Lessons learned from three interorganizational health care information systems

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Abstract

The airline, financial, retail, consumer goods and cotton industries are not alone in their increased use of interorganizational information systems (IOSs). Health care organizations are investing and participating in a growing number of IOSs, such as community health information networks (CHINs) and integrated delivery systems (IDS). This paper examines the experiences of three CHIN systems located in the US — Midwest. Multiple data sources, including executive interviews, memoranda, internal documentation and system demonstrations, provided data for this research. The history of each case provides a better understanding of systems implementation and the underlying determinants that emerged as having significant impact. Not only do these findings provide guidelines and learning tools for practitioners, but they also hold implications to the field and its current position on bipolar streams in the literature. Lastly, our findings suggest that large health care infrastructures will continue to be confronted by the presence of the World Wide Web and electronic commerce. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Health information networks; Case study; Electronic commerce; Systems implementation

1. Introduction

CHINs have been defined as [12]: Interorganizational systems (IOS) using information technology(ies) and telecommunications to store, transmit, and transform clinical and financial information. This information can be shared among cooperative and competitive participants, such as payors, hospitals, alternative delivery systems, clinics, physicians, and home health agencies.

It has been anticipated that health care organizations can reap the similar benefits associated with IOSs [2,4,16,18] as experienced by the airlines, banking, consumer goods and automobile industries...
Few studies, however, have examined the implementation and/or historical events impacting such systems. This is particularly the case for cooperative, voluntary CHIN models [6,13,23] that have received a great deal of attention in popular press [12,26]. To encourage discourse concerning these and other IS phenomena, some [21,22] have called for IS researchers to examine the history of such occurrences to establish comprehensive meaning in the field. Ferratt et al. [13] examined the development of a CHIN by seven competing hospitals in Dayton, Ohio. Using elements of case research, such as Lee’s [19]. These researchers determined how IT enables cooperative benefits among competing organizations. Several lessons learned were listed, but they are based on a single CHIN scenario. This study, however, seeks to build upon the findings of Ferratt et al. and to uncover the lessons learned from the implementations of three voluntary CHINs located in the greater Cleveland, Ohio and Milwaukee, Wisconsin areas. Further, this research seeks to uncover the constraints that may limit opportunities for cooperative IOS implementations and validate and/or challenge the lessons previously learned.

2. The research model

Fig. 1 (in the Appendix A) shows our proposed CHIN implementation model which suggests that three sets of factors (push/pull, behavioral, and shared systems topologies) stand to impact the implementation process. These factors continue to be important as organizations experience change processes and later seek to determine the technology impact on the ‘success of the implementation effort’. Evidence from the literature supporting the inclusion of the individual factors is given in Tables 1–3.

3. Research methodology

A case methodology was used to gather the data. This adheres to the strategy deployed by Ferret et al. [13] to study the Dayton, Ohio CHIN. For this research, the case studies include the Wisconsin Health Information Network (WHIN), Regional

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<th>Variables</th>
<th>Operationalization</th>
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<tr>
<td>Government policies</td>
<td>Actions that influence the direction of an industry, organization or group (e.g. regulations, mandates, laws)</td>
<td>[10,20]</td>
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<td>Competition</td>
<td>Competitive activities that influence organizational decision-making (e.g. changes in existing strategies)</td>
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<td>Economic Dimensions:</td>
<td>Anticipated benefits as a result of cooperative participation</td>
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<td>Cost reductions</td>
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Health Information Network of Northeast Ohio (RHINNO) and Northeast Ohio Health Network (NEOHN). In each of these cases, a high level of organizational access existed, and each CHIN used the same application vendor.

Thirty semi-structured interviews were conducted with key participants in these CHINs, including top management of hospitals (chief information, chief executive, and chief financial officers) and vendor representatives. Vendor representatives included members of sales, marketing, and technical staffs and were typically identified by CIOs or an internal hospital contact. Patient representatives/advocates, end-users, and physicians (who are also considered end-users) involved in the implementation process were also interviewed. Access to patients, however, was not provided, and patient advocates were not asked to participate. Data were collected from numerous written organizational documentation, internal memorandum, meeting notes, CHIN and hospital executive overviews, vendor literature, and proposals and hands-on systems demonstrations.

Each interview lasted from 60 to 90 min, and a standard questionnaire was used to gather data. In several instances (roughly 50%), participants were forwarded the questionnaire prior to the actual face-to-face session. While only one participant asked not to be recorded, 29 were; all sessions were transcribed and summarized within 24 h from notes taken during the meetings. Each interviewee was asked to check his/her summary for accuracy and additional clarification. The interview instrument (See Appendix A) links directly to each cluster of factors shown in Tables 1, 2 and 3 as well as Fig. 1.

4. Case histories

Table 4 shows an overview of the histories of the WHIN, RHINNO and NEOHN systems. These data indicate that the WHIN system has progressed further in its implementation than have the other two systems; it has 33 organizational participants and over 1100 physicians sharing health care information. RHINNO

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<td>Behavioral implementation factors included in the model</td>
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<td>Variables</td>
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<td>Quality of CHIN management</td>
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<td>Shared systems topologies implementation factors included in the model</td>
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and NEOHN, unlike WHIN, have yet to resolve the technology, infrastructure support and IOS participant issues that impact the implementation process. It is interesting to note that the RHINNO and NEOHN networks are merely 35–40 miles apart, and face similar competitive market pressures.

In terms of actual CHIN technologies that are currently in place, WHIN is supported by leased lines along with application and user-interface software that can run in both UNIX and Windows-based environments. RHINNO and NEOHN, on the other hand, do not have technologies in place to sustain their CHIN efforts.

Interestingly each CHIN effort is characterized by three opposing support structure strategies. WHIN prescribes to a formal organizational, tightly coupled entity that is functional as both a CHIN and vendor while RHINNO has attempted to pool resources from its sponsors and potential participants. NEOHN, however, has a single director that seeming reports to all participating hospital organizations.

4.1. Findings relative to the research model

Given these strikingly diverse histories, the WHIN interviewees largely supported our model while RHINNO and NEOHN representatives failed to support it. All, however, agreed that there are numerous factors that influence the implementation process; as one WHIN representative stated:

*Implementing a shared health care network is a long process which is directly or indirectly influenced by CEO/CIO/CFO personalities, our ability to deliver, physician presence, and our ability to support the technology (just to name a few).*

4.1.1. Push/pull factors

Several factors included in the model were not supported here. In fact, within and across each case, interviewees suggested that government policies tend to ‘slow the implementation process’ and that the degree to which government will monitor, control and/or participate in these cooperative models has not been clearly defined.

**Economic dimensions**, such as reduced risk, lower transaction costs and increased industry knowledge/competencies, are usually considered prior to the adoption stage of implementation. Such is the case for WHIN, RHINNO, and NEOHN organizations. However, IOS participants support the inclusion of this factor in the model but found it difficult to

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‘measure’ the impact of this shared health care information network. Many RHINNO and NEOHN organizations went further and indicated that the lack of a cost-benefit model precluded their participation in the CHINs, and WHIN members continue to struggle with this concept. To this effect, one physician pointed out: Costs and benefits are unknown at this time. This, however, is interesting and being sought by the hospital (where I practice). If the benefits do not outweigh the costs, other providers (CHIN vendors) are available After all, there is the Internet.

One RHINNO CIO supported the above while summarizing the beliefs of other RHINNO and NEOHN organizations. He concluded: Why build this huge infrastructure when patients usually remain in only one system? Why not use the Internet to do this same thing? I don’t see any (benefits)…Hospitals don’t have the systems (to support a CHIN). The proposed CHIN is a bit premature.

Of the three cases, WHIN actors did not support the contention that competition plays a pertinent role during the implementation process. Rather, WHIN was described as a community enabler; one CIO explained: The rationale was to follow banking and airline models. Competition was not a major factor in the decision process to participate. We needed a community model to deliver care.

Conversely, NEOHN and RHINNO proved to be largely influenced not only by evolving national industry trends, such as shifts toward prospective payment systems, physician group practices, and outcomes measurement, but also by competitive movements within their local area. Each CHIN could potentially serve the same geographical region while offering quite similar services in these markets. To this effect, several interviewees stated: Here, in Cleveland, competition plays a critical role. WHIN is a lone successful case, but it had its share of problems with data sharing among competitors. Full cooperation is not going to happen. Realize that RHINNO started with the Greater Cleveland Hospital Association with NO input from physicians, payors most local hospitals or employers, and this came back to bite (it), Ameritech and E&Y.

4.1.2. Behavioral factors

Though the support of local hospital associations was assumed to be important, none of the case data supported this hypothesis. WHIN participants noted that the local Milwaukee hospital association had recently endorsed its technology. This, however, has attracted additional membership to the network and can be considered a mechanism for obtaining critical mass.

On the other hand, RHINNO and NEOHN executives expressed strong opposition to the Greater Cleveland Hospital Association (GCHA) and its role as a supposedly neutral collective or potential governance moderator. Given their close proximity, participants of the two CHINs are typically members of the larger GCHA, while NEOHN providers have often sought additional membership through a smaller, less influential Akron Hospital Association. Trust among association members can be described as tentative at best.

Data suggested that hospital top management are the CHIN champions. Without their strategic, financial and technical support, implementations were considered virtually unattainable. In addition, as they are an operational CHIN and vendor organization, several participants view WHIN (the application vendor) staff as IOS champions. There are two reasons: WHIN’s trained IS technical support staff and functional groups (e.g. marketing, sales) improve market presence and provide critical mass. Therefore, the Quality of CHIN Management was consistently reduced to top management support.

Each of the cases supported the inclusion of vendor, physician and end-user (such as nurses and hospital administration) support in the model. Of these three constructs, physicians clearly played the most significant role in the implementation process. WHIN cited its efforts to target physicians — given their presence as a large service-generating constituent in the health care industry. As one CHIN application vendor concluded: Hospitals must romance physicians at all costs. CHINs must simplify the lives of physicians or they will not get off the ground.

Application vendors were viewed as the technical enablers for CHIN implementations. However, several RHINNO and NEOHN interviewees viewed them (Big 6 and telecommunications organizations) as
merely revenue seekers with little real interest in the ‘community’ concept. As one CIO summed it:

They (Big 6 and telecommunications organizations) are chopping at the bit because CHINs represent streams of revenue that they want control of. But hospitals, and to a small degree, physicians (but I don’t see them paying) are being asked to pay for CHINs.

Overwhelmingly, lack of importance of patient support emerged. Patients, though defined as customers, were often described as users of health care services but with no active voice in CHIN implementations. In fact, most interviewees considered that patients failed to understand the health care delivery process, are in need of health care education, and may only add to the cost of care, if involved. Customers (patients) were often described as ‘by-products’ of the health care delivery system. Further, privacy and security of patient medical and financial information were consistently considered as ‘noise’. One CIO offered:

When you want care, you will sign whatever to get that care.

Lastly, organizational autonomy and control was not always considered to be an issue: WHIN participants consistently debunked the role of this construct, and many stated that they gain more control by using an electronic medium to facilitate care delivery. Several interviewees cited the technology’s ability to track claims electronically, etc. On the other hand, RHINNO and NEOHN organizations clearly supported the significance of organizational autonomy and control. Many simply did not want to become a part of ‘shared basket’ with little or no organizational identity. It could be viewed as a precursor to losing competitive advantage and market share. One CIO explained:

This is important, but cooperation means sharing key, often strategic data in an integrated fashion. Procedures and policies must fit at the internal and CHIN/NEOHN levels.

4.1.3. Shared systems topologies factors

Each of the three cases supported the inclusion of information sharing and information quality. The concerns of disparate systems (clinical and financial), competing vendor hardware and software, lack of industry data sharing standards, and inefficient intraorganizational processes emerged among the interviewees. This is particularly true of RHINNO and NEOHN. One WHIN representative stated:

(To implement CHIN technologies and enable information sharing), WHIN participation requires organizational change and reengineering. Without change, organizations sustain the cost of doing normal business PLUS the cost of WHIN connectivity. This requires internal cooperation and coordination among internal hospital departments.

In terms of information quality and sharing, respondents realized the importance of process improvement and reengineering at the intraorganizational level to gain enhanced information quality. Results, however, were mixed as to the degree of improvement that would be gained by participating in a CHIN. Some asked whether participation could result in improved information quality or decision-making; several WHIN participants concluded that the technology failed to improve the quality of the information, it merely expedited the receipt of information among its participants. One executive raised concerns:

My concerns are platform related...Moving from platform to platform may hinder information sharing. Different codes result in no meaning if information sharing is going to occur. We need uniform codes, and maybe this is a place for government involvement. But...this is an awful thing to pass to the bureaucrats. Without standards, corruption is highly probable.

IOS implementations must actively engage in systems planning, needs assessment and organizational readiness activities. Direction setting, needs definition, evaluation of alternative technologies, and efficient intraorganizational processes are enablers to systems implementation.

4.2. Other factors critical to the implementation process

Overcoming vendor conflicts emerged in all three cases. According to several RHINNO and NEOHN interviewees, “vendor turf wars generate (technological) issues during CHIN implementations.” While some explicitly indicated the need for application vendors to avoid seamless, open system technologies (thereby driving up product and services costs), one CIO recommended that “we (the health care industry)
should look at the banking industry to move toward industry efficiency’.

Moreover, he cited how easily banks share ATM data without the burden of multiple platform technologies that cannot ‘communicate’. As such, ‘political issues’ seeks to assess interorganizational and intraorganizational conflicts that stand to impact the CHIN implementation process. Confrontations can stem from vendors, top management, physician groups, and other decision-makers.

CHIN implementation success depends on **systems planning, organizational readiness, and needs assessment**. Systems planning determines organizational direction and scope, while identifying solutions that can benefit all business units or CHIN participants. Likewise, organizational readiness requires that internal organizational processes must be efficient and in place to manage the impacts of broader technologies, such as IOSs. Finally, needs assessment appears to be fundamental in gaining endorsement. Thus, a clearly defined need must first be uncovered. The challenge for CHINs is to create (perceived) value and benefits. The original model, however, did not capture these elements. Thus, Fig. 2 (See Appendix A) shows the revised model as a result of the different views that emerged from the case studies.

### 4.3. Lessons learned

Unlike the success of the Greater Dayton Area CHIN, these data indicate varied degrees of implementation success (failure) among the cases. Despite this, these cases provide several lessons that focus on the implementation process.

#### 4.3.1. The constraints lesson

While the technology is critical in the implementation process, political issues among vendors and health care providers, top management support, and physician support play vital roles. Behavioral constraints must be present and/or overcome if CHINs are to obtain implementation success. Government policies and mandates, however, tend to hinder opportunities for organizations to cooperate. A shift from fee-for-service to a prospective payment system and government’s heavy presence in regulating the US health care industry via agencies, such as the Joint Commission for Hospital Accreditation, Medicare and Medicaid. Lastly, interviewees simply view government as a ‘Big Brother’ that slows down CHIN implementations.

#### 4.3.2. The planning lesson

Without careful long-term planning (strategic), CHIN implementations have a greater propensity of failure. Initiating organizations must engage in systems planning and needs assessment within their community. This caveat was particular clear in the RHINNO and NEOHN cases. Identifying and engaging key players is vital particularly as US health care organizations migrate toward Web-based, e-commerce mechanisms for care delivery.

#### 4.3.3. The (intra) interorganizational lesson

Individual organizations should assess intraorganizational processes to ensure that mechanisms are in place to support the CHIN. This can require intraorganizational process reengineering and innovation [7] prior to committing organizational human, financial, and time resources to the IOS effort. Despite this implication, a larger issue stands to confront US health care players: why invest millions in massive proprie-
tary networks, when the Internet and Web-based technologies are enabling electronic commerce applications? Such e-commerce initiatives are visible at HealthMagic (www.healthmagic.com), WebMD (www.webmd.com) and Healtheon (www.healtheon.com).

4.3.4. The organizational structure lesson

Given the enormous amount of resources needed, alternative organizational structures appear to strengthen implementation success. As in the case of WHIN, a pooled, distinct organization emerged to support the CHIN technologies’ infrastructure. The WHIN, vendor group, offers marketing, technical, and development support to its participants thus, varying greatly from the structures instituted by NEOHN (a single director hired by the CHIN sponsor) or RHINNO (loosely coupled via the three CHIN sponsors).

4.3.5. The customer lesson

According to Ferrat et al. “competitors can have a collaborative advantage in acquiring IT for sharing customer data if service to customers is improved through sharing the data”. Interviews strongly implied that the real customer is not the patient. Rather, CHIN initiatives are targeting the physician as the primary customer as service generators, care producers, and health organization owners.

4.3.6. The competitive market lesson

While hospital participants in the Greater Dayton Area Patient Health Information Network agreed to cooperatively collaborate if none achieved competitive advantage over the others, the histories of RHINNO and NEOHN did not support this. In fact, a sense of trust has yet to be established among hospital competitors. Central to this finding are unresolved issues of ‘who’ should pay for such enormous infrastructures, data access and security, and the market (Cleveland) which is characterized by the presence of a large number of redundant care plans and providers.

4.3.7. The leadership/priority lessons

CHIN project/implementation success apparently depended on the roles and functions of intraorganizational project managers who met on interorganizational CHIN steering committees. These leaders shared a common vision and undoubtedly had the necessary backing of their respective top management teams. While this may have been the case of WHIN, RHINNO and NEOHN failed to follow this model of project management. While Dayton’s project leaders served as champions, RHINNO and NEOHN data indicated that hospital top management engaged in championship behaviors and often failed to reach any consensus in planning or needs assessment.

4.3.8. The history lesson

The history of WHIN strongly lends itself to prior collaborative ventures among Milwaukee health care players (via the earlier Aurora Health System and physician network). Consequently, some organizational learning regarding cooperative collaborate resulted before the broader technology was implemented. While the same can be implied from the NEOHN case, with the development and use of the AGMC PSN, market place issues tended to preclude implementation progress.

4.3.9. The economic lesson

Though WHIN organizations have progress further within the context of the cooperative CHIN implementation model and RHINNO and NEOHN groups continue to resolve marketplace and organizational structure questions, the benefits have yet to be proven. As several hospital executives stated:

the technology is unproven...premature. Who knows the real benefits other than vendors and consulting firms who see dollar signs. .We need to determine the benefits and the costs are clear and enormous.

4.4. Limitations and conclusions

Several lessons were learned from three community health information networks, and these were compared with findings as noted by Ferratt et al. The constraints, however, that tended to preclude implementation success and ultimately can limit the use of IT for collaborative advantage were also noted. The three projects advocate the inclusion of economic, competitive market place, and organizational structure lessons. Further, these findings hold implications for health care organizations early attempts to migrate
toward integrated, large scale networks. As such, these findings highlight the challenges confronting more recent efforts of health care electronic commerce — which is characterized by uncertainty in economic returns, data sharing, and use of the World Wide Web for clinical and financial services.

Despite the contributions of this research, there are certain limitations worth noting. Each of the cases is located in the US Midwest, thereby eliminating significant health care markets even in the USA. These Midwest areas are characterized by a high degree of managed care and have often served as models for cooperative health care ventures.

Appendix A. Interview guide

Push/pull factors

1. How do you anticipate (What has been your experience) the government impacting the implementation of community health information networks? How will (has) the government’s role evolve throughout the initiation, adoption and adaptation stages of the implementation process?
2. What economic benefits is your organization anticipating (has experienced) as a result of participating in a cooperative CHIN effort?
3. Were there any costs to your organization as a result of participating in this effort? Do (have) the benefits outweigh costs? Explain.
4. How will (have) economic objectives be (been) monitored throughout the stages of the implementation process?
5. How has the competitive environment influenced your decision to participate in the CHIN? How (has) do you anticipate this to change throughout the implementation process?

Behavioral facilitators

6. What (has been) will be the role of the CHIN vendor(s)? When did (does) the vendor become critical to the implementation process? How has (does) this change throughout the process?
7. What types of services/expertise has/should the vendor provided?
8. How and when has/does your CHIN effort attempted to incorporate patient support and patient perspectives? What has been (is) the impetus for involving or excluding patients in the implementation process? How do you anticipate (has) the CHIN to impact patient care?
9. How and when has/does your CHIN effort attempted to incorporate physician support and physician perspectives? What was (is) the impetus for involving or excluding physicians in the implementation process? How do you anticipate the (has) CHIN to impact physician practices? What have been (are) the motivators to encourage physician CHIN participation?
10. How has (will) top management been involved in the CHIN implementation process? How has (will) the local hospital association been involved in the implementation process? What value/services (will) does the association provide to assist with CHIN implementation?
11. What end-users are (will be) involved in the CHIN implementation process? How was (will be) end-user support gained and how has it evolved throughout systems implementation? How is (will) end-user support assessed?
12. How has (will be) organizational control and autonomy been impacted during the implementation process? What procedures have been (will be) adopted to ensure that CHIN participants do not feel a loss of control and autonomy as a result of the cooperative effort?
13. Who (will be) are the key actors in the CHIN implementation effort? What (will be) are their roles, and how (will) did they conduct their respective roles? (Championship)

Shared topology

14. What types of information will be shared (are shared) among CHIN participants? How have your information sharing requirements changed throughout the implementation process?
15. How (has) will information sharing benefit your organization? What are some of the foreseeable limitations of information sharing among such diverse participants (e.g. hospitals, physicians and patients)?
16. Does the CHIN provide the precise (e.g. content), timely, current, relevant and accurate information you need? Does the CHIN provide quality information to facilitate your needs? If not, what is needed to improve information quality?
17. How has the CHIN impacted (expected to
impact) the quality of the information that you receive (will receive) and use to facilitate decision-making?

Behavioral facilitators

18. What (has been) will be the role of the CHIN vendor(s)? When did (does) the vendor become critical to the implementation process? How has (does) this change throughout the process?

19. What types of services/expertise has/should the vendor provided?

20. How and when has/does your CHIN effort attempted to incorporate patient support and patient perspectives? What has been (is) the impetus for involving or excluding patients in the implementation process? How do you anticipate (how has) the CHIN to impact patient care?

21. How and when has/does your CHIN effort attempted to incorporate physician support and physician perspectives? What was (is) the impetus for involving or excluding physicians in the implementation process? How do you anticipate the (how has) CHIN to impact physician practices? What have been (are) the motivators to encourage physician CHIN participation?

22. How has (will) top management been involved in the CHIN implementation process? How has (will) the local hospital association been involved in the implementation process? What value/services (will) does the association provide to assist with CHIN implementation?

23. What end-users are (will be) involved in the CHIN implementation process? How was (will be) end-user support gained and how has it evolved throughout systems implementation? How is (will) end-user support assessed?

24. How has (will be) organizational control and autonomy been impacted during the implementation process? What procedures have been (will be) adopted to ensure that CHIN participants do not feel a loss of control and autonomy as a result of the cooperative effort?

25. Who (will be) are the key actors in the CHIN implementation effort? What (will be) are their roles, and how (will) did they conduct their respective roles? (Championship)

Other issues

26. What problems and/or difficulties has your organization experienced during the CHIN implementation process?

27. Are there other critical factors to the implementation process that we have not discussed? Explain.

28. Given your current state in the implementation process, what predictions or expectations do you have concerning the later stages in the implementation process?

References


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