

Information Needs in Outbreak Management

A Local Perspective

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- “Recent” high profile outbreaks

“You’ve seen one outbreak, you’ve seen one outbreak”

- Steps of outbreak investigation

- Data needs for outbreak management

- How can EHRs help?

Ebola in West Africa



- **Detection**
 - Outbreak in W. Africa
 - Non-specific symptoms
 - Time to prepare
 - Enhanced surveillance, monitoring
 - Lab testing at NYC Public Health Lab only
- **Key issues**
 - Rapid contact investigation
 - Health care worker monitoring
 - Zero margin of error
 - High profile media event, public fear
- **Control**
 - Isolation/quarantine/active monitoring
 - Environmental clean-up

West Nile Outbreak, 1999



Detection

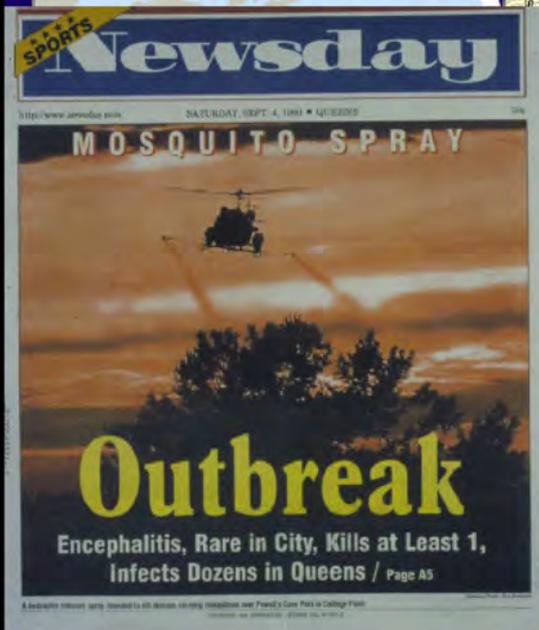
- Alert clinician
- Cluster of similar syndrome

Key initial questions

- What was the pathogen?
- Geographic extent?
 - Clinical case definition
 - Citywide active surveillance
 - Lab diagnosis – tricky!
- New unfamiliar disease (spectrum of illness, risk factors, sequelae?)

Control

- Targeted mosquito control



Apr 27, 2009 6:01 am US/Eastern



CONFIRMED: Swine Flu Outbreak At Queens School Department Of Health Tests Students At St. Francis Prep In Queens, Examine Travel Histories



Reporting
Dave Carlin

QUEENS (CBS) — Mayor Bloomberg announced in a news conference Sunday morning that the Centers for Disease Control confirmed cases of swine flu in Queens school.

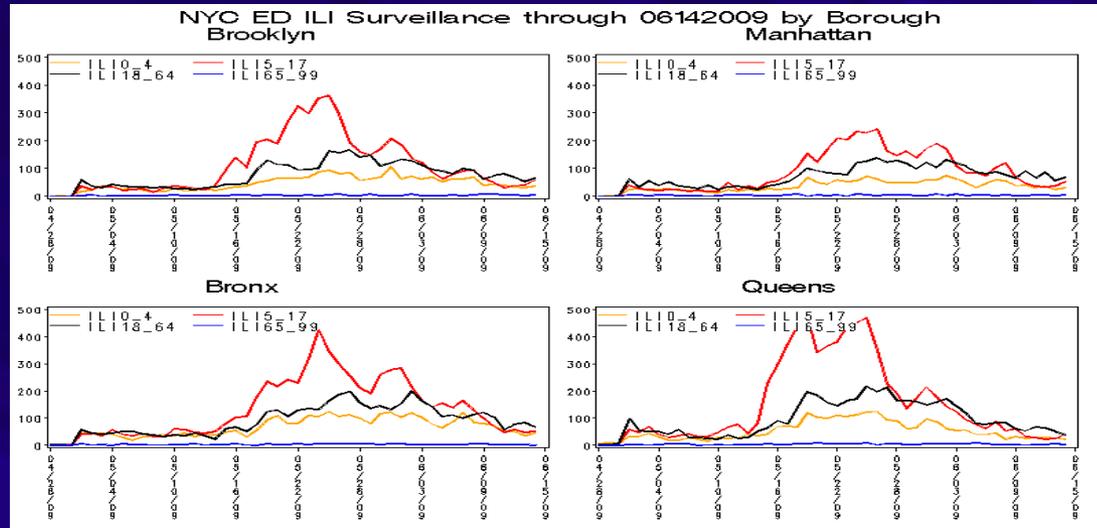
The mayor said St. Francis Preparatory School will be closed on Monday, and asked students, faculty and staff at the school who are feeling flu-like symptoms to stay home for at least 48 hours.



Pandemic Influenza H1N1

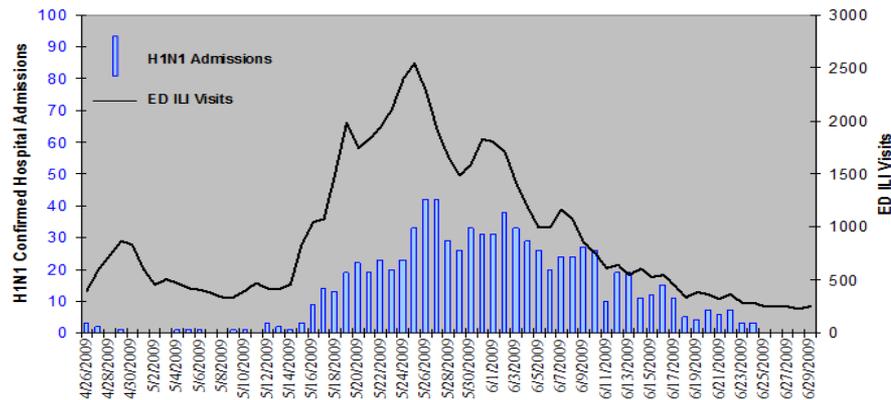
- Detection
 - Outbreak in Mexico/Novel flu
 - Large cluster at local high school
- Key initial questions
 - How widespread and epidemic trajectory
 - Virulence - how severe?
 - Numerator and denominator
 - Who is at risk for severe outcome?
- Control
 - Antivirals, vaccine
 - Community measures

ED Syndromic Surveillance for ILI (n = 50 hospitals; 95% NYC ED visits)

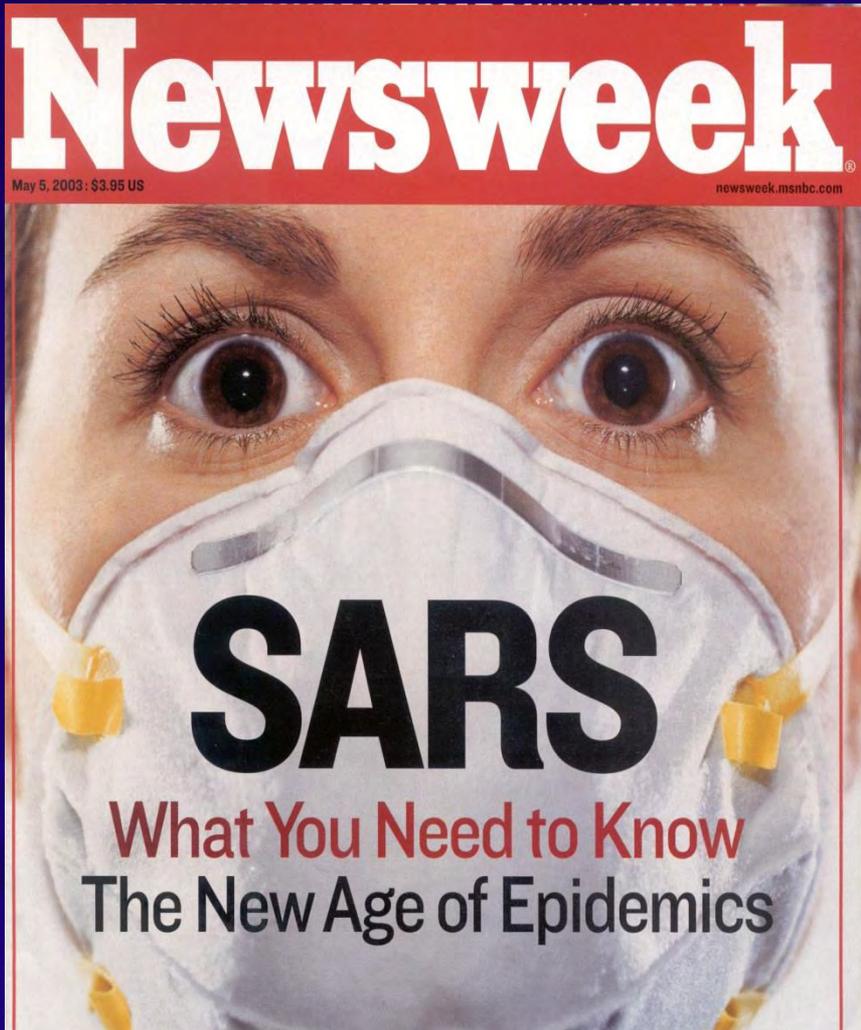


Emergency Department ILI Visits vs Hospital Admissions in NYC

Laboratory Confirmed H1N1 Hospital Admissions and Emergency Department (ED) Visits for Influenza-like Illness (ILI) in NYC
April 26 - June 29, 2009



SARS



- Detection
 - Outbreak detected in Asia
 - Intense surveillance
 - Lab dx initially not available, and then only at CDC
- Key issues
 - Was it here? (non-specific symptoms)
 - Need to use travel screening
 - Local spread?
- Control
 - Rapid identification and isolation to prevent transmission
 - Ensure adequate PPE and infection control
 - Complex contact tracing
 - Quarantine

The Every Day in NYC – this week's news

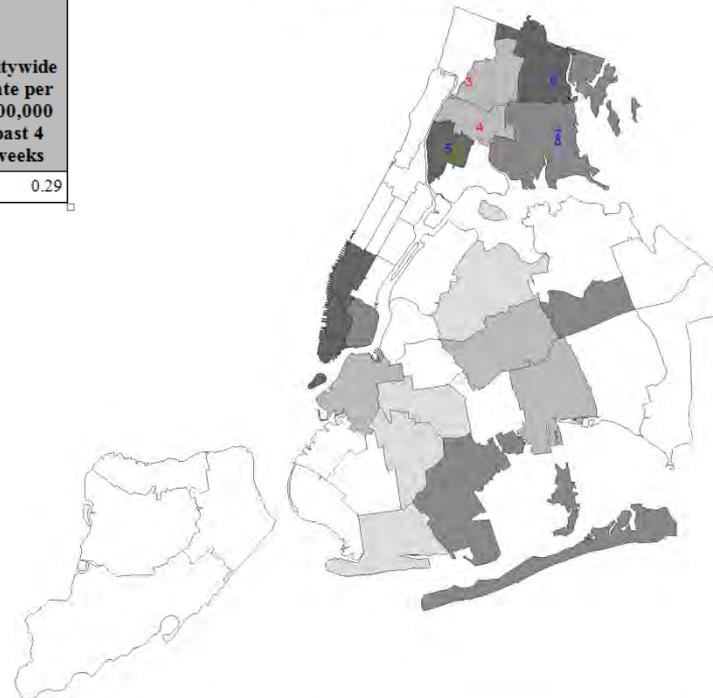
Legionella signal on routine analysis

Legionella
 Boro Signal in BRONX
 No lag was implemented to allow for data accrual

Disease	Unit of geography	Date of interest	Total dx past 4 weeks: 02NOV14 - 29NOV14	Signal Strength (# of SDs above mean)	new signal since last week?	if not new, how many new events in signal?	Rate per 100,000 in signal area past 4 weeks	Citywide rate per 100,000 past 4 weeks
Legionella	Bronx	Diagnosis date	9	2.18	yes	N/A	0.65	0.29

Total dx past 4 weeks includes only confirmed, probable, suspect and pending case statuses
 When # of SDs above mean > 2, current period is considered a signal
 A missing signal strength value indicates an SD = 0 in the baseline period

Legionella
 Boro Signal in BRONX



Rate per 100,000 for previous 4 wks

0.00 - 0.00	0.21 - 0.35
0.38 - 0.49	0.50 - 1.03
1.05 - 1.88	

*Numbers indicate the location of events in the signal.
 Blue numbers, if any, indicate events that are still pending.
 *Note that rates are meant to provide context only and do not necessarily correspond to signals.

The Every Day in NYC – this week's news

Legionella in the Bronx



2015 Alert # 1:

Possible Increase in Legionnaire's Disease in the Bronx

- 11 cases of Legionnaire's Disease cases occurred among Bronx residents in December 2014.
- Providers should consider Legionnaire's disease when evaluating patients presenting with signs of pneumonia.
 - Culturing *Legionella* from sputum or bronchoalveolar lavage specimens is the preferred method of diagnosis. Notify your lab to ensure that they use the appropriate culture media to test for *Legionella*.
 - Urinary antigen testing is also recommended but should be accompanied by an attempt to isolate *Legionella* by culture.
- Report cases promptly to the NYC Health Department and submit all *Legionella* isolates to the Health Department's Public Health Laboratory for serogrouping and molecular typing.

Please Distribute to All Clinical Staff in Internal Medicine, Pediatrics, Geriatrics, Primary Care, Infectious Diseases, Emergency Medicine, Family Medicine, Laboratory Medicine and Infection Control

January 6, 2015

Dear Colleagues,

In December, an increase in Legionnaire's Disease was noted in the Bronx. In December 2014, 11 cases



■ Detection

- Reportable disease – ELR mostly
- Complex data analysis, aberration detection, geocoded data
- Geospatial cluster and a building match – 2 cases in one building

■ Key issues

- What is the source of the OB?
- How widespread?
- How to get MDs to test, need for cultures
- Linking lab and epi data with molecular diagnostics
- Environmental sampling – PCR on water

■ Control

- Stop at the source

Pick your flavor

Sent: Tuesday, January 06, 2015 10:53 AM|

Subject: Outbreak Meeting Agenda -- January 6, 2015

Introductions or Fare-thee-wells?

New

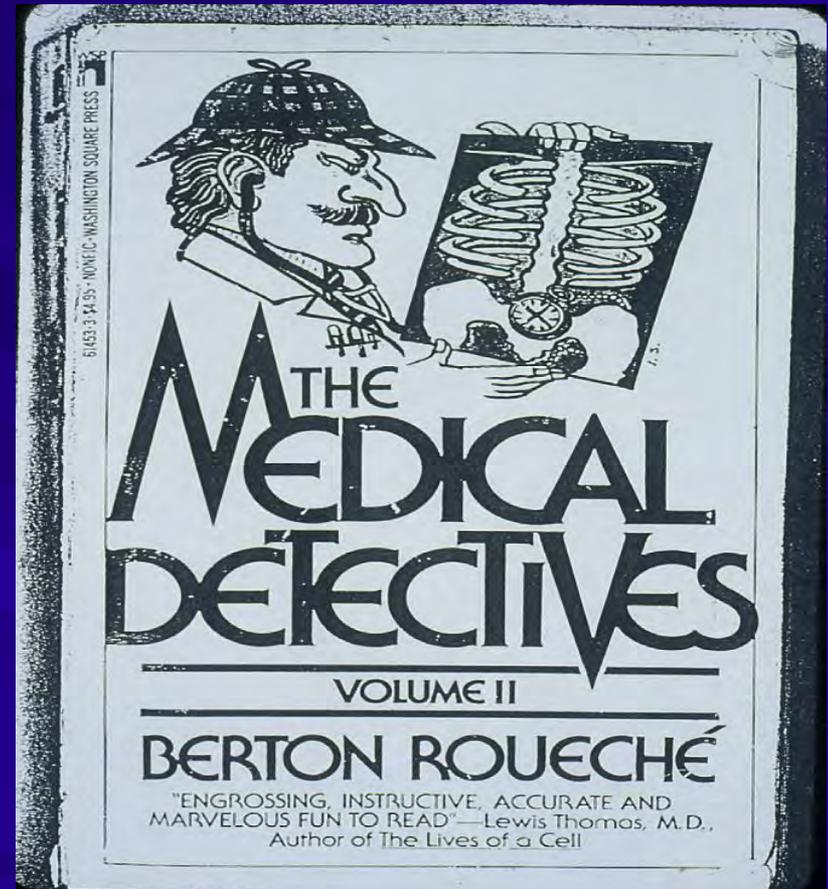
1. Meningococcal meningitis in MSM
2. Reactions following infusion of saline in 2 NYS patients
3. Kawasaki cluster at children's hospital
4. Fusarium abscess after epidural injection
5. Respiratory cluster in assisted living facility
6. Macaque bite in Indonesia
7. GI outbreak in Queens restaurant

Updates

1. R/o Ebola case-patient update
2. Legionella cluster in COOP city
3. Shigella increase in Orthodox neighborhoods
4. Ebola Update – Team

Weekly updates

Syndromic
Influenza



Steps of an Outbreak Investigation

- Detection and verification of outbreak
 - Relies on REPORTING and central data repository
 - ELR
 - Provider – electronic and traditional methods
 - Syndromic
 - Need for complete, accurate, interpretable data (range of specificity)
 - Need to know the baseline and background rates
- Active case-finding
 - Case definition may change over course of outbreak
- Triage and investigation of suspect case reports
 - Medical record review and physician interview
 - Interview patient/family re exposure and contact data
 - Collect, transport and track lab specimens

Steps of an Outbreak Investigation (cont.)

Description and initial analysis of data to develop hypotheses re. source and how transmitted

Laboratory testing, often at PHL

- Integration of Lab and Epi data

Contact tracing and management, if indicated

Environmental investigation

Epidemiologic analyses

Intervention/control measures and communication

Public Health Reporting is Critical

Electronic

- Providers – individual cases
- Laboratories – powerful but problematic
- Syndromic
- EHRs/RHIOs (?)
- Many improvements are needed

Paper/phone

- Still important

Larger and more complex outbreaks

- Demand for real time data
- Bidirectional communication with providers and labs needed
- Focus on individual outcomes (very challenging for public health)
- Need for stat GIS analysis and maps
- Evaluate control measures and treatment
- Extremely dynamic – systems require flexibility, scalability
- Multiple jurisdictions can be affected

Outbreak Data Needs

How can EHRs help?

- Improved demographics and contact info for providers and patients
- Individual look-up and query AND population data – query
- Routine reporting to support detection
- Case-finding and confirmation
- Medical risk factors – targeting population at risk
- Identifying populations in need of care
- Tracking outcomes and severity of illness
- Bidirectional communication with medical community – partner notification

Detection



Outbreak investigation
and management



Intervention/Control



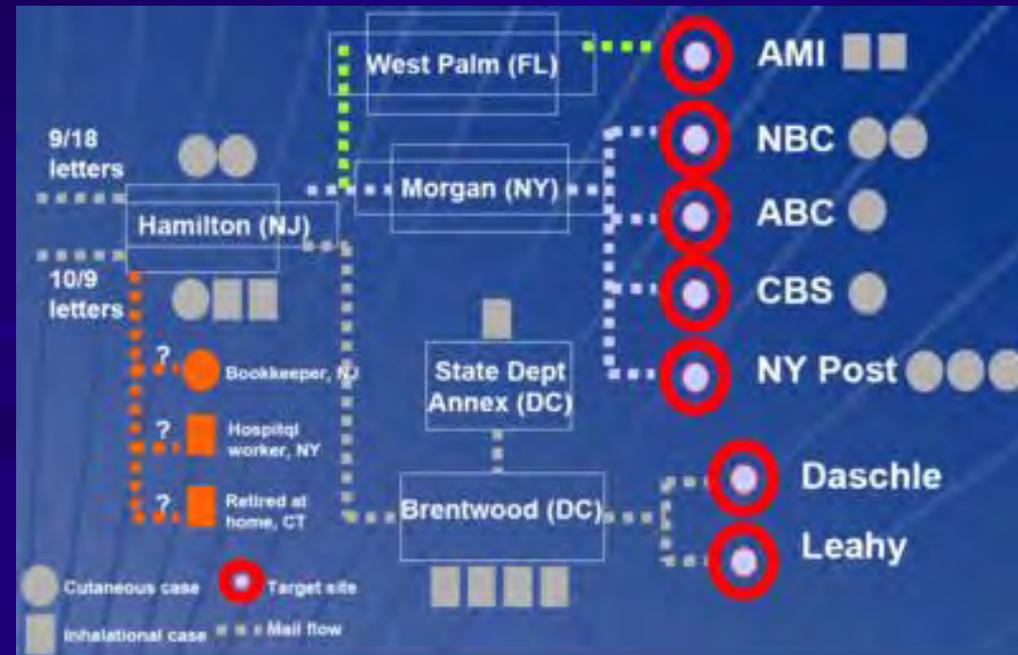
Outbreak

Thank you

Anthrax 2001



- Detection
 - Individual case in FL
 - Distinctive clinical picture – MD vigilance
- Key issues
 - 4 sites, environmental sampling
 - Huge volume suspect cases/lab samples
 - Linking lab, epi and env data
- Control
 - Prophylaxis, vaccine
 - Environmental clean-up



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Outbreak Case Management and Reporting

Janet J Hamilton, MPH

Florida Department of Health

Surveillance and Surveillance Systems Manager

Council of State and Territorial Epidemiologists (CSTE)

January 13, 2014

Different Data Needs From Clinical Care For Different Surveillance Activities



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- Vitals
- Registries – cancer, birth defects etc.
- Reportable disease/condition surveillance
- Outbreak management
- Periodic active surveillance
- Emergency situations



- The traditional core of public health surveillance
- Learn about *every* person with a reportable disease to:
 - Identify promptly all cases of diseases or conditions that require public health intervention;
 - Plan, assess or evaluate control and prevention interventions;
 - **Detect outbreaks, changing trends or patterns in disease occurrence.**

Conditions For Which Clinician Case Reporting Has Been Used



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Reportable Diseases/Conditions in Florida Practitioner* List 11/24/08

Did you know that you are required by Florida statute** to report certain diseases to your local county health department?

*Reporting requirements for laboratories differ. For specific information on disease reporting, consult Rule 64D-3, Florida Administrative Code (FAC).

- ! = Report immediately 24/7 by phone upon initial suspicion or laboratory test order
- ☎ = Report immediately 24/7 by phone
- = Report next business day
- + = Other reporting timeframe

- Infectious diseases
 - Environmental diseases
 - Birth defects
 - Cancers
 - Occupational diseases
- ALL have potential for outbreak and cluster investigations

1. Detection
2. Situational Awareness
3. Management

<p>Weak of cases, or outbreak of a on found in the general r defined setting such as a r other institution, not is of urgent public health includes those indicative in spread, zoonotic ice of an environmental, is source of exposure and rom a deliberate act of</p> <p>Deficiency Syndrome</p> <p>itis *</p> <p>•</p> <p>me, wound, unspecified,</p> <p>•</p> <p>up virus (neuroinvasive asive disease) *</p> <p>is *</p> <p>n-melanoma skin cancer, ign and borderline NS tumors)+</p> <p>poisoning *</p> <p>soning (Ciguatera) *</p> <p>ilias *</p> <p>neonates ≤ 14 days old) *</p> <p>disease (CJD) *</p> <p>•</p> <p>cephalitis virus disease d non-neuroinvasive) *</p> <p>r (non-arboviral) *</p> <p>ie to:</p> <p>llif, O157:H7</p> <p>llif, other pathogenic E. entero- toxicogenic, ogenic, hemorrhagic, trains and shiga toxin is</p>	<p>Granuloma inguinale *</p> <p>! Haemophilus influenzae (meningitis and invasive disease)</p> <p>Hansen's disease (Leprosy) *</p> <p>☎ Hantavirus infection</p> <p>☎ Hemolytic uremic syndrome</p> <p>☎ Hepatitis A</p> <p>Hepatitis B, C, D, E, and G *</p> <p>Hepatitis B surface antigen (HBsAg) (positive in a pregnant woman or a child up to 60 days old with disseminated infection with involvement of liver, encephalitis and infections limited to skin, eyes and mouth; anogenital in children ≤ 12 yrs) *</p> <p>Herpes simplex virus (HSV) (in infants up to 60 days old with disseminated infection with involvement of liver, encephalitis and infections limited to skin, eyes and mouth; anogenital in children ≤ 12 yrs) *</p> <p>Human Immunodeficiency Virus (HIV) infection (all, and including neonates born to an infected woman, exposed newborn)+</p> <p>Human papillomavirus (HPV) (associated laryngeal papillomas or recurrent respiratory papillomatosis in children ≤ 6 years of age; anogenital in children ≤ 12 yrs) *</p> <p>! Influenza due to novel or pandemic strains</p> <p>☎ Influenza-associated pediatric mortality (in persons aged < 18 yrs)</p> <p>Lead poisoning (blood lead level ≥ 10µg/dL); additional reporting requirements exist for hand held and/or on-site blood lead testing technology, see 64D-3 FAC *</p> <p>Legionellosis *</p> <p>Leptospirosis *</p> <p>☎ Listeriosis</p> <p>Lyme disease *</p> <p>Lymphogranuloma venereum (LGV) *</p> <p>Malaria *</p> <p>! Measles (Rubeola)</p> <p>! Melioidosis</p> <p>Meningitis (bacterial, cryptococcal, mycotic) *</p> <p>! Meningococcal disease (includes meningitis and meningococcemia)</p> <p>Mercury poisoning *</p> <p>Mumps *</p> <p>☎ Neurotoxic shellfish poisoning</p> <p>☎ Pertussis</p> <p>Pesticide-related illness and injury *</p> <p>! Plague</p> <p>! Polioymyelitis, paralytic and non-paralytic</p> <p>Psittacosis (Ornithosis) *</p> <p>Q Fever *</p> <p>☎ Rabies (human, animal)</p>	<p>! Rabies (possible exposure)</p> <p>! Ricin toxicity</p> <p>Rocky Mountain spotted fever *</p> <p>! Rubella (including congenital)</p> <p>St. Louis encephalitis (SLE) virus disease (neuroinvasive and non-neuroinvasive) *</p> <p>Salmonellosis *</p> <p>Saxitoxin poisoning including paralytic shellfish poisoning (PSP) *</p> <p>! Severe Acute Respiratory Syndrome-associated Coronavirus (SARS-CoV) disease</p> <p>Shigellosis *</p> <p>! Smallpox</p> <p>Staphylococcus aureus, community associated mortality *</p> <p>☎ Staphylococcus aureus (infection with intermediate or full resistance to vancomycin, VISA, VRSA)</p> <p>☎ Staphylococcal enterotoxin B (disease due to)</p> <p>Streptococcal disease (invasive, Group A) *</p> <p>Streptococcus pneumoniae (invasive disease) *</p> <p>Syphilis *</p> <p>☎ Syphilis (in pregnant women and neonates)</p> <p>Tetanus *</p> <p>Toxoplasmosis (acute) *</p> <p>Trichinellosis (Trichinosis) *</p> <p>Tuberculosis (TB) *</p> <p>! Tularemia</p> <p>☎ Typhoid fever</p> <p>! Typhus fever (disease due to Rickettsia prowazekii infection)</p> <p>Typhus fever (disease due to Rickettsia typhi, R. felis infection) *</p> <p>! Vaccinia disease</p> <p>Varicella (Chickenpox) *</p> <p>Varicella mortality *</p> <p>! Venezuelan equine encephalitis virus disease (neuroinvasive and non-neuroinvasive)</p> <p>Vibriosis (Vibrio infections) *</p> <p>! Viral hemorrhagic fevers (Ebola, Marburg, Lassa, Machupo)</p> <p>West Nile virus disease (neuroinvasive and non-neuroinvasive) *</p> <p>Western equine encephalitis virus disease (neuroinvasive and non-neuroinvasive) *</p> <p>! Yellow fever</p>
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part of Florida's disease surveillance system.
ath call the epidemiology unit at your local county health department or the Bureau of Epidemiology,
nith (FD-04): 950-245-4401 or visit http://www.doh.state.fl.us/diseases_ctrl/epi/topics/surv.htm

**Section 381.002(1)(2), Florida Statutes provides that "Any practitioner, licensed in Florida to practice medicine, osteopathic medicine, chiropractic, naturopathy, or veterinary medicine, who diagnoses or suspects the existence of a disease of public health significance shall immediately report the fact to the Department of Health." The Florida county health departments serve as the Department's representative in this reporting requirement. Furthermore, this Section provides that "Periodically the Department shall issue a list of diseases determined by it to be of public health significance ... and shall furnish a copy of said list to the practitioners...."





- Might better be called pre-diagnostic surveillance
- Detect events at the community level before diagnoses are made
- Situational awareness: monitor the progress of larger events once recognized
- Proven success! Detection algorithms (key word searches), like those needed for case reporting really work
- Speed vs completeness
 - Data sources: ED or clinic visits, poison control center calls, EMS run reports, absenteeism, key words in tweets or search engines, news reports, blogs

How Does PH Get Needed Information?



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- The *initial* report alone (from either clinician or the laboratory) often does not have all the information PH needs for completing investigations
 - PH needs Person, Place, Time (Who, When, Where, What):
 - ✓ Clinical and lab information to confirm the diagnosis
 - ✓ Treatment or medications given to the patient
 - × Where the exposure/event occurred
 - × Denominator present (total exposed/impacted)
 - × Environmental setting
 - × How the patient may have become ill (insect bites, foods consumed, travel locations, etc.)
 - × Further prevention actions needed (e.g. exposed family members needing treatment or vaccine)

✓ Maybe in EHR?

× Probably not in EHR?

Defining Data Management Needs During Outbreaks and Events



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- What data does public health need for outbreak management and investigation
- What is different about outbreaks?
 - Review some examples:
 - Ebola
 - H1N1
 - Fungal meningitis
 - MERS
 - Others
 - Lots of media attention and need for data multiple times a day! Accurate, timely case counts

Ebola - Challenges



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HEALTH ADVISORY: EBOLA
Recently in West Africa?

If you get sick, call a doctor.
Tell the doctor where you traveled.

Watch for fever, headaches, and body aches in the next 3 weeks.

3 WEEKS

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

For more information:
visit www.cdc.gov/travel
or call 800-CDC-INFO.

- New, lots of public attention
- Detailed daily travel monitoring for 21 days - many hand offs between counties within FL and across state lines
- Active review for potential cases - syndromic surveillance
- Need additional surge resources

H1N1 – Challenges

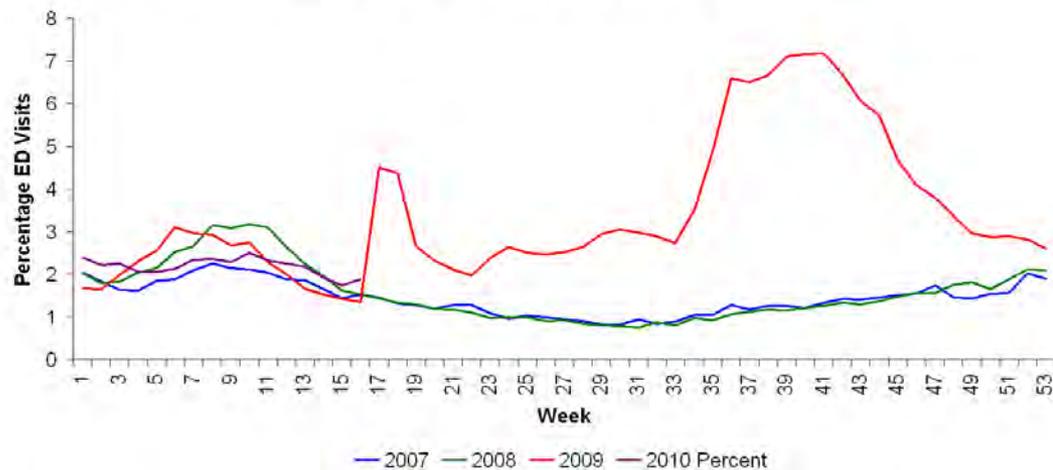
Especially early on pre-pandemic phase



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- New, many susceptibles in the population
- Communicable, rapidly spread
- Syndromic surveillance: situational awareness
- Laboratory diagnosis challenging; esp. initially testing only available at CDC; public health not prepared to be the only clinical diagnostic location, laboratory surge capacity

Influenza-like Illness Visits (by Chief Complaint) to Emergency Departments (ED)
as a Percentage of All ED Visits, Florida ESSENCE Participating Hospitals
(N=137), Week 1, 2007 through April 20, 2010

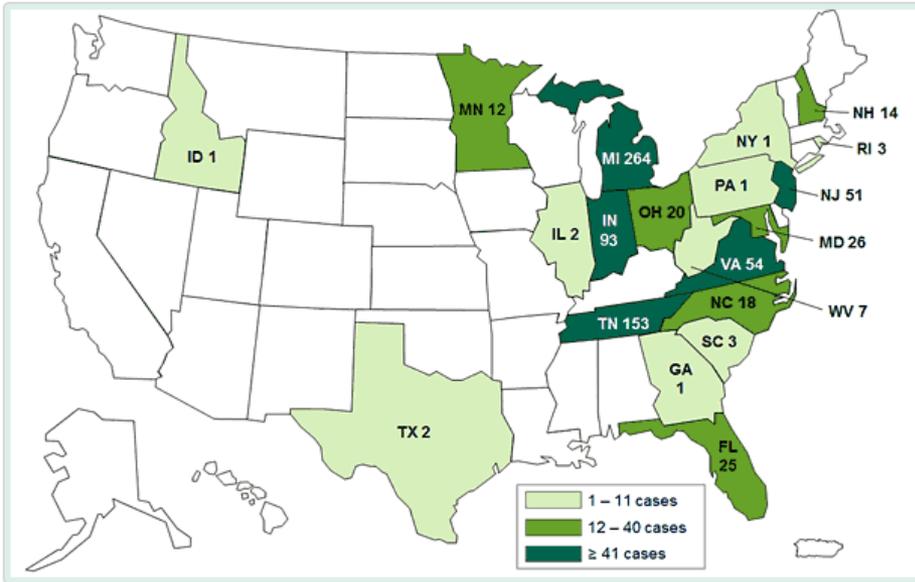


Fungal meningitis - Challenges



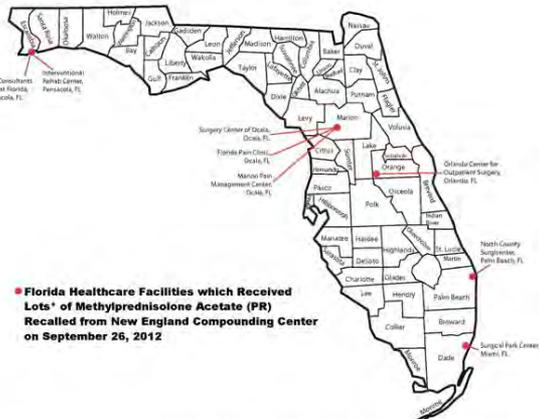
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Persons with Fungal Infections Linked to Steroid Injections, by State



- New, unexpected, non infectious
- Active surveillance for case finding
- Long incubation periods
- Many exposed, outreach multiple times to all exposed
- Detailed clinical record reviews
- Site investigations needed at multiple settings
- Need to capture, describe and retrieve relationships between people, sites, specific exposures, laboratory results
- Complicated laboratory testing, multiple specimens over time, complicated collection, complicated screening criteria
- New insights for PH to understand how EHRs are used
- Intense demand for media updates

Map 2: Map of Florida Healthcare Facilities which Received Implicated Lots* of Methylprednisolone Acetate (PF) Recalled from New England Compounding Center on September 27, 2012



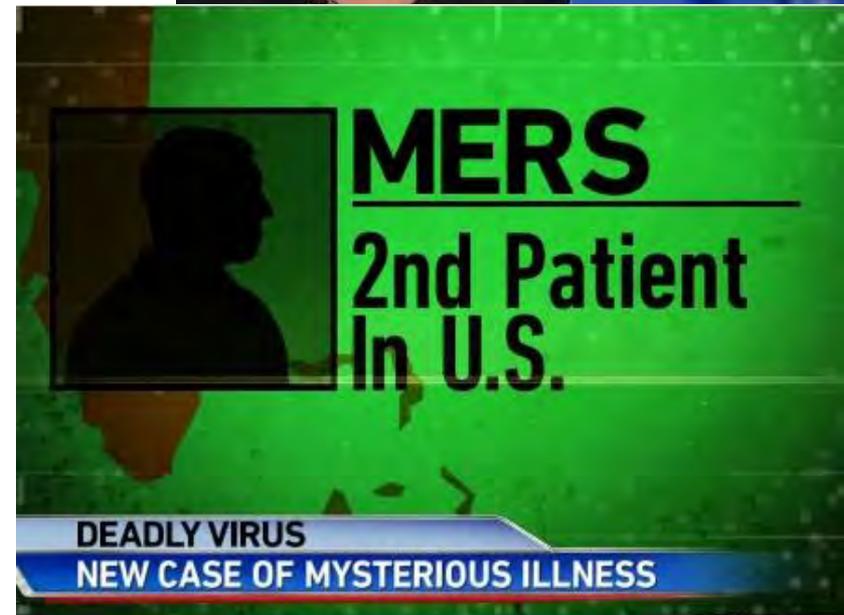
*Lot #05212012@68, by use date (BUD) 11/17/2012, Lot #06282012@26, BUD 12/26/2012, Lot #08102012@51, BUD 2/6/2013

MERS - Challenges



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- New, unclear secondary case infection rate
- Many exposed
- Multilayer contact tracing: household, healthcare workers, airline, waiting room (including people waiting with the waiting)
 - Contact specimen collection (multiple specimens on each); paired sera (multiple weeks apart); different specimens depending on type of contact
- Clinical advice: ensure appropriate isolation precautions
- Laboratory specimen collection (NP/OP, stool, urine, serum, sputum, induced sputum)
- Statewide increase in number of suspect MERS cases reported for rule out
- Other studies – collected specimens on asymptomatic contacts to determine asymptomatic secondary infection rates



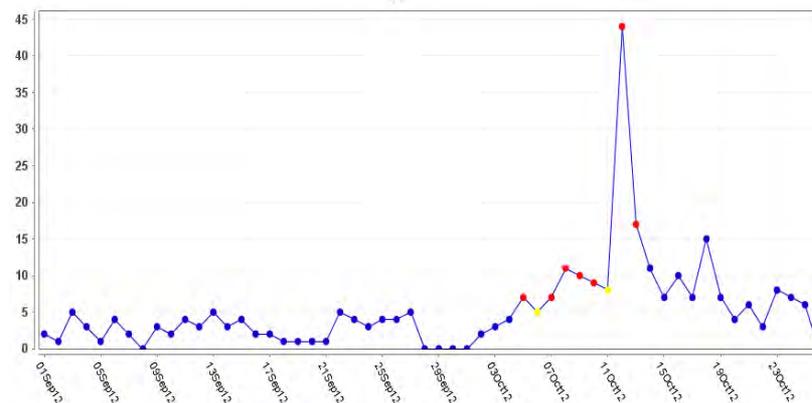
We Are Doing This Every Day

A Few Current County Level Outbreaks



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- Cluster of *Stenotrophomonas maltophilia*
 - Collection of water samples
 - Determination of those colonized vs. medially ill
 - PFGE matching to identify the cluster
- Salmonella raw milk associate outbreak
 - Transportation of raw milk (labeled as pet food) across state lines
- CO in warehouse workers
- Measles
- Meningococcal

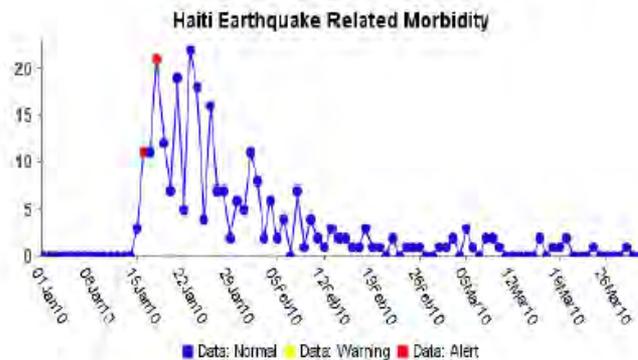
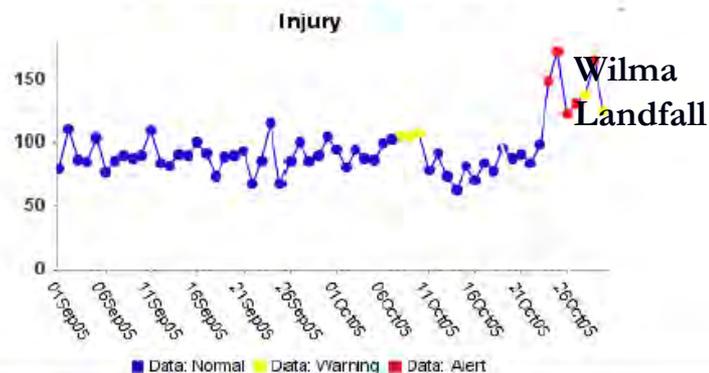
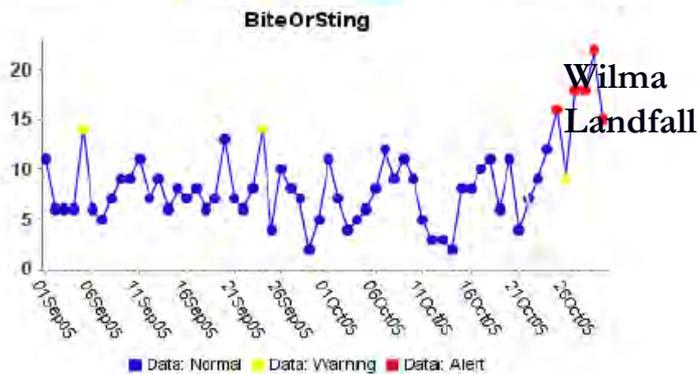
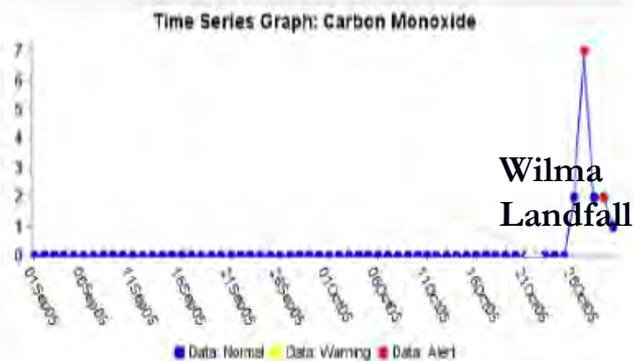


ESSENCE ED Chief Complaint "Meningitis," Statewide, 9/1-10/26/2012
Visit spike on 10/12-10/13 is due to bacterial meningitis outbreak

Syndromic Surveillance: Event Monitoring Dashboard-Morbidity Post-Disaster



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Earthquake

- Other activities: establishment of registries: responders post Gulf Oil Spill, Hurricane Katerina



- Establish data flow connections; leverage electronic feeds
 - prior to events
 - balance between speed of information vs completeness
 - ELR and syndromic surveillance = success stepping stone
 - Public health goal: reduce time *accessing* and *gathering* information → patients are contacted sooner → source of illness is identified more quickly leading to improved disease prevention

Future State: Satisfied Unmet Needs



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- Expectation of electronic information sharing to support detection, case reporting and follow-up
- Seem less interaction once the *initial* event has been identified
 - Multimodal access for Public Health to EHRs
 - Automated exchange, direct access
 - Queries looking for a specific individual, queries looking for a set of individuals based on known criteria)
- More understanding by users of EHRs that EHR data is useful beyond individual patient care
- ELR – close remaining gaps
 - free standing/commercial, federal laboratories