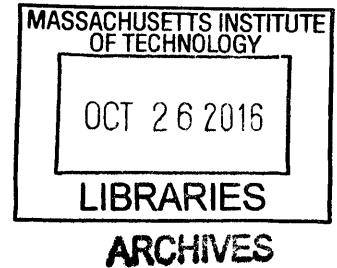


An Enterprise Architecture Evaluation of the Improving Massachusetts Post-Acute Care Transitions (IMPACT) Program

By

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Submitted to the System Design & Management Program in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Engineering and Management
at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
September 2014

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Abstract

The Post-Acute Care Transfer process is a critical area affecting the quality and safety of patient health care in the US¹. While many Post-Acute Care (PAC) centers are Electronic Health Record (EHR) -enabled, a large majority of these centers, such as nursing home and home care, are not set up for exchange of electronic health information. Regardless of EHR capabilities, there are currently no standards for health information transfer between PAC sites. The lack of standard and effective processes to collect and transfer critical patient health information during PAC transitions may be a critical component leading to issues with patient safety and quality during PAC Transitions. Additionally, issues resulting from Post-Acute care transitions (PAC transitions) are implicated as critical drivers for health care utilization in the US (2012 Medicare Chart Book).

Funded by an Office of the National Coordinator Health Information Exchange challenge grant, Improving Massachusetts Post-Acute Care Transfers (IMPACT) is an innovative project managed by the Massachusetts eHealth Institute (MeHI) that will improve care transitions to and from post-acute care organizations in Massachusetts through the automation of a new Universal Transfer Form UTF for PAC transitions. Additional technical work includes creation of the Local Area Network Device (LAND) & Surrogate Electronic Environment (SEE) platforms, which together allow long-term care providers to send and receive patient information electronically through the Massachusetts HIway. MeHI is a SDE and recipient of American Recovery and Reinvestment Act (ARRA)/Health Information Technology for Economic and Clinical Health (HITECH) federal funds to create an HIE infrastructure in Massachusetts. MeHI seeks a thorough program evaluation of the IMPACT program. Due to the complex organizational, political, and technological architecture associated with the Post-Acute Care transitions and the interface between LAND & SEE and the HIway, a systems perspective is needed to

¹ Snow, V., et al. 2009. "Transitions of Care Consensus Policy Statement: American College of Physicians, Society of General Internal Medicine, Society of Hospital Medicine, American Geriatrics Society, American College of Emergency Physicians, and Society for Academic Emergency Medicine." *Journal of General Internal Medicine* 24(8): 971-6.

accurately evaluate and provide recommendations to meet the needs of the program.

The following describes the current state assessment for both 2012 and 2013 IMPACT program following the Enterprise Strategic Analysis for Transformation (ESAT) and Enterprise Architecting (EA) methodologies developed out of MIT's Sociotechnical Systems Research Center. Additionally, consideration is given to a future state assessment, which is the ideal set of future state goal derived through a visioning workshop with key stakeholders.

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Professor of the Practice of Aeronautics and Astronautics and Engineering Systems

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Additionally, I want to thank my parents for always encouraging me to push beyond conventional limits. My ability to carry a diverse heavy load of work and excel at all I pursue is an ideal you instilled in me in my youth, though it took longer than come to fruition than you may have expected. Thank you.

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List of Abbreviations

PAC: Post-Acute Care

EHR: Electronic Health Record

ONC: Office of the National Coordinator

HIE: Health Information Exchange

MeHI: Massachusetts e-Health Institute

UTF: Universal Transfer Form

LAND: Local Area Network Adapter, an IMPACT product

SEE: Surrogate Electronic Environment, an IMPACT product

SDE: State Designated Entity

ARRA: American Recovery & Reinvestment Act

HITECH: Health Information Technology for Economic and Clinical Health Act

Mass HIway: Massachusetts Health Information highway

ESAT: Enterprise Strategic Analysis for Transformation

EA: Enterprise Architecting

MIT: Massachusetts Institute of Technology

IMPACT: Improving Massachusetts Post Acute Care Transitions

EOHHS: Massachusetts Executive Office of Health & Human Services

EMT: Emergency Medical Technician

LTPAC: Long Term Post Acute Care

CCD: Continuity of Care Document

SSRC: MIT Sociotechnical Systems Research Center

SW: Software

CMS: Center for Medicare and Medicaid

1 Introduction

Massachusetts has a long history developing standards for PAC Transitions. Over the last twenty years, the older patient care referral form (also known as the page 1, 2, and 3), a 3-page transfer form, was replaced by the Universal Transfer Form (UTF), an 8-page paper transfer form with over 100 individual data elements. The transition to the UTF occurred in response to the growing number of different health care sites developing in the Massachusetts healthcare community. Although the UTF was a far more comprehensive form than the page 1, 2, and 3, there was a general reluctance to frequently use the form, as the form included far more data elements to be completed than was generally required for a single PAC transition (L. Garber, personal communication, November 18, 2013).

Funded by the ONC State Health Information Exchange Challenge Grant Program, the IMPACT program, better known as the Improving Massachusetts Post-Acute Care Transitions program, is a collaborative effort between the Massachusetts Executive Office of Health & Human Services (EOHHS) and the Massachusetts eHealth Institute (MeHI) to deploy a secure method for multiple PAC sites to access the Mass HIE platform (the Mass HIway) to facilitate the transfer of a standardized PAC health information data set. In this partnership, MeHI leads the IMPACT program with sub-contracts to the Principle Investigators, Dr. Larry Garber and Dr. Terrence O'Malley, who lead the infrastructure development and program evaluation/metrics, respectively.

Specifically, the mission of the IMPACT Program is to develop a more effective data set for PAC transitions and architect an electronic solution for PAC transitions, ultimately demonstrating measurable improvements in care quality and health care costs. This solution was developed through the creation of a Learning Collaborative of multiple PAC transitions sites in the Worcester county area of Massachusetts. Through the Learning Collaborative, multiple different PAC

transitions sites, including Emergency Departments, EMTs, skilled nursing facilities, home care agencies, hospices, LTPAC, and rehab centers participated in creation of a novel transfer form (CCD+) that included the critical data elements required for safe and effective transitions of care in their respective organizations. A paper -based process was piloted to determine how well this solution could fit into the current workflow. Thereafter this paper form will be developed in two electronic architectures, the LAND and SEE Platforms. LAND is an interface engine that allows proprietary EHRs to transmit direct messages between PAC transitions (and other) sites through the Mass HIE, and therefore is a technical solution for sites that have sophisticated EHRs in place. SEE is an electronic secure web-based solution for PAC transitions sites that do not have access to sophisticated EHR technology. This technology allows the user to receive and send direct messages through the Mass HIE through a webmail service that has capabilities to handle view and manipulate the novel IMPACT electronic transfer form. In 2013, LAND went live and SEE was under development.

Due to the complex organizational, political and technological architecture associated with the IMPACT program, a systems perspective is applied to accurately evaluate and provide recommendations to meet the needs set forth in Challenge grant proposal. The main priority areas for evaluation of this program include:

- Enable nursing homes, home health agencies, and other long-term care facilities to participate in regional and statewide Health Information Exchange
- Improve the speed, efficiency, and satisfaction of processes to provide essential clinical data during transitions of care
- Decrease avoidable emergency room visits, hospital admissions, and hospital readmissions
- Reduce unnecessary tests and treatments
- Reduce the total cost of care
- Ability to replicate this model in other communities

2 Approach

To perform a robust and comprehensive program evaluation of the IMPACT Program, our goal is to use 1) the MIT Enterprise Strategic Analysis for Transformation (ESAT) methodology and 2) Enterprise Architecting (EA) methodologies developed out of MIT's Sociotechnical Systems Research Center (SSRC).

2.1 ESAT framework

ESAT is an integrated, analytical framework for diagnosing and improving overall enterprise performance. ESAT focuses on an understanding of the enterprise value streams, value flow between key stakeholders and the enterprise, and interactions within and across the enterprise. It also allows for the identification of enterprise “wastes” (a term used frequently in lean thinking to identify non-value added activities in an enterprise), which will then allow us to identify potential areas for improvement. MIT's ESAT framework provides enterprise stakeholders, such as Mass Tech and MeHI leadership, with a management tool that will help them understand their enterprise and create an actionable vision for the future, which will allow them to act upon the recommendations set forth from the deliverables associated with this evaluation plan.

Figure 1 below highlights the ESAT roadmap. Because this program evaluation only lasted for approximately 5 months, we focused our efforts on the strategic and planning cycles, and adapted our framework slightly to accommodate the shorter timeframe. Therefore, for the purpose of the IMPACT evaluation, the methodology will focus on the following five cycles shown below. Appendix A maps each task to a cycle.

- Strategy cycle (tasks S1 - S4)
- Planning cycle (tasks P1 – P9)
- Current state assessment cycle (tasks C1-C8)
- Future state vision and recommendations cycle (F1 – F3)

- Report generation and execution cycle (R1 – R8)

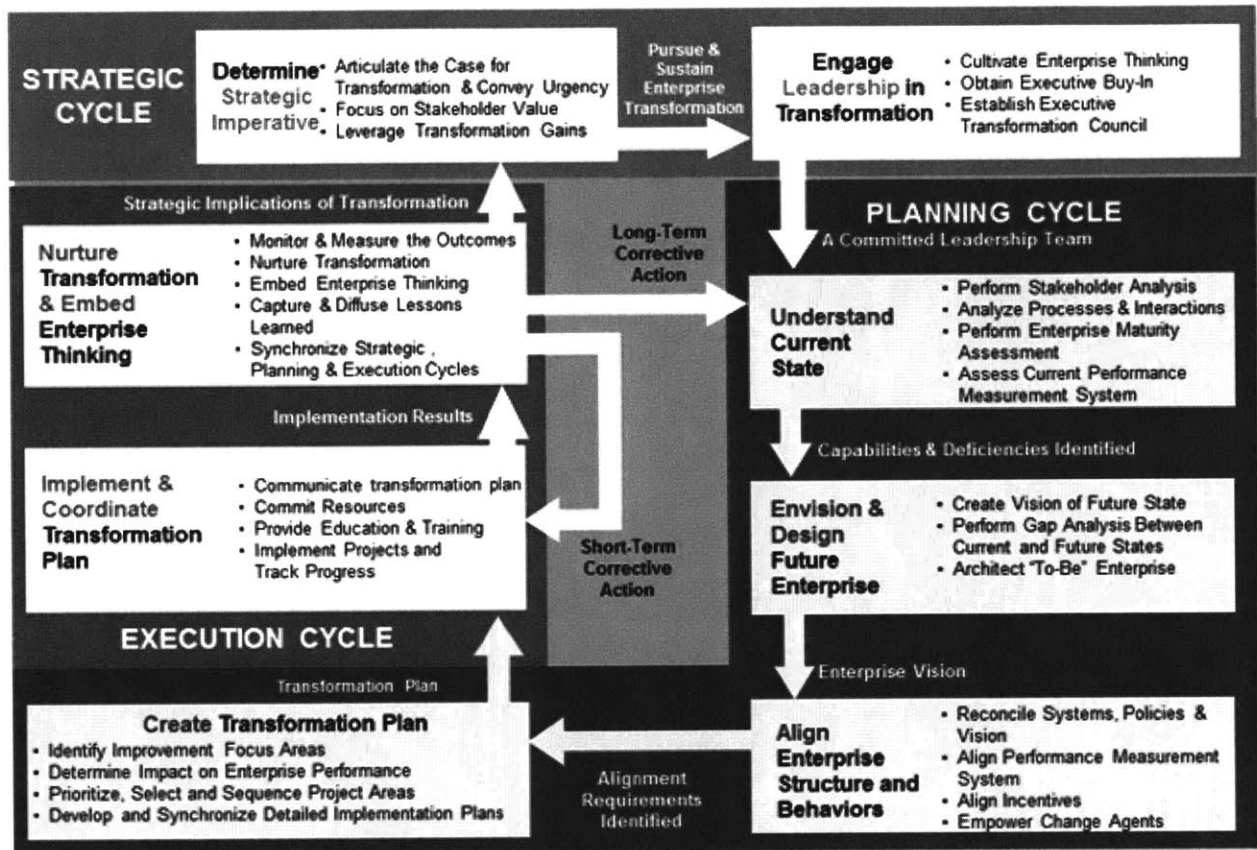


Figure 1: ESAT Enterprise Transformation Roadmap²

2.2 EA framework

To further supplement the ESAT methodology and perform an effective program evaluation, it is critical to take a holistic approach to understanding the current or 'as-is' enterprise using the Enterprise Architecting methodology (EA). The holistic EA approach goes beyond a process-centric or information technology-centric perspective. MeHI leadership needs to be able to see the entire enterprise to effectively envision the path for change and recommendations for moving forward to further improve and encourage adoption of IMPACT.

² Nightingale D.J. and Srinivasan, J., (2011) Beyond the Lean Revolution. New York, NY. AMACOM

To develop recommendations as part of the program evaluation, we will explore IMPACT in the five cycles listed above through 10 fundamental enterprise architecting (EA) elements and their interrelationships described in Table 2 below. Specifically, these elements include ecosystem, stakeholders, strategy, policy, services, processes, information, infrastructure, organization, and knowledge. These elements offer a perspective on the enterprise that helps manage complexity by isolating unique areas of focus to understand the enterprise as a whole. Table 2 below identifies 1) the cycle from the ESAT framework during which each element is analyzed and 2) outlines which tasks from Appendix A correspond to that element. Based on the ESAT and Enterprise Architecting methodologies described above, the goal is to execute on the task-oriented work plan shown in Appendix A.

Table 1: EA Elements (Nightingale and Rhodes, 2012)

Elements	Definition	Cycle	Tasks Associated with Element (as outlined in Appendix A)
Ecosystem	The exogenous element that is characterized by the external regulatory, political, economic, and societal environment in which the enterprise operates and competes/cooperates with other related enterprises	Strategy cycle	S1-S4
Stakeholders	Enterprise stakeholders are individuals or groups who contribute to, benefit from,	Planning cycle	P1 - P4

Elements	Definition	Cycle	Tasks Associated with Element (as outlined in Appendix A)
	and/or are affected by the enterprise		
Strategy	The vision, strategic, goals and enterprise level metrics	Current state assessment cycle	S1, S4, C1-C2
Policy	The regulatory, political and societal environments in which the enterprise operates	Current state assessment cycle	C1-C2
Services	The offerings derived from enterprise knowledge, skills, and competencies that deliver value to stakeholders	Current state assessment cycle	C6
Processes	Leadership, lifecycle and enabling processes by which the enterprise creates value for its stakeholders	Current state assessment cycle	C6
Information	Information is what flows throughout the enterprise, as required to perform the enterprise's mission and operate effectively. Information relates to all aspects of the enterprise,	Current state assessment cycle	C3-C4

Elements	Definition	Cycle	Tasks Associated with Element (as outlined in Appendix A)
	from administrative and financial, to product and service data, to personnel data.		
Infrastructure	Systems and information technology, communications, technology and physical facilities that enable enterprise performance	Current state assessment cycle	C7
Organization	The culture, organizational structure and underlying social network of the enterprise	Current state assessment cycle	C8
Knowledge	The competencies and explicit and tacit knowledge resident in the enterprise	Current state assessment cycle	C8

2.3 Evaluation Methods

2.3.1 Study Design

Based on the frameworks described in the previous section, the study was supplemented with qualitative social science tools (interviews and observations via site visits). See Appendix A for the project plan associated with the IMPACT evaluation. At a high level, we will use qualitative methods and tools across the program evaluation using the ESAT and EA frameworks. Qualitative methods will

include semi-structured interviews of stakeholder groups 1-4 listed below based on two published methodologies, which include Harrell *et al*³ (semi-structured interviews and focus groups, 2009) and Van de Ven⁴ (Engaged Scholarships methodologies, 2011)

2.3.2 Study Population

For the program evaluation, the populations under study are the stakeholders recommended by MeHI. The inclusion criterion for these stakeholders is that they are either invested in or affected by the program. The stakeholders were divided into 2 major groups, described below in Tables 3 and 4:

Table 2: IMPACT Pilot Site Stakeholders

Contact	Stakeholder
Administrator	Beaumont Rehab & Skilled Nursing Center - Westborough
Assistant Director of Nursing	Christopher House of Worcester
Director Case Manager	Fairlawn Rehabilitation Hospital
Director of Technology	Family Health Center of Worcester
Quality Improvement Coordinator	Holy Trinity Nursing and Rehabilitation Center
Administrator	Jewish Healthcare Center
CEO	Kindred Parkview
Director of Nursing	Life Care Center of Auburn
Clinical Liaison	Millbury Healthcare Center

³ Harrell, M. C., Bradley, M., Rand Corporation., & National Defense Research Institute (U.S.). (2009). *Data collection methods: Semi-structured interviews and focus groups*. Santa Monica, CA: RAND

⁴ Van de Ven, A. (2011) *Engaged Scholarship: Stepping Out*. Business Strategy Review, Vol. 22, Issue 2, pp. 43-45.

Director of Social Services and Assistant Administrator	Notre Dame Long Term Care Center
Administrator	Overlook VNA
Administrator	Radius Healthcare Center at Worcester
Director of Case Management	Saint Vincent Hospital
Director, Clinical Informatics	UMass Memorial Medical Center
CIO	VNA Care Network

Table 3: IMPACT Principle Investigator Stakeholders

Contact	Stakeholder
Medical Director for Informatics	Reliant Medical Group
Medical Director, Non-Acute Care Services	Partners Healthcare

2.3.3 Performance Metrics

Key Performance metrics shall include the following based on the MeHI proposal:

Table 4: IMPACT Qualitative & Quantitative Performance Metrics

Type of Metric	Metric
Qualitative	Enable nursing homes, home health agencies, and other long-term care facilities to participate in regional and statewide Health Information Exchange
Quantitative	Improve the speed, efficiency, and satisfaction of processes to provide essential clinical data during transitions of care
Quantitative	Decrease avoidable emergency room visits, hospital admissions,

	and hospital readmissions
Quantitative/ Qualitative	Reduce unnecessary tests and treatments
Quantitative	Reduce the total cost of care
Qualitative	Ability to replicate this model in other communities

2.3.4 Data Sources & Collection Methods

Multiple IMPACT pilot sites and non-pilot site stakeholders were deemed critical and were interviewed to gather stakeholder feedback on the IMPACT program for the current state assessment. Specific attention was given to gathering inputs on IMPACT key performance metrics from the perspective of the 10 fundamental enterprise elements and their interrelationships described in the ESAT and EA framework. Interview guides were created and standardized prior to execution of interviews with close consultation of the entire SSRC evaluation team. The following table exhibits the IMPACT interview guide in relation to the 10 EA elements.

Table 5: IMPACT Stakeholder Interview Guide - Bridging EA to IMPACT

EA View	Interview Questions
Strategy/Policy	<ol style="list-style-type: none"> 1. What is the mission and vision of the IMPACT program? 2. Who are the stakeholders of the IMPACT program? <ol style="list-style-type: none"> a. Needs, unmet needs? 3. What metrics are used to evaluate the IMPACT enterprise system? 4. How many nodes are currently participating in the IMPACT program? <ol style="list-style-type: none"> a. SW vendor b. Medical practice vendors c. Payer vendors? etc 5. What strategic initiatives/conditions directly affect post-acute care transitions? And adoption of IMPACT? 6. What policies are in place to support your organizational aims? What policies govern PAC transitions?

EA View	Interview Questions
	<ol style="list-style-type: none"> 7. How well does your org follow these policies (if pilot site)? 8. What stakeholder is the owner ensuring that policies are upheld through execution of the IMPACT program?
Infrastructure	<ol style="list-style-type: none"> 1. Can you please describe your organizational makeup? 2. Can you please describe any systems/resources/communications technology/facilities in place to facilitate your work? 3. What are some barriers to connecting sites through the IMPACT program? 4. What is the technical architecture of the IMPACT LAND/platform?
Processes	<ol style="list-style-type: none"> 1. Can you explain the process prior to the IMPACT project commencing for post-acute care transfers? 2. How does IMPACT process fit into current workflow? 3. How does patient consenting process work? 4. Can you explain the process after the IMPACT project commencing for PAC transitions?
Products	<ol style="list-style-type: none"> 1. What products do you generally use in the process of post-acute care transitions (i.e. laptops, phones, etc)? 2. If a magical product existed to make your work/ PAC transitions in your work easier, what would this product magically do (transmit info, provide info, etc)?
Services	<ol style="list-style-type: none"> 1. What services are currently in place in your organization to support your products (IT support, planned maintenance of equipment, HR processes for onboarding new employees, etc)? 2. If a magical service existed to make your work/PAC transitions in your work easier, what would this service magically do (transmit info, provide info, etc)?
Knowledge	<ol style="list-style-type: none"> 1. What core competencies/roles are part of your organization (in-house)? 2. What key competencies are outsourced?
Information	<ol style="list-style-type: none"> 1. What are the types of information that you require in your organization to effectively operate (generally & in the context of PAC transitions)?
Organization	<ol style="list-style-type: none"> 1. How would you describe the culture of your organization? Before and after IMPACT commenced? 2. What are major external/internal stakeholders of your

EA View	Interview Questions
	<p>organization? Are they involved in decision-making or are they simply impacted by decisions?</p> <p>3. Who are the program champions in your org?</p> <p>4. Who uses or will use the LAND/SEE platforms offered at your site by the IMPACT program?</p> <p>5. How are knowledge at best practices shared within your org?</p> <p>6. What are the organizational interfaces and gaps across the network of stakeholders engaged within IMPACT?</p> <p>7. How well do you think your organization has adapted to new technologies in health care?</p>

2.3.5 Data Analysis

The collected data is organized based on the Enterprise Architecting (EA) framework, with key concepts and indicators related to the 10 EA elements shown in Table 5. In addition, the data analysis took place mainly during tasks F1-F3 and R1-R8, which are outlined in Appendix A. The analysis is holistic, going beyond a process-centric or information technology-centric perspective. It provides an enterprise wide view for the MeHI leadership to effectively envision the path for change and recommendations for moving forward to further improve and encourage adoption of IMPACT. Data analysis methods of stakeholder interviews includes the following:

- Current State Analysis for the IMPACT program in 2012 and 2013
- An Assessment of approaches and strategies used to facilitate and expand health information exchange (HIE). Interview transcripts are assessed and categorized according the themes via qualitative methods.
- Conditions supporting and hindering implementation of strategies use to facilitate and expand health information exchange. Enablers and challenges to the IMPACT program were enumerated and mapped to EA view elements.
- An assessment of HIE performance in each of the IMPACT key program priority areas. To assess HIE performance in the key program priority areas, milestones, as well as their anticipated and actual completion dates were

examined. Additionally an X-matrix analysis is offered, which links stakeholder values with strategic objectives, enterprise processes, and metrics to analyze HIE performance in each of the key program priority areas.

- Future State Analysis: An assessment that expresses the process, organization, and strategy for the stakeholder vision to move from the current to the future state.

3 Current State Evaluation

Prior to developing a future state vision and embarking on plans to achieve the vision, it is important to assess the current state of the IMPACT project. At the time of evaluation initiation the current state included work accomplished in 2012 and 2013. The current state evaluations across 2012 and 2013 focused on and completed several critical tasks as follows:

Table 6: Current State Evaluation Critical Tasks

Task Number	Task
1	Interviewed the eligible participants, adopters and other stakeholders involved with the IMPACT program
2	Analyzed the results of the interviews.
3	Identified the lessons learned from these results.
4	<p>Provided recommendations to support the success of the IMPACT program in</p> <ul style="list-style-type: none"> ▪ Enabling nursing homes, home health agencies, and other long-term care facilities to participate in regional and statewide Health Information Exchange ▪ Improving the speed, efficiency, and satisfaction of processes to provide essential clinical data during transitions of care ▪ Decreasing avoidable emergency room visits, hospital admissions, and hospital readmissions ▪ Reducing unnecessary tests and treatments ▪ Reducing the total cost of care ▪ The ability to replicate this model in other communities

3.1 2012 Current State

In 2012, Key enablers and mitigations strategies included the creation of the IMPACT learning collaborative to develop the IMPACT data set, which a cross-pilot site vetted. This was a necessary and sufficient health information data set required for effective PAC transitions. Additionally, the learning collaborative was essential in developing the product requirements for the LAND & SEE platforms, which are electronic systems that allow PAC sites to transfer health information through the Massachusetts Health Information Exchange (Mass HIE).

Through the stakeholder interview process, a comprehensive list of enablers and challenges to the IMPACT program was developed. Additionally, stakeholder interviews were thematically analyzed to extract key needs and issues among PAC transitions in the HIE ecosystem. Furthermore, Enterprise Architecting (EA) tools were used to understand the relationships between IMPACT program metrics, key 2012 processes, strategic objectives and stakeholder values.

IMPACT strategies to improve quality of PAC transitions and reduce healthcare system utilization costs are well aligned with stakeholder values. Key processes for 2012 supported the overall program goals. Questions that will need to be addressed include whether HIE processes developed through the LAND & SEE architecture in IMPACT are sustainable upon completion of ONC grant funding. Additionally, an open question remains as to whether implementing the IMPACT electronic processes and employment of the IMPACT data set in PAC transitions yields a significant increase in care quality, reductions in adverse events, reductions in avoidable hospitalizations, and ultimately decreased healthcare utilization. These issues will be addressed only after the IMPACT program goes “live,” in 2014 and thereafter.

According to the 2012 IMPACT program progress, a key lesson learned is that the learning collaborative model is sustainable for architecting better solutions for patient care. Additionally, while it is imperative to coordinate with the national

standards organizations in development of a new patient care HIE standard for PAC transitions, coordination of this activity will be lengthy and requisite time should be allotted for these tasks.

Recommendations for the future of the IMPACT program include potentially setting up a legal version of the learning collaborative for similar work-streams. Just as the development of a new standard and electronic system for facilitation of the new standard through the Mass HIE required a cross-site collaborative workgroup, the legal framework surrounding such a novel endeavor may be more effective through a simultaneous collaborative workgroup. This may mitigate delays due to contract execution with multiple pilot sites and development vendors.

3.1.1 Approaches and strategies used to facilitate and expand health information exchange

The IMPACT program was developed in response to a need to standardize, increase efficiency, improve patient care, and reduce healthcare system utilization in PAC transitions. The PIs along with MEHI approached this complex system issue in a novel way. Through the creation and utilization of a Learning Collaborative, which included key stakeholders that represented the major types of PAC sites, a health information data set was compiled in support of new standards in PAC. This data set was made accessible to sites through the LAND & SEE platforms. In the following section, the 2012 key IMPACT processes have been assessed through thematic analysis of stakeholder interviews. As discussed in the previous “approach” section, we used the EA views to break down complexity of the system across priority areas. The following results comprise major themes extracted from stakeholder interviews that relate to key priority areas divided by EA views.

3.1.1.1 Strategy and Policy

All stakeholders interviewed agree that the mission and vision of the IMPACT program is to ensure that all participants (including PAC transitions sites) in the health care system can communicate efficiently, in a timely manner, and with the necessary information is to improve healthcare delivery and outcomes and to

reduce healthcare costs. Additionally, a theme that was expressed among all stakeholders was the unmet need for a standardized set of transfer data that PAC transitions sites could use in an efficient manner that was interoperable with their current processes. Therefore, it stands that the mission of the IMPACT program and the unmet needs are exceptionally well matched.

The 2012 subset of IMPACT goals included formation of the learning collaborative to develop and validate the CCD+ IMPACT data elements for a new standard in PAC transitions. Additionally, through this and the collaborative analysis of the 2012 PAC transition process at the Learning Collaborative sessions, the technical requirements for the LAND & SEE infrastructure would be developed thereby allowing the contract finalization with software development vendors for these platforms. Furthermore, in line with the program goals to show a reduction in healthcare utilization by using the IMPACT processes, an additional 2012 goal included completion of the framework to gather pilot site claims data in real time and track costs and avoidable hospitalizations in the context of PAC transitions.

Another theme that emerged from the PI stakeholder interviews, referred to indirectly during the pilot site interview, was the need for metrics to assess how well the IMPACT program is meeting the goals for the program. A discussion of how well the IMPACT program metrics are suited to assess the program goals is offered in the X-matrix analysis section of this report. Developing a process to gather the data to assess these metrics was a key process in 2012. This involves real-time assessment of claims data for the PAC transitions to and between the IMPACT pilot sites, which enables an assessment of health-care utilization costs, 30 day readmission rates, avoidable hospitalizations and ED visits due to problems with PAC.

One key issue that emerged associated with the strategic initiatives/conditions that affect HIE in PAC transitions is that there are no subsidies or incentives for PAC transitions sites to connect to each other through HIE. Unlike

hospitals and physicians practices that stand to gain financially from certifying to CMS Meaningful Use Requirements, PAC sites cannot use fiscal gains as a justification for adopting HIE practices to ensure better patient care. However, since hospitals and physician practices are stakeholders in PAC transitions with other PAC sites, they stand to gain from showing that HIE through EHRs meaningfully improves patient care. It is important that other PAC transitions sites be able to show meaningful improvement of patient care through electronic HIE processes. Similarly, CMS has introduced Medicare reimbursement reduction penalties for hospitals and physicians organizations that do not meet 30 day re-admission rat requirements. Therefore it stands that PAC transitions sites involved in transitions with these hospitals need not only a method to improve the safety and quality of their transitions, but also a method to show hospitals and physicians organizations that they offer better patient care during transitions than competitors. Thus hospitals and physicians organizations will be better able to meet the 30 day re-admission criteria if they select better quality of care PAC transitions sites.

Furthermore, the recent emergence of risk sharing and capitation in healthcare has encouraged healthcare providers to uncover means to reduce the cost of healthcare. While much of this has focused on preventative medicine practices, the healthcare processes are opportune areas of analysis for overall cost reduction. An analysis of all Medicare claims in 2010 indicates that patients with the greatest number of chronic conditions (six or more) are approximately 14% of the entire Medicare population. These patients used PAC services 41% of the time during the year compared to 3% in patient populations that had between one and five chronic conditions. Additionally, two-thirds of the six or more chronic condition group was hospitalized during 2010 and one-third those patients were hospitalized three or more times. Overall, these patients accounted for 47% of the Medicare spend and accounted for 70% of the within 30 day readmissions⁵. This

⁵ Cubanski J. et al. Medicare Chartbook. Fourth Edition. Henry J Kaiser Family Foundation

information implicates PAC as a critical driver to the overall healthcare cost, which indicates that it is likely an opportunity for process improvement.

3.1.1.2 Process

The key theme that surfaced associated with process included the fact that all PAC transitions sites have their own process. Each PAC transitions site has their own transfer form that is used when they transition a patient, and this form could be 2-40 pages with essential information conveyed in no systematic way. Moreover, in the current process, the senders determine what information is sent to the receivers without regard for what the information the receivers require. Additionally, often receivers are not given contact information for the sender of the transition data, and so it becomes very challenging to collect missing data required upon transitioning a patient. This process confuses the PAC transitions receiver since the receiver has no efficient way to track down all the information required by the receiver organization to offer quality and safe patient care. Even further, this precludes the PAC transitions receiver from obtaining the information required for billing and medication orders.

To mitigate this process issue, a key activity in 2012 was development of and recurring meetings with the Learning Collaborative, which is a collection of key members from each of the IMPACT pilot sites. During the learning collaborative meetings, different sites were able to inform each other of the additional information not being sent by PAC transitions senders and the reasons for why this information was essential for effective and quality PAC transitions. The Learning Collaborative was critical in determining the IMPACT data set, which is aligned with the program objective of developing new PAC transfer standards. Additionally, the IMPACT Learning Collaborative was essential to comprehending how to create an electronic standard and process that could easily interface with existing PAC processes.

3.1.1.3 Organization

Major themes on the subject of organization includes identifying the primary internal and external stakeholders of the IMPACT project in each organization, identifying the IMPACT users in the pilot site organizations, sharing of knowledge or best practices between pilot site organizations, and the PAC transitions sites adaption to new technologies in health care.

In the PI stakeholder organizations, the main stakeholders are the primary investigators involved in the administration of the IMPACT program. The separation of administrative function is such that Dr. Larry Garber handles the technical architecture interfaces and Dr. Terence O'Malley manages program metrics and evaluation of the IMPACT program. Primary external stakeholders for the primary investigators are the fourteen-sixteen pilot sites involved in the IMPACT pilot program and Learning Collaborative. Additional external stakeholders for the IMPACT PI's include EOHHS and ONC. For the IMPACT pilot sites, primary internal stakeholders include the healthcare providers who receive or transmit patient medical information related to PAC transitions. These specific internal stakeholders include skilled nursing staff, physicians, EMTs, social workers, caseworkers, and other PAC administrators who exhibit varying levels of technical competencies. It should be noted that due to the varying levels of technological sophistication in the PAC sites, adaptation to new technologies in healthcare is not uniform among the sites. While some skilled nursing facilities may use EHRs, others, and other pilot site variants, may use electronic systems solely for billing and medication tracking, and some may be completely paper based with additional information garnered through telephone calls and fax. Primary external stakeholders for pilot sites include all the other pilot sites that receive information from one another during PAC transitions.

An important recurring theme is that prior to the IMPACT program learning collaborative, standard methods of exchanging best practices between PAC sites did not exist. One should note that many of these PAC sites are competing with one

another and therefore collaboration to develop optimal standards was unlikely without the emergence of the IMPACT program Learning Collaborative in 2012.

3.1.1.4 Knowledge

The knowledge most pertinent to the IMPACT program involves health IT, or health Information Technology, competencies. Approximately half the pilot sites have in-house health IT resources and the remainder out-source those competencies. However, even with the in-house IT resources, multiple pilot sites are not EHR-enabled or have the expertise to communicate securely with other sites electronically.

3.1.1.5 Information

Major themes that emerged in the information domain include the development of the data elements list for the IMPACT data set used in IMPACT PAC transitions in 2012. While the previously offered paper UTF was comprehensive, it was unwieldy and this resulted in challenges to adoption of the UTF standard in PAC transitions. Therefore, through the learning collaborative, the most important transitions of care were identified. Thereafter, the critical pieces of information required for successful PAC transitions, or which yield better patient care and alignment with transition-specific pilot site regulations and billing were enumerated, and this list of 350 elements was sent out to 1200 PAC stakeholders statewide for input on how essential these data were to PAC transitions. Through this process five (5) separate data sets were constructed that represented 60 of the most critical PAC transitions. Thereafter, in accordance with the goals of the IMPACT program, the data element information required a standardized electronic format, which drives the 2012 development of the LAND & SEE platforms.

Additionally in 2012 and in close consultation with ONC, longitudinal coordination of care program, the LTPAC work groups, and the S&I framework, the IMPACT data set was developed for submission as a new set HL7 standards governing PAC transitions. These standards will be required for meaningful use

Stage 3 certification, such that any new EHR will need to be able to receive and transmit these elements as part of certification.

3.1.1.6 Product/Services

Typical products and services in the current state of PAC transitions in 2012 include the following:

- **Proprietary paper-based transition forms:** Most sites have their own transition forms with specific sets of data elements required to be completed and transferred at the time of patient transition. None of these different forms has the same format or same information.
- **EHR:** Some of the more sophisticated PAC sites are EHR-enabled, but the majority of sites (e.g. skilled nursing facilities) are not enabled for this product/service. As previously mentioned, much of this is due to lack of incentives for PAC sites to transition to electronic health records. The SEE infrastructure is planned as a bridge to HIE for sites that are not EHR-enabled.
- **Phone:** for the sites without sophisticated electronic records, and even for many sites with EHRs, telephones are important communication devices to obtain important and missing health information during a patient transition. The phone is useful inasmuch as the transition form includes the contact information of the sender and it is relatively easy to contact a person at the sender's phone number.
- **Email:** Another product/service that is used in PAC transitions is email exchange of patient health information. Since currently most people have email access at their workplace, this is an effective form of medical information communication; however, there are critical concerns regarding the security of general email servers for the transfer of confidential patient health information. Also, according to an IMPACT PI, some of the skilled staff at PAC sites do not frequently check email and could miss important information for patient transitions.

- **FAX:** Fax machines are used for patient health information transitions in less electronically sophisticated sites. Fax limitations are similar to the paper-based forms in that the data transferred may not be what is required at the receiving site and the formats or the forms could be confusing to the receiver site. However, there are advantages since the information is transmitted via Fax it is less likely to be lost in transition as compared to wholly paper-based systems.
- **Electronic billing systems:** Many sites use electronic billing systems to communicate patient billing and reimbursement to payers. The incentive to switch to electronic methods for billing systems is greater efficiency and less error in collecting medical bills, which benefits the revenues for the sites.
- **Electronic Pharmacy systems:** Multiple sites use electronic pharmacy/medication systems to track administration of and order medications for their patients.

3.1.2 Conditions supporting and hindering implementation of strategies used to facilitate and expand health information exchange

In the section above, strategies for the facilitation and expansion of HIE in IMPACT were examined through the EA views. In this section, these strategies are further examined to identify major enablers and challenges to 2012 IMPACT goals.

The IMPACT program faced several enablers and challenges due to policies, organization, technological architecture, procedures, and processes associated with the PAC ecosystem. Many of the PAC ecosystem challenges were considered during IMPACT program inception and mitigated through strategic program enablers and initiatives.

2012 Enablers and challenges to the IMPACT program are enumerated by EA view in the following table:

Table 7: IMPACT 2012 Enablers and Challenges by EA Element

Enterprise Architecting Views	Enablers	Challenges
Strategy	<ul style="list-style-type: none"> • Sites need to show they deliver better care than competitors • Hospitals need to show they deliver quality care to reduce financial penalties(readmission penalties) 	<ul style="list-style-type: none"> • No precedents exists for automated systems that track quality of care • No precedents exists for automated systems that track healthcare utilization • No sustainable business model yet achieved for HIE usage in PAC transitions
Policy	<ul style="list-style-type: none"> • Change in fee structure from fee for service to pay for performance • Capitated and risk sharing programs • Financial penalties for poor quality of service • Meaningful use program stage 2 - hospitals and physicians practices satisfy by sending transfer summaries 	<ul style="list-style-type: none"> • No subsidies for PAC sites to be EHR capable • No standards enforced for PAC Transition forms – everyone uses their own forms which is confusing to recipients.

Enterprise Architecting Views	Enablers	Challenges
Process	<ul style="list-style-type: none"> • Automated electronic system for LAND & See fits into current process with text message reminders • Mimics SBAR interact form process • Page 1,2,3 and history of PAC transitions transfer improvement in Mass • Learning collaborative 	<ul style="list-style-type: none"> • No longitudinal care plan for patients – still organizational silos in patient care • PAC transitions senders do not know regulations for receivers
Organization	<ul style="list-style-type: none"> • Learning collaborative 	<ul style="list-style-type: none"> • Organizational silos • Organizations do not see the priority for HIE in PAC transitions
Knowledge	<ul style="list-style-type: none"> • Learning collaborative <ul style="list-style-type: none"> – What receivers want – What senders have access to – What transfers are critical • Patient advocacy groups • Conferences 	<ul style="list-style-type: none"> • Competition amongst pilot sites • Technological competencies at sites is poor

Enterprise Architecting Views	Enablers	Challenges
Information	<ul style="list-style-type: none"> • Learning Collaborative • CCD+, CDA data set • Survey to high priority receivers 	<ul style="list-style-type: none"> • Organizational silos • Senders decide what is sent • Information currently transferred on paper – not a reliable medium in ED and other healthcare settings – can get lost • Sites don't have access to the IT platforms of their referring hospitals
Product and Services	<ul style="list-style-type: none"> • IT resources • Fax • Phone • Email • SMS • Automated Billing systems (MDS) • Reliant skilled IT nurse support staff • Automated pharmacy systems • On-site training • Trainer training at Learning collaborative • SBAR interact form 	<ul style="list-style-type: none"> • Not all organizations have EHRs • EHR vendors are not ready to connect through IMPACT • Not all organizations have sophisticated IT • Cost of connecting too high for some sites

Each of the key enablers and challenges are described in more detail below:

From the strategic perspective, key enablers are the penalties of reduced Medicare/Medicaid reimbursement for hospital and physician's organizations that do not meet certain 30 day hospital readmission criteria. This strategic initiative causes hospitals and physician organizations to prefer to collaborate with PAC sites that can demonstrate superior quality of care as compared to competitors. However, strategic challenges to the 2012 IMPACT program include the fact that since this PAC system solution is unprecedented, there are no systems or standards on which to base the system. An additional strategic challenge is that HIE has no sustainable business model, and without government funding and subsidies, HIE has not proven to be sustainable. These sustainability issues will be addressed through the low cost of IMPACT infrastructure upkeep, as well as the immediate added value of the completeness of health information brought about by the IMPACT program.

Policy enablers for the IMPACT program in 2012 include the transition from fee-for-service healthcare models to capitated, pay-for-performance, and risk sharing models of healthcare. These risk sharing models yield a need to decrease costly drivers of healthcare utilization, among which PAC is a large percentage. Moreover, these new models in healthcare also necessitate a means to indicate reduction in healthcare utilization and improved care as was seen in the strategic perspective. From a policy view, challenges to IMPACT in 2012 include no subsidies for PAC to align with meaningful use, such that EHRs and HIE are financially viable solutions. While these government subsidies allow hospitals and physician organizations to benefit financially in meaningful use, these same subsidies are not present for PAC sites. Moreover, another policy challenge to IMPACT in 2012 was that since there is currently no enforced standard in PAC transfers, every site uses their own form during transfers, and without any financial incentives, the habit of using these forms may trump adoption of the IMPACT transfer process.

The process perspective includes a number of enablers. The LAND & SEE infrastructures were developed with complete interoperability of current PAC sites

processes. For example, many of the primary SEE pilot sight users do not frequently check email throughout their work day and SEE was developed as a web-based email server for the transfer of patient health information. Therefore, rather than expect the users to be more diligent in checking their email, whenever patient information is sent via SEE, the users are alerted with a text message. Additional enablers include the long history of developing standard interfaces for PAC transfers in Massachusetts, thus many state stakeholders understand the value brought by the IMPACT program. Furthermore, the learning collaborative was a major enabler of the 2012 development of the IMPACT processes associated with LAND & SEE. Challenges to the IMPACT process perspective in 2012 include organizational silos between PAC sites. PAC sites use their own proprietary systems and only manage patient care plans, while patients are enrolled and staying at their sites. But for increased quality of patient care, patients need a longitudinal care plan across PAC sites. This is a major challenge to providing better quality of care through the IMPACT program, as it may be that full integration of patient records may be necessary to reveal gains to quality of care and decrements in healthcare utilization. Another challenge to the IMPACT 2012 from a process perspective is that the PAC system has a history of senders only sending the information they choose to send. The learning collaborative process is a strategic mitigation for this scenario; however, if the education brought about by the learning collaborative fails to change habits, the former process of senders sending the receivers what senders think is appropriate may be a great impediment to IMPACT goals.

From an organizational perspective, the learning collaborative was a key enabler for IMPACT goals. Through this collaborative process, multiple sites learned about one another's organizations and understood the reasons why each of the organizations required the transfer of different data elements. However, challenges to IMPACT 2012 goals are the organizational silos in patient care described above in the process perspective. Unless integrated patient planning is the norm, it is likely that quality of care will continue to be less than adequate. Furthermore, without the necessary governmental or other incentives, PAC sites

may not see involvement in HIE for improved patient care as aligned with their organizational aims.

Knowledge enablers for exchanging best practices and key competencies were minimal and in the form of symposia at conferences and discussions with patient advocacy groups, such as Leading Age. However, here, a major enabler was once again the learning collaborative, as it allowed competitors and partners who communicated minimally to share knowledge and best practices among the different PAC sites. Yet, challenges include competition between pilot sites. If a hospital chooses to transfer to one specific Skilled Nursing Facility (SNF), that takes business away from the other SNFs in the community. Therefore, sharing knowledge may be against organizational aims to beat the competition. Another challenge related to IMPACT goals and internal pilot site knowledge is that technological acumen can be minimal, which is a challenge related to the ease of adoption of IMPACT.

From an informational perspective, a key enablers for 2012 IMPACT goals are the development of the IMPACT data set through a survey sent to high priority PAC receivers, as well as through discussions in the learning collaborative. Informational challenges include the organizational silos leading to the lack of necessary and sufficient information for quality patient care. Additionally, challenges include the current paper-based methods of transferring patient health information. If organization competencies are technologically adequate to work with the LAND & SEE platforms, re-establishing the paper based methods, despite inclusion of the full IMPACT data set, may not yield significant improvement, as seen in IMPACT program metrics. Paper-based forms can be easily lost or misplaced in the PAC transfer process. Another key challenge is associated with the information perspective. The majority of sites do not have access to the health record system of their associates hospitals or physician organizations. Of course, LAND & SEE were developed to circumvent these issues; however, if this split is maintained, and this lack of integration is a key issue for improving patient care, the IMPACT program

may not be able to indicate that increased and complete PAC HIE benefits the healthcare system.

From a product and services view, all the current communication technologies and transfer forms listed in the table are enablers to the IMPACT goals, as they are methods to obtain and track down complete health information in support of better patient care. However, the lack of a consistent EHR presence and the costs associated with being EHR-enabled are critical challenges to IMPACT goals.

3.1.3 HIE performance in each of the key program priority areas

In the previous sections, strategies to expand HIE and enablers and challenges to those strategies were assessed. In this section, HIE performance in the IMPACT key program priority areas, the 2012 milestones, as well as their anticipated and actual completion date is examined. The following table reveals key milestones in red, bold text that were considerably delayed as compared to their anticipated completion date.

3.1.3.1 2012 Milestone Table

The following table indicates the timeline for 2012 IMPACT program development and milestones.

Table 8: 2012 IMPACT Milestone Table

No.	Milestone Category	Milestone Description	Planned Finish Date	Actual Finish Date
1	Provider Engagement	Define Learning Collaborative Scope	9/30/2011	2/1/2012
2	Technical	Issue RFR followed by RFP for LAND and SEE	10/31/2011	2/21/2012
3	Provider Engagement	Contracts/MOUs with all pilot sites	10/31/2011	5/29/2012
4	Performance Measurement	Baseline data collection	11/25/2011	2/21/2012
5	Technical	Contract(s) with LAND vendor identified from RFR	1/1/2012	7/14/2012
6	Technical	Contract(s) with SEE vendor	1/1/2012	10/1/2012
7	Performance	Compile data for performance	12/1/2011	Ongoing

	Measurement	measurement every 6 months		
8	Performance Measurement	Obtain expanded FCHP claims dataset	1/1/2012	7/31/2012
9	Technical	Reconcile CCD+ data elements with those from other national efforts (S&I Framework, Multistate Multivendor HIE/HIT Workgroup, Beacon LTPAC Affinity Group, RIQI, etc...)	2/1/2012	10/2012
10	Provider Engagement	Convene Learning Collaborative	2/1/2012	3/8/2012
11	Technical	Learning Collaborative to test and validate CCD+ data elements	3/8/2012	5/29/2012
12	Technical	Finalize technical architecture and functional requirements for SEE	8/31/2012	9/25/2012
13	Technical	Determine LAND & SEE detailed requirements for each pilot site, including data element analyses	9/30/2012	11/13/2012
14	Technical	Obtain final mapping of INTERACT2 SBAR to CDA Templates from Oklahoma or Lantana	11/30/2012	2/15/2013

Significantly delayed items in 2012 include items 3, 5, 6, 8, and 9 on the milestone table. Item 3 refers to contracts and MOUs to be signed with all pilot sites for the IMPACT program. While the majority of the pilot sites had IMPACT contracts completed by or very soon after the anticipated completion date, one site was considerably delayed. Delays related to item 5 involve LAND & SEE requirements that were specified in the RFR from EOHHS for the Mass HIway. Orion Health, the vendor for the Mass HIway, was not ready to deliver all the LAND & SEE functionality in its initial product offering, as the Orion platform could not transport or translate all the IMPACT data elements. Consequently, delays were a result of negotiations to arrive at a contracting agreement between EOHHS, Orion, and MEHI so that the additional IMPACT functionality could be established. Item 6 is associated with contract execution with the SEE platform vendor. MEHI was under the impression that Orion would be building the functionality for SEE into its Webmail software and this would be available to all Mass HIway users. However,

the cost proposed by Orion to provide the SEE functionality was greater than the IMPACT project budget. Therefore, Mass Tech had to issue an RFP to design and develop the SEE software. Due to the software requirement complexity and the cost associated with procurement, the RFP and contracting process was longer than anticipated. Item 8 relates to the work-stream to gather an expanded Fallon Community Health Plan (FCHP) claims dataset. The challenge for this work-stream was the privacy and health information security for FCHP subscribers. The delays associated with this task completion were due to the time required to gain the trust of FCHP and convince FCHP that subscriber information shall be protected. Delays for item 9 are associated with the additional unanticipated time to complete the reconciliation of the IMPACT data set with the national standards workgroups, which ultimately resulted in a more robust data set. While this work-stream will be essential to the success in adoption of the IMPACT data set as a new standard in PAC, a greater than anticipated amount of time was needed to successfully complete this endeavor due to the complexity in alignment amongst organizations.

3.1.3.2 X-Matrix

Based on the interviews conducted with the stakeholders, an X-matrix is created linking stakeholder values with strategic objectives, enterprise processes, and metrics to analyze HIE performance in each of the key program priority areas. In quadrant 1, an X is placed at an intersection point if IMPACT program metrics measure key processes. In quadrant 2, an X is placed at an intersection if strategic objectives are measured by an IMPACT program metric. In quadrant 3, an X is placed at an intersection if the stakeholder value is represented by an IMPACT program strategic objective. In quadrant 4, an X is placed at an intersection if an IMPACT program key process contributes to the delivery of a stakeholder value.

Figure 2: 2012 IMPACT X-Matrix

			X	X			Set up Learning collaborative as a longitudinal care model	X			X	X	X	X		X		X	X															
	X	X	X	X			Decrease avoidable ED visits		X				X	X	X				X															
	X	X	X	X			Decrease avoidable admissions		X				X	X	X				X															
	X	X	X	X			Decrease hospital readmissions		X				X	X	X				X															
	X	X	X	X			Decrease unnecessary tests and treatments	X	X				X	X	X				X															
						X	Reduce total cost of care			X	X	X					X		X															
X	X	X	X	X	X	X	Replicate this model in other communities	X		X	X					X	X	X	X															
New HL7 IMPACT standards in meaningful use 3 Frequency of information transfer Completeness of information transfer Healthcare utilization in response to completeness and frequency of Patient/Family satisfaction surveys Transfer document partial surveys to evolve process Receiver surveys - increased cost to track down all information	Strategic Objectives Metrics							Stakeholder Values Receiver Regulations met Sites can show that they provide better care interoperable with current billing and pharmacy systems fits into current process fits into current technology at sites improve quality of patient care gain meaningful use incentives avoid financial penalties share best practices convenient trainign for new tech/process evolving system to meet evolving healthcare reduce cost of healthcare financial viable to participate																										
	X			X	X																determine critical elements for LAND & SEE	X			X	X	X	X	X		X		X	
				X	X	X	X														define technical requirements for LAND & SEE	X		X	X	X	X	X	X		X			X
				X	X																test and validate CCD+ with learning collaborative	X	X	X	X	X	X	X	X	X	X	X	X	X
				X	X																completing contracts for LAND & SEE development with development					X					X			
		X	X			X															developing framework to track pilot site performance for baseline & post	X		X		X	X			X			X	
				X	X																Develop learning collaborative working on CCD+ alignment across national efforts	X	X	X	X	X	X	X	X	X	X	X	X	X
	X																					X					X			X		X		

Analysis of the IMPACT 2012 current state ecosystem through the X-matrix reveals critical findings associated with the four quadrants of interaction for X-matrix pairs of strategic objectives, metrics, key processes, and stakeholder values. Here the key processes were the planned 2012 IMPACT program processes; however, the stakeholder values, metrics, and strategic objectives are the same across years of the program. Quadrant 1 reveals that all the IMPACT program metrics measure key processes involved in 2012. In quadrant 2, all strategic objectives are measured by at least one IMPACT program metric. Additional methods to assess this strategic objective could include submitting recurring surveys to other community PAC sites based on insights achieved through the

IMPACT Worcester County-based Learning Collaborative. This process was completed to determine the high priority transitions and critical data elements for the IMPACT data set; however, as the program proceeds and evolves, it would be helpful to vet these new insights at other non-localized PAC sites. Quadrant 3 in the X-matrix indicates that the strategic objectives are well aligned with the IMPACT program stakeholder values, with the learning collaborative emerging as a key strategy and program objective that supports multiple stakeholder values. Likewise, quadrant 4 indicates that the program processes together successfully contribute to the delivery of the IMPACT stakeholder values. Key processes that support many stakeholder values once again include the Learning Collaborative, as well as piloting the LAND and SEE infrastructure at the pilot sites.

3.1.4 Assess how the key approaches and strategies contributed to progress in these areas, including lessons learned

Among the many key approaches and strategies, the learning collaborative was instrumental to 2012 progress on the IMPACT program. This collaborative strategy to bring together the multiple pilot sites, which represented the variety of PAC sites involved in patient transitions, was charged with the development and validation of the CCD+ IMPACT data elements. The IMPACT data elements that comprise the IMPACT data set are key milestones in the development of a new HL7 standard for PAC transitions, as well as the foundation for the LAND & SEE electronic platform requirements. Moreover, the learning collaborative was essential to understand not only the health data transfer needs (in the IMPACT data set), but also to understand the PAC transfer process and pilot site user needs for development of LAND & SEE. Key lessons learned from this collaborative were the following:

- Even PAC site competitors are willing to work together in a collaborative to architect a method to deliver better patient care and reduce healthcare utilization costs
- Senders were only sending what they thought receivers wanted and receivers were not getting sufficient health information.

- When senders were asked to revise their process to include additional data elements needed by receivers, 95% of the information was already being gathered by senders but not being sent
- When receivers received the additional information they required, they reported that they were now getting 95% of the information they needed for effective patient care

Another key approach and strategy was to ensure that the IMPACT data set was established as a national standard by working with the S&I framework, Multistate Multivendor HIE/HIT Workgroup, Beacon LTPAC Affinity Group, RIQI and others. Thus, this strategy yielded progress towards the goal of developing new PA standards that hope to yield better patient care and decreased healthcare utilization through adoption into Meaningful Use 3. Lessons learned from this initiative include allotting a greater amount of time to coordinate among national standards organizations. While the task completion was delayed eight months, the vetting of the data set by the standards organization was instrumental to developing a robust standard that is equally applicable to PAC sites outside the Worcester County region.

An additional key approach/process was to develop the infrastructure to track and chart pilot site claims data in real-time. This strategy will be the essential framework for comparing pre and post IMPACT go-live performance along the IMPACT program metrics. Lessons learned from this process include allotting significant time for contract execution for partner pilot sites, since the execution of pilot site contracts in support of this initiative were significantly delayed as compared to estimated completion dates.

3.1.5 Implication of evaluation findings and recommendations

These evaluation findings implicate the strategic initiatives and key processes for 2012 are well aligned with the overall IMPACT program goals. The key questions associated with whether the IMPACT process will achieve its program goals and whether the process is sustainable upon cessation of the program grant

funding have yet to be answered. The EA analysis of the 2012 IMPACT program indicates that the stakeholder needs in this complex ecosystem have been accounted in the program development. Moreover, the evaluation indicates that real-time claims gathering infrastructure is excellently positioned to compare the baseline (pre-IMPACT) and test condition (post-IMPACT) healthcare utilization.

A recommendation at this time in the IMPACT program phase is to develop a legal working collaboration group akin to the Learning Collaborative to better facilitate contractual issues/delays. Additionally, learning from the CCD+ alignment and coordination with the national standards organizations, more time should be allotted for similar future activities in the IMPACT project schedule

3.2 2013 Current State

2013 IMPACT initiatives involve a continuation of delayed work in 2012 as well as additional initiatives in preparation for LAND & SEE “go-live.” In 2013, key enablers and mitigations strategies included piloting the CCD+ process in a paper-based format to understand interoperability with current PAC transition workflows, developing a mini-survey process to evolve the IMPACT data elements and infrastructure in response to evolving PAC transition clinical needs, surveying the pilot sites to estimate the additional work required for senders to send a complete IMPACT data set or receivers to track down all information required to gather a complete IMPACT data set, minimally modifying workflows at pilot sites to accommodate the CCD+ transfers, and implementing the KeyHIE transform to create efficient re-use of shared data between electronic HIE, billing, and pharmacy systems.

IMPACT strategies to improve quality of PAC transitions and reduce healthcare system utilization costs are well aligned with stakeholder values. In addition, key processes and workflows were developed in 2013 to support the overall program goals. One key question that remains unanswered are whether HIE processes developed through the LAND & SEE architecture in IMPACT are sustainable upon completion of ONC grant funding. Additionally, in 2013, an open question remains as to whether implementing the IMPACT electronic processes and employment of the IMPACT data set in PAC transitions yields a significant increase in care quality, reductions in adverse events, reductions in avoidable hospitalizations, and ultimately decreased healthcare utilization. These issues will be addressed only after both the IMPACT program infrastructures, LAND & SEE, go “live” in 2014.

According to the 2013 IMPACT program progress, key lessons learned include the following:

- Even PAC site competitors are willing to work together in a collaborative to architect a method to deliver better patient care and reduce healthcare utilization costs
- The IMPACT data set transfer process fit well into the pilot site workflow and the process was such a success that many pilot sites continued to utilize the pilot process even after the pilot test ended.
- Legal & administrative aspects for interacting with multiple pilot sites and a state funded HIE infrastructure are complex and require greater time than allotted in the original IMPACT timeline.

Recommendations for the future of the IMPACT program include developing legal working collaboration groups akin to the Learning Collaborative to better facilitate contractual issues/delays, which was also identified in the 2012 Evaluation report. Additionally, in order to gauge the success of the IMPACT program in meeting timelines, additional metrics should be added for on-time completion of technical and administrative deliverables.

Both Principle Investigators were interviewed for three sessions each to comprehensively understand the current state landscape with regard to the 10 EA views and IMPACT key priorities in 2013. Additionally, three pilot sites were interviewed to receive input on the current state landscape from PAC transitions sites directly. Since the LAND platform went live in mid-2013 and SEE platform is planned to go live by July 2014, the 2013 current state assessment includes only input from multiple pilot sites that gained access to the LAND platform.

From assessing the program progress reports and the stakeholder interviews, the 2013 IMPACT key processes include:

- Technical development, testing, and documentation development for the SEE infrastructure
- Completing provider engagements with the pilot sites in order to finalize workflows

- Completing administrative tasks (LAND & SEE access) and signing necessary contracts at/with pilot sites
- Technical tasks associated with server hosting
- Implementation of the KeyHIE transform for interoperability with pharmacy and billing systems
- Completion of LAND transformation configuration
- Overseeing the go-live for both the LAND platform
- Continuing needs-gathering through organizations within the learning collaborative
- Continuing to work with national standards agencies to develop the IMPACT data set as a standard
- Collecting baseline claims data for health utilization and quality of care comparisons after go-live

3.2.1 Approaches and strategies used to facilitate and expand health information exchange

The IMPACT program was developed in response to a need to standardize, increase efficiency, improve patient care, and reduce healthcare system utilization in PAC transitions. In the following section, the 2013 key IMPACT processes have been assessed through thematic analysis of stakeholder interviews. As discussed in the previous “Approach” section, we used the EA views to break down complexity of the system across priority areas. The following results comprise major themes extracted from stakeholder interviews that relate to key priority areas divided by EA views.

3.2.1.1 Strategy and Policy

As in 2012, all stakeholders interviewed agree that the mission and vision of the IMPACT program is to ensure that all participants (including PAC transition sites) in the health care system can communicate efficiently, in a timely manner, and with the necessary information to improve healthcare delivery and outcomes and to reduce healthcare costs. Additionally, a theme that was expressed among all stakeholders was the unmet need for a standardized set of transfer data that PAC

transition sites could use in an efficient manner that was interoperable with their current processes. Therefore, it stands that the mission of the IMPACT program and the unmet needs of program stakeholders are exceptionally well-matched.

The 2013 subset of IMPACT goals included the continued usage of the learning collaborative to develop and validate the CCD+ IMPACT data elements for a new standard in PAC transitions. Additionally, through this and the collaborative analysis of the 2012 PAC transition process at the Learning Collaborative sessions, the technical requirements of the SEE infrastructure and the LAND transformation configuration were developed, thereby allowing the contract finalization with software development vendors for these platforms.

Another theme that emerged from the Principle Investigator (PI) stakeholder interviews, referred to indirectly during the pilot site interviews, was the need for metrics to assess how well the IMPACT program is meeting the goals for the program. A discussion of how well the IMPACT program metrics are suited to assess the program goals is offered in the X-matrix analysis section of this report (page 68). Completing administrative tasks, such as pilot site accessibility to the LAND & SEE platforms and completing the contract execution with pilot sites to gather the data to assess these metrics was a key process in 2013. These work streams enable assessments of health-care utilization costs, 30-day readmission rates, and avoidable hospitalizations and ED visits due to problems with PAC. To examine such metrics before and after IMPACT goes live, the IMPACT program created an automated claims retrieval system that has access to all the pilot site claims data in real-time. Setting up this system was a strategic enabler for assessing healthcare utilization and quality of healthcare.

While healthcare utilization costs pre and post-IMPACT are assessed via automated claims tracking, additional costs for senders to provide complete IMPACT data sets or receivers to track down health data for obtaining complete IMPACT data sets need to be examined for an overall IMPACT program costs. To

assess additional costs for reporting or obtaining complete data sets, surveys were sent to receivers and senders to comprehend the additional work required to complete the data sets in PAC transitions. Estimates of additional cost were inferred from the scope of extra work required for data set completion. Ultimately, sustainability of the IMPACT program can be assessed through surveys aimed at determining the work required to transfer and receive complete IMPACT sets and comparing healthcare utilization costs obtained through the automated claims tracking system pre and post- IMPACT go-live.

An additional strategic initiative was to update the IMPACT program infrastructure, as the clinical needs of the transitions evolve across the PAC sites. . To this end, the PIs included short surveys to be completed every time a sender or receiver used the IMPACT HIE system. These short surveys were meant to be least burdensome for health providers to complete, but informative enough to reveal 1) the specific data elements that are missing and need to be included and 2) the specific data elements that are no longer useful. This feature will be instrumental to evolving the IMPACT data set and the IMPACT electronic HIE system to meet the future need of PAC sites.

3.2.1.2 Process

A key theme that surfaced under our “process” lens was that all PAC transition sites have their own processes. Each PAC transition site has their own transfer form that is used when they transition a patient, and this form could be 2-40 pages with essential information conveyed in no systematic way. Moreover, in the current process, the senders determine what information is sent to the receivers without regard for what the information the receivers require. Additionally, often receivers are not given contact information for the sender of the transition data, and so it becomes very challenging to collect required data upon transition a patient. This process confuses the PAC transition receiver since the receiver has no efficient way to track down all the required information, while offering quality and safe

patient care. Even further, this precludes the PAC transitions receiver from obtaining the information required for billing and medication orders.

To mitigate this process issue, a key activity in 2013 (which started in 2012) was development of and recurring meetings with the Learning Collaborative, which is a collection of key members from each of the IMPACT pilot sites. During the learning collaborative meetings, different sites were able to inform each other of the additional information not being sent by PAC transition senders and the reasons why this information was essential for effective and quality PAC transitions. The Learning Collaborative was critical in determining the IMPACT data set, which is aligned with the program objective of developing new PAC transfer standards. In 2013, the Learning Collaborative sites worked with the PIs to minimally redesign their workflows to interface with the collection of data required in the IMPACT data set. Also in 2013, this process was successfully piloted in a paper version by a collection of sites, which helped them to understand the process implications of whether or not it was feasible to gather these data elements. The piloting project was so successful that a number of sites continued to use the IMPACT paper-based pilot process even after the pilot testing period ended. Not only does this highlight the advantages of IMPACT data set utilization, but it also ensures a smooth transition to the electronic platform upon go-live.

3.2.1.3 Organization

Major themes on the subject of organization includes 1) identifying the primary internal and external stakeholders of the IMPACT project in each organization; 2) identifying the IMPACT users in the pilot site organizations; 3) sharing knowledge or best practices between pilot site organizations; and 4) the PAC transitions sites adaption to new technologies in health care.

3.2.1.3.1 PI Stakeholder Organizations

In the PI stakeholder organizations, the main stakeholders are the primary investigators involved in the administration of the IMPACT program. The separation of administrative function is such that Dr. Larry Garber handles the

technical architecture interfaces and Dr. Terence O'Malley manages program metrics and evaluation of the IMPACT program.

3.2.1.3.2 Primary External Stakeholders

Primary external stakeholders for the PIs are the 14-16 pilot sites involved in the IMPACT pilot program and Learning Collaborative. Only 14 of 16 pilot sites will participate in the IMPACT “go-live,” as the parent company of one pilot site was not interested in participating and another pilot site ran into financial difficulties unrelated to the IMPACT program. The pilot site that did not participate due to its parent company elicits another theme about organization. To gain acceptance among the pilot sites, the IMPACT program PIs spent a great amount of time both in and outside the learning collaborative gaining the trust of the pilot site administrators. This was imperative, as the pilot site administration needed to trust the IMPACT program PIs and staff with the private/secure health information of its patients. Unfortunately, since these “trust-gaining” activities were not extended to the parent company of one pilot site, the site was mandated not to participate in the program. Additional external stakeholders for the IMPACT PI’s include EOHHS and ONC.

3.2.1.3.3 Primary Internal Stakeholders

For the IMPACT pilot sites, primary internal stakeholders include the healthcare providers who receive or transmit patient medical information related to PAC transitions. These specific internal stakeholders include skilled nursing staff, physicians, EMTs, social workers, caseworkers, and other PAC administrators who exhibit varying levels of technical competencies. It should be noted that due to the varying levels of technological sophistication in the PAC sites, adaptation to new technologies in healthcare is not uniform among the sites. While some skilled nursing facilities may use EHRs, others and other pilot site variants, may use electronic systems solely for billing and medication tracking, while still others may be completely paper based with additional information garnered through telephone calls and fax.

An important recurring theme is that prior to the IMPACT program learning collaborative, standard methods of exchanging best practices between PAC sites did not exist. Also, many of these PAC sites are competing with one another and therefore collaboration to develop optimal standards was unlikely without the emergence of the IMPACT program Learning Collaborative in 2012 and continued usage in 2013.

3.2.1.4 Knowledge

The knowledge most pertinent to the IMPACT program involves health IT, or health Information technology, competencies. Approximately half the pilot sites have in-house health IT resources and the remainder out-source those competencies. However, even with the in-house IT resources, multiple pilot sites are not EHR-enabled nor do they have the expertise to communicate securely with other sites electronically.

3.2.1.5 Information

Major themes that emerged in the information domain include the continued development of the data elements list for the IMPACT data set used in IMPACT PAC transitions in 2012 and 2013. In 2013, the five (5) separate IMPACT data sets continued to be constructed representing 60 of the most critical PAC transitions. These data sets drive the 2013 development of the LAND & SEE platforms as revealed in Figure 3. Here, the numbers indicate the 5 data sets selected for the IMPACT program, a circles, as well as bounded rows and columns, represent the critical care transitions served by the 5 data sets.

Transitions From (Senders)	Transitions to (Receivers)										
	In Patient	ED	Out patient Services	LTAC	IRF	SNF/ECF	Amb Care (PCP)	Hospice	HHA	CBOs	Patient/Family
In patient							5				
ED							3				
Out patient services									1		
LTAC							5				
IRF											
SNF?ECF									5		
Ambulatory Care (PCP)											
Hospice											
HHA	5	4	2								
CBOs											
Patient/Family											

Figure 3: IMPACT Data Sets Development

Additionally, the 2013 information views includes 1) the continued engagement with ONC; 2) longitudinal coordination of care program; 3) the Long-term PAC work groups; and 4) the S&I framework for IMPACT data set development, as a new set HL7 standards governing PAC transitions. These standards will be required for Meaningful Use Stage 3 certification, such that any new EHR will need to be able to receive and transmit these elements as part of certification.

3.2.1.6 Product/Services

Typical products and services in the current state of PAC transitions in 2013 include the following:

3.2.1.6.1 Proprietary paper-based transition forms

Most sites have their own transition forms with specific sets of data elements required to be completed and transferred at the time of patient transition. None of these forms have the same format or same information.

3.2.1.6.2 EHR

Some of the more sophisticated PAC sites are EHR-enabled, but the majority of sites, such as skilled nursing facilities are not enabled for this product/service. As previously mentioned, much of this is due to lack of incentives for PAC sites to transition to electronic health records. The SEE infrastructure is planned as a bridge to HIE for sites that are not EHR-enabled.

3.2.1.6.3 Phone

For the sites without sophisticated electronic records, and even for many sites with EHRs, telephones are important communication devices to obtain important and missing health information during a patient transition. The phone is useful inasmuch as the transition form includes the contact information of the sender and it is relatively easy to contact a person at the sender's phone number.

3.2.1.6.4 Email

Another product/service that is used in PAC transitions is email exchange of patient health information. Since currently most people have email access at their workplace, this is an effective form of medical information communication; however, there are critical concerns regarding the security of general email servers for the transfer of confidential patient health information. Also, according to an IMPACT PI, some of the skilled staff at PAC sites do not frequently check email and could miss important information for patient transitions.

3.2.1.6.5 Fax

Fax machines are used for patient health information transitions in less electronically sophisticated sites. Fax limitations are similar to the paper-based forms in that the data transferred may not be what is required at the receiving site and the formats or the forms could be confusing to the receiver. However, since the

information is transmitted via fax, it is less likely to be lost in transition, as compared to wholly paper-based systems.

3.2.1.6.6 Electronic billing systems

Many sites use electronic billing systems to communicate patient billing and reimbursement to payers. The incentive to switch to electronic methods for billing systems is greater efficiency and less error in collecting medical bills, which benefits the revenues for the sites.

3.2.1.6.7 Electronic Pharmacy systems

Multiple sites use electronic pharmacy/medication systems to track administration of and order medications for their patients.

3.2.1.6.8 Paper-based CCD+ forms

Developed through the IMPACT alpha pilot testing, these forms incorporated the complete IMPACT data set for PAC transfers. Multiple pilot sites continue to use this form in regular PAC transfer.

3.2.1.6.9 KeyHIE transfer

A technology that grabs information from PAC sites pharmacy and billing systems for reuse in HIE transfers.

3.2.2 Conditions supporting and hindering implementation of strategies used to facilitate and expand health information exchange

In the section above, strategies for the facilitation and expansion of HIE in IMPACT were examined through the EA views. As in the 2012 evaluation, in this section, strategies to expand HIE are further examined to identify major enablers and challenges to 2012 IMPACT goals.

Enablers and challenges are enumerated by EA view in Table 9. All the 2012 challenges and enablers are maintained in 2013, as the IMPACT program is not going live with both the LAND & SEE platforms until 2014. However, key additional enablers and challenges are included for the 2013 program evaluation.

Table 9: 2013 IMPACT Enablers and Challenges

Enterprise Architecting Views	Enablers	Challenges
Strategy	<ul style="list-style-type: none"> ▪ Sites need to show they deliver better care than competitors ▪ Hospitals need to show they deliver quality care to reduce financial penalties(readmission penalties) ▪ IMPACT has automated claims retrieval system with real-time logging of data to show <ul style="list-style-type: none"> – Completeness of data sent – Frequency of data sent – Health care utilization – 1.5 years of data for baseline ▪ Evolving system based on mini surveys during each transition ▪ Sender/Receiver surveys to track costs to enter or receive complete IMPACT information 	<ul style="list-style-type: none"> ▪ No precedents exists for automated systems that track quality of care ▪ No precedents exists for automated systems that track healthcare utilization ▪ No sustainable business model yet achieved for HIE usage in PAC transitions

Enterprise Architecting Views	Enablers	Challenges
Policy	<ul style="list-style-type: none"> ▪ Change in fee structure from fee for service to pay for performance ▪ Capitated and risk sharing programs ▪ Financial penalties for poor quality of service ▪ Meaningful use program stage 2 - hospitals and physicians practices satisfy by sending transfer summaries 	<ul style="list-style-type: none"> ▪ No subsidies for PAC sites to be EHR capable ▪ No standards enforced for PAC Transition forms – everyone uses their own forms which is confusing to recipients.
Process	<ul style="list-style-type: none"> ▪ Automated electronic system for LAND & See fits into current process with text message reminders ▪ Mimics SBAR interact form process ▪ Page 1,2,3 and history of PAC transitions transfer improvement in Mass ▪ Learning collaborative informs pilot sites of other site processes ▪ Workflow already modified at many sites to accommodate the IMPACT process based on the CCD+ paper pilot test ▪ KeyHIE transform that interacts and shares data from pharmacy and billing systems 	<ul style="list-style-type: none"> ▪ No longitudinal care plan for patients – Still organizational silos in patient care ▪ PAC transitions senders do not know regulations for receivers ▪ Contract execution delays with Pilot sites ▪ Complex legal framework surrounding server hosting – state employs vendors without additional pilot site agreements?
Organization	Learning collaborative surfaces organizational differences and strategies for PAC	<ul style="list-style-type: none"> ▪ Organizational silos ▪ Organizations do not see the priority for HIE in PAC transitions
Knowledge	<ul style="list-style-type: none"> ▪ Learning collaborative <ul style="list-style-type: none"> – What receivers want – What senders have access to – What transfers are critical ▪ Patient advocacy groups ▪ Conferences 	<ul style="list-style-type: none"> ▪ Competition among pilot sites ▪ Technological competencies at sites is poor

Enterprise Architecting Views	Enablers	Challenges
Information	<ul style="list-style-type: none"> ▪ Learning Collaborative ▪ CCD+, CDA data set ▪ Survey to high priority receivers 	<ul style="list-style-type: none"> ▪ Organizational silos ▪ Senders decide what is sent ▪ Information currently transferred on paper – not a reliable medium in ED and other healthcare settings – can get lost ▪ Sites don't have access to the IT platforms of their referring hospitals
Product and Services	<ul style="list-style-type: none"> ▪ IT resources ▪ Fax ▪ Phone ▪ Email ▪ SMS ▪ Automated Billing systems (MDS) ▪ Reliant skilled IT nurse support staff ▪ Automated pharmacy systems ▪ On-site training ▪ Trainer training at Learning collaborative ▪ SBAR interact form ▪ Paper-based CCD+ form ▪ KeyHIE transform to interact with pharmacy and billing systems 	<ul style="list-style-type: none"> ▪ Not all organizations have EHRs ▪ EHR vendors are not ready to connect through IMPACT ▪ Not all organizations have sophisticated IT ▪ Cost of connecting too high for some sites ▪ Orion

3.2.2.1 IMPACT Automated Claims Retrieval System

In the strategy view, a key development activity was the creation of the IMPACT automated claims retrieval system with real-time logging of data from the pilot sites. This tool is a key strategic undertaking to meet the need for a system that tracks quality of care and healthcare utilization. The automated claims retrieval system that was put in place in 2013 to track baseline claims data, will be compared to claims data after IMPACT fully goes live. The system can track the completeness

and frequency of usage of the entire IMPACT data set and simultaneously track healthcare utilization. Furthermore, PAC processes in healthcare are not static, and as the medical care required in PAC transitions evolves due to novel procedures and requisite data elements, the IMPACT process should likewise be capable of evolving.

3.2.2.2 Surveys

A key strategic enabler for IMPACT process evolution is the inclusion of mini surveys to senders and receivers in each PAC transitions. The mini surveys were designed to be short enough that senders or receivers could accomplish them without excessive additional time or burden, but they will be instrumental in identifying what data items should be added and those items that are no longer useful. Thus, this process allows for evolution of the data set in response to user needs.

In addition to tracking healthcare utilization in response to claims data before and after IMPACT goes live, the IMPACT program seeks to understand the extra work and cost imposed on senders and receivers to gather and provide the patient medical data required for transfer of complete IMPACT data sets. Thus, a key strategic enabler was to survey receiver and sender information on the extra work required to send (for senders) or track (for receivers) complete IMPACT data sets. This information can be used to estimate additional cost for senders and receivers to participate in IMPACT data set transfers, and ultimately, when combined with healthcare utilization, can inform process sustainability.

3.2.2.3 IMPACT Workflow Development and Alpha Pilot Paper-based Version of SEE

A key enabler of the IMPACT process is the IMPACT workflow development and alpha pilot paper-based version of SEE at pilot sites. Prior to building, testing and executing the electronic version of the IMPACT program, the PIs and program management wanted to understand how using the IMPACT data set would affect current workflow/process at pilot sites. Therefore, a paper-based version of the CCD+ was developed and placed in a salient orange envelope. This form accompanied patients when a transition occurred. As stated previously, the pilot

process was so successful that many sites continued to use the paper-based IMPACT data transition even after the pilot testing was completed. Therefore, not only was this pilot testing an enabler for developing better interfaces with current pilot site workflows, but it also unexpectedly led to sites adapting their process to include the IMPACT data set in transfers prior to go-live.

3.2.2.4 KeyHIE Transform

Additionally, through the learning collaborative it was discovered that pilot sites use electronic information systems for both pharmacy and billing purposes, and although much of this information was pertinent to the patient health and IMPACT data set transfers, no interface systems were being used nor was this information shared. The IMPACT program management identified a product called the KeyHIE transform, which they subsequently licensed and integrated. This product gathers information from the PAC internal pilot site billing and pharmacy systems for usage in HIE, which greatly increased health information efficiency by reusing information required for multiple PAC systems. Process view challenges in 2013 include the delays to achieve pilot site contract, which shall be elaborated on in the milestone table section, and the complexity surrounding vendor contracts for state HIE. Since Massachusetts was employing Lantana for server hosting, legal considerations were examined to understand whether pilot sites also required contracts with the hosting vendors for interoperability with the IMPACT electronic infrastructure. These challenges were due to the novelty of such a program and process.

3.2.3 HIE performance in each of the key program priority areas

To assess HIE performance in the IMPACT key program priority areas, the 2013 milestones, as well as their anticipated and actual completion date was examined. The following table reveals key milestones in red text that were considerably delayed as compared to their anticipated completion date.

Table 10: 2013 IMPACT Milestone Table

No.	Milestone Category	Milestone Description	Planned Finish Date	Expected Finish Date	Status
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No.	Milestone Category	Milestone Description	Planned Finish Date	Expected Finish Date	Status
1	Technical	Finish build of SEE (View/Edit single CDA document, Multiple Users with section-level locking, and print button) (This is all completed except for integrated testing with Orion's Webmail.)	12/31/2012	11/30/2013	Behind Schedule
2	Technical	Do security testing of SEE (Webmail has already been tested)	12/31/2012	12/4/2013	Behind Schedule
3	Technical	Do Alpha Pilot of SEE. Do a Time Study to see how long it takes to fill out compared with the paper equivalent.	12/31/2012	12/4/2013	Behind Schedule
4	Technical	Finish training documents for SEE. Make powerpoints for general distribution.	12/31/2012	12/4/2013	Behind Schedule
5	Provider Engagement	Finish workflow redesign at pilot sites	12/31/2012	12/3/2013	Behind Schedule
6	Provider Engagement	Contract for participation in state HIE signed by each pilot site, including W9 forms. Confirm pricing for each site (SVH, UMass and RMG use Large LANDs. VNACN will share the RMG	12/31/2012	11/18/2013	Completed

No.	Milestone Category	Milestone Description	Planned Finish Date	Expected Finish Date	Status
		LAND device, FHCW and Overlook will use small LANDs. Other 10 sites use SEE with 1 address each.) (14/16 done.) Grant will cover \$5K/new LAND site and the cost of SEE and Gobbler.			
7	Provider Engagement	Obtain AIMS user IDs for each Pilot Site using SEE. Collect existing user IDs and test whether they can be reused. Figure out how to have 1 administrator manage the rest of the sites user IDs and Passwords.	12/31/2012	11/18/2013	Completed
8	Technical	Establish server environment to host SEE based on volume estimates (Done). Get quotes from MA HIway's hosting environment vs. Amazon (Done). Confirm that we don't need a MiniBid (Done). Confirm that state can contract directly with hosting vendor and that Pilot sites won't need to sign	12/31/2012	12/5/2013	Behind Schedule

No.	Milestone Category	Milestone Description	Planned Finish Date	Expected Finish Date	Status
		any additional agreements(Done).			
9	Technical	Finalize standard LAND interface configurations to support pilot sites (Done). Contract with Orion developer to build configurations (Done). Finalized architecture for development work.(Done) Map IMPACT dataset to Hospital Care Management dataset (Done). Also identify which data elements are not displayable in CCD (i.e. the Plus dataset)(Done).	2/15/2013	7/17/2013	Completed
10	Technical	Obtain final mapping of MDS and OASIS to CDA templates from KeyHIE	2/1/2013	12/22/2012	Completed
11	Technical	Finish build of LAND Transformation configuration to convert CDA to text	4/1/2013	8/16/2013	Completed
12	Technical	Finish build of LAND Transformation configuration to convert CCD + data to Transfer Summary	4/1/2013	1/15/2014	Behind Schedule
13	Technical	Set up Gobbler.	4/1/2013	12/6/2013	Behind

No.	Milestone Category	Milestone Description	Planned Finish Date	Expected Finish Date	Status
		Finalize 1 SNF to test in Testing environment. If works, contract for 4 sites to test in Production. Finalize pricing			Schedule
14	Provider Engagement	Go-Live of SEE CDA editing tool sites and LAND-only sites (using CCD)	1/9 – 1/30/2013	12/11 – 12/23/2013	Behind Schedule
15	Technical	Go-live of SEE CDA reconciliation tool combined with LAND and/or Gobbler for MDS	3/31/2013	12/11 – 12/23/2013	Behind Schedule
16	Technical	Go-live of LAND for full Transfer of Care dataset	3/31/2013	1/15 – 1/31/2014	Behind Schedule
17	Technical	Extend Lantana SEE support for 6 months for \$20K	5/25/2013	11/15/2013	Completed
18	Technical/Provider Engagement	Publish article in Health Affairs (or similar) on the Learning Collaborative process/finding, and an article in JAMA (or similar) on the Care Transition Datasets.	3/31/2013		Behind Schedule

2013 IMPACT milestones 1-5, 8, and 12-18 were significantly delayed as compared to their planned execution dates.

3.2.3.1.1 Milestones 1-3

- Due to contractual delays between EOHHS, Orion and Lantana, Lantana Consulting did not have access to Orion's Mass HIway webmail test

environment for several months. Consequently Lantana could not complete the SEE application build or security testing.

- Upon SEE application testing commencement, technical issues surfaced that caused additional delays

3.2.3.1.2 Milestone 4

Although milestone 4 was completed in 2013, the training documents for SEE were completed later than expected due to delays in development of the SEE application. User training for the Pilot sites was completed in 2013.

3.2.3.1.3 Milestone 5

Milestone 5 was completed in 2013; however, delays in completion of this milestone were due to delays in development of SEE.

3.2.3.1.4 Milestone 13

Milestone 13 – implementation of the KeyHIE transform tool – was dependent on development completion of the SEE application wand, which was likewise delayed.

3.2.3.1.5 Milestone 8

Milestone 8 - establishing a server environment to host the SEE application - was significantly delayed due to decisions at EOHHS. Through several successive meetings the decision on where to host the SEE application was modified many times. The final decision to host SEE on the Mass HIway Orion server environment provides the benefit of tighter integration with Mass HIway Orion Webmail. Therefore, while delays were not ideal, the multiple round of discussion resulted in the optimal solution that provides greater system integration.

3.2.3.1.6 Milestone 12

Milestone 12 was delayed because a contract work order change needed to be executed between EOHHS and Orion to commit Orion technical resources for LAND development and configuration.

3.2.3.1.7 Milestones 14-16

The “go-live” milestones 14-16 were delayed due to the aforementioned LAND and SEE development and testing delays.

3.2.3.1.8 Milestone 18

Milestone 18, which involves publishing an article based on the Learning Collaborative and IMPACT data sets creation, has been postponed until Pilot Site feedback is available after full IMPACT system (LAND & SEE) go-live

3.2.3.2 *X-matrix*

Based on the interviews conducted with the stakeholders, an X-matrix (Figure 4) was created linking stakeholder values with strategic objectives, enterprise processes, and metrics to analyze HIE performance in each of the key program priority areas. In quadrant 1, an X is placed at an intersection point if IMPACT program metrics measure key processes. In quadrant 2, an X is placed at an intersection if strategic objectives are measured by an IMPACT program metric. In quadrant 3, an X is placed at an intersection if the stakeholder value is represented by an IMPACT program strategic objective. In quadrant 4, an X is placed at an intersection if an IMPACT program key process contributes to the delivery of a stakeholder value.

Figure 4: 2013 IMPACT X-Matrix

				X	X			Set up Learning collaborative as a longitudinal care model	X			X	X	X	X		X		X	X				
	X	X	X	X	X			Decrease avoidable ED visits		X				X	X	X					X			
	X	X	X	X	X			Decrease avoidable admissions		X				X	X	X					X			
	X	X	X	X	X			Decrease hospital readmissions		X				X	X	X					X			
	X	X	X	X	X			Decrease unnecessary tests and treatments	X	X				X	X	X					X			
X	X						X	Reduce total cost of care				X	X	X					X		X	X		
X	X	X	X	X	X	X	X	Replicate this model in other communities	X		X	X					X	X	X	X	X	X		
Sender Survey-increased cost to send all information	New HL7 IMPACT standards in meaningful use 3	Frequency of information transfer	Completeness of information transfer	Healthcare utilization in response to completeness and frequency of information transfer	Patient/Family satisfaction surveys	Transfer document partial surveys to evolve process	Receiver surveys - increased cost to track down all information	Strategic Objectives	Metrics	Stakeholder Values	Key Processes	Receiver Regulations met	Sites can show that they provide better care	interoperable with current billing and pharmacy systems	fits into current process	fits into current technology at sites	improve quality of patient care	gain meaningful use incentives	avoid financial penalties	share best practices	convenient training for new tech/process	evolving system to meet evolving healthcare	reduce cost of healthcare	financial viable to participate
X		X	X	X		X	X	technical development, testing, and documentation development for the SEE infrastructure		X		X	X				X				X	X		
		X	X					completing provider engagements with the pilot sites in order to finalize workflows				X	X	X							X			
								completing administrative tasks (LAND & SEE access) and signing necessary contracts at/with pilot sites						X	X					X				X
								technical tasks associated with server hosting				X	X									X	X	
X							X	implementation of the KeyHIE transform for interoperability with pharmacy and billing systems				X	X	X										
								completion of LAND transformation configuration				X	X											
		X	X	X	X			overseeing the go-live for both the LAND & SEE platforms.		X		X	X	X	X	X				X				X
X	X	X	X	X		X	X	Learning Collaborative	X		X	X	X	X					X	X	X	X	X	X
X	X						X	working on CCD+ alignment across national efforts										X		X		X		
		X	X	X				Collect baseline claims data for health utilization and quality of care comparisons after go-live		X						X		X					X	X

Analysis of the IMPACT 2013 current state ecosystem through the X-matrix reveals critical findings associated with the four quadrants of interaction for X-matrix pairs of strategic objectives, metrics, key processes, and stakeholder values. Several key processes include the planned 2013 IMPACT program processes;

however, the stakeholder values, metrics, and strategic objectives are the same across years of the program.

Quadrant 1 reveals that most of the IMPACT program metrics measure key processes. However, there is a lack of program metrics to measure the 2013 key processes of completing administrative tasks/signing pilot site contracts, as well of the technical tasks with server hosting and completion of LAN transformation configuration. This lack of program explicit program metrics for timely completion of these deliverables may be a reason that many of the deliverables were delayed in 2013.

In quadrant 2, all strategic objectives are measured by at least one IMPACT program metric, which indicates that the strategic objectives are well measured by IMPACT program metrics. Quadrant 3 indicates that the strategic objectives are well aligned with the IMPACT program stakeholder values, with the learning collaborative emerging as a key strategy and program objective supports multiple stakeholder values. Likewise, quadrant 4 indicates that program processes successfully contribute to the delivery of the IMPACT stakeholder values. Key processes that support many stakeholder values once again include the Learning Collaborative, as well as overseeing the go-live for both the LAND and SEE platforms.

3.2.4 How Key Approaches and Strategies Contributed to Progress

Among the many key approaches and strategies, the learning collaborative was instrumental to 2013 progress on the IMPACT program. This collaborative strategy to bring together the multiple pilot sites, which represented the variety of PAC sites involved in patient transitions, was charged with the development and validation of the CCD+ IMPACT data elements. The IMPACT data elements that comprise the IMPACT data set are key milestones in the development of a new HL7 standard for PAC transitions, as well as the foundation for the LAND & SEE electronic platform requirements. Moreover, the learning collaborative was

essential in understanding not only the health data transfer needs in the IMPACT data set, but also the PAC transfer process and pilot site user needs for development of LAND & SEE. The information from these analyses were critical to the alpha pilot processes, which assayed the efficacy and sustainability of transferring complete IMPACT data sets between PAC sites. Key lessons learned from this collaborative were as follows:

- Even PAC site competitors are willing to work together in a collaborative to architect a method to deliver better patient care and reduce healthcare utilization costs
- The IMPACT data set transfer process fit well into the pilot site workflow and the process was such a success that many pilot sites continued to use the pilot process even after the pilot test ended.
- Legal and administrative aspects for interacting with multiple pilot sites and a state funded HIE infrastructure are complex and require greater time than allotted in the original IMPACT timeline.
- An essential lesson learned from this process was to allot significant time for contract execution for partner pilot sites, since the execution of pilot site contracts in support of this initiative were significantly delayed as compared to estimated completion dates. This finding surfaced in the 2012 program evaluation as well.

An additional key approach/process was to develop the infrastructure to track and chart pilot site claims data in real-time. This strategy will be the essential framework for comparing pre and post IMPACT go-live performance along the IMPACT program metrics.

3.2.5 Implication of Evaluation Findings and Recommendations

These evaluation findings indicate that the strategic initiatives and key processes for 2013 are well-aligned with the overall IMPACT program goals. The key questions associated with whether the IMPACT process will achieve its program goals and whether the process is sustainable upon cessation of the program grant

funding have yet to be answered. The EA analysis of the 2013 IMPACT program indicates that the stakeholder needs in this complex ecosystem have been taken into account in the program development. Moreover, the evaluation indicates that real-time claims gathering infrastructure is excellently positioned to compare the baseline (pre-IMPACT) and test condition (post-IMPACT) healthcare utilization.

As in the 2012 program evaluation report, a recommendation from the 2013 IMPACT program phase is to develop a legal working collaboration group akin to the Learning Collaborative to better facilitate contractual issues/delays. Additionally, to gauge the success of the IMPACT program in meeting timelines, the X-matrix exercise and the 2013 milestone analysis indicates that additional metrics should be added for on-time completion of technical and administrative deliverables.

4 Future State Assessment

During a future state vision workshop the IMPACT Primary Investigators (PI) were requested to offer their ideal future state for the IMPACT program. The following is a summary of their future state vision:

- As a patient traverses the healthcare system or receives shared care, all care providers, regardless of technical sophistication, have access to the right information at the right time in the right format. This will optimize the quality, safety and efficiency of care delivery.
- Patients will know their medical information and what they need to do to improve or optimize it.
- All other members of the care team will know the patient's health information and what interventions are necessary.
- Providing the right information at the right time in the right format will reduce healthcare utilization.
- Providing the right information at the right time in the right format will increase the quality of healthcare.
- Longitudinal care plans will replace PAC site silos for care. Care plans will include the identification of health concerns and the mitigation plan; and health goals, with interventions/assessment of status towards those goals.
- The patient's health will be managed across all care sites, rather than only managing the patient at one particular type of site.
- Risk sharing and capitated health care payment models will replace fee-for-service.

4.1 Findings – Enablers and Challenges

Through the future state vision workshop, the ideal IMPACT program future state was identified and described through the bulleted lists in the previous section. In this section, enablers and challenges to achieving the future state vision are examined through the EA elements.

4.1.1 Strategic

From a strategic perspective, a key driver is the penalty of reduced Medicare/Medicaid reimbursement for hospital and physician organizations that do not meet certain 30 day hospital readmission criteria. As a result, hospitals and physician organizations prefer to collaborate with PAC sites that can demonstrate superior quality of care as compared to competitors.

Because the PAC system solution is unprecedented, the lack of systems or standards on which to base those systems proved to be a major challenge to the IMPACT program. However, the program developed an automated claims retrieval system that includes real-time logging of data from the pilot sites. This system tracks the completeness and frequency of usage of the entire IMPACT data set, while simultaneously allowing individual institutions to track quality of care and healthcare utilization. This automated claims retrieval system was put in place in 2013, and will be used to compare the current claims data to data collected after IMPACT goes fully live.

Along with the lack of system standards is the lack of a sustainable health information exchange (HIE) business model. Without the funding and subsidies provided by the government, the HIE has not proven to be sustainable. However, the IMPACT program has addressed the sustainability issue through the low cost of IMPACT infrastructure maintenance, as well as the immediate added value of the completeness of health information being transferred.

Furthermore, since PAC processes in healthcare are not static, as the medical care required in PAC transitions evolves, due to novel procedures and requisite data elements, the IMPACT process will likewise evolve. One example is the development and distribution of mini surveys to senders and receivers in PAC transitions. These surveys were designed to be short so senders and receivers could complete them without excessive time or burden. The information gathered will be instrumental in identifying what data items should be added or deleted from the

automated claims retrieval system. Thus, this process allows for evolution of the data set in response to user needs.

Additionally, the IMPACT program developed a more comprehensive survey to understand the extra work and cost required for senders and receivers to gather and send the patient data required for transfer of a complete IMPACT data set. The IMPACT program will use this information to estimate additional cost for senders and receivers to participate in IMPACT data set transfers, and will ultimately, when combined with healthcare utilization, inform process sustainability.

4.1.2 Policy

The main policy enabler for the IMPACT program is the transition from fee-for-service healthcare models to capitated, pay-for-performance and risk sharing models. These risk sharing models require organizations to decrease costly drivers of healthcare utilization, among which PAC is a large percentage, while at the same time improving care. Challenges include the lack of subsidies for PACs to align with meaningful use requirements, such that EHR and HIE adoption is a financially viable solution, and enforcement of standards. While government subsidies allow hospitals and physician organizations to benefit financially from meaningful use implementation, these same subsidies are not present for PAC sites. Moreover, since there is currently no enforced standard in PAC transfers, every site uses their own form during, and without any financial incentives, the habit of using these forms may trump adoption of the IMPACT transfer process.

4.1.3 Process

There is a long history of developing standard interfaces for PAC transfers in Massachusetts, thus many state stakeholders understand the value brought by the IMPACT program. From a process perspective a number of IMPACT enablers were discovered, such as the learning collaborative, LAND & SEE infrastructures, workflow development and the use of KeyHIE. The learning collaborative enabled major developments to evolve during the IMPACT project, such as the processes

associated with LAND & SEE, and the discovery that the information on pharmacy and billing systems the pilot sites use could be accessed and shared.

Prior to building, testing and executing the electronic version of the IMPACT program, the PIs and the program management wanted to understand how using the IMPACT data set would affect current workflow processes at pilot sites. So the IMPACT team developed a workflow of the paper-based version of the CCD+ at SEE Pilot sites. This form is placed in a salient orange envelop and accompanies the patient during transition. The pilot of this paper process was so successful that many sites have continued to use the paper-based system even though the pilot testing is complete. Not only did this pilot testing lead to better interfaces with current pilot site workflows, but it also unexpectedly led to sites adoption of the process and data set in transfers prior to go-live.

Additionally, the LAND & SEE infrastructures were developed with interoperability of current PAC sites processes in mind. So for instance, since many of the primary SEE pilot sight users infrequently check email throughout their work day, SEE was developed as a web-based email server for the transfer of patient health information that alerts the user of incoming transfer information through a text message. This lessens the need for the user to diligently check their emails.

Pharmacy and billing data contain information that is pertinent to the patient's health. Within the learning collaborative, it was discovered that while pilot sites use electronic information systems for both pharmacy and billing purposes, no interface systems were being used to share this information with other PAC sites. The IMPACT program management identified a product called the KeyHIE transform, which they licensed and integrated into the program. This product gathers information from the PAC's internal billing and pharmacy systems and reuses and shares only the information required by PAC sites.

Major challenges to the IMPACT project include organizational silos and incomplete information being sent between PAC sites. PAC sites use their own

proprietary data systems, and only manage the patient care plans while the patient is enrolled at their site. But for increased quality of patient care, the patient's healthcare provider needs a longitudinal care plan across all PAC sites. This presents a major challenge to providing better quality of care through the IMPACT program, as it may be that full integration of patient records may be necessary to reveal gains to quality of care and healthcare utilization.

Additionally, PAC sites have a history of sending only the information they choose. IMPACT is using the learning collaborative as a strategic mitigation for this scenario; however, if the education brought about by the learning collaborative fails to change habits, the former process of senders sending the receivers what senders think is appropriate may be a great impediment to IMPACT goals.

4.1.4 Organization

From an organizational perspective, the learning collaborative was a key enabler for IMPACT goals. Through this collaborative process, each site learned about other organizations and understood the reasons why each required the transfer of different data elements. However, challenges to IMPACT 2012 goals are the organizational silos in patient care described above in the process perspective. Unless integrated patient planning is the norm, it is likely that quality of care will continue to be less than adequate. Furthermore, without the necessary governmental or other incentives, PAC sites may not see involvement in HIE for improved patient care as aligned with their organizational aims.

4.1.5 Knowledge

Knowledge enablers for exchanging best practices and key competencies were minimal and in the form of symposia at conferences and discussions with patient advocacy groups, such as Leading Age. However, here, a major enabler was once again the learning collaborative, as it allowed competitors and partners who normally minimally communicated, to share knowledge and best practices among the PAC sites. Yet, sharing knowledge may be against organizational aims in such

cases where a hospital may choose to transfer a patient to one Skilled Nursing Facility (SNF) taking business away from another in the community. .

The major knowledge challenge is that the level of technological acumen is relatively low. This will impact the ease at which sites can and will adopt the IMPACT program and systems.

4.1.6 Informational

The development of the IMPACT data set through a survey sent to high priority PAC receivers and extensive discussions in the learning collaborative have served as key enablers of the informational process.

However, the challenges the IMPACT team face include the organizational silos leading to the lack of necessary and sufficient information for quality patient care; the current paper-based methods of transferring patient health information; and access to the health record system of the patient's associated hospital or physician organization. If organizational competencies are technologically adequate to work with the LAND & SEE platforms, re-establishing the paper based methods, despite inclusion of the full IMPACT data set, may not yield significant improvement, as seen in IMPACT program metrics. Paper-based forms can be easily lost or misplaced in the PAC transfer process.

LAND & SEE were developed so PAC sites could have access to the health record system of the patient's associated hospital or physician organization. However, the majority of sites still do not have access to the health record system of their associates hospitals or physician organizations. If this lack of access remains, integration will become a key issue for improving patient care, and the IMPACT program may not be able to demonstrate the how PAC HIE benefits the healthcare system.

4.1.7 Products and Services

From a product and services view, all the current communication technologies, such as KeyHIE transform and transfer forms, such as the paper-based pilot testing CCD+ form enable the IMPACT project to obtain and track complete health information in support of better patient care. However, the lack of a consistent EHR presence and the costs associated with being EHR-enabled are critical challenges to IMPACT reaching its goals.

4.2 Recommendations

Based on an assessment of enablers and challenges to the future vision state, the following describes recommended initiatives to facilitate achievement of the ideal IMPACT future vision state. These recommendations are categorized by the EA elements.

4.2.1 Strategy

1. Program leaders should identify a sustainable funding source to ensure success and continued growth of the IMPACT program

During the PI vision state workshop a sustainable funding source for the IMPACT program was identified as a major challenge. The IMPACT program was supported by a patchwork of funding sources found throughout the course of the project, which moved the program forward in a circuitous manner to the future state vision.

2. Continue to use sender/receiver surveys to track additional costs for the providing and sending of complete data sets

While healthcare utilization costs may be tracked through automated claims retrieval systems, an accurate estimation of healthcare utilization would include what it costs providers to gather the necessary information to complete the IMPACT data sets.

4.2.2 Policy

1. Continue efforts to standardize the PAC transitions data sets and align with standards bodies for inclusion in Meaningful Use policies

As described in the findings section, PAC transition sites generally use their own proprietary transition forms, as there is no standard form used across the community. This lack of standardization increases costs, as it takes a great deal of effort for care providers to find the relevant clinical information for their patients in a form with which they are not accustomed. Additionally, it puts patients at risk, as critical clinical information may be difficult to find or may be overlooked at the time of transition. Therefore, the IMPACT plans to harmonize and standardize a set of PAC transition data sets meets the strategic goals of reducing healthcare utilization and increasing the quality of care.

4.2.3 Infrastructure

- 1. Continue building and optimizing an in-house platform that can meet regulatory agency quality reporting needs, as well as indicate overall healthcare utilization.**

With the change in medical reimbursement and medical payment models from fee-for-service models to capitated and models based on quality metrics, there will be a need for tools calculate and report on quality measures. These tools will allow PAC sites to demonstrate a reduction in overall healthcare utilization. Additionally, Reliance on embedded 3rd party software and associated licensing costs in IMPACT infrastructure may decrease adoption potential due to financial sustainability.

4.2.4 Process

- 1. Continue to work with the learning collaborative to optimize and evolve the IMPACT platforms.**
- 2. Replicate learning model in another medical community so see if model is reproducible.**
- 3. Test pilot processes prior to “go-live” in future learning collaborative communities.**
- 4. Develop example materials of how IMPACT tools were used within current healthcare provider processes for training/teaching and/or marketing materials.**

5. Further develop methods to integrate IMPACT tools into provider workflow, such as the text message alert in the SEE platform.

A key finding of the IMPACT program was that PAC site competitors are willing to work together in a collaborative arena to architect a method that will deliver better patient care and reduce healthcare utilization costs. Thus, the learning collaborative model is sustainable for architecting better solutions for patient care. The IMPACT data set transfer fit well into the pilot site workflow. The pilot was such a success that many pilot sites continue to use the IMPACT data set even after the pilot test ended.

IMPACT platform solutions (LAND & SEE) are tools and not processes. It will be necessary for providers to slightly modify their current workflow process to integrate the IMPACT tools. For example, IMPACT PIs realized an opportunity to send transfer form notifications via text message rather than email, since many of the pilot site administrators do not check email regularly. The text message process was a notification method that integrated well into pilot site administrator's daily routine or workflow.

4.2.5 Knowledge

1. In future iterations of IMPACT, allow adequate time for achieving milestones based on knowledge gained from initial go-live.

While it is imperative to coordinate with the national standards organizations in development of a new patient care HIE standard for PAC transitions, coordination of this activity is lengthy and adequate time should be allotted for these tasks. Additionally, legal and administrative aspects for interacting with multiple pilot sites and a state funded HIE infrastructure are complex and require greater time than was allotted in the original IMPACT timeline.

2. Continue to refine the IMPACT platform tools based on input from the learning collaborative after go-live.

As aforementioned, the learning collaborative was instrumental in developing, optimizing, testing, and gaining adoption of IMPACT platform tools; however, the IMPACT program has yet to go live. Upon full go-live execution, IMPACT program leaders should gather feedback from the pilot sites to continue to evolve and optimize LAND & SEE.

4.2.6 Information

- 1. In alignment with continued evolution of the IMPACT platforms to meet clinical needs, include longitudinal care plan information in next iteration of IMPACT.**

Based on feedback from the PIs, inclusion of care plan functionality in SEE may prove to meet IMPACT metrics, such as proving reduction in healthcare utilization and increase in care quality. Additionally, if the future state of PAC transitions is in alignment with care, based on episode rather than silos of care service, including a longitudinal care plan in the IMPACT platform will likely encourage widespread adoption.

4.2.7 Organization

- 1. Continue to rely heavily on program champions for the success of the program.**
- 2. Clearly outline the value proposition of the IMPACT program to identify and recruit program champions at each organization**

Through numerous stakeholder interviews, including the MEHI program lead, the pilot sites and the PIs, a recurring theme surfaced that the success of the program, thus far was largely due to program champions, such as the IMPACT PIs. The PIs were instrumental in getting pilot site cooperation, working with 3rd party development partners, and architecting the learning collaborative.

4.2.8 Products & Services

- 1. In alignment with continued evolution of the IMPACT platforms to meet clinical needs and additional funding based on the strategy**

recommendations, develop real-time self-learning, evolving functionality in future LAND & SEE iterations.

Clinical data and needs in care transitions are not static. Clinical care and procedures evolve, based on advances in medicine and novel technologies. Inclusion of self-learning functionality in the IMPACT platform solutions (LAND & SEE) would facilitate evolution of the platform to match the evolution of clinical PAC needs.

2. In alignment with the infrastructure recommendations, program leaders should search for funding to develop in-house software products, thereby limiting the use of 3rd party products.

Since 3rd party products require license fees and external maintenance fees, it is likely that external development might affect the overall sustainability of the product. Additionally, according to the PIs, the SEE webmail might be capable of being disseminated more rapidly, if it were software that was developed in-house and not associated with 3rd party products.

4.3 Next Steps

One key question that remains unanswered are whether HIE processes developed through the LAND & SEE architecture in IMPACT are sustainable upon completion of ONC grant funding. Additionally, an open question remains as to whether implementing the IMPACT electronic processes and employment of the IMPACT data set in PAC transitions yields a significant increase in care quality, reductions in adverse events, reductions in avoidable hospitalizations, and ultimately decreased healthcare utilization. These issues will be addressed only after the IMPACT program infrastructures, LAND & SEE, go “live” in 2014, which is major next step for the program.

Additionally, the learning collaborative model was developed with the intention of replicating the model in other medical communities. Therefore, it is important to develop another learning collaborative-based medical community in a

location other than Worcester County, so the IMPACT tools can aid PAC transitions elsewhere. This next step will indicate whether the IMPACT development processes and tools are reproducible in other communities. The planned journal publication summarizing formation and usage of the learning collaborative is a critical component for success of this next step.

4.4 Conclusion

Overall, IMPACT strategies to improve quality of PAC transitions and reduce healthcare system utilization costs are well aligned with stakeholder values. In addition, key processes and workflows were developed to support the overall program goals.

As stated in the next steps, the entire IMPACT program team eagerly awaits feedback from the pilot sites, as well as healthcare utilization and quality of care data from the real-time claims retrieval system. Until that point the fundamental IMPACT hypothesis - whether complete, accurate and timely exchange of clinical information in PAC transitions yields reduced healthcare utilization, increased care quality, and increased happiness of all those on the care team (including patients and their families)- cannot be verified.

5 Appendix A

Table 11: IMPACT Task Oriented Work Plan

Task Identifier	Task Name	Start Date	Finish
	Strategic Cycle - Understanding enterprise ecosystem and landscape	9/26/2013	10/4/2013
S1	Determine the strategic imperative through a planning kickoff meeting	9/26/2013	9/26/2013
S2	Engage MeHI leadership of IMPACT program	9/30/2013	10/4/2013
S3	Understand enterprise history and ecosystem	9/30/2013	10/4/2013
S4	Understand vision for IMPACT	9/30/2013	10/4/2013
	Planning Cycle - Identify stakeholders and execution of Deliverable 1	9/26/2013	10/23/2013
P1	Conduct initial interviews and site visits for Deliverable 1	9/26/2013	10/23/2013
P2	Draft 1 of study design	9/26/2013	10/11/2013
P3	Draft 1 of study population scope	9/26/2013	10/11/2013
P4	Identify stakeholder and schedule stakeholder meetings	9/26/2013	10/25/2013
P5	Identify data types and sources	9/26/2013	10/11/2013
P6	Identify collection methodologies	9/26/2013	10/11/2013
P7	Define metrics - connections, adoption, impact	9/26/2013	10/23/2013
P8	Identify data analysis approach	9/26/2013	10/23/2013
P9	Complete evaluation plans for each program (3000 words each)	9/30/2013	10/23/2013
	Current State Assessment Cycle	10/21/2013	12/11/2013
C1	Engage members of HIT council (consumer advisory group, provider advisory group, technology advisory group, legal and policy advisory group)	10/21/2013	11/4/2013
C2	Strategy and policy view: Evaluate governance and sustainability policies of IMPACT program	10/21/2013	10/31/2013
C3	Information view: Evaluate program metrics with existing MeHI data	10/21/2013	11/20/2013

Task Identifier	Task Name	Start Date	Finish
C4	Information view: Deploy & analyze stakeholder and user satisfaction/adoption survey	10/24/2013	11/20/2013
C5	Finalize "interesting area" to study for publication quality report	10/24/2012	11/20/2013
C6	Process & Services view: Observe and evaluate current workflow and utilization of the systems	11/4/2013	11/20/2013
C7	Infrastructure view: Evaluate systems associated with the programs and their interoperability with existing systems	11/25/2013	12/3/2013
C8	Organizational and knowledge view: assess the organizational structure of the systems and training programs	12/4/2013	12/11/2013
	Future State Revision and Recommendations Cycle	12/12/2013	1/17/2014
F1	Create future state vision with MeHI program leaders and HIT councilmembers (as needed)	12/12/2013	12/20/2013
F2	Perform gap analysis between awards/grants, SOP, current state and future state vision	12/12/2013	12/31/2013
F3	Outline best practices, lessons learned, and recommendations for deliverables 4-6	12/12/2013	1/17/2014
	Report Generation and Execution Cycle	12/12/2013	2/7/2013
R1	Finalize template for 2012 and 2013 evaluation plans	12/9/2013	12/11/2013
R2	Complete 2012 evaluation results report (Deliverable 2)	12/9/2013	12/31/2013
R3	Complete 2013 evaluation results report (Deliverable 3)	12/12/2013	1/24/2014
R4	Analysis and recommendations for improvement of IMPACT Dashboard and Scorecard (Deliverable 4)	1/6/2014	1/12/2014
R5	Interviews for national benchmark report	12/12/2013	1/19/2014
R6	National benchmark report (Deliverable 5)	1/13/2014	1/19/2014
R7	Executive Summary synthesizing findings, recommendations and next steps (Deliverable 6)	1/20/2014	1/26/2014

6 Appendix B: Bibliography

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