How Can the United States Improve Detection of Bioterrorism Events?

The Role of Clinical Information Systems

HIMSS, February 11, 2003

Richard Hopkins, MD, MSPH.
Medical Epidemiologist, SAIC
Today’s presenters

- Richard Hopkins, MD, MSPH. Medical Epidemiologist, SAIC
- Louise Gresham, PhD, MPH., Epidemiologist, Health & Human Services Agency, County of San Diego; Faculty, Graduate School of Public Health, San Diego State University
- Michael Congleton, MD, PhD. Medical informatics, SAIC
- CDR Ted Robinson, MD, MPH. Epidemiologist, Naval Hospital, Camp Pendleton, CA
Broad outline of session

- What is public health surveillance and why is it important? What’s it got to do with bioterrorism?
- How can clinical information systems be used to improve surveillance?
- Some examples of surveillance systems (working and under development) that use clinical information system data directly
Roadmap to session

- Introduction (now)
- Three talks – 15-20 minutes each
- Some recommendations
- Time for questions and discussion after all three talks are done
- Wrap-up and summary at the end
What will you get out of this session?

- You will better understand what the public health and homeland security needs are for surveillance.
- You will better understand how clinical information systems can be used to enhance surveillance.
- You will understand what your facility’s part can be in enhancement of surveillance, and what your facility can gain.
Key components of a public health surveillance system

Three main ways to improve a modern public health surveillance system:

– 1. Improve ways for clinicians, labs, infection control nurses to report cases and get advice 24/7
– 2. Capture relevant data directly from clinical information systems in real time
– 3. Rapidly implement special surveillance at point of care to gather special information not available in CIS about all patients seen.
Why improve surveillance?

- Earlier detection of individual cases of bad infectious diseases allows prompt control measures to be taken – may stop outbreak.
- Earlier detection of outbreaks of bad infectious diseases allows prompt control measures to be taken – may enormously limit the size of an outbreak and save lives.
- Need fail-safe – depending on people to know or remember to report cases reduces compliance.
What happens after detection?

- Epidemiologic investigation
- Science-based control measures – treat the sick, protect the exposed, prevent further exposures
- Continue surveillance to detect geographic spread, peaking of outbreak, new risk groups
- Each of these activities has its own needs for data collection and analysis, including clinical information system data plus ad-hoc systems
Dr. Gresham’s talk

- What is surveillance?
- What are data sources used for surveillance?
- What needs to be improved to make surveillance fully useful for bioterrorism detection?
Dr. Congleton’s talk

Overview of:

- The principal components of a surveillance system including information/data collection, detection, early warning & alerts, notification & communication, and response.

- A surveillance system deployed for collecting Syndromic data – RSVP.

- A surveillance system deployed post 9/11 in NYC – LEADERS.
Dr. Robinson’s talk

- Extrapolation of military lessons to general homeland defense
- Prototypes and methods for accomplishing
  - ESSENCE and ESSENCE II (Type 2)
  - MDSS (Navy) (Type 2)
  - LEADERS (Air Force) (Type 3)
  - DTRA initiatives re: test-beds for surveillance (all three types)
Managers of clinical information systems can help their communities’ public health agencies enormously.

- Systems to assemble data from clinical information systems may also support other hospital reporting requirements.
- CDC’s National Electronic Disease Surveillance System (NEDSS) provides an architecture and messaging standards to support public health surveillance.
- Commercial CIS will eventually support surveillance and other external reporting.
Recommendations

- Collaborate within your community with those who are trying to save lives by early detection of outbreaks, including bioterrorism events.
- Advocate within your organization for increasing the priority placed on collaboration for surveillance.
- Be sure that community systems appropriately assure privacy, confidentiality and security.
- Expect to receive information your facility and practitioners can use.
More recommendations for community surveillance systems

- Build systems to require minimal monitoring.
- Keep it simple
- Aim for practical system, not perfect. We can’t afford to wait for the ideal infrastructure.
Public Health Surveillance

Dr. Louise Gresham, PhD, MPH.
Health & Human Services Agency, County of San Diego
Faculty, Graduate School of Public Health,
San Diego State University
Surveillance

▷ Inherently an applied science.

▷ The ongoing, systematic collection, analysis, interpretation and dissemination of health data.
There is a compelling PH need to

- identify cases/conditions
- identify mode of spread
- take appropriate action
Examine the natural history, clinical spectrum, and epidemiology of a disease
- who is at risk
- when/where does disease occur
- determinants of risk

Establish baseline data
- Detect aberrations
- bioterrorism
Surveillance

- Common Sources of Data
  - Vital Statistics (birth, death)
  - Laboratory Reports
  - Hospital Discharge Summaries
  - Legally Notifiable Disease Reports
Title 17, California Code of Regulations (CCR), §2500
Reportable Diseases and Conditions*

§2500. REPORTING TO THE LOCAL HEALTH AUTHORITY.

- §2500(b) It shall be the duty of every health care provider, knowing of or in attendance on a case or suspected case of any of the diseases or conditions listed below, to report to the local health officer for the jurisdiction where the patient resides. Where no health care provider is in attendance, any individual having knowledge of a person who is suspected to be suffering from one of the diseases or conditions listed below may make such a report to the local health officer for the jurisdiction where the patient resides.

- §2500(c) The administrator of each health facility, clinic or other setting where more than one health care provider may know of a case, a suspected case or an outbreak of disease within the facility shall establish and be responsible for administrative procedures to assure that reports are made to the local health officer.

- §2500(a)(14) “Health care provider” means a physician and surgeon, a veterinarian, a podiatrist, a nurse practitioner, a physician assistant, a registered nurse, a nurse midwife, a school nurse, an infection control practitioner, a medical examiner, a coroner, or a dentist.

URGENCY REPORTING REQUIREMENTS [17 CCR §2500 (b) (i)]

- Report immediately by telephone (designated by a ◆ in regulations).
- Report immediately by telephone when two (2) or more cases or suspected cases of foodborne disease from separate households are suspected to have the same source of illness (designated by a ▼ in regulations).
- Report by FAX, telephone, or mail within one (1) working day of identification (designated by a + in regulations).
- All other diseases/conditions should be reported by FAX, telephone, or mail within seven (7) calendar days of identification.

REPORTABLE COMMUNICABLE DISEASES §2500(j)(1)

- Acquired Immune Deficiency Syndrome (AIDS)
- Amebiasis
- Anisakiasis
- Anthrax
- Babesiosis
- Botulism (Infant, Foodborne, Wound)
- Brucellosis
- Campylobacteriosis
- Chancroid
- Chlamydial Infections
- Cholera
- Ciguatera Fish Poisoning
- Coccidioidomycosis
- Colorado Tick Fever
- Conjunctivitis, Acute Infectious of the Newborn, Specify Etiology
- Cryptosporidiosis
- Cysticercosis
- Dengue
- Diarrhea of the Newborn, Outbreaks
- Pertussis (Whooping Cough)
- Plague, Human or Animal
- Poliomyelitis, Paralytic
- Psittacosis
- Q Fever
- Rabies, Human or Animal
- Relapsing Fever
- Reye Syndrome
- Rocky Mountain Spotted Fever
- Rubella (German Measles)
- Rubella Syndrome, Congenital
- Salmonellosis (Other than Typhoid Fever)
- Scarlet Fever Smoking Fish Poisoning
- Shigellosis
- Smallpox (Variola)
- Streptococcal Infections (Outbreaks of Any Type and Individual Cases in Food Handlers and Dairy Workers Only)
- Swimmer’s Itch (Schistosomal Dermatitis)
National Notifiable Disease Surveillance

- Reporting mandated by state law/regulation (amended Feb 2002 to include 7 BT agents)
- Health care providers, laboratories report to local HD (county)
- County HD transmits reports to State
- Reports transmitted to CDC primarily through National Electronic Telecommunications System for Surveillance (NETSS)
CONFIDENTIAL MORBIDITY REPORT

NOTE: For STD, Hepatitis, or TB, complete appropriate section below. Special reporting requirements and reportable diseases on back.

DISEASE BEING REPORTED:

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
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<tr>
<td>Patient's Last Name</td>
<td></td>
</tr>
<tr>
<td>First Name/Middle Name (or initial)</td>
<td></td>
</tr>
<tr>
<td>Address: Number, Street</td>
<td></td>
</tr>
<tr>
<td>City/Town</td>
<td></td>
</tr>
<tr>
<td>Area Code</td>
<td></td>
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<tr>
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<td>Race</td>
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<td>Birth Date</td>
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<td>Gender</td>
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<td>Estimated Delivery Date</td>
<td></td>
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<td>Patient's Occupation/Setting</td>
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<td>Health Care</td>
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<td>SCHOL</td>
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DATE OF ONSET:

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<th>Month</th>
<th>Day</th>
<th>Year</th>
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DATE DIAGNOSED:

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<th>Year</th>
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DATE OF DEATH:

<table>
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<tr>
<th>Month</th>
<th>Day</th>
<th>Year</th>
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</thead>
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REPORT TO

Epidemiology Fax 619-515-6644
Ph 619-515-6620

STD
Fax 619-692-8541
Ph 619-692-8520

TB
Fax 619-692-5516
Ph 619-692-8610

SEXUALLY TRANSMITTED DISEASES (STD)

<table>
<thead>
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<tr>
<td>Syphilis</td>
<td>Primary (lesion present)</td>
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<tr>
<td>Syphilis Test Results</td>
<td>RPR  Titer:______</td>
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VIRAL HEPATITIS

<table>
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<tr>
<th>Hep A</th>
<th>anti-HAV IgM</th>
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<tr>
<td>Pos</td>
<td></td>
</tr>
<tr>
<td>Neg</td>
<td></td>
</tr>
<tr>
<td>Pend</td>
<td></td>
</tr>
<tr>
<td>Done</td>
<td></td>
</tr>
</tbody>
</table>
Attributes of a Surveillance System

- Simplicity/Acceptability
- Flexibility
- Timeliness
- Sensitivity
- Predictive value
- Representativeness
Surveillance

- **Passive Surveillance**
  Most notifiable diseases

- **Active Surveillance**
  Border Infectious Disease Surveillance

- **Sentinel Surveillance**
  Influenza-like-illness
  West Nile (birds, chickens)
  Encephalitis (chickens)
TOXIC-SHOCK SYNDROME (TSS)
United States, 1985-2000

National Center for Infectious Diseases (NCID) data*
National Notifiable Diseases Surveillance System (NNDSS) data

*Includes cases meeting the CDC definition for confirmed and probable cases for staphylococcal TSS. Reporting for fourth quarter 2000 not yet available
Rapid-Response Surveillance

- Has different objectives than assessing long term trends and relationships
- Profusion of computerized systems
- False alerts
Public Health Actions

- Promptly investigate
- Confirm laboratory results at PH Lab/State DHS/CDC
- Identify & interview case contacts
- Initiate active surveillance for additional cases
- Take immediate public health prevention actions
Surveillance

- New pressures for early detection
- Use of multiple data sources is more meaningful – some are electronic
- Profound urgency to use integrated electronic data
Early Detection of BT
Reducing morbidity/mortality for exposed asymptomatic persons

First cases seek medical care

BT threat agent suspected, Public Health notified

3 days to:
- identify source & exposed persons
- locate the exposed, give prophylaxis

Exposure

Time frame for effective prophylaxis of exposed asymptomatic persons (incubation period of disease)

7 Days Post Exposure
Early Detection of BT
Reducing morbidity/mortality for exposed asymptomatic

First cases seek medical care—BT threat agent suspected, Public Health notified

5 days to:
• identify source & exposed persons
• locate those exposed to give prophylaxis

Time frame for effective prophylaxis of exposed asymptomatic persons (incubation period of disease)

7 Days Post Exposure
Surveillance

- Problems with Traditional Surveillance
- How can we pick up unusual disease occurrences or outbreaks *early* (even pre-diagnostic)?
- What data sources can be used effectively?
- What analytic methods?
Enhanced Health Surveillance

SURVEILLANCE

Vectorborne Disease Surveillance
Animal Morbidity & Mortality
School Absenteeism
Influenza-Like Illness (ILI)
Food-Related Complaints

Hospital Saturation Levels
Laboratory Testing
Reportable Diseases (80+)
Syndromic/Pre-diagnostic
Death Records

Paramedic Transport Chief Complaints
ED Resource Data - 21 Hospitals
- Emergency Department Saturation (Bypass)
- Trauma, ICU, Med/Surg. Saturation
- ED diversion data utilized in ILI surveillance
- Real-Time Live

Electronic Prehospital Patient Record
- Query 159 Data Fields In Any Combination
  e.g., Flu/fever/rash, non-traumatic resp. distress, shortness of breath and gastrointestinal distress
<table>
<thead>
<tr>
<th>Hospital Name-Code</th>
<th>Trauma</th>
<th>Hospital</th>
<th>CT</th>
<th>ICU</th>
<th>Other</th>
<th>Other</th>
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<td>BALBOA</td>
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<td>OPEN</td>
<td>OPEN</td>
<td>FULL</td>
<td>CCU FULL</td>
<td>OPEN</td>
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<tr>
<td>CHILDREN'S</td>
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<td>OPEN</td>
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<td>CORONADO</td>
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<td>FALLBROOK</td>
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<tr>
<td>PARADISE VALLEY</td>
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<tr>
<td>POMERADO</td>
<td>59</td>
<td>OPEN</td>
<td>OPEN</td>
<td>NO NEURO</td>
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<td></td>
</tr>
</tbody>
</table>
Daily Tracking of EMS Respiratory Chief Complaints

Comparison of Previous Week vs. Current Day

Cumulative Sum for Time Period and Day

Hypothetical Scenario

200% Increase

Graph showing the cumulative sum for time periods and days, with a hypothetical scenario indicating a 200% increase. The graph compares data from the previous week and current day.
Health Insurance Portability & Accountability Act (HIPAA)

**Consumer Control** ⇒ New rights to control release of medical information

**Boundaries** ⇒ Information used for health purposes only, including treatment and payment

**Accountability** ⇒ Specific federal penalties if a patient's right to privacy is violated.

**Public Responsibility** ⇒ Balance privacy with the public responsibility

- protecting public health
- conducting medical research
- improving the quality of care
- fighting health care fraud and abuse

**Security** ⇒ Responsibility to against deliberate/inadvertent misuse or disclosure.
Levels of Identifiability

- Sufficiently anonymous – normal operation
- Sufficiently de-identified – unusual activity
- Identifiable – suspicious activity
- Readily Identifiable – outbreak suspected
- Explicitly Identified – outbreak detected

L. Sweeney PhD, Carnegie Mellon 2002
Systems for Public Health Surveillance

Mike Congleton, PhD, MD.
Medical Informatics, SAIC
Systems for Public Health Surveillance

- Principal components of a model surveillance system
- Surveillance system deployed for collecting Syndromic data - RSVP
- Surveillance system deployed post 9/11 in NYC - LEADERS
Principal Components of Model System

- Information/data collection
  - multiple data sources (traditional and non-traditional)
- Signal Detection
  - Artificial Intelligence, expert systems, etc.
- Warnings & Alerts
  - First responders (Fire, EMS, Police, Health care workers, etc.)
- Communication
  - Multiple agencies and organizations, public
- Response
Functional Architecture

Sources
- Covert Attack
- Outbreak
- Overt Attack
- Hi Profile Event
- Disaster

Surveillance
- Data Collection & Processing
- Event Analysis
- Map-Based Analysis
- Detection
- Pathogen Ident.

Consequence Management
- Early Warning & Alerts
- Notification & Comm
- Response

Early Warning & Alerts Notification & Comm
Sources of Data/information

- **Public sector**
  - Environmental & local public health
  - School & state health programs
  - Poison control and medical hot lines
  - State labs
  - Law enforcement

- **Private Sector**
  - Hospitals, Emergency Rooms, Physicians, Veterinarians
  - Clinics, Community Health, Medical Examiner
  - Labs,
  - EMS,
  - Reportable Diseases, Unexplained Deaths, Unusual Illnesses

**CDC**
Collection of information from existing systems will occur via electronic and/or manual data collection methods. Considerations include:

- Patients receiving care from multiple providers
- Data formats
- Traditional and non-traditional data sources including human and animal data
- Information collected by paper, faxed, and voice
- Location and time lines of data collected
- Patient privacy and medical record confidentiality
Detection

Identification of a possible outbreak or event

• Requires appropriate tools for visualization and real-time assessment

• May depend on the use of artificial intelligence, expert systems, and rules based logic
Alert/early Warning

Notification and early warning to:

• First respondents, healthcare professionals, selected agencies and organizations
  • Level of concern notification
  • Updates to changes
Communication

Communication of information to:

• Provide updates to the media,
• Alert the general population, and
• Notify the population affected
Response

Level of response is determined by the event and includes considering:

- Containment and using resources most effectively
- Triage and prioritization of treatment(s)
- Distribution of medications and supplies
- Evacuation to appropriate and available care centers
RSVP is an internet based population health surveillance tool designed to facilitate rapid communications between epidemiologists (public health officials in local public health jurisdictions) and health care providers (especially physicians, physician assistants and nurse practitioners).

- Being developed at Sandia National Laboratories, a Department of Energy laboratory in Albuquerque, New Mexico in collaboration with epidemiologists and public-health officials at the State of New Mexico Department of Health and clinicians from several clinics.
- Is configured to overcome existing barriers to reporting of suspicious or unusual symptoms in patients, and capture clinician judgment regarding severity of illness and likely category of disease.
- Provides immediate feedback for clinicians, with data of relevance to the individual patient reported as well as continuous updating of the geographic and temporal characteristics of symptom distribution in the local community.
Rapid Syndrome Validation Project

User Name: select user
Password: 

Login

Syndrome Data Overview
- Influenza-like Illness
- Acute Respiratory Distress
- Acute Hepatitis
- Fever with Skin Findings (e.g., rash)
- Fever with Altered Mental Status
- Acute Bloody Diarrhea
**Demographic Information**

**Occupation**
- CHILD CARE/SCHOOL
- HEALTHCARE PROFESSIONAL
- FOOD HANDLER
- AGRICULTURE
- MILITARY/PUBLIC SAFETY
- OTHER

**Gender**
- M
- F

**Age**
- <18
- 30
- 45
- 60
- 75
- >75

**Contact with Person with Similar Illness**
- YES
- NO

**Recent Travel**
- YES (National)
- NO
- INTERNATIONAL
- U.S.

**Clinician:** Kevin Bersell
FINDINGS OVERVIEW - Influenza-like Illness

SPATIAL DISTRIBUTION

SYNDROME SUMMARY

TEMPORAL DISTRIBUTION

ADVISORY MESSAGE

Trifcore Reference Labs: Viral Culture Report 1: 11/25/00 to 12/01/00

Total requests: 25
RSV: 1 positive by direct FA
Influenza: no positives
Parainfluenza Type 2: 3 positive by culture
Parainfluenza Type 3: 1 positive by culture
LEADERS is a suite of services and applications that provides medical surveillance and outbreak management to support military, federal civilian, state, and local healthcare professionals in the public and private sectors. It uses a surveillance concept based on enhanced capabilities provided by an application service provider (ASP).

Developed by several companies including: ScenPro Inc., E.Y.T., and Oracle.
LEADERS Functionality

- Medical surveillance
- Emergency department diversion tracking
- Map-based tools for medical surveillance
- Map-based tools for incident management and resource allocation
- Incident tracking
- Checklist management
- Comprehensive alerting functionality
- Pathogen identification
Web-based Data Entry Screens

**Patient Visit Web Form**
- One Entered per Patient
- Collects User-Defined Demographics & Syndromes
- About 2 Dozen “Keystrokes”

**Patient Census Web Form**
- Entered Once per Day
- Collects User Defined Summary Info & “Rare” Syndromes
Pathogen Testing

- Optional HW component is the Ruggedized advanced pathogen identification device, RAPID
- Identifies most agent types in <40 minutes
- Designed for transport and operation under extreme conditions
- Pages sent to user-selected experts when tests start and complete
- Test results loaded real-time in LEADERS for remote viewing
Message Board

- User Defines Type of Message/Alert to be sent
- Message/Alert Can Be Read On Cellular Phones/PDA

- Message/Alert Can Be Very Detailed
- Message Board Utilizes Paging and Notification Module within LEADERS

LEADERS
Lightweight Epidemiological Advanced Detection & Emergency Response System

Create Message Board Posting

- Category: Emergency Broadcasts
- Title: Emergency Broadcasts
- Details: Contact Dr. Smith for detailed instructions. Be can be reached at 703-458-5076

Message Board Listing

<table>
<thead>
<tr>
<th>Category</th>
<th>Date Posted</th>
<th>Posting Title</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Broadcasts</td>
<td>11/19/2001 02:44</td>
<td>Hostage Situation at Mayor's Office - Test</td>
<td>Terrorist have taken five hostages and have taken five hostages including mayor. May include Anthrax attack.</td>
</tr>
<tr>
<td></td>
<td>11/19/2001 01:13</td>
<td>HAZMAT Vehicle Overturned on Interstate 95 - Test</td>
<td>HAZMAT Vehicle Overturned on Interstate 95. Casualties are expected. All Hazmat Teams to be on Full Alert</td>
</tr>
<tr>
<td></td>
<td>11/19/2001 01:09</td>
<td>Hurricane Notification Test</td>
<td>Hurricane Albert passes off the coast. Immediate evacuation of the area.</td>
</tr>
<tr>
<td>Public Health Alerts</td>
<td>11/21/2001 12:34</td>
<td>Suspected food poisoning - TEST</td>
<td>For further information call your local public health representative or the 800 number.</td>
</tr>
<tr>
<td></td>
<td>11/21/2001 12:10</td>
<td>Anthrax breakout at elementary school-TEST</td>
<td>This is a test of the message board.</td>
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<tr>
<td></td>
<td>11/20/2001 03:11</td>
<td>Suspected West Nile Case in the Orlando area</td>
<td>Confirmation expected within 24 hours.</td>
</tr>
<tr>
<td></td>
<td>11/20/2001 11:42</td>
<td>Suspected West Nile Virus Case in Miami - Test</td>
<td>Preliminary lab results indicate exposure to West Nile Virus. Please report any suspected cases to your local health department.</td>
</tr>
<tr>
<td></td>
<td>11/19/2001 01:31</td>
<td>Influenza Outbreak Test</td>
<td>Influenza outbreak has been detected in Palm Beach.</td>
</tr>
</tbody>
</table>
Critical Care Tracking

- Displays Hospital Status by Bed Type
- Easily Updated by Hospital
- Immediately Viewable by Dispatcher
- Can Drill Down to Exact Bed counts

- Shows Time Each Hospital Dept or Unit is Open vs. On Reroute
- Administrators Gauge Their Facility’s Performance Against Average Results
Incident Management (IM) Functionality

**Incident Management**
- Incident data entry
- Incident report generation
- Emergency contact mgmt.
- Emergency contact alerts

**Medical Facility Tracking**
- DEPT Status Tracking
- Bed Count Tracking
- Historical Reporting
- Alarms and Alerts

**Portal Dashboard**
- Multiple views of IM data
- User customizable
- Search engine
- Content management

**Casualty Tracking**
- Data collection
- Location and triage history
- Count reporting

**Checklist Management**
- Create checklists
- Manage checklists
- Activate checklists

**Viewport**
- Geographic display of data
- Locate assets and resources
- Spatial analysis of data

**Medical Facility Tracking**
- DEPT Status Tracking
- Bed Count Tracking
- Historical Reporting
- Alarms and Alerts
Incident Management - Checklists

- Status is Viewable by Command Personnel
- All Status Changes Are Timestamped

Tools are Provided to View, Construct, Activate and Monitor Checklists

Hierarchical Checklists Provide Flexibility
Resource/situation Awareness - ViewPort™

- Large Collection of Icons to Drag & Drop on Map
- User Define Cordons in Incident Area
- Example of User-Placed Police Unit Icon

- Map Coverage of the Entire US
- Automatically Adjusts Detail Based on Zoom

Stored Views Allow User to Return to Areas of Interest
Epi Spatial Display - MedView™

Admissions Display
- Patient Counts
- Total Admission
- Rates
- Playback Feature

Syndrome Selection
- Date Range Selection

Thematic Map Shading
- Select Zip, County or State Regions
- Shade Region with Home/Work/Hospital
- Label with Total Admits or PAR in Region
Questions?
Homeland Defense Against Biological and Chemical Weapons

Surveillance and preventive measures have always been critical for deployed forces. Now we are all “targets”.

CDR Ted Robinson, MD, MPH.
Epidemiologist, Naval Hospital,
Camp Pendleton, CA
Current Public Health Surveillance

- Dependent on active reporting
- Varying compliance
- Incomplete and delayed data
- Sub optimal for natural outbreaks
- Dangerous in era of bioterror
  - Delay means lives
Time Factor

- Incubation times
  - To become ill
- Generations of cases
  - spread to others
- Exponential growth
  - Smallpox by factor of 10
### The Threat: Bioagents by Probability of Use as Biological Weapons *

<table>
<thead>
<tr>
<th>Very likely to be used</th>
<th>Possible use</th>
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<tbody>
<tr>
<td>Smallpox</td>
<td>Brucellosis</td>
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<td>Plague</td>
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<td>Yellow fever</td>
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<td>Q fever</td>
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<td>Typhus</td>
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*Gen A.A Vorobyev 1994*
Surveillance is Early Warning: NORAD for Biological Agents

- Need to know where, who and how many
  - Where and to what do we respond to
- Prototype used in Gulf War - 1990-91
- Diagnoses divided into categories
  - Syndromic surveillance – Dr Kevin Hansen
- Need # cases/population
  - Resources applied if incidence increased
Surveillance Methodology

- Automation for Homeland defense!
  - IM/IT to the rescue!
- Compatible data systems
  - Composite Health Care System (CHCS)
  - Ambulatory Data Module (ADM)
    - Standard Ambulatory Data Record (SADR)
  - All patient data, labs, rad and diagnoses
  - All are compatible and consistent
- System=components working toward a common goal
  - DoD is literally one healthcare system
Data Processed Through CEIS Serves as the Basis for Daily Syndromic Surveillance
ESSENCE: An Electronic Surveillance System for the Early Notification of Community-based Epidemics

- Earlier detection of aberrant clinical patterns at the community level to jump-start response
- Rapid epidemiology-based targeting of limited response assets (e.g., personnel and drugs)
- Rapidly equipping civil government leaders with outcome-based “exposure” estimates
- Risk communication to reduce the spread of panic and civil unrest

Ref - LTC Julie Pavlin
Began receiving SADR information from military facilities (MTF) in Dec 99 for the National Capital Area (NCA)

Expanded to all MTFs in September 2001
- 121 Army, 110 Navy, 80 AF and 2 CG installations monitored – grouped into 179 geographic clusters

Information available via secure website

Syndromic surveillance

Ref – LTC Julie Pavlin
Outpatient ICD-9-CM Diagnoses Are Clustered into Broad Syndrome Groups

- Respiratory (cough, pneumonia, URI)
- Gastrointestinal (vomiting, diarrhea)
- Neurologic (meningitis, botulism-like)
- Dermatologic – hemorrhagic
- Dermatologic – vesicular (smallpox-like)
- Fever/Malaise/Sepsis
- Coma/Sudden Death

Ref – LTC Julie Pavlin
Syndrome Counts for the MCRDSANDIEGO Area

Syndrome Group = GI

Current as of Monday, 28JAN02 at 04:45 hrs

Date of Appointment

PLOT  Count of Syndrome Group
       Smoothed Count (7 Day Average)
       ○ ○ ○ Monday

LTC J. Pavlin
Proposed Evolution of ESSENCE:

- Civilian Surveillance System
- NOAA Weather
- Civilian Pharm Data
- EMS Call Data
- Civilian Emergency Rooms
- Managed Care Data
- Poison Control Center
- Entomology Data
- MHS Outpatient Data
- MHS Lab, Rad, Pharm

LTC J. Pavlin
Medical Data Surveillance System (MDSS)

- Uses CHCS & ADM data
- Daily updates
- Cusum and Shewhart quality control
- More sensitive, less specific
- Need local system redundancy
### MDSS Alert Page

#### Summary Alert (Total Count)

**Alert Status for 2002-06-04**

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<th>DNBI</th>
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Optimal System Characteristics

- Passive - Not require a report
- Comprehensive - Cover pop at risk
- Diagnostic - Based on ICD-9
- Automated - Built in algorithm alerts
- Confidential - HIPAA compliant
- Timely - Daily!
- Alert level sensitive
What Can These Systems Do?

- Provide early detection of outbreaks
  - Earlier than most existing systems
- Provide epidemiologic tools to assist the outbreak investigation
- Provide information for leaders and risk communicators
- Decrease workload for labor intensive active systems
- Prompt more accurate diagnostic testing
What Can’t These Systems Do?

- Detect every outbreak early
  - Few cases, short incubation
- Decrease morbidity/mortality every time
  - Best for diseases with longer incubation periods where effective interventions exist
- Tell you the causative agent
- Investigate the outbreak for you
  - Public health professionals remain the important link
Caveats

- Own your own data, protect your own patients
  - Allows for better accountability and quality
- Response to “alerts”
  - PH dept- Global view
  - Other facilities, etc
- Sensitivity/specificity flexibility
  - Algorithms validated
- System protection – Must be very secure
Questions for us on the new paradigm?

“to provide for the common defense”, now has new meaning