

# ESSENCE Training: Gateway Region

Public Health Event Detection & Assessment (PHEDA) Program  
Missouri Department of Health and Senior Services

*Amy Kelsey and Fei Wu*

(573) 751-6161

<http://www.dhss.mo.gov/ESSENCE/>  
[ESSENCE@dhss.mo.gov](mailto:ESSENCE@dhss.mo.gov)



# Homeland Security Disclaimer

*This document was prepared under a grant from the United States Department of Homeland Security. Points of view or opinions expressed in this document and presentation are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Homeland Security.*

*Most of the material presented here was developed for the Missouri ESSENCE Program's routine training and technical support funded by the Centers for Disease Control and Prevention, Public Health Emergency Preparedness grant.*



# What is ESSENCE?

- *E*lectronic
- *S*urveillance
- *S*ystem for the
- *E*arly
- *N*otification of
- *C*ommunity-based
- *E*pidemics



# What is ESSENCE?

- Web-based automated surveillance tool
- Developed by Johns Hopkins University and Department of Defense
- Now widely used by civilian public health agencies and hospitals



# What is syndromic surveillance?

- Utilization of nontraditional data sources to detect health events earlier than possible with traditional methods like laboratory-confirmed diagnoses
- Two components
  1. Early event detection
  2. Situational awareness



# What is early event detection?

- Analysis of time-sensitive data for the purpose of detecting outbreaks as early as possible
- ESSENCE performs this function by creating an Alert List that displays potential outbreaks at the Hospital and County level



# What is situational awareness?

- ESSENCE can be used during ongoing health events to track impact in terms of time, geography, and demography
- Query portal can be used to track
  - Carbon monoxide poisoning following power outages
  - GI illness related to a known foodborne illness outbreak



# Missouri ESSENCE Mission

*Our mission is to help state and local partners respond to public health events by providing information and tools for early event detection and situational awareness*



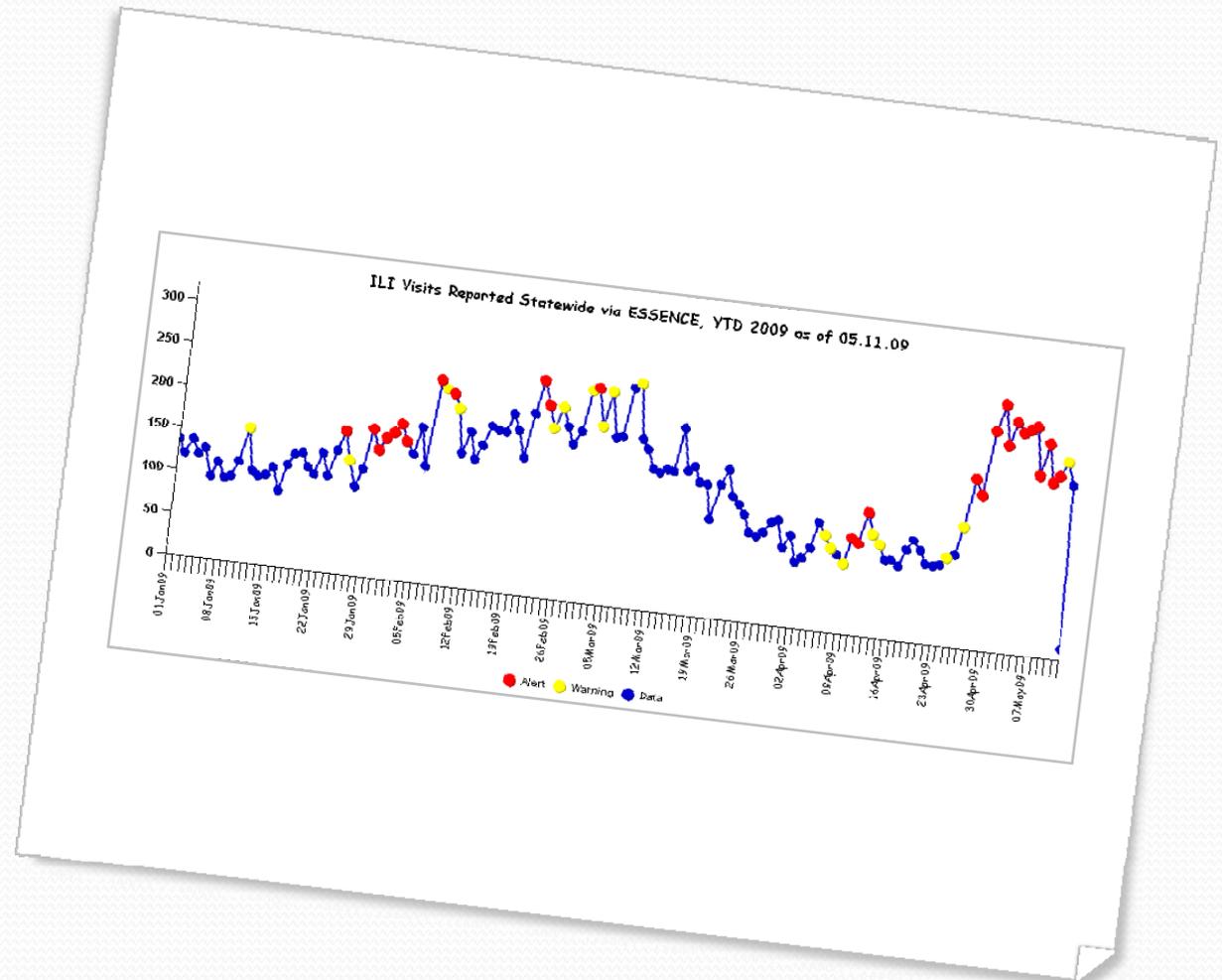
# Who is eligible for ESSENCE access?

- Any public health authority
  - Local public health agency (LPHA)
    - Missouri or Gateway area Illinois
  - Missouri DHSS
  - Illinois Department of Public Health
- Any staff from a hospital that sends data to DHSS and that are displayed in ESSENCE
  - Usually infection control staff
  - Anyone concerned with communicable disease or overall ED trends/reporting



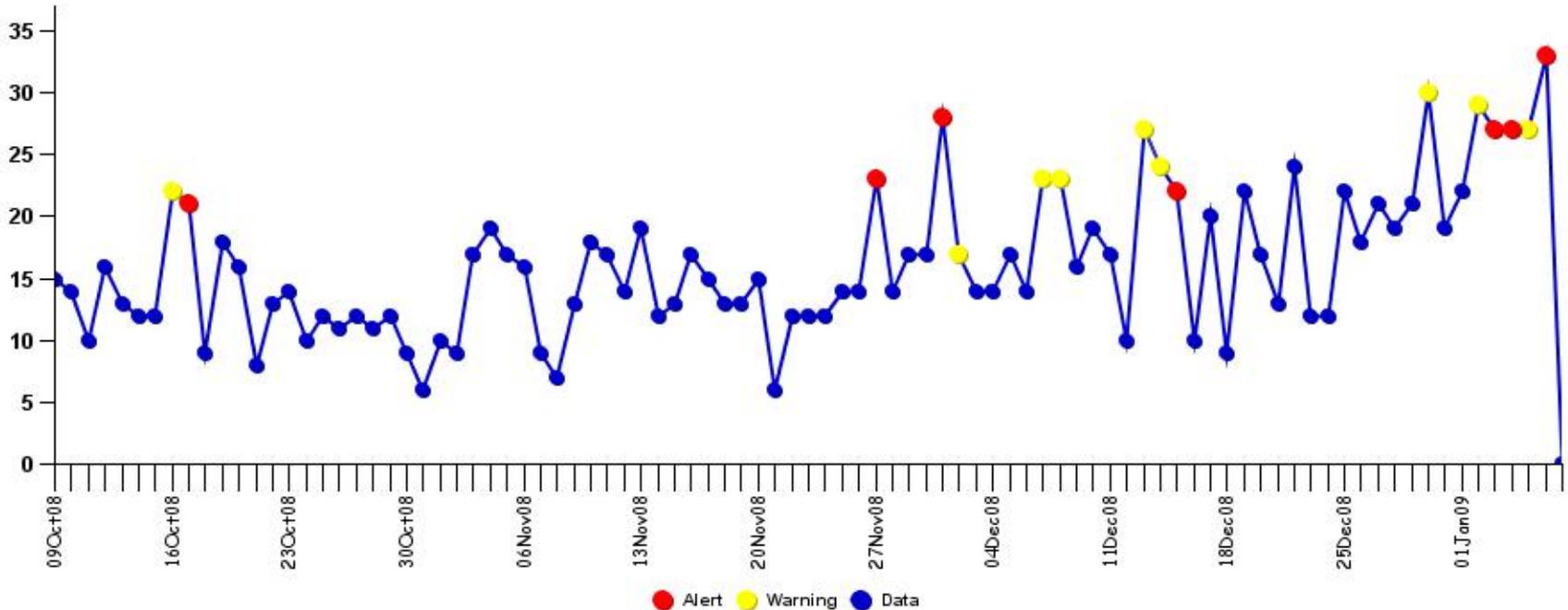
# How is ESSENCE Used in Missouri?

1. Routine Alert Investigations
2. Situational Awareness
3. Enhanced Surveillance
4. Outbreak Case Finding



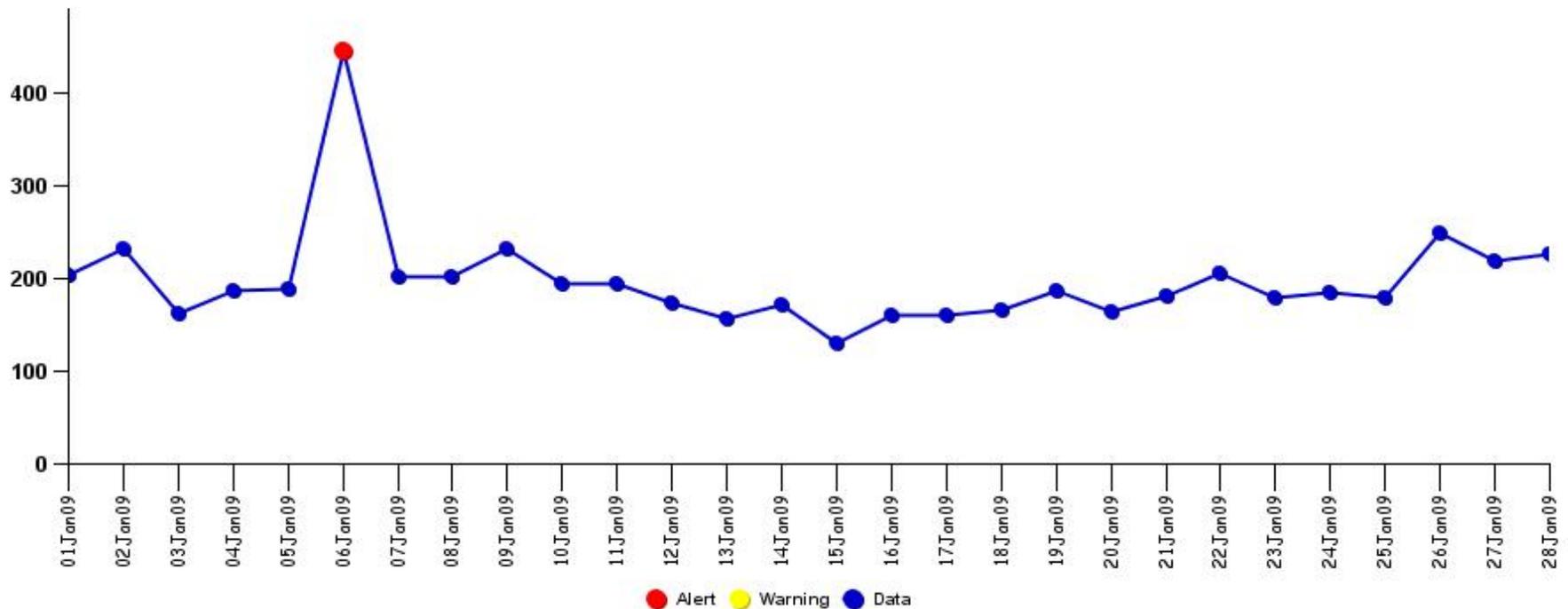
# Routine Alert Investigation

Daily Data Counts



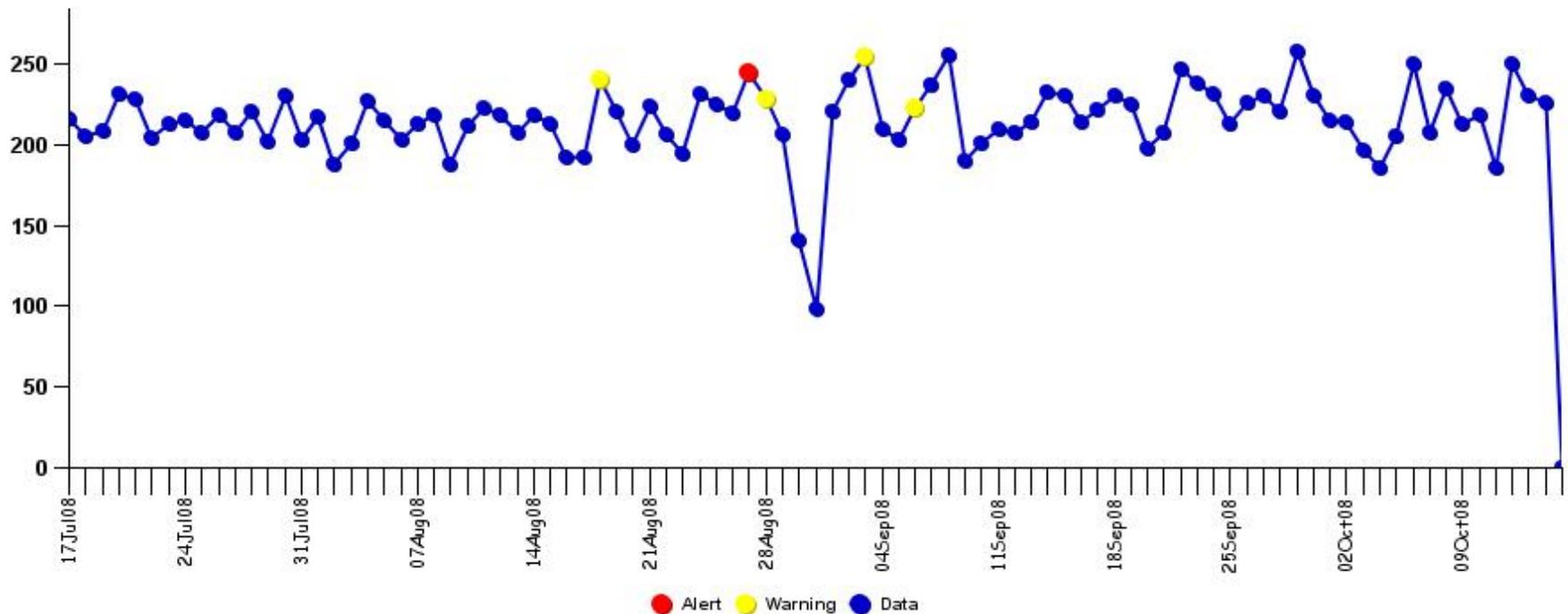
# Situational Awareness

Figure 1. Emergency Department Visits due to Slips and Falls Reported Via ESSENCE, January 1-29, 2009



# Situational Awareness

Daily Counts for All Visits -- St. Anthony's

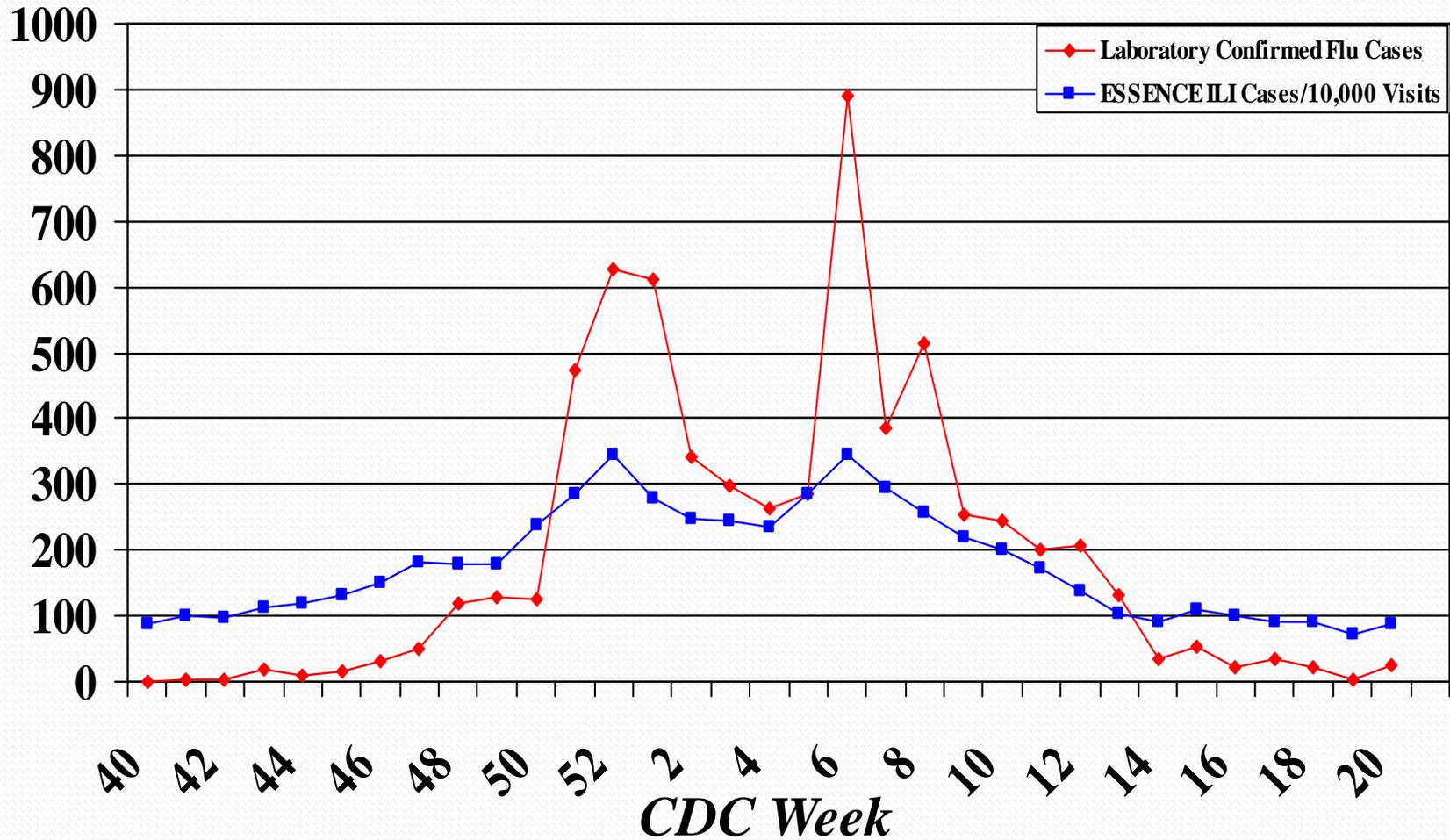


# Enhanced Surveillance

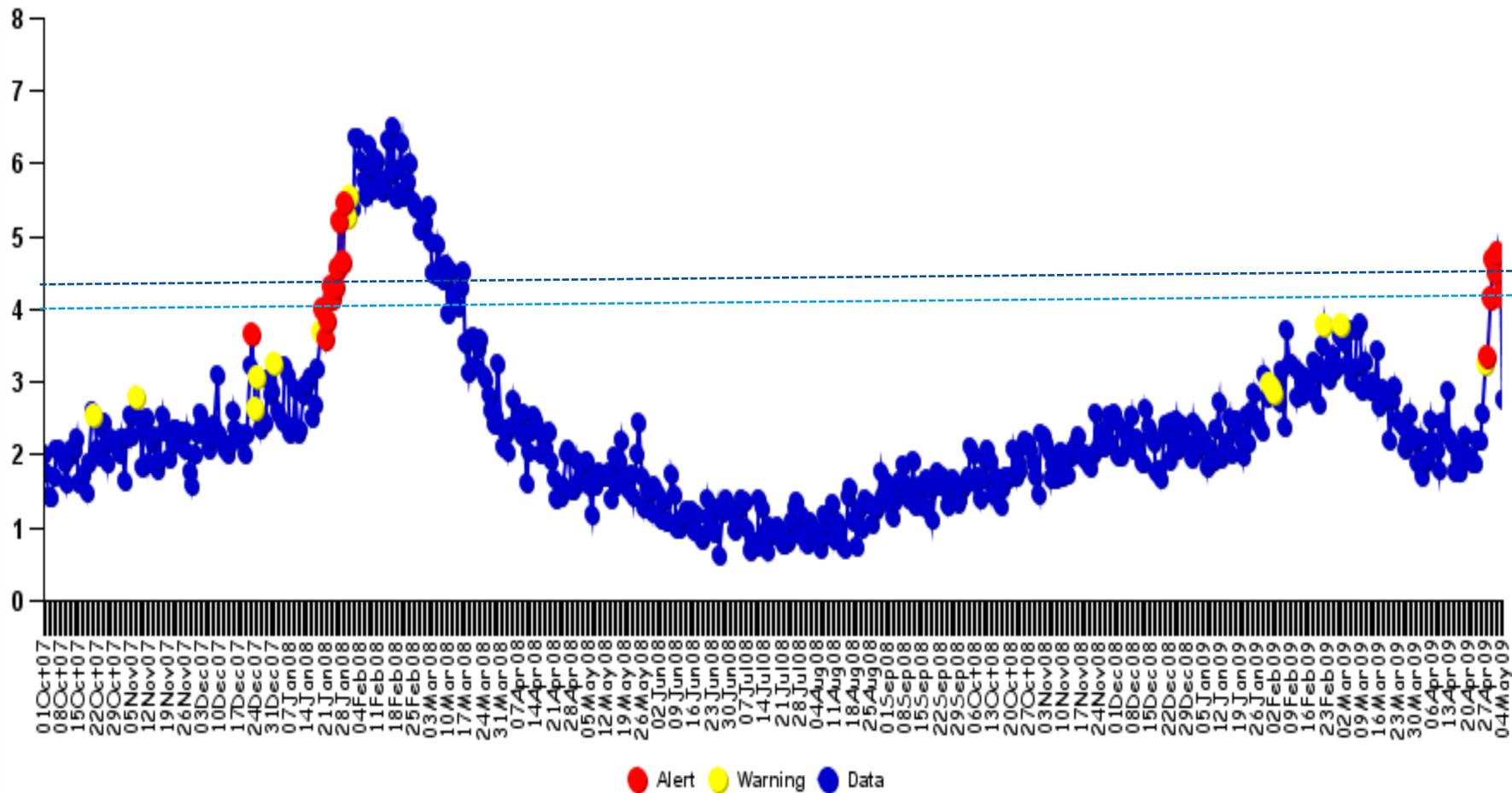
- Compare known morbidity data to ED visit data from ESSENCE
  - See how closely the two data sources track
  - Degree of overlap often unknown (co-linearity inevitable)
  - Seasonal flu and H<sub>1</sub>N<sub>1</sub>
- Case finding for Reportable Conditions
  - 2006 Hyperthermia (Reportable in MO)
    - National Weather Service in KC area comparing heat index data to ESSENCE heat illness data



# 2006-2007 Flu Season

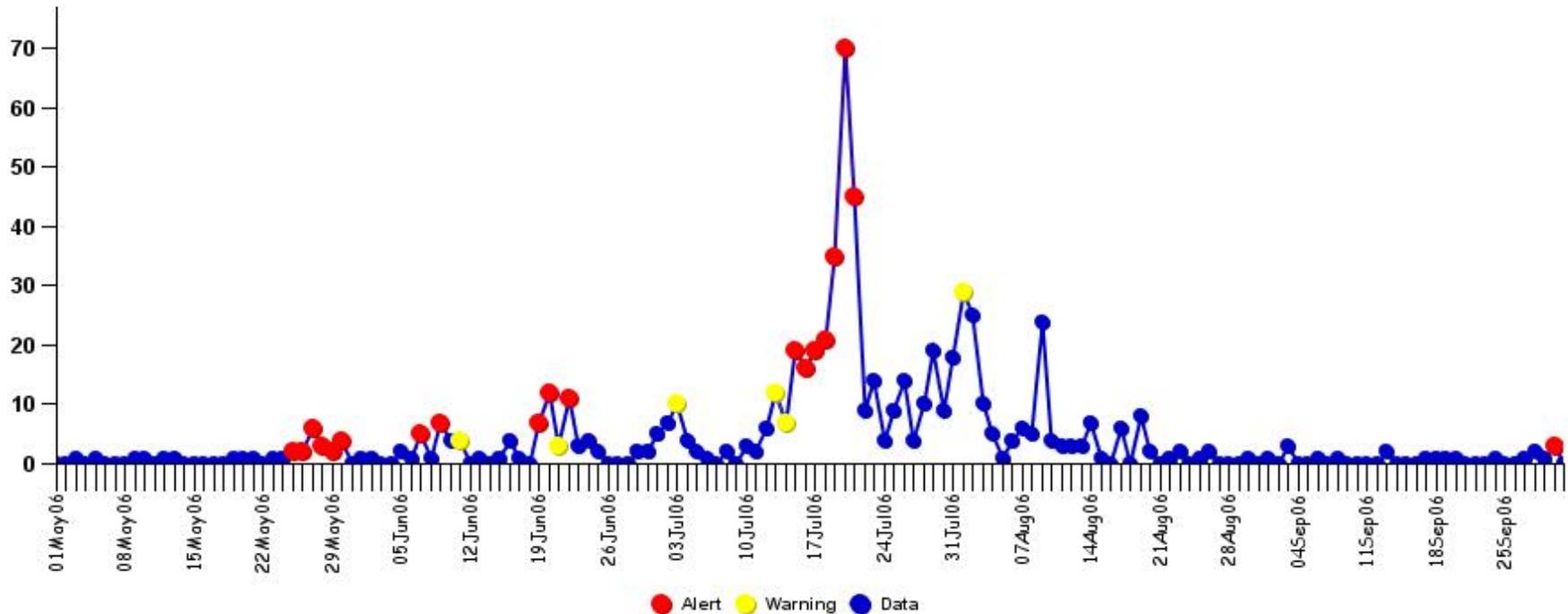


Daily Percent of ILI vs All Medical Groupings in Missouri (01Oct07~03May09)



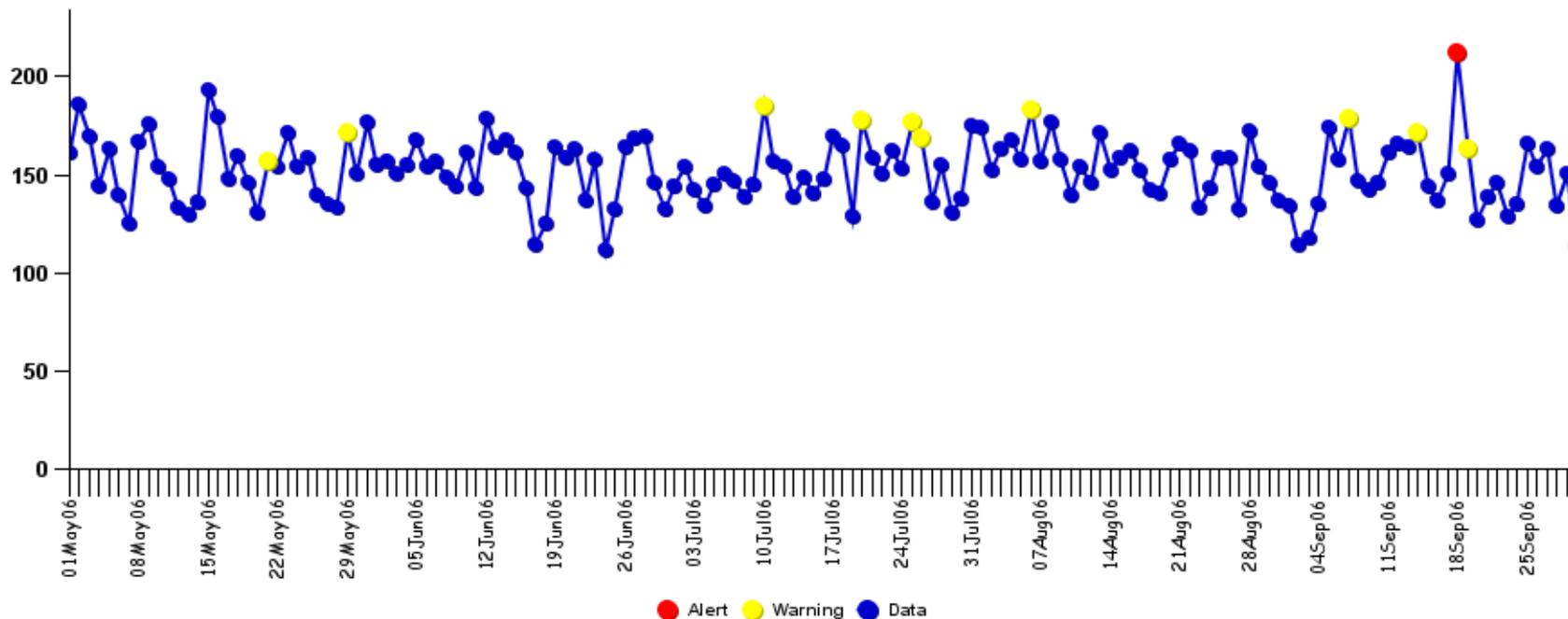
# Hyperthermia Surveillance

Frequency Potential Heat-related ER Visits, Missouri 2006



# Gastrointestinal Visits: Power Outages & Heat Wave 2006

GI Illness for St. Louis City and County, May-September 2006



# Outbreak Case Finding

- DHSS receives named patient data that are not loaded into ESSENCE
- Use case definition to find ED visits potentially associated with outbreak
- Compile names, contact info and share with public health authorities
- *Salmonella* St. Paul
  - Clustered in one county; shared with CDC
  - Never saw full report but heard we did match known cases and find new ones

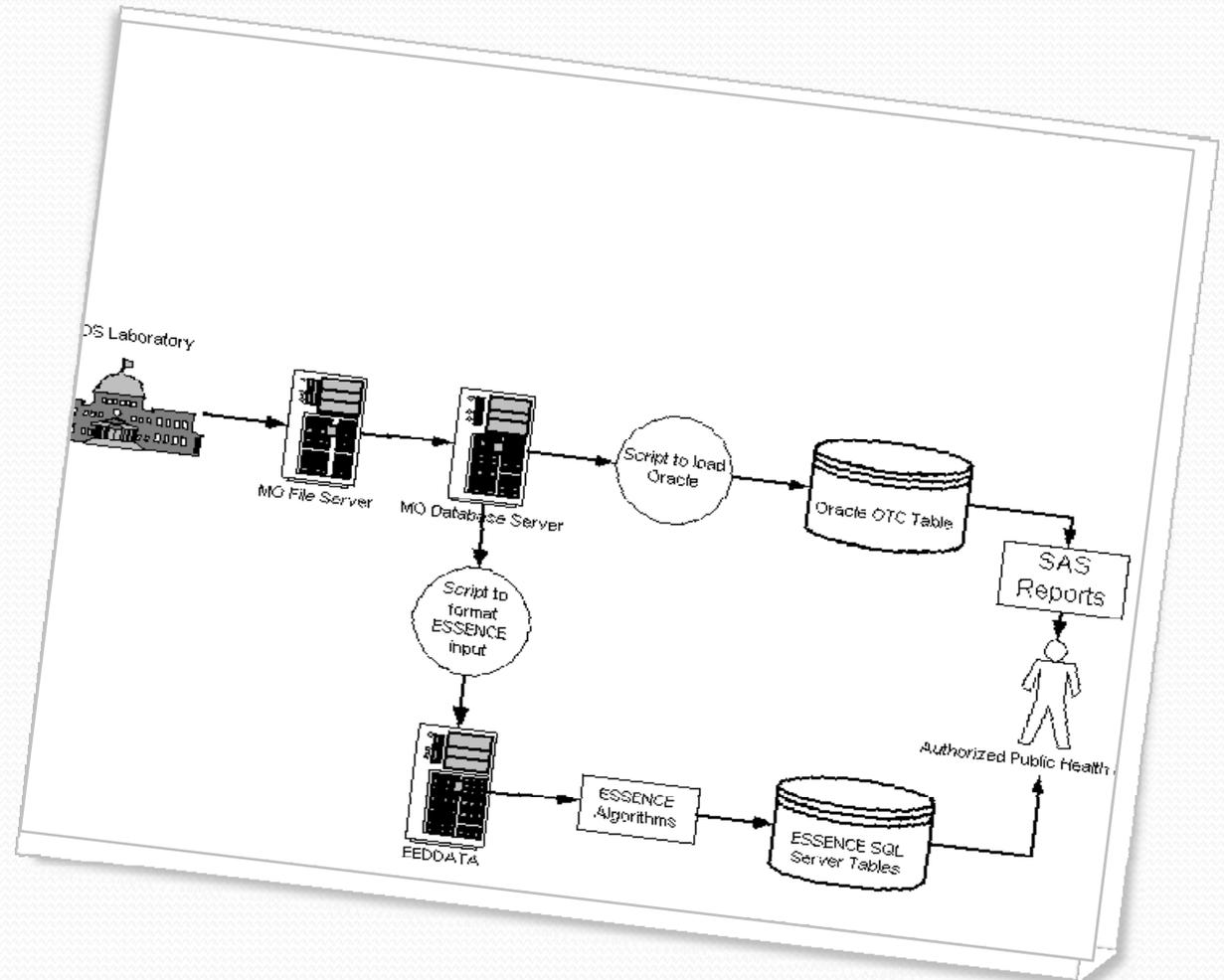


# Outbreak Case Finding

- ESSENCE is very good at this
- It is important to come up with a case definition first
  - Chief complaint keywords or syndrome/subsyndrome
  - Age range/sex/race
  - Geographic area
  - Date range/time of day
- We feel that it is more responsible to report what we find that fits the predefined case definition not hunting until we get the answer we want



# The Data



# Where do ESSENCE data come from?

- ESSENCE was acquired by DHSS in order to utilize the electronic emergency department (ED) data sent to DHSS under 19 CSR 10-33.040
- This Rule requires that 84 of Missouri's 120 hospitals with ED's send data to DHSS for the purpose of syndromic surveillance
  - Represents approximately 90% of all ED visits in MO



# Missouri ESSENCE Hospitals

## Northwest

Cameron Regional Medical Center, Inc.  
 Cass Medical Center  
 Bates County Memorial Hospital  
 Bothwell Regional Health Center  
 Centerpoint Medical Center  
 Children's Mercy Hospital  
 Excelsior Springs Medical Center  
 Golden Valley Memorial Hospital  
 Heartland Regional Medical Center  
 Hedrick Medical Center  
 Lafayette Regional Health Center  
 Lee's Summit Medical Center  
 Liberty Hospital  
 North Kansas City Hospital  
 Ray County Memorial Hospital  
 Research Belton Hospital  
 \*Research Medical Center  
 \*Research Medical Center - Brookside  
 St. Joseph Medical Center  
 St. Luke's East Lee's Summit Hospital  
 St. Luke's Hospital of Kansas City  
 St. Luke's Northland Hospital  
 St. Luke's Northland Hospital - Smithville  
 St. Mary's Medical Center of Blue Springs  
 Truman Medical Center - Hospital Hill  
 Truman Medical Center Lakewood  
 Western Missouri Medical Center

## Southwest

Citizens Memorial Hospital  
 Cox Monett Hospital  
 \*Lester E Cox Medical Center North  
 \*Lester E Cox Medical Center South  
 Ozarks Community Hospital  
 Freeman Health System - West  
 Freeman Neosho Hospital  
 McCune - Brooks Regional Hospital  
 Missouri Baptist Hospital of Sullivan  
 Nevada Regional Medical Center  
 Phelps County Regional Medical Center  
 St. John's Hospital ~ Lebanon  
 St. John's Regional Health Center  
 St. John's Regional Medical Center -Joplin

## Southeast

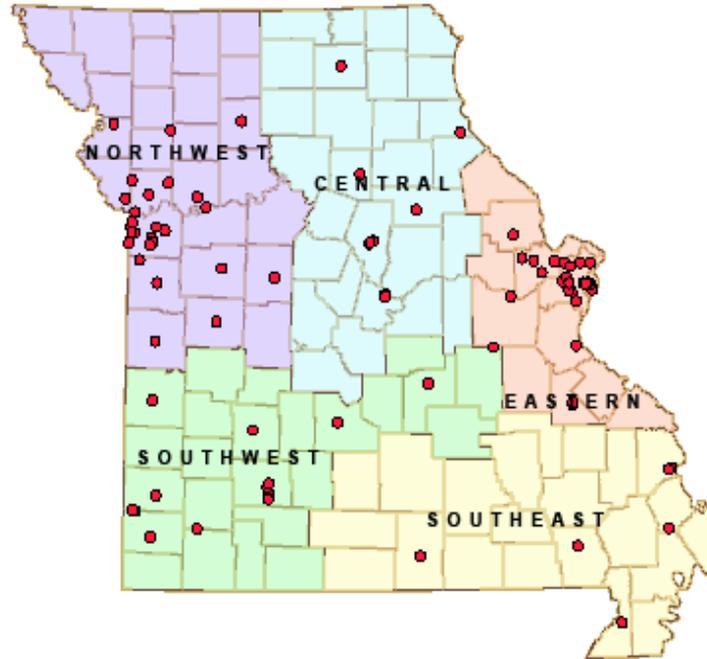
Missouri Delta Medical Center  
 Ozarks Medical Center  
 Poplar Bluff Regional Medical Center -North  
 Southeast Missouri Hospital  
 St. Francis Medical Center  
 Twin Rivers Regional Medical Center

## Eastern

\*Barnes-Jewish Hospital - North  
 \*Barnes-Jewish Hospital - South  
 Barnes-Jewish St. Peters Hospital  
 Barnes-Jewish West County Hospital  
 \*Christian Hospital Northeast  
 \*Christian Hospital Northwest  
 Des Peres Hospital  
 Forest Park Hospital  
 Jefferson Memorial Hospital  
 Lincoln County Memorial Hospital  
 Mineral Area Regional Medical Center  
 Missouri Baptist Medical Center  
 Parkland Health Center-Farmington  
 Progress West Health Care Center  
 SSM Cardinal Glennon Children's Hospital  
 SSM DePaul Health Center  
 SSM St. Joseph Health Center  
 SSM St. Joseph Health Center -Wentzville  
 SSM St. Joseph Hospital of Kirkwood  
 SSM St. Joseph Hospital West  
 SSM St. Mary's Health Center  
 St. Alexius Hospital  
 St. Anthony's Medical Center  
 St. John's Mercy Hospital  
 St. John's Mercy Medical Center  
 St. Louis Children's Hospital  
 St. Louis University Hospital - Main  
 St. Luke's Episcopal-Presbyterian Hospital

## Central

Audrain Medical Center  
 Boone Hospital Center  
 Capital Region Medical Center  
 Columbia Regional Hospital  
 Hannibal Regional Hospital  
 Moberly Regional Medical Center  
 Northeast Regional Medical Center  
 St. Mary's Health Center  
 University of MO Hospital & Clinics



\*These hospitals are submitting data in conjunction with other hospitals in their system.

# Where do ESSENCE data come from?

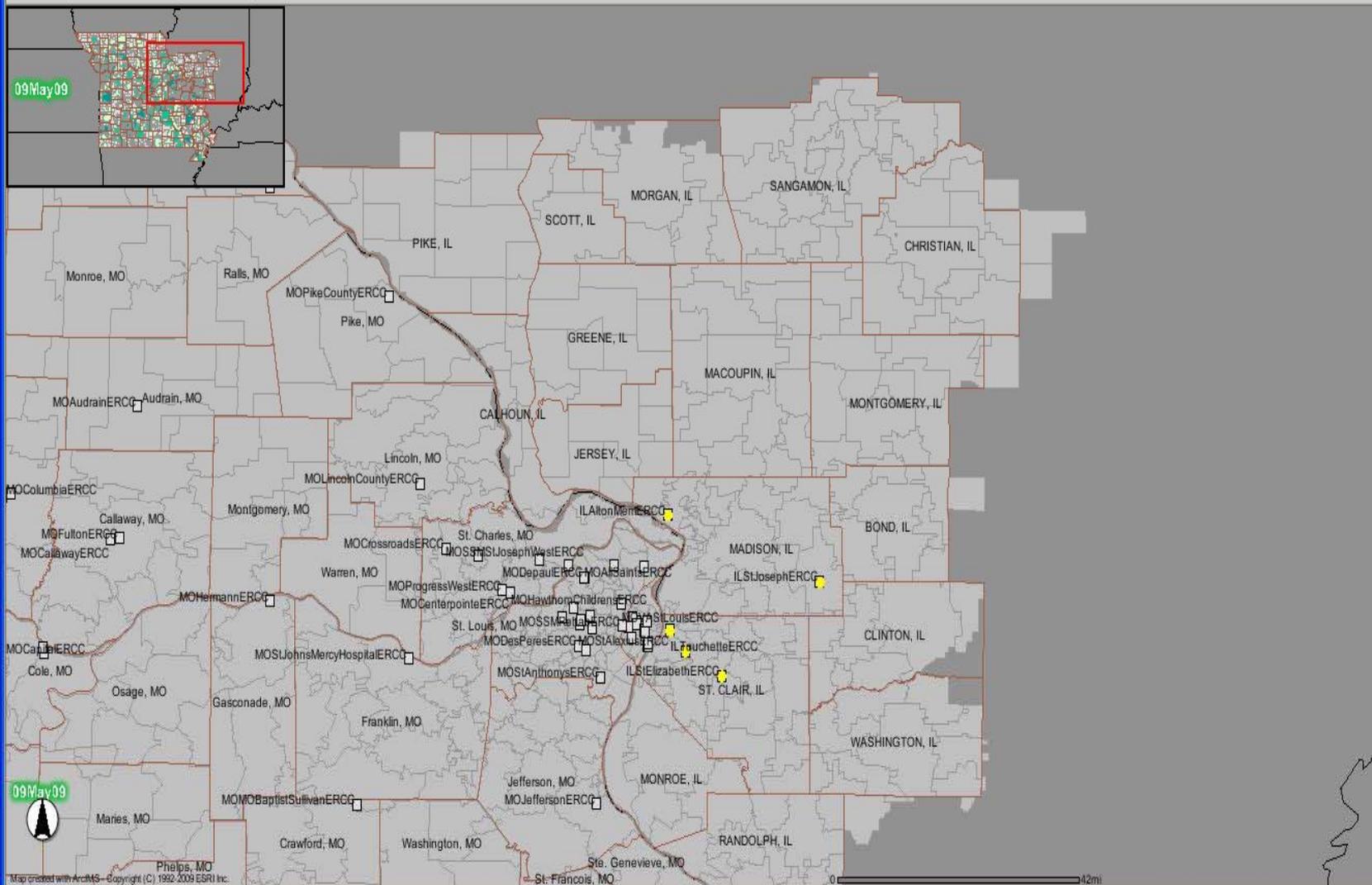
- Utilizes data from the “Hospital Information System” that each hospital maintains for its own purposes, like billing and patient records
- Put into a standard format (HL7) by each hospital and sent to DHSS in a secure manner
- Each have their own methodology and criteria
- **No special data entry required: use data already being entered into hospital’s information system**



# Illinois Hospital Data

- Data from hospitals in Madison, Monroe, and St. Clair counties in Illinois are loaded into the Missouri ESSENCE system
- ESSENCE data can be examined at the hospital level as well as at the county of residence
  - Several counties outside Madison, Monroe, St. Clair loaded for mapping and analysis





**LAYERS**

- All Layers
- Base Layers
  - Cities
  - Counties
  - DHSS Re
  - Highways
  - Hospitals
  - Lakes
  - Patrol Di
  - States
  - US Highw
  - Zips
  - theDate
- OTC Sales
  - nrdm
  - nrdm\_rtd
- ER By Hospital
  - hosp
  - hosp%
  - hosp\_rtd
- ER By Zipcode
  - er
  - er\_rtd
- Results
  - Results

Color Method: **Quartile**

**Legend**

- Selected Features
- Hospitals
- Hospitals:Labels
- Counties
- Counties:Labels
- Zips
- States

Hospitals

Rec	HOSPITAL	STATE	ZIP	NAME	ADDRESS	CITY	REGION	LAT	LOH
1	ILAltonMemERCC	IL	62202	ILAltonMemERCC	1 Memorial Drive	Alton	Madison, IL	8.904688	-0.164265
2	ILKennethHallIERCC	IL	62201	ILKennethHallIERCC	100 North 8th Street	East St. Louis	St. Clair, IL	8.8219645	-0.1580632
3	ILStElizabethERCC	IL	62220	ILStElizabethERCC	211 S. 3rd Street	Belleville	St. Clair, IL	8.510688	-0.98969
4	ILStJosephERCC	IL	62249	ILStJosephERCC	1515 Main Street	Highland	Madison, IL	8.740516	-0.6725048
5	ILTouchetteERCC	IL	62207	ILTouchetteERCC	5900 Bond Ave.	Centreville	St. Clair, IL	8.5708214	-0.1070887

[Zoom to these records](#)

# Data Loading

- Soon data received in real time will be loaded every 15 minutes every single day
  - Data received from smaller MO hospitals in batch files are loaded once daily
- Approximately new 8,000 ED visits are loaded each day for MO alone (varies by season)
- ESSENCE website available 24/7
- **Alert List will be generated once per day to keep unit of measure at each 24-hour period**



# Data Displayed in ESSENCE

- Patient data are unduplicated and de-identified
- Data are displayed within pre-defined syndrome groups & are also available for data mining using custom queries
- All available ED data are loaded
  - Varies greatly by hospital, but some hospital data date back to January 1, 2004
  - About 8.7 million records were loaded into ESSENCE as of May 12, 2009



# ESSENCE Syndrome Groups

- Respiratory (cough, pneumonia, influenza)
- Gastrointestinal (vomiting, diarrhea)
- Neurological (meningitis, dizziness)
- Fever
- Rash (vesicular rash, hives)
- Botulism-like (weakness, speech disturbances)
- Shock/Coma (syncope)
- Hemorrhagic illness (nosebleeds)



# ESSENCE Parsing

- Chief complaint data are entered at the hospital level via a drop-down menu, free-text entry, or other method
- ESSENCE automatically takes the data entered and:
  - Corrects spelling, spells out abbreviations, etc. for specified complaints
  - Puts into one or more syndrome and/or subsyndrome group
- When you query, ESSENCE pulls from “Chief Complaint Parsed”
  - If you query free text for “MVC” you won’t get any results, but you can query for “motor vehicle”, you will be successful



# ESSENCE Parsing

The screenshot shows a web browser window displaying the ESSENCE - Missouri Syndrome Definitions application. The browser's address bar shows the URL: [https://eedweb.dhss.mo.gov/missouri\\_5/Servlet/SyndromeDefinitionsServlet](https://eedweb.dhss.mo.gov/missouri_5/Servlet/SyndromeDefinitionsServlet). The application has a navigation menu with tabs for History of ESSENCE, Syndrome Definitions, Detector Algorithms, Data Dictionary, and Help. Below these are buttons for Alert List, Event List, Overview Portal, Query Portal, Matrix Portal, Weekly Percent, Map Portal, Bookmarks, and User Admin. A search bar and 'Add URL to Comment' field are also present.

The main content area is titled "ESSENCE - Missouri Syndrome Definitions" and includes links for [Chief Complaint Based](#), [Chief Complaint Explanation](#), and [ICD9 Based](#). Under the heading "Chief Complaints Based Syndrome Definitions", there are links for [Syndrome](#) and [Subsyndrome](#).

The current view is for "SUBSYNDROMES > NVD > VOMITING". It displays a "Rules" section with "Vomiting = N/A" and a "Terms" table.

Terms		
BARF	BARFED	BARFING
CANT	DOWN	DRY HEAVES
EMESIS	HEMATEMESIS	HYPEREMESIS
KEEP	KEEPING	NOT
SPIT UP	SPITTING UP	THREW UP
THROW UP	THROWING UP	UNABLE
UPCHUCK	VOMIT*	

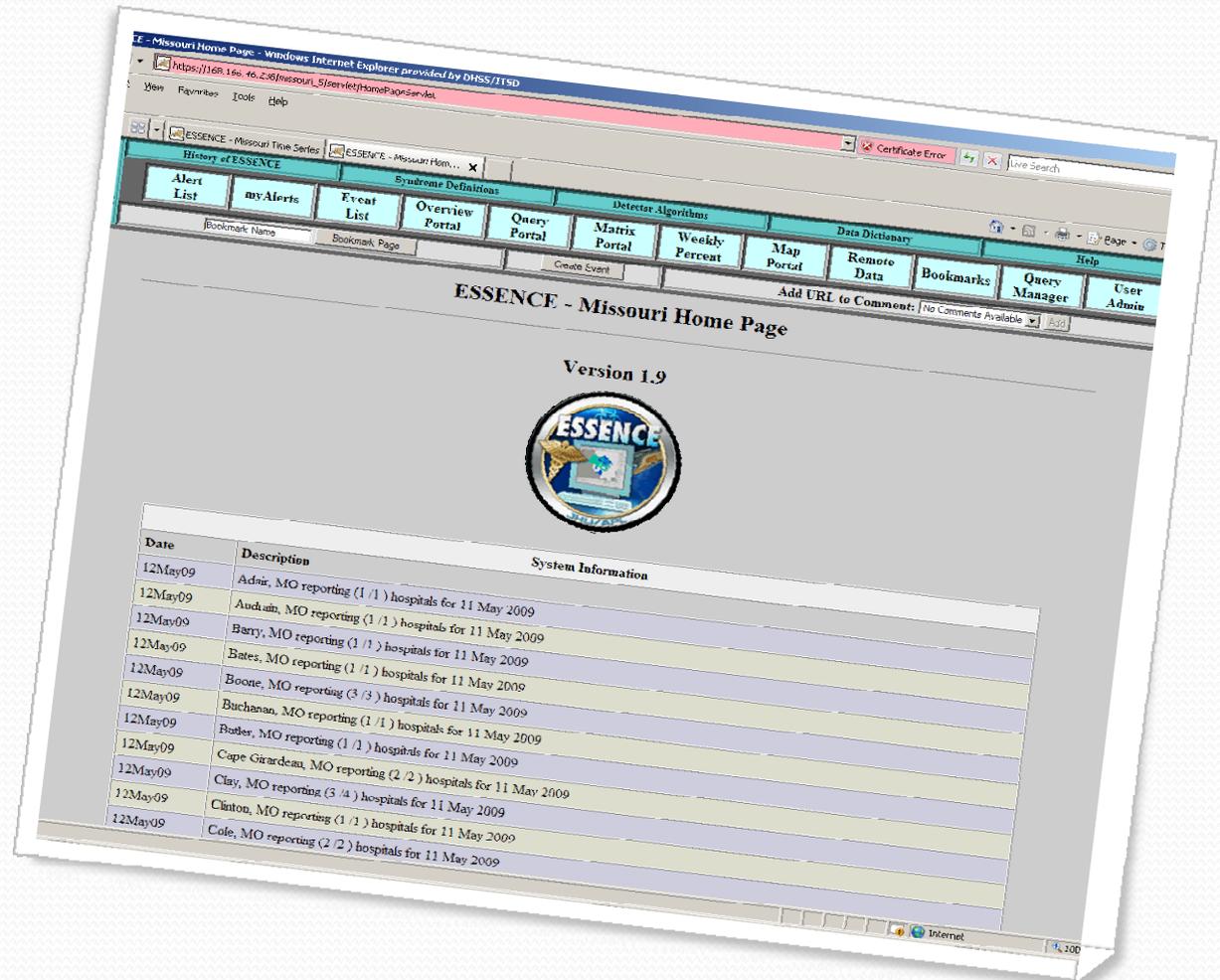
At the bottom of the page, there is a link for [Questions or Problems?](#)



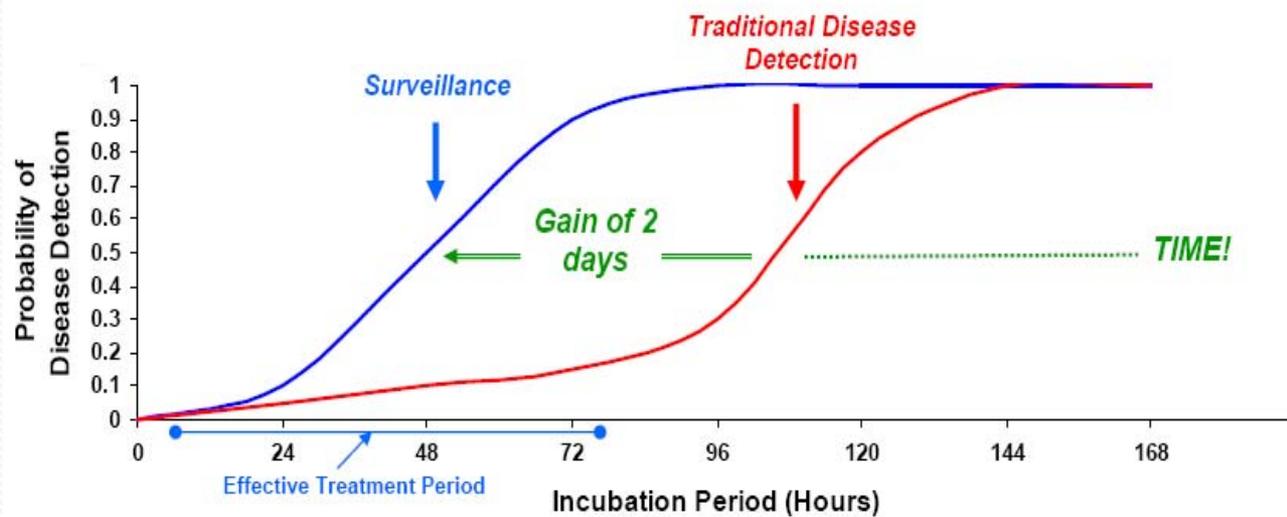
# Basic ESSENCE Functions

1. Early Event  
Detection: Alert Lists

2. Situational  
Awareness: Query  
Portal



# Early Event Detection



Johns Hopkins Applied Physics Laboratory

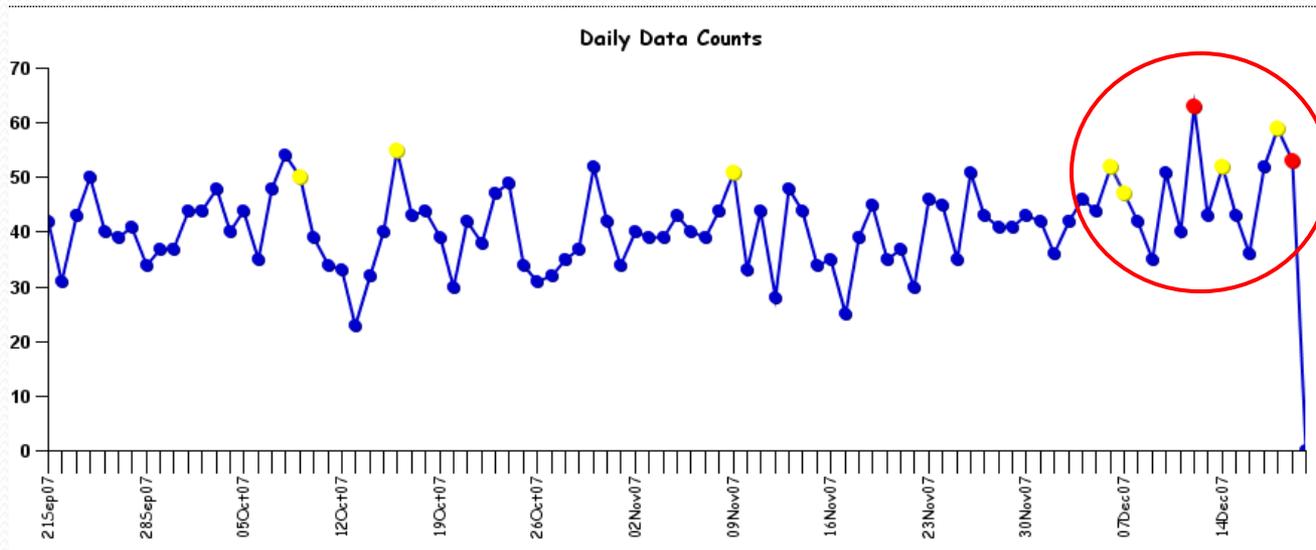


# ESSENCE Alert List Statistics

- Alert List Time Series Page Statistics
  - Detector
    - ✦ The statistical process used to generate the Alert List
    - ✦ These processes utilize: last 28 days historical data, holiday, day of week, and a 3-day moving average that weights data toward last three days
  - Level (sig. level for difference between count and expected)
    - ✦ Red flag:  $p \leq 0.01$  “Alert”
    - ✦ Yellow flag:  $p$  value between 0.01 and 0.05 “Warning”
  - Count
    - ✦ Number visits in category observed (reality)
  - Expected
    - ✦ Number visits in category Detector expected to observe (statistical)



# Flagging Events Variability Based on Algorithms



# ESSENCE Alert Investigation

- The following steps are taught to Missouri ESSENCE users during training and are used by PHEDA for daily procedures
- All local health departments (MO and IL) are free to use more/less strict criteria when determining which alerts should be investigated and how to proceed
- We highly recommend that the local health authority should be single point of contact for each hospital
  - Hospitals are busy & local health departments should be kept in the loop!
- IDPH and IL local health authorities may develop their own protocols



# ESSENCE Alert Investigation

## Step One: Review the data with a critical eye

- Look for trends that persist over more than one day especially those that increase in subsequent days (two or three red alerts in a row)
- Go into Patient List and look for trends by age, sex, zip code, county of residence
- Look for commonalities in chief complaints
- See if patients with similar characteristics were admitted at the same time of day



# ESSENCE Alert Investigation

Step Two: How likely is it these ED visits are associated with an outbreak?

- Rare syndromes more likely to flag for “mundane” complaints
  - See many stroke victims in “Bot-Like” and many seizures in “Neuro”
- Gastrointestinal Syndrome
  - “NVD” subsyndrome that contains nausea, vomiting, diarrhea is better than abdominal pain
    - Does not contain duplicates
- Respiratory Syndrome
  - Sore throat, cough, pneumonia better than shortness of breath and difficulty breathing



# ESSENCE Alert Investigation

Step Three: Use internal information/contacts to investigate

- Reportable disease figures (MOHSIS/I-NEDSS)
- Numbers of lab tests ordered
- What colleagues tell you
- What you observe in your community/news



# ESSENCE Alert Investigation

## Step Four: Contact the hospital for more information

- To prevent double-calling and to keep LPHAs in the loop, please route all questions through the LPHA that oversees the hospital involved
  - Important in the case of hospitals that see patients from a wide geographic area
- If DHSS needs to conduct an Alert Investigation, we will ask for your help or may ask permission to contact a hospital directly



# ESSENCE Alert Investigation

## Step Four (Cont.): What to say to the hospital

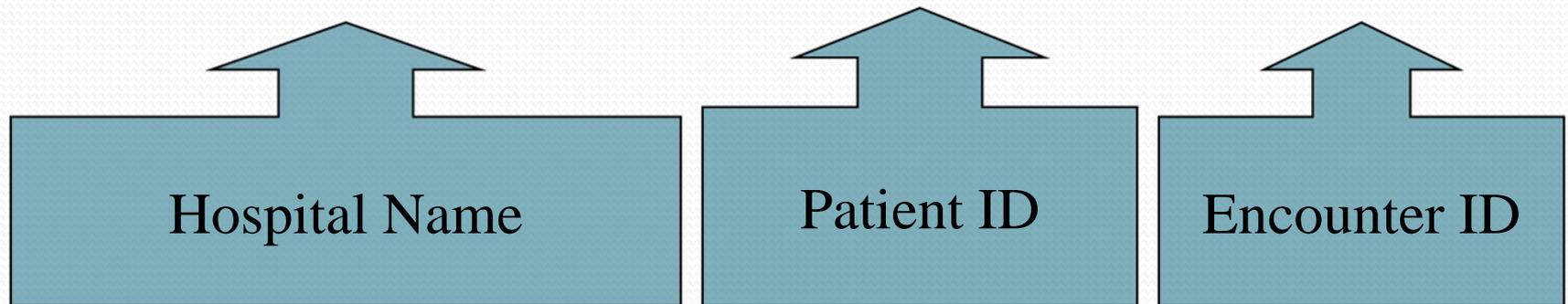
- Hospital infection control staff are busy
- Please be concise but specific: graphs and charts
- Lab confirmed cases or lab tests ordered
- Offer Medical Record Number to pull patient records
  - Similar symptoms beyond what our chief complaints show
  - Other commonalities
  - May just ask for a subset
- **If DHSS initiates the investigation, please update us on your findings!**



# Medical Record Number

- ESSENCE Medical Record Number is generated by the hospital

MOHospitalNameERCC\_01049308-0805601578



# ESSENCE Query Statistics

- ESSENCE can compute produce reliable statistical findings “on the fly”
  - Query of “GI” syndrome by region, zip code, or hospital will show whether a flag is present
  - **This can be run for previous day’s data even before Alert List has generated**
  - Query of the keyword “insect bite” by region, zip code, or hospital will show the number of visits PLUS whether that number was higher than expected



# ESSENCE Query Tips

- ESSENCE can query by syndrome, subsyndrome, or keyword
- Syndrome examples: GI, Respiratory, Rash
- Subsyndrome examples: NVD (nausea, vomiting, diarrhea), ILI, Asthma
- Keyword queries: free text query of the chief complaints field
  - Anything you can think up that someone would say was their reason for admission to the ED



# ESSENCE Query Tips

- If there is a syndrome or subsyndrome available, use it rather than “thinking up” a query
- Avoid combining syndromes or subsyndromes if possible (JHU APL can clarify this point)
  - ESSENCE pulls records by syndrome group not by person
  - Record for someone with Fever & Cough will appear in both the Fever and Respiratory groups
  - Not a real duplicate, just inconvenient
  - If you must pull records this way, refer to Excel Deduplication Tutorial at our training page



# ESSENCE Query Tips

- **Need to refer to instructions listed on the page**
- Use “or” rather than “and” to get more results
  - Can narrow down later
- Example: To detect hypothermia cases use keywords ^therm^,or,^cold exposure^
  - Using hypothermia does not pick up misspellings or entries that mistakenly list “hyperthermia”
  - Just keyword “cold” gets everyone with a cold
  - Use Bookmarks to save useful queries!
- New ESSENCE addresses this as well



# Interpretation and Reporting

- When we report our findings, we say what we observed
  - We do not claim that these are all cases of disease
  - We are comfortable reporting trends in one geo area/hospital over time
  - We do not compare two areas or populations
  - See example Situational Awareness report for disclaimers and the way we report data
- Reporting % of total is a good idea
- Be careful comparing today's real time figures to overall trend



# Mapping

- It is best to create maps based on Region (aka county) not hospital
- When we create a map, we are showing where cases are but **we do not say that areas where there are no cases mean that there is no disease there!**
  - It could be people in those areas do not go to one of the hospitals in our coverage, do not seek care for another reason, etc.
- Can locate cases we found but cannot make inferences about gaps!



# What else can ESSENCE do?

- Can pull a full ED log by day for a particular hospital (type in ^ or ^all^ in Query Tool)
- Can examine historical trends in ED visits
  - Better to use % than counts as data have been added continuously over time
- Bookmark commonly used pages
- Export data into Excel
- ESSENCE Help link can e-mail us directly from page you are having trouble with



# New Features

- JHU APL will demonstrate the new system
  - New Gateway Region in Summary Alerts
  - My Alerts
  - Advanced Query
  - Remote Data
- Additional features to be added
  - Urgent Care Data
  - More Hospitals
  - Named Patient Data Lookup for MO Hospitals
  - Hide and freeze options
  - More...



# Online Resources

- <http://www.dhss.mo.gov/ESSENCE/>
  - Training and Technical Support
  - Information for Public Health Authorities
  - Information for ESSENCE Hospitals
  - Information for Other States
  - Laws, Regulations, Manuals
  - Contact Information
    - [ESSENCE@dhss.mo.gov](mailto:ESSENCE@dhss.mo.gov)

