State of Michigan
Department of Community Health

Using the Enterprise Data Warehouse
To Improve Delivery of Health Care Services
Executive Summary

As the largest department in the State of Michigan, the Michigan Department of Community Health (MDCH) is responsible for managing the delivery of health care services to more than 1.2 million clients and overseeing an annual budget of $9.5 billion.

MDCH administers many of the state’s most critical programs, including: Medicaid (fee for service and health plans), the Women, Infant, and Children (WIC) assistance program, the state’s Childhood Lead Poisoning Prevention program, and the Michigan Child Immunization Registry (MCIR).

Many of MDCH’s clients are enrolled in multiple programs supported by the department. However, up until now, it has been virtually impossible to track and monitor services and costs associated with a single client through these separate health-related agencies included under the MDCH umbrella. Each agency administers state and/or federally mandated programs with overlapping client bases in an environment of expanding populations, increasing costs, and an ever-changing set of complex regulations.

MDCH has implemented a data warehouse solution to meet the challenge of tracking individual clients and expand its decision support capability. It began with a Medicaid-only database in 1994, expanded into managed care by utilizing the warehouse in an operational way, and has incrementally expanded its capabilities through a series of targeted project implementations.

Most recently, MDCH embarked on and completed a major project of integrating nine separate health-related agencies and data sources into a single integrated environment.

MDCH is using the enterprise data warehouse as the foundation for tying related program data together and for conducting advanced data analysis. In so doing, MDCH is able to interpret patterns and gain insights into outcomes, or put another way, determine what has happened and why, and most importantly, what will happen in the future.

MDCH has developed a unique client identifier that enables it to track individuals across multiple agency programs – in a secure and confidential manner – to analyze services and costs. The warehouse also enables the department to conduct advanced health-care analyses – including geographic analysis, cost and benefit analysis, service pattern analysis, and cost and use measures.

In short, the data warehouse has become the critical tool to help MDCH improve its delivery of health care services, determine which programs are most effective, detect fraud and abuse, reduce overall costs to taxpayers, and predict the state’s health care needs and priorities in the years to come.
A. Description of Project

Background

Michigan has long been considered a pioneer in its use of information technology to improve the operation of government and the quality of life for its citizens. The Michigan Department of Community Health (MDCH) continued this tradition when it invested in a data warehouse in 1994 to help manage its Medicaid program. The state implemented the warehouse to monitor Medicaid claims for quality of care, as well as for overpayment, fraud and abuse.

The warehouse began with 36 months of fee-for-service (FFS) claims information on providers and recipients – which quickly expanded to five years’ worth – and provided the MDCH with the ability to conduct in-depth analysis on the Medicaid program. The new system reduced the time it took staff analysts from one-to-three weeks to 10 minutes-to-one-hour. Workers were able to directly access mainframe-based data and bring it into spreadsheets on their PCs for comprehensive, rapid analysis.

A key component of the warehouse were quarterly managed care “report cards” that were generated for 4,000 primary care physicians to evaluate their performance and compare it to their peers in the same specialty. Add to that the fact that Michigan doubled its identification of fraudulent health-care activity, and that Medicaid administrative costs were reduced by 25%, and it quickly became apparent that the data warehouse was revolutionizing the way Michigan administered its Medicaid program.

Put to the Test

The full capabilities of the warehouse were quickly put to the test, when, in 1995, Michigan was studied and ranked nationally by the U.S. Centers for Disease Control and Prevention (CDC) for its performance in childhood immunization rates. Michigan’s last-place finish was considered by state officials to be a powerful wake-up call, and Governor John Engler called for a united effort to address this critical health issue.

As one part of a comprehensive initiative to improve the state’s childhood immunization rates, officials explored the potential for the warehouse to provide important information on the subject. The warehouse was not only able to tell the MDCH where it stood with its child immunization status on a county by county basis, it also rapidly provided the data necessary for notifying parents and providers across the state about the need for timely immunization schedules. The warehouse was one of many factors that helped Michigan exceed the national average in childhood immunization rates by 1997 and finish first by 2000.

Close Encounters

In 1998, Medicaid began its Managed Care Encounter System (MCES), basically requiring Michigan and all states to move from the task of managing payment claims to the more complex job of purchasing health benefits. States went from simply reimbursing to becoming value purchasers of health care, meaning they were required to set standards for providers and manage contracts with them to ensure that the right services were provided.

In Michigan, all encounter data was processed through the data warehouse, enabling MCDH to conduct data quality reporting and health plan analysis. Analysts were able to review data to ensure that health plans were providing accurate, complete, and timely encounters. Currently, 66 million encounters are loaded into the data warehouse.

MDCH further enhanced its management of health care services when it implemented an executive information and decision support system as part of the data warehouse in 2001. This system provided the department with the tools and information to better analyze and measure the effectiveness of programs,
more readily detect fraud and overlapping coverage, analyze how Michigan compares to other states, and measure the performance of health plans.

**A Single Integrated Environment Across the Enterprise**

Now, as part of the enterprise phase for the data warehouse, *MDCH has loaded data from nine separate health-related agencies into a single integrated environment*. These include: Medicaid, Women, Infants & Children (WIC), Vital Records, Michigan Child Immunization Registry (MCIR), Pregnancy Risk Assessment Monitoring System (PRAMS), Maternal and Child Health Advocacy Services, Newborn Metabolic and Hearing Screening, Childhood Lead Poisoning Prevention, and Epidemiology.

This is a critical step since many of MDCH’s clients are enrolled in more than one of these programs. As part of this enterprise integration project, MDCH has created a Unique Client Identifier that ties a client across multiple programs in a secure and confidential manner. In addition, MDCH has extended its health care analysis predictive capabilities for the future.

**Technical Infrastructure/Architecture**

The MDCH application environment is based on a centralized data warehouse architecture. The data warehouse consists of a current generation NCR 5250 Relational Database Computer (RDBC) that uses the most current release of the Teradata Relational Database Management System (RDBMS) to store the data. The data that is stored in the data warehouse is received from multiple sources. Encounter Data is submitted by the Medicaid Health Plans and received electronically through a data gateway; and data is extracted from the legacy systems for multiple departmental sources such as:

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<tr>
<th>Program</th>
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<tr>
<td>Medicaid</td>
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<td>Vital Records</td>
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<td>Child Immunization Registry (MCIR)</td>
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<tr>
<td>Women, Infants and Children (WIC)</td>
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<td>Pregnancy Risk Assessment Monitoring System (PRAMS)</td>
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<td>Maternal and Child Health Advocacy Services (MIHAS)</td>
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<td>Newborn Metabolic and Hearing Screening</td>
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<td>Childhood Lead Poisoning Prevention</td>
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<td>Epidemiology</td>
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<td>Mental Health</td>
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<td>Children’s Special Health Care Services (CSHCS)</td>
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<td>Beneficiary Provider Contact Tracking System (BPCTS)</td>
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This data is loaded and updated to the data warehouse on a pre-defined schedule. Any authorized personnel within MDCH using ODBC and ANSI standard SQL tools can access data in the warehouse. Access to sensitive information is approved only by the responsible owners of the data, using a signed and agreed upon data sharing agreement.

Other components of the MDCH application environment are distributed data marts. One is the EIS/DSS system. The Decision Support System (DSS) is an integrated application that provides on-line access to actionable information using advanced healthcare analytic methodologies. DSS users can query the database, view standard reports, and create custom measures. The base of the system is developed using raw data extracted from the data warehouse. The system is updated on a pre-defined schedule. The Executive Information System is a web-based report dissemination tool that provides users with pre-defined reports such as the Managed Care Monitoring Guide and Health Plan Key Indicators. The reports are generated from the DSS using templates and analytic measures defined by trained analysts.
The architecture incorporates file servers, desktop computers, document scanners, printers and LAN servers strategically distributed across all in-state offices.

Every hardware component of the MDCH system is, or can be, network connected via an office LAN that is connected via a hard-wire connection or a switched multi-megabit digital service (SMDS) to the state’s WAN.

**B. Significance to the Improved Operation of Government**

This integration of data across the MDCH enterprise, coupled with the Unique Client Identifier, has provided the department with broader health care analysis capabilities, better information sharing, more efficient access for staff personnel to data contained in the warehouse, and more rapid decision-making capability.

The Unique Client Identifier identifies and organizes data on all services that an individual receives across all programs. It enhances the ability to do pattern analysis, identifies gaps and duplication of services, and provides a common source for data rather than multiple programs. This promotes consistent, more efficient reporting across programs.

The advanced health care analysis capabilities of the system enables geographic analysis, cost/benefit analyses of specific health care services, and patterns of services and expenditures by provider, specialty, county, age, and many other categories. These enable MDCH to make decisions about programs, providers, fees, and level of care in a more timely manner, based on a “total view” of services a recipient is receiving, and an overall pattern in a particular category (age, geography, etc.).

**C. Benefits**

The greatest benefit of the integrated data warehouse project is the ability the MDCH has to conduct data analysis. The system allows the department to focus on groups of clients and on individuals, and provides insight into outcomes. It can help MDCH answer questions such as:

- Which clients are not taking advantage of eligible programs?
- Which recipients are most likely to stay on assistance?
- Why do some foster kids experience more health problems than others?
- How can we tell if there are fraudulent activities?

The best way to quantify the benefits of the integrated warehouse is to focus briefly on data analysis capabilities in each of the agencies, and how services can be improved by accessing data from one or more of the other agencies:

**Medicaid**

Staff personnel can compare fee-for-service paid claims to health plan encounters to determine rates of utilization, and can compare current and historic patterns among health plans. They can also match services to outcomes; for examples, they can compare maternal support services provided to pregnant women to birth outcomes contained in Vital Records data.

**WIC (Women, Infants & Children)**

Workers can use Vital Records data to help identify the potential eligible population for WIC, and can link into MCIR vaccine data to identify WIC participants who are overdue for vaccines. In addition, they can
monitor the success of the WIC program by analyzing data about participants that are also in other programs, and comparing outcomes of WIC participants to the general population.

**Vital Records**

MDCH can analyze the impact *WIC* has on the general Michigan population and on the Medicaid population by considering the following factors: birth weight, obesity, pre-natal care, iron deficiency, smoking, drinking, and economic levels. They can also analyze the cause of death and use the date of death to determine the cost of services prior to death.

**MCIR – Michigan Child Immunization Registry**

Analysts can calculate how many doses were administered under *Medicaid* and how much Medicaid pays for in a month. They can determine immunization levels by provider, and identify participants in other programs (e.g., *WIC*) that are overdue for vaccines.

**PRAMS – Pregnancy Risk Assessment Monitoring System**

By linking PRAMS participants to *Medicaid* beneficiaries, analysts can determine their Medicaid status and obtain assistance in reporting both for Medicaid and PRAMS. In addition, other data sources (e.g. census) can help agency personnel obtain current demographic and race/ethnicity information for children.

**MIHAS – Maternal and Child Health Advocacy Services**

Analysts can identify participants in multiple programs, particularly those in *Medicaid*, Maternal and Infant Support Services, and *WIC*, and determine the number of children insured versus uninsured. They can also determine potential impact on program by having access to *Vital Records* data (birth certificates) for the entire Michigan population.

**Newborn Metabolic and Hearing Screening**

MDCH staffers can link screen records to *Medicaid* beneficiaries to ensure that all Medicaid recipients are receiving their screens, as well as help to identify their current primary care physicians. They can also match screen records with *Vital Records* (birth certificates) to identify newborns who have not received hearing screens – or who have not received a birth certificate. Finally, they can match children with positive metabolic screens to *MCIR* data, particularly children who have been identified with Sickle Cell Anemia, to assure that they are receiving their immunizations, since they are at an increased risk of infection.

**Childhood Lead Poisoning Prevention**

Analysts can link lead screen records to *Medicaid* beneficiaries to determine Medicaid status, and incorporate infant deaths from *Vital Records* into the warehouse.

**Epidemiology**

MDCH can determine what the impact of chronic diseases (diabetes, asthma, cancer, etc.) on the overall population in Michigan, and determine whether – and how – the rates vary across the state. This can help determine treatment and education programs. Analysts can determine this by linking to *WIC, PRAMS, MIHAS, MCIR,* and *Medicaid* data.
Improved security across the enterprise

In addition to broadened data analysis, the integrated data warehouse improves the security of MDCH’s data. The data warehouse is a central point of control that defines and limits access to data. Access can be limited to specific data elements or levels of aggregation for specific users. Access can be monitored and tracked. And, identifying information can be easily masked in a consistent manner that protects confidentiality and still allows users to match individuals across data sets.

D. Return on Investment, Financial Benefits

The Michigan Department of Community Health financial justification for the investment in the Executive Information System/Decision Support System was two-fold: improved program effectiveness and efficiencies; and increased analytical productivity. The enterprise data warehouse has become the critical tool to help MDCH improve its delivery of health care services, determine which programs are most effective, detect fraud and abuse, reduce overall costs to taxpayers, and predict the state’s health care needs and priorities in the years to come. Adding data from other programs to the Medicaid data sets continues to enhance the value of the warehouse as a source of information for predicting future utilization trends and for identifying appropriate changes in current policy.

Some examples of how the additional data sets interact with the ongoing analysis of existing data include:

- Identification of coverage overlaps – instances where individuals are obtaining similar or duplicate services from different programs. Elimination of these overlaps helps to deliver a higher quality of services for individuals and may provide for cost efficiencies and/or access to more federal funding.
- Eliminating inappropriate payments and contacts. Coordinating eligibility with lists of deceased residents is an important fraud issue.
- Estimating the effects of program and/or coverage expansion.
- Providing a source for comparisons. To the extent that Medicaid recipients are a subset of a broader data set (e.g., Medicaid births relative to all Michigan births), the ability to profile the Medicaid population against an external data set provides for a meaningful evaluation of quality.

The data warehouse has enhanced the Department’s ability to evaluate managed care plans’ payment rates and policies, thus maximizing the Medicaid program savings while sustaining quality care. It has:

- Enhanced the State’s ability to measure, analyze, and improve the effectiveness of major program initiatives, such as managed care, MiChild and the use of prescription drugs by Medicaid beneficiaries.
- Enhanced monitoring and evaluation of the performance of managed care plans to encourage strong performers, and improve under performers
- Strengthened budget development activities, including assessment and forecasting.
- Increased access to information, and proactively alerts departmental staff to information driven policy changes; this facilitates discussions on trends and other service patterns changes.
E. Beyond DCH – Utilizing the Data Warehouse in Other Human Services Agencies

With DCH’s success in using the data warehouse, Michigan has expanded the implementation to encompass the state’s other large human services agency, the Family Independence Agency (FIA).

FIA oversees $3.5 billion in state and federal programs, including Temporary Assistance to Needy Families (TANF) and food stamps. The agency tracks more than 265,000 food stamp cases statewide and another 78,000 cash benefits cases, plus more than 4,000 certified retailers who participate in these programs.

The state uses a sophisticated information technology solution to deliver these vital public assistance programs, that combines data warehousing with Electronics Benefits Transfer (EBT). Public assistance and food stamp recipients now access their benefits using a plastic card called the Michigan Bridge Card, which is similar to an ATM or debit card. This allows users to purchase goods and obtain cash benefits at enrolled retailers or ATMs, and has ended the use of Food Stamp coupons in the state.

Michigan has contracted with a leading national provider of EBT services to manage individual recipient and retailer accounts – essentially, the “front end” of the EBT system. The Bull data warehousing solution provides the information backbone necessary to effectively manage and monitor the entire EBT program.

FIA uses the warehouse to validate the daily numbers that its EBT vendor provides to the agency. The current system calls for the vendor to pay retailers and ATM owners daily, and submit a morning report to FIA that identifies the total amount dispersed. FIA uses the report to repay the EBT vendor in a “daily draw” process. The agency uses the data warehouse to verify and validate the EBT vendor’s numbers, allowing FIA to independently track every dollar that is spent in these programs.

The warehouse also helps FIA track potential fraud and abuse by monitoring retailer volume and average sales amount per transaction. If volume levels or average vary widely from one month to the next or from one similar retailer to the next, a red flag goes up inside FIA.

Finally, the data warehouse has improved client service by enabling FIA to allocate staff members more equitably among Michigan’s counties, matching their expertise with the types of cases that require attention (food stamps, child day care). And, the system has increased efficiency and morale by eliminating thousands of hours of manual entry that had been required for staff members to fill out forms.
Exhibit I: Michigan DCH Data Warehouse