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# Dynamic Capabilities in Home Health: IT-Enabled Transformation of Post-Acute Care

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## Abstract

*Home health care can enable shorter hospital stays, reduce re-hospitalization, and contribute to lowered out-of-hospital morbidity and mortality. However, recent changes in Medicare payments and regulations in the US have challenged home health care providers' business models. Against this backdrop, we draw on the dynamic capability perspective to examine how one home health care provider responded to this challenge over the period 2000-2009 by combining adaptive organization principles and information technology (IT) to transform its post-acute care delivery. The transformation leveraged the organization's existing dynamic capabilities; improved nursing practices; engaged physicians, nurses, managers, and patients; and implemented remote patient monitoring and other IT-enabled innovations. Integrating information systems and health services literatures, we identify the processes targeted by the transformation, analyze how the provider built adaptive care delivery capability enabled by IT, and demonstrate how the transformation led to improved clinical and financial outcomes. In addition, we offer new insights into the micro-foundations of dynamic capabilities by distinguishing between capabilities at the transactional and transformational levels, and explaining how different types of IT-enabled capabilities shaped, and were shaped by, the home health care provider's responses to environmental changes.*

***Keywords***: *Dynamic Capabilities, Adaptive Health Care Organization, Remote Patient Monitoring, IT-Enabled Home Health, Post-Acute Care, Case Study, Qualitative Research*

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# Dynamic Capabilities in Home Health: IT-enabled Transformation of Post-Acute Care

## 1. Introduction

Information technology (IT) has the potential to improve cost-effectiveness, quality, safety, and accessibility of health care services (Blumenthal et al., 2008; Chiasson & Davidson, 2004; Devaraj & Kohli, 2000; McCullough, Casey, Moscovice, & Prasad, 2010; Schoen, Davis, How, & Schoenbaum, 2006). Although IT innovations in health care have lagged behind other industries (Menon, Lee, & Eldenburg, 2000; US Congress, 1995), the strong potential for improvements and increasing pressures to transform health care delivery have led to accelerated interest in and application of IT (Thompson & Dean, 2009; Tuttle, 1999). As a result, recent literature has reported on a portfolio of IT-enabled transformations based on, for example, electronic medical records (EMR) (Davidson & Chiasson, 2005; Hanseth, Jacucci, Grisot, & Aanestad, 2006; Lapointe & Rivard, 2005), computerized physician order entry (Davidson & Chismar, 2007), picture archiving and communication systems (Paré, Lepanto, Aubry, & Sicotte, 2005), clinical decision support systems (Devaraj & Kohli, 2000), and telemedicine (Cho & Mathiassen, 2007; Paré, Jaana, & Sicotte, 2007; Paul & McDaniel Jr., 2004).

One important role of IT is to enable organizational responses to dynamic environments (Boynton, 1993; Overby, Bharadwaj, & Sambamurthy, 2006; Sambamurthy, Bharadwaj, & Grover, 2003). In the context of health care, this is particularly important because financial and regulatory changes – such as increasing health care delivery costs, increasing reporting requirements, and decreasing reimbursements – challenge organizations to consider how IT can help improve operations. As a case in point, recent changes in Medicare payment policy have challenged home health care organizations (called home health agencies, or HHAs) to consider investments in remote patient monitoring (RPM) and related IT to improve the efficiency of operations and quality of clinical outcomes. These IT applications have the potential to help HHAs respond to changing demands by transforming delivery of health services to home-bound patients.

The dynamic capability perspective (Eisenhardt & Martin, 2000; Helfat et al., 2007; Teece, 2007; Teece, Pisano, & Shuen, 1997) has been extensively used in the strategic management literature to investigate how organizations can create, extend, or modify their resource base in response to rapidly changing environments. The perspective describes specific organizational processes, routines, and competences that allow managers to generate new value-creating strategies in response to emerging requirements (Eisenhardt & Martin, 2000). In recent years, information systems (IS) researchers have adopted the dynamic capability perspective to frame investigations of how IT can help organizations overcome environmental challenges and compete successfully (Banker, Bardhan, Chang, & Lin, 2006; Jarvenpaa & Leidner, 1998; Pavlou & El Sawy, 2006; Sambamurthy, et al., 2003; Wheeler, 2002). However, few studies have explored IT-enabled dynamic capabilities within health care, and no studies have used this perspective to investigate how HHAs can overcome the severe regulatory and financial challenges they face.

Against this backdrop, we offer contextually sensitive contributions (Chiasson & Davidson, 2004) to IS and health services research based on a longitudinal study of IT-enabled transformation of one HHA – THA Group. First, we demonstrate how THA Group responded to the rapidly changing financial and regulatory environment by investing in IT. These investments helped the HHA overcome the limitations of traditional delivery models for post-acute care through adaptive organization design principles (Haeckel, 1995, 1999), allocating resources in response to actual needs rather than based on pre-defined schedules. Second, following Teece's (2007) call for studies of the microfoundations of dynamic capabilities, we identify the distinct processes that enabled the HHA to sense, seize, and reconfigure its resources. Specifically, we introduce the distinction between dynamic capabilities at the transactional and transformational levels to explain how different types of IT-enabled capabilities over time shaped, and were shaped by, the HHA's responses to environmental changes.

# 2. Literature Review

## 2.1. Home Health Care

Home health care – defined as the delivery of health services by nurses, health aides, or therapists in a patient's home – is a key component of post-acute care services. It represents a critical transition in the continuum of care for patients with chronic disease, patients requiring recuperative and rehabilitative services after discharge from acute-care hospitals, and, especially, the elderly (Fishman, Penrod, & Vladeck, 2003; Freedman et al., 2004; Gage, 1999; Lin, Kane, Mehr, Madsen, & Petroski, 2006). By transferring care to the home setting, home health care reduces hospital length of stay for patients with certain conditions, and thus, lowers overall care costs (Hughes et al., 1997; Kane et al., 2000; Shepperd, Harwood, Gray, Vessey, & Morgan, 1998). At the same time, home health care reduces post-acute re-hospitalization and out-of-hospital mortality (Fabacher et al., 1994; Stewart, Pearson, & Horowitz, 1998; Stuck, Egger, Hammer, Minder, & Beck, 2002) and benefits patients and their families by providing care in home settings (Cummings et al., 1990; Hughes et al., 1992). In the US, about 3.1 million patients (8.9 percent of Medicare beneficiaries) used home health care in 2007, and total payments were $15.4 billion. More than 9,800 HHAs participated in the program in 2008, of which nearly 80 percent were for-profit (MedPAC, 2009).

Changes in regulatory and payment policy created difficult strategic and operating conditions for HHAs in the US during the late 1990s. The Balanced Budget Act of 1997 sought to halt the rapid growth of Medicare home health expenditures that had occurred since the 1980s. The legislation increased eligibility requirements, tightened integrity standards, mandated uniform outcomes-based reporting, and replaced cost-based with cost-with-limits reimbursement through an interim payment system (MedPAC, 2009; Porell, Liu, & Brungo, 2006). After the interim payment system took effect in October 1997, Medicare's home health payments dropped more than 50 percent, from 18 billion dollars in 1997 to 8.6 billion dollars in 2001 (MedPAC, 2009, p133). The introduction of a new prospective payment system in 2000 paid a fixed dollar amount per episode of care (instead of paying per visit), further squeezing HHAs' revenue stream. Facing this steep decline in revenue, the majority of HHAs in the US struggled to find ways to stay in business. Not surprisingly, the number of Medicare-certified HHAs decreased by one third, from 10,447 in 1997 to 7,058 in 2001 (MedPAC, 2009, p123). As total home health-related visits dropped by 65 percent between 1997 and 2000, HHAs were forced to cut costs, reduce staff and services, and make more efficient and effective use of clinical resources (Kulesher, Wilder, & Paugh, 2008; Murtaugh, Pezzin, McDonald, Feldman, & Peng, 2005). Many HHAs shifted their focus to include non-post-acute services such as physical, occupational, and speech therapy (MedPAC, 2009, p135). The challenging external environment particularly affected smaller, newer, freestanding HHAs, and those HHAs that operated with visit-intensive practices.

The current literature on home health offers detailed analyses of utilization (McCall, Petersons, Moore, & Korb, 2003), clinical outcomes (McCall, Korb, Petersons, & Moore, 2002; Schlenker, Powell, & Goodrich, 2005), and the geographic distribution of HHAs after the changes in 1997 (Choi & Davitt, 2009; Porell, et al., 2006). However, few studies focus on how HHAs responded to the financial and regulatory challenges. A rare exception is a recent study (Kulesher, et al., 2008) that explored the effects of the prospective payment system on hospitals, skilled nursing facilities, and HHAs. Adding to these insights, we present a detailed case analysis of how THA Group leveraged IT to respond to this challenging environment.

## 2.2. IT in Home Health Care

IT-enabled innovations such as telemedicine and remote patient monitoring (RPM) allow delivery of health services beyond the traditional physician's office or hospital settings (Chiasson & Davidson, 2004). In particular, RPM enables transformative innovation in health care and reshapes the boundaries of hospitals by moving unstable, but not acutely ill, patients from inpatient to outpatient settings (Goldsmith, 2004; Hillestad et al., 2005). Valuing their role, the American Recovery and Reinvestment Act of 2009 recommends assistance to health care organizations to develop and

implement RPM and related IT as they "facilitate home health care and the monitoring of patients recuperating at home" (US Government, 2009, p121). These forms of IT can reduce length-of-stay in hospital telemetry units and emergency department observation beds, and avoid capital expenditures for additional bed capacity. In a recent review of the telemonitoring literature, Paré et al. (2007) found that RPM had positive effects on clinical effectiveness outcomes (e.g., decrease in emergency visits, hospital admissions, average hospital length of stay) in pulmonary and cardiac disease care. Besides, RPM can address the situation of acute shortages in clinical staff, especially nurses, in many parts of the world by making the existing staff more effective (Paré, et al., 2007).

RPM uses sensor monitors to collect a range of vital signs such as heart rate, electrocardiogram, temperature, respiration, blood pressure, blood oxygen, and weight, and transmits these clinical data securely to accessible databases and even directly to providers through a fixed-line telephone, cable, satellite-based telemetry, or cellular network (Field & Grigsby, 2002; Paré, et al., 2007). RPM is typically used in conjunction with decision support systems such as an integrated dashboard at a dedicated facility that displays patient's physiological data to on-duty nurses. Using trended data on the dashboard, the on-duty nurses can identify when health changes occur and trigger appropriate responses, allowing case manager nurses and intensivists to respond quickly to incipient problems (Hillestad, et al., 2005). The integration of homebound patient's vital signs into EMR systems can provide further decision support tools for attending physicians.

The combination of RPM and these other forms of IT can help HHAs respond to external challenges, such as the shift from payment-per-visit to payment-per-episode introduced in 2000. They can help HHAs manage a large number of patients in home and community settings, extend the capacity of scarce critical care staff, and match a patient's acuity level to an appropriate level of care (Goldsmith, 2004). Taking into account that the average margins for HHAs are projected to reduce further (MedPAC, 2010, p211), RPM and related IT can facilitate more efficient post-acute care and help HHAs continue their operations in a sustainable manner. This, however, requires HHAs to leverage IT to provide cost-effective care by sensing patients' condition at pre-determined intervals, and responding by allocating clinical resources to those patients requiring in-person assistance.

Despite potential benefits to patients, HHAs, and hospitals, we found no study in the IS literature that investigates RPM and related IT in the context of home health care; Paré et al. (2007) drew their sample of 65 empirical studies on home telemonitoring published between 1990 and 2006 entirely from the clinical literature. A few studies of RPM in home health care have recently been published in the health services and health informatics literature. For example, Hensel et al. (2006) considered obtrusiveness in home health technologies; Effken and Abbott (2009) examined the role of IT in home telemonitoring in rural, underserved populations; and Whitchurch et al. (2007) examined a wireless, home-based patient monitoring system. In another study, Coye et al. (2009) investigated how RPM and IT-enabled decision support improved chronic care management in the context of the Veterans Health Administration. The system allowed physicians to make decisions based on patients' remote self-monitoring and reporting of their chronic disease status, and demonstrated improved outcomes by reducing the number of required emergency room (ER) visits. However, we found no studies that explored how RPM and related IT can help HHAs respond to changing environments.

## 2.3. Dynamic Capabilities

The dynamic capability perspective (Eisenhardt & Martin, 2000; Teece, 2007; Teece, et al., 1997) can help explain how and why organizations invest in IT in response to changing environments (Boynton, 1993; Overby, et al., 2006; Sambamurthy, et al., 2003). Teece et al. (1997) defined dynamic capabilities as an organization's "ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments." These competences denote managerial and organizational processes or routines through which the organization achieves new and innovative forms of competitive advantage (Leonard-Barton, 1992; Teece, et al., 1997). By altering an organization's resource base, dynamic capabilities can open alternative paths by creating new market opportunities and adapting to exogenous change (Eisenhardt & Martin, 2000; Helfat, 1997; Helfat, et al., 2007). More recently, Teece (2007) has explicated the microfoundations of dynamic capabilities – the distinct skills, processes,

procedures, organizational structures, decision rules, and disciplines – that undergird firm-level sensing of opportunities and threats, seizing opportunities for change, and reconfiguring tangible and intangible assets. In recent years, many researchers have contributed to our understanding of the nature, underlying mechanisms, and outcomes of dynamic capabilities (Barreto, 2010).

Several studies have explored the role of IT-enabled dynamic capabilities. An early study by Boynton (1993) explored how IT could help an organization achieve "dynamic stability" when faced with frequent, rapid, and unpredictable change in its markets, customer demands, technologies, competitive boundaries, products, and processes. Jarvenpaa and Leidner (1998) investigated how an organization developed specific dynamic capabilities to overcome cultural, technological, and political constraints to compete successfully with foreign competitors. Wheeler (2002) applied the dynamic capability perspective to propose a theory of IT-enabled organizational networks. In more recent studies, Sambamurthy et al. (2003) offered a general framework for studying IT-enabled dynamic capability; Daniel and Wilson (2003) identified distinct dynamic capabilities related to e-business transformation; Sher and Lee (2004) explored how IT can enhance dynamic capabilities through knowledge management; and Pavlou and El Sawy (2006) examined IT-enabled dynamic capabilities in new product development. Other studies have discussed the role of IT in developing specific dynamic capabilities (Banker, et al., 2006; Busquets, 2010; Koch, 2010; Mathiassen & Vainio, 2007; Neumann & Fink, 2007).

However, we found only a handful of studies relating dynamic capability and IT usage within health care. Davison and Hyland (2002) and Hyland et al. (2003) examined IT-enabled capabilities in delivering hospice-based palliative care; Reeves and Ford (2004) compared dynamic capabilities of for-profit and not-for-profit health organizations; Ridder et al. (2007) investigated how IT-enabled dynamic capabilities contributed to successful implementation of diagnosis-related groups across clinical departments in a German hospital; and, Pablo et al. (2007) studied how a public health organization identified, enabled, and managed dynamic capabilities for service delivery. Although there is also a strong interest in developing approaches to adaptive health care organizations (Anderson & McDaniel Jr., 2000; Begun, Zimmerman, & Dooley, 2003; Plsek, 2001; Tan, Wen, & Awad, 2005), this literature does not draw on dynamic capability theory or explore how IT can enable adaptive health care organizations. Instead, these studies apply general systems thinking and complexity science theory to understand the dynamics involved as health care organizations respond to environmental demands. Against this backdrop, we investigate how and why THA Group invested in RPM and related IT to respond to the challenges it faced.

## 2.4. A Sense-and-Respond Approach

Haeckel (1995, 1999) suggested a sense-and-respond approach to develop and manage an organization's dynamic capabilities. The approach is based on specific assumptions for how an organization's overall design can support dynamic capabilities (Haeckel, 1999). The strategy should focus on creating and developing mechanisms that enable responsiveness to change rather than on planning specific actions that implement stated goals; the structures should consist of dynamic networks of modular, collaborative capabilities rather than static hierarchies of tasks and responsibilities; and, governance should occur through coordination based on shared values and context-specific information rather than dedicated command and control activities. As detailed below, the sense-and-respond approach offers actionable principles for how an organization's processes should be designed and managed to support dynamic capabilities (Haeckel, 1999). For these reasons, and because the approach has proven useful in other studies of IT-enabled dynamic capabilities (Mathiassen & Vainio, 2007), we use Haeckel's sense-and-respond approach to investigate how THA Group leveraged IT to adapt to a changing environment.

The sense-and-respond approach suggests that successful adaptive organizations have the ability to translate environmental signals quickly into meaning and subsequent action (El Sawy & Majchrzak, 2004; Haeckel, 1999; Haeckel & Nolan, 1993). Such organizations can sustain a mode of operation in which they detect potentially relevant events, filter and make sense of those events in relation to their context, and initiate appropriate responses while effectively pursuing current activities. The translation happens through a four-phase adaptive loop in which an organization first senses environmental

changes and internal states; next, it interprets the changes in the context of relevant experiences, aims, and capabilities, separating threats from opportunities and discarding irrelevant information; then, it decides if and how to respond; and finally, it acts on its decisions (Haeckel, 1999, p14). The progression from sensing to interpretation to decision to action is an iterative process that monitors results of previous actions and responds to environmental changes that occurred since the previous cycle. Haeckel's sense-and-respond approach is consistent with Teece et al.'s (1997) organizational and managerial processes involved in developing dynamic capabilities: coordination, learning, and reconfiguration. Also, El Sawy and Pavlou's (2008) dynamic capability model consists of four sense-and-respond strategies: sensing the environment, learning new skills, integrating knowledge, and coordinating activities.

According to Haeckel, adaptive organizations engage in systemic management to act flexibly while maintaining integrity and coordination (1995, 1999). Coordination is achieved through four design principles: 1) Processes that learn: Change-sensitive processes know when and how to respond, often enabled by technology that provides the necessary information about the organization's customers and environment (Mathiassen & Vainio, 2007). 2) Value-based governance: While governance principles articulate the values that define the organization's business context, a governance model defines the hierarchy of key accountabilities, and a governance process updates and embeds governance principles into organizational routines. 3) Dynamic personal accountabilities: The accountabilities specify the organization's process outcomes but allow individuals flexibility in performing the processes. Hence, accountabilities manifest as dynamic commitments between people, and they are negotiated through protocols that allow processes to be adapted and coordinated in response to specific events and needs. 4) Modular processes and services: To be adaptive, organizations must allow "modular disaggregation of the functions in the value chain" (Haeckel, 1999, p53), and recombine modular processes and services to produce a cost-effective, tailored response for each customer.

## 3. Research Design

Our research is organized as a qualitative, longitudinal case study (Miles & Huberman, 1994; Yin, 2003) of THA Group, a home health care provider based in Savannah, Georgia. Qualitative methods are helpful when exploring emerging issues (Miles & 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). For these reasons, we found a longitudinal case study appropriate for examining the many phases of IT selection, adoption, and integration that occurred in THA Group's care delivery model between 2000 and 2009.

THA Group provides a full continuum of in-home services, including medical home health care for the residents of coastal Georgia and South Carolina. A staff of 105 clinicians, therapists, and other caregivers provide these services. THA Group started home health care operations in 1995, and at the time of investigation operated five offices (three in Georgia, and two in South Carolina). We selected this case based on purposive sampling (Kuzel, 1992; Miles & Huberman, 1994, p27), to investigate the role of IT in developing dynamic capabilities in a home health care context. THA Group was among the pioneering HHAs that started using RPM and related IT to improve the efficiency and effectiveness of its operations. While many HHAs were struggling to respond to the challenging financial and regulatory environment in 2000, THA Group's decision to use IT to transform its home health delivery model was visionary. Our case study is revelatory in nature (Yin, 2003); it was designed to examine why and how THA Group combined RPM and related IT with adaptive design principles in response to a challenging environment. As we were offered unlimited access to data about THA Group's efforts, we could investigate in detail the context, the content, and the processes involved in the transformation (Pettigrew, 1990, 1997) and, in that way, account for the many different variables under analysis (Devers, 1999; Yin, 1999).

## 3.1. Data Collection

We collected primary data during a visit to THA Group headquarters in Savannah in March 2009. In a communication prior to our visit, we requested access to principal stakeholders associated with THA Group's home health operations: nurses, managers, IT staff, and some patients who use its remote monitors. THA Group not only agreed to our request by allowing access to these individuals, but also invited two referring physicians to meet with us. Table 1 contains a brief profile of these informants. We visited four field offices, each serving post-acute patients in a designated local community, and interviewed nurses and support staff at each location. We accompanied case manager nurses to four patient homes, and observed how the nurses planned for patient visits, interacted with the patients in their homes, and compiled and transmitted reports using wireless-enabled laptops after each visit. We also visited the Central Station, which contains an integrated dashboard that receives vital signs transmitted from the individual monitoring units. Finally, we interviewed the two physicians who referred patients to THA Group, and asked them about the quality of care and overall satisfaction with RPM. In all, we conducted 22 semi-structured in-person interviews with 15 decision makers and professionals.

Following Yin (1999), we collected evidence from multiple sources to enhance the quality of our data. We reviewed secondary data sources such as the Outcome and Assessment Information Set (OASIS, available from http://www.cms.hhs.gov/oasis/), internal communications, standard operating procedures, minutes from planning sessions, presentations, and other written materials. We have included basic descriptive information about these data sources in Table 1. We prepared a protocol to structure the interview process, and tailored it for specific interviewees. For example, we asked the nurses about their day-to-day responsibilities, interactions with the referring physicians, perceived challenges and benefits of RPM and related IT, and patients' reactions to the monitoring technology in their homes. The interviews varied in duration, from 20 minutes to nearly three hours. We recorded all interviews after receiving explicit permission, and the researchers took separate notes. We did not record patient interactions to accommodate privacy concerns.

## 3.2. Data Analysis

Data analysis was conducted by all four researchers, two of whom had significant experience in process analysis and two were clinical experts who provided contextual knowledge to analyze the case data. The analysis occurred in three steps:

1. Identification of key events and timeline – The interpretation of key events and general timeline (Langley, 1999) of THA Group's transformation of home health operations evolved through discussions among the researchers based on reading and re-reading of interview transcripts and researchers' notes. We validated our interpretations with current managers at THA Group. The timeline helped us identify relevant antecedent conditions and outcomes of the transformation process, and it provided a general chronology of events associated with selection, adoption, and integration of RPM and related IT between 2000 and 2009 (Figure 1). During this step, we put particular emphasis on analyzing relevant outcome indicators – both financial and clinical – to offer evidence of the impact of the IT-enabled transformation on THA Group's service delivery. Clinical indicators (Figure 2) were validated with data from public sources (www.Medicare.gov), and financial indicators (Figure 3) were based on reports made available by THA Group.

2. Identification of key processes – Following Miles and Huberman (1994), we created a preliminary list of pattern codes as "first level coding" to help tie data directly to the study's research objectives and important concepts. Pattern codes can represent an "initial plot of the terrain," emergent themes, causes or explanations, relationships among people, or theoretical concepts (Miles & Huberman, 1994, p70). Accordingly, we first identified key business tasks affected by or created during THA Group's IT-enabled transformation, and then compiled these tasks into overarching processes that we could use as pattern codes. After several iterations, six key processes emerged: patient engagement, patient care, resource management, information management, infrastructure management, and organizational learning. These processes (Table 2) covered all tasks and activities relating to THA Group's home health operations. Using these processes as pattern codes, we manually coded the transcribed material to identify evidence of how clinical and other staff used RPM and related IT to

deliver health services to home-bound patients. Having two clinical experts in the research team greatly facilitated this analysis, as they both possessed detailed knowledge of the home health care context. To further improve the reliability of our analysis, we requested feedback from key informants at THA Group, and revised accordingly (Mays & Pope, 1995).

**Table 1. Data Sources**

**Semi-structured interviews (in-person) (Total=22)**

| # | Key Informants | Position / nature of engagement with THA Group | # interviews |
|---|---|---|---|
| 1 | Ms. B | President and Chief Executive Officer | 2 |
| 2 | Dr. R | Chief Medical Officer and Principal | 2 |
| 3 | Manager 1 | Vice President, Customer Communications and Business Development | 3 |
| 4 | Manager 3 | Vice President, Performance Excellence | 3 |
| 5 | Manager 4 | Vice President, Strategic Positioning and Planning | 2 |
| 6 | Manager 5 | Center Director | 1 |
| 7 | Manager 6 | Assistant Vice President, Technology Integration Coordination and Clinical Outcomes | 1 |
| 8 | Manager 7 | Clinical Director (West Chatham, GA office) | 1 |
| 9 | Manager 8 | Clinical Director (Statesboro, GA office) | 1 |
| 10 | Physician 1 | Georgia Referring physician | 1 |
| 11 | Physician 2 | South Carolina Referring physician | 1 |
| 12 | Nurse 1 | Case Manager Nurse (West Chatham, GA office) | 1 |
| 13 | Nurse 2 | Case Manager Nurse (Bluffton, SC office) | 1 |
| 14 | Nurse 3 | Case Manager Nurse (Beaufort, SC office) | 1 |
| 15 | Nurse 4 | Case Manager Nurse (Statesboro, GA office) | 1 |

**Field observations (Total=9)**

| # | Name | Detail | Number |
|---|---|---|---|
| 1 | Patient Home 1 | Monitor use by female diabetic patient in Pooler, GA | 1 |
| 2 | Patient Home 2 | Monitor use by male diabetic patient in Pooler, GA | 1 |
| 3 | Patient Home 3 | Monitor use by male patient recuperating from congestive heart failure (CHF) in Beaufort, SC | 1 |
| 4 | Patient Home 4 | Monitor use by male CHF patient in Savannah, GA | 1 |
| 5 | Demonstration 1 | Updating patient information via EMR by case manager nurse (after visiting Patient Home 1) | 1 |
| 6 | Demonstration 2 | Monitor configuration and use | 2 |
| 7 | Demonstration 3 | Accessing patient vital signs trend data by clinical nurse in West Chatham, GA office | 1 |
| 8 | Demonstration 4 | Central Station operations | 1 |

**Internal and published documents (Total=14)**

| # | Type | Details | Number |
|---|---|---|---|
| 1 | Internal Reports | Coordinating Council Reports 2006, 2007, 2008 | 3 |
| 2 | Technical specifications | Honeywell HomMed Genesis monitor (internet-enabled) | 1 |
| 3 | Publications | (Bolch, 2004; Bolch, Rosengart, & Piette, 2009; Sheehy & Rosengart, 1994) | 3 |
| 4 | Other documents | "Telephonic Visit" script, care delivery process flow diagrams, conference presentations, marketing brochures, and patient training materials (such as, refrigerator magnets) | 5 |
| 5 | Public data | Reports from www.Medicare.gov | 2 |

Note: GA: Georgia; SC: South Carolina

3. Application of Haeckel's adaptive principles – Finally, we analyzed how THA Group's home care delivery and support processes were transformed, and how the new processes reflected adaptive design principles (Haeckel, 1995, 1999). For each of Haeckel's four principles – processes that learn, value-based governance, dynamic commitments, and modular design – we identified practices that showed how the clinical staff and managers at THA Group applied these adaptive principles (Table 3). Where necessary, we sought clarifications through follow-up interviews.

Thus, we followed both deductive and inductive reasoning (Mason, 2002, p180) during data analysis. In Step 1, we used the traditional antecedent conditions–outcome framing deductively to interpret key events and create a timeline of the IT-enabled transformation at THA Group. In Step 2, we followed an inductive approach to identify six key processes based on detailed empirical evidence of tasks and activities related to THA Group's home health operations. In Step 3, we again followed a deductive approach and applied the sense-and-respond framework (Haeckel, 1995, 1999) to interpret the case.

# 4. Results

## 4.1. Technological Response to New Rules

In 1995, Ms. B collaborated with Dr. R to create THA Group by acquiring a small, family-owned HHA in Hilton Head Island, South Carolina. Prior to this, Ms. B and Dr. R had worked together in Savannah at Memorial Health University Medical Center, where Dr. R was the Junior Vice President of Strategic Value Management and Director of Education, and Ms. B worked as a nurse practitioner and later as Vice President of the largest hospital-based HHA in the country. Ms. B and Dr. R formed a lasting relationship at THA Group, with Ms. B, as President and Chief Executive Officer, providing the vision and the entrepreneurial energy, and Dr. R, as Chief Medical Officer, leading the quality and process improvement initiatives and providing clinical guidance. Over the next few years, THA Group expanded its services, developed relationships with local physicians who referred their post-acute patients needing home health care, and expanded operations to nearby coastal counties. During this period, they followed the traditional model of care: The nurse case managers visited patients according to pre-defined schedules and used very little IT. From the very start, however, THA Group adopted Deming's philosophy of value-based management and continuous improvement (Deming, 1986; Laffel & Blumenthal, 1989; Sheehy & Rosengart, 1994).

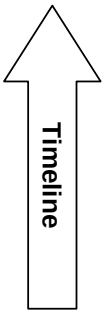
The introduction of the interim payment system in 1997 reduced payment rates and increased the reporting requirements for THA Group and other HHAs. The looming introduction of the prospective payment system in October 2000 further threatened to reduce the revenue stream for HHAs, as it would pay a predetermined base payment per 60-day episode of care. Although this payment was case-mix adjusted for the health condition, clinical characteristics, and service needs of the beneficiary, and allowed for outlier payments (CMS, 2009), it represented a major payment reduction relative to the then operational payment-per-visit policy under Medicare. Consequently, THA Group actively began considering ways to provide more efficient and effective delivery of home health services.

During the summer of 2000, Ms. B attended a conference in Florida in which she saw telemonitors that could transmit vital signs remotely. This experience enabled her to recognize new opportunities for home health care delivery:

> *In the expo hall, I immediately saw that this was the future. If you could know when your patient really needed you, think what you could do with outcomes. … In home care up until that point, everything was a guessing game. You thought you ought to see the patients three times a week, you set up these frequencies for the first three weeks, and then maybe you needed to visit four times a week…. The telemonitors could take the guesswork out of it. … This was our "A-ha" moment that caused us to jump into the deep end of the ocean with telemonitoring.*

Ms. B and Dr. R decided that telemonitoring was indeed the future of their home health delivery. Ms. B told us that this was not a difficult decision to make in 2000, because "come October, the whole name of the game was going to be making only necessary visits to the patients' homes or you would go broke." Hence, THA Group selected a vendor to provide federally approved monitors and a central station to collect and analyze data transmitted from each monitor. By January 2001, THA Group had installed 25 monitors – small tabletop units, the size of a clock radio, connected via telephone lines – in the homes of patients who agreed to have them. Each monitor was supplied at no charge to the patient. The monitors collected and transmitted patient vital signs and alerted a remote nurse if greater clinical consideration was required. This allowed THA Group to use its clinical resources more efficiently. By September 2006, THA Group had more than 275 such monitors in patient homes, added another central station, and expanded its home health operations to other coastal counties in Georgia and South Carolina.

Responding to the need for case manager nurses to efficiently record patient encounters, THA Group also implemented an EMR system in 2006 and provided wireless-enabled laptops to the nurses in 2007, allowing the nurses to access the EMR and transmit patients' status and related information to the referring physicians. Confirming its utility, a case manager nurse jokingly told us, "I can access data everywhere, everywhere except in my home." As patient and physician acceptance of telemonitoring improved, THA Group installed more units in patient homes, including new generation "Genesis" monitors that allowed remote programming through an Internet service protocol. In 2009, THA Group focused on an integrated information management initiative, further linking patients, physicians, nurses, and managers and allowing a seamless flow of information among all stakeholders. Figure 1 summarizes major events in THA Group's IT-enabled transformation of their home health delivery.




- 2009: Integrated information management initiative
- 2007: Referring physician integration initiative for post-acute care
- 2007: Nurses start using mobile laptops
- 2006: *THA Group* implements EMR
- 2006: *THA Group* installs 275 monitors and two Central Stations
- 2004: *THA Group* creates council system of leadership
- 2001: *THA Group* installs 25 monitors and a Central Station
- 2000: *THA Group* starts exploring technology options
- 2000: Prospective payment system escalates financial pressure
- 1998: Interim payment system begins generating financial pressure
- 1995: *THA Group* adopts value-based delivery model
- 1995: *THA Group* established through acquisition of existing home health agency

**Figure 1. Key Events at THA Group**

## 4.2. IT-Enabled Transformation of Home Health Delivery

The primary goal of THA Group's home health care delivery was to achieve quality clinical outcomes while maintaining a high level of patient surveillance, reducing the actual number of necessary in-person home visits, and simultaneously decreasing unnecessary re-admissions to the hospitals (as each re-admission results in reduced reimbursements from Medicare). To meet this goal, Dr. R and other managers at THA Group continuously tinkered with clinical and support processes. After 2001, their efforts focused on leveraging RPM and related IT to transform the following six key processes: patient engagement, patient care, resource management, information management, infrastructure management, and organizational learning. Table 2 summarizes the characteristics of these processes.

**Table 2. IT-Enabled Care Delivery Processes at THA Group**

| # | Process | Description | IT Usage | Process transformation |
|---|---|---|---|---|
| 1 | Patient Engagement Process | Integrating post-acute patients into care delivery | • RPM monitor and sensors installed in patient's home | Supplement traditional engagement process with patient empowerment and technology-assisted activities |
| 2 | Patient Care Process | Providing clinical care to patients | • RPM monitor to collect patient's vital signs<br>• Fixed-line phones, cellular network, or satellite-based telemetry to transmit data<br>• Central Station to receive patient's data | From pre-defined scheduling to nurse visits based on evolving patient needs |
| 3 | Resource Management Process | Providing clinical resources | • Central Station to monitor patient data and take action based on triage protocols<br>• Fixed-line or cellular phones to connect to patient and check condition as necessary | Dynamic scheduling of nurse resources in response to actual patient needs |
| 4 | Information Management Process | Collecting and sharing patient information | • Specified sensors and RPM monitor at patient's home to collect vital signs<br>• Visit reporting system<br>• EMR to update patient record and exchange information with physicians | From paper-based visit reporting to real-time capture and sharing of patient information through EMR |
| 5 | Infrastructure Management Process | Managing infrastructure for care delivery | • Internet-enabled RPM monitors to allow remote reconfiguration as needed<br>• Central station to collect and monitor patient data<br>• Wireless laptops to update patient record in EMR, exchange information with physicians, and transmit visit-related reports | Patients connected to central station 24-7 through RPM monitors; nurses connected to physicians via wireless laptops and EMR |
| 6 | Organization Learning Process | Enabling continuous, value-based improvement | • Management dashboard to facilitate management's review of projects<br>• Dynamic project portfolio management system to track individual projects | Learning facilitated and stakeholders actively engaged through an elaborate council system |

Patient Engagement Process – Prior to 2000, THA Group followed the traditional home health care engagement process: when a physician referred a patient to THA Group, a designated nurse visited the patient at home to check vital signs and general condition. On that basis, the nurse set up a schedule of follow-up visits. After THA Group implemented RPM and related IT, it actively involved the patients in monitoring vital signs and using the telemonitoring system to complement the nurses' visits. Once a nurse placed a monitor at a patient's home and explained how to transmit vital signs, THA Group supplemented this training with professionally designed materials (available as refrigerator magnets) to help manage specific illnesses such as diabetes, congestive heart failure, chronic obstructive pulmonary disease, and hypertension. Text and visuals in these materials prompted the patient to monitor vital signs regularly, and recommended that the patient or a family member call the home care nurse first, unless the patient's condition required emergency medical services (in which case they should call 911). This would help reduce unnecessary visits to the ER. In addition, as Dr. R explained:

> *For three consecutive days at the outset, the patient got a phone call from the case manager, asking, "Do you have any questions?" In other words, there's a built-in automatic relationship building, baseline development start-up that occurs that's not just a passive wait to see when the data comes in.*

Accordingly, during follow-ups over the phone ("Telephonic Visit") and in-home visits, the home care nurse reinforced the content of the training material.

Patient Care Process – Before RPM implementation, THA Group's nurses made frequent visits to provide post-acute care to homebound patients, primarily to check vital signs. In response to patients' needs, the nurses constantly reviewed the frequency of visits, often conducting unscheduled – in some cases daily – visits to any patient in an unstable condition. As long as Medicare reimbursements were on a per-visit basis (which was the case before the prospective payment system came into effect in October 2000), frequent patient follow-ups were not an issue for THA Group or other HHAs. However, after the prospective payment system resulted in a fixed payment per 60-day episode, THA Group used RPM and related IT to transform its patient care process. According to the new process, after a patient transmitted vital signs as required by the referring physician, the central station collected the data, trended them, and generated alerts if vital signs were outside parameters previously and individually determined and set for the patient. Dr. R explained this individualized monitoring process:

> *You start to really know the patient, and the more you know what that patient's baseline is and what the variables are, the more an unusual value will stand out like a red flag.*

An on-duty nurse at the central station continuously monitored these unusual values ("alerts"), and if needed, made contact to inquire about the patient's condition. Following THA Group-specified, disease-specific triage guidelines, the nurse asked the patient to transmit the vital signs again, and if the repeat vital signs suggested a need for intervention, sent the assigned case manager nurse to the patient's home, or contacted the referring physician to inform or seek advice. Thus, THA Group's new care process empowered patients through telemonitoring and feedback, and enabled case manager nurses to adjust their provision of care based on the evolving needs of each patient. The patient care process evolved as THA Group continued to experiment with its overall disease management process. One outcome of this evolution was the change in mindset regarding which post-acute patients to monitor. Ms. B said, explaining the change:

> *We shouldn't ask who should we monitor, but instead why shouldn't everyone be monitored. We realized that it needs to be the standard of care, and unless it is contrary to care because of dementia or other such reason, everyone needs to be monitored.*

Dr. R reinforced:

> *Initially, we were asking patients for their permission to install monitors in their homes. Then we stopped asking. We marched in with the monitor and other equipment and said, 'This is our standard of care. This is how we practice medicine.'*

Resource Management Process – Prior to RPM implementation, the initial scheduling of home care nurses depended upon an in-person assessment of the patients' general condition and the nurses' experience with similar patients. Adopting systematic planning techniques, THA Group made efforts to improve the efficiency of nurse scheduling and routing to reduce travel costs, but these savings did not compensate for the reduction in reimbursements after the prospective payment system came into effect. After implementation of RPM and related IT, THA Group adjusted the allocation of nursing resources dynamically, based on real-time information about each patient's condition combined with the assigned nurse's knowledge of the patient. This approach allowed greater efficiency in clinical resource management and reduction in traveling costs, as many patients did not require as frequent in-person nurse visits. Through regular updates about patients' conditions, THA Group's nurses developed improved relationships with the referring physicians and helped improve their acceptance of IT-enabled care delivery.

Information Management Process – Prior to RPM implementation, THA Group's home care nurses collected the patients' vital signs and transmitted them via phone or fax to the referring physicians to inform or seek advice. Each nurse also shared this information and related reports – one for each patient – with the senior managers at THA Group for planning purposes. This paper-based communication system was time-consuming and error-prone because of media breaks. After RPM implementation, each patient transmitted data directly to the central station, where the on-duty nurses performed protocol-based triage and faxed vital sign trends to the patient's referring physician. As a nurse explained, this process required smoothening:

> *Initially, we sent everything. We faxed the patient's information every day to the doctor's office, and all of a sudden, they started asking, 'Where is all this paper coming from? What do you expect me to do about this?' We realized that this was not working for the doctors. We decided to only send trends when they required the doctor's attention.*

The implementation of EMR in 2006 also linked directly to the physicians, thus integrating them further into the care delivery process. This allowed case manager nurses easy access to document clinical notes and review plans of care, medications, and doctors' orders while in the patient's home. In 2006, THA Group also developed a visit reporting system to track key information relating to nurses' visits to patient homes. These new approaches to patient information capturing and sharing led to improvements of the overall care process and provided senior managers with an up-to-date and detailed foundation for planning.

Infrastructure Management Process – Between 2001 and 2006, THA Group implemented a policy that would extend IT-enabled home health care delivery to all its post-acute patients (Figure 1). Some nurse visits involved re-configuring RPM monitors – to change the schedule of audible patient prompts ("Hello, it is time to take your vital signs!"), or to add vital signs to be measured as per recommendation of the referring physician. THA Group reduced the number and duration of these visits by gradually implementing new generation monitors that offered more configuration options and allowed remote configuration via Internet protocol. A case manager nurse told us how the new monitors saved her some patient visits:

> *(Now) I can set my patient's monitor to Daylight Savings Time from my office. And, I can set the volume of prompts based on what the patient needs.*

Further, after the initial implementation of EMR in 2006, case manager nurses had to return to their base offices to enter visit-related reports. To address this problem, THA Group implemented a wireless solution in 2007, which allowed each nurse to access EMR and transmit visit-related reports while still at the patient's home. These reports were instantly available to the referring physician and the nurse managers, allowing them to collaborate in real time and make decisions in response to patient condition or physician requirement. In 2007, THA Group hired a dedicated IT manager to monitor usage, facilitate collaboration across involved stakeholders, and ensure effective implementation of new IT initiatives.

Organization Learning Process – In 2004, THA Group developed an in-house council system to support IT-enabled transformation of their care delivery. THA Group created a Strategic Council – consisting of Ms. B, Dr. R, and other senior managers – that yearly evaluated ongoing initiatives and identified new strategic imperatives. Each imperative had a council that described critical actions and key deliverables. Mrs. B explained the purpose of these councils:

> *They are like the nanny of a strategic imperative and they look after it all year. They help move the imperative forward.*

For example, in 2007, the Center Council focused on improving work practices at the central station and developed a "playbook" for IT-enabled triage of high-risk patients as a key deliverable. In 2009, the Best Practices Council focused on transforming case management practices across all branches and developed another "playbook" with standard operating procedures and educational activities to ensure consistent best practices in all branches. Dr. R described the constitution of these councils:

*We try to have cross representation from different parts of our organization and from different functional levels in these councils. Thus, we could have a physical therapist sitting in a council meeting with a clinician or a nurse.*

A Coordinating Council, consisting of a core group of vice-presidents, met weekly and provided necessary resources, direction, and oversight for each individual council. In 2009, THA Group developed an IT-enabled management dashboard, as part of a wider portfolio management initiative to track progress of critical actions for each strategic imperative.

### 4.3. Building Dynamic Capabilities

Next, we use Haeckel's four adaptive principles to examine how THA Group used RPM and related IT to develop dynamic capabilities. Table 3 summarizes how the adaptive principles apply to THA Group's core processes.

**Principle 1:** Processes that learn allow organizations to adapt to environmental changes (Haeckel, 1995, 1999). THA Group focused on developing them at two levels: a) transactional, which focused on home health care delivery and b) transformational, which focused on developing an adaptive home health care organization. On the transactional level, THA Group redesigned patient engagement, patient care, resource management, and information management processes to sense individual patient needs on a 24-7 basis and to have nurses and physicians respond accordingly. In doing so, THA Group strived to develop an efficient and effective home health delivery model. Following Haeckel's adaptive loop, RPM monitors sensed and transmitted patients' vital signs at pre-determined intervals; on-duty nurses at central stations interpreted the data; in case of abnormal vital signs, the nurses followed specified triage procedures and interacted directly with the patient or engaged the case manager nurse. On that basis, the patient, the case manager nurse, or the physician took appropriate actions. This system served as the backbone for dynamically attending to patients and engaging clinical resources appropriately. On the transformational level, THA Group designed infrastructure management and organization learning processes to sense needs and opportunities for further developing its care delivery model and practices. Following the adaptive loop, senior managers were constantly involved in assessing current delivery practices and new technological options, making decisions on how to utilize existing solutions effectively and invest in new ones.

**Principle 2:** Value-based governance empowers individuals and groups to respond in a consistent manner without explicit and costly coordination (Haeckel, 1995, 1999). Since 1995, THA Group focused on developing a patient-centered home health organization rooted in quality management principles, and engaging clinical and managerial staff in meeting patients' needs in a cost-effective manner. Throughout the transformation process, THA Group consistently communicated the values of improved clinical outcomes and reduced costs to all stakeholders. The senior executives developed a culture of accountability, accepting that one must first "live out" a change before seeking to change others. On the transactional level, the effective sharing of these values combined with a detailed triage protocol, allowed on-duty nurses at the central station and case manager nurses to make autonomous decisions on when and how to respond to each patient. On the transformational level, Ms. B and Dr. R championed the process and empowered nurses, IT staff, and managers to experiment with solutions that would make measurable improvements. The adopted values also ensured that the transformation initially focused on clinical processes, nursing practices, and patient conditions. Only after these processes had stabilized around 2004, the focus broadened to include administrative processes. As a result, THA Group adopted and experimented with RPM before considering EMR, wireless laptops, or other IT.

**Table 3. Applying Adaptive Principles at THA Group**

| # | Adaptive Principle | Level | Examples of Adaptive Practices |
|---|---|---|---|
| 1 | Processes that learn | Transactional | ● Patient care process to sense needs of individual patients on a 24-7 basis<br>● Resource management process to enable case manager nurses to respond appropriately to evolving needs of patients |
| | | Transformational | ● Infrastructure management process to integrate RPM and related IT<br>● Organizational learning process to help sense needs and opportunities to develop its care delivery model and practices |
| 2 | Value-based governance | Transactional | ● Empower clinical nurse managers to make autonomous decisions relating to care delivery<br>● Develop triage protocols enabling on-duty nurses in central stations to make decisions on when and how to respond to each individual patient |
| | | Transformational | ● Champion patient-centered care delivery, rooted in quality management principles<br>● Initial focus on the clinical processes, nursing practices, and patient conditions<br>● Empower nurses, technical staff and managers to experiment with new solutions |
| 3 | Dynamic commitments | Transactional | ● Allocate clinical nursing staff to only those patients needing in-person nursing assistance<br>● Use trended data at central stations to determine appropriate actions for each patient's condition |
| | | Transformational | ● Create cross-functional, ad-hoc teams to work on emerging strategic imperatives<br>● Launch new imperatives in response to identified needs and new technological options |
| 4 | Modular design | Transactional | ● Develop home care delivery process to provide customized care for each patient<br>● Develop disease-specific and condition-specific triage procedures at central stations |
| | | Transformational | ● Incremental implementation of RPM and related IT to facilitate care delivery<br>● Rollout of the wireless-enabled laptops to facilitate access to EMR for nurses visiting patients<br>● Council organization and operation, each focused on specific deliverables for a strategic imperative |

**Principle 3:** Dynamic commitment of resources is a prerequisite for effectively adapting to emerging situations (Haeckel, 1995, 1999). On the transactional level, the predominant model in the home health industry is schedule-based in-person visits to patients based on relatively static commitment of nursing resources determined at the outset of a patient's enrollment. A major differentiator of THA Group's new delivery model was the dynamic allocation of clinical resources to those patients needing in-person nursing assistance. While a case manager nurse managed the home health needs of THA Group's post-acute patients in a designated geographical area, the nurse would dynamically change her focus among assigned patients based on individual needs. This approach, combined with on-going remote support of patients from the on-duty nurses at the central station, allowed each case manager nurse to commit effectively to a larger pool of patients. On the transformational level, dynamic commitment was reflected in the composition and management of the councils, in which nurses, managers, and IT experts formed ad-hoc teams to work on emerging strategic imperatives. The Imperative Council and Coordinating Council governed this approach by evaluating ongoing imperatives and by launching new imperatives in response to identified needs and new technological options.

**Principle 4:** Modular design allows organizations to quickly reconfigure services and processes in response to emerging needs and challenges (Haeckel, 1995, 1999). On the transactional level, THA Group developed a modular home care delivery system in which all activities in patient engagement, patient care, resource management, and patient information management were designed to sense evolving patient needs and respond appropriately. The basic unit of operation is the case manager nurse, focused on providing care to assigned patients, with other activities organized to help commit resources efficiently and effectively based on patient needs. For example, the set-up of monitors at patient homes, reconfiguration of monitors, and vital sign monitoring as well as disease-specific and condition-specific triage procedures at the central station were developed as separate modules that helped customize care for each patient. On the transformational level, the RPM technology itself is modular, allowing incremental implementation as well as scaling and substitution of monitors and central stations. The rollout of the wireless-enabled laptops in 2007 represented another example of a modular, incremental approach to IT implementation. Finally, the council organization and operation was modular too: each council represented a project-based organization focused on specific deliverables to achieve a strategic imperative. The council structure made the organization flat and networked, allowing quick decision making and accountability at all levels.

### 4.4. Clinical and Financial Outcomes

IT-enabled transformation of THA Group's home care delivery model improved its organizational performance. In the first five years of RPM implementation, THA Group scored better than national and state averages for all quality measures. In its Georgia operations, THA Group reduced the re-hospitalization rate (in each 60-day episode) from 38 percent to 20 percent, and the emergent care rate from 27 percent to 17 percent. The corresponding re-hospitalization rates for its patients in South Carolina decreased from 27 percent to 20 percent, and the emergent care rate remained stable at 18 percent. Figure 2 shows recent data (updated in September 2009) on two key quality measures (hospital re-admission and admission to ER) for THA Group's Georgia operations.

THA Group also succeeded in reducing the number of skilled nurse visits per patient per 60-day episode by over 40 percent between 2001 and 2009, as shown in Figure 3. An immediate outcome of this was improved efficiency of clinical resources. In 2008, THA Group had nine case manager nurses to provide RPM-enabled care to more than 300 patients. According to Ms. B's estimate, without RPM it would have required at least 15 nurses to provide care for the same patient population. Thus, THA Group increased the case capacity and productivity of the clinical staff, resulting in direct bottom-line benefits. In addition, their IT-driven care model also resulted in increased customer loyalty (i.e., patients preferring THA Group to other HHAs) and physician referrals.

Finally, during the first five-year period after RPM implementation, THA Group saved $670,000 in direct costs, primarily due to reduced travel of the nursing staff. In comparison, the total investments in RPM and related IT over the same period were $330,000.

## 5. Discussion

Based on data covering a nine-year period (2000-2009), we have demonstrated how THA Group combined dynamic capabilities with investments in RPM and related IT to lower costs and improve the quality of home health services. Specifically, we explained how THA Group overcame the limitations of traditional delivery models through adaptive organization design, and built new dynamic capabilities on the transactional as well as the transformational level to meet the evolving needs of patients and allocate clinical resources more efficiently.

Related to the literature on health-IT, our study provides contextually sensitive contributions (Chiasson & Davidson, 2004) to our understanding of IT-enabled transformation of home health care (Coye, et al., 2009; Effken & Abbott, 2009; Hensel, et al., 2006; Paré, et al., 2007; Whitchurch, et al., 2007). Changes in Medicare payments and regulations after 1997 challenged the traditional business model of HHAs, affecting their financial viability and forcing many HHAs to improve performance or close down operations (Kulesher, et al., 2008; Murtaugh, et al., 2005). In response to these challenges, THA Group leveraged various forms of IT, including remote monitors, sensors,

telephones, wireless-enabled laptops, satellite-based telemetry, and central stations to improve the quality of clinical outcomes (Figure 2) and efficiency of operations (Figure 3). Implementation of EMR further facilitated care delivery by integrating referring physicians.

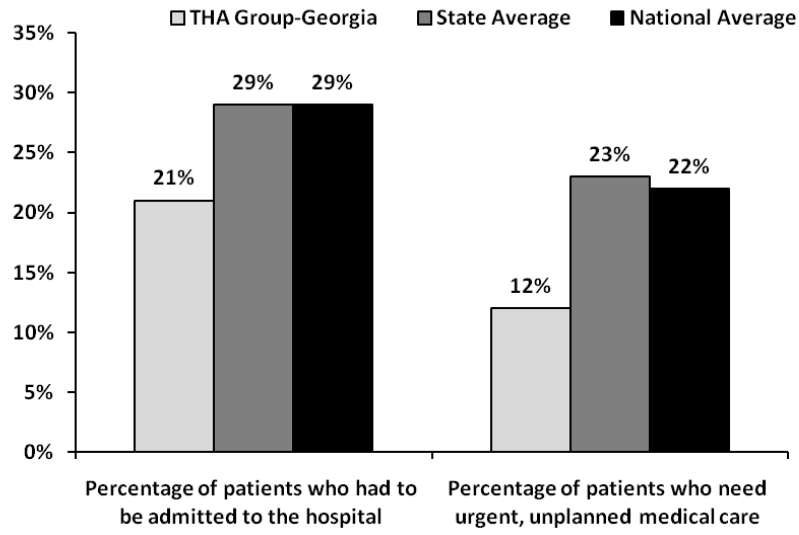



**Figure 2. THA Group's Clinical Outcomes (Source: http://www.medicare.gov/HHCompare)**

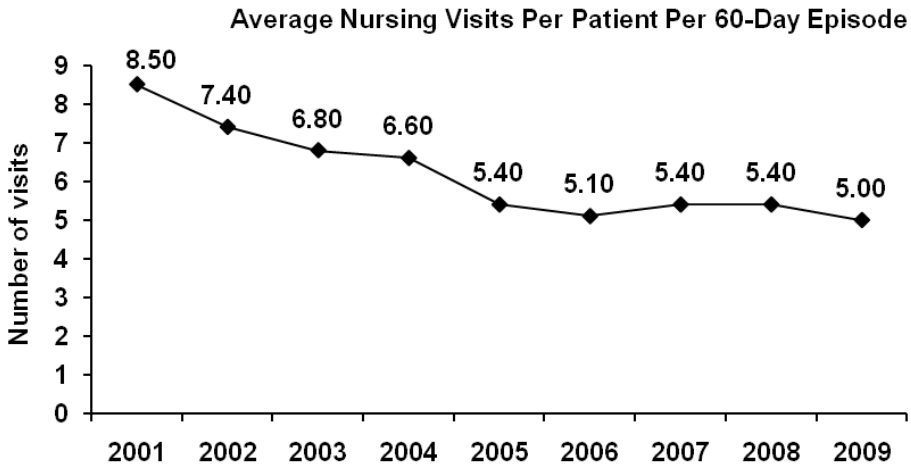



**Figure 3. THA Group's Average Nursing Visits per Patient per Episode**

Earlier health-IT studies (Blumenthal, et al., 2008; Chiasson & Davidson, 2004; Devaraj & Kohli, 2000; McCullough, et al., 2010; Paré, et al., 2007) suggest that IT can reduce overall cost, improve accessibility and quality of care, and help to address shortages of clinical resources. Our study contributes to this line of reasoning by demonstrating how and why IT helped THA Group transform its home health delivery processes. Davenport described a generic framework with nine distinct opportunities for how IT can enable such process transformations (1993, p50). Table 4 shows how THA Group's efforts leverage all nine opportunities and, hence, constitute a comprehensive demonstration of how IT can transform home health care delivery.

**Table 4. THA Group's IT-transformation of Home Health – Based on Davenport (1993)**

| Impact of IT | Description | Example | Value Proposition |
|---|---|---|---|
| Automational | Eliminating human labor from a process | • RPM collects and transmits data to central station | • Save time for case managers |
| Informational | Capturing process information for purposes of understanding | • Visit Reporting System to manage nursing resources and allocate individual nurses to specific patients | • Improve utilization of clinical resources |
| Sequential | Changing process sequence, or enabling parallelism | • Monitor several patients in parallel and only attend to those in need of care through call from central station or visit by nurse | • Improve patient care and productivity of case managers |
| Tracking | Closely monitoring process status and objects | • On-duty nurses at central station continuously monitor patients' vital signs | • Improve patient care |
| Analytical | Improving analysis of information and decision-making | • On-duty nurses at central station review alerts and take necessary actions following triage protocols | • Improve ability to quickly respond to patient needs |
| Geographical | Coordinating processes across distances | • Configure RPM monitors remotely | • Save travelling cost for case managers |
| Integrative | Coordination between tasks and processes | • Coordinate care with referring physicians based on sharing of EMR and central station alerts | • Improve patient care coordination across organizational boundaries |
| Intellectual | Distributing expert knowledge | • Develop and share a "playbook" for IT-enabled triage of high-risk patients | • Improve work practices at central station |
| Disintermediating | Eliminating intermediaries from a process | • Nurses' direct electronic reporting using wireless laptops eliminates clerks' entering of paper-based reports into EMR | • Reduce personnel cost and media-breaks |

In effect, THA Group transformed its plan-based home care delivery model into an IT-driven event-based model. By engaging patients, case manager nurses, on-duty nurses at central stations, and referring physicians in the care process, THA Group developed a network of modular, collaborative processes (Table 2) that could be dynamically adapted to emerging patient needs. In addition, by improving the organization's information and management processes, THA Group facilitated distributed decision making and coordination, enabling clinical staff to make autonomous decisions related to care delivery. These transitions happened iteratively, rooted in THA Group's basic approach to quality management (Deming, 1986; Laffel & Blumenthal, 1989), and focused on first improving clinical services to its patients and only then on developing improved administrative and managerial support for these services.

Turning to the literature on IT-enabled dynamic capabilities, our study explains how THA Group followed Haeckel's adaptive design principles (1995, 1999) to develop different types of IT-enabled capabilities that shaped, and were shaped by, the organization's responses to environmental changes (Table 3). In this analysis, we observed dynamic capabilities at two levels: 1) transactional, which helped THA Group sense patient condition and dynamically commit nursing resources to respond to patient needs and 2) transformational, which helped THA Group sense challenges and opportunities in its environment and develop appropriate strategic responses.

In a recent study, El Sawy and Pavlou (2008) suggested a distinction between operational and dynamic capabilities. Operational capabilities refer to the planned ability to execute substantive day-

to-day activities effectively, whereas dynamic capabilities refer to the ability to reconfigure existing operational capabilities to match the changing business environment. This distinction suggests that dynamic capabilities connote change, while operational capabilities suggest stability (Teece, et al., 1997; Winter, 2003). Similarly, in an earlier study, Collis (1994) distinguished between functional, dynamic, and managerial capabilities, in which the managerial level focused on the organization's ability to recognize the value of other resources and develop novel strategies for competitive advantage.

Our findings differ from these conceptions of dynamic capabilities in one important way: We suggest that there are dynamic capabilities integrated into the firm's core processes (which we refer to as "transactional level capabilities") in addition to dynamic capabilities detached from the firm's core processes (which we refer to as "transformational level capabilities"). As our results demonstrate, THA Group successfully harnessed capabilities on both these levels. On one hand, it developed the ability to sense-and-respond on the transactional level through day-to-day dynamic allocation of nursing resources based on patients' needs. On the other hand, it developed its ability to sense-and-respond on the transformational level through ongoing strategic change efforts aimed at improving its home care delivery model and related infrastructure. Moreover, the transactional level capabilities were intrinsically related to, and co-evolved with, the transformational level capabilities as several IT-enabled sense-and-respond cycles operated and interacted continuously.

Prior to 2000, THA Group had already developed several transformational level capabilities: a patient-centered organization with emphasis on clinical practices, a value-based model of home health delivery rooted in quality management principles, and ability to sense changes in the environment and seek appropriate organizational responses. These existing dynamic capabilities (Ambrosini, Bowman, & Collier, 2009) shaped the adoption of RPM and related IT between 2000 and 2009. Moreover, as THA Group increasingly integrated IT into its care delivery process, the technologies strengthened existing dynamic capabilities and helped build new ones. As a result, THA Group developed an RPM-enabled patient engagement process that empowered patients and encouraged their participation, a clinical resource management process with dynamic allocation of nursing staff in response to evolving patient needs, an infrastructure management process that facilitated incremental implementation of RPM and related IT, and an organizational learning process that emphasized continuous sensing and responding to perceived needs. In this way, our study offers new insights into the micro-foundations of dynamic capabilities by identifying the distinct processes that enabled THA Group to sense, seize and reconfigure its resources enabled by IT (Teece, 2007).

## 6. Conclusion

We have applied Haeckel's sense-and-respond framework (1995, 1999) to explain how an HHA leveraged IT to overcome regulatory and financial challenges and deliver above-average home health care. From a practical point of view, the findings provide valuable managerial insights for HHAs and other health organizations that struggle to sustain their operations amidst rising costs, declining reimbursements, shortage of clinical staff, and tightening regulatory standards. The research clearly demonstrates how managers of HHAs and similar health care organizations can improve quality of care and reduce costs by adopting an IT-enabled delivery model that facilitates dynamic allocation of clinical resources based on actual needs.

Drawing on a single case (Miles & Huberman, 1994; Yin, 2003) limited our ability to conduct cross-case comparisons or generalize findings to other contexts. However, the limited generalizability of case study research should be balanced against the advantages of its attention to context, dynamics, and multiple stakeholder perspectives (Mason, 2002). Accordingly, we have provided a rich description of the situation at THA Group, and, particularly, of the events leading to its new care delivery model, to help researchers assess our findings and their transferability to other contexts (Lincoln & Guba, 1985). Our research design also involves retrospective analysis of events spanning a nine-year period, which may introduce recall bias and multiple interpretations of events. We minimized this effect by interviewing multiple stakeholders; triangulating among different data sources; checking against public data, government reports, and internal communications; using

multiple methods and investigators to interpret the data; and iteratively seeking feedback on our interpretations from key stakeholders (Miles & Huberman, 1994, p267; Yin, 2003).

As a result, our research contributes to our understanding of IT-enabled dynamic capabilities by demonstrating how IT can help organizations overcome environmental challenges and maintain competitive advantage (Banker, et al., 2006; Jarvenpaa & Leidner, 1998; Pavlou & El Sawy, 2006; Sambamurthy, et al., 2003; Wheeler, 2002). Heeding recent calls (Teece, 2007), we explored the micro-foundations of dynamic capabilities by analyzing how one HHA leveraged its existing capabilities to develop new and stronger ones. We identified the distinct processes that enabled THA Group to sense day-to-day as well as long-range opportunities and challenges in its environment and, in response, reconfigure its resources (Teece, 2007). Further, we distinguished between dynamic capabilities at the transactional and transformational levels, and demonstrated how they evolved and interacted over time to shape new capabilities enabled by IT (Zollo & Winter, 2002).

These findings have implications for future research into IT-enabled dynamic capabilities. First, we have demonstrated how the sense-and-respond model (Haeckel, 1995, 1999) can inform investigation of IT-enabled dynamic capabilities in a specific industrial and organizational context. Future studies can further develop this approach in other contexts with different process characteristics and technologies, e.g., the use of RFID technology to support inter-firm coordination across complex supply chains or the use of collaboration technologies to support globally distributed software development. Second, we suggest IT can support the micro-foundations of a firm's dynamic capabilities on two distinct but intrinsically related levels, the transactional and transformational. Future studies can validate this insight and further investigate how similar conceptual distinctions, e.g., between exploitation and exploration (March, 1991) or alignment and adaptation (Tushman & Romanelli, 1985), can help us understand the role IT plays in shaping the micro-foundations of an organization's dynamic capabilities.

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