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# A THEORY OF RURAL TELEHEALTH INNOVATION – A PARADOXICAL APPROACH

*Completed Research Paper*

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## **Abstract**

*Telehealth promises to provide underserved communities with better medical services and to help rural healthcare institutions become financially sustainable. However, these institutions find it challenging to implement telehealth because their resources are severely constrained even to maintain current operations. This paper investigates how a rural health institution successfully addressed this paradoxical situation by integrating telehealth into its operations over a 20-year period. We identify three sets of tensions that manifest during the telehealth implementation process: autonomy vs. dependence (relating to resource acquisition), controlling vs. drifting (relating to enabling the innovation), and exploration vs. exploitation (relating to creating a sustainable solution). Drawing on Poole and Van de Ven's (1989) paradoxical approach, we develop four propositions comprising a theory of rural telehealth innovation. We suggest that three paradoxes shape rural telehealth innovation: Paradox of Alliance, Paradox of Governance, and Paradox of Learning, and explain how innovation unfolds in response to these paradoxes.*

**Keywords** - telehealth, rural healthcare, paradoxical thinking, IT adoption, qualitative study, process theory

## **Introduction**

The healthcare system in the U.S. faces serious challenges, including increasing demands, spiraling costs, inconsistent and poor quality of care, fragmented processes, and slow responsiveness (Corrigan et al. 2001; Kohn et al. 1999; Porter and Teisberg 2004; Rai and Sambamurthy 2006). While these endemic problems adversely impact a large proportion of the U.S. population, rural communities face several additional challenges (Gamm et al. 2002). Here, residents suffer from a “triple jeopardy” – the unenviable situation of being rural, poor, and lacking insurance (Rowland and Lyons 1989). Rural healthcare institutions are therefore called upon to do more to protect the health of people with substantially fewer resources than institutions in urban areas (Moscovice and Stensland 2002; Ricketts 2000). Dwindling economies, large indigent populations, unhelpful policy changes, and lack of investments in public health infrastructures further exacerbate the situation in rural areas (Slifkin et al. 2001). As a consequence, rural healthcare institutions remain vulnerable and fragile (Gamm et al. 2002) and, over the last two decades, many of them have closed, or face closure (Drain et al. 2001; Holmes et al. 2006).

Telehealth can help address rural healthcare challenges by providing access to medical services to underserved communities over distance. In fact, telehealth represents an “alternative healthcare delivery system” (Bashshur et al. 2000b) and rural healthcare institutions need to explore the opportunities offered. However, these institutions have severely constrained resources to provide even the most basic medical services. As a result, rural health managers and policy makers face a difficult paradox (Lewis 2000; Poole and Van de Ven 1989):

***The Rural Healthcare Paradox:*** How can rural healthcare institutions engage in innovations to become financially viable and effectively meet community demands when available resources are severely constrained even to execute current operations?

The purpose of this paper is to theorize how rural healthcare institutions can address this paradoxical situation by successfully deploying telehealth to deliver services to the local community. We investigate how South East Health District (SEHD), the largest public health district in Georgia, integrated telehealth as an important and sustainable part of its operations. Based on data covering a 20-year period, we offer contextually sensitive contributions to information systems research within healthcare (Chiasson and Davidson 2004). As a common language for future interdisciplinary research, we synthesize technological, managerial, and healthcare perspectives into a theory of rural telehealth innovation. To our knowledge, this is the first paper to develop a theory to help understand how rural healthcare institutions can successfully deploy telehealth into their day-to-day operations. Our research also has practical implications that may help rural healthcare managers address the tensions implicit in telehealth implementation.

## **Telehealth Innovation**

Telehealth encompasses the distant delivery of health related services through the transfer of audio, video and graphical information via telecommunication networks (LeRouge et al. 2007; Paul et al. 2004; Perednia and Allen 1995). The 1990’s witnessed a proliferation of telehealth, primarily due to advances in network technologies, advanced interfaces, and mobile technology (Maheu et al. 2001). These networks, initially built for medical consultative and diagnostic purposes, are now also used for planning, coordination, education, collaboration, and other supporting activities to provide a wide variety of telehealth services (Moore 1999).

Drawing on Hersh et al. (2006), we distinguish between different types of telehealth services, as shown in Table 1. Medical institution-based services involve real-time interactions that conventionally would require face-to-face encounters between a patient and a health professional. Medical home-based services enable physicians, nurses, and allied staff to monitor physiological measurements, test results, images, and sounds collected in a patient’s residence or a nursing facility. Medical information services allow remote interpretation of medical data (such as digital still or moving images, audio and text) to support clinical decision-making. These services are typically asynchronous and non-interactive, thus eliminating the need to have the patient and the specialist available at the same time. Educational services involve staff and patient education and training using telehealth technologies such as video-conferencing. Finally, collaboration services include real-time coordination, planning, reporting, and information sharing across medical and allied staff groups using telehealth technologies.

**Table 1 - Telehealth Services - based on Hersh et al. (2006)**

Types of Services	Examples	Key References
Medical institution-based services	<ul style="list-style-type: none"> <li>• Triage for stroke patients</li> <li>• Remote consultation with a neurologist</li> <li>• In-ambulance, pre-hospital diagnosis of patients</li> </ul>	(Cho and Mathiassen 2007; Chua et al. 2002; Terkelsen et al. 2002)
Medical home-based services	<ul style="list-style-type: none"> <li>• Rehabilitation program for multiple sclerosis patients</li> <li>• Asynchronous monitoring of blood glucose for diabetic patients</li> <li>• Monitoring of pulmonary patients after lung transplant</li> </ul>	(Egner 2003; Montori et al. 2004; Morlion et al. 2002)
Medical information services	<ul style="list-style-type: none"> <li>• Epidemiological vigilance</li> <li>• Evaluation of medical conditions using high resolution images</li> <li>• Evaluation of gastrointestinal endoscopy transmitted by video</li> </ul>	(Miscione 2007; Oztas et al. 2004; Wildi et al. 2004)
Educational services	<ul style="list-style-type: none"> <li>• Training non-medical persons in early recognition of medical conditions</li> <li>• Continuing medical education of staff</li> <li>• Lactation consulting for new mothers</li> </ul>	(Chao et al. 2003; Sinclair et al. 2000)
Collaboration services	<ul style="list-style-type: none"> <li>• Developing and sharing medical protocols</li> <li>• Research collaboration</li> <li>• Administrative coordination and status reporting</li> </ul>	(Constantinides and Barrett 2006; Paul 2006; Robinson et al. 2003)

Existing research on telehealth innovations reveals important insights. First, despite decreasing equipment costs, rapidly evolving technologies, and proliferation of applications, telehealth dissemination has been slow and uneven (Field and Grigsby 2002). Studies offer many explanations such as knowledge barriers, policy constraints, reimbursement issues, and start-up funding (Bashshur et al. 2000a; Grigsby et al. 2002). As a result, most studies report on pilot systems or systems failure; there are few examples of sustainable telehealth innovations (Cho and Mathiassen 2007). In fact, telehealth solutions are seldom successfully integrated into day-to-day operations despite being both medically and technically viable (Craddock 2002; Sanders and Bashshur 1995; Wright 1999).

Second, telehealth covers a variety of medical specialties and delivery options. Clinicians, nurses, health workers, and patients use these services in diverse physical settings (Chau and Hu 2004; Meade and Lam 2007; Nicogossian et al. 2001). Most studies focus on medical institution-based, home-based, and information services (see Table 1 for examples). Relatively few studies, such as Miscione (2007), Paul (2006), and Robinson (2003), focus on educational and collaboration services, even though these account for a significant proportion of telehealth use (Grigsby 2002).

Third, existing studies focus on telehealth in a variety of contexts, such as university hospitals, independent physicians' offices and public health departments (Field and Grigsby 2002; Grigsby 2002). However, most studies focus on large hospitals or government agencies with substantial resources (Chau and Hu 2004; Constantinides and Barrett 2006). Few telehealth studies consider resource-constrained institutions located in rural or medically underserved areas. Notable exceptions include Mbarika et al. (2004), Miscione (2007), and Cho et al. (2007).

Against this backdrop, the purpose of this research is to investigate how a rural public health district successfully integrated telehealth into its operations and enhanced its service delivery. This case allows us to study how the rural health institution adopted telehealth innovation for delivering medical, educational, and collaboration services, and how the innovation became a sustainable part of healthcare delivery despite the Rural Healthcare Paradox. We base our research on process theory (Constantinides and Barrett 2006; Gallivan 2001; Langley and Truax 1994; Montealegre 1999; Newman and Robey 1992) and dialectical theory, assuming that individuals and organizations exist in a pluralistic world of colliding events, forces or contradictory values that compete with each other for domination and control (Van de Ven and Poole 1995). These oppositions may be internal or external to organizations, and the balance between them determines how processes shape over time.

## Paradoxical Thinking

Researchers define paradox in many ways: an informal umbrella for interesting and thought-provoking contradictions; an opposition between two accepted theses; and, two contrary or even contradictory propositions that seem logical in isolation, but inconsistent and irrational when taken together (Lewis 2000; Van de Ven and Poole

1988; van Heigenoort 1967). Paradoxical thinking can help understand the dialectics of complex organizational processes by unweaving irrational and inconsistent opposites, discovering different assumptions and shifting perspectives, posing problems in fundamentally different ways, posing different research questions, and developing new theoretical contributions (Cameron and Quinn 1988; Poole and Van de Ven 1989). Researchers have applied paradoxical analysis to a variety of organizational phenomena: manufacturing (Eisenhardt and Westcott 1988), quality management (Klein 1994), product development (Lewis et al. 2002), strategic alliances (Clarke-Hill et al. 2003), corporate governance (Sundaramurthy and Lewis 2003), knowledge management (Chae and Bloodgood 2006), and organizational change (Lüscher and Lewis 2008).

Poole and Van de Ven (1989) present four approaches to investigate paradoxes and build theory. These approaches are applicable individually, or in combination: 1) *Opposition*: Identify events and articulations of actors as evidence of the paradox and its oppositions. This approach helps juxtapose contradictory propositions and assumptions, and reveal the dialectic between opposing elements. 2) *Spatial separation*: Resolve paradox by identifying levels of analysis of opposing elements and their connections (e.g., part-whole, micro-macro, and individual-society). This approach can reveal that one opposite operates at one level (e.g., micro), while the other operates at a different level (e.g., macro). Similarly, for spatial distinctions, one opposite can operate in one physical or social locus (e.g., upper echelons), while the other operates in a different locus (e.g., line workers). 3) *Temporal separation*: Resolve paradox by separating opposing elements temporally. This approach can reveal that one opposite exerts influence during one period, and the other during a different period. 4) *Synthesis*: Resolve paradox by identifying new concepts and propositions, addressing limitations or flaws in current theory, and by building new theory.

Lewis (2000) offers an alternative approach to build theory based on paradoxical analysis. Her framework suggests examining: 1) how paradoxes stem from opposing cognitive and social constructs, 2) how reinforcing cycles might generate because of involved actors' defensive reactions, and 3) how managerial interventions help actors avoid being stuck in these cycles. We use Poole and Van de Ven's (1989) approach in this study because their explicit emphasis on spatial and temporal separation lends itself well toward the multi-level nature of telehealth innovations and the longitudinal nature of our data. We believe that the use of these approaches will generate insights about the dilemmas managers face and the courses of actions they can take to address the Rural Healthcare Paradox.

## **Research Method**

We designed the research as a qualitative, longitudinal case study of SEHD from 1988 to 2008. Qualitative methods are particularly helpful when exploring emerging issues (Miles and Huberman 1994), as they provide rich descriptions of phenomena, the context of events, as well as the events themselves (Sofaer 1999). The case study approach is particularly useful when examining contemporary events where behaviors cannot be manipulated and there are too many variables to use an experimental approach (Yin 2003). Longitudinal studies help understand how content and context interact and change over time in complex transformations (Pettigrew 1990). Therefore, a longitudinal case study is appropriate to help understand *how* SEHD addressed the Rural Healthcare Paradox by going through several phases of telehealth technology selection, adoption, and integration over a 20-year period.

At SEHD, a staff of over 400, including more than 100 nurses provides services for women and children, emergency preparedness, chronic diseases prevention, and health promotion. We selected this case based on purposive sampling (Mason 2002) to develop new theory about rural telehealth innovation. SEHD represents a rare case of successful adoption of telehealth in a rural institution; it was the only one of five pilot programs in the Georgia Statewide Telemedicine Program (GSTP) that eventually became sustainable (the other program to survive beyond the initial grant period was the Georgia prisons telemedicine system, which remains fully state-supported). The study is explanatory (Yin 2003), revealing how SEHD addressed the Rural Healthcare Paradox.

### ***Data Collection***

Data collection occurred between December 2007 and March 2008, beginning with a visit to SEHD headquarters in Waycross, Georgia. Following Yin (2003), we collected evidence from multiple sources to enhance data quality and facilitate research. We conducted 25 semi-structured in-person and telephone interviews with 19 decision-makers and professionals. Typically, each interview lasted about one hour and the researchers took separate notes. To reduce recall bias, we asked multiple interviewees to reflect on the same events, collected as many facts as possible from secondary sources, and triangulated between the different data sources (Miles and Huberman 1994; Yin 2003).

We observed how physicians, nurses and managers used telehealth in their day-to-day operations. We also reviewed grant proposals, technical specifications, published papers, and other written materials (see Table 2).

<b>Table 2 - Data Sources</b>			
<b>Semi-structured interviews (in-person and via telephone) (Total=25)</b>			
#	Key Informants	Position and duration of engagement with SEHD	Number
1	Ted Holloway	Public Health Director (1972-2005)	1
2	Curtis Brantley	Director, Ware County Children's Initiative (since 1974)	2
3	Manager 1	Public Health Director, SEHD (since 2005)	2
4	Manager 2	Telehealth program manager, SEHD (2000-2005)	1
5	Manager 3	Telehealth program manager, SEHD (since 2005)	3
6	Manager 4	Nurse Manager, SEHD	1
7	Manager 5	HR Manager, SEHD	1
8	Physician 1	Chair, Department of Pediatrics, MCG	1
9	Physician 2	Pediatric genetics specialist, MCG	1
10	Physician 3	Sickle cell anemia specialist, MCG	1
11	Physician 4	Pediatric pulmonology specialist, MCG	1
12	Physician 5	Director, Center for Telehealth, MCG	3
13	Nurse 1	Pediatric pulmonology (since 1995)	1
14	Nurse 2	Pediatric genetics (since 1995)	1
15	Nurse 3	Pediatric nutrition (since 1993)	1
16	Nurse 4	Telehealth service coordinator (since 1990)	1
17	Technician 1	Network consultant (2000-2005)	1
18	Technician 2	IT specialist (since 2006)	1
19	Technician 3	Videoconferencing scheduler (since 2007)	1
<b>Field observations (Total=4)</b>			
#	Name	Detail	Number
1	Obesity workshop	Nutrition workshop for children conducted by a remote nutritionist	1
2	Pediatric genetics clinic	Counseling session by a specialist located at MCG using telehealth	1
3	Staff training session	Continuing medical education for nurses located throughout SEHD	1
4	Session scheduling	Scheduling of videoconferencing sessions for users at remote sites	1
<b>Internal and published documents (Total=16)</b>			
#	Type	Details	Number
1	Grant applications	HRSA/OAT, 2001 (#1H2ATM00293-01) *	1
2	Technical specifications	Telehealth network diagrams – 2002, 2005, 2008	3
3	Research reports	Alliance for Converging Technologies (1996), Spell et al. (2000)	2
4	Journal publications	Adams and Grigsby (1995), Karp et al. (2000), Keenan (1999), Sanders et al. (1996), Stachura (2001)	5
5	Annual reports	Parks (2006), Parks (2007)	2
6	Other documents	Stachura and Adams (2000), SEHD Strategic Financial Plan (2001), Personal communications, Newsletters	4

\* HRSA/OAT: Health Resources and Services Administration/Office for the Advancement of Telehealth

### Data Analysis

We transcribed the interviews and analyzed data following three steps. First, we manually coded all key events to establish a chronology (Miles and Huberman 1994). We classified events as encounters or episodes based on their disruptive effects and duration, and used temporal bracketing (see Figure 1) to create a timeline (Newman and Robey 1992). To improve reliability, we presented the process chronology to all key informants and revised accordingly.

In the second step, we used Atlas.ti for coding and analyzing the data. To develop a coding scheme (Table 3), we analyzed the chronology of events and the innovation process (see Figure 1), and identified three tensions: dependency vs. autonomy (focused on acquiring resources), controlling vs. drifting (focused on enabling the innovation process), and exploration vs. exploitation (focused on creating a sustainable solution). In addition, we included “Other tensions” to capture tensions not included in our initial analysis. We then defined each construct based on analysis of exemplar events. Two researchers independently coded three interviews (initial inter-coder reliability of 55%), jointly reviewed the codes, and discussed any differences. This led to increased coding scheme precision. Results were then discussed with the third researcher until agreement was reached. One researcher then coded all remaining interviews and a second researcher reviewed the coding. For the first four interviews, inter-coder reliability fluctuated between 62% and 85%; subsequent inter-coder reliability was consistently over 80%.

<b>Theme</b>	<b>Tensions /Oppositions</b>	<b>Description</b>	<b>Keywords</b>
<i>Acquiring necessary resources</i>	<b>I. Dependency</b>	Rural health institutions engage in alliances with other organizations or individuals to gain access to complimentary resources	<ul style="list-style-type: none"> <li>• Alliances</li> <li>• External resources</li> <li>• Relationship</li> </ul>
	<b>II. Autonomy</b>	Rural health institutions need to be able to undividedly focus on serving the needs of the local community	<ul style="list-style-type: none"> <li>• Community needs</li> <li>• Local resources</li> <li>• Medical needs</li> </ul>
<i>Enabling the innovation process</i>	<b>I. Controlling</b>	Rural health institutions adopt new technologies and create new services through planned managerial interventions	<ul style="list-style-type: none"> <li>• Rationalistic</li> <li>• Predictable</li> <li>• Plan</li> <li>• Stable environment</li> </ul>
	<b>II. Drifting</b>	Rural health institutions adopt new technologies and develop new services based on external events and local improvisations	<ul style="list-style-type: none"> <li>• Opportunistic</li> <li>• Unpredictable</li> <li>• Improvise</li> <li>• Turbulent environment</li> </ul>
<i>Creating a sustainable solution</i>	<b>I. Exploration</b>	Rural health institutions seek discontinuous innovation in services through adoption of new technological options	<ul style="list-style-type: none"> <li>• Search</li> <li>• Discovery</li> <li>• Innovation</li> <li>• New technology</li> </ul>
	<b>II. Exploitation</b>	Rural health institutions incrementally improve services through use and adaptation of existing local technological capabilities	<ul style="list-style-type: none"> <li>• Selection</li> <li>• Implementation</li> <li>• Existing technology</li> <li>• Improved services</li> </ul>
<b>Other tensions</b>	N/A	Look for evidence of other tensions	• N/A

In the third step, we followed Poole and Van de Ven’s (1989) approach to paradoxical analysis. For each of the three sets of opposites, we identified incidents in the transcribed material; analyzed how opposites were spatially positioned; and, examined how they unfolded over time. We present these analyses in the Results section below. Finally, we synthesized the analyses by explaining the successful adoption of telehealth at SEHD and by developing propositions for how paradoxes can be used to investigate and manage rural telehealth innovation.

### **Telehealth Innovation Process at SEHD**

Figure 1 summarizes the telehealth innovation process at SEHD and provides context for our paradoxical analysis. Following Newman and Robey (1992), encounters represent relatively brief events that punctuate the process and offer opportunities for establishing a new equilibrium, whereas episodes represent relatively long periods of equilibrium wherein the patterns set during an earlier encounter play out.

**Antecedent conditions** - In 1974, when Dr. Ted Holloway became director, SEHD had no pediatric sub-specialists, and a poor and underinsured population discouraged specialists from visiting or opening practices. Holloway aspired to bring the same level of pediatric specialty care to the region as was available in the cities in Georgia. He soon met

Curtis Brantley, an accountant and local community leader with a great sense of social responsibility, who said, “*My vision was to improve how they (underprivileged children) live and how they make their way into the world*”. Brantley described Holloway as “*a visionary, with a strong belief in the public health system*”. These two champions collaborated for almost 30 years, with Holloway providing vision and leadership, and Brantley engaging local churches, public schools, and businesses to support their initiatives.

**Encounter 1 (1988)** - Holloway and Brantley started the Diversified Agencies Involved in Serving Youth (DAISY) clinic and hired a pediatrician as the director. The clinic was based on ongoing collaborations between SEHD and Medical College of Georgia (MCG), and it provided school-based health services, including programs relating to teen pregnancies, and drug and alcohol abuse (Keenan 1999).

**Episode 1 (1988-1993)** - Holloway engaged external clinical experts, primarily from MCG, to provide pediatric specialty care at SEHD. These specialists drove 185 miles from Augusta to Waycross to conduct in-person outreach clinics at DAISY. During this period, Brantley recruited key operational support and local resources for the expansion of DAISY’s services. The clinic was successful in improving healthcare for underserved children, but soon began to experience significant time delays in services because of demographic and economic barriers.

**Encounter 2 (1993)** - In 1992, the Georgia Department of Administrative Services (DOAS) established the GSTP network. Holloway and Brantley negotiated for SEHD to become a pilot. A single T-1 link connected SEHD to MCG in December 1993. DOAS managed line and maintenance contracts. The monthly cost per site was about \$2,500, with 50% subsidized for the first three years. It was anticipated that by the end of the subsidy period, reimbursement for telehealth services would offset those costs (Adams and Grigsby 1995).

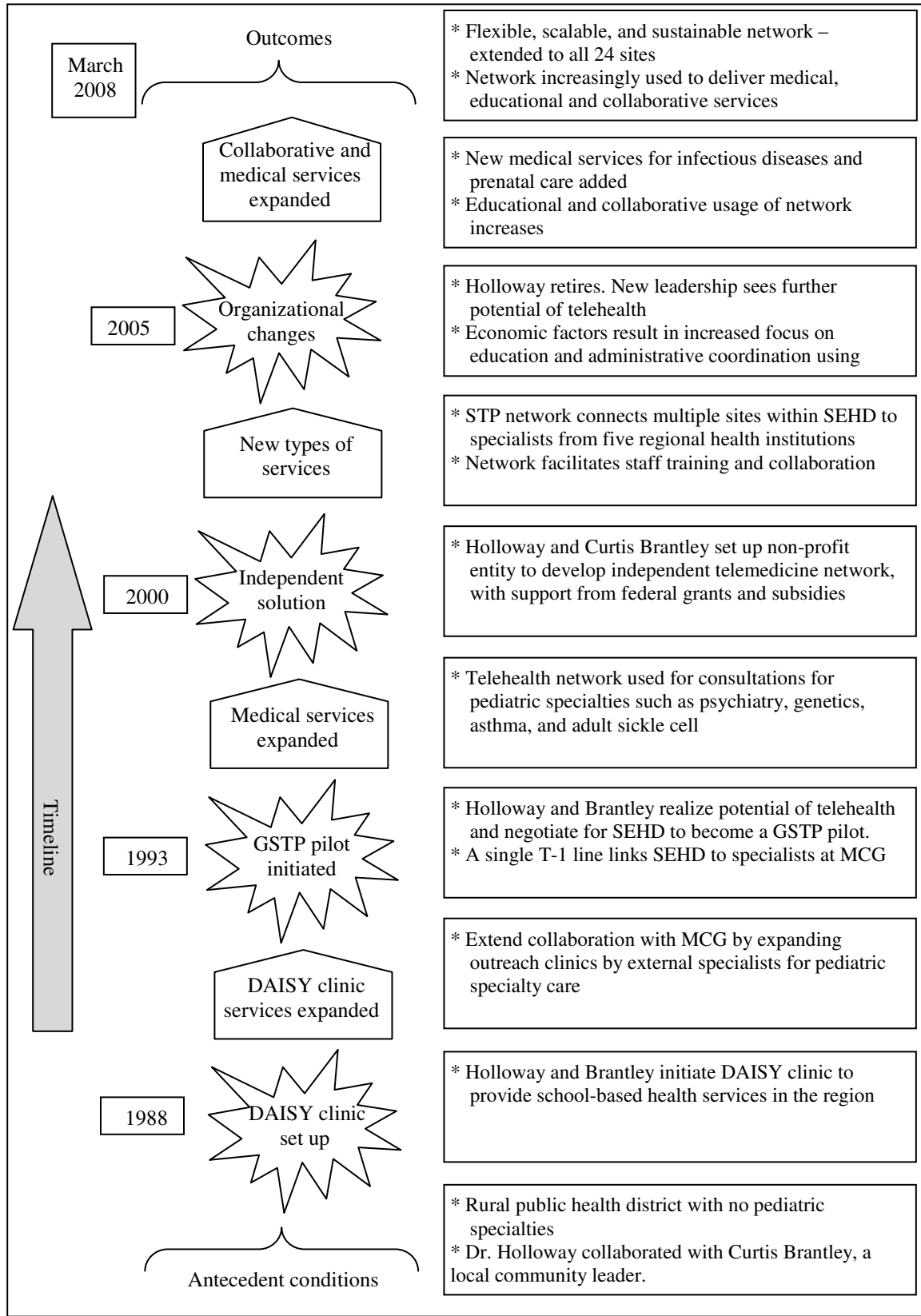
**Episode 2 (1994-1999)** - The GSTP network expanded to connect three remote sites to SEHD headquarters at Waycross. Within two years, SEHD became one of GSTP’s most active sites. The network was primarily used for pediatric sub-specialty consultations, including immunology, pulmonology, neurology, sickle cell disease and genetics (Karp et al. 2000). Specialists from MCG continued to conduct in-person outreach clinics at reduced intervals, supplementing the telehealth consultations. During this period, the network also provided training to primary practitioners in sub-specialty areas such as pediatric asthma, genetics, and pulmonology.

**Encounter 3 (2000)** - In 1999, SEHD’s original funding from the GSTP project expired and the design of the network prohibited individual sites from receiving telecommunications cost relief from the recently established federal Universal Services Fund (USF) program. Although the GSTP network was a clinical and technical success, the sites experienced doubling of their telecommunications costs. Holloway and Brantley concluded that setting up an independent network was the only viable solution. To achieve this goal, they set up a non-profit, unincorporated association, the Southeast Telehealth Partners (STP). In September 2000, they received a three-year grant from the HRSA/OAT. STP negotiated directly with regional telecommunication provider and reduced costs by 75%.

**Episode 3 (2000-2005)** - In 2000, Dr. Holloway hired a program manager and engaged a consultant to help design and set up a secure, independent telehealth network based on Internet Protocol and the H.323 standard for video conferencing. By mid-2005, the network connected patients and staff at 16 of 24 SEHD sites. Two new tertiary partners joined the network to provide telemedicine clinics for high-risk obstetrics and perinatal care. In 2003, SEHD received a second round of three-year funding from OAT for network expansion. SEHD set up links to Grady Hospital in Atlanta for infectious disease consultations and to Emory Hospital in Atlanta for HIV consultations. SEHD also added three sites under the Women, Infant, and Child (WIC) program to provide nutritional and lactation consulting. The number of medical consultations increased from about 250 per year in 2000, to almost 1000 annually by mid-2005. This growth facilitated staff education and collaboration via videoconferencing. Non-medical usage of the infrastructure now represented almost 40% of network traffic.

**Encounter 4 (2005)** - Dr. Holloway retired in early 2005. The new SEHD director considered telehealth a strategic asset and hired additional staff, including a new program manager. In fall 2005, Hurricane Katrina caused a sudden increase in oil prices in U.S. This led to an almost doubling of travel reimbursements for SEHD staff and Georgia’s Department of Human Resources (DHR) did not allocate any funds to cover this increase. These events led to the increased use of telehealth for education and collaboration.





**Figure 1 – The Telehealth Innovation Process at SEHD**

**Episode 4 (2005-March 2008)** - As the program manager told us, “it became clear that expanding the STP network to all counties would enable staff to participate in training without the travel and costs associated with it”. In 2006, SEHD received a third round of three-year funding from OAT and the STP network expansion was complete by February 2007. The new configuration allowed patients at any site within SEHD to consult with specialists from five regional medical institutions. The nurses and managers used the network for administrative coordination, program updates, continuing medical education, and protocol sharing. SEHD also used the network to provide emergency preparedness training to local communities. As a result, educational and collaboration services now comprised almost 85% of network traffic.

**Outcomes (March 2008)** - The independent telehealth network at SEHD grew to become sustainable, supported in part by federal funding, but increasingly paying for itself through new services and savings in travel expenses and time. The network connected a staff of more than 400, located at 24 sites across 16 counties of SEHD. At any time, a videoconferencing session can connect up to 16 sites simultaneously (See Table 4 for basic configuration of the telehealth system). In addition, the network connected to medical specialists at five major medical institutions in Georgia. A centralized staff of three network specialists and a manager supported the infrastructure while at the same time providing IT support for SEHD. A full-time scheduler managed the increased load of the day-to-day linking of sites for virtual meetings. A vendor in Ohio provided network support via remote access to the routers. Based on this configuration, SEHD continued to explore ways to realize the full potential of telehealth to provide additional medical, educational, and collaboration services.

	<i>GSTP Network</i>	<i>STP Network</i>	<i>STP Network</i>
Year:	1993	2000	2008
Basic system:	T-1 line with switched telephone network, and hardware-specific video network	T1-line with Internet Protocol and the H.323 standard for video conferencing	T1-line with Internet Protocol and the H.323 standard for video conferencing
Router:	NA	Cisco 1721 / 2620	Cisco 1721 / 2620 / 2950 / 3640 / 3745 /3845 /
Video conferencing system:	PictureTel-680	Polycom iPower-PT970	Polycom iPower-9400 / iPower-9800 / VSX3000 / VSX7000
No. of connected SEHD sites:	3	3	24
No. of connected medical partners:	1	1	5

## Results

We followed Poole and Van de Ven’s (1989) first three approaches to analyze the conflicting yet interwoven forces and perspectives that manifested themselves through different events at SEHD. Our data analyses provided evidence of the three sets of opposites (cf. Table 3). In the interview data, we found 55, 18, and 31 expressions of these opposites. In addition, we systematically reviewed the process account and the process model (Figure 1) to identify further evidence. Table 5 summarizes the results of the analyses.

<b>Theme</b> (# of Quotes)	<b>Opposite I</b> (Number of Quotes) and Illustrative Examples	<b>Opposite II</b> (Number of Quotes) and Illustrative Examples
<i>Acquiring necessary resources</i> (55)	<b>Dependency</b> (37)	<b>Autonomy</b> (18)
	<ul style="list-style-type: none"> <li>SEHD seeks specialists from MCG for outreach clinics and telehealth-based medical consultations (Episode 1 and 2)</li> <li>SEHD partners with other regional health institutions (Episode 3)</li> <li>SEHD seeks federal grants to support its</li> </ul>	<ul style="list-style-type: none"> <li>SEHD sets up DAISY clinic to provide school-based health services (Encounter 1)</li> <li>SEHD joins the GSTP network to provide telehealth-based medical services to local community (Encounter 2)</li> <li>SEHD breaks off from the GSTP and</li> </ul>

	telehealth initiatives (Encounter 3, Episode 3 and 4)	establishes independent network (Encounter 3)
<i>Enabling the innovation process (18)</i>	<b>Controlling (11)</b>	<b>Drifting (7)</b>
	<ul style="list-style-type: none"> <li>• SEHD becomes part of GSTP telehealth program (Encounter 2)</li> <li>• SEHD hires a network consultant to design the independent network (Episode 3)</li> <li>• SEHD’s IT department takes responsibility for managing the network (Episode 4)</li> </ul>	<ul style="list-style-type: none"> <li>• The focus of services provided by SEHD changed from being medical to educational and collaboration (Episode 3 and 4)</li> <li>• Managers and nursing staff at SEHD started to experiment with new applications of telehealth (Episode 4)</li> </ul>
<i>Creating a sustainable solution (31)</i>	<b>Exploration (10)</b>	<b>Exploitation (21)</b>
	<ul style="list-style-type: none"> <li>• SEHD explores options to provide telehealth-based medical services by joining GSTP (Encounter 2)</li> <li>• SEHD explores new infrastructure options after breaking away from GSTP network (Encounter 3)</li> </ul>	<ul style="list-style-type: none"> <li>• SEHD uses telehealth infrastructure to provide additional medical services (Episode 3)</li> <li>• SEHD increases telehealth-based educational and collaboration services (Episode 3 and 4)</li> </ul>
<b>Other tensions</b>	N/A	N/A

**Dependency-Autonomy Tension**

**Identify oppositions** - Over a period of 20-years (1988-2008), SEHD actively engaged in collaborative relationships with organizations and individuals to gain access to complementary resources. It approached specialized tertiary hospitals and experts for sub-specialty consultations; funding agencies for financial help; and, technology providers and experts for technical assistance. Each relationship created dependencies and helped SEHD meet local community demands. Holloway provided the rationale for building an early relationship with specialists from MCG: “... (In SEHD) we had very few specialists and sub-specialists .... Our early intervention program needed this multidisciplinary team with a pediatric nutritionist, occupational therapist, a speech therapist, neurologist, pediatrician and we didn’t have those folks in the community.” Later, as the number of people using outreach clinics increased substantially, the ability of SEHD to provide services suffered. This situation forced SEHD to seek new alliances. As a result, SEHD became a pilot site in the GSTP telehealth program in 1993 (Encounter 2) allowing them to provide new telehealth-enabled medical services (Episode 2). Later, SEHD expanded the network and collaborated with other regional health institutions to provide additional medical services (Episode 3).

Throughout the process, SEHD demonstrated high levels of autonomy in constantly seeking to serve local community needs. The director of the Center of Telehealth at MCG told us, “.... (SEHD) has been a leader in identifying its local needs. It was fully aware of what “menu” items it needed to offer in order to provide the services that were required” [Physician 5]. As a result, SEHD made several independent decisions: without external encouragement, SEHD decided to engage in the GSTP program (Encounter 2); when funding suffered, SEHD decided to break away from the GSTP program and establish an independent network (Encounter 3); and, managers and nursing staff actively engaged in developing collaboration and educational services (Episodes 3 and 4).

**Spatial Separation** - In terms of levels of analysis, the new alliances primarily created dependencies at the inter-organizational level. SEHD became a pilot site in the GSTP telehealth program in 1993 (Encounter 2) and used that relationship to expand their existing collaboration with MCG. Later, when SEHD created an independent network in 2000-2001 (Encounter 3), they expanded their relationships with MCG and other regional healthcare institutions. In terms of spatial location, the increased dependencies manifested themselves as contractual relationships and as new forms of collaboration with external medical specialists and technology experts.

SEHD’s autonomy expressed itself at the organizational level. Managers at SEHD made several key decisions based on the assessment of local community needs, such as joining the GSTP network (Encounter 2) and later creating an independent network (Encounter 3). The following comment by the telehealth program manager emphasizes this strong commitment to serve the local community (Episode 3): “We had an infectious disease position in our district that was funded by the State (of Georgia), but she could not be in sixteen places at one time. So we added six county health departments into the (existing telehealth) network that enabled them to have the children’s services and the adult sickle cell, and it also enabled us to provide infectious disease services to those six health departments.” [Manager 2] In terms of spatial location, SEHD’s autonomy primarily expressed itself through internal actions of managers and nursing staff.

**Temporal Separation** - The degree of dependence varied over the years. In 1993, SEHD depended financially and technically on the GSTP program (Encounter 2). Creation of the independent network after 2000 (Encounter 3) decreased technical dependencies, but made SEHD financially dependent on a new funding agency (Episode 3). The expansion of the network after 2005 (Episode 4) helped decrease this financial dependency as SEHD found new sources of revenue (such as providing nutritional and other services under WIC program), reduced its costs, and increased staff efficiency by using telehealth for medical, educational and collaboration services.

SEHD maintained its autonomy over the years. The key managers were always mindful of SEHD's mission as a rural public health services provider, and their high commitment to serve the local community remained unchanged during 1988-2008. This commitment was already apparent in 1988, when SEHD initiated the DAISY clinic (Encounter 1). The commitment sustained during this period resulting in a situation in 2008, where the expanded telehealth network allowed SEHD to offer a portfolio of medical services based on collaboration with five regional healthcare institutions (Episode 4). Moreover, the sustained, strong autonomy at SEHD did not hinder the creation of new alliances with external partners. As a result, SEHD became increasingly independent of external funding and the telehealth solution evolved to become an integral part of SEHD's day-to-day operations.

In summary, dependency and autonomy manifested themselves differently throughout the innovation process. There was a clear spatial separation between them: dependency operated at the inter-organizational level and manifested itself as relationships with external partners, while autonomy operated on the organizational level and manifested itself through internal activities at SEHD. The dependencies never jeopardized SEHD's autonomy to make independent decisions. Moreover, the sustained, strong autonomy at SEHD did not hinder the creation of new alliances with external partners. As a result, SEHD became increasingly independent of external funding and the telehealth solution evolved to become an integral part of SEHD's day-to-day operations.

### ***Controlling-Drifting Tension***

**Identify oppositions** – From the beginning, SEHD was aware of its resource limitations and astutely engaged in adopting telehealth innovations to meet local community needs. Hence, a number of events resulted from planned managerial initiatives. In 1988, Holloway and Brantley created the DAISY clinic (Encounter 1). Similarly, in 1993 and again in 2000 managerial interventions led to new telehealth infrastructure at SEHD (Encounter 2 and 3). Later, in 2001, management hired an external consultant to design the independent network (Episode 3), and by 2005, SEHD's IT department took responsibility for managing the network (Episode 4).

Based on constant management encouragement, the innovation process also moved forward through local improvisations. Holloway explained: *"We hired people who were interested (in telehealth). Then we threw the ball into the air and had people jump at it.... We did marketing of telehealth inside the institution, and showed them what it could do for rural communities.... We encouraged them to use the system in new ways."* Concurrently, SEHD faced external events that forced them to rethink current operations and economize with resources (Encounter 4). Eventually, the cultivation of participation and the financial pressures led to a shift from medical services towards collaboration and educational services. As a result, in 2007 non-medical services accounted for 85% of network usage.

**Spatial separation** - In terms of levels of analysis, controlling at SEHD manifested itself through deliberate management decisions at the organizational level. For example, Holloway and Brantley initiated the DAISY clinic in 1988 (Encounter 1), they joined the GSTP program in 1993 (Encounter 2), and in 2000 they adopted a new network solution when the first solution was no longer sustainable (Encounter 3). In terms of spatial location, these planned initiatives focused on establishing technological infrastructure and new medical services within SEHD.

Drifting primarily manifested itself at the individual level. There was a notable shift in the types of services supported by telehealth. During the early stages (Episodes 2 and 3), the intention was to use telehealth to increase SEHD's medical services and as late as 2001, these services accounted for 60% of network traffic. However, by 2007, the mix of services had changed dramatically; educational or collaboration services now accounted for 85% of network traffic. This change resulted from uncoordinated local experiments focused on using the infrastructure to develop collaboration and educational services in response to the financial challenges SEHD faced in 2005 (Encounter 4).

**Temporal separation** - Controlling and drifting were emphasized at different stages and the balance between them shifted throughout the innovation process. Controlling dominated initially as Holloway and Brantley initiated the DAISY clinic (Encounter 1), as SEHD became a GSTP pilot telehealth program (Encounter 2), and as SEHD decided to establish an independent solution (Encounter 3). Drifting manifested itself after 2001, and accelerated after 2005 as the sudden increase in travelling costs forced the managers and nursing staff to experiment with new applications of telehealth (Episode 4). Interestingly, the shift between controlling and drifting appeared to be the result of deliberate management priorities; at the same time, however, it was triggered by events outside management control. As a result, the combination of planned management initiatives and local improvisations enabled the innovation process and helped integrate telehealth into SEHD's day-to-day operations.

In summary, controlling and drifting manifested themselves differently throughout the innovation process. Where major infrastructure decisions with significant financial implications were involved, SEHD relied on planned intervention by management to ensure sufficient control over the process. Controlling therefore dominated in the early stages of the innovation process and became manifest primarily at the organization level in new infrastructures and medical services. In contrast, drifting dominated the latter stages of the innovation process and became manifest primarily at the individual level as managers and nursing staff developed new collaboration and educational services in response to unexpected financial pressures. Interestingly, the shift between controlling and drifting appeared to be the result of deliberate management priorities triggered by events outside management control. As it turned out, the combination of planned management initiatives and local improvisations enabled the innovation process and helped integrate telehealth into SEHD's day-to-day operations.

### ***Exploration-Exploitation Tension***

**Identify oppositions** - SEHD engaged in multiple discontinuous innovations (cf. Encounter 2 and 3). Each of these represents exploration to help SEHD meet local community needs. Brantley provides the rationale behind joining the GSTP Pilot in 1993 (Encounter 2): *"How can we get specialty care to people that really need it without them having to go to the expense (of going to the specialists)? That was the thought process of how it all really started. Somebody said (at a telehealth conference that Ted Holloway attended in Atlanta), here is a new technology, and here is the opportunity. Ted said, "I want it.""* SEHD used the opportunity provided by the GSTP to set up a telehealth infrastructure and expand collaborative relationships with specialists at MCG and other regional hospitals. However, SEHD later reconsidered the engagement in the GSTP program and explored new infrastructure options (Encounter 3).

In between disruptive events such as these, SEHD incrementally improved medical services through exploitation of its existing infrastructure. Said an SEHD manager (Episode 3): *"Initially, it was just a telemedicine network. Then we expanded it with MCG connection. The SEHD telehealth program now has an Infectious Diseases Clinic, which is currently running pilots in Waycross and Augusta. We also have a HIV clinic and Wellness centers. There is also a nutritional service program that we now have."* [Manager 3]

**Spatial separation** - In terms of levels of analysis, exploration of new technological options occurred primarily at the organizational level. SEHD became a pilot site in the GSTP program (Encounter 2) and used that to leverage their collaboration with MCG. Later, when SEHD created an independent network (Encounter 3), they expanded their relationships with other regional healthcare institutions. In terms of spatial location, exploration focused on new infrastructure solutions and external partnerships with federal and regional institutions.

Exploitation of the existing infrastructure occurred primarily at the individual level. As an example, nutritionists began to use the telehealth system for counseling sessions across the sixteen counties of SEHD as it saved them several hours of travelling every day (Episode 4). The telehealth program manager explained it this way: *"Five nutritionists serve all of the twenty-four sites in 17 health departments. The idea is for clients to come into a WIC (Women, Infant and Child) center nearby. ....Every day you can meet a nutritionist."* [Manager 3] In terms of spatial location, the primary target of exploitation was enhanced interaction between individuals within the organization, such as coordination meetings and continuing medical education (Episode 4). Other exploitations led to enhanced collaboration with external partners, such as supplementing the outreach clinics with telehealth consultations by specialists from regional health institutions (Episode 4).

**Temporal separation** - The balance between exploration and exploitation shifted during the innovation process. Exploration dominated in late 1980's and early 1990's, when Holloway and Brantley considered technology options to meet local community needs (Encounters 2 & 3). Subsequently during 1994-1999, the emphasis shifted towards

exploitation, as SEHD expanded the network to connect three remote sites to its headquarters at Waycross to provide medical consultations with specialists from MCG (Episode 2). After 1999 when the GSTP funding for the telehealth pilot expired, exploration once again dominated the process. Holloway and Brantley considered new technological options and found that a separate network was the only viable solution (Encounter 3). Finally, over the next years the emphasis was once again on exploitation as SEHD used the network to connect patients and staff at all SEHD sites and to add non-medical applications such as staff training, administrative coordination, collaboration, and protocol sharing (Episode 4). This temporal separation between exploration and exploitation suggests SEHD management was skillful in identifying new opportunities at key junctures of the innovation process, while incrementally adding telehealth applications to offer an increasing portfolio of medical, educational, and collaboration services.

In summary, exploration and exploitation manifested themselves differently throughout the innovation process. The spatial analysis suggests exploration primarily manifested itself at the inter-organizational level targeting new infrastructure solutions and external partnerships. In contrast, exploitation primarily manifested itself at the organizational level and focused on using the existing infrastructure to enable new patterns of collaboration within SEHD and with medical specialists at regional health institutions. This difference helped SEHD separate concerns between responding to its external environment and improving its internal operation. In terms of time, exploration and exploitation dominated during separate stages of the innovation process. A number of external events triggered exploration and helped or forced SEHD to change its course of action (cf. Encounter 2, 3 and 4). These disruptions were followed by stages dominated by exploitation in which SEHD expanded the network and developed additional applications (cf. Episode 2, 3 and 4). This temporal separation between exploration and exploitation suggests SEHD management was skillful in identifying new opportunities at key junctures of the innovation process, while incrementally adding telehealth applications to offer an increasing portfolio of medical, educational, and collaboration services.

## Discussion

Our analyses explain how SEHD overcame the Rural Healthcare Paradox by resolving the three sets of tensions with telehealth. First, it was not possible for SEHD to implement telehealth without acquiring additional resources. SEHD therefore entered into a number of alliances with external partners to acquire the medical, financial, and technological resources required for telehealth innovation. However, in actively seeking these alliances to secure the necessary resources, SEHD maintained its high level of autonomy based on its strong commitment to serve the local community. Second, SEHD enabled telehealth implementation by combining planned management interventions with local improvisations. Activities controlled by management dominated in the early stages of innovation, whereas drifting based on improvisations and local experiments dominated the latter stages. Third, SEHD created a sustainable telehealth solution by relying on both exploration and exploitation of technological options. External events triggered exploration and helped or forced SEHD to change its course of action. Exploitation of the network followed these disruptions, providing impetus to expand the network and develop additional applications. Motivated by these findings, we suggest that rural institutions face three specific paradoxes as they seek to address the Rural Healthcare Paradox through adoption of telehealth innovations. The basic proposition is as follows:

***Proposition 1:*** *In addressing the rural healthcare paradox through the adoption of telehealth innovations, institutions face specific paradoxes related to acquiring the necessary resources (the Paradox of Alliances), enabling the innovation process (the Paradox of Governance), and creating a sustainable solution (the Paradox of Learning).*

Resource dependency theory contends that most organizations do not control all the resources necessary for survival and therefore depend on other organizations (Burt 1983; Gulati and Gargiulo 1999; Pfeffer and Salancik 1978; Ulrich and Barney 1984). As a result, organizations become parts of coalitions that alter their structure and patterns of behavior (Ulrich and Barney 1984). The organizations that provide resources frequently seek accommodations from the recipient organization (Oliver 1990). Studies of nonprofit organizations have argued that public funding may cause nonprofit organizations to distort their missions and lose managerial flexibility and autonomy (Grønbjerg 1993; Salamon 1995; Smith and Lipsky 1993). Jung and Moon (2007) specifically mention reduced freedom to set goals, allocate resources, formulate and pursue self-determined plans, and select programs and service. These theoretical insights combined with the analyses of the innovation process at SEHD motivate the following:

***Proposition 2:*** *The Paradox of Alliance requires continuous negotiation between the institution's dependency on other organizations to provide complimentary resources and the autonomy required to serve the local community. Dependency reveals itself through external partnerships, whereas autonomy reveals itself through internal goals, action plans, and service offerings.*

Orlikowski and Hofman (1997) distinguish between organizational change as anticipated, emergent, and opportunity-based. Similarly, Ciborra and associates (2000) combine improvisational adoption of technology with planned managerial interventions. According to this view, innovation adoption manifests itself primarily through two forms of change management: controlling and drifting. Controlling represents the traditional, top-down approach to change management, and involves planning and designing the innovation adoption. In contrast, drifting manifests itself on the local-level as “plasticity in response to the re-inventions carried out by users and specialists, who gradually learn to discover and exploit features, affordances, and potentials of systems” (Ciborra 2002, p-87). This process requires key stakeholders to remain flexible and constantly negotiate technology adoption practices between control and drift, creating momentum and direction according to organizational goals through attempts to control, while at the same time exploring options and innovations from drifting forces inside and outside the firm (Tjornehoj and Mathiassen 2008). The governance structure at SEHD exhibited both control and drift and this combination enabled the innovation process. These considerations motivate the following:

***Proposition 3:*** *The Paradox of Governance requires negotiation between controlling major anticipated infrastructure decisions and drifting to adapt the infrastructure to implement emergent and opportunity-based changes. Controlling dominates the early stages of the innovation process, whereas drifting leverages the infrastructure through local experiments at later stages.*

Finally, while exploration allows access to new capabilities or development of new knowledge, exploitation allows maximizing the potential of existing capabilities or reusing and refining existing knowledge (Abernathy 1978; March 1991; Pentland 1995; Smith and Zeithaml 1996). Organizations that focus only on exploration are likely to suffer the costs of experimentation without gaining many of its benefits, whereas organizations that focus only on exploitation are likely to find themselves trapped in “suboptimal stable equilibria” (March 1991). As a result, organizations must balance the conflicting needs of exploration and exploitation (Levinthal and March 1993; March 1991). This balancing act manifests itself in organizational decisions relating to allocating resources, creating explicit processes and policies, and developing organizational structures. In a resource-constrained rural healthcare institution like SEHD, the need to balance between exploration and exploitation of telehealth was even more critical, as its financial viability depended on the success of this balancing act. This leads to our fourth proposition:

***Proposition 4:*** *The Paradox of Learning requires continuous negotiation between exploration of new technological options and exploitation of the existing infrastructure. Exploration manifests itself at the inter-organizational level and leads to new infrastructure solutions and partnerships, whereas exploitation manifests itself at the organizational level and leads to new collaboration patterns enabled by the existing infrastructure. The balance between exploration and exploitation shifts during the innovation process.*

Combining technological, managerial, and healthcare perspectives, these propositions and the underlying constructs are a first demonstration of how paradoxical analysis lends itself toward theorizing the adoption of complex IT-based innovations (Lyytinen and Damsgaard 2001; Orlikowski and Gash 1994). Moreover, the underlying analyses and explanation of how SEHD successfully addressed the Rural Healthcare Paradox makes important contextually sensitive contributions to the health information systems literature on telehealth innovation (Chiasson and Davidson 2004). The proposed theory and the case analyses add to the relatively few studies (such as Cho et al. (2007)) that help us understand how telehealth innovations can move beyond the pilot stage and become sustainable. They also provide important evidence on how various forms of medical services can complement collaboration and educational services to exploit telehealth infrastructures (Miscione 2007; Paul 2006; Robinson et al. 2003). Finally, they increase our understanding of how resource-constrained healthcare institutions located in rural or medically underserved areas can successfully adopt telehealth innovations (Cho and Mathiassen 2007; Mbarika 2004; Miscione 2007).

## **Limitations and Implications**

The study draws on a single case, and any changes in the institutional setting, context, or antecedent conditions may produce different outcomes (Miles and Huberman 1994; Yin 2003). Moreover, our research design involved a

retrospective analysis of events spanning a period of 20 years. As Cowley (2006) has reported, retrospective reports may be cognitively distorted by subsequent events. In addition, such reconstruction of past events may introduce recall bias, and multiple interpretations of the involved encounters and episodes. Another limitation relates to the role of federal grants in the innovation process, for these may have changed the interplay between the encounters/episodes, and the sets of opposites discussed in this research. Finally, our analysis finds evidence of three consistent paradoxes. Other studies, conducted in different contexts, may find fewer or more paradoxes, name them differently, or may describe similar paradoxes with different oppositions. For example, Sundaramurthy and Lewis (2003) discuss the paradox of governance as a struggle between control and collaboration.

The limited generalizability of a case study should be balanced against the advantages of attention to context, dynamics, and multiple stakeholder perspectives (Mason 2002). We have provided a rich description of the context at SEHD (cf. Figure 1 and Table 2) to assist researchers in assessing our findings and their transferability to other social settings (Lee and Baskerville 2003; Lincoln and Guba 1985). Moreover, our longitudinal design allowed us to investigate complex dynamics at SEHD through the lens of paradoxical thinking (Sundaramurthy and Lewis 2003). The prolonged engagement of the three-month study also supports the case's internal validity (Erlandson 1993). To minimize the effects of recall bias and distortions due to retrospective reconstruction, we interviewed multiple stakeholders, conducted field observation, triangulated between different data sources, had multiple investigators interpret the data, and iteratively sought feedback on our interpretations from key stakeholders. We had access to the managers who initiated the telehealth initiative at SEHD and, to the extent possible, we attempted to have the opinion of at least two stakeholders on every episode and encounter. This helped improve the confirmability and credibility of the study (Devers 1999).

Notwithstanding the limitations, this study provides important theoretical and practical implications. IT innovation contexts are seldom straightforward, unrestrained, and without competing, and often opposing, forces at play (Lewis 2000; Poole and Van de Ven 1989). As modern organizations engage in IT innovation they cannot simply choose between dualities as cooperation and competition (Clarke-Hill et al. 2003) or flexibility and efficiency (Adler et al. 1999). Instead, they face a constant challenge of managing seemingly conflicting goals and combining competing approaches to facilitate change. This research demonstrates how paradoxical thinking can help researchers identify the tensions inherent in specific innovation contexts and use them to explain the relationship between innovation behaviors and outcomes. Paradoxical thinking might therefore prove useful in future grounded theory development, particularly in new, evolving contexts relating to change management in organizations by generating creative insight based on seemingly contradictory forces and competing perspectives.

Our results suggest that managers of rural healthcare institutions face three sets of tensions, related to resources, technology, and learning. Moreover, in addressing these tensions, managers should identify linkages between the opposing forces, and understand the levels of analysis and temporal dependencies of the struggle. Thus, our research has implications for practice by showing how organizations can integrate IT innovations by appropriately responding to the competing demands that manifest during the innovation process.

Future researchers may apply a similar research approach in studies of rural telehealth implementations that have failed (such as the other GSTP pilots), or are struggling, and explore why these programs did not succeed. Multiple case study designs would test the validity of our findings by permitting literal or theoretical replication. Researchers may investigate whether a different trajectory of events, including federal grants and other actions, leads to a different set of outcomes, including different tensions or paradoxes. Researchers may also conduct studies covering shorter periods, focusing on variations in technology implementation and use in different health organizations, over different periods. Other related areas for future researchers would be to investigate how different actors reconfigure their practices to accommodate the innovation at local level, how the innovation changes the communication patterns over time, how the actors assess strengths and limitations of the innovation, and overall appropriateness of this form of care for specific groups. Future researchers may also focus on telehealth-enabled organizational learning (Robinson et al. 2003), including the nature and extent of collaboration and knowledge sharing in cross-functional and cross-organizational virtual settings (Malhotra et al. 2001).



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