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Taming the RHINo: Interorganizational Implementation Issues of Regional Health Information Networks

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Introduction

Mounting pressures for health care reform are driving a variety of changes in the health care industry. The traditional model of isolated health care entities is giving way to the formation of integrated health care delivery systems (Peters, 1994). The success of these systems rests in part on their ability to tie together geographically dispersed players and integrate operations to provide economic incentives for all participants. In this evolving health care environment, information provides the power to control and manage patient care and to substantially reduce health care delivery costs. Movement away from traditional, extensive paper processes to electronic, interactive systems is expected to generate significant savings and overall improvement in care due to improved availability and timeliness of information (Marcoux, 1994). Unfortunately, broadly-based information systems to support the administrative and clinical information needs of integrated delivery systems are rarely found.

Regional health information networks (RHINs), also referred to as community health information networks, are an emergent form of interorganizational information system (IOS) currently under development as one answer to the information needs of the changing health care industry (Bergman, 1994). A RHIN is an integrated collection of computer and telecommunications capabilities that transport patient clinical and financial information among health care entities within a specific geographic area. RHINs provide the capability for data access and sharing across a wide spectrum of health care industry participants. This paper presents an exploratory study of one of the first RHINs to be developed and implemented in the United States. The purpose of the study was to identify the current status of the network in terms of user information satisfaction and utilization, and to identify key implementation issues of the RHIN. Prior research on the development/implementation of interorganizational systems and the adoption of innovations formed the basis for interpretation of the study findings.

Research Approach and Results

The exploratory study consisted of four distinct phases: descriptive analysis, user satisfaction analysis, utilization analysis, and implementation analysis. Each of these phases and their results are summarized below.

Phase 1: Descriptive Analysis

In the first phase of the study, unstructured, in-depth interviews were conducted with the RHIN vendor representatives, and archival data involving the creation and marketing of the RHIN were examined. During this phase of the study, the objective was to provide descriptive background on the initial development and current status of the RHIN.

The RHIN has been in operation for approximately two years. It was formed as a commercial venture and collaborative effort between a major health care provider and a telecommunications company. It provides information access between and among health care entities in a single state geographical region. The RHIN consists of a central switching system, a user interface, and information provider interfaces. The information provider interface, located at each provider site, translates data into a consistent format for transmission across the RHIN.

Information providers participating in the RHIN at the time of the study are hospitals that make patient data available to authorized users. Users, primarily physician office staff, dial up to the central RHIN switching system to access information from the information providers. All users access the RHIN with user interface software that provides consistent presentation and display of information, regardless of the information's source. The user interface software is relatively simple and straightforward, and users require a modest amount of initial training in order to access the RHIN. Multiple levels of security protect the patient data from unauthorized access and use. The information transactions supported by the RHIN include requests for: patient demographics and insurance information, patient census and eligibility, lab results reporting, medical records abstracts, electronic claims submission, claim status inquiry, and medical records transcriptions. The distribution of RHIN participants at the time of the study is summarized in Table 1 (A).

**Table 1.
Key Findings**

<p>(A) Descriptive Analysis</p> <p><u>RHIN Participants:</u></p> <p>1000+ Physicians 13 Hospitals 4 Billing Services 3 Insurance Organizations 2 Ambulance Services 1 Home Health Care Organization 1 Nursing Home</p>	<p>(C) High Volume RHIN Transactions:</p> <ol style="list-style-type: none"> 1. Patient Census List 2. Patient Vitals List 3. Physician List 4. Query by Patient Name 5. Medical Transcription Report 						
<p>(B) User Information Satisfaction Analysis, n=102</p> <p><u>RHIN Total Satisfaction (Range: 11 to 55):</u> 46.5</p> <p><u>Satisfaction Ratings by Factor (Scale: 1 to 5):</u></p> <table border="0"> <tr> <td>RHIN Information Product</td> <td align="right">3.9</td> </tr> <tr> <td>RHIN Staff and Services</td> <td align="right">4.1</td> </tr> <tr> <td>User Knowledge and Involvement</td> <td align="right">4.1</td> </tr> </table>	RHIN Information Product	3.9	RHIN Staff and Services	4.1	User Knowledge and Involvement	4.1	<p>(D) Factors Influencing RHIN Implementation/Use:</p> <p><u>Organizational Level:</u></p> <ol style="list-style-type: none"> 1. Network Externalities 2. Unequal Interdependent Benefits 3. Unequal Independent Benefits <p><u>Individual Level:</u></p> <ol style="list-style-type: none"> 4. Perceived Relative Advantage 5. Availability of Substitutes 6. Degree of Visibility 7. Time for Experimentation 8. Perceived Benefits from Use 9. Ease of Access
RHIN Information Product	3.9						
RHIN Staff and Services	4.1						
User Knowledge and Involvement	4.1						

Phase 2: User Satisfaction Analysis

In the second phase of the study, the short-form of the user information satisfaction scales (Baroudi and Orlikowski, 1988), was modified to reflect the specific context of the RHIN. All RHIN users who had been assigned a login name and password prior to the date of the study received a survey by mail. Of a possible 1,280 responses, 102 surveys were returned for a response rate of eight percent.

Following the recommended framework for diagnostic use of the user information satisfaction scales (Baroudi and Orlikowski, 1988) the survey data were examined to provide a starting point for analysis of user satisfaction and problem areas related to RHIN implementation. The results of the analysis are displayed in Table 1 (B). The total satisfaction scores were moderately high, suggesting moderately high satisfaction with the RHIN by current users.

Since the user information satisfaction scales are designed to measure satisfaction across three dimensions, the subtotals for these factors were examined next. The factor subtotals are represented by the average of their component scales. Once again the scores appeared moderately high, with no significant difference in satisfaction between the three dimensions based on the results of appropriate t-tests ($p = .01$). From a diagnostic perspective, the results of the survey indicate that RHIN users are highly satisfied with the information provided by their access to the RHIN, their interactions with RHIN staff and services, and with their level of knowledge and involvement in the development of the RHIN.

Phase 3: Utilization Analysis

In the third phase, utilization was explored by examining usage patterns reported by survey respondents and machine-generated usage statistics captured by the network switching software. Most of the network volume was generated by six of 20 key transactions provided by the network, as shown in Table 1 (C). Respondents reported using the RHIN between 1 to 5 hours per week on average, which was further supported by machine-generated statistics.

Approximately 49% of respondents indicated they were not regular users of the RHIN, which was also indicated by the machine-generated statistics. In addition, follow-up calls to 30 survey non-respondents identified non-use as the key reason for failure to participate in the survey. These statistics indicated a significant degree of non-use by participants in the RHIN. This led to the fourth phase of the study which focused on the factors influencing adoption and use of the RHIN.

Phase 4: Implementation Analysis

In the final phase of the study, an interview guide was developed based on findings of the prior phases. A series of semi-structured interviews were conducted with a cross-section of RHIN users representing 25 participating organizations. The interviews revealed two distinct levels of network participation. These levels and the factors influencing them are summarized in Table 1 (D).

Issues related to the adoption and implementation of the RHIN at the organizational level are consistent with those identified in prior IOS research (Riggins, 1993; Clemons and Kleindorfer, 1992; Barrett and Konsynski, 1982). The interview results suggest that network externalities and unequal interdependent benefits influence RHIN participation. Network externalities, present when the demand of one entity for the network depends on the use of the network by others, are highly likely to influence the decision of some health care entities to join the network. If an organization determines that a significant number of organizations with which they must exchange information are not participating, they will choose not to participate. Unequal interdependent benefits imply that how one organization implements the IOS may directly affect the benefits received by one or more of the other participating organizations. If an organization perceives too much variability in the implementation/use by organizations with which they exchange information, or if they perceive that other participants will receive greater benefits, the organization may choose not to participate.

Another issue related to the decision to participate in the RHIN which was not identified in prior research involves unequal *independent* benefits from RHIN implementation. Two key characteristics of the RHIN which distinguish it from other forms of IOS are the third-party facilitated structure and the heterogeneity of participants. Prior research on IOS emphasized dichotomous structures, such as buyer-seller relationships, which are characterized by a high degree of homogeneity among participants. In these structures the IOS initiator frequently wielded market power to coerce sellers into participation. In contrast, the RHIN examined here

represents a third-party, semi-collaborative, market-driven IOS structure characterized by a high degree of heterogeneity among potential participants. Under this structure, clear explication of the anticipated benefits are needed to motivate organizations to participate. The identification of independent benefits of RHIN participation within heterogeneous organizations becomes problematic due to the broad range of internal activities and processes which are potentially impacted by RHIN implementation. The existence of both unequal interdependent benefits and potential independent benefits makes the anticipated impact from RHIN implementation difficult to measure. Many organizations will be hesitant to participate without a clear picture of what they can expect to gain from their investment.

The second level is the voluntary adoption and use of the RHIN by an individual within the adopting organization. Issues at this level are consistent with Rogers' (1984) innovation adoption characteristics. Most notable among these characteristics are the concept of relative advantage and the availability of substitutes. While RHIN was perceived as having greater relative advantage than mail or courier, its advantage over phone, fax, or finger tip access to a patient medical file was perceived by some users as marginal. Discussions with high volume RHIN users revealed that heavy reliance on RHIN occurred because their specific data needs could not easily be fulfilled by phone or fax requests. Additional comments gathered during the interviews suggested that the RHIN suffered from low visibility in some organizations. Five percent of respondents (all physicians) indicated that they did not know what RHIN was, even though it had been installed in their organization for at least three months. This may be due to a focus on RHIN use for financial or administrative purposes, rather than an emphasis on the use of RHIN to access clinical information. Other factors identified as contributing to RHIN usage levels included: lack of time to experiment with the RHIN to see how it could be used to complement on-going work processes, lack of perceived benefit from RHIN use, inaccessibility/poor location of the RHIN terminal, and difficulty of data transfer between RHIN and other applications.

Conclusions and Future Research Directions

RHINs provide an important mechanism for information automation and sharing among organizations in the rapidly changing health care industry. Since the development of technologies to facilitate integrated health care delivery systems is central to their success, the role of RHINs in supporting health care reform is significant. The emergence of RHINs provides the rare opportunity to conduct meaningful longitudinal studies of the industry-wide impact of this emerging information technology.

As an emerging form of IOS, RHINs represent a significant departure from the IOS documented in prior research. Future research efforts should focus on the identification and documentation of other third-party facilitated IOS structures. The heterogeneity of participants and the difficulty in measuring impacts of

participation also present unique and interesting methodological challenges worthy of further consideration in future studies of interorganizational information systems.

References are available upon request.