Abstract

This study investigates telemedicine as a collaborative technology innovation in healthcare organizations. We use the collaborative ontology [17] inspiring this mini-track to describe our instantiation of telemedicine, namely telestroke services. We discuss how the telestroke project initiation process is managed and how this process impacts the overall success of the telemedicine programs through the lens of three distinct telemedicine business models. We provide insights on the effects of the varying business models focusing on commonalities and differences in project initiation phase. We base our findings on a multi-case qualitative data set.

1. Introduction

Health Information Technology (HIT) is one area where governments and healthcare organizations continue to spend money with the hopes of improved outcomes and reduced costs. Taken alone, a project characterized as IT, healthcare, or inter-organizational would likely be classified as a complex project. When these characteristics are aggregated under one project, we have a formidable challenge, particularly when the project goal is to produce a sustainable service or work flow. These projects reach many as the far-reaching effects of HIT projects affect not only those employed in the healthcare industry’s governmental and private sectors, but also the majority of citizens that seek healthcare for themselves or loved ones.

In fact, telemedicine is one of these HITs that has been stated to have “the potential for ameliorating seemingly intractable problems in health care such as limited access to care among segments in the population— especially the geographically disadvantaged—uneven quality of care, and cost inflation” [6]. The tremendous value implied in this statement is not clearly evident in research or practice in a way to provide strategies for sustainable telemedicine programs [13] though investment in telemedicine by governments around the world has spurred growth. [3] Geographically dispersed health professionals can use collaboration technology to communicate with each other, review patient records, manage workflows, and improve the delivery of care.

This study looks at one complex telemedicine service: telestroke programs. These programs use video conferencing and other telecommunications capacity to strive to reduce stroke-related permanent disability and death. We use the collaborative ontology [17] to depict the dynamics of technology mediated collaboration in healthcare.

Technology – A new telestroke service is a symbiosis of system, strategy, and technology. Telestroke services represent a collaborative new process of care (technology) to facilitate strategies for bridging distance, expanding market share, or perhaps becoming a center of excellence in the emergency care of stroke patients. Technology’s impact on the efficiency and effectiveness of telestroke collaborations will be determined by the architecture of the technology, the systems developed around it, and the strategy for implementing it. “The efficacy of the architecture will determine the efficacy of the system, and the efficacy of the system will determine the efficacy of the strategy” [17].

Partnerships - A telestroke service creates higher-order partnership between two or more healthcare facilities. Clinicians partner with each other across organizations to provide the telestroke service.

Content – Telestroke is a combination of data, analysis, diagnosis and treatment. Emergency room patient data is passed to a remote stroke specialist who assists with diagnosis and making the “call” for
administering appropriate treatment (specifically the patient’s receipt of the drug tissue plasminogen activator, tPA, which may greatly reduce the effects of stroke, if appropriately administered).

**Media** – A critical and increasingly important application of telehealth is the use of video conferencing for patient exams (see Fig. 1 in[12]). In this context, video conferencing is frequently used to support a knowledge discovery process (concerning the medical condition of the patient), as well as decision-making in the form of diagnosis and recommended protocols. Telestroke programs facilitate these type of critical diagnosis and decision making through rapid linkages between patients where specialized care may not be available (remote, rural, or awkward locations) to expert stroke care (often in major urban centers) via telecommunications equipment in a very time sensitive situation. Video conferencing between an emergency room staff and a stroke expert coupled with electronic access to medical images and patient records reduce the time from emergency room arrival to evaluation and treatment when expert neurological care is not locally available.

**Purpose** – The purposes of a telestroke encounter are patient care as well as efficiency.

The objective of our study is to investigate the relationship between telestroke project initiation (PI) and telestroke business models that provide technology solutions to support partnerships and deliver content through the selected media to achieve the defined program purpose. The Project Management (PM) discipline provides guidelines for PI. The initiation phase is considered a key phase in starting new initiatives that move organizations from strategy to execution. Although PM tenants are generally applicable for different fields, the telemedicine field has few studies that link the PM concepts to the application of programs. Little is known about the underlying nature of the initiation phase in telemedicine projects and particularly in telestroke implementations.

There are different components that need to be orchestrated in the initiation phase to avoid risks in implementation, some of them inside the organization and others in the external environment. It is not enough to understand key initiation phase components; organizations also need to align these components to their own strategy and business model. Understanding the business model employed is important because it enables us to see how context, structure and strategy embody multiple and mediating roles relates to a specific initiative or way of operating [5]. When we look at telestroke through the lens of competing business models, we have an opportunity to understand how the PI can be structured to achieve best results. *Research Question: How is the initiation phase enacted for various telestroke business models (BM)?*

We will address this research question by 1) specifying key characteristics of telestroke BM, 2) identifying actors that directly participate in the initiation phase of telestroke projects, 3) describing the key characteristics for each business model case context and the process that the initiation phase follows and 4) comparing telemedicine business model implications for key components of the PI phase. Our analysis will highlight both commonalities and differences in PI across the various BM.

The rest of paper presents an overview of literature followed by our methodology, description of the case study where we explore and compare various telestroke PI components under the lens of various BM, and our conclusions.

### 2. Background

Telemedicine is one type of service that healthcare organizations provide with the help of collaboration technologies (such as video conferencing) and inter-organizational systems. As organizations explore harnessing technology to establish new forms of collaborative work [13], new work models and PM practices need to be constructed, validated, and further refined in terms of cross-system realities for several reasons. First, participating units might differ significantly in terms of stage of healthcare, management, and technical development and maturity. Second, regulatory, social, and cultural environments may vary substantially. Third, various stakeholders in collaborative work may have different or even conflicting goals and ascribe to their own definitions of work or project success. In addition, managing cross-organizational projects and work teams involved in these new forms of work requires a high level of coordination that exceeds the need for more typical teams within one organizational unit or company. These efforts begin with PI. PI is the first phase in a project’s life cycle and includes the tasks associated with defining a project’s objectives and scope and gaining organizational leadership’s approval of and dedication to the initiative.

The recommended first stage in any project is the initiation phase, also called the project definition or conceptualization phase. This phase has been categorized as the most important step in the project [10] and a key element for project success [15]. The
The initiation phase is a complex stage that involves process, communication, politics, strategy alignment and multiple actors with a common interest in developing an idea [18] [4]. PM frameworks that identify process and deliverables during the initiation phase can easily be found in the literature [2]. Additionally, the initiation phase involves many soft skills and complex decisions for organizations [15, 18]. We propose that analyzing this stage can provide a good opportunity to identify key components of the initiation stage that increase the probability of sustainable programs in a given business model.

The recipe for project success has been identified as executive support, user involvement, experienced project manager, clear business objectives, and minimized scope [9]. The strategic alignment has been seen as a key factor in project success. The project charter, the main deliverable in this phase, helps to join strategy with project execution and solidify the relationship between the project and the organization’s owner.

The key questions raised in the initiation phase are around idealization, strategy alignment, project goals and the way that the project responds to multiple stakeholders’ interests [18] [4] [11]. Each project is different and requires careful analysis to cover these key points before the journey begins. Although this seems like an obvious step, the organizations face the risk of this step taking too long and hence the project losing “momentum” during PI. The momentum is defined as an energy pattern that needs to be recognized to move the project to a successful implementation path [16]. Sometimes this is positive energy and in other cases it is negative energy resulting from delays or problems related to the project [16].

PM literature indicates the following are key initiation phase components that help to set the stage for project success:

- Identify benefits of PI [15]
- Affirm that the project converges with the organizational vision [13]
- Secure project sponsorship [2]
- Ensure project responds to the respective needs of key stakeholders [15]
- Determine if the organizational infrastructure supports the project [11]
- Identify external environmental challenges [2]
- Consider change management issues [8]
- Specify project scope [8]
- Develop a project charter [2].

BM are a way for companies to try new ideas, technologies and concepts. BM are variations on the generic value chain of a project or operations, that is, stories with the same underlying theme [14] Various “story lines”, that is BM, may drive a telemedicine initiative, with each having its own version of plot and characteristics to targeting successful telemedicine services. Increased understanding of the essence of BM and their place in the corpus of the organizational sciences helps our understanding of a variety of subjects including market behavior, competition, innovation, strategy and competitive advantage [19]. We explore and recognize various BM in this study to better understand key initiation phase components by acknowledging that organizations align PI components to their own strategy and business model.

The focus of this study is telemedicine programs that utilize videoconferencing in an innovative way to deliver care and improve access. This form of telemedicine is considered one of the most demanding, complex, and promising ways of delivering value. Medical video conferencing services are provided and received by various healthcare institutions. Telemedicine service delivery requires at least two institutions (provider and the receiver) and it has been argued that the differences at the organizational and environmental settings impact the planning of telemedicine programs [7].

3. Methodology

Reviews of telemedicine in the healthcare domain call for qualitative, in field approaches to better describe and explore telemedicine systems [3]. To investigate our proposed research question, we followed a comparative case study approach using three cases [20].

3.1. Case Study Sites and Data Collection

We began our study in 2011 by identifying three distinct telestroke programs with different organizational configurations. Two of the authors conducted phone interviews with four different subjects who represent the three organizations (see Table 1). The interview protocol included 15 open-ended questions about the vision, mission of the organization, how telehealth is aligned with this vision, how the telestroke projects were initiated, the challenges and the best practices founded and the business model that was built as a result of the project. The interviews lasted between 1 to 1.5 hours. These subjects represented different roles in the telestroke project for each organization. The interviews were audio recorded, transcribed and upload in Dedoose software [1] for data analysis.

3.2. Data Analysis
Two authors conducted a literature review about PM initiation phase and identified key components reported in other studies (see key initiation phase components listed in the background section). We used these components as the initial set of codes in Dedoose software.

<table>
<thead>
<tr>
<th>Subject Profile</th>
<th>Configuration</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1: Chief Medical Officer</td>
<td>Company provides for Profit Services to:</td>
<td>On-going</td>
</tr>
<tr>
<td></td>
<td>• Hospitals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Rehabilitation Centers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Physicians</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mental Health</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Independent Centers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Home Health Agencies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>all around the world using their network of physicians.</td>
<td></td>
</tr>
<tr>
<td>Subject 2: Project Manager of a Private Neurological Service Company</td>
<td>Attempts at statewide telemedicine System with medical school and rural hospitals involved.</td>
<td>Initial stage</td>
</tr>
<tr>
<td>Subject 3: Medical Director for the Office of Telehealth (State office)</td>
<td>Telehealth system provides neurological consulting services to hospitals within and outside the health system:</td>
<td>On-going</td>
</tr>
<tr>
<td></td>
<td>• 2 Hubs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 10 Spokes within the health system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 4 Spokes outside the system</td>
<td></td>
</tr>
</tbody>
</table>

During the coding process we did not restricted ourselves to this group of codes. As we discovered new concepts being addressed by the interviewee that did not map to the existing codes, we created a new code for each new concept. We used these codes to better understand the similarities and differences between the three implementations. We also used them to identify PI concepts that are unique to telehealth projects.

4. Business Model Findings

In this section we 1) share our results of key characteristics of PI in 3 different telemedicine BM, 2) identify actors that partner in the initiation phase of telestroke projects and 3) describe the key characteristics for each business model case context.

4.1. Case 1: For-profit organization providing telemedicine services internationally

This business model is defined as a healthcare business dedicated to providing state of the art neurological consulting services to hospitals. The company provides these services through the application of advanced telemedicine technology nationwide with 40 tele-neurologists. Hospitals and health institutions request the services of this organization and neurological services are provided via telemedicine technologies to as many healthcare institutions as appropriate. The hospital has often co-branded with an academic institution. The client pays on a monthly basis for the service in addition to an initial start-up fee. In this case, the hospitals that require services typically need to fill a gap between the specialty services they currently have available and the community’s need for these services. Telestroke is an established and ongoing initiative in this business model.

This business model is not focused on funding or capacity concerns; the main goal is to find a way to deliver the service to a particular healthcare institution and population. Understanding the business involves identifying and measuring this gap and determining necessary resources to fill the gap.

**Key Players:** The neurologists are key to success. Nursing personnel are also involved, and the business has plans to incorporate full time personnel for training and change management purposes.

Depending on the size of the partnering healthcare organization, a significant amount of effort is expended in the PI phase in this business model. Having access to the people in charge of making the final decisions is a key component of the success of this model’s implementation in a hospital. In large hospitals, the negotiation and decision making process can take time and many stakeholders are involved.

**Complexity:** This organization provides services in four states in the US and is planning to add clients in other states and countries. This indicates geographically disperse clients, different licensing agreements for the clinicians to practice in different states, and potentially different reimbursement rules. Providing the right technology for the service is necessary for implementation. In this model, some strategic partnerships have been created to provide the technology (equipment and software) to clients.

**Collaboration:** This model identified that the strong collaboration between physicians, radiologists, and nurses is critical for its sustainability. Creating a non-collaborative atmosphere increase the possibility of low stakeholder project buy-in. These actors need to be flexible in the way that they handle patients and effectively collaborate to ensure success.

**Funding:** Due to significant initial costs associated with this business model and the potential for slow expansion, it could take the organization a while to recover this initial investment.

**Project Tone:** This model exists in an environment of understanding that this is the
direction in which medicine is heading; the leaders and receiving organizations recognize that telemedicine is here to stay.

Organizational Readiness: Although the actors identified that there is not a formula in place for the initiation of this kind of initiative, they recognized the importance of making sure to communicate with all stakeholders as early as possible and continually update the stakeholders as necessary. Everyone in the project needs to understand the process before the service goes live. On the technical side, this case mentioned the importance of the support and maintenance of the equipment to ensure good service and performance of the equipment. Training is a key component of readiness; it is important to train individuals thoroughly, consistently, and accurately.

Each healthcare facility needs to understand the model’s capabilities and have the same, reasonable expectations. Facilities often want to rush the process and the organizational leadership needs to pace implementation appropriately. Quality assurance and risk mitigation is important in this model.

Marketing: Initial marketing efforts were not extensive, but later the organization started to develop a marketing strategy, identify potential customers and their market segment. Marketing efforts have helped the organization locate new hospitals for partnerships.

Governance: There is a board of directors that oversees each project.

Sustainability: Having the right equipment and personnel is vital for the service’s growth and sustainability. Since this business model relies on profits generated through the telemedicine program, continued growth is critical for sustainability.

Operational Licensure: Each tele-neurologist needs to be medically licensed in each state in which he or she treats patients. Because of the nature of telestroke services, this can require many licenses for each physician and is a complicated and burdensome aspect of these projects.

Success Measurement: The organization has reflected that each individual implementation, and the business model in aggregate, is a success. Organizational leadership has not, however, identified any particular key performance indicators to be used as success metrics to date.

Risk: The risks in this project were classified as organizational, legal, technical, and financial. The most important risk was ensuring organizational ability to predict and react to regulatory changes in the general and healthcare environments.

Project Management: This project did not adhere to any PM methodology; it did not follow any formal process or have a formal project champion.

Organizational leadership created a blue print for the project and this was largely the extent of the advance planning process. The blue print developed was a general telemedicine blue print for the company and not specifically a plan for the telestroke initiative.

4.2. Case 2: University-based statewide telehealth implementation initiative

This business model represents an attempt to design a regional system facilitating the receipt of health services, including neurological services, for the population located in rural areas. This model features a partnership between university affiliates and state governmental representatives who are working to design and implement the statewide telemedicine initiative.

With a steering committee as its governance, the initiative has a different perspective than the profitable business model. In this case, finding a sustainable telemedicine model is the critical issue. Issues relating to reimbursement have been vague and complex. Ability to form partnerships with healthcare organizations may be a critical piece of this program’s success.

Unique conditions generate resistance in this business model. The leadership committee recommends to hospital systems that they invest in the appropriate equipment to participate in this telemedicine network but this investment and participation is not mandated. This governance structure has, in some ways, been a barrier to this model’s implementation. There is not always an incentive for individual hospitals and systems to participate. Investing in the appropriate equipment is beneficial to these institutions, from a financial standpoint, if patients then use their services at increasing rates. Because of the need to share equipment and distribute patients throughout the state, there is not always high return on investment for hospitals making the investment.

Service Boundary: Geographic location would typically determine where a patient goes for emergent neurological care, but in telestroke, the neurologist that initially takes the call to do the initial assessment of the patient may not necessarily be the neurologist the patient later physically sees.

Key Players: This business model features key players with differing roles from around the region; each person is on the panel to offer a unique perspective and has a different agenda. The initiative finds support in larger healthcare organizations in order to increase access to resources and become part of higher-level political initiatives. Each player’s differing views make universal buy-in more difficult to achieve and slows the initiative’s progress.
With the growing interest in telemedicine due to recent governmental support, vendors are offering equipment and solutions to the states. For this reason, dealing with the local government is important when trying to make the right investment decisions and avoid the potential pitfalls.

**Complexity:** The complexity in this instance was associated with the different interests of various stakeholders and the importance of designing an adequate model for the state that could satisfy the stakeholders’ visions. The recommended project needs to take into account different hospitals in the state, their current technological capacity and their utilization rates. For the hospitals that do not have a strong technological foundation, additional considerations should be made and more steps will be necessary during the telemedicine program implementation.

**Funding:** The financing of this initiative is a major concern in this business model. The project’s governance team does not have the authority to make investments and produce the needed return on investment for each hospital potentially in the network. The project began a process to identify how to get the necessary support for the project from different governmental and telemedicine interest groups.

In this business model, the participating hospitals are expected to invest in their own technology infrastructure for the telestroke service. However, by participating in the telestroke service, these hospitals are not guaranteed to get all the patients in their facilities for treatment after the emergency care. The hospitals evaluate the decision to participate or not in the initiative according to the payoff of the investment. Uncertainty of the payoff makes these hospitals hesitant in making this large investment. The telemedicine group, which is a state initiative, is trying to find a solution for this uncertainty in order to establish a sustainable program. This business model may require a statewide telehealth infrastructure where the government makes the initial investment and then charges the hospitals that are joining a service fee for using the state infrastructure.

Reimbursement is another issue to consider. When Medicare did not reimburse for telemedicine services, a huge portion of the patient population that would most benefit from telemedicine could not use the services. It is critical for this business model that Medicare participates in telemedicine reimbursement.

**Governance:** Governance of this project is by a steering committee with representatives from the telemedicine group, associated university, and government. Government involvement and support is present because this project is designed to improve healthcare at the state level. The committee’s main actions in the initial stage of the case were aligning the viewpoints and interests of the interested parties and committee members to establish a vision and general scope for project.

**Operational Licensure and Credentials:** The project leadership did not consider many of the specific operational details while the project was in the initial conceptualization phase. Obtaining the appropriate operational licensure and credentials to operate a full-scale telestroke service could be a significant hurdle to implementation. Planning and groundwork must be done in the initial phases of the project in order to avoid delays or legal issues and mitigate risk.

**Risk:** Identifiable risk includes both operational viability and technical feasibility. Issues such as community benefit, service availability, and payment structure must be addressed to establish support for and the sustainability of the program. Additionally, the technology involved must be carefully considered as implementation is costly and technical standards must be met across a variety of hospitals in the network.

**Project Management:** PM was not established in this case. The initial phases of project planning dealt more with conceptualization: identifying the stakeholders, key players, impact, sources of funding, and, ultimately, project feasibility.

### 4.3. Case 3: Private hospital network

The case study organization is a not-for-profit health system located in the south and serves a large community in a single state. The organization strives to provide healthcare to each area of the state, including its rural areas. The health system, with its 9,000 employees, provides services through hospitals (15), rehabilitation centers, physician clinics, mental health facilities, independent living centers and home health agencies spread over 50 towns and cities. There are more than 2500 physicians affiliated with this health system in the state.

First telemedicine service in this organization started in 193 through a series of grants awarded by the federal government and the state to improve access to healthcare services for rural residents, to reduce isolation of rural practitioners and to provide health resources to a larger community. Now, the telehealth program has a sustainable corporate business model and is house within the IT group.

The history of the organization indicates that telemedicine is not new to this firm. This service was new and unique, however, in two aspects: 1) it was designed to provide specialist expertise, stroke neurologists, to rural communities real time in
emergency departments for a specific type of emergency, acute stroke and 2) it was the first service that was initiated without grant funding to satisfy a need the organization identified in the community and committed resources to develop and implement a sustainable successful solution.

This business model differs from others with state scope in that the promotion of this service is starting in the rural communities and using the most specialized resources in central areas to support hospitals that do not have that specialist. Due to the fact that this business model operates in a network of hospitals where each hospital can be include in the network, telestroke program could be seen as a competition between different hospitals. By participating in this telestroke network, hospitals gain the ability to accept stroke patients that they would not be able to treat in a timely manner before the program was in place.

Funding: The reimbursement structure in this model involves hospitals in the system paying a fee for use of the telestroke service. A key component in this business model is determining the appropriate reimbursement rate in order to maintain a profitable margin for the program while not inhibiting use of the service by hospitals.

Governance: Defining the project’s governance in this organization presented a challenge. The interactions between the system’s central facilities and rural hospitals are complicated and initially, it was not clear which hospital should lead the project. There was also complexity surrounding who should own this initiative; it could be either an information technology initiative or a corporate initiative. IT initially owned the project, but ownership shifted to a more centralized corporate team. It took time to determine the right owner for the initiative and to establish the role of IT in this corporate initiative.

The governance structure was further complicated by the organization’s upcoming change in top leadership. The case demonstrated that a change in power can result in a shift in a project’s vision.

Key Players: Each hospital in the network is a stakeholder in the project and each has their own unique interests. The hospital directors or representatives are key players in decision-making and local implementation. The hospital directors played a significant role within their institutions, garnering awareness and support for the project and collaborating with the administration and physicians.

Complexity: In this project the primary complexity identified was in technology and technical implementation. The videoconference system between remote sites and the central hub presented challenges associated with implementation, acceptance and use by practitioners, and quality assurance relating to critical medical dimensions.

Another issue contributing to project complexity is the variety of hospitals in the network. Each site had its own interests and wanted to establish its own infrastructure and protocols. Individual site analysis is necessitated to avoid making generalizations and assumptions. Maintaining compliance and standards at the various sites will present an ongoing challenge.

Collaboration: A key element in this project was establishing partnership and cooperation between the actors. Cooperation between the IT department, who handled a large operational component of the project, and the project’s corporate governance was necessary for successful implementation. All actors involved in the telestroke service needed to collaborate successfully; this includes neurologists, hospitalists, emergency room physicians, nurses, other clinical staff, and administration.

The collaboration necessary between facilities is also a consideration. Some hospitals experienced more difficult implementation periods than others, largely based on size of the hospital and the technological maturity of the facility, and support from elsewhere in the system was needed. Each of these facilities has its own governance and collaboration between leadership teams was essential.

Set Expectations and Project Tone: The project strives to increase health literacy of community members, ensure patients receive quality neurological care, involve patients in the management of their condition, and improve health outcomes at the state level. Realistic expectations should be set and goals should be considered at every decision making stage.

Organizational Readiness: Each stakeholder needs a complete understanding of the telestroke service and the organizational goals. For this reason, marketing and education are key components of the project’s implementation. The organization is not prepared to go live with a telestroke service until its employees are fully trained and understand the initiative at hand. This is a long process and should be started well ahead of the service’s implementation.

Marketing: The strongest marketing tool identified in this project was “word of mouth”. Awareness of the project led to interest and participation, increasing project momentum. Additionally, a brochure was created and dispersed in the community detailing the services available at the telestroke facilities.

Project Management: PM specialists or project managers were identified and involved from the beginning of the project to ensure similar assumptions and expectations. This facilitated an executable business plan with an implementation
timeline and helped to avoid dissonance between stakeholder expectations and project reality.

5. Comparing BM for Project Initiation

We return to the previously discussed key initiation phase components supported by literature to compare PI approaches among the three BM presented. We tie our insights to the collaboration ontology guiding this mini-track to highlight both application and expansion of this model to PI for a telemedicine project.

5.1. Identify benefits of PI (Technology)

Each of the three organizations, representing three diverse BM, has a unique interest in the launch of a telestroke service as its leadership designed it. The profitable model considers more traditional business concerns and opportunities. The not-for-profit organizations discuss how to establish and sustain the initiative to meet community needs.

All three organizations identified the same primary benefits inherent in establishing telestroke services. These benefits include the improvement of neurological medical services available and expanding the availability of these services to a larger geographic region.

5.2. Identify external challenges (Technology)

Each of the three BM recognized the importance of having a complete understanding of the business and learning how to make the telestroke service sustainable. Creating the right business model for the parties involved and the circumstances at hand can be the first challenge to overcome; it can be difficult to establish a model that gets the services to each entity in need. Obtaining the necessary physician and organizational licensure is a challenge faced by BM operating in numerous states. For not-for-profit organizations, the key challenges relate more to convincing various stakeholders of the need for and value of telestroke service lines.

5.3. Develop a project charter (Technology)

In essence, a charter is a manifestation of project strategy for the architecture and system. In the general PM literature, it is speculated that the presence of a charter in the PI stage is predictive of the project’s success. Of these three telestroke projects, only one of them mentioned having a project charter. One other project had a “blue print” document for the project. We should note that we did not ask them directly if they had a project charter. However, we did ask them how the project was managed and other governance related questions. These two projects seemed to progress much faster and produced measurable results quickly compared to the project that did not mention anything along the lines of a project charter.

5.4. Secure project sponsorship (Partners)

A project sponsor is a similarly important component of a project’s success. The project sponsor is in charge of approving the project. These three telestroke projects do not mention one definite, formal project sponsor and manifestations of sponsorship demonstrate some interesting aspects of partnerships. The not-for-profit organizations find project sponsorship in multi-disciplinary committees. These committees authorized the projects and did much of the initial planning. There needs to be consensus reached in the committee, though, before a project can be planned in detail. In the statewide initiative, some of the committee members, as the interviewee stated, “wanted to move forward with video supported telestroke, and the other half of the committee [thought] that this was probably not necessary and everything was fine in their organizations and they didn’t see any advantage for spending the time or effort in this kind of process.” In the profitable model, discussions took place between the leading decision makers and the new customers in order to reach a final agreement.

5.5. Ensure project responds to the needs of key stakeholders (Partners and Content)

In the course of enabling this service line, partnerships may be formed among administrators, nurses, doctors, researchers, IT personnel and others either within or across participating healthcare facilities. Various partners, who are also key stakeholders, will contribute to the development of system content. Although in some cases committees are established to facilitate this process, this leadership structure comes with its own difficulties.

The not-for-profit business model demonstrated concern surrounding whether the project responded to all of the stakeholders’ needs. The project aimed to respond to the needs of the general population, numerous stakeholders and partners from the medical community, and address the governmental interest in increasing quality of and access to care. Additionally, some members of the governance committee weighed profit-related concerns more heavily. The committee needed to reach consensus and ensure the initiative is sustainable.

5.6. Gather organizational support (Partners)
The project’s parent organization has the ability to either enable or constrain the project’s initiation. This issue was especially relevant in the profitable telestroke business model - the business model that features a true, single parent organization. The organization’s goal is to be profitable and this goal guides decision-making regarding where and when to sell the project to new customers. The project is either enabled or constrained on a case-by-case basis.

5.7. Specify project scope (Technology)
Project scope definition and change management are key issues in the initiation process. Each of the three BM engaged in these processes. The scope of each telestroke project varied but there were components that each project incorporated.

5.8. Manage Change (Media and Content)
Each organization enacted community education and utilized key clinical stakeholders in the change management process. Workflow changes related to the new protocols and services are inevitable once telestroke services are fully implemented and these challenges were identified in each organization’s reflection. PM and change management efforts brings about some new or enhanced face-to-face meetings and email among players that may not have worked together before, and customer facing promotion (mass media). In addition, the change introduced by the telestroke project also spawned new content, namely ideas for other telemedicine service lines.

5.9. Align with the vision (Purpose)
The project’s content and objectives should align with the organization’s mission and strategic goals. All mentioned quality of care; as the representative from the private hospital network said, “[the] hope is that no matter where you live in [the state] that you will be able to access the [appropriate] standard of care ... and that there is no disparity for those rural residents.” The profitable model is built on the vision of providing the telemedicine services in as many facilities as possible in order to increase the health care organization’s market.

In the not-for-profit model, converging the missions and visions of the governance board is challenging because of the differing expectations from the initiative. The private hospital network’s mission to spread the services across the area’s rural communities and telestroke, as a means to this end, and their desire to achieve “Center of Excellence” status for multiple facilities in their network easily converges with this mission.

Informants for the telestroke project for the private health network indicated that the telestroke effort was indirectly supporting the organizational vision to move towards closer collaborative associations among the network components, which was an administrative goal. Telestroke also supported educational goals regarding the National Institute of Health’s Stroke Scale and related best practices and possible inter-professional education.

6. Conclusions
We introduced a multi-part case study and presented our findings using the dimensions of the collaboration ontology. Our data generated new insights regarding all dimensions in this ontology.

Technology – Even though the media and purpose chosen by all three BM were the same (telemedicine for emergency stroke care), we identified different technology architectures, systems and strategies in use. In all three cases, the BM they chose to implement were partially the driver for the differences in the way technology was implemented. However, we also identified that the types of partnerships and how they were negotiated had an important effect on the technology decisions. Moreover, the existing IT infrastructure was taken into account as these decisions were finalized.

Partners – In the course of enabling this service line, partnerships may be formed among administrators, nurses, doctors, researchers, and others either within or across participating healthcare facilities. Our data showed that IT personnel and technology vendors could be one of the key partners in a telemedicine program in addition to the ones listed in the ontology. One could consider IT as part of the administrative group. However, in the institutions we looked at, there was a clear distinction between the partnerships with administrators and partnerships with IT departments and personnel. They were considered to be an important key player.

Content – Telestroke requires a combination of data, analysis, diagnosis and treatment exchange between different partners. Our data showed that the ability to push different types of contents for one program allowed organizations to consider other purposes for sharing one or more types of content in the infrastructure built. For example, ability to exchange diagnosis and treatment content for care delivery allowed organizations to use the same content for education and marketing purposes.

Media – Telestroke requires a number of institutional systems to be in place to deliver the care in emergency departments (ED). Neurologists and ED doctors need to be connected live via videoconferencing for diagnosis and treatment
decisions and exchange lab results data and potentially other medical records of the patients through secure data exchange. Moreover, we also observed that during the process of setting up this enhanced technology based communications, more virtual face-to-face meetings were enabled among players that may not have worked together before. We also observed that the organizations were willing to utilize mass media to promote their success stories.

**Purpose** – Our data provided some new insights in this dimension of the ontology. Education is one of the ranches of the ontology listed under education. We observed that in addition to formal/direct education, the telestroke network whose main purpose was to provide care became an indirect means for educating clinicians in the ED and increasing community awareness to stroke as a disease. We also identified that gaining market share is an indirect purpose of most of the telestroke programs that are originally initiated to provide increased access to care. Some of the organizations also used telestroke programs to become centers of excellence in providing care for stroke or to disseminate admissions vision for becoming a more connected network of hospitals. In summary, the four listed arms of the ontology reflect the main purpose of organizations in establishing telemedicine networks. However, the list could be expanded with these second tier purposes that most organizations need to consider in order to justify their large investments in the technology and infrastructure.

Future studies can investigate how organizations manage other stages of the PM process. Future work should directly link the PI decisions to program success in telemedicine environments. These findings will help practitioners to better manage the telemedicine PI process towards a sustainable service line.

7. References