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I-NEDSS is a web-based application utilized by all 95 local health departments in Illinois and by health care providers and laboratory staff throughout Illinois to report and investigate infectious disease conditions, clusters and outbreaks.

As of March 13, 2006, I-NEDSS users include 114 state health department users, 657 local health department (LHD) users, and 375 health care providers (representing 85% of hospitals in the state). In addition, the I-NEDSS application receives electronic laboratory reporting via HL7 messaging from the state laboratory, LabCorp and Mayo Clinic. The LHD system averages 2,340 unduplicated cases per month. Since implementation of health care provider reporting in January 2005, 14,321 cases have been reported by providers via I-NEDSS.
9. Number of FTEs:
 - a) In entire organization: 1082
 - b) Directly affected by submission: 10
10. Description of Public Health Program(s) directly affected by submission:
The Division of Infectious Diseases is housed within IDPH's Office of Health Protection. Within the Division of Infectious Diseases are five sections – Sexually Transmitted Diseases, HIV/AIDS, Communicable Diseases, Vaccine Preventable Diseases and Tuberculosis. I-NEDSS is designed to bring together disease reporting, surveillance, case management, analysis, and outbreak detection and management processes for all five sections. I-NEDSS is also being developed for lead surveillance and case management by the Environmental Health Division (also within IDPH's Office of Health Protection).

11. Please list the names of the members of the Electronic Public Health Information Team (who will be considered authors of the application)
Judy Kauerauf, MPH

Section B. Guidelines for Application

The Organization:

The Illinois Department of Public Health (IDPH) was created in 1877 to regulate medical practitioners and to promote sanitation. Today, IDPH is responsible for protecting the public health of the state's 12.4 million residents, as well as countless visitors, through the prevention and control of disease and injury. The Department's nearly 200 programs touch virtually every age, aspect and cycle of life. Dr. Eric E. Whitaker, M.D., M.P.H. is the IDPH Director and state health advisor to Governor Rod R. Blagojevich.

IDPH adheres to the principle that "public health services are best and most efficiently delivered at the local level by local health departments." In Illinois, 95 local health departments, covering 99 of the state's 102 counties, serve 99.5 percent of the population. To help these agencies in delivering the best possible services to the people of Illinois, IDPH offers various kinds of assistance, including technical support and consultation.

The Division of Infectious Diseases functions within IDPH's Office of Health Protection. Within the Division of Infectious Diseases are five sections – Sexually Transmitted Diseases, HIV/AIDS, Communicable Diseases, Vaccine Preventable Diseases and Tuberculosis. Each section is responsible for disease control and containment, as well as disease prevention through screening, vaccination and prevention programs. I-NEDSS is designed to bring together disease reporting, surveillance, case management and outbreak detection and management functions for all five sections. I-NEDSS also is being developed for lead surveillance and case management by the Environmental Health Division (also within IDPH's Office of Health Protection).

I-NEDSS serves as the central repository for receiving and retrieving important information on reportable diseases and conditions in Illinois. It is a web-based system that provides for browser-based data entry by local health department staff and health care providers, and electronic messaging of laboratory data. There are five main components of the I-NEDSS application:

The LHD and IDPH surveillance system where new reports are added, lab and provider reports received and merged into existing reports, existing cases updated, out-of-jurisdiction cases transferred, investigation data elicited and entered, workflow managed, case statuses confirmed, cases closed, and data transmitted to CDC. As soon as data are entered or updated by LHDs, these data are accessible to state health department staff per security roles and rules.

The Provider Reporting system where health care providers and laboratories report and update cases. As soon as data are entered by providers, these data are accessible to both local and state health department staff per security roles and rules.

Electronic Laboratory Reporting (ELR) where required information is received via an HL7 message using LOINC and SNOMED codes. As soon as data are entered via ELR, these data are accessible to both local and state health department staff per security roles and rules.

The I-NEDSS Administrative component where organizations are added and managed; code values are entered, updated and activated; and questions are added and activated “on the fly.”

The I-NEDSS Analysis, Visualization and Reporting (AVR) functionality where state and local health department staff, as well as providers, access reports in real-time against all data within their jurisdiction. Access to data is provided based on a user’s role, jurisdiction and disease access level. In addition, all users have real-time access to aggregate (non-identifiable) data. The AVR includes canned reports, semi-ad-hoc reporting and full ad-hoc reporting options for all level of users against both transactional (new) cases and historical cases. Through the software Business Objects, users can format their reports in a variety of outputs and apply epidemiological calculations.

Phase 2 of the AVR deployment (January 2008) will include historical disease data integration across all communicable, vaccine preventable, and sexually transmittable diseases. The will enable end users to quickly visualize five-year trends in disease across the state. This deployment will also include census data integration for rapid rate analysis. Census data combined with historical disease counts will allow the automated alert notifications to have sophisticated threshold values to more accurately detect data aberrations. The new version of the AVR also will be equipped with alerting and notification functionality that will be used to detect aberrations in the data (e.g., one case of a BT category agent enter or new case counts that are above the five-year median.) Future enhancement of the AVR will incorporate GIS (Geographical Information Systems) capabilities for all users. This level of spatial analysis will allow investigators to visualize disease incidence and prevalence to target interventions where most needed and evaluate their efficacy.

Management:

a. Objective

The mission of I-NEDSS is to prevent and control communicable diseases and events in Illinois by providing accurate, timely and complete data on reportable conditions to state and local health authorities. The purpose of the Illinois National Electronic Surveillance System is to enhance both the timeliness and quality of information reported, to reduce the reporting burden on providers, and to improve the abilities of state and local health departments to: 1) identify and track emerging infectious diseases and potential bio-terrorism threats, 2) investigate outbreaks, 3) monitor reportable communicable diseases, and 4) provide data to improve stakeholders’ abilities to prevent and control diseases.

Prior to the development of I-NEDSS, disease reporting in Illinois was paper-based and not integrated. Data from one disease section was not available to another disease section (e.g., STDs and Hepatitis). Data flowed to IDPH from paper reports and then was entered into a mainframe database. Only limited IDPH staff had access to the data. If a LHD wanted to maintain its own data that LHD would need to

create its own database(s). This resulted in a significant waste of resources with regard to double data entry and database maintenance. For those LHDs not maintaining their own databases, they would need to contact IDPH for data. In addition to having siloed databases, the previous system constituted a significant time delay. The paper-based system also did not afford any level of validation to ensure that mandatory fields were captured and that all fields were validated to the extent possible. Mailing, faxing and filing challenged the confidentiality of reported data.

I-NEDSS users at all levels have access to data that are consistent and complete. Access to data begins as soon as a case is entered. This allows local and state health department staff to detect bioterrorism agents, pandemic influenza, outbreaks or emerging diseases at the earliest point possible. Epidemiologists also are able to analyze data in realtime and against a dataset that is edited and validated at the point of entry. Resources are saved with local and state health departments using a single system. Security is ensured through user authentication through the IDPH's LDAP directory and data encryption via the IDPH WebPortal.

b. Project Organization

The development and implementation of I-NEDSS is divided into the following roles and responsibilities.

Management: The I-NEDSS team at IDPH includes an administrator, statistical coordinator, technical writer and two data technicians. The I-NEDSS Administrator is responsible for ensuring that programmatic needs for information management, surveillance and epidemiology are addressed through system development. The I-NEDSS Statistical Coordinator is responsible for managing data within the central repository, ensuring data integrity (including de-duplication) and producing statistical reports. The I-NEDSS Technical Writer is responsible for writing all I-NEDSS procedures and coordinating the Change Control Board. The I-NEDSS data technicians work on data deduplication and other data integrity functions. Staff from IDPH's Information Technology Division oversee each step of the development process and provide project management. The Project Manager is responsible for management of technical implementation of I-NEDSS and serves as the principle technical contact for ongoing operation and development.

The I-NEDSS Executive Steering Committee provides administrative direction and decision making and includes the Division Chief for Infectious Diseases, the acting IT Chief, the I-NEDSS Administrator, the I-NEDSS Project Manager, the Chief of Legal Services, the OHP Medical Director and representatives from Epi Studies and the Office of Preparedness and Response. In addition, an 11-member Local Health Department I-NEDSS Advisory Group provides ongoing input to IDPH on I-NEDSS development. A Change Control Board (CCB) includes one member from the I-NEDSS Team, one member from each of IDPH's five Infectious Diseases sections, the state veterinarian, the IT assistant administrator and three LHD members. The CCB reviews, approves and prioritizes all requests for changes to the system.

Analysis: Members from all Division of Infectious Diseases programs (Communicable Disease, HIV/AIDS, Immunization, Sexually Transmitted Diseases

and Tuberculosis) serve as subject matter experts on module development and system enhancements. IDPH has a five-year contract with Rose International for development of I-NEDSS. As needed, Rose assigns business analyst to new development areas. During the analysis and requirements gathering process, the LHD Advisory Panel reviews and provides input on new analysis. The last step in analysis involves final sign-off of the use case to ensure that all aspects have been considered prior to the design process.

Design: The I-NEDSS architecture facilitates new development/coding within a fraction of the time it would require under standard architecture. The application is built using Java/j2EE technology and application analysis and design patterns that result in an application that is flexible, standardized, modular and easy to maintain.

Testing: The first line of vigorous testing is completed by the development team utilizing Functional Tester for regression and system integration testing. This is followed by user acceptance testing by IDPH staff and then LHD users. Any identified problems are addressed and retested.

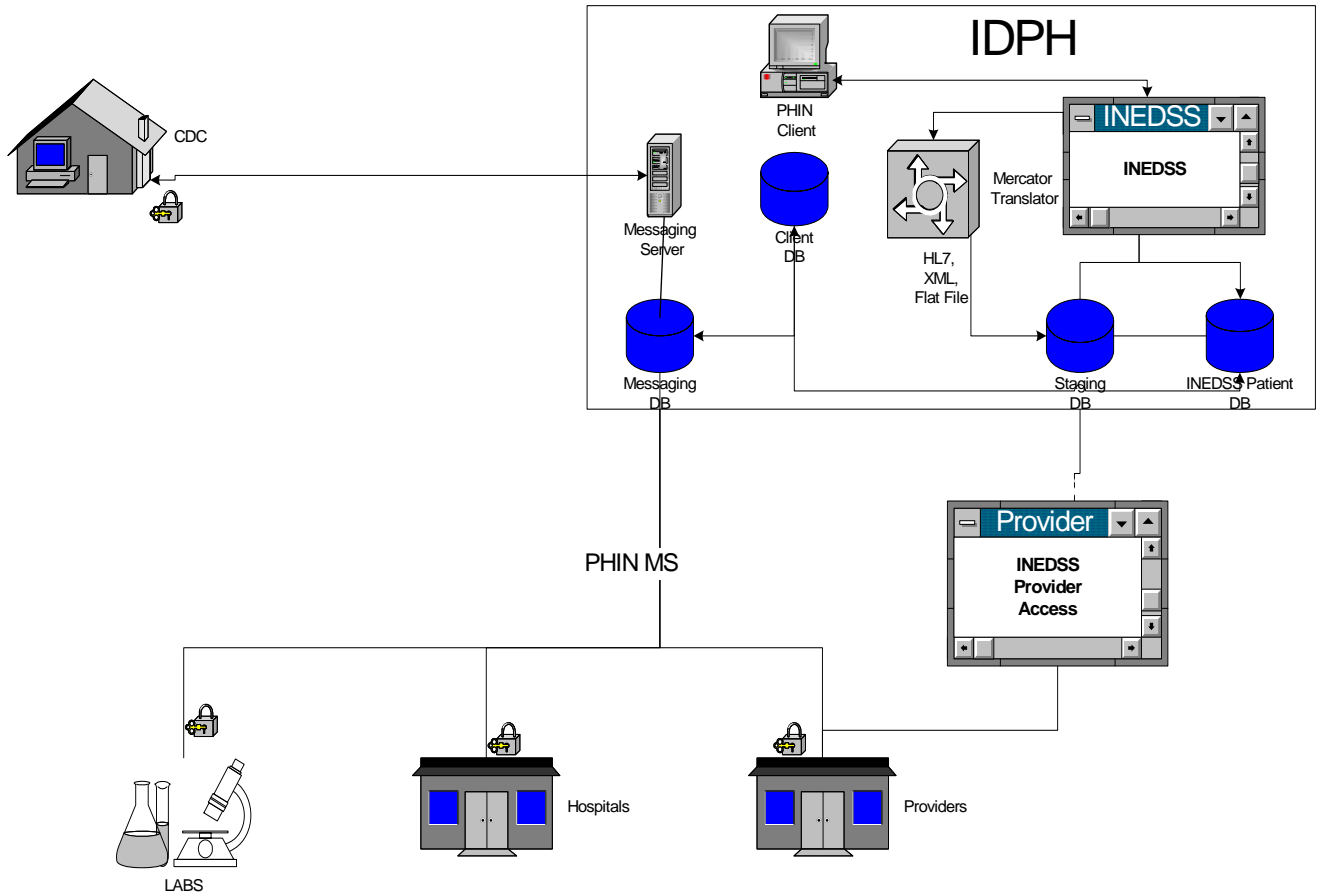
Training: Training is provided by IDPH I-NEDSS staff who employ five methods to train I-NEDSS users. Procedures that give step-by-step instructions are available and are posted below the application link. Online training tutorials are available on the IDPH Intranet site. Computer-based classroom training sessions are provided in the format of new user and update training courses. Site visits are made to LHDs in need of one-on-one training. WebEx is used to train one to five users using an interactive web-based format. The IDPH Help Desk is used to facilitate calls regarding I-NEDSS.

Implementation

a. Public Health Organization

I-NEDSS is utilized by IDPH Division of Infectious Disease staff and by staff at all 95 local health departments (LHDs) in Illinois. As of March 13, 2006, I-NEDSS users include 114 state health department users and 657 LHD users, including those from the Cook County Department of Public Health (the largest local health department in the country). In addition, 375 health care providers (representing 85% of hospitals in the state) are registered users of I-NEDSS Provider Reporting. The diagram on the following page illustrates how data flow between the organizations that routinely use I-NEDSS to submit reports, manage cases and retrieve data.

INEDSS PHIN Messaging Service



b. Scope

The following describes the current functionality of I-NEDSS for data access, data entry, decision support, workflow and communication.

When the I-NEDSS application is first opened by a state or local health department (LHD) user, the "My Cases" screen appears. This contains any new cases assigned to the user, as well as those that have been previously opened and are pending investigation. The first step to add a new case is to search the I-NEDSS central repository to see if the case has been previously reported. (Access to case data is restricted to the user's jurisdiction.) If so, new information on the current disease occurrence is added to the person's record. If the case has not been previously reported, a new person and case are created. Throughout the investigation process, a user can enter data into I-NEDSS as it becomes available. To navigate the system, users can utilize a fast-track method that takes them screen to screen in a logical progression, screen links to get to a specific page, or the "view/edit all case details" link that gives the user a full, one-page view of the entire case records with links to

each page. Upon completing a case investigation, the user submits the case to IDPH to finalize before transferring needed data to CDC. In order to identify and respond to high priority cases and outbreaks in the timeliest manner, IDPH Infectious Diseases staff have access to case information throughout the local investigation process.

Currently, I-NEDSS includes morbidity reporting for all reportable communicable diseases (excluding TB, HIV/AIDS and STDs). Morbidity reporting includes demographic data, general illness data (hospitalization and physician information and onset date), and general risk factor data (occupation, residential situation, and a drop-down selection of generalized risk factors). The screens used for morbidity reporting are those shared by all diseases. I-NEDSS also has disease-specific modules for 46 diseases. A module includes the shared screens as well as specific screens for symptoms, clinical information, treatments, epi data, and contacts. The 46 diseases are grouped into the following modules:

- enteric diseases (amebiasis, campylobacteriosis, cryptosporidiosis, cyclosporiasis, E. coli, giardiasis, HUS, salmonellosis, shigellosis, yersiniosis)
- vaccine preventable diseases (rubella, diphtheria, polio, varicella, mumps, measles, pertussis, tetanus)
- non-bacterial CNS diseases (aseptic meningitis; encephalitis, other; Eastern equine encephalitis; Western equine encephalitis; Japanese encephalitis; meningitis, other; Murray Valley encephalitis, West Nile virus; St. Louis encephalitis; Powassan encephalitis; Dengue fever)
- bioterrorism agents (anthrax, brucellosis, botulism, plague, Q fever, tularemia, unusual illness)
- tickborne diseases (ehrlichiosis, Lyme disease and Rocky Mountain spotted fever)
- novel influenza
- pediatric influenza deaths

Hospital-based infection control professionals and other providers utilize I-NEDSS for browser-based reporting of all reportable communicable diseases (except HIV/AIDS, STDs and TB). The I-NEDSS Provider Reporting screen includes one screen for demographic and general illness information with links at the bottom of the page for additional information (lab data, as well as epidemiologic, symptoms and treatment information). Currently, there are 375 registered I-NEDSS Provider Reporting Users, representing 86% of Illinois hospitals (90% of hospitals outside of Chicago). To date, 13,539 cases have been entered by providers.

Electronic Laboratory Reporting (ELR) functionality in I-NEDSS occurs when IDPH establishes a data exchange using HL7 messaging and LOINC and SNOMED codes with a reference or hospital lab in Illinois. Currently, IDPH State Public Health Labs, Lab Corp and Mayo Clinic send ELR data into I-NEDSS, representing to date 10,911 reports, 4,816 reports and 1,279 reports, respectively. We are currently working on adding additional reference labs (ACL, Quest), POD hospitals (11) and additional results from the state lab.

To access ELR and provider reports, the LHD clicks the Lab/Provider Reports link and attempts to match the lab/provider report against the central repository to see if the person or person and case already exist in I-NEDSS. If so, the user merges the person or person and case into I-NEDSS. If no match is found, the user brings the new case into the I-NEDSS central repository.

I-NEDSS is developed using application analysis and design patterns that result in an application that is flexible, standardized, modular and easy to maintain. The application is built using Java/j2EE technology on an AIX unix operating system with DB2 databases. The diagram on page six illustrates the messaging system utilized by I-NEDSS to move data between data sharing partners. Integrated electronic data interchange and electronic laboratory reporting into the I-NEDSS application uses standard messaging formats, e.g., X12 and HL7, as well as flat-file formats. IDPH currently utilizes Mercator software for message parsing and translation.

The I-NEDSS architecture is designed in a dynamic manner that enables questions to be added/activated "on the fly." This unique architecture allows new module development within a fraction of the time it would require under standard architecture. It also readily equips I-NEDSS with the capacity to handle outbreaks (e.g., adding questions about consuming peanut butter) and emerging diseases (e.g., adding monkey pox as a new disease).

c. Integration Level

The I-NEDSS application is working toward full integration of disease reporting and surveillance systems within the Division of Infectious Diseases. Once TB and STD modules are added in November 2007 and the HIV/AIDS module in 2008, full integration within Infectious Diseases at IDPH will be accomplished. I-NEDSS is currently integrated with the IDPH State Laboratory for enteric and CNS non-bacterial diseases and plans to fully integrate all infectious disease testing as the state lab finalizes its LIMS implementation.

IDPH plans to integrate with other IDPH electronic systems, including the Vital Registry System. Future plans include a real-time exchange of data between the two systems for purposes of reporting and data validation. For example, when a death certificate is entered into the Vital Records System where the code for a cause of death is equal to a reportable infectious disease, a standardized message will be sent into I-NEDSS and processed as a new report. If a case already exists, new information from the death report will be merged into the existing case. In addition, IDPH plans to integrate I-NEDSS with its Immunization Registry, I-CARE, to access vaccination information for cases with vaccine preventable diseases. This will improve the accuracy of correlations between vaccine history and disease, and ensure that the investigator intervenes appropriately.

d. Privacy Protection

I-NEDSS is located within the IDPH WebPortal that is protected by firewalls and data encryption. A user is authenticated based on his/her user identification and password through the public health directory, LDAP. The portal registration process includes signature documents affirming the user's role and need for I-NEDSS access. Use of I-NEDSS is in compliance with HIPAA laws, as well as Illinois statutes. Access to I-

NEDSS data is limited by the user's health jurisdiction, role and disease responsibilities.

e. System Implementation

An iterative approach is utilized for I-NEDSS development. The initial design and core pages were developed with input from all sections within IDPH's Division of Infectious Diseases and as consistent with CDC's NEDSS standards and PHIN requirements. With this in place, I-NEDSS began modular development as follows:

I-NEDSS Release 1.0 was deployed in March 2004 and included a module for enteric diseases (amebiasis, campylobacteriosis, cryptosporidiosis, cyclosporiasis, E. coli, giardiasis, HUS, salmonellosis, shigellosis, yersiniosis). The enterics module collects and validates required disease, laboratory and epidemiological information for enteric disease cases. I-NEDSS 1.0 also included ad-hoc reporting using Business Objects software providing state and local users with several options for creating new reports, as well as to view canned reports developed by IDPH.

I-NEDSS Release 2.0 included the second I-NEDSS module, facilitating electronic reporting by local health departments of vaccine preventable diseases (diphtheria, measles, mumps, pertussis, polio, congenital rubella, rubella, tetanus). Release 2.0 was deployed in August 2004.

I-NEDSS Release 3.0 was deployed on January 18, 2005 and included the following:

- enhancements to Release 1.0 (enteric diseases module) and 2.0 (vaccine preventable disease modules),
- deployment of new servers and other hardware that improved performance, most notably speed,
- the central nervous system, non-bacterial diseases (aseptic meningitis; encephalitis, other; Eastern equine encephalitis; Western equine encephalitis; Japanese encephalitis; meningitis, other; Murray Valley encephalitis, West Nile virus; St. Louis encephalitis; Powassan encephalitis; Dengue fever) module,
- the LHD morbidity module, a module for reporting via I-NEDSS all remaining communicable and vaccine preventable diseases, excluding HIV/AIDS, STD and tuberculosis,
- legacy data in I-NEDSS Reports for all data contained in the IDPH Communicable Diseases database from 1989 to 2003, and
- the Provider Reporting module that launched browser-based data entry for infection control professionals and other providers to report all communicable and vaccine preventable diseases (excluding HIV/AIDS, STD and TB cases) to their local health departments.

I-NEDSS Release 4.0 was deployed on May 3, 2005. The updated version of I-NEDSS included legacy data in I-NEDSS Reports for vaccine preventable diseases from 1994 to 2003, electronic laboratory reporting of arbovirus test results from the IDPH state laboratory and system enhancements.

I-NEDSS Release 5.0 was deployed on December 19, 2005 and included the following:

- bioterrorism modules for anthrax, brucellosis, foodborne botulism, wound botulism, infant botulism, plague, Q fever, tularemia, and unusual illness,
- a tickborne diseases module for lyme disease, Rocky Mountain spotted fever and ehrlichiosis,
- electronic lab reporting (ELR) from LabCorp into I-NEDSS,
- the addition of the Common Lab page for all diseases. The Common Lab page was built to accept electronic laboratory reports and allows I-NEDSS to capture as much data as is available from the electronic laboratory message. The Common Lab page was added to I-NEDSS Provider Reporting, the morbidity module (for those diseases for which a complete I-NEDSS modules has yet to be developed), and replaced the Lab Results page in existing modules, and
- the implementation of 16 change requests.

I-NEDSS Release 5.5 was deployed on October 1, 2006 and included the following:

- a novel influenza module as part of IDPH's response to the threat of avian influenza. This module will be used for case reporting of a novel influenza strain (e.g. H5N1). If case reporting reaches epidemic or pandemic levels, an aggregate system for reporting will replace the case reporting system,
- a pediatric influenza death module for reporting of pediatric (<18 years) deaths due to influenza, including seasonal influenza, and
- implementation of several change requests.

I-NEDSS Release 6.0 was deployed on March 17, 2007 and included the following new components:

- new functionality for managing negative lab results (e.g., CNS disorder and enterics),
- the ability to find new lab and provider reports while in an I-NEDSS case,
- new functionality for capturing "At Onset" fields for race, ethnicity, age, address and county. The significance of these fields is to capture current demographic data specifically related to a case (disease) that may differ from the demographic data on the person (e.g., person is reported with a new disease at a later date and has a new address and is a year older),
- the addition of the Year Counted field to keep a consistent count of data reported to CDC, and
- electronic lab reporting into I-NEDSS from the IDPH state lab for enteric diseases, including both positive and negative results.

I-NEDSS Release 6.5 was deployed in July 2007 and launched I-NEDSS' new Analysis, Visualization and Reporting functionality. This release significantly improved users' abilities to run reports against the data in I-NEDSS by providing:

- significant improvements in statistical capabilities and overall report building functionality,
- improved canned reports,
- a user-friendly interface for developing reports,
- access to historical and current data from the same universe for running trend data,
- flexibility in adjusting report output,
- improved exporting features,

- alerting and notifications against data aberrations, and
- access to census data within the AVR allowing users to easily run population-based rates.

As I-NEDSS evolved, the needs to query the data grew. I-NEDSS AVR began with an early and very basic version of Business Objects that ran queries against the I-NEDSS database. This version, like I-NEDSS, was deployed in an IBM web-sphere portal environment. This allows all users to analyze data without the need to install programs on their local machines. In Winter 2006, IDPH began gathering requirements for the next version of the AVR, prompted by user requested for additional AVR functionality. It was decided that the new version of Business Objects (vXIR2) running against a data warehouse with a 60 second refresh would meet those requirements. This methodology is commonly used in the business world but has not been frequently applied to disease surveillance.

I-NEDSS' novel approach to its AVR allows all users real-time access to the data they submit in any manner they choose. Many states and local jurisdictions have developed reporting systems that utilize "canned reports." I-NEDSS AVR allows full access to a jurisdiction's data. While this open access to ad hoc reporting has benefits, it also presents a degree of difficulty with regards to training. IDPH understands that it is imperative that users receive at least a moderate amount of training. This training has been effective in allowing users to feel a level of comfort with the new AVR. A secondary benefit of the training is that the users take ownership of their disease data and its integrity.

GIS functionality for mapping and geo-spatial analysis will be added to the AVR later in 2007. A proof of concept for bridging data in the I-NEDSS AVR with GIS functionality was proven successful. This will allow IDPH to move forward on a GIS solution that will work seamlessly within its AVR. For example, a user will be able to visualize data from a tabular report by clicking the mapping link.

Release 7.0 is scheduled for January 2008. This will include modules for hepatitis and tuberculosis. Release 8.0 (2008) will include modules for bacterial CNS diseases, sexually transmitted diseases and lead, as well as improved deduplication functionality, an outbreak system feasibility study, and novel influenza aggregate reporting (for phase 6 of a pandemic influenza response). Future development will include a quarantine and isolation monitoring system and modules for HIV/AIDS (Release 9.0) and the remaining communicable diseases which include fungal diseases (histoplasmosis and blastomycosis), legionellosis, malaria and streptococcal diseases.

f. **Current State**

I-NEDSS is currently utilized by 114 IDPH Division of Infectious Disease staff members at the central office and at regional offices for day-to-day disease surveillance and control activities. In addition, the data from I-NEDSS are utilized for research, planning and policy making. Data from the system are made available to the public on IDPH's website and also on an as needed basis (e.g., during the West Nile Virus season, data on case numbers are provided in press releases along with information on how the general public can protect themselves from infection).

I-NEDSS also is used by all 95 local health departments (LHDs) in Illinois with a total of 657 registered users. LHD infectious disease epidemiologists, disease investigators, administrators and field staff use I-NEDSS as an integral part of their agencies' disease control and prevention programs. For reportable vaccine preventable and communicable diseases, I-NEDSS represents 100% of disease reporting by local health departments.

A total of 375 health care providers (representing 85% of hospitals in the state) are registered users of I-NEDSS Provider Reporting. Between 2005 and 2006, the number of reports submitted by providers increased by 47% from 5,380 to 7,913 reports. In the last quarter of 2006, more reports originated in I-NEDSS from electronic lab and provider reports (55%) than from LHD browser-based entry (45%).

Value

a. Success in Meeting Objectives

Measures of Quality. Analysis and requirements gathering for each I-NEDSS module includes identifying needed rules, validations and required fields. When implemented, these ensure that at the point of entry and/or closure I-NEDSS data are consistent (free-form text data entry is avoided whenever possible), validated (e.g., exposure dates occur before onset date) and include required fields (e.g., patient's county, race, lab results). Deduplication measures are employed to ensure the quality of the person-centric system and that cases are counted only once.

Process Efficiency. Information technology project management principles are strictly adhered to during all phases of I-NEDSS development, implementation and maintenance. Thorough documentation is an inherent part of I-NEDSS development. New development is documented in use cases to ensure that the resulting design and development address the specific requirements for IDPH's disease surveillance and control. When any change to the system is proposed, it must be funneled through the change control process. Any I-NEDSS user can submit a change request that is then reviewed by the I-NEDSS administrator and project manager for approval with regard to implementation practicality. The majority are approved and forwarded to the I-NEDSS Change Control Board (CCB) for review, approval and prioritization. The CCB includes one member from the I-NEDSS Team, one member from each of IDPH's Division of Infectious Diseases sections, the state veterinarian, the IT assistant administrator and three local health department members. The CCB reviews each change along with supplemental information on estimated cost and system implementation impact. All change requests that are approved by the CCB are prioritized for placement in the I-NEDSS release timeline.

The I-NEDSS application is shared across all sections in IDPH's Division of Infectious Diseases. This allows IDPH to maximize resources, standardize data collection and examine diseases data on one platform. In addition, it lessens the "learning curve" by minimizing the number of systems IDPH and LHD staff have to learn, builds a higher level of expertise, and provides a larger pool of users which is important for outbreak/surge needs. I-NEDSS generates collaborative partnerships between state and local health departments and local health departments and their

providers through data and information sharing. In addition to providing a mechanism for communication, I-NEDSS AVR provides users at all levels with access to data for improved outbreak and aberration detection.

Productivity. Between 2005 and 2006, the number of reports submitted by providers increased by 47% from 5,380 to 7,913 reports. In the last quarter of 2006, more reports originated in I-NEDSS from electronic lab and provider reports (55%) than from LHD browser-based entry (45%).

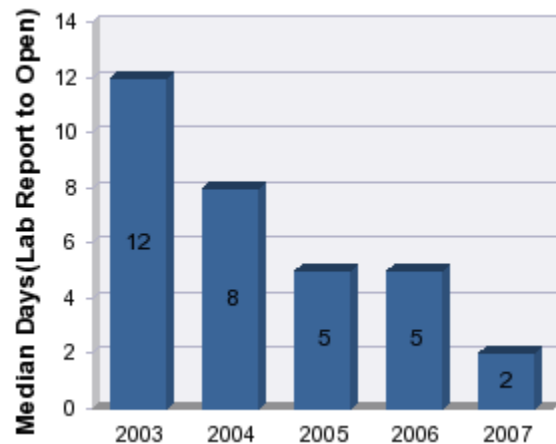
The release of the I-NEDSS new AVR (Analysis, Visualization and Reporting) functionality has significantly improved the productivity of report generation for state and local health department users. The AVR includes canned reports, semi-ad-hoc reporting and full ad-hoc reporting options for all levels of users against both the transactional (new) cases and historical cases. The I-NEDSS AVR provides users with a real-time tool for evaluating the number of ill individuals within their jurisdiction and making aggregate comparisons with other like-sized or neighboring jurisdictions. This functionality has been important in detecting disease rate aberrations.

The I-NEDSS AVR has been productively utilized in multiple disease outbreaks. With this new version, it is easy to compare places where food items were consumed or purchased to determine potential sources of common infection. These data also can be analyzed statistically or graphically leading to easy visualization of trends. For example, the AVR was extremely helpful in determining the source of a *Salmonella newport* outbreak. Demographic data collected in I-NEDSS were utilized to determine the cohort disproportionately impacted by the illness. Risk factors were analyzed using I-NEDSS reports. Commonalities among ill individuals were found which enabled environmental health staff to conduct focused inspections to determine the causative agent.

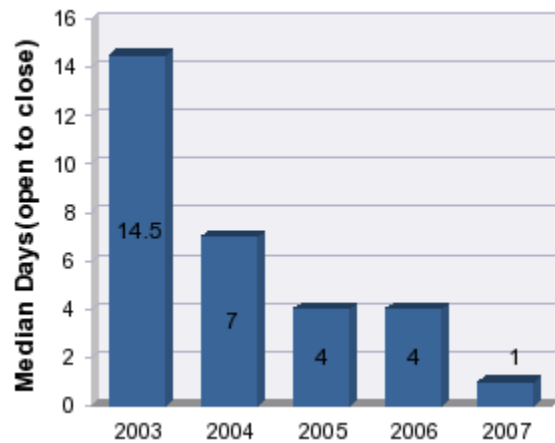
One of the most promising features of the new AVR is the ability to send alerts that are dependent upon events. For example, if a case of anthrax is reported in I-NEDSS, the AVR can be set to send an automated alert to a user through e-mail. Alerts can also be set to notify a user if a pre-determined threshold is reached. For example, a notification could be sent if the number of Salmonellosis cases is greater than would be expected for a given time period using preset confidence intervals.

Future enhancement of the AVR will incorporate GIS (Geographical Information Systems) capabilities for all users. This level of spatial analysis will allow investigators to visualize disease incidence and prevalence to target interventions where most needed and evaluate their efficacy.

Timeliness. I-NEDSS has achieved significant progress in reporting with regard to timeliness and toward the goal of early event detection. The median number of days between the lab report date (when the diagnosis is usually first known) and the date entered into I-NEDSS decreased more than two fold between 2004 and 2005 and also between 2006 and 2007. The graph on the following page shows progress achieved with timeliness of reporting between 2003 and 2007.



Similar timeliness progress has been observed between the date the local health department opened a case in I-NEDSS to when it was closed. The graph below shows similar progress in improving timeliness to a median of one day in 2007.

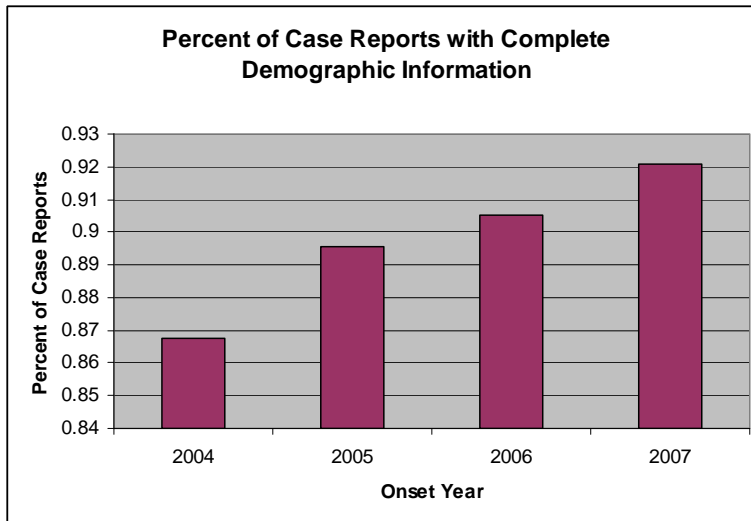


Together, both measures of timeliness support the value of I-NEDSS in improving disease control and prevention in Illinois.

Completeness. I-NEDSS not only facilitates expedited transmission of reportable disease information to local and state public health authorities, but also serves the function of housing historical communicable disease data. This allows I-NEDSS to be more than a disease reporting system. Users are permitted continued access to their data so that disease trends can be identified and quality assurance can be evaluated.

Providing a quality tool with access to both current and historical data has been important for ensuring “buy in” from users. It is recognized that if I-NEDSS is not seen as a valuable tool to state and local health department staff, along with providers, the quality of disease reporting would be low. A recent statewide quality assurance report indicated a 92% completeness rate on case demographic information, representing an approximate 2% annual increase. This increase in case

report quality, as shown below, demonstrates the value placed on the data by users and their commitment toward continued improvement.



Customer Service. In July 2005, the first I-NEDSS Satisfaction Survey was administered to local health department (LHD) users via a web-page survey designed with Inquisite Web Survey System, version 6.5. The objectives of the survey were to gauge users' satisfaction with I-NEDSS and to identify areas for improvement. In general 81% (165) respondents were at least satisfied with I-NEDSS. At least 65% agreed to very strongly agreed that I-NEDSS met their expectations for an electronic reporting system and 65% were at least satisfied with its ability to store "sensitive" information securely. The majority of respondents (52%) were satisfied to extremely satisfied with the addition of provider reporting, although 40% were still undecided. The top three features liked best about I-NEDSS were (1) I-NEDSS is user friendly; (2) it improves timely reporting; and (3) its accessibility. Responses regarding promptness of data entry from non-electronic lab or provider reports were very encouraging. Of those responding to this question (134), the majority (59%) reported entering the initial report into I-NEDSS right away, then complete the remaining questions on the paper form and enter the information into I-NEDSS. An additional 19% reported entering the information into I-NEDSS while completing the investigation. When comparing data entry time from past (prior to January 2005) to present, 57% (77) of respondents to this question said their time has improved, while 39% (53) said it stayed about the same. The LHD survey will be readministered during summer 2007 to measure progress in user satisfaction at the local health department level. Since I-NEDSS has experienced significant growth and enhancements since the 2005 survey, improved customer satisfaction is expected and is supported through anecdotal data.

A user satisfaction survey of I-NEDSS Provider Reporting users will be administered this spring with results expected in summer 2007. Initial pilot testing and additional anecdotal data on provider reporting show a high level of satisfaction across many levels.

b. Cost and Benefits Offsetting Costs

To date, IDPH has spent five million dollars analyzing, developing, implementing and maintaining I-NEDSS. Funding almost exclusively has been through the CDC's Bioterrorism and Preparedness and Pandemic Influenza grant funding. Prior to 2007, the only other funding source had been through the CDC's Epidemiology and Laboratory Capacity grant. The justification for developing I-NEDSS through these funding sources is that an electronic disease surveillance system serves as the foundation for a bioterrorism response through early event detection, identification, and surveillance. Additionally, as a bioterrorism system, I-NEDSS is consistent with the all hazard approach, provides views of data at all levels for improved data sharing and detection, conducts ongoing drills and testing to build competency at all levels, provides surge from all program levels, allows users to see the entire picture/history of infectious disease to differentiate and understand situational information, and improves the timeliness and completeness of disease surveillance.

Projecting a cost-benefit figure on I-NEDSS implementation can be difficult. I-NEDSS has improved the timeliness of reporting which allows both state and local health department to investigate cases more quickly and provide interventions to prevent secondary cases and control outbreaks. The cost savings in terms of health care costs, lost wages, etc., from preventing morbidity and mortality is certainly a benefit, albeit not a tangible dollar amount.

Prior to the implementation of I-NEDSS, some LHDs maintained their own databases. By providing one statewide system, IDPH has saved local health departments (LHDs) the expense of software installation and database construction and maintenance. LHDs that did not have their own databases had to contact IDPH for line lists and statistics on their jurisdictions' cases. With I-NEDSS, all LHDs, as well as I-NEDSS Provider Reporting users, have access to their own data and aggregate (non-identifiable) data for cases outside of their jurisdictions. This results in significantly increased monitoring of disease occurrences, trends and outbreaks leading to earlier event detection.

IDPH is offsetting costs and achieving increased benefits by utilizing I-NEDSS in other public health programs. The lead program is currently developing a module within I-NEDSS. Non-bioterrorism diseases, e.g., HIV/AIDS, also are planning to build modules within I-NEDSS. Both are using Illinois general revenue sources to fund development.

Evaluation and user satisfaction are described in the previous section.