Value Realization from Adoption of Integrated Electronic Health Records

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Abstract

While the U.S. government is making a significant investment in supporting the implementation of integrated electronic health records, the benefits of vendor supplied software in community health networks has not yet been clearly demonstrated. Four themes have been identified as not well researched and therefore limiting IT value research in general: (1) co-creation of IT value, (2) IT embeddedness, (3) information mindset, and (4) intangible value [1]. We suggest that these four areas need to be addressed in order to demonstrate how value can be realized from implementation and integration of electronic health records. Focusing on these issues will not only help us assess benefits, but also elucidate the changes in work processes, organizational structures, and attitudes that will help promote benefit. We illustrate with findings from the first phase of a longitudinal study on adoption of a system that integrates ambulatory OB/GYN practices with the triage unit at an academic community hospital, using vendor supplied software.

1. Introduction

The U.S. government has created incentives to spur implementation of electronic health records (EHRs), with the expectation of significant benefits in the next decade. We believe that these benefits will only occur if (1) high adoption rates are achieved and (2) complementary changes in health care delivery take place. While IT adoption and value realization research can provide a foundation for studying payoff from these systems, it needs to be extended to address the specific complementary changes for achieving benefits from shared health records. Full value from these systems will require embedding the technology within new work processes, significant shared acceptance and use of these systems, and new information capabilities, requiring complementary changes in roles, relationships, organizational structures, and culture.

The American Recovery and Reinvestment Act of 2009 allocated $36 billion to hospitals and physicians for health information technology, with early adopters receiving the biggest payments. The U.S. government is expecting that the overall budget impact from the incentive program will be $20 billion and predicts that an additional $16 billion will come from anticipated savings that will occur between 2016 and 2019 as a result of their anticipated widespread adoption and use [2].

The government is hoping to greatly increase the adoption rate of electronic health records to 90% by 2015 from the current low adoption rates estimated in the teens nationally [2-4]. Providers must adopt electronic health records (EHR) that meet meaningful use regulations. These criteria require significant sharing and integration of information in each of three stages as shown in Table 1. Thus, proposed benefits assume high levels of adoption, and using the systems to enable sharing information and significant integration to achieve the proposed improvements in care.

Many CIOs question the ability to meet these standards within this timeframe [5]. So, can the U.S. achieve 90% adoption of electronic health records that are meaningfully used during this time period, in order to achieve significant benefits? Adoption to date has already been less than anticipated. The U.S. multi-payer system has contributed to much slower adoption compared to other countries [6] and lack of standardization of work processes and competitive forces in the U.S. present numerous challenges. While a 2005 RAND study reported that 15-20% of U.S. physicians’ offices and 20-25% of hospitals had adopted electronic record systems [4], more recent estimates have suggested that adoption rates are significantly lower, particularly for fully functional systems, as shown in Table 2 [3, 7].

Even if high adoption rates are achieved, will this adoption translate to projected benefits? Despite research identifying success factors for health IT projects, a majority still fail [8]. And what are the benefits? How should payoff be measured and what types of benefits can we expect? It has been shown
that systems can be used simply to exploit existing capabilities, but they can also be used for exploration, building new capabilities [9]. If we truly want to go beyond exploiting these systems to reduce costs, we need to understand what changes in attitudes and use can lead to new benefits resulting from exploring new opportunities to gain and use the information.

**Table 1. Meaningful Use Criteria [10]**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Criteria</th>
<th>Adoption Dates</th>
<th>Requirements for sharing and integration of information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>- Electronically capturing health information in a coded format</td>
<td>2010</td>
<td>Care coordination requires exchange of information, but could be unstructured</td>
</tr>
<tr>
<td></td>
<td>- Using that information to track key clinical conditions</td>
<td></td>
<td>Reporting clinical quality measures involves integration with public health systems</td>
</tr>
<tr>
<td></td>
<td>- Communicating that information for care coordination purposes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Implementing clinical decision support tools to facilitate disease and medication management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Reporting clinical quality measures and public health information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>- Assuring continuous quality improvement at the point of care</td>
<td>2013</td>
<td>Exchange of structured information</td>
</tr>
<tr>
<td></td>
<td>- Exchange of information in the most structured format possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>- Promoting improvements in quality, safety and efficiency</td>
<td>2015</td>
<td>Patient access to information</td>
</tr>
<tr>
<td></td>
<td>- Decision support for national high priority conditions</td>
<td></td>
<td>Comprehensive patient data involves integration from multiple sources</td>
</tr>
<tr>
<td></td>
<td>- Patient access to self management tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Access to comprehensive patient data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Improving population health</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2. Adoption Rates of EHRs**

<table>
<thead>
<tr>
<th>System Type</th>
<th>Functionality</th>
<th>2008 [3]</th>
<th>2009 Preliminary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>- Patient information such as demographics, problem lists, medications, and clinical notes</td>
<td>13%</td>
<td>20.5%</td>
</tr>
<tr>
<td></td>
<td>- Orders for prescriptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Viewing labs and results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully functional</td>
<td>- Patient notes with medical history and follow up</td>
<td>4%</td>
<td>6.3%</td>
</tr>
<tr>
<td></td>
<td>- Orders for lab and radiology tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sending prescriptions and orders electronically</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Returning electronic images</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Clinical decision support</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2. EHR value: where is the evidence?**

The most widely cited study on EHR benefits is a 2005 RAND study that predicts efficiency and safety savings for both inpatient and outpatient care to average more than $77 billion per year when 90% adoption is achieved, with average annual savings of $42 billion during the adoption period [11]. Additionally, this study suggests that HIT enabled prevention and management of chronic disease could double those savings if a substantial portion of providers and consumers participate. Many have questioned the basis for this study, suggesting that the base case from which this study extrapolates is...
problematic [12], and assumes a level of interoperability that significantly exceeds current capabilities.

Systematic reviews of the literature examining implementation results have yielded mixed results. Some studies have questioned the benefits [13-15]. Some studies have not found significant care benefits from investment in HIT, for example, see [15]. Many of the studies that demonstrated benefits were developed and evaluated by academic and institutional leaders in HIT [16]. Questions have been raised about both the scalability and the transferability of these systems – especially when such systems are developed commercially rather than grown organically as part of an emergent change effort [17]. While “benchmark institutions have demonstrated the efficiency of HIT in improving quality and efficiency, whether and how other institutions can achieve similar benefits, and at what costs, are unclear” [18].

Some have questioned whether seamless integration between different electronic health record systems will ever happen [13]. Even if technical issues are resolved, there are political and competitive issues that can impede interoperability. Researchers have suggested that there is a need to study the communication requirements for collaborative clinical work, the socio-technical fit of the systems, and the ethics and practicality of data sharing [13]. Without sharing and integration of these systems within work processes, the benefits may not be achievable. The IT value realization literature has addressed the role of complementary investments in organizational change in order to achieve benefits from information systems.

3. IT value research

There has been a great deal of research related to extracting benefits from information systems. For reviews of these studies see [19, 20]. These studies suggest that firm level IT payoff depends upon investment in complementary assets as well as alignment with strategy.

Studies have shown that the productivity paradox was an artifact of time and measurement [21, 22]. A review of the evidence of payoff at the firm level suggests that the wide range of performance of IT investments among different organizations can be explained by complementary investments in organizational capital such as decentralized decision making systems, job training, and business process redesign [20].

The process approach to IT value realization research opens up the “black box” of IT investment-payoff linkage and enables an understanding of the complementary investments needed to ensure successful IT investment [23]. Until we can understand what the complementary investments are and how best to measure them, the process approach offers an effective means to examine the IT payoff [24].

Many researchers have recognized the need for considering organizational factors in addition to IT investment [25-28]. For example the effectiveness with which IT investment is converted to useful output is affected by the implementation process, organization culture, and management skill [29]. Accounting for the complementary changes has been suggested as fundamental to understanding the role of IT in adding value to organizational initiatives [30]. Davern and Kauffman emphasize the importance of IT value conversion contingencies including complementary assets [31]. Complementary assets include business process design and human capital, including management skills, user training, and applications of standards. Business process reengineering has been demonstrated to be a very important complement to IT investment in measuring IT payoff [32] [33] [34] . Other critical factors that influence payoff include organizational change management [35], absorptive capacity [36]; strategic alignment with business strategy [37], changes in reporting structures [33], work reorganization investments [38], shared knowledge [39], and open communication [40]. Studies of interorganizational investment in IT suggest that both parties must be ready to engage in digital interactions [41].

While the IT value research has focused on the role of complementary change, there has been a call to extend research in four major areas [1]:

(1) Co-creation of value: How can companies with different or new IT resources equitably partake in co-creation of IT based value?

(2) IT embeddedness: How can we digitize various functional and dynamic business capabilities in order to increase business value under various conditions?

(3) Information mindset: How can we create information capabilities that enhance and do not destroy digital business capabilities?

(4) Measuring value: What are the indirect and intangible paths to economic value that can be influenced by information and IT capabilities, and how do we foster them?

We believe that these four deficiencies in the theoretical frameworks for IT value research are particularly limiting our ability to understand how to benefit from integrated electronic health records. Since evidence of benefits is limited, and it is
expected that the impact of HIT will depend upon the context in which it will be implemented, the organizational change and workflow redesign required by and accompanying HIT implementation needs to be investigated [17]. Focusing on these themes can help us achieve this.

4. Extending IT value research to benefits from adoption of integrated EHRs

We now discuss how these four themes can augment IT value research in explaining how benefits can be measured and achieved with integrated health records. We focus primarily on these four factors as these have been the ones that have been identified as deficient in IT value research in general, and, we believe that this deficiency is particularly relevant to studying benefits from EHRs.

4.1 Co-creation of value with EHRs

The value projections from electronic records in health care assume sharing data between healthcare organizations. As outlined in Table 1, the meaningful use guidelines currently allow both unstructured and structured data sharing (Stage 1) with increased structured data sharing requirements in Stage 2. Yet the distinction between stand-alone electronic and interoperable records has been muddled in recent research. In fact, even the terms electronic medical records (EMRs) and electronic health records (EHRs) have traditionally been used interchangeably both in research and practice. In 2008 the National Alliance for Health Information Technology (NAHIT) proposed distinct definitions for these terms, such that EMR signifies standalone systems that are shared only within a single organization involved in an individual’s health and care (e.g. a physician’s office) and EHRs refer to interoperable systems that are shared across more than one healthcare organization [42]. Yet many of the research studies on benefits of electronic records have not distinguished between standalone EMR systems and interoperable EHR systems. We believe that the meaningful use criteria support interoperable systems and that benefits will come from integration.

Since the emphasis will be on developing more interoperable capabilities, it is co-creation of value that is critical to understand. Co-creation of value through IT involves creation and realization of value through multiple parties, achieving value from collaborative relationships among parties, and structures and incentives for parties to participate in and equitability share emergent value [1]. If a system is being implemented to share data between a hospital and ambulatory practice, for example, better information is needed about how the two can co-create value. Research that focuses on just one partner can underestimate the total potential value and especially the changes that will be needed in the relationships so that greater value is achieved from the interactions. Research needs to focus on which interactions support value, what types of relationships will be created and realized, and the structures and incentives for parties to participate. We need to understand where the value is derived when sharing these records and how the relationships need to change. This research may suggest the types of health organizations that would receive the greatest benefits from these systems and identify characteristics of health care communities where investment can have the greatest payoff.

This research needs to take place at three levels, shown in Table 3. At the first level, we will have different parties within the same organization sharing data, for example, hospitals and their owned ambulatory practices. This requires sharing of information between groups that may have different cultures. For example, the hospital unit will typically focus on a specific episode of care whereas the ambulatory practice is more focused on lifetime care. Ambulatory practices may have more entrepreneurial cultures than hospitals whose need for integrated controls may have led to more bureaucratic cultures. Sharing of information may require cultural adjustments between the two groups. A theoretical framework based upon cultural change could support an understanding of the requirements for different units to collaborate and the value that can be obtained from this collaboration. At the second level, we will have independent physicians sharing information with hospitals to which they admit or labs that process their orders. Half of all U.S. physicians in 2004-2005 worked in practices with less than nine physicians; one third of these in solo and two physician practices [43]. In this case, we have independent objectives with shared needs, so we will need to consider not only cultural differences, but also incentives for partners who have independent objectives but a need to collaborate and share data. And finally, as EHR adoption moves forward and meaningful full use criteria evolve, it is expected that additional value will come from regional and competitive health networks sharing information. This will require a theoretical framework that is based upon power and exchange. The concepts of opportunism, incomplete contracts, and bargaining will be relevant to this research [1].
Table 3. Research foundations for co-creation of value from sharing of electronic medical records

<table>
<thead>
<tr>
<th>Scope of sharing</th>
<th>Critical Differences</th>
<th>Research Foundations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital and hospital owned ambulatory practices</td>
<td>Cultural</td>
<td>Culture</td>
</tr>
<tr>
<td>Hospital and independent owned ambulatory practices within health network</td>
<td>Contractual</td>
<td>Incentive structures</td>
</tr>
<tr>
<td>Between health networks</td>
<td>Competitive</td>
<td>Competitive forces</td>
</tr>
</tbody>
</table>

4.2. Information embeddedness

IT embeddedness refers to the integration of IT within the process such that it becomes indistinguishable from the product. One of the key concerns that physicians have regarding introduction of electronic medical records is that it adds a burden that detracts from their process of providing medical care and consultation. But if the technology can be embedded in improved care processes, greater value can be achieved. For example, drug interaction detection is an embedded capability that could add value to the care process if used appropriately. A medical records system that would automatically alert providers of interactions could save physicians the time it takes to review all medications and use either their own knowledge or additional databases to determine if there are specific interactions. Other types of alerts and audit capabilities that are embedded in the system could save providers time; e.g., providing auditing alerts to insure complete documentation, or providing treatment guidelines, for example, “If stress test results are negative, then suggested next step is ….”

A common approach to IT value research is the assumption that a firm’s possession of IT resources will lead to the creation of capabilities that enhance performance. The government incentives assume that this will occur. But research has shown that different IT capabilities lead to different types of value. If we are truly to achieve benefit from EHRs, we need to focus on the identification of digital capabilities that could be provided and develop a theoretical framework for the contingencies under which digitization is more or less useful. For example, while the system may have certain embedded features, the workflow may have to change in order to receive value from these features. If the cost of changing workflow does not exceed the benefit from these features, then these features may not be utilized or may be underutilized. Changing workflow and processes requires a commitment to change management. New digital capabilities can influence the structural and social relationships. If the impact of these capabilities on roles and relationships is not well understood and planned for, their value may not be achieved.

A clear analysis and understanding of how IT can be embedded in care capabilities would have two outcomes. First, we could assure that electronic health record systems are configured to provide the necessary functionality to be integrated into care, rather than an additional burden to physicians to keep records. The focus would be on care capabilities that could be enhanced by electronic records, not just on proposed efficiency gains. And second, this understanding can be used to illustrate value to physicians and hospitals to support faster adoption.

4.3 Information mindset

Improved information capabilities, not just better IT capabilities, are instrumental in fostering better business capabilities and ultimately an organization’s ability to differentiate. While embedded IT can create new digital capabilities, it is an organization’s management and use of that information that provides even greater value. Many businesses that invested huge amounts of money in enterprise applications to support their businesses, including ERP, CRM, and SCM, are now focusing on business intelligence capabilities that enable them to effectively use the information from these systems. Similarly, we anticipate that the value from electronic health records will come from the intelligence capabilities that will be created.

The stage 3 meaningful use guidelines for electronic medical record implementation, in particular, focus on this aspect of value, the value that comes from decision support capabilities. It is assumed that historical data in integrated systems will enable much more analysis that can improve overall quality of care. Understanding what these improved information capabilities are now can help organizations not only implement the best EHR systems now, but more importantly support the organizational and process changes that could best support utilizing this information. Since increased information can have negative implications including
overload, misinformation, power plays, and politics [1], understanding the improved information capabilities that are anticipated and the required changes in organizations and processes can increase the positive outcomes, while minimizing negative ones. It is expected that power, exchange, and information overload theories could be used to develop theoretical frameworks relating information capabilities and change effects. The focus will be on reengineering the mindset of the users.

4.4 Value expansion: indirect and intangible value

IT value research has generally focused on measuring economic value. However, indirect and intangible value created by IT is particularly important for health information technology. Data completeness for care decisions may be improved with electronic health records. This is expected to decrease adverse outcomes. The government investment is based not only upon improved efficiency, but also upon assumptions that quality, safety, and ultimately population health will improve. These variables need to be better measured and relationships between EHRs and these outcomes need to be established, particularly through understanding the types of changes that will need to take place in the organizations and processes to complement the investments so that these outcomes occur.

5. Case study

The Lehigh Valley Health Network (LVHN) located in Northeastern Pennsylvania is implementing a standard electronic medical record in its physician owned OB/GYN ambulatory practices and linking these records to the system used in the triage unit of Labor and Delivery at the Lehigh Valley Hospital to create a perinatal continuum of care. Medical records and information must flow from the OB/GYN practices to Triage and from Triage back to the practices every time a patient is seen but is not admitted, and again from the practices, through Triage, to Labor & Delivery once a patient is formally admitted. Previously, records were transmitted by courier or fax, methods that proved inadequate. LVHN is implementing an HIT solution that enables two-way exchange of patient data between a commercial, certified ambulatory EMR and a commercial inpatient EMR system from the same vendor, with the goal of improving data access and completeness at all points in the perinatal continuum care.

The integration of information on the perinatal continuum of care can act as a microcosm of what might occur for the general U.S. population once all lifetime health information is captured within an electronic record Most initial implementations capture only recently recorded information so that it will be quite some time before the value of lifetime information can be evaluated. However, by focusing on pregnancy episodes, we can measure the effect of integrating all data collected over the relevant nine month period and the changes that need to occur for the integration to be successful.

Four different OB/GYN practices have moved to a standard electronic medical records system. Three of these practices upgraded from another medical records system within the last two years and the fourth and largest practice updated from paper records just within this past year. The office medical record is now being printed in the triage unit so that the most recent prenatal history is available at triage. In the past, this data was often unavailable, out of date, or delivered by fax or courier. Key prenatal history data elements such as blood pressure measurements have begun to flow from the office systems directly into the triage system, so that providers viewing the triage system can view data that were previously entered into the ambulatory systems right along with the updated triage information. With this information in one place, the provider can save time by not having to refer to the office record. However, many providers are not yet utilizing this feature; instead when they are the triage unit, they are referring to paper copies of the office record. However, many providers are not yet utilizing this feature; instead when they are the triage unit, they are referring to paper copies of the ambulatory records system rather than viewing this information directly in the triage system. Once additional data flows directly between systems and the next phase of the project, which involves sending summary data back to the office systems, is completed next year, it is expected that the integrated system will provide greater value.

We have begun a three year longitudinal evaluation of this implementation project so that we can analyze work practice changes and benefits over time. We are using a multiple case embedded design, with the individual participant as the unit of analysis and the practice location as the unique case at different points in time [44]. We are analyzing adoption of integrated features as they are added and will be assessing the benefits over time as these features become better utilized. At this time the focus of the first stage of our analysis has been on the implementation of the electronic medical records system in the ambulatory practices and understanding the challenges of integration arising from the availability of initial data from the ambulatory system.
in the triage unit. The qualitative part of our study involves interviewing users in both the ambulatory practices and the triage unit as well as systems personnel. Interviews will continue over a three year period as we capture and track integration benefits for each practice so that we can triangulate these benefits with the complementary changes made by the individual units. At this time, we have completed our first round interviews with more than twenty personnel including physicians, nurses, and administrative personnel in each of the four ambulatory practices and the triage unit. The interview data is analyzed with NVIVO software. We provide some findings from this first stage of the analysis.

6. Discussion of preliminary findings

Our preliminary findings from this first stage of the project have helped us create and validate a conceptual foundation that draws upon the under-researched themes in IT value research, shown in Figure 1. We believe that this expanded model provides a richer interpretation of how value is created for integrated medical records systems.

Figure 1. Achieving benefits from perinatal continuum of care

This implementation will co-create value among units of the same organization since the hospital owns the four OB/GYN practices, defined as level 1 co-creation of value. Since all units are part of the same organization, mandated usage can be established. However, to create value for all units, complementary changes in roles, relationships, processes, cross organizational structures, communication patterns, policies, and especially cultural differences must be addressed. The four practices are themselves culturally very different. One is a clinic primarily serving a largely Hispanic population with language barriers, the second is an in-hospital high risk pregnancy unit, the third is a community practice that upgraded from a legacy electronic medical records system, and the fourth is a high volume community based practice with multiple offices that upgraded from paper records. Co-creation of value will come from shared acceptance and use behavior. The triage unit is focused on episodic care; the ambulatory units on lifetime care. The types of data that they are accustomed to viewing reflect these differences. The system used in triage is more focused on individual data elements, whereas the ambulatory system includes many complete documents. Providers now need to insure that they “sign-off” documents promptly, since the “sign-off” is the trigger to transmit records from the ambulatory practices to the triage unit. If a provider does not sign off, the latest information is not available in the triage unit. Understanding the cultural differences and processes that impact co-creation of value can help establish best practices for system usage as well as required training and audit abilities in order to increase shared usage and value.

Embedded IT capabilities should influence individual acceptance and use behavior. The embedded capabilities being created through this perinatal continuum of care at the triage unit are a record of prenatal history contained directly within the triage system, particularly key data elements such as cervical exam results, blood pressure measurements, non-stress test results, prior uterine incision type, and group B strep test results. However, early usage suggests that if all key items required by the providers are not embedded within the system, providers will not use this embedded capability. In fact, in the early stages of this implementation, problem lists are not yet included in a meaningful manner within the prenatal history records, and thus the providers are not yet utilizing the embedded features of the integrated triage system. In fact, electronic records from the office practices are being printed out in the triage unit and these are the sources of prenatal history. It is expected that as more complete data become available, the integrated system will replace the reliance on paper records. Understanding how embedded information can lead to value can help determine strategies for rolling out shared electronic records, particularly in terms of providing value that will translate into appropriate usage. It can also be helpful in determining best strategies for insuring complementary changes in work processes as well as appropriate training.

Results from the first stage of implementation suggest that some physicians are interested in using the new electronic template to generate additional...
measures that were not previously available; others have simply struggled to adjust their work processes to accommodate the new systems. Understanding what drives the information mindset in individuals could help promote value realization. Nurses seem focused on making the new system as similar as possible to their old work practices. One hypothesis for this difference is that they did not have as much initial down time to learn the systems as the providers, a facilitating condition that may affect their individual acceptance. During initial adoption of the system, total office visits were reduced to provide physicians time to adapt to the new system. However, since the numbers of incoming calls and lab tests could not be reduced, perhaps nurses did not have sufficient time to learn the system, thus not having the opportunity to build the information mindset. Another hypothesis could be that this is the result of differences in types of jobs or the backgrounds of the participants. Another hypothesis could be that their roles have not changed in a manner that would support the need for generating additional information. Understanding what builds an information mindset could support developing improved training processes, and establishment of appropriate organizational or process changes that would increase value from the implementation of these systems by building the information mindset of the users.

Early results also suggest that the integration can create information overload. Currently users are finding that the patient problem lists are very cumbersome to navigate because they include non-relevant information to the specific case. As more physicians in the network adopt this system, this problem will only exacerbate. Understanding how to reduce information overload can support improved benefits from the system.

IT value research assumes an endogenous variable with obvious and direct economic impact [1]. However, clearly the integrated perinatal continuum of care should result in more intangible benefits. Since the integration of data using these commercial applications is still in its infancy, we do not have benefits results. However, we can use our conceptual model to determine the expected paths to benefits achievement. While we expect that productivity should increase after an initial implementation time period, we believe that we need to focus on intangible benefits and the paths to these benefits. The key benefit is improved pregnancy outcomes, which can be measured by a reduction in adverse events. The Lehigh Valley Health Network has tracked the adverse outcomes index since 1999. By tracking outcomes over time and comparing with health care networks without this level of integration, we expect to demonstrate value in terms of reduced adverse outcomes. The path to this goal and a key contributor to this value is the increase in completeness of data. As the system is implemented and integrated into work processes, we survey users on the completeness of the following clinical data elements: cervical exam, blood pressure measurement, up-to-date antenatal problem list, non-stress test result, prior uterine incision type, group B strep test result, and for Medicaid patients, a request for tubal sterilization. Another intangible outcome is improved safety and provider satisfaction which can be measured via surveys that will be administrated throughout the process and we expect to see improvements in satisfaction over time. Finally, patient satisfaction surveys are routinely administered by the hospital and we expect that specific questions such as “how well staff worked together to care for you” should improve over time as data is more readily available. Insuring that these benefits occur will require complementary change in work processes and organizational structures. Understanding what these changes are can help support the implementation process. By focusing on the complementary changes that support greater value from useful embedded system capabilities and improved information capabilities, we expect to see increased patient satisfaction. By triangulating benefits to changes made in different units, we can use process theory to better understand the change needed.

7. Summary

While the U.S. government has provided significant incentives for adoption of electronic health records meeting meaningful use guidelines that require significant sharing and integration of information, achieving these benefits has been questioned. We have suggested four specific avenues of theoretical research that could better enable us to understand how we can receive value from the adoption of integrated electronic medical records. These factors influence individual and shared acceptance of electronic health records as well as achieving benefits from shared and integrated records. Studying co-creation of value will need to draw upon cultural differences and complementary changes that improve shared acceptance and use. Understanding the embedded capabilities of an integrated records system can impact individual acceptance and use behavior. Understanding the complementary changes in roles, relationships, processes, organizational structures, communication
patterns, policies, and culture can help us understand how to co-create value from shared use, and improve the information mindset for greater value. Value can be measured by understanding the impact of intangibles such as greater data completeness which hopefully can then lead to improved patient outcomes and a better environment for both patients and providers.

By incorporating these concepts into our qualitative assessment of the implementation of this system, we hope to better elucidate the requirements for value realization, providing insights for how to achieve benefits from implementation and integration of electronic health records systems. As more data is integrated, we will measure benefits over time and continue to analyze the changes needed to achieve these benefits and change mindsets of users so that we can further refine our theory and provide additional insights into the complementary changes required in U.S. medical networks for realizing value from integration of electronic medical records.

Because integration of vendor supplied software is in its infancy, these preliminary findings can help inform future practice. These results can also help inform other health systems that are in the early stages of adopting and integrating commercial applications.

10. References


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