Grant Final Report

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Improving Rural Health Care: Implementing Innovative Integration Solutions

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Abstract

Purpose: The Mt. Ascutney Consortium implemented an enterprise and user customizable Provider Portal for viewing key information from disparate internal and external information systems.

Scope: The portal provides the front end view for access to patient data. The integration engine extracts data from multiple, existing internal and external systems and displays the user defined data on a single screen. An integration engine facilitates synchronization of the data. The portal allows access, via single sign-on technology and context management, to information on a single patient without searching each application.

Methods: Identification of key healthcare information relevant to local providers includes the internal hospital information system, the outpatient physician practice Electronic Medical Record (EMR) system, the Dartmouth Hitchcock Medical Center Clinical Information System (CIS), and the Valley Radiology Picture Archive Communication System (PACS).

Results: Accessibility to healthcare data can be achieved in an efficient and reliable manner. Required interfaces can be managed internally by leveraging existing vendor to vendor data feeds by routing them through the integration engine. Records retrieval is more efficient by reducing the need to locate and access information in multiple systems and in paper charts. The selected system capabilities allow for parallel development that provide organizational posture to participate in other HIE activities.

Final Report

Purpose

The historical closed systems nature of the health care environment has resulted in tactical responses to meeting the demands of improved quality of patient care, improved efficiency in healthcare delivery, improved patient safety, improved reporting of healthcare outcomes, and reduction in costs. From the perspective of organizational theory, Katz and Kahn describe an open system as more susceptible to efficiency and survival.[1] By transforming from a tactical operating environment to a strategic one, the aforementioned goals could be realized.

Mt. Ascutney Hospital is not unlike other provider care organizations throughout the country and the world. While the organizational systems are in place to provide the highest level of care, it too operates from a tactical position. That is to say; the external inputs are primarily the patients and the payers. These inputs are processed through the provision of care, and the outputs are healthier patients and the generation of bills to provide revenues. The management strategy, at the highest level, is to achieve compliance with payer rules, state and federal laws, and to operate within ethical boundaries.

The underlying problem from a systems perspective, and especially with technological systems, begins within organizational boundaries at the user level, through departmental and enterprise operations/processing, and on to external entities and systems such as payers and other external stakeholders. Historically, users, departments, hospitals, clinics, payers (self, private, state, federal, etc), and state health departments operate with their own agendas. Hospital system users desire software and technology to make their jobs easier, hospital departments leverage technology to assist with their group tasks, organizations leverage systems to manage operations and to provide tools to affect patient care, health departments implement systems to track population disease statistics, and payers operate to disperse the minimum amount of funds necessary that result from claims. The resultant effect is the large number of information systems, on various platforms and architectures, in place to collect similar operational and patient care data to be sent to, transmitted, and shared in formats specified by the recipient users, departments, and organizations, which have a stake in patient care activities.

The purposes of this project are as follows:

1. Achieve interoperability of critical disparate internal and external legacy information systems to reduce redundancy of patient registration activities at each encounter.

2. Provide a single view of critical user and enterprise defined data elements that support the continuum of care and organizational operations.

3. Eliminate or reduce the costs and number of vendor developed and supported interfaces.

4. Provide patient context, single sign-on access to multiple systems to reduce the amount of time and keystrokes required to login and search for additional patient information prior to or during a patient encounter.

5. Facilitate efficient reporting of patient management and care outcomes.

6. Implement a strategic information system that is parallel to other active or planned initiatives and can send and receive electronic data when necessary.

7. Provide internal and remote, read-only access to the provider portal.

8. Incorporate an information security model consistent with systems and organizational policies for user access to data.

A proof of concept was achieved as a result of an AHRQ HIT planning grant awarded to Mt. Ascutney Hospital in 2004.[2] Identification of the software and technology that supports this solution without the need to replace existing information systems, was extensively tested and selected for its user customization features, quick time to go-live, low cost of sustainability, and user defined database and cross-platform capabilities.

Scope

Mt. Ascutney Hospital is a progressive community hospital with five locations and approximately five hundred employees serving a population of thirty thousand patients. The hospital remained a member of the Dartmouth Hitchcock Alliance (DHA), a regional network of non-profit healthcare providers prior to and throughout the project. The hospital and its alliance partners suffer from communication deficiencies, where inpatient and outpatient care facilities are unable to communicate with each others' information systems. Four of the area hospitals receive Radiology services from Valley Radiologists, PA for interpretation of Radiologic studies and interpretations. Dartmouth Hitchcock Medical Center (DHMC) is a nonprofit tertiary care facility and is a primary source to Mt. Ascutney Hospital for referrals to the hospital's rehabilitation services. As the closest Level I Trauma Center and tertiary care facility to Mt. Ascutney Hospital, Dartmouth Hitchcock Medical Center receives a high number of referrals for trauma patients.

Mt. Ascutney Hospital has implemented numerous information systems over the years to satisfy user efficiency, support departmental operations, track patient safety and care, and to provide required reporting data to internal and external entities. Multiple billing systems are in place to accommodate payer rules for care provision activities and claims submissions. Individual departments leverage ambulatory care systems that meet their needs for documentation and work flow. The inpatient units maintain numerous systems, including paper charts, to document their care and patient education activities. Reporting is required to numerous external oversight agencies including the Department of Health, Department of Banking, Insurance, Securities and Health Care Administration (BISCHCA), and the Center for Medicare/Medicaid Services (CMS), among others. Patient demographic and insurance information is maintained in each of these systems, thereby requiring the patient to be registered and have their information verified at each encounter to accommodate the numerous systems and reporting requirements.

The relationship with DHMC, as the Internet Service Provider for Mt. Ascutney Hospital, provides for secure connectivity between the two organizations. Their CIS information system is available to physicians for access to records for patients that receive services at both organizations.

Valley Radiologists is a for profit professional group of four radiologists who access the physical films and digital outputs at the hospital location to perform their studies. This at times results in significant delays resulting from Radiology physician travel to the facility to perform their studies and document their interpretations.

Methods

Project Planning and Execution

The Consortium leveraged formal project management methodologies to plan and implement the system. Physician and IT staff from each consortium member and vendor organizations comprised the project team. Integration of the consortium and vendor's project plans formed the basis for required tasks, resources, costs, milestones, and tracking requirements. Implementation of a phased approach across the three year project period allowed timely identification of key systems and data to be leveraged for the project. Each one year period comprised a phase of the project. This was necessary to maintain availability of staffing resources to other projects scheduled and in progress as internal and regional organizations continued aggressive information technology system implementations. The detailed project plan was required and submitted for approval to numerous stakeholders including AHRQ, Consortium organization's management teams, and the Institution Review Boards (IRB).[3]

Phase 1. Implementation of the Provider Portal and the integration of data from two primary systems, the Hospital Information System (HIS) and the clinic Electronic Medical Record (EMR) system. Implementation of Single Sign-on to both systems with patient in context from the portal. Synchronization of like data across both systems.

Phase 2. Integration of data from the PACS system and retrieval of data for the portal, and integration of DHMC CIS data and Single Sign-on to the CIS system.

Phase 3. Evaluation, implementation, and integration of other key internal and external systems deemed appropriate for the display and synchronization of data.

The same project management methodology is applied to each year or phase of the project. Like tasks carry down from phase one. Detailed planning for the second and third year was reserved, pending outcomes from the work of the previous phase.

Vendor contracting was consistent with project funding timelines. Payment milestones were incorporated into the project plan as key deliverables were met. Each phase adhered to the same milestones carried over from the previous phase. Key deliverables within scope were identified and considered an achieved milestone at the completion of detailed user acceptance testing activities and successful evaluation.

The ongoing changes to payer and business rules, state and federal regulations, organizational administrative changes, and other technology projects indicated a need to maintain a dynamic project plan that could be adjusted as needed to accommodate required

changes to scope that affected key systems, resources, and initiatives, yet still achieve the desired outcomes for the project.

Phase one was implemented as planned. Hospital Information System (HIS) and Electronic Medical Record (EMR) defined data elements were incorporated into the portal views. The base configuration contains Patient Searches, Patient Demographics Details, Patient Admission Details, Laboratory Results, and Laboratory Reports. All of this information will be displayed within the clinical portal.

The clinical portal is one hundred percent web based so that physicians located anywhere in the region will have access to the clinical portal. Single Sign-on scripting was developed to provide user logon into HIS and EMR applications from within the portal. User level groups were applied to mirror the same level of application security resident in all information systems, including privacy locks for patients opting out of information sharing. Key features implemented in the portal view include:

- Latest vitals (blood pressure, height, weight, BMI)
- Vitals history summary
- Medication summary
- Allergy summary
- Immunization summary
- Referral summary
- Order summary (Lab & Radiology)
- Lab results and trend analysis.
- Insurance summary
- All scanned documents from central organization scanning system.
- Patient Chart content view
- Provider specific work lists
- Provider specific lab work lists
- Provider specific outstanding radiology orders
- Patient encounter summary

Phase two of the project plan required significant changes because of organizational leadership changes, system changes, and developing external projects. This phase focused

primarily on the acquisition and implementation of a PACS system and the integration and Single Sign-on of the DHMC CIS system.

The PACS system implementation was delayed as result of a four hospital initiative to acquire a shared system. These four hospitals are those served by Valley Radiologists. A significant amount of time was expended searching for infrastructure and a solution that would meet the needs of all five organizations involved (the four hospital participants and Valley Radiologists). It was also necessary to provide secure, high bandwidth connectivity between to four PACS servers that also would provide remote access to the PACS system to alleviate travel requirements to each hospital location to perform radiology studies.

A significant upgrade was delivered to the HIS that had a negative impact to the screen login mapping for Single Sign-on. The scripting tool used for single sign-on maps the user login to an x,y coordinate on the computer screen. When the HIS upgrade was applied, the user login window was placed in a different location on the screen resulting in the need to re-map the login script. Individual scripting is required for each Microsoft Windows operating system (W2000, XP, Vista, Server 2000, Server 2003). Because of the method the vendor uses to license the third party scripting tool for single sign-on it was necessary to have the primary portal vendor apply updates to the single sign-on scripts, as changes were needed. The licensing script provider, Boston Workstation, does not provide licenses to end user organizations and was not willing to provide training on script modification except to the vendor using their tools as part of their applications. The method of licensing is not recommended and going forward, Mt. Ascutney Hospital will consider alternate methods of single sign-on to applications external to the portal. This indicates further the necessity of a test environment early on as an environment to develop and test adjustments to the system. Clinical Context Object Workgroup (CCOW) compliant application will eliminate the need for custom SSO scripting because it is fully integrated within the Rhapsody engine.[4,5]

Other third party software compatibility issues arose with Java technology. Numerous vendor applications throughout the organization required specific versions of Sun's Java product. Multiple versions of Java do not run simultaneously on individual workstations.[6] The PACS vendor provided an update to their software to match the version the portal required so both applications could run on a single machine. The Emergency Department's application required an older version of Java that would not allow both the portal and the ED application to run at the same time on any workstation.

DHMC administration was reorganized when the CEO retired. As a result of their re-assessment of systems, they agreed going forward to only accommodate Single Sign-on capabilities to CIS. They did not wish to pursue data sharing as a result of an upcoming initiative to replace their CIS system.

In parallel to the Mt. Ascutney Consortium work on the portal project, the Vermont Information Technology Leaders (VITL) was designated by the Vermont Legislature as the formal group to pursue HIE activities throughout the state. In October 2006 VITL signed an agreement with the Vermont Department of Health to provide comprehensive data services for the Blueprint for Health's Chronic Care Information System (CCIS). The Vermont Blueprint for Health–Chronic Care Initiative is a public/private collaboration to address the growing health and cost burden of chronic disease. Originally deployed by the Vermont Department of Health (VDH) and the Vermont Program for Quality in Health Care (VPQHC) as a pilot project in two communities, it will be implemented statewide as part of the VITL strategy for a statewide network. VDH conducted a study of the pilot to ensure consistency with statewide initiatives and

ultimately contracted with VITL for implementation services for the Chronic Care Information System (CCIS) in 2006. The Blueprint engages patients and their providers in a technology-assisted interactive manner to support healthy life styles and encourage preventive and effective care in the community setting. The Blueprint is a patient-centered initiative and relies on technology tools including centralized information systems, patient follow-up tools and evidence-based treatment guidelines, supported by health system organizations and public health. The CCIS is being deployed in 2007. At this same time, and as a result of the Consortium's capabilities to share information electronically realized through this project, Mt. Ascutney Hospital was awarded funding to participate as the pilot site for the CCIS project.[7]

A full test system was implemented to accommodate portal development activities that would not interfere with portal functionality already in use throughout the organization.

The consortium project team focused on the addition of user specified data elements to the portal, enhancements to Single Sign-on scripting that would initiate patient context searching in external systems, data feeds to the Vermont information data repository and Business Associates and Data use agreements necessary for the participation in the Blueprint CCIS activities. Scripting was also modified during this period to accommodate the HIS user logon screen re-mapping as a result of an applied software update. The DHMC system Single Sign-on scripting with patient context searching was implemented as scheduled during this period.

Phase three of the project, reserved for the identification of additional internal and external systems, was modified to incorporate the PACS system that went live in October 2007. Work to identify rules for data synchronization continued with a minimal set of demographic data identified as feasible to update automatically across systems. Data feeds to the Blueprint CCIS were initiated and tested to provide real-time Admit, Discharge, and Transfer data, along with patient lab results to the CCIS repository, as identified through the Blueprint project companion guide. This phase was also identified as the period to implement Secure Socket Layer security to enable web based access to the portal without the need for Virtual Private Network (VPN) connectivity.

In its 2008 report to the Vermont Legislature, VITL reported that the first data for the Vermont CCIS began flowing to the Vermont health information exchange in December 2007 from Mt. Ascutney Hospital, the first of six participants selected to participate.[8]

External labs processed through MayoNet were transmitted via modem and manually entered into the internal lab system to become part of the clinical record and for transmittal of the results to the EMR and the portal. During this period, Mt. Ascutney hospital assisted MayoNet with the transition from the manual modem transmit process to receiving results in a standard HL7 message format through the integration engine acquired through this project.

Evaluation

A significant list of metrics was developed to track the success of each phase of the project. The project team initially identified thirty outcomes that would indicate progress and project success. The metrics were however, such that it would become a project in itself to compile and analyze the data necessary to maintain them. The Health Information Technology Evaluation Toolkit was leveraged to identify and rank meaningful metrics key to the project's success, along with methods for acquiring sufficient data, and a process of analysis.[9] A significant number of previously identified metrics were vendor deliverables that became part of user acceptance testing criteria.

The goals of the evaluation are to measure the technological and human impacts and the business case of the systems integration and Clinical Portal solution. Key stakeholders for the purposes of this evaluation are identified as AHRQ, the three Consortium partners' Boards of Directors and their Institutional Review Boards, Healthcare Providers, and Patients.

Technological Impacts

- Data will be available from both the current and potential IT systems to be accessed.
- Data from all systems will be accurately displayed.
- Data in all systems will be accurately synchronized.
- Data in all systems will be synchronized and displayed in a timely manner.
- Data synchronized and displayed in the Clinical Portal will be the correct data for the needs of authorized providers and patients in the formation of an Electronic Health Record (EHR).
- Data will remain secure in legacy systems and will also be secure in the Clinical Portal solution. The single sign-on feature will translate to all legacy systems, to reduce the number of passwords to be managed by providers. Data will be easily available from remote locations and will remain secure in those locations and everywhere else it will be accessed and displayed.

Human Impacts

- Provider adoption
- Provider usability
- Quality of images (such as in radiology, for example)
- Provider satisfaction
- Patient satisfaction
- Reduced patient time in waiting room
- More provider/patient interaction
- Reductions of the number of adverse drug events, by having accurate medication and allergy information available at the point of care
- Decreased visit-cycle time

Business Case

- Reduction of duplications of patient registration in multiple systems during each visit
- Reduced provider time-on-task
- Reduction in travel by VRPA, the Consortium's remotely-located radiology partner
- Elimination of duplicate costs for multiple interfaces, including elimination of reliance on vendors to program and maintain interfaces
- Reduction in time-on-task to manually scan records from one system to another.
- Reduced delays in billing because of notes remaining uncompleted while awaiting additional documentation, such as scanned documents, radiology reports, laboratory and test results, advanced directives, etc.

From the above list, nine feasible metrics were chosen to indicate project progress and success, each of which was applied as necessary to each phase of the project.

First Measure

Goal. Selected data will be available in both internal and external IT systems that store patient data across the continuum of care and can be accessed, synchronized and displayed in the EHR Clinical Portal as part of the patient record. Measure: Data elements transferred via the interface engine as indicated by the rhapsody monitoring tool. This will be monitored by the rhapsody administrator weekly. Because the data sets are so small, there is no need to do random sampling to achieve a more valid statistical analysis.

Success Criteria. By the end of the project period, data transfer will reach a 100% level of reliability. Acquired data will be easily accessible and will make sense to authorized users.

Findings. Work-arounds identified early on were contributors to manual compilation of data as users interacted with the systems to provide only the minimum information necessary to accomplish their required tasks. The HIS was allowing the users the option of entering Medical Record Numbers, which in the realm of information sharing, would not allow for data matching unless a unique identifier is available. When the Medical Record Number field was forced, the Health Information Management department was generating them and distributing available numbers on a patient list to various registration locations throughout the organization. This resulted in mistakes causing duplicate numbers to be assigned to the same patient, or mis-keying of the record number. In some instances, data entry clerks would simply enter a single character to satisfy the required field entry. Because of the portal project, the HIS was re-configured to automatically generate a medical record number before the user could move past the data entry field. This is a significant achievement as information exchange activities progress.

Lab result data presented the greatest challenge in achieving one hundred percent matches between the internal lab information system and the portal. We used the LIS vendor transmittal log that maintained a record of all lab results sent out of the LIS system. This was used to compare against the receiving vendor database to verify the integration engine functionality. Common issues were the result of an external provider not configured to receive labs and mis-matches in the spelling of provider's names between internal systems. The integration engine allowed filters to programmatically adjust these data elements prior to passing them on to internal systems including the clinical data repository. One hundred percent match of data was achieved within the portal by the end of the third year of the project period.

To begin sharing lab data with external systems, internal lab dictionaries were mapped to Logical Observation Identifiers Names and Codes (LOINC) to accommodate the various custom lab dictionaries that would eventually share data from multiple systems throughout the State. Validation planning has been communicated as a need to VITL and VDH for the Statewide information exchange initiatives in progress.[10]

Second Measure

Goal. Data from other systems being accessed will be displayed accurately. Measure: Data will be validated from the back end repositories by comparing data sets from the legacy systems to the portal repository data sets. This is accomplished programmatically using unmatched query tools such as MS SQL. This will be done by the assigned programming resources for this project. Additionally, as part of User Acceptance Testing, scripts will be provided to designated end users to match the data from the originating systems to the data displayed within the portal. Because the data sets are so small, there is no need to do random sampling to achieve a more valid statistical analysis.

Success Criteria. For this testing to be considered accurate and complete there must be a 100% concordance between the legacy data and the portal data.

Findings. Prior to portal go-live, user acceptance test scripts were used to validate the accuracy of the data within the portal. There were four scripts developed and assigned to end users to verify data matches between the portal and the primary information systems providing data to it. The four scripts were customized to address the functional areas of administration, clerical, nursing, and physician user functionality. Defects were tracked and rated by severity with the highest priority defects comprising cause for go-live delays until defects were corrected.

In addition to the user test scripts, data match queries were used to compare record counts across systems to verify accuracy. These record sets were compared across databases and log files throughout the project period to verify data match within the portal. This validation continues on a monthly basis to ensure ongoing accuracy. One hundred percent concordance has been achieved with internal system data matching. The threshold for record matching was consistently measured at ninety two to ninety six percent based on the record match criteria. Records falling below that threshold are held in a queue within the integration engine and matched administratively before being send through the message stream. Records within the portal repositories are checked weekly and matched administratively to assign records to the correct master person index as needed for aggregation to the correct patient in the portal.

Third Measure

Goal. Data in all systems will be accurately synchronized. Measure Synchronized data = disparate system data and synchronized data = displayed data. At the end of the interfacing of each of the systems, selected test data sets will be altered and project personnel will review whether or not those data sets have been updated in each of the discreet systems. A weekly query of the data identified as changed in the legacy systems will be compared using an MS SQL unmatched query to identify discrepancies in the synchronization process. This will be done less frequently once 100% accuracy is achieved consistently.

Success Criteria. There must be 100% accuracy. If there is not 100% accuracy at each point of the testing the system will continue to be modified until it is reached.

Findings. One hundred percent of data synchronization was achieved within the portal data repositories for the required data elements as specified. Work continues to identify business and payer rules that would enable data synchronization for patient demographic and insurance data across other applications. An internal sub-committee was formed to identify implications of automatic updating of patient records in disparate systems. This work remains in progress.

Fourth Measure

Goal. Data synchronized and displayed in the Clinical Portal will be the correct data for the needs of the providers and patients in the formation of an Electronic Health Record (EHR). Measure: A preliminary survey to identify needed data elements will be distributed to 150 identified end users of the portal solution using Survey Monkey and paper formats. The survey will be a modification of a validated survey used by the Vermont Information Technology Leaders (VITL). The results of this survey will form the data elements displayed on the portal. A follow-up survey will be distributed to the respondents of the first survey. The selection on priorities will be compared to determine if the same data elements are requested.

Success Criteria. Return of 50% of the surveys will provide an appropriate sample. 75% concordance between the first survey and the second survey in preferred data elements will constitute success.

Findings. We designed a provider survey for distribution on April 1, 2006 consistent with our Evaluation Plan. This survey was used to identify portal display data. It is also designed to give us a sense of organization readiness and likelihood to adopt. We are using a subscription web service to distribute the report electronically. Paper copies have also been distributed for those that have not responded to the survey electronically. We achieved a fifty-two percent response rate for the survey. The initial feedback indicates that our user requirements relative to the functional design specifications are missing some preferred data. We have left the sign-off on these design specifications open with the vendor so we may include them in the portal design. While our survey response rate of fifty percent was exceeded by seven percent, ninety-eight percent of the primary clinical users of the portal have responded to the survey.

Fifth Measure

Goal. There will be an increase in problem list information accessed by authorized physicians using the new Clinical Portal system. Measure: Comparison of those authorized, but not using legacy systems, with those using the portal as obtained through the audit trails maintained in each of the systems. An audit trail for problem lists in HIS and EMR will be run prior to implementing the portal. An audit trail for problem lists in the portal will be run 6 months after implementation.

Success Criteria. There will be an increased number of authorized providers using the new Clinical Portal system and an increased total number of providers treating patients. There will be a 50% increase in accessing problem lists.

Sixth Measure

Goal. Adequate healthcare provider training in the use of the Clinical Portal's tools. Measures: A Likert type survey will be administered to those attending training one week after to determine their satisfaction, confidence in use of the system, ability to customize, and need for additional components. The survey will be designed by the project team and administered by the Clinical Informatics Facilitator assigned to the project. Survey Monkey and paper copy will be used.

Success Criteria. At least 50% will return a usable survey. Of those, 75% of the respondents will rate the benefits of the training in the 4-5 positive range on the Likert scale.

- Estimated Duration vs. Actual Duration
- Number of Attendees - Estimated vs. Actual
- Percent of Total Attended
- Percent of Estimated Attended

Findings. Training materials were developed that addressed each of the functional areas for how the portal would be used. As with the UAT scripts, training materials were customized to each of the user roles; portal administration, portal nurse, portal physician, consultant, and staff support. Twenty-four portal users were identified as potential power users or "train the trainer" staff. This role would be the point of contact for after-hours shifts throughout the hospital. The training was an advanced user class that targeted existing computer users serving this role with other software applications. There were three power user-training sessions held in August. Each session was two and a half hours. Twenty of the identified twenty-four staff attended power user training. These portal users also assisted with the execution of User Acceptance Testing. Administrator and End User training was accomplished between 10/2/06 and 10/13/06. Estimated classroom sessions were expected to be forty-five. One hundred and four end users were trained in thirty-eight classroom sessions during this time. Each session lasted one hour with a maximum class size of five attendees. The average class size was three attendees.

Previously estimated power user count was twenty-four attendees. This indicates that eighty three percent of identified power users attended advanced training. Estimated number of end users to be trained was two hundred. Actual attendance for end user training was one hundred and four, or fifty two percent of those expected. End users that did not attend training as expected were contacted and scheduled for the month of November. A post training survey was administered to attempt to determine the effectiveness of the training. Response rate was significantly low with only eight staff responding.

Seventh Measure

Goal. Provider usability. Measure: Data flow in the Clinical Portal will be configured to provider specifications. To determine provider usability, usability questions will be added to the Likert type survey administered to those attending training. The survey will be designed by the project team and administered by the Clinical Informatics Facilitator assigned to the project. Survey Monkey and paper copy will be used.

Success Criteria. At least 50% will return a usable survey. Of those, 75% of the respondents will rate the benefits of the training in the 4-5 positive range on the Likert scale.

Findings. Less than fifty percent return a useable survey. Also during this process, the assigned project staff left his employment with Mt. Ascutney thereby creating a gap in the ability to provide active follow through. Three months were lost in hiring a replacement, which caused the project to continue forward as scheduled given the project timelines and availability of vendor staff.

Accepted project metrics clearly indicate a level of success in the implementation of provider portal. User adoption remains challenging, however, it is unrealistic to expect every provider to immediately shift his or her work processes throughout long-term project implementation that is not considered a complete system until after the final year of the project. The portal has seen increased user access throughout the period and ongoing awareness activities serve to increase user adoption. Monthly newsletters are used to communicate benefits of and enhancements to the portal.

Early expectations focused on the front-end interface with Single Sign-on capabilities to provide the greatest “bang for the buck” for key stakeholders. In reality, the current value is on the back end where immediate cost saving have been realized through the implementation of an integration engine that reduces the cost of addition interface purchases by leveraging those already in place. It also provides value in enabling participation in external initiatives like the statewide Health Information Exchange and the Chronic Care Information System.

Eighth Measure

Goal. There will be the elimination of duplicate costs for multiple interfaces, including the elimination of reliance on vendors to program and maintain interfaces. Measure: A comparison will be made between the costs of the Orion interface engine and the estimated cost of individual vendor provided interfaces for legacy systems. Actual costs will be used, understanding that costs of personnel would make the total cost much higher.

Success Criteria. A savings of at least 15%. Cost reduction. Current interface programming from existing vendors for the HIS and the EMR average $16,000.00 for the sending and receiving ends of the interface. The MAHHC Emergency Department has requested a laboratory interface between the Laboratory Information System (LIS) and their ED application. Cost is estimated to be $10,500.00 on the LIS end and $35,000.00 for ED application programming. The estimated cost of the PACS Radiology Information System and its Demographic Interface programming is $25,000.00. Initial first-year savings from committed-to interfaces will be $86,500.00 by programming these interfaces with existing staff, using the vendor tools set provided for the project.

Findings. There were twenty-three communication routes required for various projects related to this one not counting the PACS project. At an average rate of eight thousand dollars for each end of a route, or communication point programmed by the vendors, this represents realized savings of approximately three hundred and sixty eight thousand dollars across the three-year project period. The PACS project required custom vendor programming in the HIS at a cost of sixty five thousand dollars. Actual savings through the leveraging of the integration engine is three hundred and three thousand dollars.

Ninth Measure

Goal. There will be reduced delays in billing, because of elimination of notes remaining uncompleted awaiting additional documentation, including scanned documents, radiology reports, advanced directives, etc. Measure: Delays in billing result from uncompleted notes. This has a negative impact on cash flow. Delays in note completion results from the time awaiting additional lab and/or test results, scanned documents, and/or radiology reports to be documented within patient visits. We will compare the average number of days to complete notes for billing pre-implementation vs. the average number of days to complete notes for billing post-implementation. A query of the difference between the visit date and the committed date for the visit documentation will be run to determine average number of days for billing prior to portal implementation. At a 6 month point following portal implementation the query will be run again to determine if the number of days to billing has decreased.

Success Criteria. Number of days to billing is decreased by at least one.

Findings. It was not possible to determine the impact to days to billing because of this project. At the end of the first year of the project, in October 2007, a billing module provided by the existing, HIS vendor was implemented to replace the clinical billing system, Medical Manager. Data cleanup resulting from the implementation last approximately three months thereby extending days to billing as the software was implemented. Numerous billing, coding, and transcription staff were added throughout 2007 and in 2008 the billing staff and departments were reorganized into work teams. While the statistics show Health Information Management (HIM) and transcription staff is active users of the portal, the reorganization is ongoing. Other external variables include changes to payer rules that also influence days to billing.

Results

Significant challenges and barriers exist in successfully implementing a solution such as this. At the forefront are the various payer and regulatory requirements for claims submissions and reporting. These challenges are compounded when patients have multiple payers, multiple prescriptions, and multiple provider encounters on a given day. Rules such as these require multiple systems to be in place thereby requiring manual retrieval of data for the qualified events, to then be compiled into electronic claims submissions. These rules are clear indicators of the need to adjust to a strategy of providing healthcare, as opposed to reactive tactical imposition of rules with which organizations must comply. The shift would be more in the realm of implementing information systems to support the work as opposed to having the systems drive the work.

State initiatives for health information exchange are taking a fragmented approach early on. The original plans to the Vermont Blueprint were to focus on patient information from Hospital Service Areas. The majority of patients in the New England region is transient and has encounters at multiple hospitals, consultant, and tertiary care centers within and outside of the state. The approach to Hospital Service Areas was removed as a requirement, and all hospital patient information was determined acceptable, pending patients opting in for information sharing. In Vermont however, the exchange will only accept and process information for Vermont residents. This has obvious implications for cross-border sharing as State projects mature across borders. This approach appears unnecessary, except for early manageability, given the capabilities of the currently available tools that enable information sharing.

User adoption is a key consideration for the success of HIT implementations. The existing impact on user adoption is the large number of information exchange activities and systems that providers will be expected to access and provide information to. In Vermont, in addition to the Blueprint CCIS project, there is also a statewide medication history project where information is provided by payers and pharmacies in a registry system. The CCIS will provide information on chronic disease patients for provider decision support. Internal systems require provider interaction to document care resulting form their patient encounters. These competing projects employ the same metrics for user adoption and maintain expectations that providers will access those systems. Providers wonder how they can be expected to interact with all of these systems during patient encounters. Worse, they wonder what, if any, implications there will be if they do not access a system where pertinent information resides and an adverse event could have been prevented if those systems were accessed.

The integration engine is an organizationally maintained utility that allows message development, transport, filtering, and tracking. When the basic legacy interfaces were initially routed through the engine, it eliminated any questions of where interface errors originated. The engine allows the identification and capture of errors within message feeds and can hold them until administratively corrected, or automatically correct them and continue their transmission. It also allows for the re-direction and re-formatting of existing feeds to be sent to additional receiving locations.

Strategically, throughout the project, the Mt. Ascutney Consortium presented to various alliance members and other interested parties. Contracting through DHA allowed alliance members to acquire the vendor products at a reduced rate. Numerous facilities leveraged this pricing and implemented the integration engine at their facilities. From a sustainability

perspective, the only ongoing cost to Mt. Ascutney hospital for the products implemented for this project is an annual support fee that can be purchased at the individual organization's discretion. For the first year following the project period, this was negotiated down because of the DHA contracting in which the terms of support cover all alliance organizations using the products, resulting in a savings of eleven thousand dollars to Mt. Ascutney Hospital and a reduced service and support fee of forty-six thousand dollars. This is significant because, as a perpetual license agreement in the purchase of the software tools, this fee can be eliminated when the portal development is reduced and services can be purchased only as needed to acquire updates and technical support.

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