The Public Health Response to Global Climate Change

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Global Climate Change

- Widespread scientific consensus:
  - The world's climate is changing
    - At least partly due to human activities
    - Greenhouse gasses
    - Rising global mean temp
    - Rising ocean temp
    - Rising sea levels

Global Climate Change

- The climate will continue to change for the foreseeable future
  - CO_2 persists in the atmosphere for 100 years

Global Climate Change

- Current and future effects on human health
  - Direct
    - Injuries and fatalities from severe weather events, floods and heat waves
    - Infectious diseases due to changes in vector ecology
    - Atopic conditions/asthma due to increased/changing allergen production
    - Food and water contamination due to changing marine or other ecosystems
      - E.g. Red Tides

Global Climate Change

- Current and future effects on human health
  - Indirect
    - Population displacement leading to increased global migration/refugees
      - Famine
      - Desertification
      - Civil conflict
      - Rising sea levels
    - Economic stresses
      - Changing patterns of agriculture/production
      - Competition for increasingly scarce resources
        - » E.g. water, land
    - Cultural, psychological stresses

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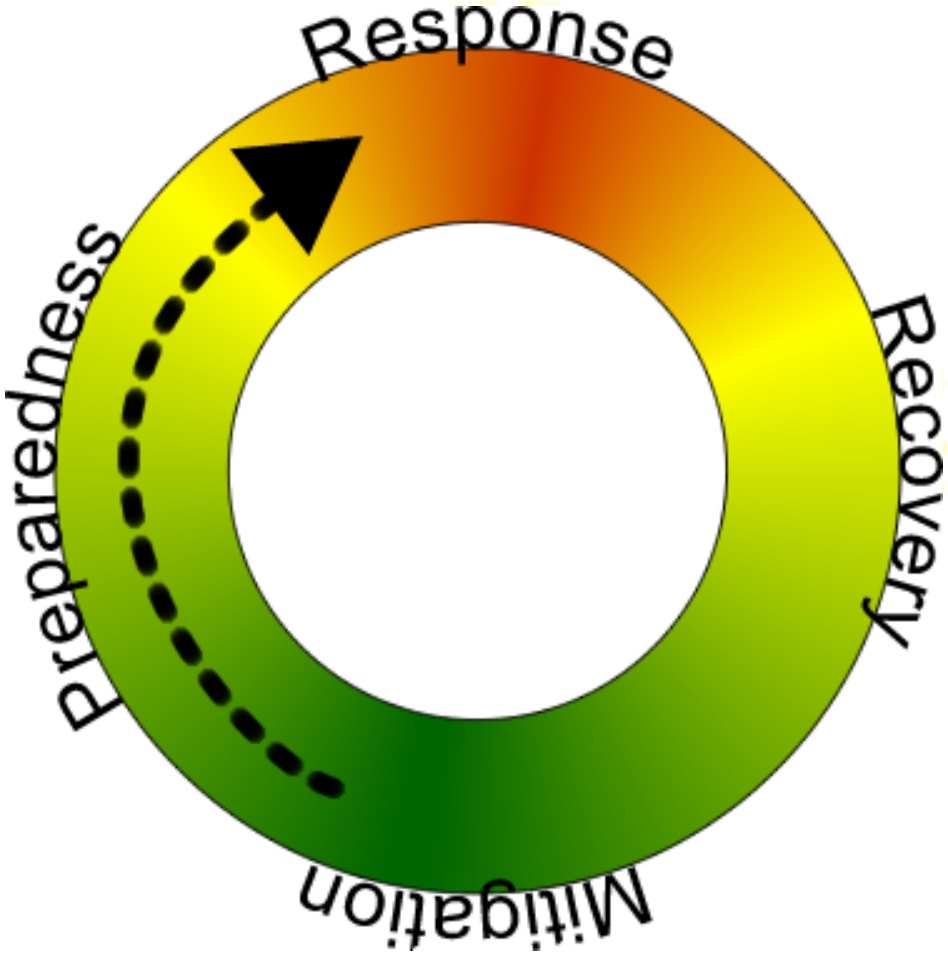
Emergency Management Cycle



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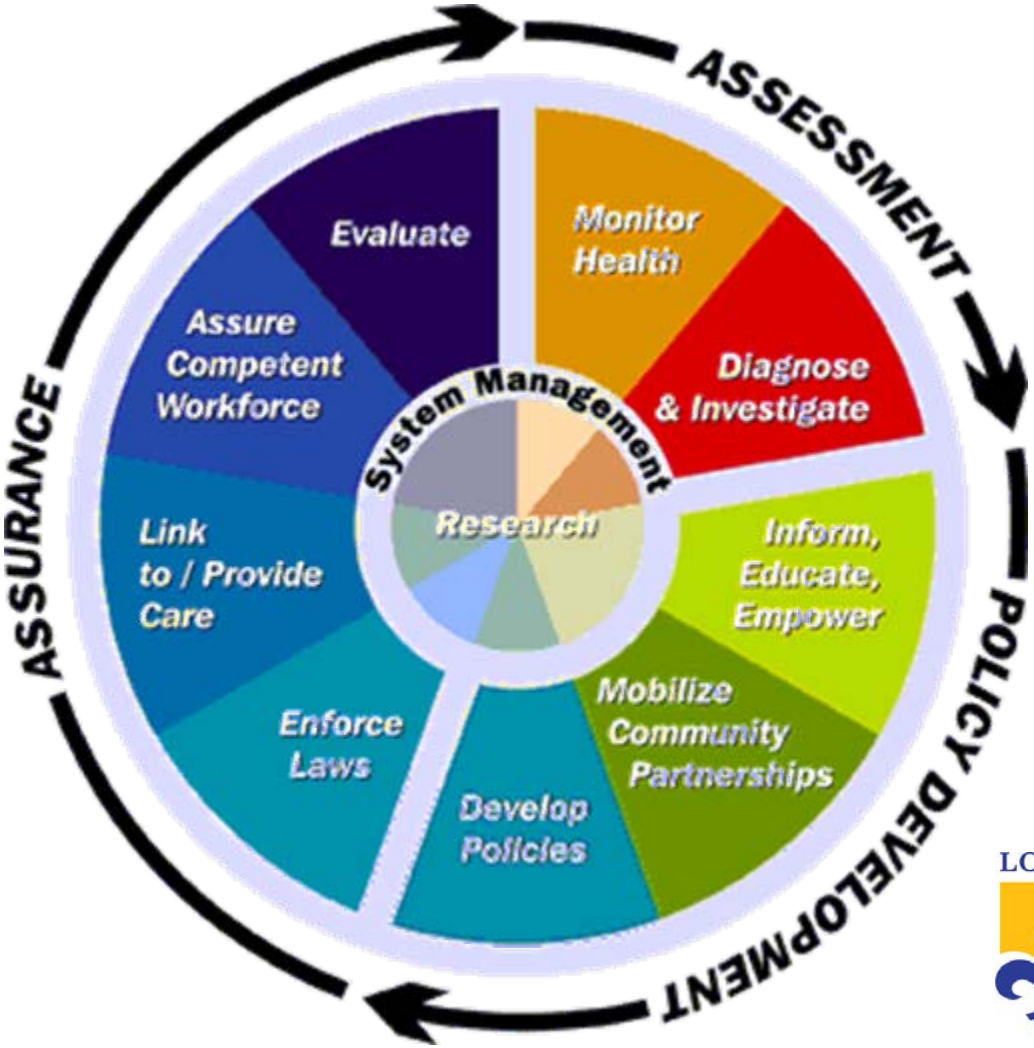
Essential Services of Public Health



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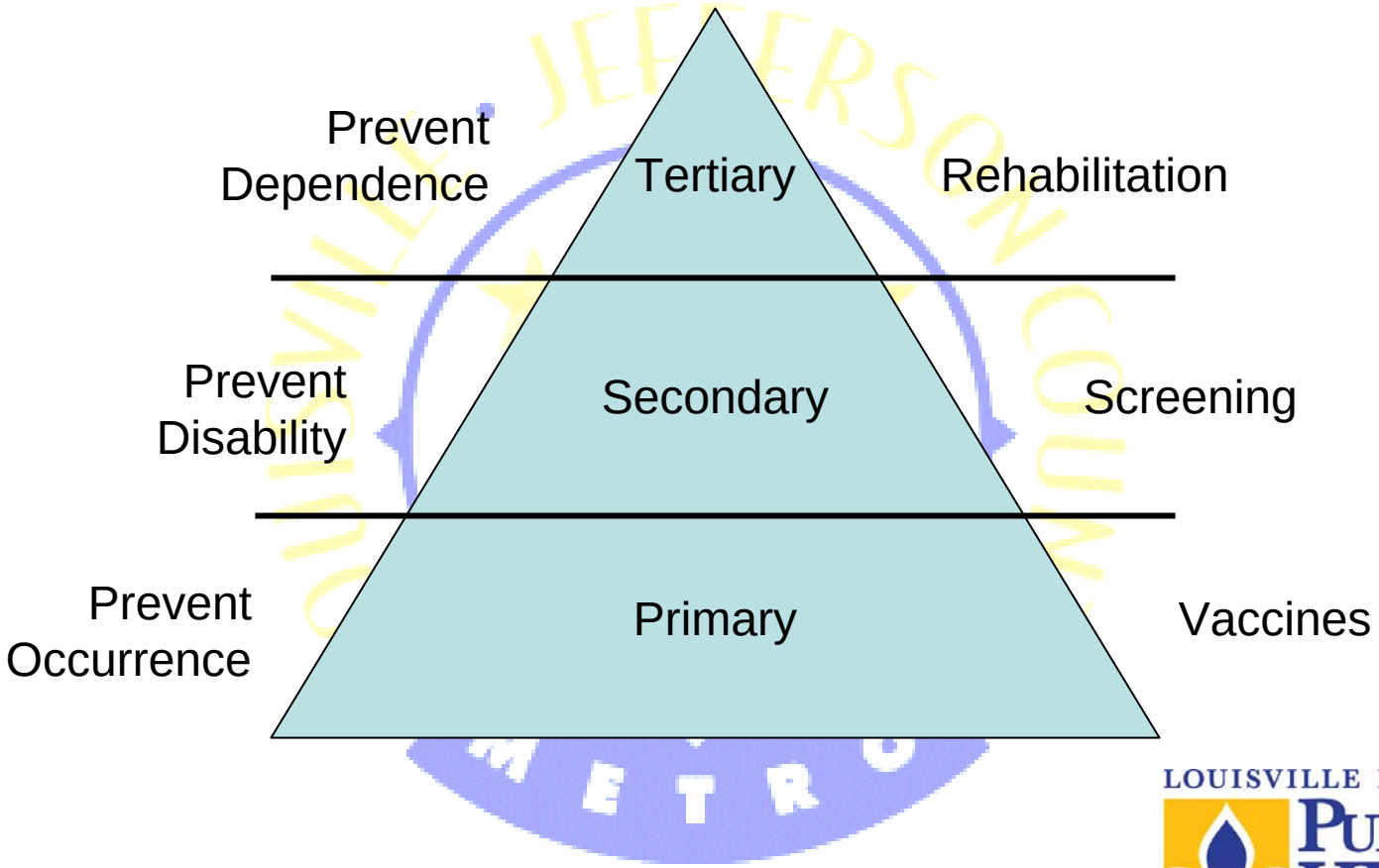
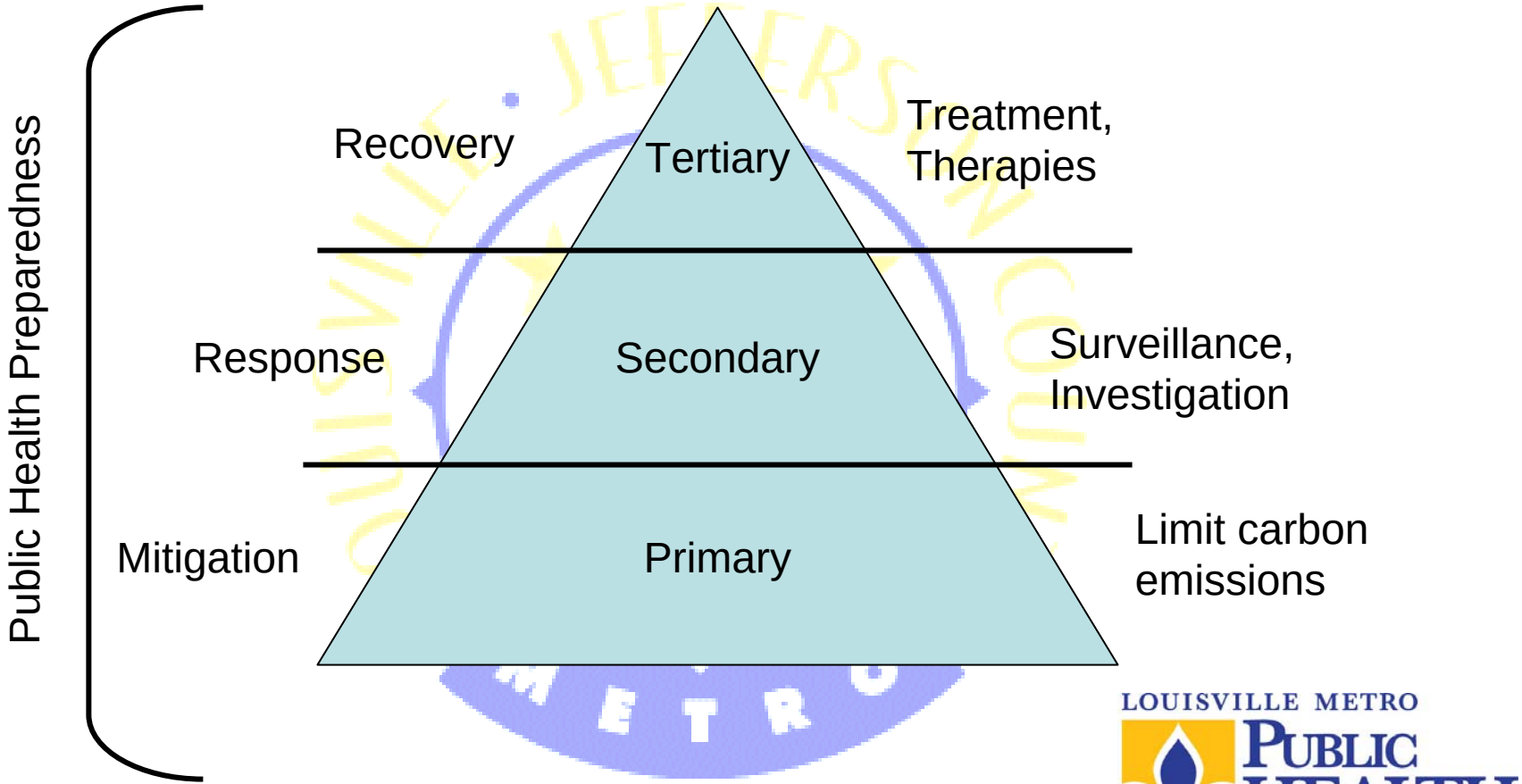
Prevention


Prevent Dependence
Tertiary
Rehabilitation
Prevent Disability
Secondary
Screening
Prevent Occurrence
Primary
Vaccines

Hybrid Model



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Hybrid Model

- Mitigation/Primary Prevention
  - Policy Development
    - Inform, educate and empower
    - Mobilize community partnerships
    - Develop policies
- Response/Secondary Prevention
  - Assessment
    - Monitor Health
    - Diagnose and Investigate
- Recovery/Tertiary Prevention
  - Assurance
    - Link to care
    - Assure competent workforce
    - Assessment

Public Health Surveillance

- What is it?
  - The ongoing systematic collection, analysis, interpretation and dissemination of health data

Public Health Surveillance

- What is it for?
  - Monitor health events
    - Detect sudden changes in disease occurrence and distribution
    - Follow secular trends and patterns of disease
    - Identify changes in agent, host or environmental factors
    - Detect changes in heath care practices
  - Assist in planning, implementation and evaluation of public health programs and interventions

The Need for Enhanced Public Health Surveillance Capabilities

- Newly emerging or reemerging dangers to public health
  - Bioterrorism
  - Newly emerging or reemerging diseases
  - Antibiotic-resistant strains
- Detect outbreaks (epidemics) in real or near-real time

Traditional Surveillance Systems

- Passive
- Diagnosis-based
- Highly specific, not very sensitive
- No longer considered timely enough for optimal public health response to outbreaks

Early Warning System for Outbreaks

- Complementary surveillance systems needed
- Can signal an alert very early in outbreak
  - Sufficient lead-time for rapid intervention
  - Limit morbidity and mortality

Syndromic Surveillance

- Nonspecific, pre-diagnostic data
- Nontraditional data sources
  - Existing sources established for other purposes
- Monitor incidence of broad, symptom-based categories of events
- Sacrifice specificity for sensitivity

Syndromic Surveillance

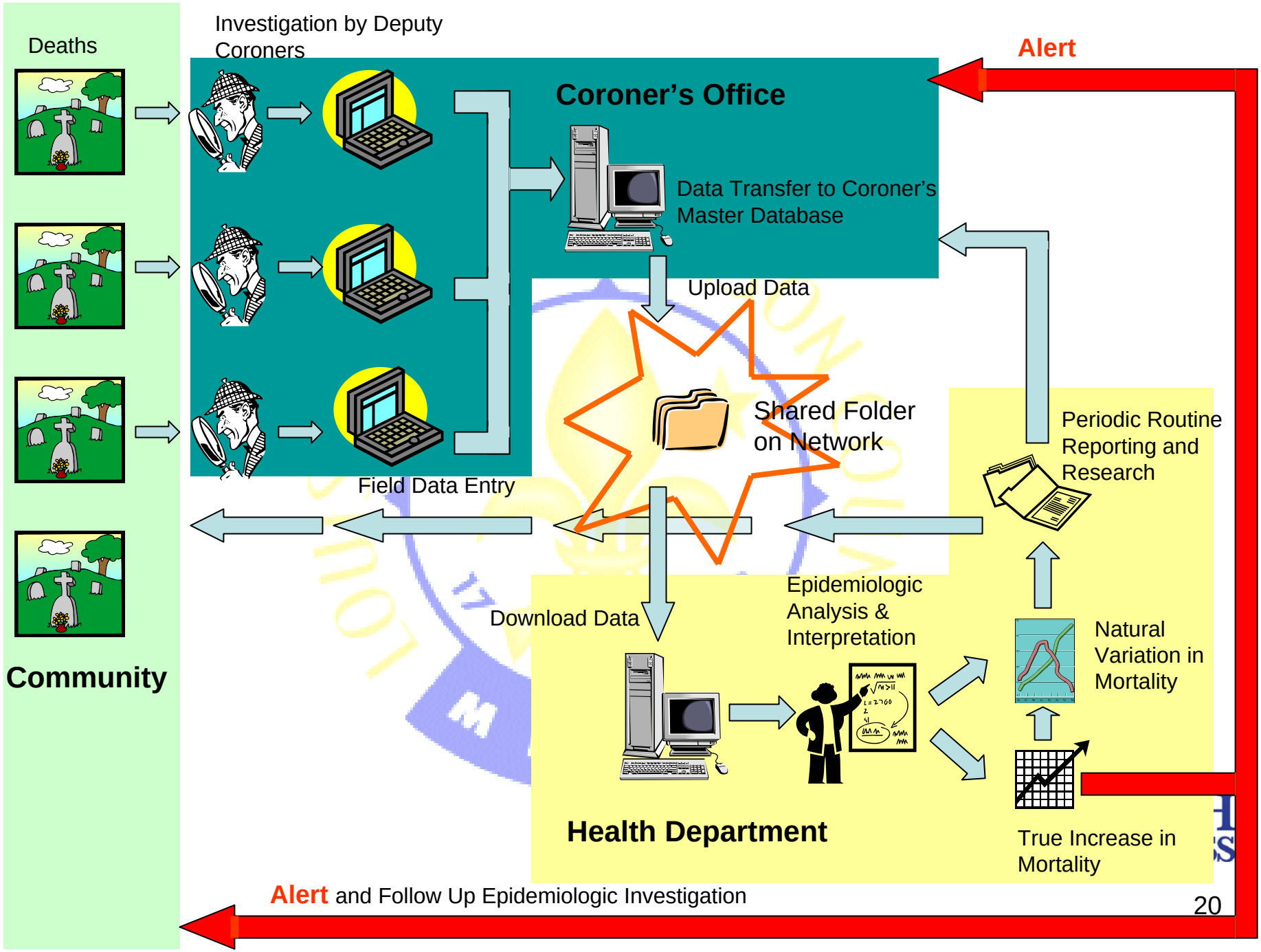
- Identify significant increases in the incidence of certain categories of health events
  - Incident temporal or spatio-temporal clusters
  - Detected by applying analytic algorithms to surveillance data streams
    - Trigger alerts when statistically significant signals are detected

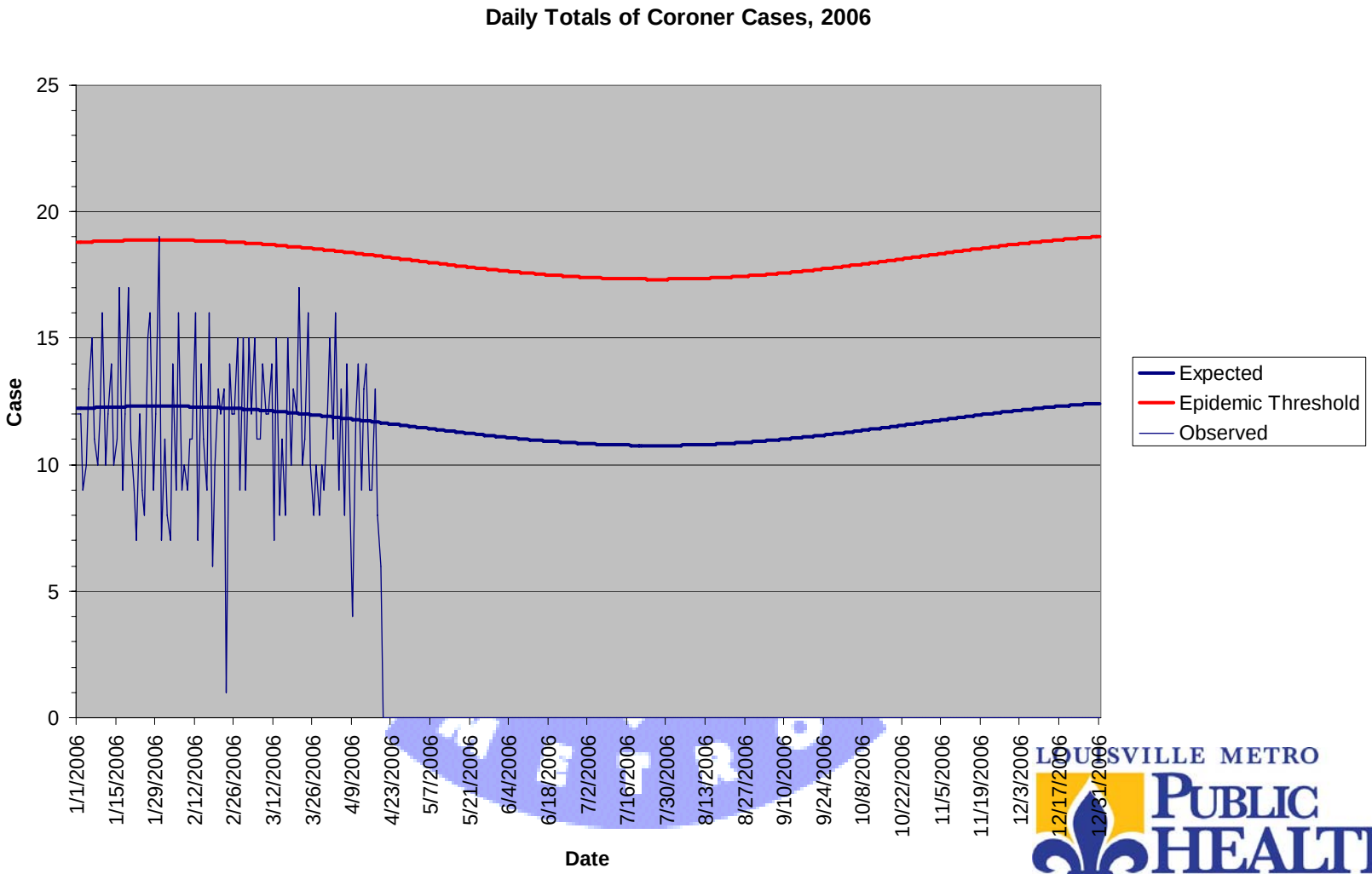
LMPHW Early Outbreak Detection Activities

- Mortality
  - Coroner's cases
- Acute morbidity
  - Hospital emergency department data
    - Chief complaint/clinical presentation
    - Discharge diagnosis
  - Ambulance dispatch data

Coroner's Case Data

- Daily counts of coroner's cases, which are taken as an indicator of unexpected or unexplained deaths, are monitored.


Deaths
Investigation by Deputy Coroners
Alert
Coroner's Office
Data Transfer to Coroner's Master Database
Upload Data
Shared Folder on Network
Periodic Routine Reporting and Research
Field Data Entry
Epidemiologic Analysis & Interpretation
Download Data
Natural Variation in Mortality
Community
Health Department
True Increase in Mortality
Alert and Follow Up Epidemiologic Investigation



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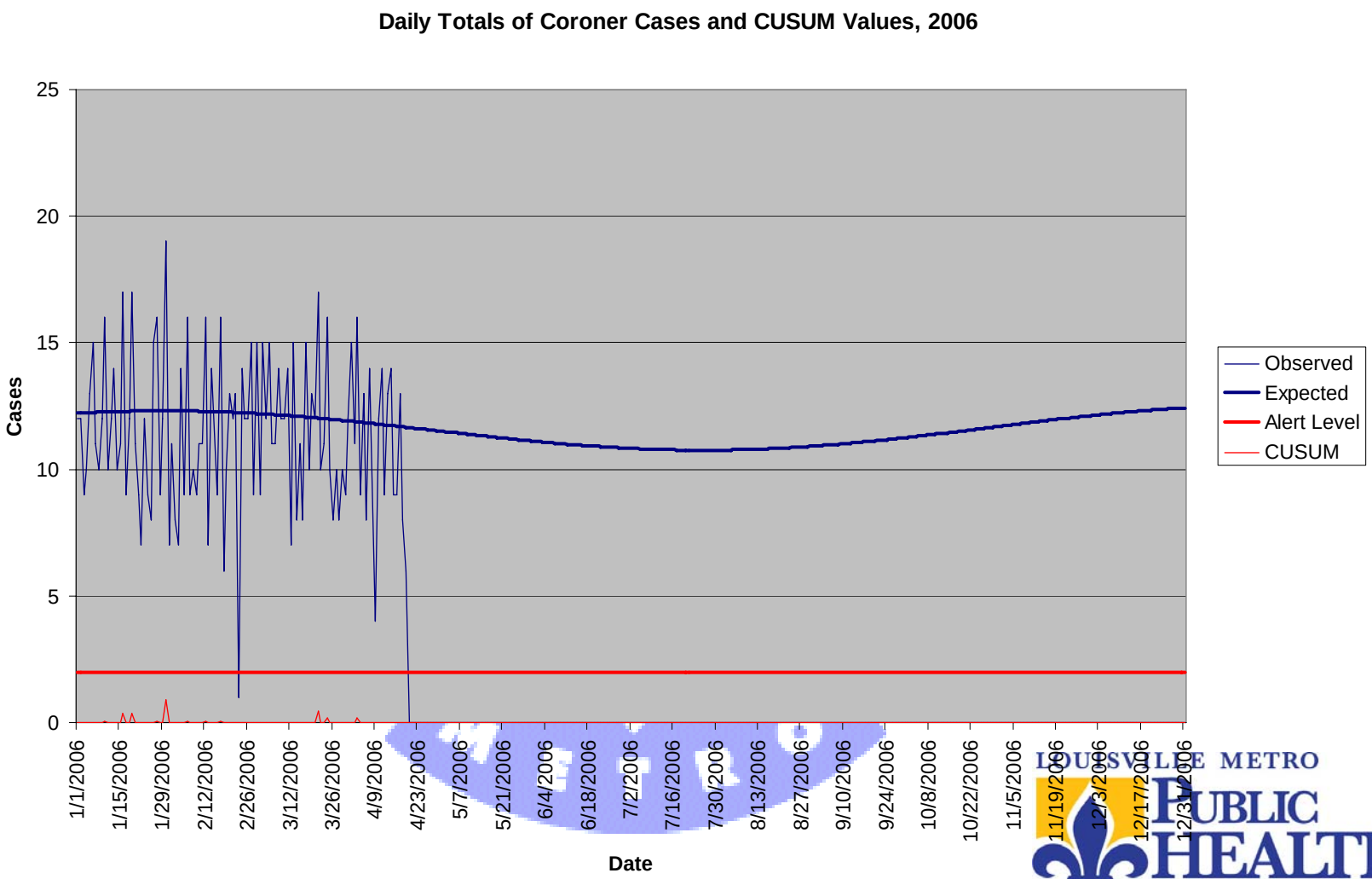

Daily Totals of Coroner Cases and CUSUM Values, 2006
Cases
25
20
15
10
5
0
1/1/2006
1/15/2006
1/29/2006
2/12/2006
2/26/2006
3/12/2006
3/26/2006
4/9/2006
4/23/2006
5/7/2006
5/21/2006
6/4/2006
6/18/2006
7/2/2006
7/16/2006
7/30/2006
8/13/2006
8/27/2006
9/10/2006
9/24/2006
10/8/2006
10/22/2006
11/5/2006
11/19/2006
12/3/2006
12/17/2006
12/31/2006
Date
Observed
Expected
Alert Level
CUSUM

Surveillance of EMS Runs

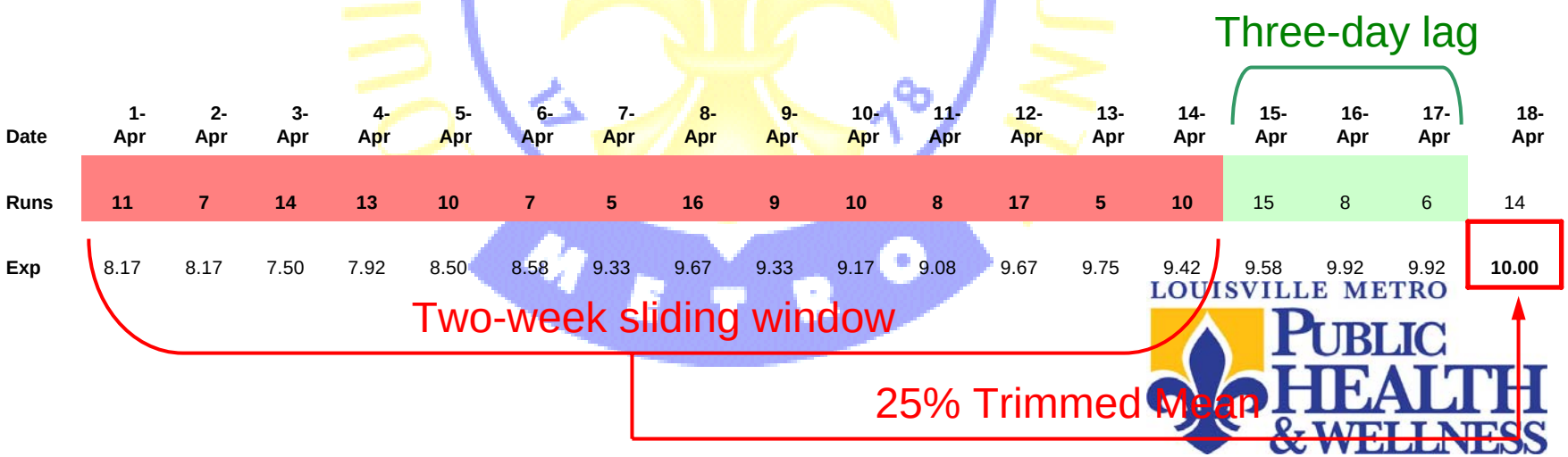
- All runs
- Abdominal pain/problems
- Breathing problems
- Cardiac or respiratory arrest/death
- Chest pain
- Convulsions/seizures
- Sick person (specific diagnosis)
- Unconscious/fainting (near)
- Unknown problem (man down)

Surveillance of EMS Runs

- Data extracted from Intergraph CAD server using web-based report function that queries CAD databases

Data Analysis

- Syndromes monitored for departures from expected incidence on a daily basis



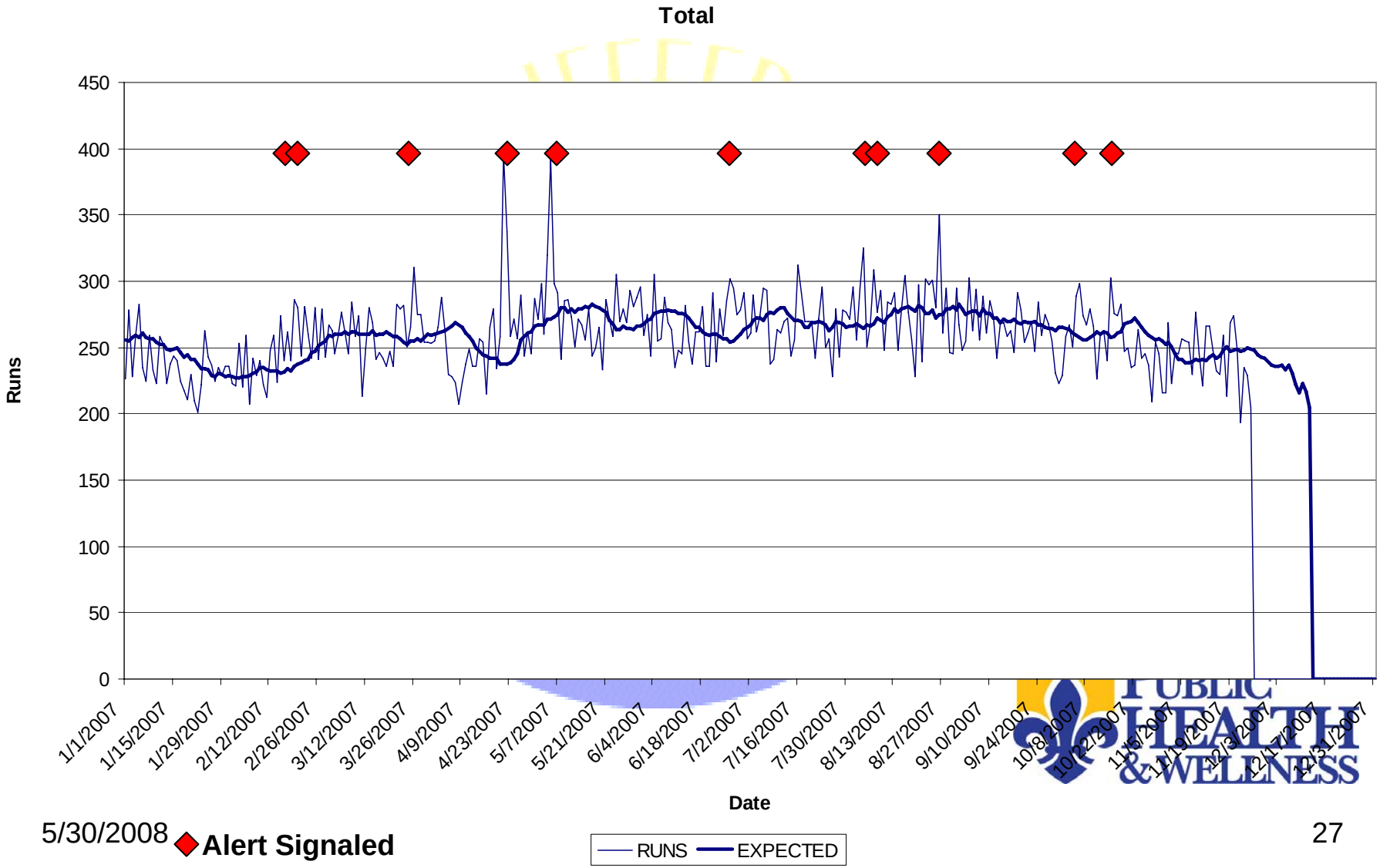
Date	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr	7-Apr	8-Apr	9-Apr	10-Apr	11-Apr	12-Apr	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr	18-Apr
Runs	11	7	14	13	10	7	5	16	9	10	8	17	5	10	15	8	6	14
Exp	8.17	8.17	7.50	7.92	8.50	8.58	9.33	9.67	9.33	9.17	9.08	9.67	9.75	9.42	9.58	9.92	9.92	**10.00**

Data Analysis

- Daily syndrome counts are analyzed using the Cusum method

Date	Runs	Exp	Y	K	H	Y-K	Cusum	Status
6/21/2007	12	9.416666667	0.841844442	1	2	-0.158155558	0	NORMAL
6/22/2007	13	9.166666667	1.26610833	1	2	0.26610833	0.26610833	NORMAL
6/23/2007	7	8.583333333	-0.540436118	1	2	-1.540436118	0	NORMAL
6/24/2007	10	8.5	0.514495755	1	2	-0.485504245	0	NORMAL
6/25/2007	13	8.5	1.543487266	1	2	0.543487266	0.543487266	NORMAL
6/26/2007	14	8.75	1.774823935	1	2	0.774823935	1.318311201	NORMAL
6/27/2007	17	8.916666667	2.707006025	1	2	1.707006025	3.025317226	ALERT

Example



5/30/2008 ◆ **Alert Signaled**

Hospital Emergency Department Data

- Five sentinel hospital sites
  - Norton, Kosair, Audubon, Southwest, Suburban
- All patients categorized into one of seven locally developed “syndromes” based on presenting symptomology/chief complaint
  - Respiratory, GI, ID (Fever/ILI), Neuro, Cardiac, Psych, Other
- Daily counts in each syndrome monitored for significant increases

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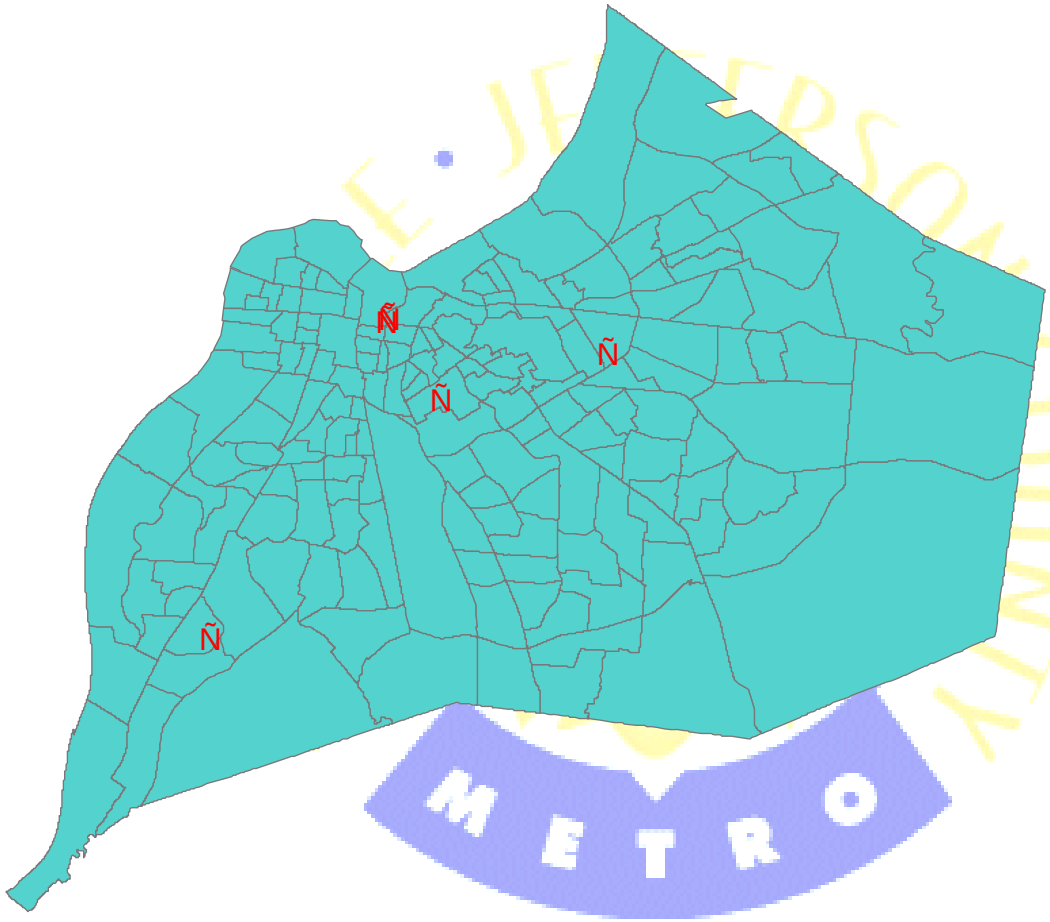

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	GI (Vomiting, Diarrhea)								
Date	**Cases**	**SNR**	**Expected**	**Y**	**K**	**H**	**Y-K**	**CUSUM**	**Status**
2/16/2006	43	14.87889	14.80201	0.019983	1	2	-0.98002	0	Normal
2/17/2006	41	15.35581	14.7985	0.144872	1	2	-0.85513	0	Normal
2/18/2006	35	13.20755	14.79406	-0.41248	1	2	-1.41248	0	Normal
2/19/2006	27	10.22727	14.78867	-1.18613	1	2	-2.18613	0	Normal
2/20/2006	50	16.28664	14.78236	0.391253	1	2	-0.60875	0	Normal
2/21/2006	48	18.75	14.77511	1.034093	1	2	0.034093	0.034093	Normal
2/22/2006	51	19.24528	14.76693	1.165395	1	2	0.165395	0.199489	Normal
2/23/2006	27	10	14.75783	-1.2385	1	2	-2.2385	0	Normal
2/24/2006	54	22.88136	14.7478	2.117956	1	2	1.117956	1.117956	Normal
2/25/2006	62	21.16041	14.73685	1.673299	1	2	0.673299	1.791254	Normal
2/26/2006	48	15.43408	14.72499	0.184789	1	2	-0.81521	0.976043	Normal
2/27/2006	45	20.93023	14.71221	1.621113	1	2	0.621113	1.597156	Normal
2/28/2006	82	30.14706	14.69853	4.029491	1	2	3.029491	4.626647	Alert
3/1/2006	59	21.14695	14.68394	1.686606	1	2	0.686606	5.313254	Alert
3/2/2006	43	17.84232	14.66845	0.8287	1	2	-0.1713	5.141954	Alert
3/3/2006	56	22.58065	14.65206	2.071316	1	2	1.071316	6.21327	Alert
3/4/2006	67	21.26984	14.63479	1.734407	1	2	0.734407	6.947677	Alert
3/5/2006	65	21.95946	14.61663	1.920613	1	2	0.920613	7.86829	Alert
3/6/2006	54	16.56442	14.5976	0.514782	1	2	-0.48522	7.383072	Alert

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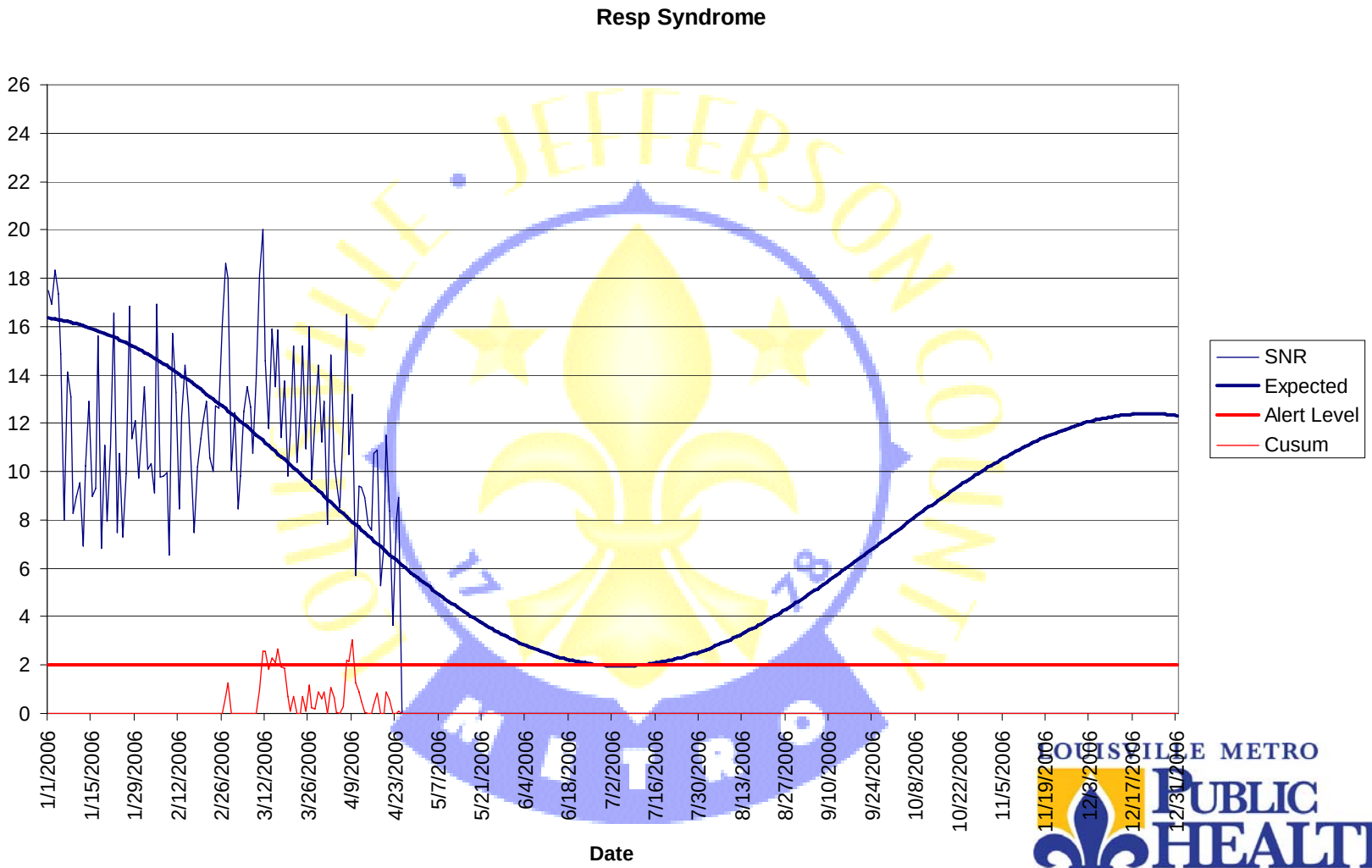

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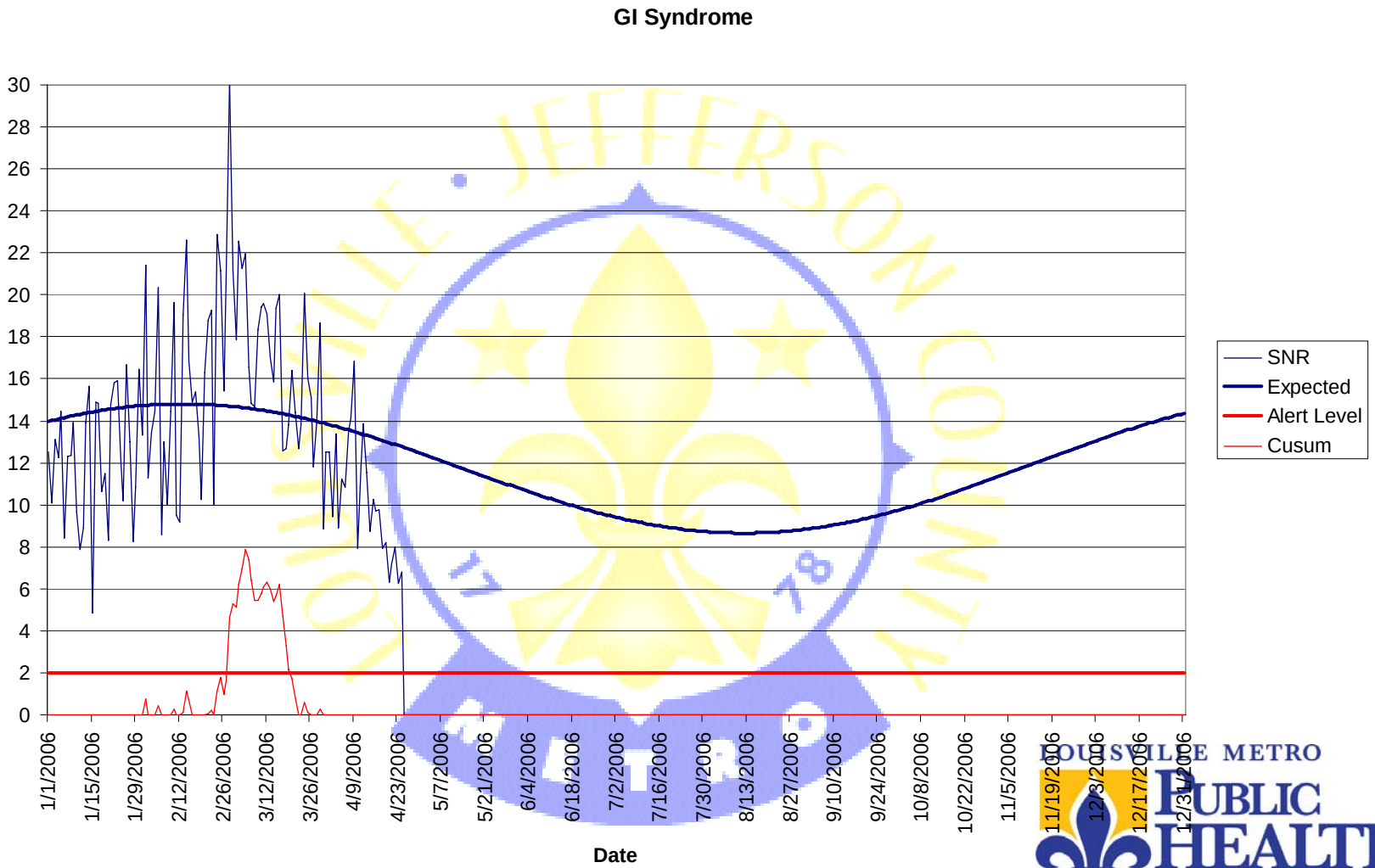

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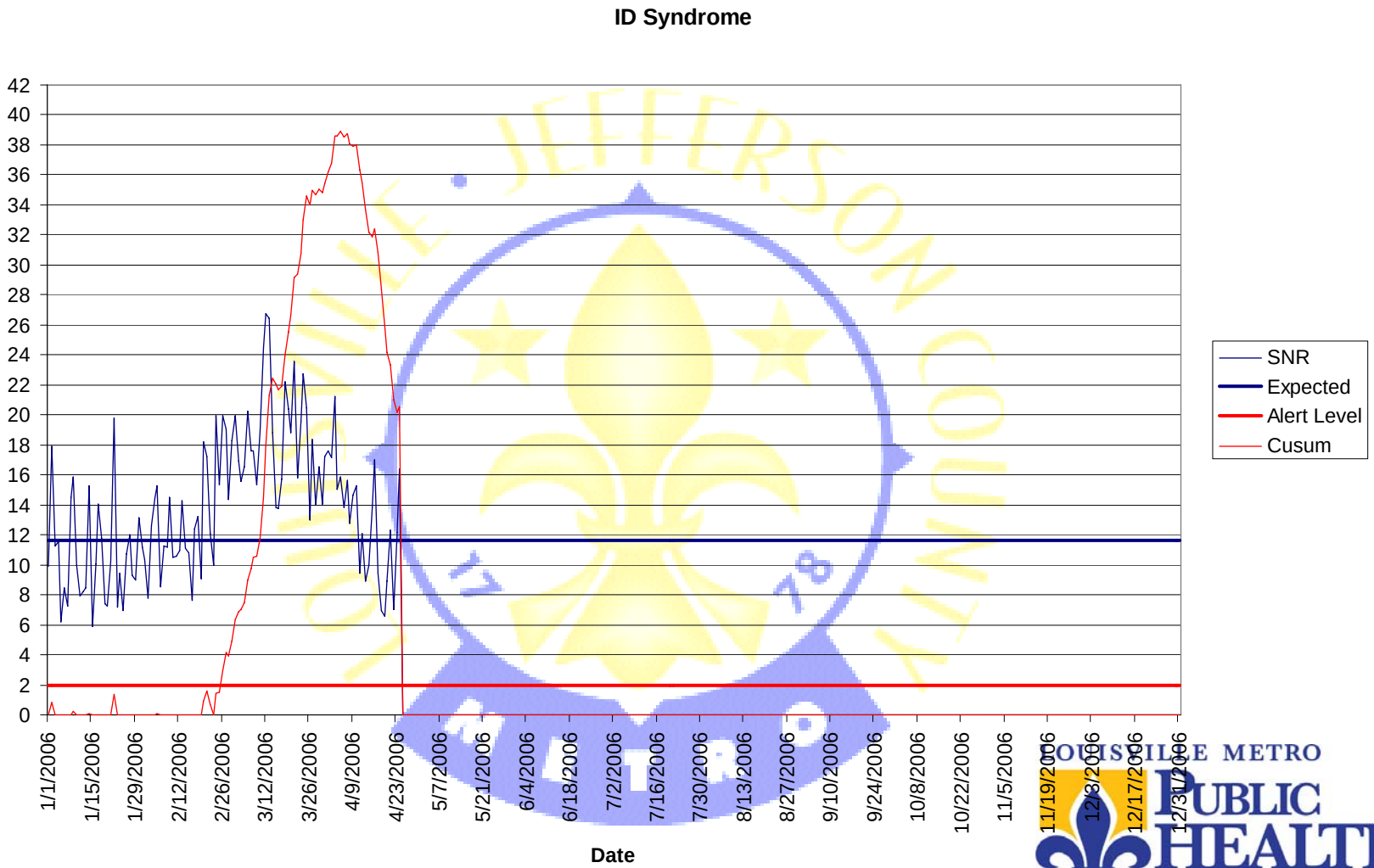

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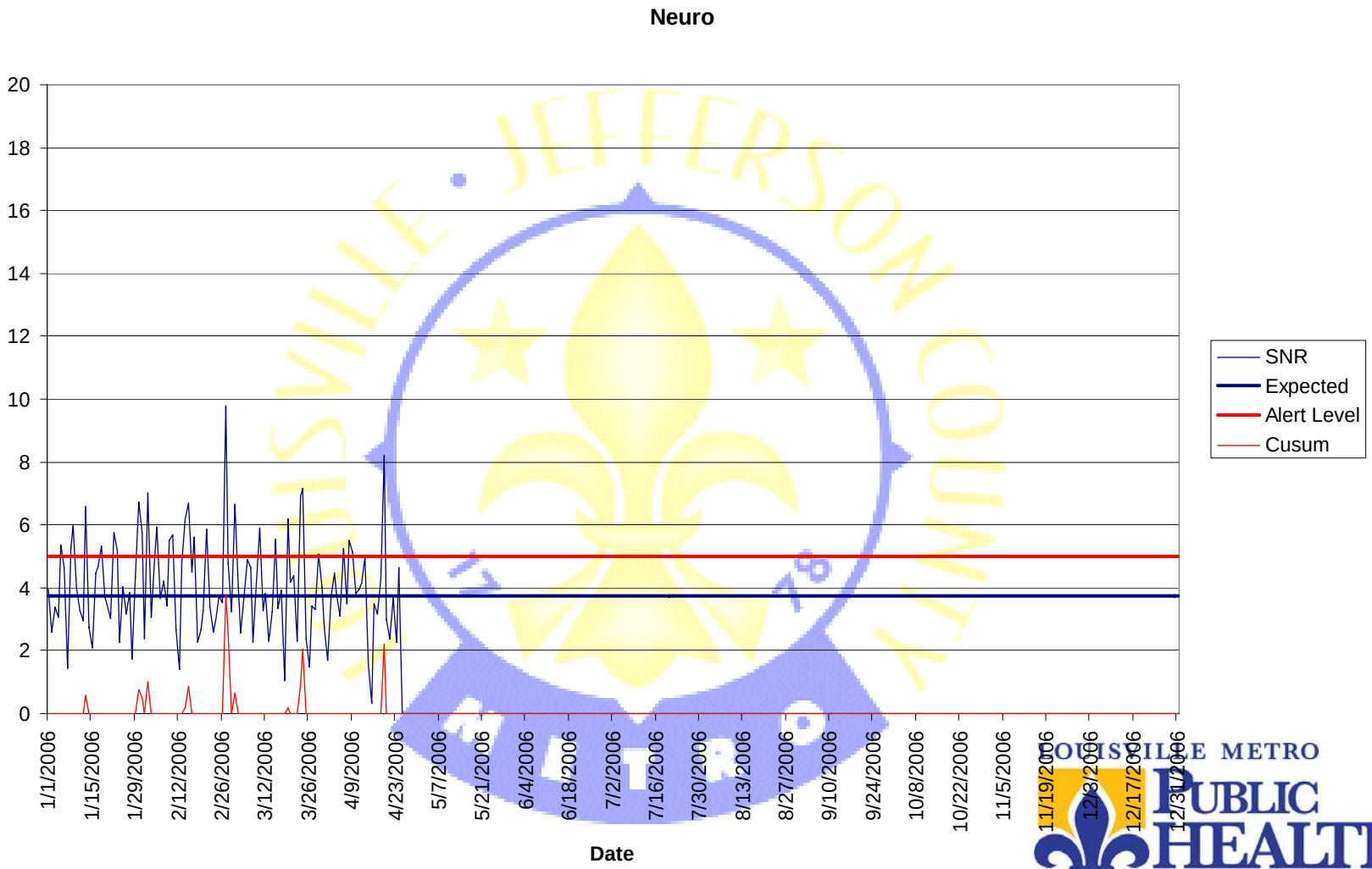

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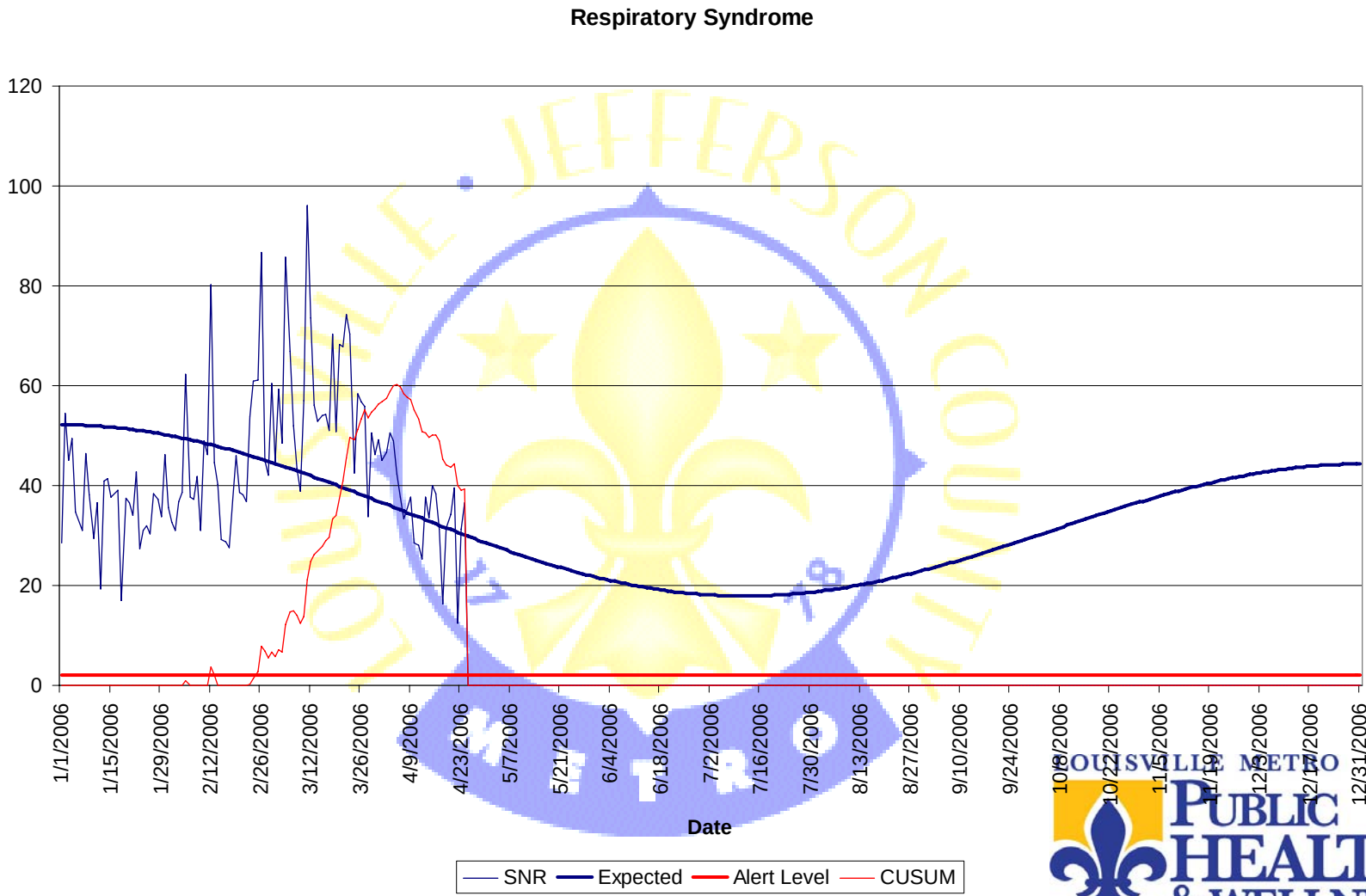
Hospital Emergency Department Data

- Provisional system based on two sentinel hospitals that provide ICD-9 coded data
  - Norton, Kosair
- All patients categorized into CDC developed syndromes defined by groupings of ICD-9 codes based on the ED discharge diagnosis
  - Botulism-like illness, Fever, GI, Hemorrhagic illness, Lesion, Lymphadenopathy, Neuro, Rash, Respiratory, Severe illness/death



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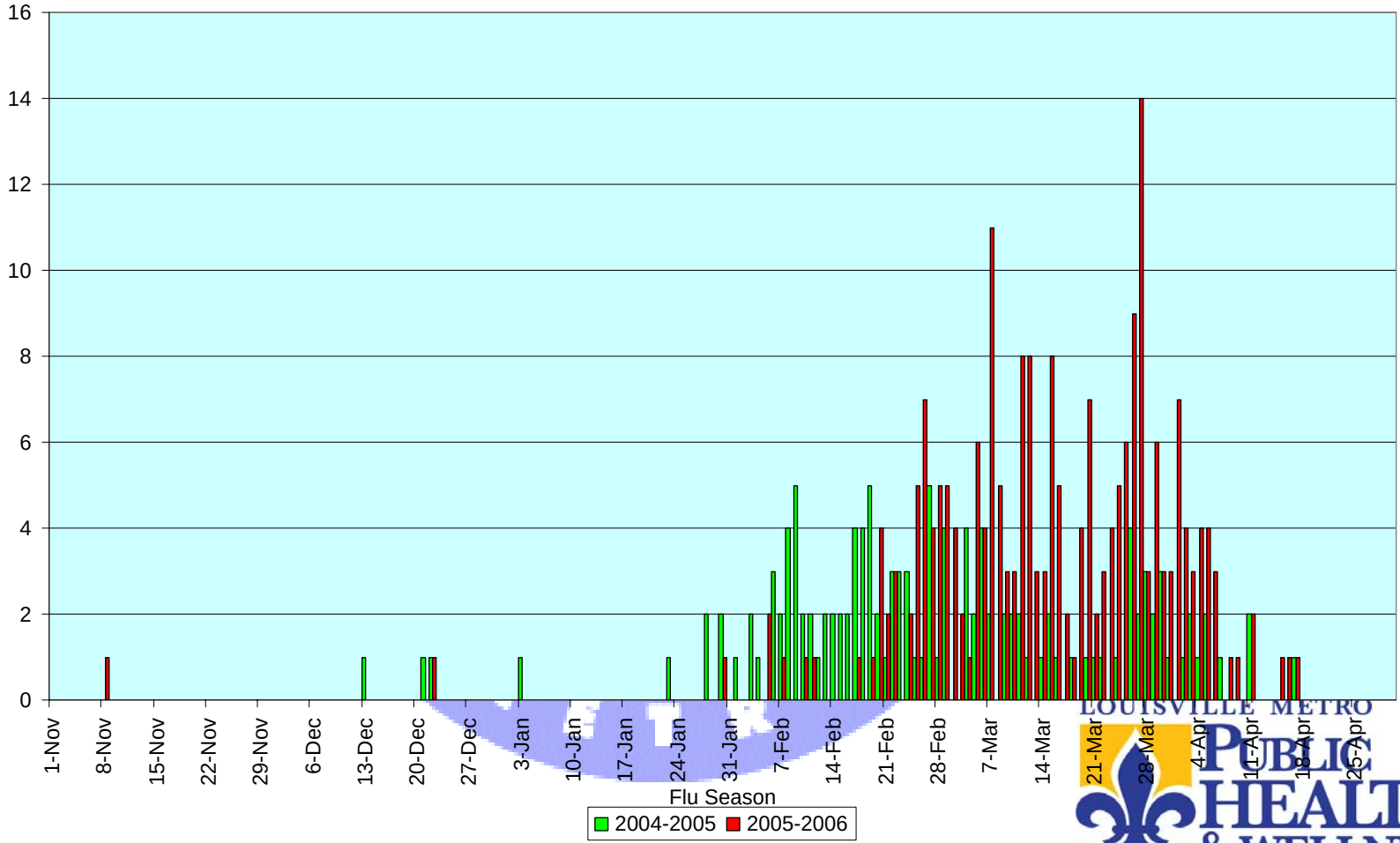
Emergency Department Influenza Diagnoses by Season: Kosair and Norton Hospitals



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What to do about Alerts?

- Indicate the need to raise the index of suspicion

Causes of Alerts

- There are a number of possible reasons for perceived increases in the frequency of health events with categories, including
  - Artifact
  - Natural variance
  - Seasonality
  - “True” increases due to common source or contagious outbreaks

Problem of Non-Specificity

- Nature of detected increases in health event incidence generally not discernable
  - Epidemiologically related cases of a specific disease usually cannot be distinguished from unrelated events within a particular syndrome

Meaning of Alerts

- Surveillance alert not positive indicator of an outbreak
- Health events within a particular category warrant further scrutiny and closer monitoring

Follow-up on Alerts

- Before the existence of an outbreak can be confirmed, supplemental data will usually have to be collected
- Currently, the capacity for timely followback for the purpose of retrospective collection of case data is severely limited

Usefulness of Alerts

- Surveillance alerts not useful as a trigger for retrospective analysis
- More useful as an indication that providers should be notified to be especially alert

Communication of Surveillance Alerts

- Raise the index of suspicion
- Make providers more likely to report:
  - Cases of reportable disease
  - Unusual numbers of particular diseases or conditions
  - Atypical clinical presentations

When to Investigate

- The accumulation of evidence from surveillance alerts and vigilant, informed providers will assist public health officials in deciding whether and when an epidemiological investigation is warranted

Health Situational Awareness

- In addition to early warning of potential outbreaks, another very useful aspect of syndromic surveillance systems is their ability to provide public health officials with “health situational awareness,” which can be defined as a broad contextual awareness of the local morbidity and mortality background against which the public health significance of specific health events can be viewed