

## Section A. Identifiers

1. Name and Title of Submitter: Simi Octania-Pole, Director of Data Systems, Communicable Disease Service, New Jersey Department of Health and Senior Services
2. Public Health Organization Name: New Jersey Department of Health and Senior Services (NJDHSS), Communicable Disease Service (CDS)
3. Public Health System Name: Communicable Disease Reporting and Surveillance System (CDRSS).
4. Address: Communicable Disease Service, PO Box 369
5. City: Trenton                      State: NJ                      ZIP: 08625-0369
6. Telephone: 609-588-7500                      Fax: 609-588-2546
7. Email: [Simi.Octania-Pole@doh.state.nj.us](mailto:Simi.Octania-Pole@doh.state.nj.us)      Website: <https://cdrs.doh.state.nj.us>
8. Description of Communities served: CDRSS serves over 900 trained users covering various public health partners which include public health nurses, epidemiologists, health officers, clerical and administrative support staff, public health educators, hospital infection control professionals, and laboratory staff. There are trained users in each of New Jersey's 114 local health departments which cover 566 municipalities in 21 counties. Other partners include the 22 Local Information Network and Communications System or LINCS agencies, and 80 acute care hospitals and medical centers.
9. Number of FTEs:
  - a. In entire organization: 145 FTEs in CDS
  - Directly affected by submission: 4.5 FTEs in OITS; 2.5 FTEs in CDS
10. Description of Public Health Program(s) directly affected by submission: The Communicable Disease Service's Infectious and Zoonotic Disease Program and the Vaccine Preventable Disease Program.
11. List of members of the electronic public health information team who will be considered authors
  - a. Simi Octania-Pole, PhD
  - b. Christina Tan, MD
  - c. Marlene Bednarczyk, MSQSM
  - d. Eileen Troutman, MBA
  - e. Atul Verma

## **Section B. Guidelines for Application**

### **The Organization**

New Jersey has a population of over 8 million people distributed over 21 counties in 566 municipalities. Currently, the state has approximately 80 acute care facilities, most with in-house laboratories. The New Jersey Department of Health and Senior Services (NJDHSS) is the lead public health agency in the state and collaborates closely with the state's 114 local health departments (LHDs) which have primary responsibility of public health issues in their respective jurisdictions.

The Communicable Disease Service (CDS), within the NJDHSS, works to protect the health of New Jersey's residents by upholding its mission to monitor the incidence and prevalence of communicable and infectious diseases in New Jersey; develop recommendations regarding their prevention and control; and communicate those recommendations to health care providers, public health officials, policymakers and other relevant agencies.

CDS has offices in Hamilton, Paterson, Camden, Newark, and Bridgeton, and includes four programs: the Infectious and Zoonotic Disease Program, the Sexually Transmitted Disease Program, the Tuberculosis Control Program and the Vaccine Preventable Disease Program. CDS employs approximately 145 staff who receive and evaluate urgent disease reports, control the impact that infectious diseases have in the community, respond to both routine and emerging infectious diseases and outbreaks in an efficient and timely manner, and provide appropriate health education to the public, LHDs, hospitals, physicians and other health care providers. CDS staff are on-call 24 hours per day to accept and respond to immediately reportable disease reports and potential communicable disease public health emergencies from LHDs, hospitals, and other health care providers.

### **Management**

#### *1. Objectives:*

CDS had several goals and objectives for implementing an electronic notifiable disease system:

- To improve timeliness of notifiable disease reporting.
- To improve data quality by enhancing report completeness and accuracy.
- To minimize underreporting through developing methods to accept electronic laboratory reports and to enroll local public health and healthcare partners statewide.

#### *2. Project Organization:*

##### *Development and implementation history*

In 2000, CDS received federal funding to plan and implement an electronic disease surveillance system that would improve the timeliness and quality of notifiable communicable disease data. Using information collected from several joint application development sessions with healthcare professionals, local health officials and laboratory officials, CDS staff worked

closely with staff from NJDHSS's Office of Information Technology Services (OITS) to develop a system in-house.

In the fall of 2001, CDS launched the Communicable Disease Reporting System (CDRS), a secure, Internet-based, case-centric database. Since CDRS implementation, the number of reported notifiable diseases doubled from 14,608 in 2002 to 29,967 in 2004. The percentage of notifiable disease reports entered by local health departments and hospitals increased from approximately 11% of all CDRS cases in 2002 to 50% in 2004. During 2003 to 2004, CDRS had over 600 statewide users and over 250 user groups based on jurisdiction and function, including epidemiologists, data entry staff, hospital infection control professionals (ICP), and commercial and hospital laboratories. In 2004, CDS determined that users entered cases an average of 3 to 4 days after illness onset, compared to 28 days in 2003.

Despite these initial successes with increased and timely reporting and widespread CDRS use, CDS recognized CDRS's limitations. First, CDRS did not meet full PHIN compliance standards since it was a case-based, not patient-centric, system. Secondly, CDRS did not have extensive data entry screens and limited the amount of case information that public health and healthcare users could record, subsequently restricting CDRS's optimal use as a case management system. Finally, users mainly used CDRS to share notifiable disease data with CDS but did not utilize CDRS's report functions which only provided rudimentary data summaries.

To this end, in 2005, CDS began converting CDRS to a patient-centric system and expanded its capacity to support surveillance activities. CDS renamed CDRS to the Communicable Disease Reporting and Surveillance System (CDRSS) to underscore the system's expanded capabilities. Highlights of CDRSS included a separate module to capture influenza-like illness data from schools, hospitals, and long-term care facilities; disease mapping; enhanced reports for epidemiologic and administrative activities; and expanded data entry screens that allowed users to enter information on risk factors, clinical presentations, contact tracing, and case classification in discrete data fields.

The current system uses industry standard enterprise Java/Web technologies and tools including:

- J2EE (EJB's, JSP, XML, HTML, AJAX, Javascript etc)
- BEA Weblogic (Application Server)
- Oracle (Database)
- Data Warehousing and Data Staging (HL7)
- Quest's Toad (PL/SQL and Oracle)
- Crystal Reports (Reporting)
- ARCSDE (Spatial Engine)
- ARCIMS (Geo-coding and Mapping)
- Orion's Rhapsody (Data mapping for HL7)

### *Roles/responsibilities for managing system effort*

During CDRS's initial development and implementation stages, OITS had three FTEs (including a project manager and programmers), and CDS dedicated 0.5 FTE. Approximately two to five CDS epidemiologists provided consultation which at best had been sporadic and overextended a small number of people. Subsequently, CDS hired three FTEs including a coordinator and technical assistants. However, there was still inadequate involvement of representatives from all user groups, including local health and hospital concerns, which led to development of system portions that were incompatible with epidemiologic needs and use.

In light of these challenges and hiring freezes that prevented bringing on additional staff dedicated to electronic reporting initiatives, in 2005, CDS established a multi-disciplinary steering committee prior to developing and implementing CDRSS. The steering committee included CDS staff (e.g., epidemiologists, data analysts), local health department staff, and programmers to represent the areas of data management, surveillance/epidemiology, administrative functions, laboratory functions, technical/programming areas and local health department and hospital concerns. CDS hired a consultant to serve as an engagement manager whose main function was to moderate the steering committee meetings and record the steering committee's deliberations, including writing up user requirements generated out of committee discussions. Based on initial meetings, the steering committee defined its main responsibilities, including:

- defining application goals,
- identifying system functionalities that impact different user groups,
- assigning specific tasks to committee members to ensure accountability,
- establishing timetables to accomplish tasks,
- checking that programmers accomplished accurate translations of epidemiologic needs,
- gathering ongoing feedback from current users, and
- prioritizing suggested new functions for application.

From 2005 to the present, the steering committee has met every two weeks to help ensure its ongoing commitment to its self-defined responsibilities.

### **Implementation**

*a. Public Health Organization:* CDRSS is the primary tool for reporting and managing information on New Jersey's notifiable communicable diseases among state and local public health and health care partners. Due to positive feedback from the New Jersey Health Officers Association (NJHOA), the current communicable disease reporting regulations are being modified to mandate use of electronic reporting by the local health departments.

## *b. Scope and current functionalities*

### Case management

All data access is based on user role and jurisdictional privileges. CDS staff can view all case information; local and county staff can view only cases within their jurisdiction; and hospital ICPs can view cases either created by them or those associated with their medical facilities. Viewing privileges are further defined by user roles within an organization: for example, data entry staff has access to fewer fields while investigators (including epidemiologists, public health nurses, and ICPs) can view all case information. Additionally, CDRSS can specifically tailor data access privileges to the individual user within, or in addition to, his/her general broader user group. For example a public health nurse might work part-time at two LHDs and will have viewing privileges to both jurisdictions.

All cases have report status designations which facilitate communicable disease investigation workflow. For example, CDRSS will automatically assign a report status of “Pending” to any new case created through an electronic laboratory report. CDRSS then generates a list of “Pending” cases for LHDs, based on case-patients’ residences. Once a LHD completes a case investigation, it will change the case’s report status to “LHD Closed”. CDS staff can generate a list of “LHD Closed” cases for review. CDS staff change report statuses to “DHSS Approved,” as per case definitions. Cases that have both the report status “DHSS Approved” and case status of “Confirmed” (or “Probable” with certain diseases) are published in CDC’s MMWR.

Also, CDRSS fully integrates case data from web entries and electronic laboratory reports (ELR). When an ELR comes into CDRSS, CDRSS will check if a case already exists in the system, per matching with patient’s given demographic and contact information in the laboratory report. If a case exists for a specified patient, CDRSS will add the new electronic laboratory data to the case, mark it “Re-opened,” a flag for the LHD to review the new data. If the automated process cannot find a match, CDRSS will create a new case and mark it “Pending” for subsequent LHD follow-up.

Based on case definitions and investigation protocols for specific diseases, CDS staff implemented business rules into CDRSS for processing subsequent laboratory reports, which are periodically verified to ensure that any reporting changes are current and reflected accurately in CDRSS workflow. For example, after CDS staff designate chronic hepatitis C cases as “Confirmed,” CDRSS automatically appends subsequent lab results to these existing confirmed cases. In contrast, with new hepatitis B lab results, CDRSS automatically changes any chronic or acute hepatitis B cases occurring among females (or gender unknown) between the ages of 10 to 55 years to “Re-opened” status to facilitate perinatal hepatitis B investigations; CDS staff then assess “Re-opened” cases to determine case-patient pregnancy status (a field rarely populated by clinical laboratories).

CDRSS organizes information into several tabs for case management purposes. These can further be used to generate several different reports that summarize data, including:

- patient information (e.g., disease name, demographic and contact information),

- clinical status (e.g., illness onset, patient education, treatment, physician and hospital information, immunizations),
- signs and symptoms,
- laboratory results,
- contact tracing (e.g., details on contacts, details on public health response including prophylaxis measures; if a contact becomes a case, the case-ID becomes populated),
- epidemiology (e.g., risk factors), and
- case classification.

Finally, CDRSS has the ability to geocode all cases, a major highlight of the system, since in New Jersey, post office names and municipal jurisdictions do not always match one-on-one. For example, an address with a mailing city listed as ‘Princeton’ and ZIPCode as ‘08540’ could actually belong to any of nine municipalities from three distinct counties which fall under the jurisdiction of one of eight different health departments. By locating the address on a map, the case automatically appears on the “Pending” list of the LHD who, as the appropriate jurisdiction, can respond more efficiently.

Outbreak Management: The outbreak management module is integrated into case reporting. CDS staff can assign an outbreak number that links cases associated with a specific outbreak, facilitating the ability to run reports (including maps) and summarize data related to outbreaks. A case can be assigned to an outbreak either at the time of initial data entry or can be later updated during follow up. In addition, CDRSS allows users to change case details (i.e., customize risk factors for a specific outbreak) according to outbreak-specific case definitions and classifications, as needed, since outbreak-specific case definitions often evolve as an outbreak progresses. For example, during a fall 2006 multistate *E. coli* O157:H7 outbreak associated with Taco Bell restaurants, the final outbreak-specific case definitions were significantly different from the standard surveillance case definitions. CDS staff customized case data fields to include Taco Bell exposure history and most commonly identified symptoms.

Analysis, Visualization and Reporting: CDRSS has extensive report generating capabilities that can be viewed as tables, charts and maps. In addition, the reports can be exported into several formats including Excel and delimited formats, for more sophisticated analysis with statistical and geospatial software. For general CDRSS users, the system can display a wide variety of reports including temporal comparisons for tracking an outbreak. Also, visualization of data, especially the capability to map case contacts up to five tiers is a very powerful tool for summarizing and identifying potential clusters.

While most reports run from the transactional database, an historical database is also available to generate reports that exactly match annual MMWR final numbers: CDRSS maintains snapshots of the database reflecting the day the year-end final disease counts were submitted to CDC, which users may use for their own analytic purposes. These snapshot databases provide consistency in reports generated by local, county or state health departments for public release. Additionally, these snapshots also encourage LHDs to improve year-end case close-outs in a timely manner, as LHDs can see how many additional case investigations were completed after the final CDC submission (otherwise not counted in that year’s final annual numbers).

Laboratory Reporting Administration: To facilitate electronic laboratory reporting, a separate module has been created in CDRSS to assign specific laboratory tests to diseases. CDS staff familiar with LOINC and SNOMED classifications create these relationships through easy-to-understand screens without requiring programming changes every time a new disease or lab test is added for electronic transmission by a clinical lab. Additionally, utilization of LOINC and SNOMED codes facilitates laboratory data standardization, including test results from clinical laboratories that do not send electronic laboratory reports.

Influenza-like Illness (ILI) Module: CDS staff use the ILI Module to collect weekly aggregate ILI and respiratory syncytial virus surveillance reports from hospitals, schools and long term care facilities. This module is extremely flexible, and CDS staff can modify data reporting intervals (e.g., hourly or daily reports) for enhanced surveillance during an epidemic, namely tracking of aggregate disease activity during widespread outbreaks.

Antimicrobial Resistance Module: This module is currently under testing and is scheduled for a mid-2008 release. It will be available to all hospitals for reporting aggregate antibiograms or cumulative susceptibility data generated in their laboratories. The module allows hospitals to customize their lists of antibiotics and drug resistant bacteria to facilitate data entry and account for hospital-specific data. Standardized reports can be generated by staff, based on user privileges.

*c. Integration Level:*

The CDRSS technical group has been among the leading state collaborators with CDC's team to deploy Orion's Rhapsody software for processing ELR. This group is currently working on implementing PHIN-MSS to send messages from CDRSS to the data brokering team at CDC. Currently, CDRSS administrative staff can generate files directly from CDRSS for NETSS transmission to CDC. Once PHIN-MSS is fully deployed, CDRSS will transition to NEDSS transmissions.

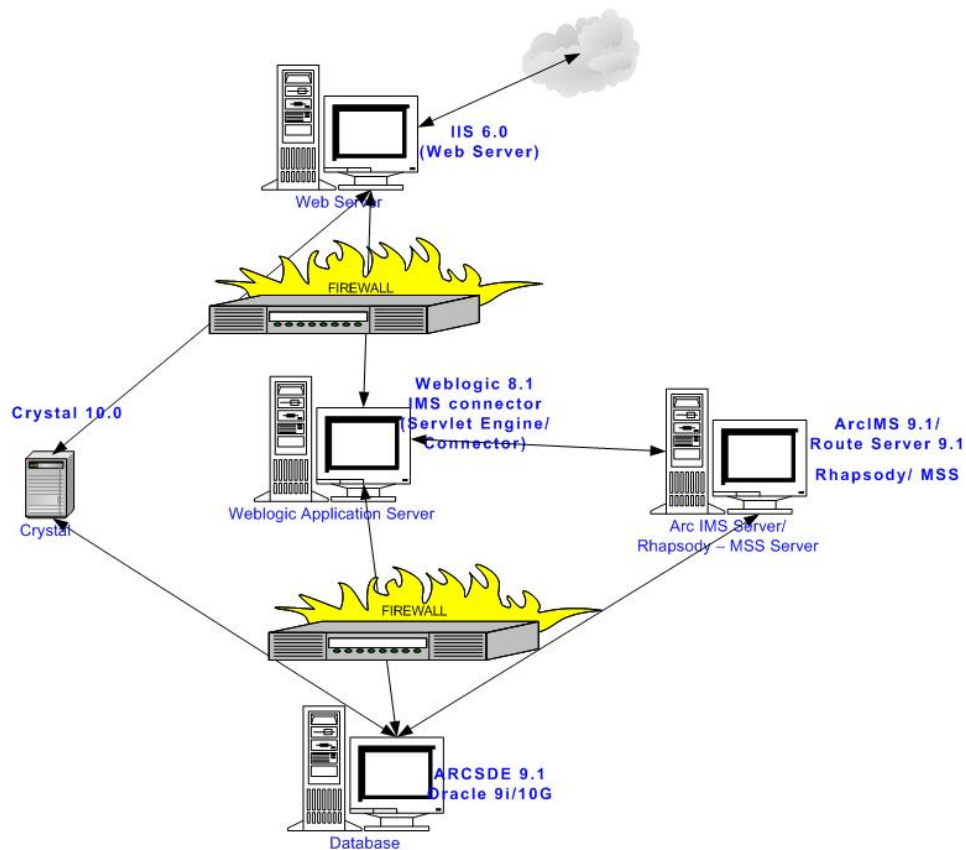
CDRSS is fully integrated with LabCorp's public health reporting system and receives daily automated data transmissions. CDRSS has also developed an interface with a New Jersey acute care hospital laboratory to receive laboratory test results. NJDHSS's Public Health and Environmental Laboratories are also currently transmitting limited data to CDRSS and intend to complete ELR implementation in the next few years.

CDRSS developers are also using PHIN VADS to standardize vocabulary. Most dropdown values in CDRSS correspond to the VADS data set. The Rhapsody route to map HL7 values is also directly taken from PHIN VADS. All race and ethnic categories adhere to OMB standards as specified in PHIN VADS.

d. *Privacy Protection*

CDRSS has been developed as per standards mandated by the state's Office of Information Technology (OIT) in a three-tier architecture which provides a secure environment for data storage (Figure 1). Access to all information is based on the user's jurisdiction and role in public health. Aggregate data are available to all users; case-specific information is limited to a need-to-know basis. User-IDs and passwords are alpha-numeric and case-sensitive. Users are required to sign a data confidentiality agreement before getting access to data and sign off electronically on the agreement from time to time. Users are required to change passwords every 60 days. Periodic e-mails are sent to all users, and CDRSS staff verifies all undeliverable e-mail addresses. In order to protect the identity of cases, case-IDs are used to communicate information among users.

**Figure 1: NJDHSS OITS – CDRSS architecture**



NJ DHSS OITS 11/07

e. *Training/ System Implementation:*

Prior to CDRS implementation, CDS staff manually entered paper reports of notifiable diseases into an Epi Info database. After CDRS implementation, in October 2001, the first users were OITS and CDS personnel whom the OITS program manager trained on an as-needed basis. CDS had designated only one dedicated data entry staff to handle paper reports during this initial internal roll-out period.

In early 2002, one CDS staff person provided 30-minute PowerPoint trainings to LHD health officers in five counties. However, during this time, CDRS received limited data from these pilot counties, namely because end users and data entry staff had not received adequate training, and OITS and CDS provided little help desk support to assist users.

By November 2002, CDRS gained capability to receive electronic laboratory reports from LabCorp, a major commercial laboratory in New Jersey. Additionally, CDS hired a dedicated NEDSS lead to further develop, coordinate and conduct CDRS trainings throughout the remainder of the state.

By the end of 2003, CDRS was rolled out to all LHDs statewide through half-day, hands-on training sessions that targeted not only health officers but also other LHD staff, including data entry personnel. CDS and OITS established a help desk and methods to track user feedback. After the rollout to LHDs, CDRS trainings then included hospital staff (including lab staff). CDS staff subsequently modified the CDRS training manual to include user-based feedback and incorporated additional interactive tools in training sessions.

During the transition to the CDRSS system in 2005, CDS staff followed a standard operating format to support maintenance of CDRS and the developing CDRSS. User requirements for CDRSS were identified and documented. OITS developed functionalities accordingly, in consultation with the CDRSS Steering Committee, which approved and prioritized various components of CDRSS development. CDS staff developed test scripts, and state and LHD staff tested versions of CDRSS.

CDS staff developed, piloted and implemented new training materials before CDRSS's rollout in January 2006. CDS staff had determined that a significant number (approximately 49%) of CDRS users were inactive, and in light of this finding and related concerns over data security, CDS staff targeted CDRSS training to active CDRS users. By the end of 2005, two CDS staff trained over 500 persons on CDRSS. By mid-2006, CDS staff trained another 250 users and developed train-the-trainer materials. In December 2006, CDRSS had approximately 800 trained and active users.

Since 2006, two CDS staff manage the CDRSS help desk phone line and e-mail account, participate in testing of system upgrades, develop and update training materials, and design and deliver the training sessions. When required, OITS provides technical support and information to incorporate into trainings. Users continue to make suggestions for enhancements and identify bugs or problems, all of which are documented and referred to the CDRSS Steering Committee for review, approval and prioritization.

CDS staff have developed additional advanced trainings to address needs of experienced CDRSS users. For example, trainings on CDRSS reports show users how to generate reports to facilitate investigation and general public health activities, including year-end data closeouts and summaries of disease trends. CDS staff provide both basic and advanced trainings either at state offices or at local sites, modifying trainings according to user needs.

## Value

### 1. *Success in Meeting Objectives:*

#### Improved timeliness of notifiable disease reporting

Prior to implementation of an electronic reporting system, CDS accepted paper reports of notifiable conditions. CDS received reports days to months after illness onset, and, as a result, CDS entered cases into its Epi Info-based database up to five months after illness onset. A CDS study determined that users entered cases an average of 3 to 4 days after illness onset in 2004, compared to 28 days in 2003.

In addition, data are more readily available to all users, since data updates by users are immediately seen in CDRSS and accessible to any user statewide. Also, CDRSS facilitates communication among public health providers, and e-mail alerts instantly inform state and LHD staff of new reports from hospitals and laboratories, predominantly important for immediately reportable diseases or early detection of outbreaks, including the following examples:

- During summer 2004, CDS staff noted an increase in *Salmonella berta* incidence in the Trenton area, prompting quick evaluation of regional hospital and laboratory data. Early recognition of increasing incidence helped implementation of enhanced surveillance which subsequently identified additional *S. berta* clusters in adjacent states and in turn led to rapid implementation of outbreak control measures.
- During 2005 to 2006, CDS and LHD staff reduced the incidence of hepatitis A through timely case investigations and enhanced CDRSS use, in conjunction with an extensive statewide education campaign and the aggressive encouragement of LHDs to implement appropriate control measures. The data show a 30% reduction of hepatitis A cases (158 cases in 2005 to 111 in 2006), likely representing a decrease in secondary transmission, and an almost four-fold increase in appropriate public health response, including increased numbers of contacts receiving timely post-exposure prophylaxis.

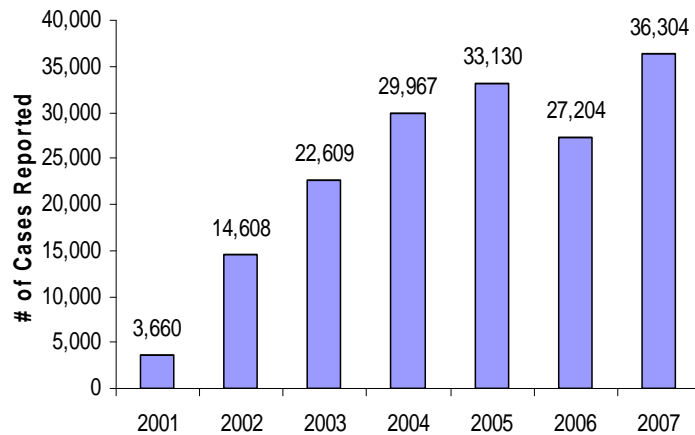
#### Improved data quality, including completeness and accuracy

Discrete data fields in CDRSS permit users to more completely document case information. CDS staff perform regular analyses of CDRSS data and generate error reports (e.g., erroneous birthdates that indicate patients who are 944 instead of 44 years of age) which CDS and LHD staff then investigate and correct. Each CDRSS case must be designated the report status “DHSS Approved” (regardless of case status which indicates whether it meets case definition or not) before it is transmitted to CDC and counted in New Jersey’s year-end MMWR transmission.

Minimized underreporting through developing methods to accept electronic laboratory reports and to enroll local public health and healthcare partners statewide

With implementation of electronic reporting augmented by electronic laboratory transmissions, New Jersey has seen a sharp increase in the number of notifiable disease reports (Figure 2).

**Figure 2: Number of Notifiable Diseases Reported to NJDHSS, 2001- 2007**



Local public health and healthcare partners are fully engaged in reporting with over 900 users from all 566 municipalities in New Jersey. Data entry has shifted from 100% at the state to more than 90% entered locally or electronically (Table 1) with progressively more cases being documented each year. From October 2001 to December 2007, 167,482 cases were entered in the CDRSS.

**Table 1: Distribution of data sources, 2001-2007**

Year	Total # of Cases Reported	% Entered Manually		% Entered by Electronic Lab Transmissions
		State	LHDs/Hospitals	
2001	3,660	100	0	0
2002	14,608	66	12	22
2003	22,609	25	29	46
2004	29,967	16	50	34
2005	33,130	12	54	34
2006	27,204	6	59	35
2007	36,304	*12	50	38

\* Note: Increase was an aberration due to system updates at LabCorp resulting in ELR interruption and paper reports being sent directly to NJDHSS.

Finally, a history of quick responses to user inquiries has ensured increased user acceptability:

- In 2006, CDS and OITS handled 2,000 help desk inquiries and successfully closed 1,981(99.05 %).
- In 2007, CDS and OITS handled 1,550 help desk inquiries and successfully closed 1,542 (99.48%).

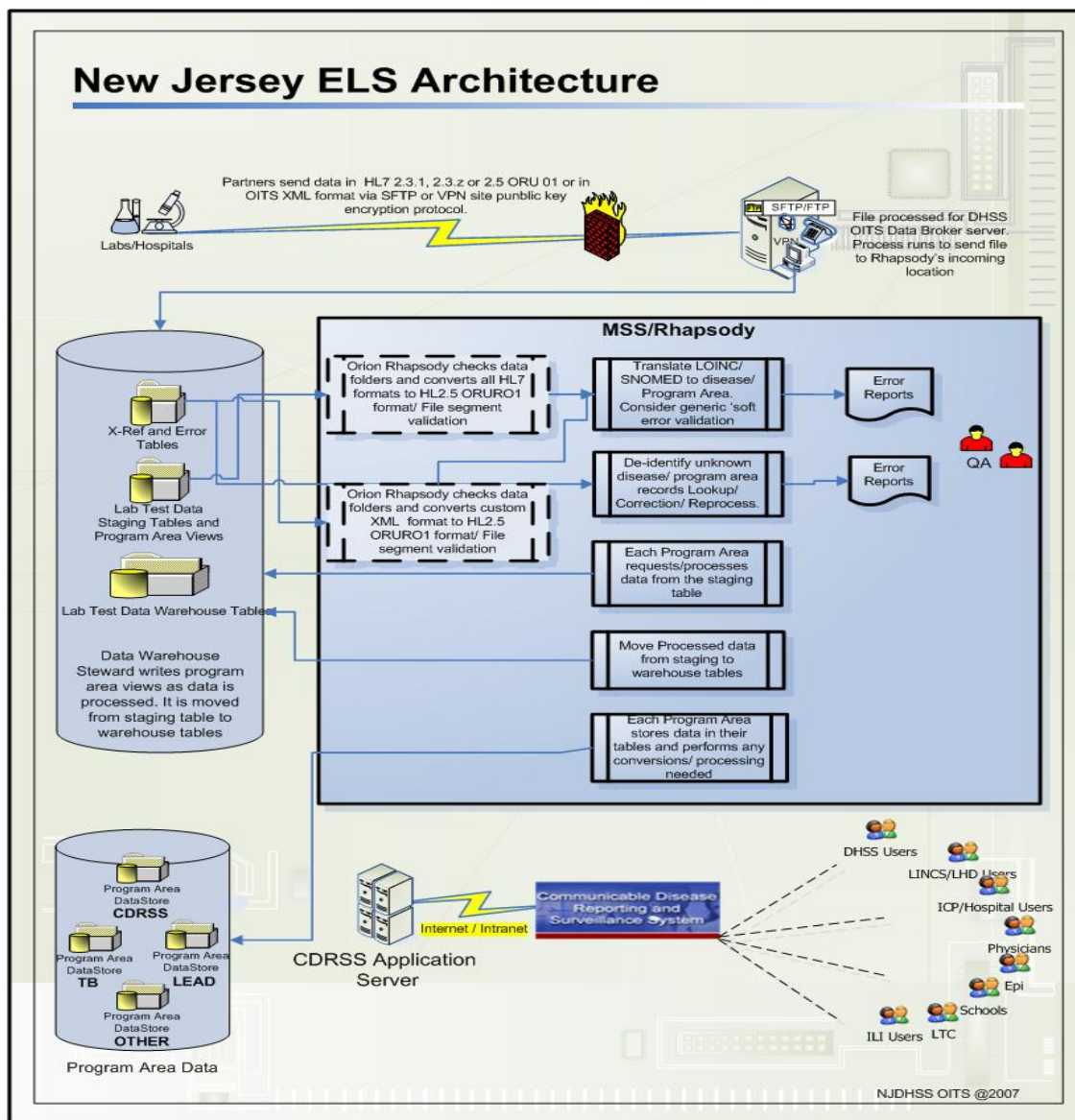
2. *Costs and Benefits Offsetting Costs:* From 2001 to March 2008, CDS has spent \$6.5 million in developing and implementing CDRSS, from its inception as CDRS in 2001 to the current version. This figure includes funding for staff, consultants, hardware and software. All funding for electronic reporting has come through federal grants such as the Bioterrorism Cooperative Agreement and the Epidemiology and Laboratory Capacity grant.

One of the most tangible benefits from electronic reporting is the sharp decrease in the burden of data entry on CDS staff, since local health departments enter their own information. In 2003, CDS had 4 dedicated data entry clerks entering case reports; in 2007, there is no dedicated data entry staff. Similarly, with increasing implementation of electronic laboratory reports, the local health departments are also beginning to experience a decline in initial data entry needs. Electronic reporting has not only increased the number of case reports but has also improved the timeliness of receiving information and has helped improve the public health response time, as evidenced in the examples cited in the previous section.

The current implementation of ELR using the CDC-recommended Orion Rhapsody software (Figure 3) has been developed in phases due to staffing and funding limitations. Phases I and II are complete and implemented into CDRSS, phase III can be used beyond CDS by all other programs in NJDHSS that receive electronic records from laboratories and hospitals, such as lead screening, newborn hearing screening, and the cancer registry. The ELR setup is flexible and can parse one data source into multiple program area applications. For example, lead screening results can be parsed to both the immunization registry and the lead program.

The one-time cost of establishing this system is an investment with broader impact, since ELR can now be utilized by several other programs at no additional cost. In addition, as ELR will be mandated through proposed changes to New Jersey's reportable communicable disease regulations (N.J.A.C. 8:57), the infrastructure will already be set up for other programs to receive data from all commercial and hospital labs, thus decreasing the burden on hospitals to submit data to different programs in NJDHSS. Ultimately, ELR will help consolidate resources, increase efficiencies, and provide a secure mechanism for data exchange, thereby protecting the confidentiality of NJ residents.

**Figure 3: New Jersey's Electronic Laboratory System Architecture**



3. *Lessons Learned/Critical Success Factors:*

- a. To what do you attribute your success?

Streamlined and efficient communication among all CDRSS stakeholders (CDRSS Steering Committee, CDS and OITS staff, local users) contributes significantly to CDRSS's success. Processes were developed to triage help desk calls and e-mail to appropriate staff for rapid response, all change requests were logged and discussed by the steering committee, and information was provided to the technical staff at OITS in an efficient manner - all of which also contributed to increased accountability. User feedback was taken very seriously, and all efforts were made to address them and make the system more user-friendly.

Emphasis on on-going improvement in training efforts also contributes to CDRSS's success. Training methods and materials are continuously developed as the users become more sophisticated and their needs change. Initial trainings were more focused on data entry while recent trainings emphasize reports and analysis. Providing continuing education credits for public health staff has also been very useful for creating and maintaining an engaged user base.

On the technical side, a key factor in the success of CDRSS is ongoing awareness of new developing technologies and adhering to national standards, as demonstrated by rewriting the ELR code to map through Rhapsody using standardized HL7 formats.

Finally, CDRSS's users are critical to the system's success. Every enhancement in CDRSS is driven by user requests. More than 100 change requests were documented, evaluated and prioritized within the first year of operation, resulting in a wide range of improvements including e-mail alerts for incidences of immediately reportable diseases; administrative capacity to edit an incorrectly spelled patient's name without completely recreating the case; capacity to date stamp and document administrative changes to user groups, users and disease reporting in order to leave an audit trail; and expansion of public health response and outbreak management sections.

b. In hindsight, what do you wish you had known before you started?

Thorough and ongoing documentation must begin at the point an electronic system is conceived. Since development of an electronic reporting system is a long, on-going process, documentation provides historical context and rationales for system changes, in light of expected personnel changes.

Communicable disease investigators and epidemiologists, while extremely skilled at data analysis and public health response, might not possess optimal skill sets to coordinate and direct development of an electronic reporting system. Similarly, IT/programming staff, though technically fluent, might not have the skills to accurately translate disease investigation needs into an optimal reporting system. In recognition of the challenges bridging the epidemiologic and IT gaps, CDS created a new position, Director of Data Systems, to coordinate IT efforts for all data management systems and services throughout CDS, identify where resources could be shared or expanded, and bridge communications between CDS and OITS staff.

Developing an electronic reporting system is time- and labor-intensive for communicable disease investigation staff, and the resource intensiveness at times might be underestimated.

Communicable disease staff must recognize the importance of commitment to the electronic system and the long-term and broader-reaching impact of their time and labor investments. Staff must balance prioritizing electronic system development with competing interests from their routine responsibilities.

- c. Many other public health entities hope to implement electronic systems and need as much advice as they can gather. Share your thoughts on what is important:
1. Involve end users as early as possible in the development process. Be clear on the work flow and the varied needs of end users and stakeholders. Build your system according to the functionalities needed, not just what IT can provide.
  2. Be clear on what factors will motivate your end users to use your system and articulate to them the benefits of your system. Incorporate those motivating factors in your user requirements to ensure that your users will use the system.
  3. If you are building in stages or modules, ensure that each stage or module is compatible with the overall system and meets specifications.
  4. Manage your project. Have a time line and deliverables.
  5. Remember to document why you have made specific choices, so that if you have to change later on you will know the basis for the original decisions and understand the implications of the changes, which inevitably will occur.
  6. When documenting change requests, be as clear as possible. When IT is providing a solution, request screen shots as concrete examples so you can visualize what you are getting and confirm that the screen shots appropriately capture what you need. Discrepancies prior to production are easy to rectify. After production, correcting discrepancies becomes expensive both in terms of money and credibility.
  7. Survey other states and vendors before selecting a software or a system.

**Dissemination:** In 2005 and 2006, NJDHSS enjoyed successful CDC site visits during which the CDRS/CDRSS program was labeled “exemplary” and a “model site” for others to follow. As a result, CDC invited CDS and OITS staff to present at the 2005, 2006, and 2007 PHIN Annual Conferences. CDS and OITS staff have participated in CDC’s monthly National ELR conference calls and CDC’s ED conference calls. In 2004, the Medical Society of New Jersey’s peer-reviewed journal, *New Jersey Medicine*, featured CDRS in an article about communicable disease surveillance in New Jersey. In a 2005 MMWR issue, CDC highlighted New Jersey and two other states’ electronic reporting efforts. In 2007, CDS staff provided a roundtable discussion and demonstration of CDRSS at the Annual Council of State and Territorial Epidemiologists’ Meeting.

**Transportability:** Several state health departments have approached NJDHSS regarding adopting CDRSS in their jurisdictions. CDS staff has had preliminary conversations and discussions at forums such as the 2007 CSTE Conference to explore the feasibility of deploying CDRSS in other jurisdictions. While the application is extremely transportable, dedicated staff are needed to develop a deployment team. Given the extent and intricacies of the application for hardware and software, security setup and firewall issues, and jurisdictional and programmatic differences, streamlining the application in a different jurisdiction can be challenging. Due to staffing shortages and a hiring freeze, at this time CDS cannot offer implementation help to other state health departments but would be very willing to help train a dedicated deployment team should the CDC or any agency offer to provide the resources to do so.

## **Limitations and future directions**

- Currently, CDRSS collects data related to reportable vaccine-preventable and most infectious and zoonotic diseases, with the exceptions of HIV, sexually-transmitted diseases and tuberculosis. CDS hopes to integrate the STD and TB Programs into CDRSS and has begun discussions with program staff to examine feasibility and other concerns. However, the major limiting factor to further progress has been lack of IT/programming staff, in light of recent hiring freezes.
- Several LHDs have identified physician practices who are interested in using CDRSS. The CDRSS Steering Committee is exploring the possibility of developing a physician reporting module.
- The CDRSS Steering Committee is exploring the possibility of allowing users to attach documents (e.g., radiology diagnostic results, hospital discharge summaries) to CDRSS cases, thereby creating a more complete case history similar to an electronic health record.
- CDS plans to integrate vaccination history from the New Jersey Immunization Information System into CDRSS, for those cases that exist in both systems.