8-16-1996

Modeling Information Exchanges Among Health Care Organizations: A Baseline Cost Study

Kathy S. Lassila
University of Southern Colorado

Rita H. Cheng
University of Wisconsin-Milwaukee

Modeling Information Exchanges Among Health Care Organizations: A Baseline Cost Study

Kathy S. Lassila University of Southern ColoradoRita H. ChengUniversity of Wisconsin-Milwaukee

Introduction

Pressures for health care cost reductions under capitated managed care plans are spurring the development of emerging technologies to support the efficient exchange of information among health care providers and payors. One of the key objectives of these development efforts is providing remote access to health care and billing information from any location. Many healthcare providers are currently exploring the viability of community health information networks (CHINs) to provide broad-based remote access to information. CHINs enable health care entities with widely disparate information systems to share medical records and business transactions electronically. Health care entities may include hospitals, physicians, insurance companies, and many related organizations.

The successful implementation of CHINs is currently hindered by a lack of cost benefit data to justify the significant investments involved in their creation and implementation.(Bazzoli, 1995). The task of assessing the business value of CHINs is further complicated by their unique characteristics which make previously defined methods difficult to apply in the CHIN context. The objective of this study was to define a measurement method suitable for the CHIN context. A modeling approach which integrates dataflow diagramming and activity-based costing techniques was used to establish a framework for determining the baseline direct operating costs associated with key information exchanges among health care entities. The model can be used to assess the impact of alternate information exchange activities made possible by CHIN participation. In the next section, significant prior research pertaining to the measurement of the value of IS is briefly presented along with the current obstacles to measuring the value of CHINs. In the following section a research approach designed to address the obstacles to CHIN impact measurement is described. An overview of the study findings and a discussion of the use of the model are then presented, followed by conclusions and suggestions for further research.

Background

The challenges of measuring the business value and impact of IS have been widely documented in popular literature and addressed in a variety of significant research efforts in the past decade. Measurement approaches have included traditional cost benefit techniques, user

information satisfaction, function point analysis, balanced scorecard, process value analysis, and other methods (Kaplan and Norton, 1992; Clemons, 1991; Eccles, 1991; Strassman, 1990; Carlson and McNurlin, 1989; Weill and Olson, 1989; Sassone, 1988; Miller and Doyle, 1987;). Some of these approaches have emphasized defining the overall value of the IS function to the organization, while others have focused on defining the outcome of IS investments in terms of organizational performance. Many studies have focused on defining the value of a specific IS application; however, little work has been done which addresses the unique characteristics of measuring the value of health information networks.

Several obstacles, defined in prior research, exist in determining the business value of community health information network participation (Lassila and Cheng, 1995). First, few fully-functioning CHINs are currently in operation. As an emerging technology, the full impacts of CHIN participation have yet to be identified and exploited. Second, the heterogeneous user population includes a multitude of different health care entities who use different features and functions of the CHIN. This indicates that benefits from participation may vary widely depending on usage patterns within a specific user context. Third, the decision to participate in the network is based on the participation in the network by other users. And fourth, the impact on any one user is determined by use of the CHIN by other network participants. The last two issues are consistent with the finding of research in interorganizational information systems which have identified network externalities and unequal interdependent benefits as important constructs in network implementation (Riggins and Kriebel, 1994; Riggins and Muhopadhyay, 1994; Clemons and Kleindorfer, 1992).

Research Approach

Since the focus of a community health information network is on the exchange of patient administrative and medical information, the level of analysis selected for the development of the cost model was the information

exchange transaction. Current CHIN design and implementation focuses on the hospital as key information provider and physician offices and other entities as information users. Exchanges with insurance companies also are targeted in these efforts. To bound the current study, information exchanges between hospital and physician offices, and from these two entities to insurance companies were targeted,

Information exchanges among these entities typically arise from the set of activities involved in the process of a patient encounter. Thus, a patient flow process beginning at the point of an initial patient request for an appointment and concluding at the point of payment for services rendered during treatment of the patient was identified as the primary research context. The patient flow process at each of 18 health care provider sites was documented through a series of semi-structured interviews. The interview protocol allowed researchers to simulate the patient flow process by "walking through" the actual activities performed by each provider during a typical patient encounter. The 18 sites included: 4 primary care physician practices, 6 specialty care physician practices, 1 large multi-specialty clinic, 1 small family practice medical clinic, and 7 hospital departments (which included Medical Records, Utilization Review, Emergency, Admitting, and Business Office).

A modified data flow diagramming technique which combined both logical and physical elements in the same diagram was used to transform the documented patient flow processes into graphical formats. The process diagrams were reviewed by study participants to verify accuracy and completeness of the tasks in the documented process, and appropriate modifications were made following review sessions. After the process diagrams were completed and verified, external information requests were identified and mapped to information responses. The information requests/responses were compared among all sites, and a set of key information exchanges were derived and later verified by study participants. These information exchanges, grouped by type of health care entity, are shown in Table 1.

An activity-based cost approach, suggested in prior research on information technology value measurement, was used to create baseline costs for each information exchange process (Carlson and McNurlin, 1992). Each key information exchange was decomposed, by process task, into its constituent time, labor, and materials elements. An example of a key information exchange graphical process diagram and the corresponding process cost decomposition are illustrated in Figure 1. Data used to depict the baseline costs were gathered from a variety of sources, including self-report, direct observation, internal reports, and previous data collection efforts. Data elements for identical tasks were averaged across field sites to arrive at a working value for the baseline cost model.

Results and Discussion

Baseline costs for each information exchange are also shown in Table 1. The information exchanges are grouped according to which health care entity is bearing the associated cost. For example, a request for clinical information issued to a hospital from either a primary care or specialty care physician involves verifying and generating the requested information, and receiving and storing the information when provided. The cost of this portion of the information exchange is approximately $4.67. The other portion of this information exchange occurs when the appropriate hospital department, typically the medical records department, responds to and fulfills the information request. On average, it costs a hospital department $5.10 per information request response. Thus the total cost per clinical information exchange is $9.77.

Similarly, the total cost of an information exchange involving a consult between a primary care physician and specialist is approximately $16.72, where a cost of $6.38 per consult is borne by the requesting primary care physician and a cost of $10.34 per consult is borne by the specialist. Both of these exchanges represent relatively high cost activities.

By aggregating the time, labor, and material costs across information exchanges, it was possible to determine a distribution of direct costs from a component perspective. From the physician side, approximately 95% of direct costs involved in information exchanges are attributed to labor. The preparation of the information request and associated processing of the response are the labor-intensive components. With respect to information exchanges from the hospital side, approximately 68% of the direct costs are attributed to labor. The fulfillment of the information request has significant material expenses related to the photocopying and transmission of the response, typically via fax, regular mail, or courier.

The approach to modeling and costing information exchanges described here can be used as the basis for assessing the impact and business value of CHIN participation by comparing the cost of existing activities in current information exchange processes with the cost of new information exchange activities made possible by CHIN use. This assumes that the new information exchange activities are modeled and decomposed into cost components using the same format and approach. While the values provided in this study are the result of a limited sample size, those organizations exploring the development and implementation of a CHIN can gather data specific to their potential participant population and produce a reliable estimate of current and proposed information exchange costs. Obviously the difference in these costs, presumably a reduction, represents a potential benefit from CHIN participation. However, the cost framework provides only one tool to quantify the benefits. Other impact measurement tools need to be incorporated to capture significant benefits such as more timely access to patient data and quicker turnaround time on patient consult reports.

Conclusions

A significant contribution of the process modeling and costing approach to the measurement of IS business value and impacts described here is that it effectively resolves several obstacles to measuring the cost benefit of CHIN participation and successful CHIN implementation. First, the baseline costs derived from the approach can be used to formulate "what if" scenarios for guiding development of CHIN features and functionality. These scenarios will not only help potential participants understand the value of CHINs, but also enhance their understanding of how CHINs can best be used to provide the greatest possible impact on internal work flows. Second, because the baseline process an cost models can be made context specific, the approach will work for measuring the potential impacts of CHIN use in a variety of different environments. This deals effectively with the heterogeneous user issue. Third, the process modeling and cost approach can clearly identify a "value path" during CHIN implementation. Ideally, those users with greatest initial benefits can be targeted first during CHIN implementation to help foster the "critical mass" necessary to make network participation both beneficial and attractive to others. And finally, modeling all sides of an information exchange helps participants understand how their use of the network contributes to the effective use of the network by others.

The initial baseline cost study described here was limited to information exchanges between hospitals and physicians, and from those parties to payors. Further work is needed to examine information exchanges with a broader range of health care entities. In addition, based on CHIN cost benefit information revealed in the framework, it may be possible to develop an optimization model for CHIN implementation planning which identifies the most efficient sequence in which to add participants to the network. This is particularly valuable given the considerable investment and complexities inherent in CHIN start-up efforts. Overall, the process modeling and costing approach described here provides a strong foundation for the empirical measurement of CHIN impacts.

References Available Upon Request

Table 1. Key Information Exchanges

Physicians: Primary Care	Physicians: Specialty Care	Hospitals
Patient Eligibility Determination $1.40	Patient Eligibility Determination $2.10	Patient Insurance Verification $5.00
Patient Pre-Certification for Tests $5.46	Patient Pre-Authorization $2.00	Utilization Management $4.35
Referral Authorization for Consult $3.99	Fulfillment of Consult Request $10.34	Fulfillment of Med. Info. Requests $5.10
Request for Specialty Consult $6.38	Request for Clinical Information $4.67	Fulfillment of Ins. Info. Requests $2.00
Request for Clinical Information $4.67	Request for In-Patient Information $5.09	Billing/Claims Submission $6.00
Request for In-Patient Information $5.09	Billing/Claims Submission $6.00	Billing/Claims Investigation $4.09
Billing/Claims Submission $6.00	Billing/Claims Investigation $4.09	
Billing/Claims Investigation $4.08		

Figure 1. Example of Process Diagram and Cost Decomposition