1. Identifiers and Contacts

- **Name of Project or Proposal**
  
  **Michigan Disease Surveillance System (MDSS)**

- **Name of MDIT or State Agency**
  
  **Michigan Department of Community Health (MDCH), Bureau of Epidemiology**

- **Name of Sponsor**
  
  **Centers for Disease Control and Prevention, Public Health Emergency Preparedness**

- **Name of Project Manager or Contact: Name, telephone, e-mail**

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- **Name of contact person for any vendor involved in drafting the materials**

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- **Recommended nomination category (e.g. G2C, G2C)**

4. Digital Government: Government to Government (G to G): *Initiatives aimed at enhancing G2G interactions, transactions, and/or services. Includes multi-state, multi-agency, state to local government, state to federal government, integrated justice systems, and state to employee programs / projects that have produced significant efficiencies and/or improved service.*
State of Michigan

Michigan Department of Community Health

Michigan Department of Information Technology

Michigan Disease Surveillance System – Protecting Public Health through Information Technology

NASCIO 2005 Recognition Awards
Category:
Digital Government: Government to Government
Executive Summary - Michigan Disease Surveillance System

Overview of the Michigan Disease Surveillance System The state and local health departments within Michigan, with support from healthcare providers, report over 65,000 cases of communicable diseases annually. Surveillance for these diseases is a cornerstone of public health decision-making and practice. Key to reducing the morbidity and mortality associated with these communicable disease events is prevention through early detection and intervention. Prior to 2004, the primary method for reporting communicable diseases in Michigan was a combination of disparate paper-based systems, faxed and mailed case reports, and then dual-entry into DOS-based systems for centralized review and reporting to the Centers for Disease Control and Prevention (CDC). The Michigan Disease Surveillance System (MDSS), implemented by the Michigan Department of Community Health (MDCH) Bureau of Epidemiology and Michigan Department of Information Technology, provides a secure, web-based system that essentially eliminates the need for dual-entry or submission of paper-based reports between providers (both professional practitioners and laboratories), local health departments, the MDCH, and CDC. Data are transmitted and stored in compliance with the CDC’s Public Health Information Network security and data standards and several national standards such as Health Level-7.

Improvement in Operations and Benefits to Michigan State and Local Governments Prior to implementation of the MDSS, state and regional epidemiologists would not typically receive reports of communicable diseases, except in the most urgent situations, until case investigation was completed – often 30 to 90 days after initial case referral to a local health department. With the MDSS, local, regional and state epidemiologists are aware of cases upon referral and communicate with appropriate public health and medical staff often within 1-5 days from referral. Additionally, each case investigation requires completion of up to 6 pages of detailed information. The MDSS eliminates the need for manual completion, mailing, faxing and storing paper versions of these lengthy reports, which increases security of privacy protected data and reduces paper handling and storage costs. Furthermore, epidemiologists now have immediate, electronic access to a rich set of case investigation data in a common format with map visualization, reporting and easy export to standardized analytical software tools to perform epidemiological studies. Equally important for epidemiological studies, the MDSS provides ready access to these data in a common format from 1992 to the present.

Return on Investment for the Michigan Disease Surveillance System Development and implementation of the MDSS was done through CDC grants requiring enhancement of public health emergency preparedness and response. The approximate total investment to develop and implement the MDSS was $2.6 million including hardware, software, development, training and operations. Three other states thus far have also received the software itself at substantially lower cost to further leverage the federal and state investment. The effort required to investigate and report cases has decreased with the MDSS, yet data are more accurate, complete and timely. Along with improving the routine collection and analysis of communicable disease reports and public health intervention, the MDSS greatly enhances the State of Michigan’s ability to respond to an intentional or naturally occurring major public health event. The cost to develop and implement the MDSS is a small fraction of the hundreds of millions of dollars Michigan spends treating communicable diseases (HIV/AIDS treatment costs alone are well over $80 million annually). Earlier detection and intervention clearly provides both financial and quality of life benefits in return for this small investment with the concomitant benefit of greatly increasing Michigan’s public health emergency response preparedness.
A. Overview of the Michigan Disease Surveillance System

The Michigan Department of Community Health (MDCH) and 45 county and regional health departments work together with healthcare providers to protect the public health of Michigan’s citizens. A cornerstone of public health decision-making and practice is surveillance for communicable diseases. Over 65,000 cases of communicable diseases are reported annually by healthcare providers to local health departments and the MDCH for case investigation. Summary data extracts are then submitted to the Centers for Disease Control and Prevention (CDC) on a weekly basis. Key to reducing the morbidity and mortality that can be associated with these communicable disease events is disease prevention through early detection and public health intervention. The Michigan Disease Surveillance System (MDSS), implemented by the MDCH Bureau of Epidemiology and Michigan Department of Information Technology (MDIT), provides a secure, web-based system that essentially eliminates dual-entry or submission of paper-based reports between providers, local health departments, MDCH, and CDC.

Prior to 2004, the primary method for reporting communicable disease cases in Michigan was a combination of several disparate paper-based systems, faxing and mailing of case reports followed by dual-entry into DOS-based systems for centralized review and reporting to the CDC.

The MDSS was developed based on the CDC’s Public Health Information Network National Electronic Disease Surveillance System standards and logical data model. Thus, the MDSS not only serves as a replacement for reporting communicable diseases, but is the statewide enterprise solution for reporting cases of emerging infectious diseases, case tracking in the event of a bioterrorism incident, and performing longitudinal case reporting and management for diseases such as tuberculosis, HIV/AIDS, and hepatitis. Local health departments and providers can also use the data from the system toward managing programs, business practices and local reporting.

Issue Addressed and Solution The objectives in implementing the MDSS are three-fold:

- minimizing reliance on paper-based reporting and the need to enter data into multiple databases (reporting efficiency);
- increasing the amount of relevant data available in a format suitable for appropriate epidemiologic analysis; and, most importantly
- substantially reducing the time from patient illness to public health intervention (investigation and reporting timeliness).

As stated above, with over 65,000 cases reported annually even a small decrease in the time required to investigate and report each case is leveraged over a substantial number of investigations. The impact of implementing the MDSS in terms of these objectives was immediately observed upon deployment.

As summarized in the diagram below, the application is a secure, web-based solution that applies a java-based interface with an Oracle database operating through Michigan’s single sign-on system provided by IBM Tivoli. The MDSS integrates geo-coding and geographic information system (GIS) display capabilities using ESRI software tools. The GIS layers (e.g., roads, cities and towns, waterways, county and ZIP code boundaries) and geo-coding addresses are provided through web-services from the MDIT Center for Geographic Information.
**Business Client and Collaboration** The MDSS was developed through a public-private sector collaboration with the MDCH Bureau of Epidemiology and Michigan’s 45 local health departments as the primary customers.

- MDCH Bureau of Epidemiology and representative local health departments established the MDSS business requirements.
- The MDIT and not-for-profit Altarum Institute provided technical and program management services to the MDCH.
- MDSS software was developed by Scientific Technologies Corporation (STC), based on the CDC and State of Michigan’s standards and requirements.
- The MDSS is currently being hosted and administered by the MDIT.
- The MDCH Bureau of Laboratories, with support from Epic Systems Corporation, prepared an electronic laboratory reporting interface based on HL-7 standards to facilitate automated reporting of laboratory data into the MDSS.
- Funding was provided by the CDC through Public Health Preparedness and Emergency Response grants to the State of Michigan.

**Implementation Time Frame** The implementation timeframe of the MDSS was:

- Prototype version of the MDSS was developed and implemented between February 2002 and July 2002 to establish business requirements plus technical feasibility of customer preferences for alternative technology solutions.
- Grant funding was secured in Fall 2002 and application development was initiated in February 2003.
- Training on the production system was completed in December 2003 with representative parallel operations and testing platforms before full release in June 2004.
- The system has been fully operational since June 2004. There are over 650 active users who have reported more than 58,400 individual cases since June 2004.
B. Significance to the Operations of Government

Ultimately, the goal of communicable disease surveillance is the identification of trends that may warrant public health intervention. Historically, Michigan and the rest of the United States have responded to notification of disease at the local level with efforts toward gathering information around the individual cases. However, any transmission from this wealth of data was inefficient both in content and in timeliness. In fact, of the wealth of data gathered, very little has been maintained in surveillance systems for evaluation by the public health community. In order to fully evaluate suspected communicable disease events, review and integration of a variety of paper forms was necessary and access to these documents was not consistently centralized. Further, the data from these cases was placed in virtual silos that were not flexible in communications. Finally, while mandated by law, there were no consistent methods available to facilitate appropriate communicable disease reporting from either the medical or medical laboratory communities in the State.

Design of the MDSS involved the re-construction of a variety of disparate communicable disease forms into a consistent look and feel while still gathering and retaining appropriate information for individual case follow-up. Taking this one step further, these forms were integrated with the MDSS as data gathering tools that are linked to the underlying database. For the first time, public health professionals have available to them electronically, all of the case follow-up information for review and assessment. Further, since this is now an integrated web-based application, this information is available as it is entered into the system by local agencies. Integration of geo-coding and mapping functionalities provides for a real-time, seamless migration of referrals to the appropriate governmental agency. The inclusion of health care providers as a role on the MDSS allows the medical care community to directly refer cases into a consistent environment vs. different modalities for different jurisdictions. Finally, the introduction of electronic laboratory reporting via HL-7 messaging greatly enhances the accuracy and timeliness of referrals to the system. The public health community can now evaluate the entire communicable disease status for the State, not only those cases that have been completed, entered and transmitted to the MDCH.

The MDSS not only greatly enhances the ability to investigate, report and analyze data since its implementation, but also facilitates integrating historical data from 1992 to the present into a single database with a common format to support longitudinal epidemiological analyses.

Longitudinal analysis is a key element to epidemiological investigation and the MDSS provides near instant access to over 13 years of communicable disease history for the entire State of Michigan.

Along with the dramatic increase in cases investigated and reported via the MDSS, there has been a constant and continuing increase in active users, further demonstrating and supporting the value to local and state agencies. As of May 5, 2005 there were:

- 680 active users with assigned roles on the system
- 518 Local Health Department Users
- 88 MDCH Users
- 74 Healthcare Provider and Other Users

With respect to case investigation and reporting, since the launch of the MDSS in June 2004 there have been 59,277 individual cases entered into the system. Additional features incorporated into the application include automated electronic laboratory submission of case referrals. In the first quarter of 2005, the MDCH Bureau of Laboratories has submitted 1,852 referrals electronically which amounts to 13% of the 14,319 case records referred to the system during that same time frame. Using the MDSS, surveillance case information has been forwarded to the federal level via weekly data extracts. The focus now is on increasing the number of laboratory and private practice health care providers who provide referrals directly through the MDSS to increase reporting completeness and timeliness while
further reducing the burden from paper-based reporting. Several major laboratories that serve the State of Michigan already have systems in place to submit HL-7 standard based electronic laboratory results and are moving toward automating reporting functions to the MDCH via the MDSS in the same model that implemented for the MDCH Bureau of Laboratories.

C. Benefits Realized by Service Recipients, Taxpayer, Agency or State

Prior to implementation of the MDSS, state and regional epidemiologists would not typically receive reports of communicable diseases, except in the most urgent situations, until the case investigation was completed – often 30 to 90 days after initial case referral to a local health department. With the MDSS, local, regional and state epidemiologists are aware of cases upon referral and can monitor for new cases, discover epidemiological links with other cases, identify communicable disease outbreaks, and communicate with appropriate public health and medical staff often within 1-5 days from referral. Additionally, each case investigation requires completion of up to 6 pages of detailed information. The MDSS eliminates the need for manual completion, mailing, faxing and storing paper versions of these lengthy reports, which increases security of privacy protected data and reduces paper handling and storage costs. Furthermore, epidemiologists now have immediate, electronic access to a rich set of case investigation data in a common format with map visualization, reporting and easy export to standardized analytical software tools to perform epidemiological studies. Equally important for epidemiological studies, the MDSS provides ready access to legacy data from 1992 to the present.

Moving from disease-based data silos to the person-centered structure of the MDSS as advocated by the CDC’s logical data model allows for integration of information between disease groups that promotes a more complete assessment and portrayal of the health indicators of the State as well as the inclusion of other conditions in the system (e.g., Sexually Transmitted Disease, Rabies).

The system has been built to nationally promulgated standards. Ultimately, this design situates the State of Michigan very well for anticipated modifications to the reporting mechanisms from State to Federal governmental levels.

D. Return on Investment (ROI) – MDSS Financial and Quality of Life ROI

Development and implementation of the MDSS was done through CDC grants requiring enhancement of public health emergency preparedness and response. The approximate total investment to develop and implement the MDSS was $2.6 million including hardware, software, development, training and operations. On-going operations, not including planned expansion of system capabilities, are less than $250,000 per year for maintenance and help desk operations. Since the MDSS serves as the enterprise solution for broader communicable disease functions, additional investments are planned as CDC and national standards are established and implemented by public and private entities. Equally important, three other state health departments thus far have also received software from STC based on the MDSS. This investment in a Michigan developed product has resulted in substantially lower costs to those states that further leverage the federal and State of Michigan investment. These and other states must only pay the costs of customization, hardware, training and maintenance.

The MDSS is designed to not only facilitate health department investigations, but also, for the first time, to directly engage other stakeholders such as healthcare providers and laboratories. The greatest impact of the system lies within its ability to quickly gather and analyze information, ultimately enhancing the

|The average time from onset of disease to full investigation and report to MDCH has decreased by more than 30% relative to previous years.|
overall public health response. Enhancing the data system promotes analysis on additional information, which ultimately results in a more rapid intervention and a reduction in the disease burden on the community.

**Although the true number of Hepatitis A Virus cases prevented cannot be quantified, if even one case is prevented for each referral, $391,246 will be saved annually in direct and indirect medical costs.**

An example of this reduction can be gleaned from the MDSS data set. Since January 2005, the median length of time from diagnosis of Hepatitis A Virus infection to referral to a local health jurisdiction has been reduced from 13 to 7 days, with 77% reported within 10 days of diagnosis. This provided for several additional days during which public health staff could identify and appropriately treat case contacts. For the five-year period from 2000-2004, the average annual occurrence of Hepatitis A was 276 cases (69 and 207 among children and adults, respectively). If this trend were to continue, 212 cases per year would be identified with enough time to administer prophylaxis – 53 among children and 159 among adults. A case of Hepatitis A among children costs $968, on average, while one among adults costs $2,138. Although the true number of prevented cases cannot be quantified, if even one case can be prevented for each identified referral, $391,246 will be saved each year in direct and indirect medical costs.

An example of this reduction can be gleaned from the MDSS data set. Since January 2005, the median length of time from diagnosis of Hepatitis A Virus infection to referral to a local health jurisdiction has been reduced from 13 to 7 days, with 77% reported within 10 days of diagnosis. This provided for several additional days during which public health staff could identify and appropriately treat case contacts. For the five-year period from 2000-2004, the average annual occurrence of Hepatitis A was 276 cases (69 and 207 among children and adults, respectively). If this trend were to continue, 212 cases per year would be identified with enough time to administer prophylaxis – 53 among children and 159 among adults. A case of Hepatitis A among children costs $968, on average, while one among adults costs $2,138. Although the true number of prevented cases cannot be quantified, if even one case can be prevented for each identified referral, $391,246 will be saved each year in direct and indirect medical costs.

This figure will vary according to the particular disease being reported. For example, during an outbreak in Milwaukee in 1993, the estimated cost-per-case of cryptosporidiosis infection ranged from $116 for a mild case to $7,808 for a severe case. There were an average of 146 cases of cryptosporidiosis in Michigan each year from 2000-2004. By preventing even a small number of these cases due to earlier identification of infection source, the cost to society could be reduced by thousands of dollars per year. The savings are even greater for diseases in which early identification and prevention measures may prevent death, such as bacterial meningitis due to *Neisseria meningitidis*. Since bacterial meningitis occurs most frequently among children and young adults, the cost-per-life lost has been estimated at between $1.2 and $4.8 million and the cost-per-case of meningitis associated with long-term consequences has been estimated at $1,298 to $14,600. **While the occurrence of bacterial meningitis is lower (68 cases per year, on average), the ability to prevent even one case would result in enormous savings to society as the mortality rate is greater than 15%.**

At the 2005 Public Health Information Network meetings in Atlanta, GA, Harvard University’s Center for Information Technology Leadership Chair, Blackford Middleton, estimated that the implementation of free text electronic case and vital statistics reporting results in over-all savings of $12.67 per case. As a very conservative approach, one might assign that value only to the ELR referrals in the MDSS, which would result in a first quarter savings of $23,464. We expect that in the near future, fully 75% of cases will be reported electronically with potential annual savings of over $500,000.

Along with improving the routine collection and analysis of communicable disease reports and public health intervention, the MDSS greatly enhances the State of Michigan’s ability to respond to an intentional or naturally occurring major public health event. **The cost to develop and implement the MDSS is a small fraction of the hundreds of millions of dollars Michigan spends treating communicable diseases (HIV/AIDS treatment costs alone are well over $80 million annually).** Earlier detection and intervention clearly provides both financial and quality of life benefits in return for this small investment with the concomitant benefit of greatly increasing Michigan’s public health emergency response preparedness.

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1 Source: CDC Division of Bacterial and Mycotic Diseases
http://www.cdc.gov/ncidod/dbmd/diseaseinfo/meningococcal_g.htm#Can%20meningitis%20be%20treated