



Department of Mental Health

**Phase II – CIMOR Evaluation
(Strategic Assessment of DMH IT System Operations)**

**High-Level Alternative Recommendations Report
And
Cost Benefit Analysis**

Deliverables #10 and #11

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1 Executive Summary

Fox Systems, Inc. was engaged by the Mental Health Commission and Information Technology Services Division (ITSD) to conduct a review of the current health of the Customer Information Management Outcomes and Reporting (CIMOR) Project.

In Phase I of the project, Fox assessed the current state of CIMOR system and project using industry best practices and made recommendations for improvements.

Phase II of the project includes a strategic assessment of DMH Information Technology system operations including:

- A review of current market offerings for public and proprietary systems providing functionality similar to that included in CIMOR;
- A review of other State of Missouri initiatives that may relate to DMH efforts; and
- A High-Level Alternative Recommendations Report and Cost Benefit Analysis (CBA) of the options available to DMH.

Section two of this report presents a summary of findings from Phase I and other Phase II reports mentioned above. Those findings were the basis for this report.

In section three, FOX presents the results of its analysis of DMH's opportunities for partnership with other state agencies. Information on partnerships is provided separately from the options analysis because no state agency operates a system that supports all or part of the functionality currently required in CIMOR.

Section four presents the option's analysis along with FOX recommendations for future DMH systems. The contract required FOX to consider the following options in completing this High-Level Alternative Recommendations Report and CBA: 1.) Complete replacement of CIMOR with a Commercial-Off-The-Shelf (COTS) product; 2.) CIMOR expansion using COTS; 3.) Partner with other agencies; and 4.) Other options. FOX did not consider partnering with other agencies as a solution option because no other state agencies were found to have systems capable of supporting the DMH business functions. The other option FOX analyzed was to continue to retain CIMOR "As Is" without further enhancement.

1.1 Summary of Findings

1.1.1 Partnership Opportunities Findings

DSS MO HealthNet Division recently entered into a new contract to reengineer and modernize the Medicaid Management Information System (MMIS). The new system will provide technologies including service-oriented architecture (SOA), enterprise service bus (ESB), multi-tiered benefit plans, and Electronic Health Records that may be of benefit to DMH in administering its programs more efficiently. Additionally, it appears the DMH would benefit from the continuing other partnership opportunities with MO HealthNet already underway such as:

- Continue use of CyberAccess™ from MHD as the means to communicate and display medical and pharmacy claims data for providers and consumers.
- Leverage Medicaid funding for MMIS and CMSP systems with the 2006 Health Care Technology Funds to display behavioral health information within CyberAccess™.



DMH may also want to consider collaboration with MO HealthNet and Department of Health and Senior Services (DHSS) to develop an enterprise-wide robust data warehouse to support population-based research into effective treatment practices and implementation of the MO HealthNet initiatives identified for behavioral health, including pay for performance and evidence based practices. Agency end users expressed a strong business need for an easy to use reporting capability. Using a collaborative approach with MO HealthNet all parties would be able to leverage federal MMIS funding for this project.

CyberAccess™ is a proprietary web-enabled software product from ACS Heritage used for tracking and processing inquiries from physicians on a patient-by-patient basis. While the query capabilities within the CyberAccess tools are quite impressive and allow physicians to review a patient's historical claims (drug prescriptions, institutional, outpatient services, labs), determine whether a drug requires prior authorization; and submit requests for prior authorization or medical services, it lacks the full range of data warehousing capabilities needed by DMH users. The complete findings of this high-level review are provided in section 3.1.3.

Important characteristics of an enterprise-wide data warehouse would be to place information at the user's fingertips:

- Provides a data repository of essentially all data collected by an organization for a long term (e.g., seven to ten years) history
- Data within the repository (database) is retained within tables organized in a way that optimizes fast data retrieval;
- Sophisticated business intelligence query tools are available to trained users;
- Business intelligence query software is designed to enable users to initiate ad hoc reports and queries into the data using intuitive graphical point and click commands directly from their desktop workstations;
- Business intelligence software provides the capabilities for data mining, spreadsheet presentation, graphics displays, and wide variety of means of detecting, comparing, and interpreting conditions within the entire set of data contained within the repository;
- Enable population based studies as well as a wide range of utilization analyses;
- Allows users to import/export data to Excel spreadsheets for in-depth financial analysis;
- Good data warehouse systems provide fast enough response to queries so that research can be done iteratively because the results of one query usually result in additional questions that may require continued refinement and submission of additional queries to complete and analysis.

1.1.2 Options Analysis Findings and Recommendations

The options analyzed in this report include: 1.) Retain CIMOR "As Is" without further enhancement, 2.) Complete Replacement of CIMOR with a COTS product; or 3.) Enhance/Integrate COTS with CIMOR. Indicated below is a summary of the findings:

- FOX recommends that DMH not consider continuation of CIMOR in its "As Is" state. CIMOR does not contain all functionality necessary to support business need as expressed in interviews with business users and providers, nor has all functionality originally planned been added to the system. The disadvantages of retaining CIMOR



with its current level of functionality clearly outweigh the advantages. This option would lock DMH into the status quo instead of expanding and improving the system to meet future needs.

- FOX recommends that DMH not consider a complete replacement of CIMOR. The costs to implement a COTS product in terms of resources, time, and impact to the provider community are not warranted given the current level of functionality in CIMOR and user satisfaction expressed during the Phase I interviews. COTS readily available in the mental health marketplace do not have all the required functionality to support DMH business needs. In addition, the system platform and language for some COTS products do not meet DMH architecture standards and/or ITSD technical standards.
- FOX would recommend that DMH consider the option for expanding the functionality of CIMOR as the most economical and efficient strategy for meeting the department's information technology needs. Implementing EMR technologies are necessary to bring Psychiatric hospitals up to current industry best practices. Begin a collaborative effort with MO HealthNet and DHSS to implement an enterprise-wide data warehouse is strongly suggested to meet DMH information and reporting needs.



2 Summary of Previous Findings

This report is based on the findings described in the previously mentioned reports:

- CIMOR Health Check Report
- Other Current Market Offerings Report; and
- Report on Other State of Missouri Initiatives

Summaries of findings from previous reports are provided below to facilitate the reader's review and understanding of the analysis within this report.

2.1 CIMOR Health Check Report

Phase I of the project included an in-depth review of the current "As Is" state of the CIMOR Project and system. As part of this review, Fox conducted interviews with Executives who were asked to envision how the Department of Mental Health (DMH) will function five to ten years into the future. Additionally, Executives, Business Owners, the DMH ITSD staff, and Providers were interviewed to identify CIMOR project goals and objectives, review business processes, and to gain a first hand understanding of perceived CIMOR system strengths and weaknesses.

The CIMOR Health Check Report explains in detail what CIMOR system does and how the system is perceived by three of its stakeholders ITSD, DMH Business Owners, and DMH Providers. The report also provides an analysis of the current technical environment (hardware and software); and reviews the CIMOR's billing/claims processes and capabilities. An analysis of the current CIMOR implementation project compared to industry best practices for implementation of large complex systems is provided and includes a review of the CIMOR project management approach, risk management, and results of the lessons learned from a facilitated session as expressed by participating CIMOR implementation members.

A summary of the findings which are pertinent to options for continued operation of CIMOR is provided below.

The CIMOR system is functional and in operation.

Approximately 81% of the originally planned functions of CIMOR have been made operational, and CIMOR has successfully replaced several older obsolete 'legacy' DMH systems. Most Providers perceived the system foundation as sound, the screens are fairly easy to navigate, and where the system works it works reasonably well, problems are being resolved and functionality is improving. When claims/encounters are accepted into the system and there is no reason to void or re-bill the claim, the process works. Much of the current user dissatisfaction is associated with the delay in completion of some CIMOR functions. This causes the need for duplicate entry in CIMOR as well as in some legacy systems during the interim period until the CIMOR functionality will be implemented to replace the legacy systems.

The ADA Business Owners perceive the system as working very well. ADA is the only division who has fully adopted CIMOR at this point in time, including the claims processing functionality. The business rules ensure all data needed to support the grant are entered into the system and business rules which have been included in Provider contracts are being enforced. Providers are monitored and the system keeps spending within approved consumer budgets.



CIMOR Architecture is appropriate current technology.

An early decision to use a web-based deployment and Microsoft software (the “.NET framework”) demonstrated foresight on the part of DMH ISTD. That decision has positioned CIMOR well for maintainability and expandability on a current technology platform. The three-tier architecture, the hardware utilized, and the Microsoft .NET framework are industry-standard approaches to this type of business application. Scalability in terms of hardware and software to support DMH business needs for the next several years does not appear to be an issue, as long as sufficient funding and adequate support staff expertise are maintained.

There are differing perceptions of how well CIMOR works depending upon who was interviewed.

The business owners perceive that CIMOR has been successful in enforcing compliance by providers with business rules that have not been previously enforced. This is expected to ensure better data within the system for required reporting and to enable demonstration of conformance with the requirements of funding authorities.

The providers are less satisfied because a much higher level of business rule process enforcement is now required from them and because the transition to the new system was primarily to address the needs of DMH and not to facilitate their business processes. To complicate matters for providers, there were initially system problems that caused them to develop a backlog of encounter entries which slowed their cash flow. Also, some providers must still use a DMH legacy system for some activities and CIMOR for others.

The ITSD system developers view CIMOR as a quantum technological improvement that accomplishes the primary objectives of integrating the functionality of many older technology systems into an enterprise-wide system. They feel that the functions that have been specified to be incorporated into the system have been accomplished.

The agency and end users expressed a strong need for an easy to use reporting capability.

Even though the current CIMOR system has a data warehouse capability, it is not considered to be an easily understood and usable tool for performing ad hoc reporting. Users expressed the need for more intuitive business intelligence software tools and a simpler data table structure that is optimized for ease of query and retrieval.

There are opportunities for Collaboration with other state programs, including Medicaid.

Many of DMH's health care initiatives depend upon obtaining information or funding from other Missouri state agencies. A large percentage of DMH's consumers are Medicaid eligible, so it is important to be able to interact with the Department of Social Services (DSS) to determine client eligibility and to submit claims for payment through MO HealthNet. DMH is involved with other social services agencies in the planning for a new children's data warehouse. Many of the future information system needs identified in this review, such as electronic health records, data warehouse reporting, and service coordination, would require sharing data or systems with other agencies.

2.2 Market Offerings Report

This analysis consisted of six COTS products selected for review by the Department. All the systems analyzed are sophisticated, comprehensive electronic behavioral health medical record systems. The benchmark used for this study was the fully enhanced CIMOR with all planned and newly identified business functions. Thus some of these robust, sophisticated systems may have a lower than expected rating because their attributes are not currently part of and not



planned for CIMOR. For example, VistA supports multimedia, dentistry, prosthetics, etc. So even though VistA has many more capabilities than CIMOR, these capabilities were not considered since they are not or were never planned to be implemented in CIMOR.

Table 1, Table 2, and Table 5 summarize the results of this market offerings analysis. It shows that there are no clear winners among the Commercial-Off-The-Shelf (COTS) products. Every product has its strengths and weaknesses.

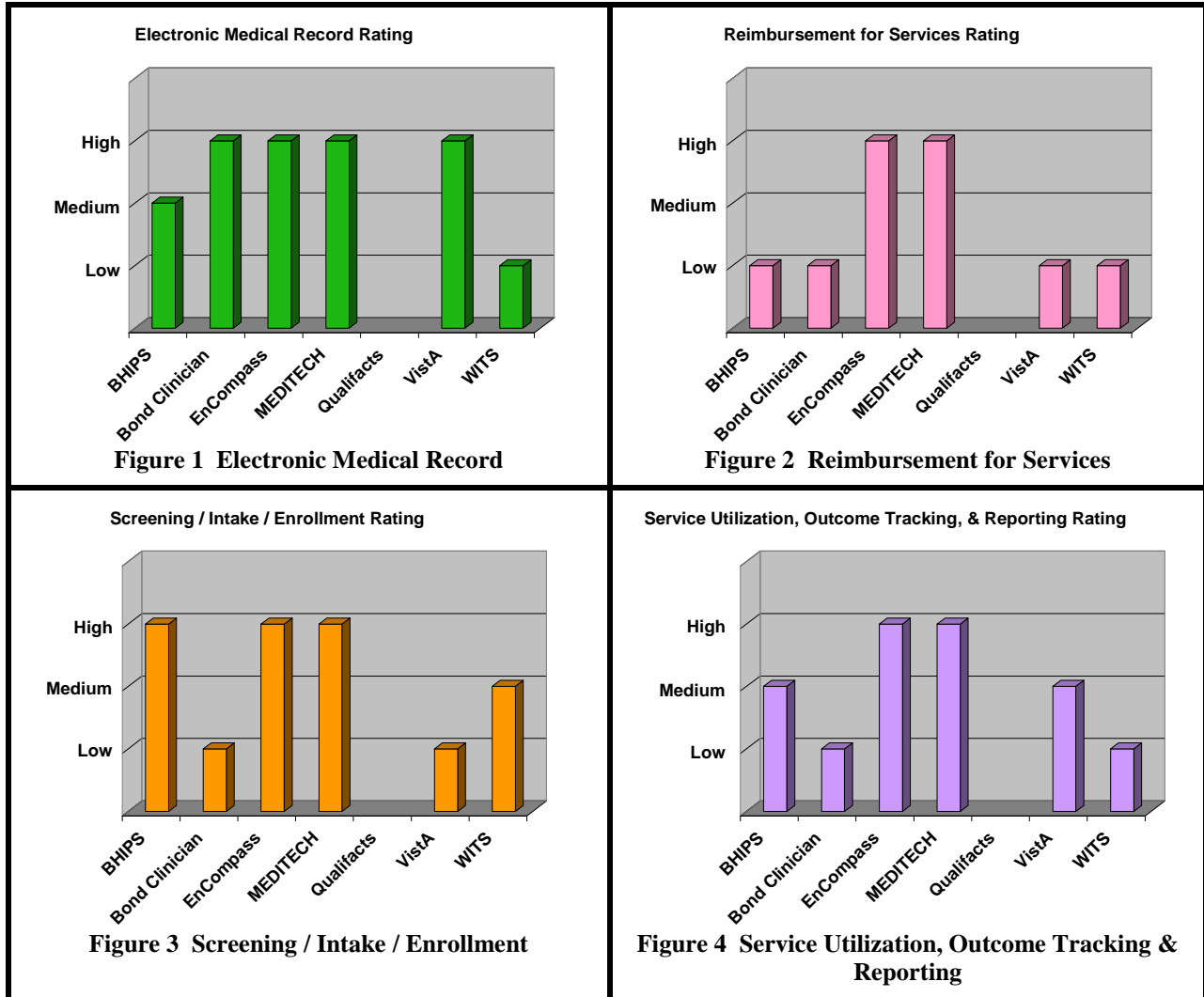
Table 1 Evaluation of COTS

System	Functional Match TO CIMOR Including Planned Enhancements¹	Technical Match
BHIPS	● Medium – 30 missing components	● High
Bond Technologies	● Medium - 38 missing components	● High
EnCompass	● High -2 missing components	○ Low
MEDITECH	● High – 13 missing components	○ Low
Veteran’s Administration VistA	● Medium - 39 missing components	○ Low
Web Infrastructure for Treatment Services WITS	● Medium - 27 missing components	● High

¹ CIMOR has 29 enhancements slated for implementation.



Table 2 CIMOR Business Function Category Comparison



In terms of technical architecture BHIPS is most similar to CIMOR. Both use Microsoft .NET technology. Both utilize Microsoft operating systems. Both use C# as the programming language of choice. But BHIPS has a large number of missing functions.

Bond Technologies also uses Microsoft .NET technology. It is programmed in JAVA. Bond Technologies is almost tied with Vista for having the most missing functions at 38. Bond Technologies would maintain the system for not only DMH but all its other customers. Thus, changes unique to DMH might be difficult if not impossible to accomplish. Bond Technologies would have to have some incentive to program uniquely for DMH.

EnCompass is a web based architecture but it is on a Linux platform. It also uses a DB2 database engine. These are consistent with present ITSD standards but not with current DMH technology standards. EnCompass is also hosted. However, this could be subject to change during contract negotiations. Of special mention is the fact that EnCompass is missing only two CIMOR business functions. This is the closest functional fit of all the COTS packages. EnCompass most likely would not be uniquely customized for DMH.



MEDITECH uses client/server platform architecture. This could be considered a step backward by some. Most likely more applications will become web based as opposed to staying or being developed as client/server systems. MEDITECH uses its own proprietary programming language to develop its systems. The same situation that exists with Bond Technologies regarding DMH unique applications also exists for MEDITECH. MEDITECH would maintain the system for not only DMH but all its other customers. Thus, changes unique to DMH might be difficult if not impossible to accomplish. MEDITECH like Bond Technologies would have to have some incentive to program uniquely for DMH.

VistA is enormous in every sense of the word. It costs more to implement and costs more to operate than any of the other packages. It also has more missing functions than any other package. It is written in M and ninety-five percent (95%) of all VistA systems in the VA run on Alpha/VMS/Cache. None of this is consistent with ITSD standards.

WITS, like EnCompass, is consistent with CIMOR in its technical architecture. WITS is web based and written in C# for the Microsoft .NET architecture. It runs on Microsoft Windows operating systems. Most systems are hosted, but that is not required. WITS has 27 missing CIMOR functions that would have to be developed. The entities that have implemented WITS have formed the WITS Collaboration Center to maintain the source code. The WITS Collaboration Center Process gives great autonomy to each member state (i.e., governmental entity) that participates. The core WITS system is free (i.e., no charge to license the product) but the state has to pay for the following:

- Development of code unique to the licensing state
- An annual maintenance fee
- Hosting the system if that option is chosen.

With joining the collaborative the state also agrees to share any and all changes made to the state's unique version of code in perpetuity with the collaborative. The significance of this is that even if the state opts out of the collaborative, the state is still legally obligated to share any and all changes made to the state's unique version of code. For example, suppose the state opted out of the collaborative and contracted a third party vendor to maintain the state's existing code and to develop new code. All the changes made by this contractor would then have to be shared with the collaborative.

In general the collaborative shares code developed for all states in the collaborative. The state requesting development of a particular application pays for its development. The application is written in such a way so as to strip those components unique to that requesting state out leaving only those components that then become core system components. The next state that wants to use that module would pay development costs for only those components unique to it while taking advantage of the core components previously developed. No other state in the collaborative has to agree to any state's unique requests.

The collaborative is structured to allow each state as much freedom, flexibility, and uniqueness as desired. This means that if State A wants an application written so uniquely as to appeal and to be applicable to only State A, this is no problem. State A simply pays for the development and the code becomes available to the collaborative.

All this may be accomplished because the code is developed and maintained by FEI.com.

A state may even modify its own version of the system itself. Because any and all changes to the system must be shared, the new code is accepted by FEI.com on behalf of the collaborative.



Because FEI.com is charged with maintaining the core system, the state may be charged for whatever work has to be performed on the code to make it suitable for and consistent with the core system.

Based upon the results of the analyses, the most feasible COTS product for DMH consideration is the following:

- BHIPS
- Bond Technologies Clinician
- EnCompass
- WITS

These four packages are candidates because they are consistent with ITSD standards and the use of web based systems.

Individual components of these four packages could also be considered as solutions to particular problems. Hooks may be present to allow integration with CIMOR. Insufficient detail is available at this time to determine whether that is possible. But .NET platforms stand a better chance of integration than other proprietary solutions.

The least feasible product is VistA. It uses architecture alien to ITSD. It would be the most expensive product to implement and operate. It has the most missing CIMOR functions.

MEDITECH is a powerful option that should not be overlooked. Its architecture is not consistent with ITSD. But one must first consider how important the business case is compared to the technology case. In general business wins every time. But there are exceptions and this could be one.

2.3 Other State Initiatives Report

The following conclusions were drawn as a result of the review of other State of Missouri technology initiatives. It is apparent from the review of the Transformation of Missouri Medicaid to MO HealthNet Report, Missouri Health Information Technology Task Force Report and recent legislation (e.g., SB 577) that there are opportunities for DMH to partner with other agencies. The MO HealthNet Division and the Department of Health and Senior Services are most likely as all three agencies provide healthcare and share similar or same patient populations. Conclusions regarding other state initiatives include:

- Missouri has placed a high priority on bringing in new technology to assist in the administration of their health care programs.
- Missouri has identified such technology improvements as EMR/EHR, telemedicine, web services technology for prior authorization and e-prescribe as being applicable to their overall goals for improving healthcare in Missouri.
- MO HealthNet's EHR and CyberAccess™ capabilities bring technology to health care providers making information readily available for better coordination of care. These capabilities can help support evidence based medicine. DMH would benefit from these functionality provided by the MO HealthNet program through federal funding
- DMH lags behind other states in utilizing Electronic Medical Record (EMR) technology in state psychiatric facilities. According to the 2006 SAMHSA survey most states reported having already implemented an EHR in their State Psychiatric Hospitals and/or their Community Mental Health System.



- Some new technologies planned for MO HealthNet such as EHR, service-oriented architecture, enterprise service bus, and multi-tiered benefit plan capabilities will enable the Medicaid Management Information System (MMIS) to be more interoperable with ('talk to') other systems of the State. This is good timing as the MO HealthNet Division is just beginning requirements analysis under their new MMIS vendor contract. MO HealthNet has already received 90% federal funding to enhance the MMIS.
- In an age of increased accountability and tightened budgets, DMH must be able to analyze treatment data to identify effective treatment practices. Once effective treatment practices are identified these can be used to implement policies concerning treatment and establish performance standards and indicators to measure performance.
- There is no state agency operating a system that meets DMH business needs and with all the functionality required in CIMOR.



3 Partnership Opportunities

The DMH has an opportunity to collaborate with the MO HealthNet Division on several new technology initiatives as described below. All of these fall within the purview of the MO HealthNet Transformation or were identified for adoption by the Missouri Health Information Technology Task Force. This is a good time to begin collaboration as the MO HealthNet Division is just beginning requirements analysis under their new MMIS vendor contract. Some collaboration has occurred for telehealth initiatives such as CyberAccess™ and SmartPA™ and additional functionality is anticipated to be included in the future. MO HealthNet has already received 90% federal funding to enhance the MMIS.

3.1.1 Modernization of Medicaid Management Information System

DSS MO HealthNet Division recently entered into a new contract to reengineer the Medicaid Management Information System (MMIS). Some new technologies planned include service-oriented architecture (SOA), enterprise service bus (EBS), multi-tiered benefit plans, and Electronic Health Records:

1. Service Oriented Architecture / Enterprise Service Bus - These technologies will enable the MMIS to be more interoperable with ('talk to') other State agency's systems. SOA and new standard Web services technology will be used to send and receive services to / from any authorized requester. Moving to more simplified integration allows agencies to leverage existing systems, move from manual / batch processing to real-time information and enable IT to efficiently implement.
2. Multi-tiered Benefit Plans - A multi-tiered benefit plan capability is being implemented within the reengineered MMIS, making it possible to process Medicaid and non-Medicaid claims within a single system. The new MMIS will use a rules engine to control pricing, edits, and audits making it much easier to establish different processing rules for different health plans. The enhanced SmartPA™ Web-based prior authorization tool will provide the capability to enforce DMH business rules for claims that have been submitted directly to MHD from the providers.
3. Electronic Health Record - Some form of EHR will be implemented in the reengineered MMIS and DMH EHR needs could be satisfied by partnering with MHD. It would be advantageous to leverage Medicaid approved enhanced funding for the project.

The DMH has defined the EHR to include the total package of services provided for a lifetime of a patient – the dataset is more limited but would contain all patient episodes of care. Collaboration with MO HealthNet on an EHR and/or personal health record would be timely as MHD begins to define requirements for their EHR initiative. DMH could lobby to have HL7 Behavioral Health as well as medical profile standards for EHRs implemented within the MMIS.

The DMH has an opportunity to join the HL7 standards work groups to assist in promoting and developing the industry standards for EHRs.



3.1.2 Telemedicine / Telehealth Initiatives

According to the American Telemedicine Association, telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status. Examples of telemedicine include: videoconferencing, transmission of still images, ehealth, including patient portals, remote monitoring of vital signs, continuing medical education and nursing call centers².

MO HealthNet is currently using telemedicine capabilities for monitoring patients enrolled in its Chronic Care Improvement Program. Additionally in the new CMSP contract, MO HealthNet will be making electronic personal health records available to participants through a Web portal.

Nationally 35 SMHAs reported being engaged in activities to promote the use of telemedicine to provide mental health services.³

Telemedicine is experiencing rapid growth nationally as well as in Missouri. The use of telemedicine significantly increases access to care and reduces overall cost. SB 577 requires DSS to promulgate rules governing the practice of telehealth in the MO HealthNet. The DMH is currently collaborating with MO HealthNet in the development of CyberAccess Web tools for use by providers and consumers. This initiative will make medical and behavioral health information more available for care coordination. Protecting the security of protected health information (PHI) as required by HIPAA is a significant consideration in the use of this type of technology.

DMH could benefit from the other MMIS initiatives including:

- Continue use of CyberAccess™ from MHD as the means to communicate and display, medical, institutional, labs, and pharmacy data for providers and consumers.
- It would be advantageous to leveraging Medicaid funding for MMIS and CMSP systems as well as 2006 Health Care Technology Funding to display behavioral health information within CyberAccess™.

3.1.3 Enterprise Wide Data Warehouse

Collaborate with MO HealthNet and DHSS to develop an enterprise-wide robust data warehouse to support research into effective treatment practices and to implement the MO HealthNet initiatives identified for behavioral health, including pay for performance and evidence based practices. Agency end users expressed a strong need for an easy to use reporting capability. Consider leveraging Medicaid funding for MMIS to fund this project.

For example: The enterprise in "enterprise-wide" would include all State social services agencies (MHD, DMH, and DHSS). The new DW would include all the atomic-level data from the existing CIMOR DW and the historical data from the previous DMH DW. The agencies could feed necessary financial data from SAM II into the new EDW to enable a single repository for financial reporting of the social services consumers. Optimize the data structure for query; provide also multi-dimensional summaries for quick response and consistent reporting of commonly-accessed data. Incorporate the planned capabilities of the Children's DW into this

² Missouri Health Information Technology Task Force. Missouri Healthcare Information Technology Final Report, Submitted to Governor Matt Blunt, September 2006.

³ State Profile Highlights as published at <http://www.nri-inc.org/projects/profiles/profiles05/emr2006.pdf>



EDW. Leverage Medicaid funding for construction of the EDW. Merge data with MHD's planned metadata management system.

3.1.4 CyberAccess™ Versus Enterprise Wide Data Warehouse

CyberAccess™ is a software product from ACS Heritage for tracking and processing inquiries from physicians. It is web-enabled so that it can be accessed by hand held PDA devices or from desktop or laptop PC workstations. The tool allows the physician to review a patient's history of drug prescriptions, institutional, outpatient, labs and physician claims provided by the MO HealthNet program and determine whether a drug requires prior authorization. It has two years of claims history. The repository of claims history is updated daily. Limited data about providers and recipient demographics are also retained in the repository. SmartPA™ is integrated into CyberAccess™ and provides capability to initiate prior authorization requests for MO HealthNet clinical services. MO HealthNet plans to enhance CyberAccess™/Smart PA™ to include DMH behavioral health services and to allow Department of Health and Senior Services (DHSS) waiver services prior authorizations, and to add the capability to write prescriptions electronically (e-prescribe).

CyberAccess™ is not a data warehouse in that it does not contain the complete history of all services and all the related financial, eligibility, and demographic data. CyberAccess™ does not provide the ad hoc reporting, analytical query, and data mining capabilities that would be provided by a data warehouse system. CyberAccess™ is more transaction specific to enable zeroing in on one individual's medical history rather than providing analyses, reports, and summaries of entire populations or subsets of populations.

An enterprise-wide data warehouse is a system that provides a data repository of essentially all data for an organization for a long term, usually seven to ten years, of history.

- Data within the repository (database) is retained within tables organized in a way that optimizes fast data retrieval
- Sophisticated business intelligence query tools are available.
- The business intelligence query software is designed to enable users to initiate ad hoc reports and queries into the data using intuitive graphical point and click commands directly from their desktop workstations.
- Business intelligence software can also provide the capabilities for data mining, trend analysis, financial analysis, data summarization, graphical presentation, spreadsheet presentation, and a wide variety of means of detecting, comparing, and interpreting conditions within the entire set of data contained within the repository.
- The data warehouse allows users to import/export to Excel spreadsheets for in-depth financial analysis.
- Good data warehouse systems provide fast enough response to queries so that research can be done iteratively because the results of one query usually result in additional questions that may require continued refinement and submission of additional queries to complete an analysis.

3.1.5 Electronic Medical Record (EMR)

DMH has identified such technology improvements as electronic medical record (EMR) for Psychiatric hospitals as being a goal for improving healthcare in Missouri. The Electronic



Medical Record (EMR) is defined as the record for a specific inpatient stay and includes a complete comprehensive record of a specific encounter. Some preliminary work for implementing an Electronic Medical Record (EMR) has been undertaken but will require substantial time and money for the DMH and their healthcare providers. The DMH will likely have to “go it alone” on the inpatient EMR initiative as MHD and DHSS do not appear to have a need for these functionalities (e.g., scheduling, CPOE, dietary) within an EMR.

3.1.6 Obstacles to Collaboration

The following obstacles need to be considered when partnering with other state agencies on health information exchange initiatives:

1. Oftentimes the hardest obstacle to implementing technology is making the cultural shift. Technological advances require staff to fundamentally change the way they do their work. This is particularly true where the work is primarily manual and done in a paper culture. Though technology can reduce complexity and help overcome barriers between state agencies, it can be difficult to align new technology with current business processes. Agencies must work collaboratively toward a set of common goals and be willing to change business processes to use the new technology.
2. The biggest hurdle to expanding the use of technological innovations in healthcare is funding, since these advances can require substantial up-front investment. In social services agencies any new technology project must compete with needed consumer services. Also to be successful, there is a need to build in time to educate staff on the new technology.



4 Option Analysis

In this section FOX provides the findings on the alternatives available for implementing each option, along with the advantages, and disadvantages of the option, and implementation costs. The options analyzed are:

- Retain CIMOR “As Is” without further enhancements
- Replace CIMOR with A COTS Product
- Enhance / integration of CIMOR with A COTS Product

4.1 Approach to Analysis

The findings from the reports discussed in Section 2 were used to evaluate options to retain CIMOR without further enhancement or to replace or enhance CIMOR with COTS products. As mentioned above, no state agency operates a system that meets DMH business needs and with all the functionality required in CIMOR. A number of COTS were identified for possible replacement of CIMOR.

4.2 Option 1 – Retain CIMOR As Is

As a first step in the analysis, FOX evaluated the advantages and disadvantages of retaining CIMOR with its current level of functionality.

Table 3 Advantages and Disadvantages of CIMOR As Is

Advantages	Disadvantages
Open architecture that meets state standards.	Does not meet all current business needs.
Current functionality meets many of the DMH business needs and ITSD could fully implement claims payment and billing requirements with minimal development.	Payment and billing functionality not fully integrated into CIMOR. Two legacy systems must be maintained. Data from the legacy systems in a different data warehouse from CIMOR making reporting generation cumbersome.
No additional costs or resource usage.	Electronic medical record (EMR) is not implemented for psychiatric hospital. The lack of an EMR could jeopardize accreditation and, hence, Medicaid funding.
	Query tools and data base table structure are not conducive to easy report generation.
	Continued need for resources to support legacy systems.

4.2.1 Recommendations

The disadvantages of retaining CIMOR with it’s current level of functionality clearly outweigh the advantages. CIMOR is not meeting current business needs as expressed by business owners and users. This option would lock DMH into the status quo instead of expanding and improving



the system to meet future needs, FOX does not recommend continued operation of CIMOR “As Is”.

4.3 Option 2 – Replacement of CIMOR

In this section FOX presents the findings concerning the option of replacing CIMOR with an existing system, either a COTS product or a system operated by another state agency. In completing the review of other state initiatives FOX determined that there is no state agency operating a system that meets DMH business needs and with all the functionality required in CIMOR. A number of COTS were identified for possible replacement of CIMOR.

4.3.1 Analysis of Alternatives

Table 4 summarizes the findings for each COTS product.

Table 4 Alternatives Analyzed for Replacing CIMOR with A COTS

System	Functional Match	Technical Match	Cost ⁴	Comments
Market Offerings				
BHIPS	● Medium – 30 missing components	● High	\$8 to 14 million	This alternative was rejected because of the number of missing components.
Bond Technologies	● Medium – 38 missing components	● High	\$12 to 20 million	This alternative was rejected because of the number of missing components.
EnCompass	● High -2 missing components	○ Low	\$5 to 8 million	This would be an acceptable alternative except for the fact that it operates on a on a Linux platform.
MEDITECH	● High – 13 missing components	○ Low	\$8 to 13 million	This could be an acceptable alternative except for the fact that it operates on client/server platform and is written in proprietary programming.
Veteran’s Administration VistA	● Medium – 39 missing components	○ Low	\$21 to 28 million	This alternative was rejected because of the number of missing components and the cost.
Web Infrastructure for Treatment Services WITS	● Medium – 27 missing components	● High	\$6 to 10 million	This alternative was rejected because of the number of missing components.
Opportunities to Collaborate: None				

⁴ Ibid.



Table 5 COTS Technical Specifications

COTS	Describe architecture	Modularity	System customizations and configuration
CIMOR	.Net Framework Microsoft SQL Server 2000 Windows Server 2003	C#	Up to 100% customized
Market Offerings			
BHIPS	.NET Framework Real-time Either Sybase or Microsoft SQL Server Microsoft 2003 Server	C#	Open Source
Bond Clinician	JAVA ASP.Net 2.0 Framework Microsoft SQL N-Tiered Technology	JAVA Modular	
EnCompass	Completely web based Linux Server using DB2 Database Can export to SQL database	JAVA Extremely modular each form/program is a module	Up to 100% customized
MEDITECH	Microsoft Windows NT Microsoft SQL Server or Oracle Magic client server (they wrote)	Their own language (Magic CS)	
VistA	Linux client-server architecture FileMan database	MUMPS	
WITS	C# .NET, SQL Server, ADAM, Model View Controller, Open Source, web- based.	C# .NET WITS is a set of modules from which States choose a specific set based on their needs.	Depending on the complexity, some are C# coded business rules, but the majority of "look and feel" changes are handled through simple XML files and user- controlled code tables



4.3.2 Advantages and Disadvantages

Table 6 Advantages and Disadvantages of Replacing CIMOR with a COTS Product

Advantages	Disadvantages
Many of the enhancements will be in the bases product.	The cost of a replacement will be a minimum of \$5 million, while ITSD estimates that the needed enhancements could be implemented for approximately \$2 million. In addition, there will be training costs for the new system.
The system functionality has been tested in other state programs	A replacement would require large commitment of staff resources both from ITSD and CIMOR users.
The numbers of COTS products available should result in competitive pricing.	None of the COTS systems meet all of the DMH functionality requirements. The most compatible systems do not meet state IT standards. EnCompass is on a Linux platform with a DB2 database. MEDITECH is written in a proprietary language and MEDITECH is unlikely to modify the system to meet Missouri specific requirements.
ITSD will benefit from lessons learned during other implementations of the COTS product	Users do not want a replacement and will be reluctant to participate in requirement sessions on existing functionality.
Some of the COTS available are open source systems.	It is unlikely that EnCompass, MDEITECH, or Bond will customize COTS product for Missouri specific requirements.

Additional Decision Criteria

A report prepared for the National Association of State Alcohol and Drug Abuse Directors, on Behavioral Health Integrated Provider System (BHIPS), includes a decision table (see Table 7) to help states evaluate the feasibility of implementing BHIPS. Applying the criteria in this table would require a detailed gap analysis that is beyond the scope of this report, but the table is included here for reference in evaluating the option to replace CIMOR.



Table 7 BHIPS Decision Table for Determining Action to Take⁵

Line #	Amount Of Change To Fit State's Business Rules	Recommended Action
1.	One-third or more (33%)	Don't implement the BHIPS system. When this level of change is needed, a state is effectively writing a new system. It would be preferable to start with a clean slate and simply develop a new software model. A second option would be to expand a different electronic system that would require fewer changes.
2.	Roughly one-fourth (21 to 30%)	Implement the BHIPS system only if it meshes strongly with your organization's culture. Your organization should already be very firmly set in this applications technology and should use tools in a similar fashion. This means that many of the changes are database list-based, and that the overall flow of the business process matches the Texas program closely. This also means that no major rewriting will be needed to interface with other existing systems. Before proceeding, bring in a second outside technical person to help review and validate whether the planned changes make sense.
3.	From 10% to 20%	Develop an estimated timeframe for changes. Before making a final decision, the state's technical staff should review the needed changes and build a time estimate. If the time estimate is acceptable, and the organization meets the requirements regarding technical staff and hardware/software, then it makes sense to implement the BHIPS system.
4.	Less than 10%	Decide on implementation. Provided that the organization passes the technical staff and hardware/software requirements, then it makes sense to implement the BHIPS system.

4.3.3 Recommendations

FOX recommends that DMH not consider a complete replacement of CIMOR. The cost of a COTS implementation is not warranted given the current level of functionality in CIMOR and user satisfaction expressed during the Phase I interviews. There is no one COTS product in the marketplace that has all the required functionality to support DMH business needs. In addition, the system platform and language for some COTS products do not meet DMH architecture standards and/or ITSD standards.

4.4 Option 3 – CIMOR Enhancement/Integration – COTS Products

In this section we present the opportunities to implement needed enhancements to CIMOR by using a COTS product. During the market offerings study Fox did a high level review to determine which COTS product offered the functionality that has been identified as needed enhancement to CIMOR. Fox also identified no enhancements that might be implemented through a partnership with other agencies.

⁵ Texas Behavioral Health Integrated Provider System (BHIPS), p. 43, http://www.nasadad.org/resource.php?base_id=902.



4.4.1 Analysis of Alternatives

Table 8 indicates which COTS products include the enhancements slated for inclusion in CIMOR. Table 5 presents a summary of the technical specifications of each COTS product. Also refer to Appendix 1 for definition of each enhancement and Appendix 2 for an additional matrix on market offerings. We found that while each COTS product provides much of the missing functionality, particularly EnCompass, which is missing only 2 components needed by DMH business users.

Table 8 Component Availability

Enhancement ⁶	Market Offering
1. Access to Recovery (ADA ATR) – 1	WITS
2. Assessments – 15	All
3. Assessments: Clinical Intake Screening – 17	BHIPS, EnCompass, and WITS
4. Assessments: Rapid Intake w/Assessment Screening -99	BHIPS, Bond Clinician, EnCompass, MEDITECH, and WITS
5. Assessments: State Reporting Assessment – 16	All
6. Case Management: Caseload Management – 22	All
7. Case Management Schedule of consumer visits or treatment – 21	All
8. DMH Intra-agency Communication – 46	All
9. EMR Maintenance – 105	All
10. EMR Maintenance: Crisis Action Plan View – 65	BHIPS, Bond Clinician, EnCompass, MEDITECH VistA, and WITS
11. EMR Maintenance: Discharge Plan – 66	BHIPS, Bond Clinician, EnCompass, MEDITECH, and VistA
12. EMR Maintenance: Lab – 106	Bond Clinician, MEDITECH, and VistA
13. EMR Maintenance: Physician Orders – 62	Bond Clinician, EnCompass, MEDITECH, and WITS
14. EMR Maintenance: Progress/Case Documentation – 107	All
15. EMR Maintenance: Referral View – 67	All
16. EMR Maintenance: Treatment Plan View – 68	All
17. EMR Maintenance: Summary Views – 64	Bond Clinician, EnCompass, MEDITECH, and VistA
18. EOC Forensic Services – 102	EnCompass and MEDITECH
19. Exchange client Information with	All

⁶ Please see Appendix 1 for details on each enhancement.



Enhancement ⁶	Market Offering
Providers – 109	
20. External Consultations – 108	All
21. Long Term Treatment, Discharge and Aftercare Planning – 63	All
22. Online Help – 101	All
23. Outcomes: Delivered Services Data Mart – 72	All
24. Outcomes: Outcomes Web Link – 73	All
25. Registration / Admission / Program Assignment: Referrals Management – 90	All
26. Standard Means Test: Applying Standard Means Test to invoices based on DMH priorities – 77	EnCompass, VistA, and WITS
27. Third Party Liability (TPL): Insurance Billing – 87	BHIPS, EnCompass, VistA, and WITS
28. Waiting Lists – 89	All

Generally, the COTS products include most of the enhancements currently required in CIMOR. Table 9 presents a summary of enhancements not found in each COTS product.

Table 9 Enhancements Not Available in Each COTS Product

BHIPS	MEDITECH
Access to Recovery (ADA ATR) –	Access to Recovery (ADA ATR) – 1
EMR Maintenance: Lab – 106	Assessments: Clinical Intake Screening – 17
EMR Maintenance: Physician Orders – 62	Standard Means Test – 77
EMR Maintenance: Summary Views – 64	
EOC Forensic Services –	VistA
Third Party Liability (TPL): Insurance Billing – 7	Access to Recovery (ADA ATR) – 1
	Assessments: Clinical Intake Screening – 17
Bond Clinician	Assessments: Rapid Intake w/Assessment Screening -99
Access to Recovery (ADA ATR) – 1	EOC Forensic Services – 102
Assessments: Clinical Intake Screening – 17	
EOC Forensic Services – 102	WITS
Standard Means Test – 77	EMR Maintenance: Discharge Plan – 66
	EMR Maintenance: Lab – 106
EnCompass	EMR Maintenance: Physician Orders – 62
EOC Forensic Services – 102	EMR Maintenance: Summary Views – 64
Third Party Liability (TPL): Insurance Billing – 87	EOC Forensic Services – 102
	Third Party Liability (TPL): Insurance Billing – 87



4.4.2 Advantages and Disadvantages

Table 10 Advantages and Disadvantages of Integration with COTS

Advantages	Disadvantages
The enhancements will be implemented with functionality that has been tested in other state programs	Not all systems meet state IT standards. EnCompass is on a Linux platform with a DB2 database, which is within the state architecture but not within the DMH architecture. MEDITECH is written in a proprietary language and not within state standards. It is unlikely that MEDITECH would modify their system to meet Missouri specific requirements.
The numbers of COTS products available should result in competitive pricing making the cost of implementing COTS lower than ITSD development costs.	It is unlikely that any one COTS product will provide all missing functionality and integration with multiple systems or CIMOR development will most likely be required.
ITSD will benefit from lessons learned during other implementations of the COTS product	Fully integrating a COTS product with technical specifications different from CIMOR may present some challenges.
Users will support expansion if it provides missing functionality and improves reporting capabilities.	COTS may not meet all Missouri specific criteria.
Fewer ITSD resources should be required for integration of COTS than development of the functionality.	It is unlikely that EnCompass, MDEITECH, or Bond will customize COTS product for Missouri specific requirements.
Some of the COTS available are open source systems.	

4.4.3 Recommendations

DMH should consider conducting a gap analysis of business requirements and issue a Request for Information (RFI) to identify the availability and costs of COTS products that will provide the required functionality. The RFI would specify DMH business requirements and request sufficient information from responders to determine if functionality provided within their products would satisfy DMH functional needs.

In reality if the DMH undertakes this alternative it may be determined that some enhancements would be more efficiently provided through in-house development of the enhancement in CIMOR. FOX has not attempted to consider an alternative of a combination of in-house development and COTS packages to satisfy all of the necessary enhancements because:

- There is no cost information available at this time regarding the individual functional components of the COTS products, and,
- The cost of in-house development of each of the remaining enhancements has not been determined.



Appendices



Appendix 1 CIMOR Enhancement Matrix

Appendix 1 CIMOR Enhancement Matrix

IQ # (1)	Business Function in Interview Questionnaire (IQ) (Sept. 2007) (2)	ID # (3)	Identified (ID) Sub-Function (Sept. 2002) (4)	Currently In CIMOR (5)	Planned CIMOR Enhancement (6)	Function Description (7)
1	Access to Recovery (ATR)	1	Access to Recovery (ADA ATR)	Yes	Yes	Administration and implementation of business rules to support the ADA grant for Access to Recovery, including voucher management and services delivery.
5	Assessments	15	Assessments	Partial	Yes	Variety of assessments to be determined.
		16	State Reporting Assessment	Partial	Yes	Support assessments data required for state reporting
		17	Clinical Intake Screening	Partial	Yes	High-level screening upon enrollment to determine if consumer has service needs across DMH divisions.
8	Case Management	21		Partial	Yes	Schedule of consumer visits or treatment appointments in group settings. Include a link to progress notes.
14	Consumer Banking	37	Client Banking	Yes	Yes (1099)	Management of consumer funds held in trust by state-owned facilities. Includes deposits (manual and electronic), withdrawals, transfers, calculation of interest, and 1099 preparation/submission.
20	DMH Intra-agency Communication	46	Messaging	No	TBD	Automated messaging at specified action points within CIMOR processes
28	Medical Record Maintenance	62	Physician Orders	No	Yes	Physician and nursing orders
		63	Long Term Treatment, Discharge & Aftercare Planning	No	Yes	Treatment plans, aftercare plans, habilitation plans, discharge plans.
		64	Summary Views	No	Yes	Medical record-related information summarized for quick-view or analysis purposes
		65	Crisis Action Plan View	No	Yes	Printable summary of specific actions planned
		66	Discharge Plan	No	Yes	Printable summary of plan for discharge
		67	Referral View	No	Yes	Printable summary of consumer referral
		68	Treatment Plan View	No	Yes	Printable summary of consumer treatment plan
32	Outcomes	72	Delivered Services Data Mart	Minimal	Yes	Provide access to data warehouse data in appropriate format to handle easy analysis and summary of services provided to consumers
		73	Outcomes Web Link	Minimal	Yes	Inclusion of screens for collecting outcomes assessment information and ability to print the assessments.
35	Prioritization in applying Standard Means Test (SMT)	77	Applying Standard Means Test to invoices based on DMH priorities	Yes	Yes	Application of standard means test (consumer ability to pay) during payer determination and invoice generation using priorities for programs established by DMH.
44	Third Party Liability (TPL)	87	Insurance Billing	No	Yes	Automated generation and processing of insurance claims



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IQ # (1)	Business Function in Interview Questionnaire (IQ) (Sept. 2007) (2)	ID # (3)	Identified (ID) Sub-Function (Sept. 2002) (4)	Currently In CIMOR (5)	Planned CIMOR Enhancement (6)	Function Description (7)
46	Waiting Lists	89	Waiting Lists	Yes	Yes	Management of future services that may be provided to a consumer, for which a consumer is waiting.
		90	Referrals Management	No	Yes	Handle external referrals detail information and tracking for consumer records
		91	Authorization XML Viewer	No	No	Process not used
		97	Mental Status Exam	No	TBD	Implementation of an assessment or screening regarding mental status of consumer.
		98	Symptoms List	No	TBD	Look-up of symptoms to aid physician service delivery
		101	Online Help	Yes	Yes	Easily accessible help information to assist users with various activities within the system
		102	EOC Forensic Services	No	Yes	Forensic orders
		105	Electronic Medical Records Maintenance	No	Yes	Electronic medical records of all consumers being served
		106	Lab	No	Yes	Lab function including doctor's orders
Additional Functionality mention in EHR Evaluation Report and not listed above.		107	Progress/Case Documentation	No	Yes	Evaluating and summarizing services provided and progress towards achieving goals or outcomes on the treatment plan for summarizing client contacts and ancillary patient information and for justifying medical records and recording the results of consultations this is tied to individualized habilitation plan.
		108	External Consultations	No	Yes	Any type of assessment or healthcare completed from providers outside a facility. Integrated with CPOE and scheduling.



Appendix 2 Enhancement Availability in COTS

Appendix 2 Enhancement Availability in COTS

Enhancement	Functionality Fit					
	BHIPS	Bond Clinician	EnCompass	MEDITECH	VistA	WITS
Number of Yes and No for each COTS product	7	5	4	2	4	7
Access to Recovery (ADA ATR) – 1	N	N	Y	N	N	Y
Assessments – 15	Y	Y	Y	Y	Y	Y
Assessments: Clinical Intake Screening – 17	Y	N	Y	N	N	Y
Assessments: Rapid Intake w/Assessment Screening -99	Y	Y	Y	Y	N	Y
Assessments: State Reporting Assessment – 16	Y	Y	Y	Y	Y 1	Y
Case Management: Caseload Management - 22	Y	Y	Y	Y	Y	Y
Case Management: Consumer Group Management - 21	Y	Y	Y	Y	Y	Y
DMH Intra-agency Communication – 46	Y	Y	Y	Y	Y	Y
EMR Maintenance – 105	Y	Y	Y	Y	Y	Y
EMR Maintenance: Crisis Action Plan View - 65	Y	Y	Y	Y	Y	Y
EMR Maintenance: Discharge Plan – 66	Y	Y	Y	Y	Y	N
EMR Maintenance: Lab – 106	N	Y	N	Y	Y	N
EMR Maintenance: Physician Orders – 62	N	Y	Y	Y	Y	N
EMR Maintenance: Progress/Case Documentation - 107	Y	Y	Y	Y	Y	Y
EMR Maintenance: Referral View – 67	Y	Y	Y	Y	Y	Y
EMR Maintenance: Treatment Plan View - 68	Y	Y	Y	Y	Y	Y
EMR Maintenance: Summary Views – 64	N	Y	Y	Y	Y	N
EOC Forensic Services – 102	N	N	N	Y	N	N
Exchange client Information with Providers - 109	Y	Y	Y	Y	Y 1	Y
External Consultations – 108	Y	Y	Y	Y	Y 1	Y
Long Term Treatment, Discharge and Aftercare Planning - 63	Y	Y	Y	Y	Y	Y
Online Help – 101	Y	Y	Y	Y	Y	Y
Outcomes: Delivered Services Data Mart – 72	Y	Y	Y	Y	Y	Y
Outcomes: Outcomes Web Link – 73	Y	Y	Y	Y	Y	Y
Registration / Admission / Program Assignment: Referrals Management – 90	Y	Y	Y	Y	Y 1	Y
Standard Means Test – 77	Y	N	Y	N	Y	Y
Third Party Liability (TPL): Insurance Billing – 87	N	Y	N	Y	Y	N
Waiting Lists – 89	Y	Y	Y	Y	Y	Y

1 VistA provides a way for this function to / from other providers or services within the hospital system, at their own facility or another facility.



Appendix 3 COTS Cost Comparison and Missing Functionality Count

Appendix 3 COTS Cost Comparison and Missing Functionality Count

Line #	Item Category	BHIPS	Bond Clinician	EnCompass	MEDITECH	VistA	WITS
1.	Missing function count	30	38	2	13	39	27
2.	System purchase / lease cost	\$0	\$6,500,000	\$0	\$6,500,000	\$0	\$0
3.	Missing functions replacement cost	\$4,800,000	\$6,800,000	\$0	\$2,000,000	\$7,000,000	\$4,200,000
4.	Implementation cost	\$3,360,000	\$650,000	\$4,150,000	\$0	\$6,930,000	\$1,080,000
5.	Annual operating / maintenance cost	\$515,000	\$650,000	\$420,000	\$420,000	\$12,000,000	\$400,000
6.	Total planned enhancements cost	\$2,208,000	\$1,798,000	\$1,798,000	\$1,491,000	\$2,618,000	\$2,105,000
7.	Total first year costs (excluding enhancements)	\$8,675,000	\$14,600,000	\$4,570,000	\$8,920,000	\$25,930,000	\$5,680,000
8.	Total first year costs (including Enhancements)	\$10,883,000	\$16,398,000	\$6,368,000	\$10,411,000	\$28,548,000	\$7,785,000
9.	Total cost after first year	\$515,000	\$650,000	\$420,000	\$420,000	\$12,000,000	\$400,000

Cost Estimation Assumptions and Methodology

The COTS vendors had to make cost estimates without knowing who the potential client was or anything about the client's business environment. The same is true for the public domain entities. The only pieces of information the vendors had to use were the Functionality Comparison Matrix and their system in Appendix 1.

Due to this extremely limited information all vendors emphasized that the cost estimates were only ballpark guesses. Vendors further indicated that firm numbers could be provided only after consultation with DMH on the exact system requirements. One of the major assumptions made was that regardless of the system selected DMH wants to keep all of the existing CIMOR functions. Thus, if a system lacked one or more functions, then the vendor would have to add that function. In the instance of Open Source software, then ITSD would have to arrange to have the missing functions added. The system purchase / lease price is either obtained from the vendor, published materials, or estimated using a best guess approach. Open Source software is free and thus the cost is \$0.

Indicated below are the assumptions used to generate the cost ranges for each system.

1. CIMOR cost estimates provided by ITSD are accurate statements of CIMOR costs.



2. CIMOR cost estimates provided by ITSD are accurate statements of the cost to complete each enhancement.
3. Staff is assumed to have productive hours 1,750 hours per year with an average cost of \$70,000 per year including benefit costs of 48%. Therefore, the average fully-loaded hourly rate for an ITSD developer is assumed to be \$40.
4. All programming work is to be performed by either contract labor or the vendor at contract labor rates, both of which are defined to \$90/hour.
5. A 30% contingency is added to this to account for underestimated hours or rates
6. With the exception of missing functions, planned enhancements, and the enhancements in Matrix Error, DMH is satisfied with the "as is" capabilities of any system or system enhancement purchased and will change any and all DMH operational procedures and activities to conform to the newly acquired software. This means that no system modifications will be required or are expected.
7. No other costs (e.g., hardware, network, expendables, training, travel, etc.) are required for any activity, item, enhancement, or system other than hours worked. In addition, ITSD will not have to hire any additional personnel to purchase / lease, install, operate, maintain or otherwise staff any system or system enhancement. The exception to this is if Open Source software is selected in which case contract labor will be retained.
8. The cost estimates are incremental costs to those ITSD currently experiences. That is, ITSD would see these additional costs added to its budget.
9. Where the implementation cost was not provided by the vendor it can be calculated using the assumptions below. The amount of time to implement a COTS system is about 3 months. The cost to implement a system is about 10% of the total development cost. The cost to implement a system is computed using $\text{MAX}(10\% \text{ total development cost}, (3/12) \times \text{annual operating cost})$, where "3" is the three month to implement and the "12" is twelve months in one year. Note that $(3/12) = 25\%$. No additional implementation costs are required or expected beyond those cost estimates calculated. For example, no programming, reformatting, etc., is required or expected beyond that budgeted in the cost estimates. The exception to this is when the vendor provides a specific implementation cost.
10. The annual cost to operate / maintain a system is 10% of the total system development / purchase / lease cost unless otherwise stated (e.g., vendor specifies the cost).
11. The 150,000 individual DMH serves (<http://www.dmh.missouri.gov/about.htm>) is an accurate, unduplicated count (i.e., unique individuals) of the number of patients DMH serves each year.
12. Maintenance costs are for a full year in the first year.
13. Washtenaw Community Health Organization's implementation costs were \$553,512 (http://www.sccmha.org/whats-new/SCCMHA_07_Prog%20Report.pdf) for 20,000 consumer demographic records. The 20,000 is an unduplicated count. Ratio analysis may be used to scale the 20,000 to 150,000 consumers. Likewise other costs associated with EnCompass can be calculated using ratio analysis.



14. The \$80 / patient per year for VistA maintenance cost (<http://www1.va.gov/opa/pressrel/pressrelease.cfm?id=1152>) is accurate and applies to the 150,000 annual DMH patients.
15. The vendors supplying costs for their systems provided a best guess effort to approximate system charges. The vendor's reserve the right to publish a final cost after discussions with the State.
16. The amount of time to finish a partially completed function (e.g., TPL - Private Insurance Billing for BHIPS) is identical the total amount of time estimated to write the function from scratch.
17. DMH does not want to give up any functions they now have in CIMOR if and when a new package is selected. Thus, they must first replace any missing function.
18. Any and all software additions and/or enhancements required prior to and for implementation will be conducted by the vendor. In this instance no surcharge is added to implementation since the vendor is intimately aware of the software. In the event Open Source software is used, then an additional "surcharge" is added to the implementation cost since ITSD and its contract labor will have no experience with the Open Source software and will have to learn by trial and error.
19. The system purchase / lease price is either obtained from the vendor, published materials, or estimated using a best guess approach. Open Source software is free and thus the cost is \$0.
20. The cost of implementing missing functions is assumed to be the average estimated cost of implementing enhancements at the contractor rate: \$90 hours times 1,750 hours plus a 30% contingency factor or \$205,000.
21. If ITSD is responsible for implementing the system (i.e., Open Source), then the formula MAX (10% total development cost, (3/12) X annual operating cost) is adjusted so that the development costs is augmented by the cost of the missing functions and enhancements. This is done because ITSD and its contractors will not have knowledge about the system.

Cost estimates for this report were prepared using the process described below.

- Individual components such as those shown in the Functionality Comparison Matrix (e.g., Medical Record Maintenance - Physician Order Entry) were not priced separately by vendors. Costs are computed by using an hourly contract rate of \$117 times the development hours estimated by ITSD. Example:
 - Estimated hours of ITSD development of Medical Record Maintenance - Physician Order Entry is 3,500 hours (\$140,000 times \$40 per hour)
 - Estimated cost of Contractor development of Medical Record Maintenance - Physician Order Entry is \$410,000 (3,500 hours times \$90 per hour, plus a 30% contingency factor rounded to the nearest \$1000).
 - Estimated costs less than \$1,000,000 are rounded to the nearest \$1,000. Estimated costs \$1,000,000 and above are rounded to the nearest \$10,000.