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2d Session

HOUSE OF REPRESENTATIVES

REPORT
109–436

STRENGTHENING DISEASE SURVEILLANCE

EIGHTH REPORT

BY THE

COMMITTEE ON GOVERNMENT REFORM

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APRIL 25, 2006.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
Washington, DC, April 25, 2006.

Hon. J. DENNIS HASTERT,
Speaker of the House of Representatives,
Washington, DC.

DEAR MR. SPEAKER: By direction of the Committee on Government Reform, I submit herewith the committee's eighth report to the 109th Congress. The committee's report is based on a study conducted by its Subcommittee on National Security, Emerging Threats, and International Relations.

TOM DAVIS,
Chairman.

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APRIL 25, 2006.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. TOM DAVIS, from the Committee on Government Reform submitted the following

EIGHTH REPORT

On April 6, 2006, the Committee on Government Reform approved and adopted a report entitled, "Strengthening Disease Surveillance." The chairman was directed to transmit a copy to the Speaker of the House.

EXECUTIVE SUMMARY

The spread of the H5N1 virus and the threat of pandemic influenza is the most recent reminder of the need for sensitive, vigilant disease surveillance. In 2002, the world conducted an involuntary, live-fire exercise of public health capacity against bioterrorism. Severe Acute Respiratory Syndrome [SARS] emerged from the microbial hothouse of the Far East through the same vulnerabilities and vectors terrorists would exploit to spread weaponized, genetically altered disease. The global response to SARS underscores the vital significance of sensitive disease surveillance in protecting public health from natural, and unnatural, outbreaks. It also discloses serious gaps and persistent weaknesses in international and U.S. health monitoring.

The lessons of the West Nile virus and mail-borne anthrax have not gone unheeded. Substantial enhancements have been made to the accuracy, speed and breadth of health surveillance systems at home and abroad. The limited impact of SARS here can be attributed, in part, to increased preparedness to detect, control and treat outbreaks of known and unknown diseases.

But the surveillance system standing guard over America's public health today is still a gaudy patchwork of jurisdictionally narrow, wildly variant, technologically backward data collection and

communications capabilities. Records critical to early identification of anomalous symptom clusters and disease diagnoses are not routinely collected. Formats for recording and reporting the same data differ widely between cities, counties and states. Many key records are still generated on paper, faxed to state or Federal health authorities and entered manually one or more times into potentially incompatible databases.

In a world made smaller by the speed of international travel and the rapid mutation of organisms in our crowded midst, the incubation period between local outbreak and global pandemic is shrinking. Virulent, drug-resistant organisms easily traverse the geographic and political boundaries that still define, and inhibit, public health systems. Efforts to build a more modern "system of systems" envision routine collection and rapid dissemination of real-time data from public and private health systems and laboratories. Early warning capabilities would be enhanced through the fusion of innovative syndromic surveillance—automated screening of emergency room traffic, pharmacy sales, news wires and other public data streams for potentially significant early signs of an outbreak.

Pieces of this planned health monitoring system can be assembled at different times and places, but no fully national system yet integrates the observations and communications needed to protect public health from rapidly emerging biological hazards. Successfully operating the elaborate, elegantly sensitive surveillance network of the future will require unprecedented levels of human skill, fiscal resources, medical information and intergovernmental cooperation.

At this moment, sophisticated radars scan the skies and the seas to detect the approach of forces hostile to the peace and sovereignty of this Nation. A similarly unified, sensitive system of disease sensors is needed to detect the advance of biological threats to our health and prosperity.

Finding

1. Disease surveillance systems are fragmented and have been slow to adapt to new technologies which could improve the timeliness of outbreak reporting.

Recommendation

1. The Centers for Disease Control and Prevention should clearly define the technical parameters and set a specific timeframe for establishing a unified national disease surveillance system to replace the current patchwork of reporting and monitoring programs.

I. BACKGROUND

According to the Centers for Disease Control and Prevention:

> Public Health Surveillance is the ongoing systematic collection, analysis and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these

> data to prevention and control. A surveillance system includes a functional capacity for data collection, analysis, and dissemination linked to public health programs.[1]

Concerns about bioterrorism, and improvements in technology, have led to an increased emphasis on the development of early warning systems to detect the presence of disease. The sooner public health authorities are made aware of contagious disease outbreaks, the sooner protective measures can be put in place to contain and control its spread. An effective public health response will depend on the timeliness and quality of communication among local, state and Federal levels.

There are several types of surveillance systems:

- Passive surveillance systems rely on laboratory and hospital staff and providers to take the initiative to provide data on diagnosed illnesses to health departments. The health department will analyze and interpret the information.
- An active surveillance system is one in which public health officials contact laboratories, hospitals and providers to acquire information on conditions or diseases in order to identify cases.[2]
- A syndromic surveillance system monitors various non-diagnostic data elements that may indicate emergence of disease in a population.
- A diagnosis based surveillance system monitors only physician or laboratory confirmation of a disease.[3]

Traditional disease reporting and surveillance methods were paper-based and relied on astute clinicians. In the past, accuracy was valued over speed when it came to disease surveillance. Traditional surveillance systems required a disease to be diagnosed before it was reported. Physicians and public health officers would gather data and send paper copies by mail. Federal, state and private laboratories would determine the cause of disease and confirm diagnoses. However, this process could take several days to weeks.[4]

Recent advances in technology have led to the development of automated systems that can track symptoms along with demographic information in order to provide earlier notification of potential outbreaks. Syndromic surveillance involves monitoring the population for clusters of symptoms that may provide an early warning of the presence of diseases. It is the, "collection and analysis of prediagnosis information that lead to an estimation of the health status of the community."[5]

Syndromic surveillance uses health care indicators such as emergency room primary complaint, international classification of disease billing codes, requests for specific laboratory tests, and over-the-counter medication sales. These indicators are then grouped

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[1] Rebecca A. Meriwether, "Blueprint for a National Public Health Surveillance System for the 21st Century," Online at: [http://www.cste.org/pdffiles/Blueprint.pdf] (accessed Mar. 23, 2006).

[2] U.S. General Accounting Office, Pub. No. GAO–03–373, *Bioterrorism: Preparedness Varied Across State and Local Jurisdictions,* 18–20 (April 2003).

[3] Joe Lombardo and LTC Julie Pavlin MD MPH, "Bio Surveillance: Utilizing ESSENCE II in Emergency Response," presented at the 2003 NDMS Conference, Mar. 9, 2003, p. 3.

[4] The New York Times, "Threats and Responses: The Bioterror Threat," Jan. 27, 2003, p. 3.

[5] Joe Lombardo and LTC Julie Pavlin MD MPH, "Bio Surveillance: Utilizing ESSENCE II in Emergency Response," presented at the 2003 NDMS Conference, Mar. 9, 2003, p. 7.

into specific syndromic categories such as respiratory, gastrointestinal, neurological, dermatological, febrile, etc.[6] Other data sources for disease indicators include school absenteeism, pharmaceutical sales, nursing home information and animal and agriculture health. Syndromic surveillance looks for the change in the distribution or frequency of health indicators or syndromic groupings of indicators compared to anticipated occurrences.[7] This can lead to a more timely notification process since the information is based on symptom reporting and not diagnosis. However syndromic surveillance systems can generate false positives (detecting an event that isn't there). A system that is sensitive and timelier will have a higher rate of false positives. Thus a balance must be created between the timeliness of detection and the ability to respond to and pay for the cost of false positives.

A. CENTERS FOR DISEASE CONTROL AND PREVENTION [CDC]

The Centers for Disease Control and Prevention have taken steps toward strengthening U.S. disease surveillance and testing a national surveillance system to provide early warning of public health threats.

The National Electronic Disease Surveillance System [NEDSS] is a CDC initiative that, "promotes the use of data and information system standards to advance the development of efficient, integrated, and interoperable surveillance systems at Federal, state and local levels."[8] The initiative is designed to, "1) facilitate the electronic transfer of appropriate information from clinical information systems in the health care industry to public health departments, 2) reduce provider burden in the provision of information, 3) enhance both the timeliness and quality of information provided."[9]

The vision of NEDSS is, "to have integrated surveillance systems that can transfer appropriate public health, laboratory, and clinical data efficiently and securely over the Internet. This will help improve the Nation's ability to identify and track emerging infectious diseases and potential bioterrorism attacks as well as to investigate outbreaks and monitor disease trends."[10] NEDSS is designed to make electronic disease reporting timely, accurate and complete, by consolidating and standardizing the many different systems used by state health departments to report disease data to CDC.[11]

NEDSS brings together different surveillance systems by establishing standards for data, information architecture, security and information technology. These standards will enable patient data to be entered once at the point of care, instead of being re-entered by local and state health officials. By standardizing this information,

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[6] Joe Lombardo and LTC Julie Pavlin MD MPH, "Bio Surveillance: Utilizing ESSENCE II in Emergency Response," presented at the 2003 NDMS Conference, Mar. 9, 2003, p. 7.

[7] Joe Lombardo and LTC Julie Pavlin MD MPH, "Bio Surveillance: Utilizing ESSENCE II in Emergency Response," presented at the 2003 NDMS Conference, Mar. 9, 2003, pps. 7–8.

[8] CDC Web site article on the National Electronic Disease Surveillance System [NEDSS], p. 1. Online at: [http://www.cdc.gov/nedss/index.htm] (assessed Mar. 23, 2006).

[9] CDC Web site article on the National Electronic Disease Surveillance System [NEDSS], p. 1. Online at: [http://www.cdc.gov/nedss/index.htm] (assessed Mar. 23, 2006).

[10] CDC Web site article on the National Electronic Disease Surveillance System [NEDSS], p. 1. Online at: [http://www.cdc.gov/nedss/index.htm] (assessed Mar. 23, 2006).

[11] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004) p. 4.

NEDSS will help health officials to recognize patterns of potentially related cases nationwide. Data can be shared easily.[12]

The CDC created NEDSS in order to move disease reporting from a paper based system to an electronic, real-time reporting system.[13] NEDSS would link the health care system electronically and enable public health officials to be notified as soon as clinical laboratory receives a specimen, or makes diagnoses. According to Dr. David Fleming, Deputy Director for Public Health Science, CDC,

> In the future, NEDSS coupled with a electronic real-time reporting of births and deaths (vital statistics) and computerized medical records, not only in hospitals but also in ambulatory care offices, could facilitate immediate awareness of unusual illnesses such as anthrax or smallpox, as well as our ability to detect more subtle problems that may be dispersed across the country.[14]

Dr. Fleming stated, "The fundamental principle that NEDSS is operating on is to say that, independent of whether systems are homegrown or developed outside, that they have to conform to an agreed-upon set of strict standards that assures interoperability." [15] He further explained,

> At the end of the day, these systems will be indistinguishable and transparent from each other as far as enabling the needed transfer of information. But the reality is—is that in different jurisdictions there are different needs and issues such that it does make sense for a particular jurisdiction adhering to a set of standards to say, we want to be able to customize this to meet not only the national needs but our local needs as well.[16]

However, as of January 3, 2006, only 11 states were using the CDC NEDSS Base System [NBS] to send reportable public health case data to CDC. Four additional states were in the final testing phase of the NBS with plans to send data to CDC in the next 2 to 4 months. Several states were still in early discussions with CDC regarding the potential for using NBS in the future.[17]

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[12] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 11.

[13] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 6.

[14] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, pps. 10–11.

[15] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, pps. 36–37.

[16] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, pps. 36–37.

[17] E-mail correspondence from Zeno W. St. Cyr, Senior Legislative Analyst, Department of Health and Human Services to Subcommittee on National Security, Emerging Threats, and International Relations, Kristine K. Fiorentino, professional staff member (Jan. 11, 2006) (7:16 p.m.). See committee files.

The CDC is also collaborating with the American Association of Health Plans, Harvard Medical School, five health plans or physician groups (Harvard Pilgrim Health Care/Harvard Vanguard Medical Associates (Massachusetts), Health Partners (Minnesota), Kaiser Permanente (Colorado), Scott and White Healthcare System (Texas), the Austin Regional Clinic (Texas)), and Optum, a nationwide consumer health information company; to implement a syndromic surveillance system covering more than 20 million individuals with pre-paid healthcare in all 50 states. This system uses data from routine and urgent office visits and from nurse telephone triage and health information systems. Information is received daily, and syndromes are grouped into specified geographic regions.[18]

The system will be based on an earlier project between CDC and Harvard Pilgrim Health Care entitled, "National Bioterrorism Syndromic Surveillance Demonstration Program," which gathered symptom data from nurse call-in lines, and physician visits using patient zip codes to look for patterns of symptoms. Conducting surveillance through health plans is thought to be quicker than tracking emergency room visits since patients may call nurse help lines when symptoms first appear, before seeking emergency care.[19]

Another effort, BioWatch, is a mutli-agency program with the Department of Energy [DOE], the Environmental Protection Agency [EPA], and the Department of Health and Human Services. The program includes air filter sampling to look for bio-agents in certain cities. The filters are tested for six agents. The program is an extension of EPA air quality testing. Since 2003, 30 cities have been included in the program. There are 27 Laboratory Response Network [LRN] BioWatch labs that test filters for bio-agents.[20] In late September 2005, the Bio Watch filters detected *Francisella tularensis* (tularemia) in the Capitol region. Health officials were not notified until 6 days after tularemia was detected. Thankfully, the incubation period for tularemia passed without any incident of human or animal illness. Besides concerns regarding a lag time in notification, detection systems are futher impeded by the lack of validation and standardization of detection thresholds. The subcommittee held a hearing in April 2005 looking into the agancies' activities to detect anthrax contamination in the U.S. Postal Service facilities after the 2001 anthrax incident and found the process had not been validated. Without validation, one cannot guarantee the results are accurate.[21]

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[18] Journal of Urban Health, "Syndromic Surveillance Using Minimum Transfer of Identifiable Data: The Example of the National Bioterrorism Syndromic Surveillance Demonstration Program," Jan. 24, 2003, p. 1.

[19] National Journal, "Health Plans Search For Bioterror Symptoms," Apr. 19, 2003, p. 1.

[20] CDC BioWatch information sheet received as an attachment in an E-mail from Zeno W. St. Cyr, Senior Legislative Analyst, Department of Health and Human Services to Subcommittee on National Security, Emerging Threats, and International Relations, Kristine K. Fiorentino, professional staff member (Jan. 11, 2006) (7:16 p.m.). See committee Files.

[21] Chairman Tom Davis, Committee on Government Reform correspondence with Dr. Julie L. Gerberding, Director of the Centers for Disease Control and Prevention, and Michael Chertoff, Secretary of the Department of Homeland Security, October 3, 2005. See also *Assessing Anthrax Detection Methods,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 109th Cong., 1st sess., Apr. 5, 2005, Serial No. 109–57, U.S. Government Printing Office, Washington: 2005.

Data from yet another CDC program, called BioSense, can be used to match data from BioWatch to compare indicators.[22] BioSense is a syndromic surveillance system that takes data from the Department of Defense Military Treatment Facilities, the Department of Veterans Affairs treatment facilities and Laboratory Corporation of America (LabCorp®) test orders. Data includes the International Classification of Diseases, Ninth Revision, Clinical Modification [ICD–9–CM] diagnosis codes along with patient age, sex, zip code of residents, and facility identifier.[23]

The Enhanced Surveillance Project [ESP] is another CDC program that can be used during special events to monitor sentinel hospital emergency department visit data to establish syndrome baseline and threshold data. ESP has been used at the World Trade Organization Ministerial in Seattle and the Republican and Democratic National Conventions.[24]

The Health Alert Network [HAN] is a nationwide program to establish communication, information and distance learning. The HAN will link local health departments to one another and to laboratories, CDC, and community first responders. Early warning systems such as broadcast faxes can be used to alert local, state, and Federal authorities.[25]

The National Electronic Telecommunications System for Surveillance [NETSS] is a computerized public health surveillance information system that provides the CDC with weekly data regarding cases of nationally notifiable disease. The list of mandatory notifiable diseases changes overtime and varies by state. The Council of State and Territorial Epidemiologists [CSTE] determines the list of infectious diseases, conditions, and toxic exposure under nationwide surveillance in consultation with CDC.[26]

The CDC has also provided funding for bioterrorism surveillance and epidemiology coordination to all state health departments, and some major metropolitan cities and territories. Several cities and states have implemented their own syndromic surveillance systems including California, New Mexico, Texas, Boston, New York City, and Pittsburgh.[27] Pittsburg uses a syndromic surveillance system entitled Real-time Outbreak and Disease Surveillance [RODS]. RODS collects data from hospitals including patients' chief complaints, and classifies them according to syndrome in order to look for potential disease outbreaks.[28]

The National Retail Data Monitor [NDMR] is a syndromic surveillance system developed by the University of Pittsburgh in collaboration with the CDC. NDMR is used by state public health officials to monitor sales data of over the counter medications from

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[22] CDC Information Council Meeting Minutes, Feb. 27, 2003, Online at: [http://www.cdc.gov/cic/minutes/CIC%20minutes%202–27–03.pdf] (accessed Mar. 23, 2006).

[23] CDC MMWR "BioSense: Implementation of a National Early Event Detection and Situational Awareness System," Aug. 26, 2005. Online at: [http://www.cdc.gov/mmwr/preview/mmwrhtml/su5401a4.htm] (assessed Mar. 23, 2006).

[24] CDC Web site article on Enhanced Surveillance Project [ESP] Online at: [http://www.bt.cdc.gov/episurv/esp.asp] (assessed Mar. 23, 2006).

[25] CDC Health Alert Network, Online at: [http://www.bt.cdc.gov/documentsapp/han/han.asp] (accessed Mar. 23, 2006).

[26] CDC Web site article on National Electronic Telecommunications System for Surveillance [NETSS]. Online at: [http://www.cdc.gov/epo/dphsi/netss.htm] (accessed Mar. 23, 2006).

[27] The New York Times, "Threats and Responses: The Bioterror Threat," Jan. 27, 2003, p. 3.

[28] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 58.

19,000 stores and pharmacies that might indicate the onset of a disease outbreak.[29]

The Infectious Diseases Society of America Emerging Infections Network [IDSA–EIN] is a network of more than 900 infectious disease practitioners who provide assistance to CDC and state health departments during outbreak investigations.[30]

Several surveillance systems have been established to monitor the safety of the food supply. The Epidemic Information Exchange [Epi–X] is a web-based communication system used by CDC to share information about food health concerns with local and state and Federal health officials.[31] The Electronic Laboratory Exchange Network [eLEXNET] is a web based program for sharing food safety laboratory data among local, state and Federal agencies.[32] The Foodborne Disease Active Surveillance Network (FoodNet) is a surveillance system used to detect diseases and outbreaks in food.[33] PulseNet is a nationwide system of public health laboratories that provide DNA "fingerprinting" on bacteria that may be foodborne in order to provide an early warning system for outbreaks of foodborne disease. DNA patterns are compared through a database at CDC.[34]

The National Animal Health Reporting System [NAHRS] collects data from state veterinarians regarding confirmed clinical disease in livestock, poultry and marine life. This program is a joint venture between the United States Department of Agriculture [USDA] the U.S. Animal Health Association, the American Association of Veterinary Laboratory Diagnostics and several states.[35] The National Veterinary Services Laboratories [NVSL] are veterinary laboratories run by the USDA that provide diagnostics for domestic and foreign animal diseases.[36]

There are several international disease surveillance systems. The Global Outbreak Alert and Response Network [GOARN] issues real-time outbreak alerts worldwide from various sources including media reports, laboratories, and World Health Organization offices. The Global Public Health Intelligence Network [GPHIN] is an internet based system developed in Canada and used by the World Health Organization. GPHIN searches through media sources for information on disease outbreaks.[37]

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[29] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 57. See also Emerging Infectious Diseases, "Medication Sales and Syndromic Surveillance, France," March 2006, p. 416.

[30] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 56.

[31] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 55.

[32] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 54. See also Emerging Infectious Diseases, "Web-based Surveillance and Global Salmonella Distribution, 2000–2002," March 2006, p. 381.

[33] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 55.

[34] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 58.

[35] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 56.

[36] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 58.

[37] U.S. Government Accountability Office, Pub. No. GAO–04–877, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* (September 2004), p. 55.

B. DEPARTMENT OF DEFENSE GLOBAL EMERGING INFECTIONS SURVEILLANCE AND RESPONSE SYSTEM [DOD–GEIS]

The Department of Defense Global Emerging Infections Surveillance and Response System [GEIS] was established in response to Presidential Decision Directive NSTC–7, June 1996. According to President Bill Clinton, "the mission of the DOD would be expanded to include support of global surveillance, training, research, and response to emerging infectious disease threats." DOD–GEIS is designed to, "strengthen the prevention of, surveillance of and response to infectious diseases that are a threat to military personnel and families, reduce medical readiness or present a risk to U.S. national security."[38]

DOD–GEIS is managed by a Central Hub office located at the Walter Reed Army Institute of Research. DOD–GEIS operates within five Army and Navy overseas medical research laboratories, and within the infrastructure of the military health system [MHS]. DOD–GEIS works to strengthen laboratory-based surveillance, and monitors for global emerging infections.[39]

In response to concerns about bioterrorism, and calls to create an early warning system, DOD–GEIS created the Electronic Surveillance System for the Early Notification of Community-based Epidemics called ESSENCE. ESSENCE started receiving Ambulatory Data System [ADS] information from military treatment facilities [MTF] in December 1999 for the National Capital Area [NCA]. Seven syndrome groups were created based on the International Classification of Diseases, Ninth Revision, Clinical Modification [ICD–9–CM] codes. ICD–9–CM is the official system of assigning codes to diagnoses and procedures associated with hospital utilization in the United States.[40] These groups include respiratory, gastrointestinal, neurologic, dermatologic-hemorrhagic, dermatologic-vesicular (smallpox-like), fever/malaise/sepsis, and coma/sudden death.[41] In September 2001, ESSENCE began receiving information from all MTFs that submit data to the ADA. ESSENCE collects information that is available via secure DOD website.[42]

Every 8 hours data is downloaded and graphs of syndrome counts are automatically generated. Based on historical data, a baseline of normal ranges is created. If syndrome counts exceed baseline ranges, further investigation will be needed to determine the cause. Syndromic cases can be sorted by patient home zip code. There are plans to sort active duty personnel records by work zip code since geographic identification is useful in determining the

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[38] DOD GEIS Web site article "About DOD–GEIS." Online at: [http://www.geis.fhp.osd.mil/aboutGEIS.asp] (assessed Mar. 24, 2006).

[39] DOD GEIS Web site article "About DOD–GEIS." Online at: [http://www.geis.fhp.osd.mil/aboutGEIS.asp] (assessed Mar. 24, 2006).

[40] International Classification of Diseases, Ninth Revision, Clinical Modification, Sixth Edition, Online at: [http://www.cdc.gov/nchs/about/otheract/icd9/abticd9.htm] (accessed Mar. 23, 2006).

[41] Joe Lombardo and LTC Julie Pavlin MD MPH, "Bio Surveillance: Utilizing ESSENCE II in Emergency Response," presented at the 2003 NDMS Conference, Mar. 9, 2003, p. 10–11.

[42] DOD GEIS Web site articles on ESSENCE: Electronic Surveillance System for the Early Notification of Community-based Epidemics. Online at: [http://www.geis.fhp.osd.mil/GEIS/SurveillanceActivities/ESSENCE/ESSENCE.asp] p. 3. (assessed Mar. 24, 2006).

source of an outbreak.[43] ESSENCE has already detected outbreaks domestic and worldwide. Most of the detected outbreaks were in the gastrointestinal or respiratory category.[44]

In fiscal year 2001, Walter Reed Army Institute of Research [WRAIR] DOD–GEIS entered into a Cooperative Research and Development Agreement with the John Hopkins University Applied Physics Laboratory for development of nontraditional sources of data for disease outbreak detection and management. This agreement led to ESSENCE II, a project that was awarded a Defense Advanced Research Projects Agency [DARPA] grant for $12 million over a 4 year period.[45]

Essence II is a syndromic surveillance system that collects nontraditional data sources from military and civilian outpatient visits, over the counter drug sales, school absenteeism, and animal health data in Washington DC, Maryland and Virginia. ESSENCE II also collects data on emergency room activity, requests for lab tests, confirmed lab results, 911 calls, and ems services. The ESSENCE II system is only accessible by secure web site to health departments participating in the program. Maryland, the District of Columbia Health Department, and the Virginia Health Department are members of ESSENCE.[46]

Syndromic based systems such as ESSENCE have several limitations. There is a lag time in data acquisition. Currently, data is received within 1 to 3 days of a patient visit. However some believe this is not timely enough should an outbreak occur.[47] An astute clinician may call attention to an illness of concern faster than a syndromic surveillance system. In the case of the anthrax incidents in 2001, it was a Florida clinician who determined it to be anthrax.[48] However, others argue while a syndromic surveillance system may not be useful to catch a small number cases, it will be helpful in recognizing larger incidents of bioterrorism.

There is also debate within the public health community as to whether syndromic surveillance systems are worth the financial and manpower costs. Surveillance systems may place an increased burden on public health personnel since they will be responsible for checking out and responding to alerts from surveillance systems. Thus, it is necessary to ensure sufficient staff will be available to monitor and provide consequence management for surveillance systems.[49] Syndromic surveillance systems are still relatively new and concerns about false positives may limit their sensitivity and timeliness for detecting events. An astute clinician may call attention

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[43] DOD GEIS Web site articles on ESSENCE: Electronic Surveillance System for the Early Notification of Community-based Epidemics. Online at: [http://www.geis.fhp.osd.mil/GEIS/SurveillanceActivities/ESSENCE/ESSENCE.asp] p. 2. (accessed Mar. 24, 2006).

[44] Joe Lombardo and LTC Julie Pavlin MD MPH, "Bio Surveillance: Utilizing ESSENCE II in Emergency Response," presented at the 2003 NDMS Conference, Mar. 9, 2003, p. 19.

[45] DOD GEIS Web site articles on ESSENCE: Electronic Surveillance System for the Early Notification of Community-based Epidemics. Online at: [http://www.geis.fhp.osd.mil/GEIS/SurveillanceActivities/ESSENCE/ESSENCE.asp] p. 3. (accessed Mar. 24, 2006).

[46] DOD GEIS Web site articles on ESSENCE: Electronic Surveillance System for the Early Notification of Community-based Epidemics. Online at: [http://www.geis.fhp.osd.mil/GEIS/SurveillanceActivities/ESSENCE/ESSENCE.asp] p. 3. (accessed Mar. 24, 2006).

[47] DOD GEIS Web site articles on ESSENCE: Electronic Surveillance System for the Early Notification of Community-based Epidemics. Online at: [http://www.geis.fhp.osd.mil/GEIS/SurveillanceActivities/ESSENCE/ESSENCE.asp] p. 2. (accessed Mar. 24, 2006).

[48] The Washington Post, "Unprepared For a Plague" (Apr. 18, 2003), p. 1.

[49] National Association of County & City Health Officials [NACCHO] statement entitled, "Strengthening Local Public Health Readiness." See committee Files.

to an illness of concern faster than a syndromic surveillance system. In the case of the anthrax incidents in 2001, it was a Florida clinician who determined it to be anthrax.

C. GOVERNMENT ACCOUNTABILITY OFFICE [GAO] REPORTS

There are various challenges to improving health data collection and reporting. The threat of bioterrorism has placed additional burden on public health departments to develop surveillance capacity and to have staff available to provide timely analysis and response.

A GAO report entitled, *Bioterrorism: Preparedness Varied across State and Local Jurisdictions* found shortages in personnel in state and local public health departments, laboratories and hospitals. Some states and cities were concerned they did not have enough epidemiologists to do the appropriate investigations in an emergency.[50]

GAO found local officials felt their surveillance systems were inadequate to detect a bioterrorist event. Some of the cities used a passive surveillance system. A passive surveillance system is not timely, and is therefore inadequate for identifying diseases early. There is also chronic underreporting and a time lag between diagnosing a condition and the health department's receipt of the report. Many local health departments were lacking the resources needed to sustain an active surveillance system. According to GAO, "To improve disease surveillance, six of the states and two of the cities we visited were developing electronic surveillance systems."[51]

Another GAO report entitled, *Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts* found "state public health departments and CDC are implementing an initiative designed to make electronic disease reporting more timely, accurate and complete. However, the implementation of this initiative is incomplete."[52]

II. DISCUSSION

A. FINDING

1. Disease surveillance systems are fragmented and have been slow to adapt to new technologies which could improve the timeliness of outbreak reporting

At a subcommittee hearing, Dr. Seth Foldy, Commissioner of Health, Milwaukee, WI testified:

> The Nation's traditional approach to disease surveillance has been slow and cumbersome. States establish lists of reportable diseases. Physicians and laboratories confirm the diagnosis of a reportable disease and record the information manually on paper. The paper is sent to the local or state health department, which processes it and determines whether it needs to be sent elsewhere and whether action needs to be taken. Often the paper forms are miss-

[50] U.S. General Accounting Office, Pub. No. GAO–03–373, Bioterrorism: Preparedness Varied Across State and Local Jurisdictions (April 2003), p. 17.
[51] U.S. General Accounting Office, Pub. No. GAO–03–373, Bioterrorism: Preparedness Varied Across State and Local Jurisdictions (April 7, 2003), p. 18.
[52] U.S. Government Accountability Office, Pub. No. GAO–04–877, Emerging Infectious Diseases: Review of State and Federal Disease Surveillance Efforts (September 2004) p. 1.

> ing crucial pieces of information, such as the address or phone number of the patient" It can take a long time before these pieces of paper add up to the identification of a disease outbreak. Valuable time for preventing the spread of the disease is lost.[53]

Dr. Foldy further stated:

> Traditionally legally mandated disease reporting that is based on the definitive diagnosis of illness and relies on clinicians making the effort to notify public health authorities may be too slow and unreliable for some of today's challenges. It has been estimated that each hour delay in the recognition of an airborne anthrax might cost hundreds of millions of dollars due to missed opportunities to limit exposures and offer prophylactic treatment. Moreover, the traditional model will not detect emerging communicable diseases that too new for mandated reporting regulations.[54]

The Institute of Medicine [IOM] report entitled, *Microbial Threats To Health: Emergence, Detection, and Response* observed:

> The ability to gather and analyze information quickly and accurately would improve the Nation's ability to recognize natural disease outbreaks, track emerging infections, identify intentional biological attacks, and monitor disease trends. Surveillance systems within the United States, however, remain fragmented and have not evolved at the same rate as the electronic technological advances that could significantly improve the timelines and integration of data collection.[55]

The IOM recommended, "Research on innovative systems of surveillance that capitalize on advances in information technology should be supported."[56] However IOM stated, "Before widespread implementation, these systems should be carefully evaluated for their usefulness in detection of infectious disease epidemics, including their potential for detection of the major biothreat agents, their ability to monitor the spread of epidemics and their cost effectiveness."[57]

The IOM report further stated, "CDC should take the necessary actions to enhance infectious disease reporting by medical health care and veterinary health care providers."[58]

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[53] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, pps. 79–80.

[54] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 80.

[55] Institute of Medicine, *Microbial Threats To Health: Emergence, Detection, and Response,* 2003, p. 10.

[56] Institute of Medicine, *Microbial Threats To Health: Emergence, Detection, and Response,* 2003, p. 11.

[57] Institute of Medicine, *Microbial Threats To Health: Emergence, Detection, and Response,* 2003, p. 11.

[58] Institute of Medicine, *Microbial Threats To Health: Emergence, Detection, and Response,* 2003, p. 10.

The difficulties posed by the wide variance in capabilities and the lack of computerized systems in the health community were noted in Dr. Fleming's statement, "There are two things. One is the capacity on the clinical side, the clinical laboratory side, to computerize and send their information. So even if a public health department is equipped to receive information, that information can't be received if it can't be sent on the clinical side."[59] When asked by Congressman Janklow, "What's holding that up?" Dr. Fleming replied, "There's a wide range of systems that are out there, and in fact some aspects of the health care system still aren't computerized."[60]

Dr. Foldy also noted this lack of computer access in his statement, "I hasten to remind the committee that, prior to Congress creating specific health alert network funding that was earmarked to local health departments, the majority of health departments had no Internet connections in this country."[61]

Marcy C. Selecky, president of the Association of State and Territorial Health Officials also noted local health department weaknesses in her statement, "In many parts of the country, only the state Health Department has the sophisticated laboratory and highly trained laboratorians, epidemiologists and other public health professionals needed to tackle the most serious public health challenges."[62]

When discussing the current status of disease surveillance Dr. Fleming stated, "The system is working. We can make it better. It's not broken, but it can be improved." However when Congressman Janklow asked Dr. Fleming, "In terms of the world that we live in where terrorism is directed toward us, are we where we need to be?" Dr. Fleming replied, "No."[63]

Even with the various types of disease surveillance systems currently in place, diseases can still slip through the system.

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[59] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 53.

[60] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 54.

[61] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 128.

[62] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 68.

[63] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 55.

B. RECOMMENDATION

1. The Centers for Disease Control and Prevention should clearly define the technical parameters and set a specific timeframe for establishing a unified national disease surveillance system to replace the current patchwork of reporting and monitoring programs

Given the fragmented state of U.S. disease surveillance, the subcommittee recommends the Centers for Disease Control and Prevention set a clear timeframe for modernizing, improving, and linking disease surveillance systems.

The threat of bioterrorism as well as new emerging diseases such as SARS makes it imperative local and state public health departments are modernized and disease surveillance is strengthened. The CDC is responsible for providing "national and international leadership in the public health and medical communities to detect, diagnose, respond to, and prevent illnesses including those that occur as a result of a deliberate release of biological agents," and is therefore responsible for setting this timeframe.[64]

Dr. Julie A. Pavlin, chief, Department of Field Studies, Walter Reed Army Institute of Research, has noted the basic requirements for a robust, timely surveillance system,

> Any surveillance system for bioterrorism must be dual use and able to detect diseases of natural occurrence, because in most cases it will not be readily apparent if a disease outbreak is natural or manmade. The system must assist public health officers, and not overly burden them with false alarms and unreasonable costs. Finally, the surveillance system must augment other public health practices, and assist in educating clinical colleagues on the importance of maintaining a high index of suspicion and reporting unusual diseases or disease clusters.[65]

During a subcommittee hearing on Public Health Surveillance, Congressman Chris Bell noted his concern about the lack of a timeline for the establishment of a national disease surveillance system,

> I want to go back for just a minute to this idea that was discussed with the previous panel of trying to create one unified system for reporting . . . I'm curious as to where you would rate the importance and if you are as troubled as I am by the fact that we at the present time don't know how much it would cost and really don't have any time line for getting there, and the amount of money being committed toward spending on that type of surveillance system is decreasing rather than increasing.[66]

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[64] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 8.

[65] Dr. Julie A. Pavlin, "Medical Surveillance for Biological Terrorism Agents," Human and Ecological Risk Assessment, June 2005, p. 534.

[66] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 127.

Ms. Selecky responded

> . . . There are multiple plans, they're private and public, and having a one system fits all doesn't cut it in this country very often. That's why I think that you hear us talking about common standards so that the information that's collected can speak and give us the information that we need to take quick and rapid action.[67]

There is concern public health officials may be waiting for the perfect disease surveillance system, instead of using what is available now. Ms. Selecky noted this concern during the subcommittee hearing, "When I hear you all talk about and when we talk about a common system, I get concerned that we are waiting for the perfect system when what we really need to have are the foundations to be able to use whatever system exists."[68] Ms. Selecky stated, "We can't wait for someone to say, here is the perfect system that is going to be used nationally."[69]

The importance of early detection of a disease is apparent in Dr. Fleming's statement,

> One key successful defense against any threat to the health of the public, whether naturally occurring or deliberately caused, continues to be accurate, timely recognition of a problem. Awareness and diagnosis of a condition by a clinician or laboratory is a key element of our current surveillance system. Clinicians and laboratories report diseases to State and Local health departments which share information with CDC.[70]

A nationwide disease surveillance system would help ensure the timeliness of this recognition.

While the establishment of a nationwide disease surveillance system is essential, the subcommittee also acknowledges a disease surveillance system is only as good as the public health response that comes after it to prevent and save lives. Effective disease surveillance will require a commitment of funds not just to Federal agencies, but also to the state public health departments, who will be on the frontlines of any disease outbreak, epidemic, or pandemic. Dr. Fleming expresses this clearly in his statement,

> the true measure of a system is how responsive it is not in detecting the event, but in responding to the event and putting the actions in place that need to be put there to keep people healthy. And so my definition of the perfect

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[67] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 127.

[68] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 135.

[69] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 132.

[70] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 9.

> system, if you will, is a system that is rapid enough such that the preventative action that need to be put in place will happen before individuals become sick or die.[71]

Monitoring CDC publications and peer review articles since the testimony at the subcommittee hearing confirms a lack of adequate progess toward a unified surveillance system. It would be unwise to expect the individual pieces of disease surveillance to come together on their own and grow into a coherent whole.

[71] *Homeland Security: Improving Public Health Surveillance,* hearing before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 108th Cong., 1st sess., May 5, 2003, Serial No. 108–55, U.S. Government Printing Office, Washington: 2003, p. 51.

APPENDIXES

APPENDIX I

Disease Surveillance Systems

BIOSENSE	
eLEXNET	Electronic Laboratory Exchange Network
ESSENCE	Electronic Surveillance System for the Early Notification of Community-based Epidemics
Epi–X	Epidemic Information Exchange
ESP	Enhanced Surveillance Project
FoodNet	Foodborne Disease Active Surveillance Network
GEIS	Global Emerging Infections Surveillance and Response System
GOARN	Global Outbreak Alert and Response Network
GPHIN	Global Public Health Intelligence Network
HAN	Health Alert Network
IDSA–EIN	Infectious Diseases Society of America Emerging Infections Network
LRN	Laboratory Response Network
NAHRS	National Animal Health Reporting System
National Bioterrorism Syndromic Surveillance Demonstration Program	
NEDSS	National Electronic Disease Surveillance System
NETSS	National Electronic Telecommunications System for Surveillance
NRDM	National Retail Data Monitor
NVSL	National Veterinary Services Laboratories
PulseNet	
RODS	Real-time Outbreak and Disease Surveillance

APPENDIX II

Surveillance Systems Monitoring Infectious Diseases

121 Cities Mortality Reporting System
As part of its national influenza surveillance effort, the CDC receives weekly mortality reports from (now) 122 cities and metropolitan areas in the United States within 2-3 weeks from the date of death. These reports, compiled by the Epidemiology Program Office (EPO) of CDC, summarize the total number of deaths occurring in these cities/areas each week, as well as the number due to pneumonia and influenza. The reports received through the 121 Cities Mortality Reporting System are published as Table 4 of the Morbidity and Mortality Weekly Report (MMWR). For more information, visit the section of EPO's web site concerning public health surveillance: www.cdc.gov/epo/dphsi/phs.htm#121.

Active Bacterial Core Surveillance (ABCs)
At 9 Emerging Infections Program sites (EIPs), surveillance is conducted for invasive bacterial diseases due to pathogens of public health importance. Visit their home page: www.cdc.gov/ncidod/dbmd/abcs/default.htm

BaCon Study
The American Association of Blood Banks (AABB), American Red Cross (ARC), the Hospital Infections Program at CDC, and the U.S. Department of Defense (DoD) are initiating the first nationwide study to assess the frequency of blood component bacterial contamination associated with transfusion reaction (BaCon Study). Visit their home page: www.cdc.gov/ncidod/hip/bacon/index.htm

Border Infectious Disease Surveillance Project (BIDS)
The Border Infectious Disease Surveillance (BIDS) Project is a binational surveillance system for infectious diseases along the U.S.-Mexico border. The network conducts active, sentinel surveillance for syndromes consistent with hepatitis and febrile-rash illness at clinical facilities in 4 areas on both sides of the border. BIDS was established to help public health officials better understand and detect important infectious disease problems along the U.S.-Mexico border. The project is a collaboration of CDC, 9 U.S. and Mexican border state health departments, the Mexican Secretariat of Health, and the Pan American Health Organization. For more information, consult the BIDS project's first summary publication: Doyle TJ, Bryan RT. Infectious disease morbidity in the US region bordering Mexico, 1990-1998. *JID* 2000;182(5):1503-10.

Dialysis Surveillance Network (DSN)
The Dialysis Surveillance Network (DSN) is a voluntary national surveillance system initiated by CDC in August 1999. This system was created to assist hemodialysis centers in tracking vascular access infections and other bacterial infections in hemodialysis patients, as well as to monitor the rates of colonization and infection by antimicrobial-resistant bacteria in these patients. Data gathered through the DSN are used to compare rates between the participating centers (benchmarking) and to motivate change in practices among the centers, in order to prevent further infections. Visit their home page: www.cdc.gov/ncidod/hip/DIALYSIS/dsn.htm.

Electronic Foodborne Outbreak Investigation and Reporting System (EFORS)
EFORS is currently used by 50 states to report data about Foodborne Outbreaks, on a daily basis. Visit their home page: www.cdc.gov/foodborneoutbreaks/reporting_outbreak.htm

EMERGEncy ID NET
EMERGEncy ID NET is an interdisciplinary, multicenter, emergency department-based network for research on emerging infectious diseases. It was established in cooperation with the National Center for Infectious Diseases, as part of the CDC's strategy to expand and complement existing disease detection and control activities. The network is based at 11 university-affiliated, urban hospital emergency departments with more than 900,000 combined annual patient visits. It also was developed to be a mechanism for rapidly responding to new disease or epidemics. Current projects include investigation of bloody diarrhea and the prevalence of *Shiga* toxin-producing *Escherichia coli*, animal exposures and rabies postexposure prophylaxis practices, and nosocomial emergency department *Mycobaterium tuberculosis* transmission. Other areas of interest or future investigations planned include the study of antimicrobial use, meningitis, and encephalitis, and consideration of other public health concerns such as injury and national and international network expansion. For more information, contact the system administrator at IDNET@ucla.edu.

Foodborne Diseases Active Surveillance Network (FoodNet)
The Foodborne Diseases Active Surveillance Network (FoodNet) is a collaborative project among CDC, the 9 Emerging Infections Program sites (EIPs), the U.S. Department of Agriculture (USDA), and the U.S. Food and Drug Administration (FDA). FoodNet consists of active surveillance for foodborne diseases and related epidemiologic studies designed to help public health officials better understand the epidemiology of foodborne diseases in the United States. Visit their home page: www.cdc.gov/foodnet/.

Global Emerging Infections Sentinel Network (GeoSentinel)
GeoSentinel is a provider-based sentinel network of the International Society of Travel Medicine (ISTM), funded through a cooperative agreement with CDC. GeoSentinel consists of travel/tropical medicine clinics around the world that monitor geographic and temporal trends in morbidity among travelers and other globally mobile populations. A rapid worldwide query and response function electronically links 1,500 ISTM providers around the world. Visit their home page: www.istm.org/geosentinel/main.html.

Gonococcal Isolate Surveillance Project (GISP)
The Gonococcal Isolate Surveillance Project (GISP) is a collaborative project to monitor antimicrobial resistance in *Neisseria gonorrhoeae* in the United States. Visit their home page: www.cdc.gov/ncidod/dastlr/gcdir/Resist/gisp.html.

Hemophilia Surveillance System (HSS)
The Hemophilia Surveillance System (HSS) is the first population-based study of hemophilia in the United States. Data from the medical records of more than 3,000 persons with hemophilia have been abstracted and entered into a computer database. The database will be an invaluable source of information needed to achieve the goal of reducing or preventing the complications of hemophilia. The system is part of the Hematologic Diseases Branch, Division of AIDS, STD, and TB Laboratory Research (DASTLR), in NCID. You may submit questions about the system to the Hematologic Diseases Branch, via their HDB contact page, or you can e-mail the branch directly at hdb@cdc.gov.

Integrated Disease Surveillance and Response (IDSR) is a strategy of the African Regional Office of the World Health Organization (WHO/AFRO). The IDSR strategy aims to improve the availability and use of surveillance and laboratory data to control priority infectious diseases that are the leading causes of death, disability, and illness in the African region. The purpose of IDSR is to improve the ability of districts to detect and respond to

outbreaks of priority infectious diseases with well-known and available interventions. Visit their home page: www.cdc.gov/idsr/index.htm

Intensive Care Antimicrobial Resistance Epidemiology (ICARE)
The CDC Hospital Infections Program, in cooperation with the Rollins School of Public Health at Emory University, began Project ICARE (Intensive Care Antimicrobial Resistance Epidemiology) at a subset of hospitals participating in the National Nosocomial Infections Surveillance (NNIS) system at CDC. Project ICARE provides data on the prevalence of antimicrobial resistance and antimicrobial use in U.S. healthcare settings. Visit their home page: www.sph.emory.edu/icare/ (Please note that their Web page is not part of the CDC Web site.)

International Network for the Study and Prevention of Emerging Antimicrobial Resistance (INSPEAR)
INSPEAR is an international surveillance program established by the Hospital Infections Program in conjunction with international partners in 33 countries. INSPEAR is a response to the global emergence of drug-resistant organisms and the resulting need for international surveillance programs and the strengthening of the microbiologic and epidemiologic capacities of hospitals worldwide. Visit their home page:
www.cdc.gov/ncidod/hip/surveill/inspear.htm

Measles Laboratory Network (Global Laboratory Network For Measles Surveillance)
The measles laboratory network within the Pan American Health Organization, in partnership with the Measles Virus Section of the Centers for Disease Control and Prevention, has improved the capacity and quality of measles surveillance in the regions of the Americas and the Caribbean. This website is intended to facilitate communication among laboratories that conduct measles diagnosis and virus characterization, as well as those involved in surveillance of measles.
www.cdc.gov/ncidod/dvrd/revb/measles/index.htm

National Antimicrobial Resistance Monitoring System: Enteric Bacteria (NARMS)
NARMS was launched as a collaboration between CDC, the Food and Drug Administration-Center for Veterinary Medicine (FDA), the United States Department of Agriculture-Food Safety and Inspection Service and Agricultural Research Service (USDA), and state and local health departments to prospectively monitor the antimicrobial resistance of human nontyphoid *Salmonella*, *Escherichia coli* O157:H7, and *Campylobacter* isolates. Visit their home page: www.cdc.gov/narms/.

National Malaria Surveillance System
The National Malaria Surveillance System collects epidemiological and clinical information on malaria cases diagnosed in the United States. This system is managed by the Malaria Branch of the Division of Parasitic Diseases. Visit the Malaria home page. Malaria cases are reported by state health departments, laboratories, and health care providers. The Malaria Branch has revised the malaria case surveillance form, CDC 54.1 01/2002.

An electronic version of this revised form is now available at
www.cdc.gov/malaria/clinicians.htm#report
For more information regarding the malaria surveillance system or assistance in completing the form, please call the Malaria Branch at 770-488-7788.

National Molecular Subtyping Network for Foodborne Disease Surveillance (PulseNet)
PulseNet is a national network of public health laboratories that performs DNA "fingerprinting" on bacteria that may be foodborne. Visit their home page: www.cdc.gov/pulsenet/

National Nosocomial Infections Surveillance System (NNIS)
The NNIS system is conducted by the Hospital Infections Program to collect high quality nosocomial infection surveillance data that can be aggregated into a national database. Visit their home page: www.cdc.gov/ncidod/hip/surveill/nnis.htm

National Notifiable Diseases Surveillance System (NNDSS)
Maintained by the Epidemiology Program Office (EPO) of CDC, the NNDSS is a mechanism for the regular collection, compilation, and publication of reports of disease considered notifiable at the national level. Data on selected notifiable infectious diseases are published weekly in the *MMWR* and at year-end in the annual *Summary of Notifiable Diseases, United States*. For more information, visit the section of EPO's web site concerning public health surveillance: www.cdc.gov/epo/dphsi/phs.htm.

National Respiratory and Enteric Virus Surveillance System (NREVSS)
NREVSS is a laboratory-based system that monitors temporal and geographic patterns associated with the detection of respiratory syncytial virus (RSV), human parainfluenza viruses (HPIV), respiratory and enteric adenoviruses, and rotavirus. Influenza specimen information, also reported to NREVSS, is integrated with CDC Influenza Surveillance. Data are collected from collaborating university and community hospital laboratories, selected state and county public health laboratories, and commercial laboratories. These participating laboratories report virus detections, isolations, and electron microscopy results on a weekly basis. Visit their home page: www.cdc.gov/ncidod/dvrd/revb/nrevss/index.htm.

National Surveillance System for Health Care Workers (NaSH)
The National Surveillance System for Health Care Workers (NaSH) was developed by CDC in collaboration with healthcare facilities to systematically collect information important to prevent occupational exposures and infections among health care workers. Visit their home page: www.cdc.gov/ncidod/hip/SURVEILL/nash.htm

National Tuberculosis Genotyping and Surveillance Network
To study the epidemiologic significance of the nation's tuberculosis problem, CDC established the National Tuberculosis Genotyping and Surveillance Network in April of 1996. The members of the network input data on DNA fingerprint images, along with epidemiologic information, to a centralized database at CDC. Visit their home page: www.cdc.gov/ncidod/dastlr/tb/tb_tgsn.htm

National West Nile Virus Surveillance System
The National West Nile Virus Surveillance System was developed in 2000 to monitor the geographic and temporal spread of West Nile virus in the United States. Currently, 48 states and 4 cities have surveillance systems in place to monitor West Nile virus activity. Data are being collected on a weekly basis for the following five categories: wild birds, sentinel chicken flocks, human cases, veterinary cases, and mosquito surveillance. Visit the surveillance system's home page: www.cdc.gov/ncidod/dvbid/westnile/surv&control.htm

Public Health Laboratory Information System (PHLIS)
PHLIS collects data on cases/isolates of specific notifiable diseases from every state within the United States. Data are reported to PHLIS electronically. Visit their home page: www.cdc.gov/ncidod/dbmd/phlisdata/default.htm

Surveillance for Emerging Antimicrobial Resistance Connected to Healthcare (SEARCH)
SEARCH is a network of voluntary participants (i.e., hospitals, representatives of private industry, professional organizations, and state health departments) who have joined together to report the isolation of *Staphylococcus aureus* with reduced susceptibility to vancomycin. Visit their home page: www.cdc.gov/ncidod/hip/aresist/search.htm

Unexplained Deaths and Critical Illnesses Surveillance System
The system is designed to improve CDC's capacity to rapidly identify the cause of unexplained deaths or critical illness and to improve understanding of the causes of specific infectious disease syndromes for which an etiologic agent is frequently not identified. Active population-based surveillance is conducted in 4 Emerging Infections Program sites (EIPs) with a total population of 7.7 million 1- to 49-year-olds. National and international surveillance are passive for clusters of unexplained deaths and illnesses. Visit their home page: www.cdc.gov/ncidod/dbmd/diseaseinfo/unexplaineddeaths_t.htm.

United States Influenza Sentinel Physicians Surveillance Network
Approximately 260 physicians around the country report each week the total number of patients seen and the number of those patients with influenza-like illness by age group. View the weekly influenza summary update: www.cdc.gov/ncidod/diseases/flu/weekly.htm.

Viral Hepatitis Surveillance Program (VHSP)
The VHSP collects clinical, serologic, and epidemiologic data pertaining to risk factors of disease acquisition. It is operated by the Hepatitis Branch, Division of Viral and Rickettsial Diseases. Contact the program by calling (888) 4-HEP-CDC or (888) 443-7232.

Waterborne-Disease Outbreak Surveillance System
Since 1971, CDC, the U.S. Environmental Protection Agency (EPA), and the Council of State and Territorial Epidemiologists (CSTE) have maintained a collaborative surveillance system of the occurrences and causes of waterborne-disease outbreaks. This system includes data regarding outbreaks associated with drinking water and recreational water. Outbreak reports are collected annually and are published every 2 years as an MMWR Surveillance Summary. For additional information, contact (770) 488-7760. This system is managed by the Division of Parasitic Diseases.

(Source: CDC)

APPENDIX III

Reportable diseases

Disease	Number of jurisdictions reportable
brucellosis	52
diphtheria	52
measles	52
pertussis	52
tetanus	52
tuberculosis	52
botulism	51
gonorrhea	51
Lyme disease	51
malaria	51
plague	51
rubella	51
salmonellosis	51
shigellosis	51
syphilis	51
anthrax	50
campylobacteriosis	50
mumps	50
tularemia	50
AIDS	49
cholera	49
cryptosporidiosis	49
legionellosis	49
listeriosis	49
Meningococcal disease	49
psittacosis	49
HIV infection	48
invasive Hemophilus influenzae disease	48
rabies	48
trichinellosis	47
typhoid fever	46
poliomyelitis	45
Rocky Mountain spotted fever	45
giardiasis	44
human rabies	44
yellow fever	44
chancroid	43
enterohemorrhagic Escherichia coli O157:H7 infection	43
congenital rubella syndrome	42
Hansen's disease	42
Q fever	40
Streptococcal, group A, invasive disease	40
hepatitis A	39
hepatitis C	39
ehrlichiosis	37
smallpox	37
hepatitis B	36

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(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

Streptococcus pneumoniae, invasive disease	35
toxic shock syndrome	35
cyclosporiasis	34
enterohemorrhagic Escherichia coli infection	34
hemolytic uremic syndrome	33
animal rabies	31
hantavirus pulmonary syndrome	31
leptospirosis	31
varicella	30
amebiasis	29
vibriosis	29
yersiniosis	29
vancomycin resistant Staphylococcus aureus infection	25
dengue	24
encephalitis	24
perinatal hepatitis B virus infection	24
Streptococcal, group B, invasive disease	24
viral hemorrhagic fever	24
aseptic meningitis	23
Chlamydia trachomatis genital infection	23
lymphogranuloma venereum	23
vancomycin intermediate Staphylococcus aureus infection	23
Creutzfeld-Jakob disease	22
lead poisoning	21
viral hepatitis	21
arboviral encephalitis	20
Chlamydia trachomatis infection	20
influenza	20
typhus	20
acute hepatitis A	18
bacterial meningitis	18
granuloma inguinale	18
hantavirus infection	18
West Nile encephalitis/meningitis	18
hepatitis D	17
Reye's syndrome	17
rheumatic fever	17
acute hepatitis B	16
bite - wound	16
congenital syphilis	16
Kawasaki syndrome	16
pesticide poisoning	15
viral encephalitis	15
acute hepatitis C	14
babesiosis	14
eastern equine encephalitis/meningitis	14
elevated blood lead levels	14
malignant neoplastic disease	14
St. Louis encephalitis/meningitis	14
Streptococcal toxic shock syndrome	14
diarrhea-associated hemolytic uremic syndrome	13
infant botulism	13

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

Streptococcus pneumoniae, invasive, drug-resistant disease	13
vancomycin resistant Enterococcus infection	13
West Nile fever	13
coccidioidomycosis	12
histoplasmosis	12
severe acute respiratory syndrome	12
toxoplasmosis	12
chronic hepatitis B virus infection	11
glanders	11
hepatitis E	11
meningitis	11
pelvic inflammatory disease	11
relapsing fever	11
Staphylococcal enterotoxin B poisoning	11
western equine encephalitis/meningitis	11
adverse reaction to vaccine	10
arboviral infectious disorder	10
foodborne botulism	10
hepatitis non-ABCD	10
California serogroup encephalitis/meningitis	9
congenital herpes simplex	9
poisoning by ricin	9
vaccinia	9
blastomycosis	8
foodborne illness	8
illness due to biological chemical or radiological terrorism agents	8
methicillin resistant Staphylococcus aureus infection	8
paralytic shellfish poisoning	8
primary syphilis	8
secondary syphilis	8
silicosis	8
Staphylococcal toxic shock syndrome	8
wound botulism	8
asbestosis	7
Colorado tick fever	7
food poisoning due to Clostridium perfringens	7
mercury poisoning	7
paralytic poliomyelitis	7
Venezuelan equine encephalitis/meningitis	7
adverse reaction to smallpox vaccine	6
chlamydial infection	6
ciguatera fish poisoning	6
food poisoning	6
genital herpes simplex	6
gonococcal conjunctivitis neonatorum	6
melioidosis	6
mycobacteriosis	6
neonatal conjunctivitis	6
spinal cord injury	6
chemical poisoning	5
congenital malformation	5
early latent syphilis	5

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

Hemophilus influenzae meningitis	5
human granulocytic ehrlichiosis	5
human monocytic ehrlichiosis	5
La Crosse encephalitis/meningitis	5
meningococcal meningitis	5
meningococcemia	5
methemoglobinemia	5
occupational asthma	5
scombroid fish poisoning	5
Streptococcus pneumoniae, invasive, drug sensitive	5
traumatic brain injury	5
waterborne illness	5
carbon monoxide poisoning	4
chronic hepatitis C	4
coal workers pneumoconiosis	4
cryptococcosis	4
echinococcosis	4
enteroinvasive Escherichia coli gastrointestinal tract infection	4
enteropathogenic Escherichia coli gastrointestinal tract infection	4
Guillain-Barre syndrome	4
monkeypox	4
murine typhus	4
nongonococcal urethritis	4
pneumococcal meningitis	4
poisoning	4
seafood causing toxic effect	4
spongiform encephalopathy	4
Streptococcal, invasive disease	4
toxic effect of heavy metal	4
viral meningitis	4
acute hepatitis E	3
amnesic shellfish poisoning	3
arboviral disorder of CNS	3
arboviral meningitis	3
auto inoculation with vaccinia virus	3
bacterial meningitis, other	3
botulism other	3
burn	3
congenital hypothyroidism	3
contact vaccinia	3
cysticercosis	3
drowning and non-fatal immersion	3
eczema vaccinatum	3
enterohemorrhagic Escherichia coli serogroup O157 infection	3
female chlamydial pelvic inflammatory disease	3
female gonococcal pelvic inflammatory disease	3
fetal alcohol syndrome	3
firearm injury	3
generalized vaccinia	3
hepatitis	3
hypersensitivity pneumonitis	3
late latent syphilis	3

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

louse-borne typhus	3
nipah virus infection	3
phenylketonuria	3
Powassan encephalitis/meningitis	3
progressive vaccinia	3
thrombotic thrombocytopenic purpura	3
toxic effect from eating mushrooms	3
trachoma	3
Vibrio parahaemolyticus infection	3
Vibrio vulnificus infection	3
acute hepatitis delta co or super infection	2
animal plague	2
arsenic poisoning	2
autistic disorder	2
birth defect	2
byssinosis	2
cadmium poisoning	2
cat scratch disease	2
chlamydial cervicitis	2
chlamydial pneumonia	2
chlamydial urethritis	2
community acquired methicillin resistant staphylococcus aureus infection	2
congenital toxoplasmosis	2
congenital vaccinia	2
cytomegalovirus infection	2
disease due to retroviridae	2
enterohemorrhagic Escherichia coli serogroup non-O157 infection	2
enterotoxigenic Escherichia coli gastrointestinal tract infection	2
erythema multiforme	2
farmers' lung	2
galactosemia	2
genital warts	2
gonococcal cervicitis	2
gonococcal urethritis	2
gonorrhea of pharynx	2
hemophilia	2
Hemophilus influenzae epiglottitis	2
human T-lymphotropic virus infection	2
human T-ymphotropic virus type I infection	2
infection by Yersinia enterocolitica	2
injection site infection	2
Lassa fever	2
legionnaire's disease	2
maple syrup urine disease	2
Marburg hemorrhagic fever	2
mesothelioma	2
neonatal chlamydial conjunctivitis	2
neonatal diarrhea	2
neoplasm of central nervous system	2
neural tube defect	2
neurosyphilis	2
neurotoxic shellfish poisoning	2

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

new variant Creutzfeldt-Jakob disease	2
occupational disorder	2
perinatal Staphylococcus infection	2
Pneumocystis carinii pneumonia	2
pulmonary mycotoxicosis	2
respiratory syncytial virus infection	2
rickettsialpox	2
sickle cell trait	2
Staphylococcus aureus infection	2
Streptococcal disease	2
taeniasis	2
vancomycin resistant Staphylococcus epidermidis infection	2
abdominal wall anomalies	1
acute conjunctivitis	1
acute post-Streptococcal glomerulonephritis	1
adult respiratory distress syndrome	1
adverse reaction to pertussis vaccine	1
Alzheimer's disease	1
anisakiasis	1
asphyxiation and strangulation	1
avian encephalomyelitis	1
bacillary dysentery	1
bartonellosis	1
biotinidase deficiency	1
bovine spongiform encephalopathy	1
cerebral palsy	1
cervicitis	1
chlamydial epididymitis	1
chronic berylliosis	1
cleft lip	1
cleft palate	1
cleft tongue	1
cleft uvula	1
complication following abortion	1
congenital adrenal hyperplasia	1
congenital chromosomal disease	1
congenital cytomegalovirus infection	1
cutaneous schistosomiasis	1
dengue hemorrhagic fever	1
developmental delay	1
disease caused by Rickettsia	1
disease due to orthopoxviridae	1
Down syndrome	1
drug overdose	1
drug resistant gonorrhea	1
Ebola hemorrhagic fever	1
electrocution and non-fatal electrical shock	1
enterococcus infection	1
equine encephalitis	1
failure to thrive	1
fugu poisoning	1
fungal meningitis	1

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

genitourinary Chlamydia infection	1
gonococcal endocarditis	1
gonococcal meningitis	1
gonococcemia	1
gonorrhea of rectum	1
head injury	1
hearing loss	1
Hemophilus influenzae infection	1
hepatitis C virus infection past or present	1
herpes simplex	1
human ehrlichiosis other or unspecified	1
human papilloma virus infection	1
human T-lymphotropic virus type II infection	1
hypospadias	1
immunosuppression related infectious disease	1
inclusion conjunctivitis of the adult	1
infection by diphyllobothrium latum	1
infection due to Mycobacterium bovis	1
isosporiasis	1
Japanese encephalitis	1
Kyasanur Forest disease	1
late syphilis with clinical manifestations other than neurosyphilis	1
latent syphilis	1
listeria meningitis	1
longitudinal deficiency of limb	1
louse-borne relapsing fever	1
lymphatic filariasis	1
lymphocytic choriomeningitis	1
mammal bite	1
microsporidiosis	1
mucopurulent cervicitis	1
multi-drug resistant tuberculosis	1
noise-induced hearing loss	1
nonparalytic poliomyelitis	1
nosocomial infectious disease	1
nutritional anemia	1
occupational bronchitis	1
occupational dermatitis	1
occupational injury	1
occupational lung disease	1
pediatric HIV infection	1
pneumoconiosis	1
pneumonia	1
prion disease	1
pulmonary Staphylococcal enterotoxin b poisoning	1
rotavirus infection	1
salpingitis	1
scabies	1
scarlet fever	1
scrub typhus	1
septicemia of newborn	1
silo-fillers' disease	1

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.

spotted fever group rickettsial disease	1
Stevens-Johnson syndrome	1
Streptococcal, beta-hemolytic, invasive disease	1
sudden infant death syndrome	1
tick-borne hemorrhagic fever	1
tinea capitis	1
toxic effect of metal	1
toxic effect of mycotoxin	1
toxic hepatitis	1
traumatic amputation	1
urethritis	1
vaccine associated paralytic poliomyelitis	1
viral myocarditis	1
visceral larva migrans syndrome	1

(Source: Doyle, Ma, Groseclose, Hopkins, *A Knowledge Base to Support Notifiable Disease Surveillance* BMC Medical Informatics and Decision Making 2005, 5:27, August 16, 2005.