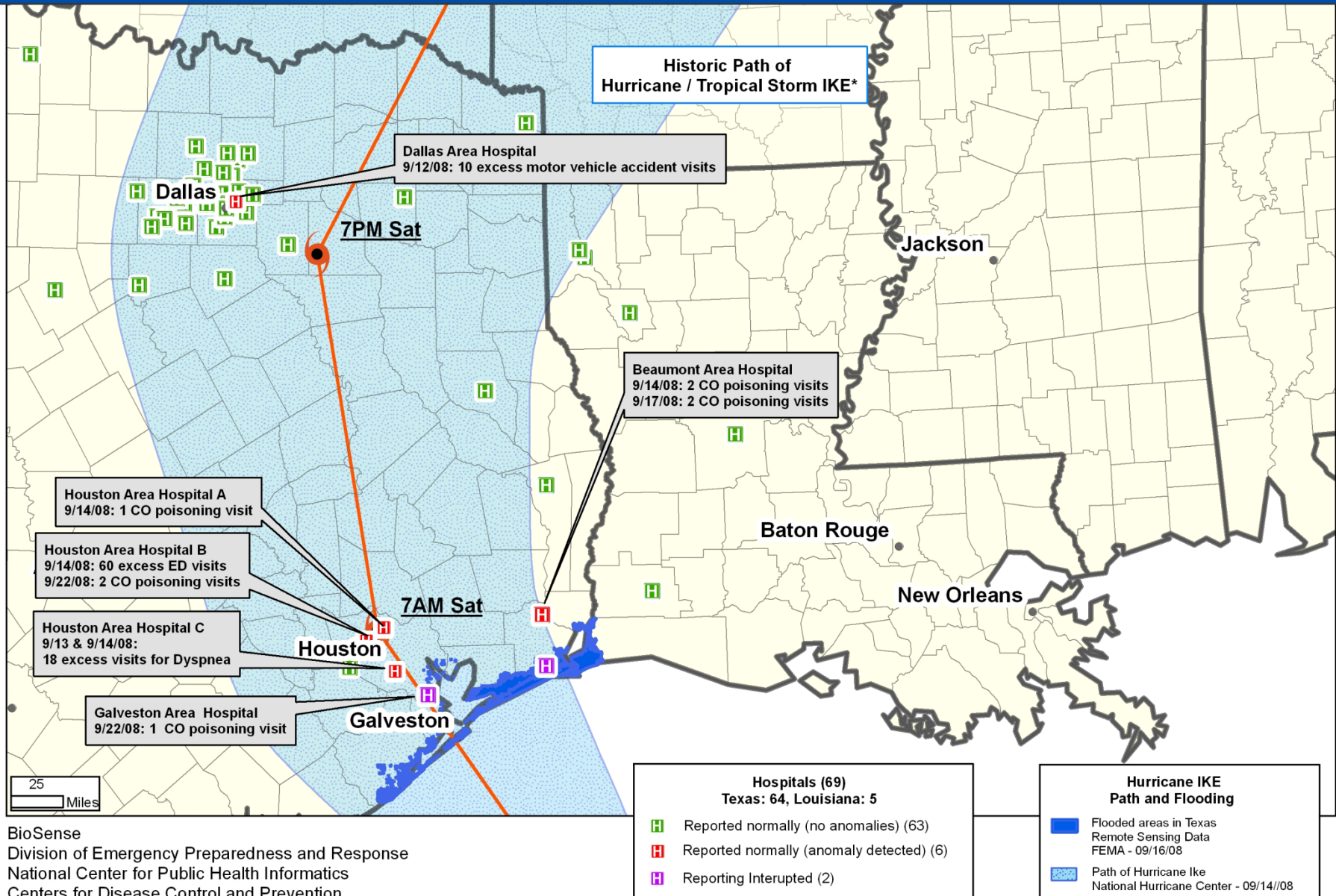
Post-Disaster Response

FIGURE 2. Number of emergency department visits, by chief complaint* and diagnosis† of asthma — six hospitals, San Diego, California, September 22–November 17, 2007



Monitoring health effects of wildfires using the BioSense System—San Diego County, CA, October 2007. MMWR 57: 741-744
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5727a2.htm?s_cid=mm5727a2_e

BioSense Facilities in Gulf Coast Region - September 12 - 25, 2008 -



BioSense and Hurricane Ike



Morbidity and Mortality Weekly Report

www.cdc.gov/mmwr

Weekly

August 14, 2009 / Vol. 58 / No. 31

Carbon Monoxide Exposures After Hurricane Ike – Texas, September 2008

During power outages after hurricanes, survivors can be at risk for carbon monoxide (CO) poisoning if they use portable generators improperly (*1*). On September 13, 2008, Hurricane

calls and deaths associated with CO exposures deemed to be unintentional were included in this analysis. CDC obtained surveillance data from five different sources: 1) the National

BioSense and Oral Health

- ❑ **Increase in # of ED visits due to dental problems that could be treated in outpatient setting**



Costly and inappropriate care

- ❑ **No surveillance system to characterize this problem**

BioSense and Oral Health

- ❑ **Assess the trend in the number of visits to EDs for ambulatory care sensitive dental problems (ACSDP) in NC by age group**
- ❑ **Identify rates of ACSDP ED utilization by county**

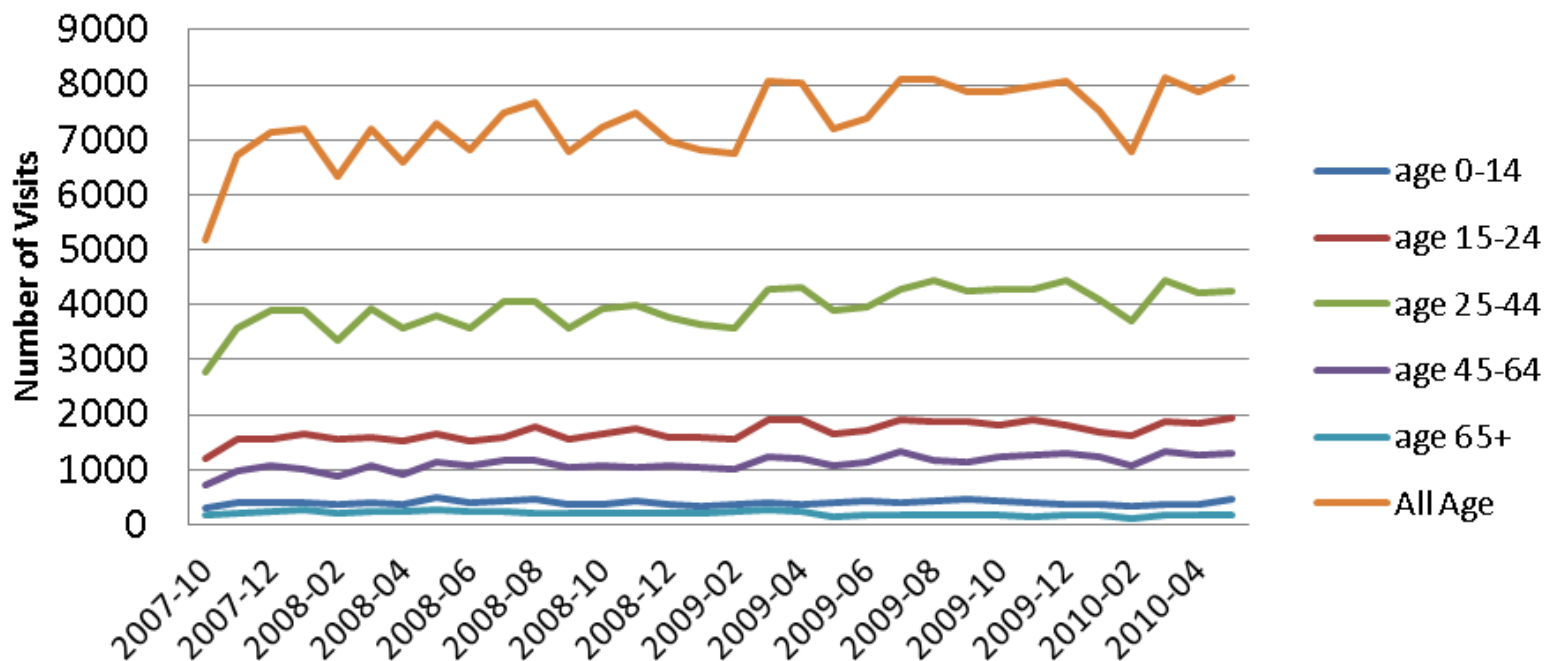
BioSense and Oral Health

- ❑ Defined ambulatory care sensitive dental problems with ICD-9-CM codes 521, 522, 523, 525, and 528 (tooth decay, gum diseases, oral abscesses)***
- ❑ Merged NC county-level population data for rate calculation**
- ❑ Rates were age-adjusted to NCHS 2000 standard population**

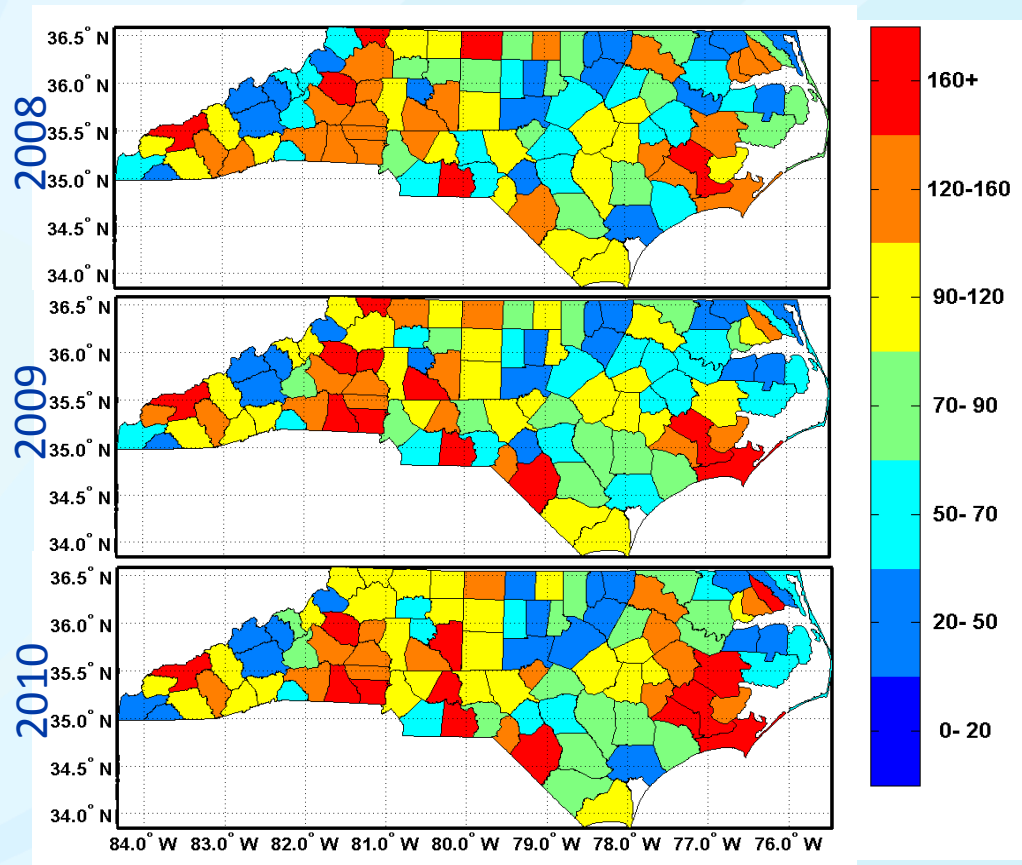
*Millman M. Access to Health Care in America. National Academies Press, 1993.

BioSense and Oral Health

Visits to Hospital Emergency Departments for Ambulatory Care Sensitive Dental Problems by month of visit and age in years - North Carolina, October 2007 - April 2010



BioSense and Oral Health



Estimated visit rates per 10,000 population

BioSense and Suicide

- ❑ **Assess the trend in suicide ideation and attempts using electronic ED chief complaints**
- ❑ **Defined suicide-related ED visits using text phrases from chief complaints**
- ❑ **Used Chi-square tests of trends to assess changes**

Suicide Ideation and Attempts

Figure A. Number of ED Visits with a Chief Complaint Involving Suicide Ideation or a Suicide Attempt by Quarter and Year: 2008-2010

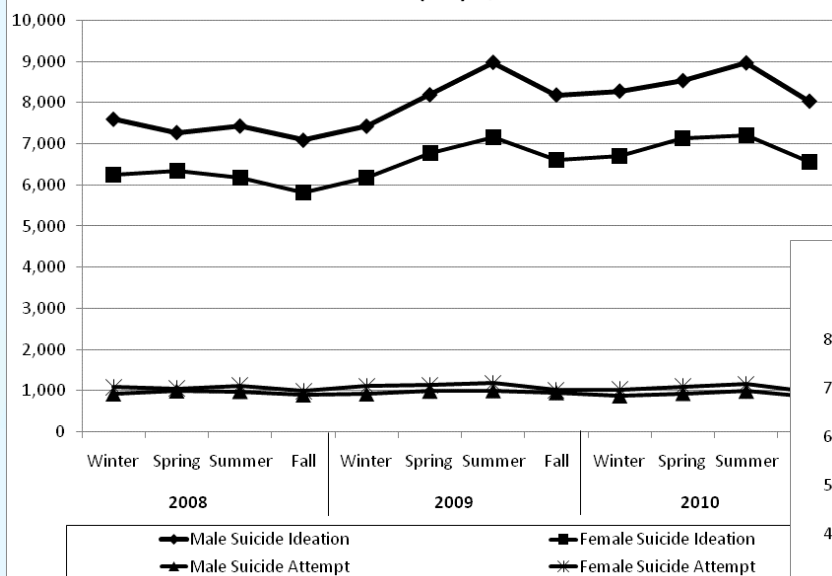
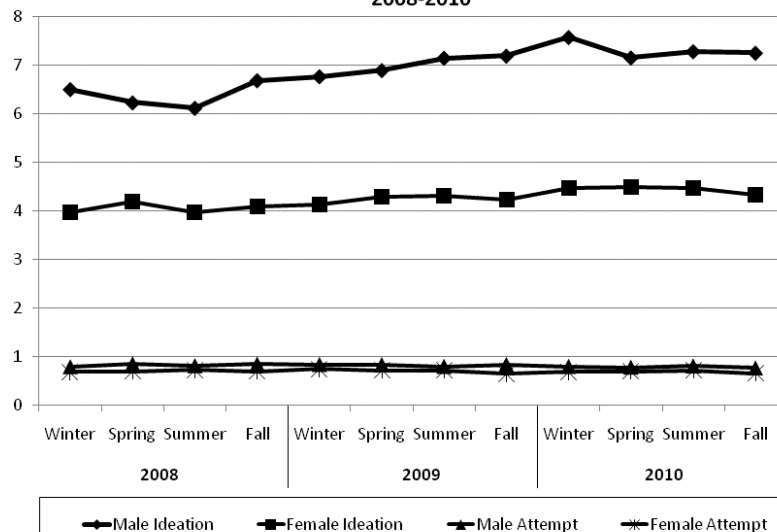


Figure B. Proportion of ED Visits per 1,000 with a Chief Complaint Involving Suicide Ideation or a Suicide Attempt by Quarter and Year: 2008-2010



Thank You!

<http://biosenseredesign.org>

<https://biosen.se>

info@biosen.se

Taha A. Kass-Hout, MD, MS

Director

Director, Division of Informatics Solutions and Operations
Public Health Surveillance and Informatics Program Office
Centers for Disease Control & Prevention (CDC)

Partners



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