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A Critical Success Factor Approach to Address Telemedicine Implementation Challenges - A Longitudinal study

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Abstract

The lack of understanding of what is truly critical to the success of emerging health services innovations may result in the failure of those innovative projects. This is particularly true in the case of HIT innovations struggling for reimbursement recognition, willing early adopters, and attention of over-extended IT departments. With the help of a seven-year longitudinal case study, we use empirically rooted critical success factors (CSF) framing to explore and identify the key facilitators and interim outcomes associated with the implementation of telemedicine in the form of a telestroke extension to a hospital network and how these CSFs in turn address the telestroke implementation specific challenges.

Keywords: Critical Success Factors, facilitators, interim outcomes, qualitative, telemedicine, telestroke

Introduction

The world witnessed a sudden and rapid transition of conventional in-person healthcare consultations into virtual care or telemedicine, brought about by the COVID-19 global pandemic. The unprecedented health crisis substantially altered the attitudes toward healthcare delivery, evidenced by the uptick of the adoption and implementation rates of telemedicine, as the primary modality of care. For example, a recent report on the telemedicine market which estimated a growth projection from USD 90.74 billion in 2021 to USD 636.38 billion in 2028 at a CAGR of 32.1%, establishes the indispensable role of telemedicine in the future healthcare infrastructure for integrated and quality care. More importantly, several healthcare organizations have already realized telemedicine's criticality in providing a care continuum after the pandemic (Cormi et al. 2020). With the rapid integration of telemedicine into standard care, it is essential to understand the factors that influence the successful implementation of these complex healthcare networks over time.

Healthcare organizations undergoing technology transformations, including the implementation of telemedicine projects, face the challenge of determining the factors that facilitate their success. Although telemedicine projects equalize care for underserved and rural patients (Kane-Gill and Rincon 2019), they face numerous organizational and implementation barriers. Additionally, these implementations also suffer from high failure rates (Alaboudi et al. 2016; Cho et al. 2009), three-fourth of those being ultimately abandoned. A typical telemedicine implementation represents a complex adaptive system that must also address clinical content, people, workflow, internal organizational features and external considerations including regulatory and social norms (Cresswell and Sheikh 2013; Sittig and Singh 2010). All these project elements, with their associated barriers that impede success, must be effectively managed to derive the intended benefits of these implementations. Widespread diffusion of telemedicine requires an understanding of what is truly critical to a successful rollout that overcomes the obstacles associated with any emerging health services technology innovation that faces competing innovation paths, constrained resources, and pressure to show promising outcomes.

Information systems literature regularly reports long lists of “important things to consider” when embarking on digital healthcare initiatives. Such published lists, over a dozen review articles in the past eight years, seem to have strayed from the empirical roots, meaning, and application of the original construct to discern critical knowledge, identify relationships and responsibility, and show a pathway to action. The critical success factors (CSF) method, commonly attributed to Rockart (1979), looked for “the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization (p. 85)” to identify information needs. Similarly, Leidecker and Bruno (1984, p. 24) called them “characteristics, conditions or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a firm competing in a particular industry”. The two definitions point out specific areas, in a particular organizational or industry context, that when embraced over

time leads to organizational success. These definitions focus on organizational performance. The allure of the concept that managing a few factors could lead to success spread quickly.

Success factors can now be found across many literatures especially those focusing on information technology implementation like healthcare. Generalizable factors across several contexts, although sought after, diverge from the originally prescribed rules to identify these factors. Borman and Janssen (2013, p. 391) recognized this divergence noting that "later work by contrast has focused on CSFs from a broader, anonymous, perspective identifying general sets associated with projects". The current state of the CSF literature now consists of lists of non-contextual success factors focusing on a specific case of technology implementations. For example, a review of clinical information systems (CIS) typifies this mindset: "success factors are understood as groups of organizational, functional, technical or other requirements that have been identified to foster the integration or evolvement of CIS towards supporting the concept of integrated care" (Hoerbst and Schweitzer 2015, p. 82). Overall, the early conceptions of a CSF were context specific (i.e., to a project) but over time evolved to general lists of success factors applicable to any project (Borman and Janssen 2013).

The historical intent of a context-sensitive CSF (Rockart 1979) at a particular organizational level has been diluted over the decades and most CSF articles no longer trace their methodology to Rockart (1979)'s original work. The departure from the original CSF concept of specificity to an organization limits the current usefulness of the CSF method. Furthermore, the evolution from specific success factors to lists of success factors to general best practices may represent the tendency to move away from the exhaustive exploration of specific factors to easily applied practices for the busy project manager.

Furthermore, the literature on barriers to success intermingles with success factors [xxxx cite]. Finally, the health CSF literature says little about success factors that represent the phasing of projects and post-implementation performance [xxxx need cites]. Unfortunately, the CSF literature remains mostly silent on the process factors, influencing the sustainability of the implemented service.

Responding to a call for setting transformative goals in health services research (Rapport et al. 2018), this case study of a seven-year longitudinal study of the implementation and adoption of a telemedicine implementation, a tele stroke service line extension, provides an opportunity to develop a framework to address the lack of context-specificity of the success factor lists. The CSF research guides our framework developed to address the research question: *How are telestroke implementation challenges successfully addressed?*

The developed framework demonstrates how interim outcomes, resulting from the facilitators at different important organizational hierarchical levels, addressed the telestroke implementation

specific challenges.

Theory and Background

In this section, we present our review of the CSF literature for healthcare technology implementations. Overcoming these challenges drives the quest to identify the right set of success factors for one's own HIT project. The search for these success factors in the HIT literature starts this section. Reviewing these efforts identifies gaps in the understanding of CSFs which serve as the starting point of the proposed framework.

History of Healthcare Implementation Success Factors

Over a dozen review papers published since 2010 in the HIT literature seek to identify the factors that lead to project success. Table 1 lists these reviews in chronological order that describe the HIT domain and the types of factors identified. Two reviews concern telemedicine (Brewster et al. 2014; Saliba et al. 2012). The first type of review collects only the factors or categories of factors that lead to implementation success (Ahmed et al. 2018; Baysari et al. 2016; Cresswell and Sheikh 2013) constituting the so-called "shopping lists". A different set of reviews recognize that success can be limited by barriers, not just the factors that lead to success (Brewster et al. 2014; Gesulga et al. 2017; Gnanlet et al. 2019; Kruse et al. 2016; Saliba et al. 2012). Other reviews catalog success factors against a framework such as the Delone and McLean model (Nguyen et al. 2014), HOT-fit (Kilsdonk et al. 2017), implementation research (Ross et al. 2016), and normalization process theory (Mair et al. 2012). Only one review addresses success factors in the context of CSFs (Hoerbst and Schweitzer 2015).

Table 1
Recent Review articles in Healthcare IT addressing success factors

Study	**Method**	**HIT Domain**	**Factors**	**# article**
(Mair et al. 2012)	Framework	e-health systems	4 meta-factors understudied	37
(Saliba et al. 2012) ~~IJMI~~	Barriers-Facilitators	Telemedicine across borders	Barriers and enablers	94
(Cresswell and Sheikh 2013) ~~IJMI~~	Factors	Health information technology	Technical (4), Social (6), Org (9)	13 reviews
(Brewster et al. 2014)	Barriers-Facilitators	Telehealth	10 frontline staff (nurse) acceptance	14
(Nguyen et al.	Framework	EHR	13 contingent factors	98

2014) ~~IJMI~~		Implementation		
(Hoerbst and Schweitzer 2015)	Critical success factors	Clinical information Systems	43 success 24 barriers	40
(Baysari et al. 2016)	Factors	Medication management	Critical factors (nine areas)	77
(Kruse et al. 2016)	Barriers-Facilitators	EHR	39 barriers	27
(Ross et al. 2016)	Framework	e-health systems	39 categories	44
(Gesulga et al. 2017)	Barriers-Facilitators	EHR	Barriers (primarily people and procedure)	38
(Kilsdonk et al. 2017) ~~IJMI~~	Framework	CDSS Implementation	421	35
(Ahmed et al. 2018)	Factors	eHealth systems	5 challenge areas 4 Opportunity areas	44
(Gnanlet et al. 2019)	Barriers-Facilitators	Healthcare IT	Impediments by stage	
(McLachlan et al. 2019)	Barriers-Facilitators	Learning health systems	Barriers, facilitators, benefits for ICT, process, management and resources	26

CSF research in HIT continues with a number of studies in the past decade. Table 2 lists these studies in chronological order. These studies identified a small number of factors compared to those identified by the reviews in Table 1. Only one study specifically addressed telemedicine and found that three of 67 identified factors considered critical: security, cross-platform, and user-friendly (Maris et al. 2017). These three factors are only technical even though reviews identified the need for factors in technical, social, and organizational categories (Cresswell and Sheikh 2013; Kilsdonk et al. 2017).

Table 2
CSF Studies in Healthcare IT

[possibly list the categories of factors]

Study	Domain	# factors	Method
(Kaye et al. 2010)	E-health and Healthcare IT	9 barriers: lack of clear benefits, sufficient incentives and adequate support for clinicians as well as payer–provider relationships, marketplace competition and privacy legislation; success factors: innovative leadership, integrated management and collaboration with the doctors based on concrete needs, benefits, incentives and support.	Report comparison
(Axelsson et al. 2011)	HIS	Best practices successful due to process change	Case
(Standing and Cripps 2015)	EHR	6 including contextual factors: user-stakeholder involvement; vision-strategy and strategic alignment; communication and reporting; process for implementation-migration-integration-training; plan for ICT infrastructure; contextual factors	2 case comparison
(Almeida et al. 2016)	e-Health		
(Maris et al. 2017)	Telemedicine	67 CSF considered – 3 critical (security, cross-platform, user-friendly)	Survey – 12 participants
(Sidek and Martins 2017) ~~IJMI~~	EHR in dental clinics	6 CSF categories: usability of system, emergent behaviours, change management, project organisation, training, and requirements analysis	Case study of 15 clinics
(Misra and Bisui 2018)	Personalized medicine	12 CSF Significant: data management, team work and composition, privacy and confidentiality, mind-set, return on investment, sufficient time, R&D and alignment SEM???	Survey – 92 responses
(Nguyen et al. 2018)	Healthcare BI systems	23 CSF Supports phases	9 interviews
(Soomro et al. 2018)	e-Roster	Senior management support, Rostering policy and compliance, Technical support, Interviews, Leadership, Clear goals and objectives, Gradual cChange, Effective communication, Monitoring and reporting	Interview – 15 participants

Gaps in CSF Understanding

Studying these HIT reviews and the studies on CSF point out several gaps. Most success factor research focuses on human and technology to the exclusion of organizational factors (Cresswell and Sheikh 2013; Kilsdonk et al. 2011). Literature does not address the specificity of a success factor to a particular context with some researchers wondering if these lists aren't just best practices [need cite]. Most studies focus on implementation of HIT technology rather than successful implementation which suggests a time dimension and the possibility of intermediate outcomes [cite]. Going beyond implementation also means measuring project success, rather than the installation of technological features. Furthermore, little is known how success factors relate to one another or variables such as success. These gaps are addressed in this section.

Holistic view of success factors

HIT projects get implemented in the ecosystem of a complex health system. The information and communication technologies constitute only one element of a system that includes clinical content, a user interface to access the content, and a workflow embedded in an organizational setting (Sittig and Singh 2010). A review of telemedicine projects identified determinants that influenced implementation including technology, acceptance, financing, organization, along with policy and legislation (Broens et al. 2007). A systematic review of clinical leadership practices for successful HIT adoption identified ways to cultivate the necessary IT competencies, establish mutual partnerships with IT professionals, and execute proactive IT behaviors (Ingebrigtsen et al. 2014). Successful innovation initiatives had a sound business case, a change process in place, and engagement with stakeholders such as clinicians (Wutzke et al. 2016). A review of telemedicine that focused on videoconferencing identified the ways to prepare an organization for technology adoption such as a user training plan, protocols for system use and promoting inter-professional collaboration (Jarvis-Selinger et al. 2008). These determinants, behaviors, and factors often appear as CSF success factors.

A CSF analysis of informatics tools needed for chronic disease management found it necessary to consider health delivery system enhancements, organizational partnerships, funding mechanisms, project management, practice models, and formal knowledge translation practices (Green et al. 2006). Similarly, a systematic review of clinical information systems distinguished between barriers and success factors. While barriers were often user-related, the success factors were distributed amongst organizational and technical concerns not just user-related ones (Hoerbst and Schweitzer 2015). Moving beyond review articles to specific CSF studies in telemedicine, a recent survey of ten practitioners assessed 67 success factors (Maris et al. 2017) with security, cross-platform, user-friendly, and usefulness identified as critical ones. Thus, CSFs in telemedicine will likely represent a broad spectrum of concerns just as in other industries.

Missing specificity

The CSF method was born out of the frustration Rockart's (1979) executive clients had in determining what were "the most critical pieces of information contained in the [information system] reports". Bullen and Rockart (1981, p. 7) go beyond information needs and defines CSF as "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization."

The historical intent of a context-sensitive CSF at a particular organizational level has been diluted over the decades and most CSF articles no longer trace their methodology to Rockart's original work. Borman and Janssen (2013, p. 391) recognized this divergence noting that "later work by contrast has focused on CSFs from a broader, anonymous, perspective identifying general sets associated with projects". They tried to reconcile Rockart's context-specific perspective with the universal project-level perspective that now dominates the literature. For example, the CSF definition in the context of enterprise resource planning (ERP) projects was broadened to any condition or element seen necessary in order for the implementation to be successful (Finney and Corbett 2007). While partly to address the narrowness of Rockart's interview approach, these authors also sought to identify CSFs beyond a specific aspect of implementation. Looking for patterns across the literature (e.g., most common ones), as most studies currently do, also means that context-specific CSFs will be overlooked. In addition, most ERP cases are large enterprises such that the most common CSFs tend to be organizational (Leyh and Sander 2015). Perhaps not surprisingly, a workshop consisting of small and medium enterprise practitioners found much more specific CSFs but applicable across varying levels of the organization (Lückmann and Feldmann 2017). No equivalent study has been done in HIT. However, as HIT researchers argue that these generic CSFs have limitations and many contextual dimensions need to be considered (Standing and Cripps 2015).

Rockart's framework also points to the context specific nature of a CSF. Rockart (1979) focused on industry CSFs but pointed to Anthony et al (1972), who emphasize that management control must be tailored to a particular company and manager. Citing the thesis of Mooradian (1976), Rockart (1979) shows how CSFs varied across three medical group practices reflecting the stage of growth, location, and their strategic plans. In sum, a handful of factors should be viewed as being critical with respect to a particular industry and company while respecting the temporality of information needs.

Further support for a limited number of success factors continued beyond the original Rockart article. Boynton and Zmud (1984) said "Critical success factors are those few things that must go well to ensure success for a manager or an organization, and therefore, they represent those managerial or enterprise areas that must be given special and continual attention to bring about high performance (p.17)". Caralli et al (2004, p. 111 their emphasis) add a strategic element to

CSFs saying that "CSFs are more than just guiding principles; instead, they are considered to be an important component of a strategic plan that must be achieved *in addition* to the organization's goals and objectives."

Identified success factors in HIT tend to be specific to the type of system being implemented: availability of results in emergency rooms (von Eiff and von Eiff), database-driven factors for data consolidation and ability to de-identify data in an integrated EHR (Crossfield and Clamp 2013), whereas clinician acceptance important in telehealth (Wade et al. 2014), and policy and compliance in rostering (Soomro et al. 2018). The notion of a CSF shopping list stems from the limits that specificity of a success factor places on generalizability and the effort to develop CSFs for a specific industry and organizational context. A generalized list applicable to any project certainly would be attractive.

Barriers vs enablers (facilitators)

When looking to revisit the CSF concept one realizes that the bulk of the HIT literature summarized by the reviews in Table 1 focused on barriers (Brewster et al. 2014; Gesulga et al. 2017; Gnanlet et al. 2019; Kruse et al. 2016; McLachlan et al. 2019; Saliba et al. 2012) more than success factors.

Healthcare researchers also seek to find barriers to implementation and the factors that lead to successful projects though not directly tying themselves to CSFs as defined by Rockart and colleagues. A sample of review papers touching this subject include success factors in health information systems (Ahmed et al. 2016), EMR failure rates and CSFs (Sumner 2015), HIE barriers (Basmah and Daniel 2017) and success factors (Feldman et al. 2014), patient portals (Kruse and Goetz 2015), and EHR (Ben-Zion et al. 2014).

A stream of literature suggests that minimizing barriers to innovation opens the door to success or the so-called "flipside of success"(Hueske and Guenther 2015). Such a position suggests that success factors just mitigate barriers but Rockart's original intent were the [need quote] things to focus on.

Examples do exist in which an area of the project might be a success factor but also a barrier. Such categories would be expectation, attitude and outcome, management and steering, end-user involvement, system learning, usability, and system enhancements (Janols et al. 2014). Similarly, a review of dental systems found that categories for perceived facilitators and barriers fell under usability of system, emergent behaviors, change management, project organization, training, and requirements analysis (Sidek and Martins 2017). A barrier such as ineffective communication) may be turned into a success factor (Soomro et al. 2018).

Yet no consensus exists on the relationship between a barrier and success factor. A review of clinical information systems concluded that barriers were user-related whereas success factors spanned a number of categories including organizational and technical (Hoerbst and Schweitzer 2015). A review of the eHealth literature found that barriers were technical interoperability, lack of a holistic approach to design and implement a system, and technology disconnect (Alkhaldi et al. 2014). These barriers can exist at the lowest levels of an organization such as user training to project leadership to the organization itself and to the industry (McLachlan et al. 2019). These barriers or impediments change during the phases of a project (Gnanlet et al. 2019).

No one argues that barriers hinder HIT projects. Barriers need to be overcome (Brewster et al. 2014; Kruse et al. 2016; Saliba et al. 2012; Standing and Cripps 2015). Just as CSFs have shopping lists for success, lists of adoption barriers can be found spanning a spectrum of technology project areas like financial, workflow, and staffing (Kruse et al. 2016). Methods exist to identify barriers (Brewster et al. 2014; Gesulga et al. 2017).

Unfortunately, the literature generally doesn't define the terms used interchangeably for barriers or success factors. Only one article defines barriers, benefits, and facilitators (McLachlan et al. 2019):

- Barriers are those things that inhibit implementation and use of a particular technology or system,
- Benefits are the positive outcomes realised by resolving a barrier through engaging a facilitator
- Facilitators are those interventions described as easing the burden of implementation and use of a technology
- A facilitator is targeted towards resolving one or more related barriers.

A facilitator is targeted towards solving one or more related barriers. Facilitators are those inventions described as easing burden of implementation using technology.

A facilitator is targeted towards resolving

Theoretical framework

Research Methodology

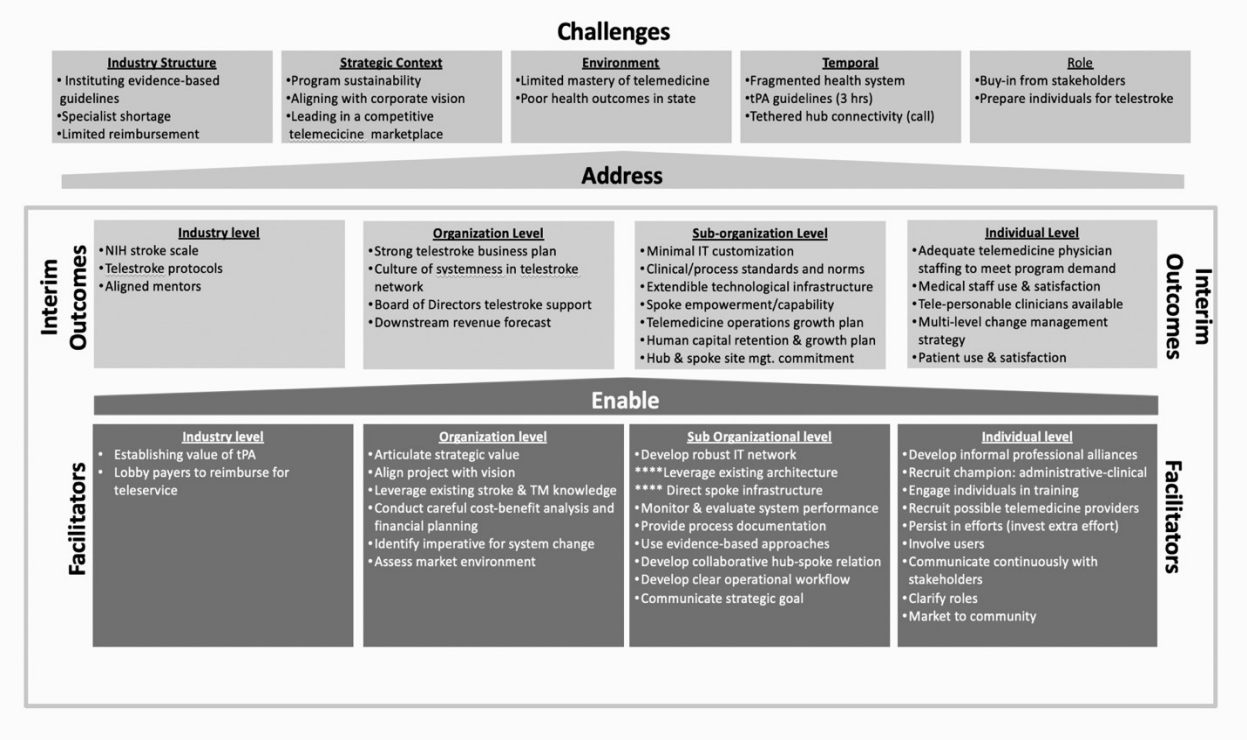
(Baxter et al. 2014) [related to logic models] p. 6 " … A key aim of logic models is to uncover assumptions in the chain of reasoning between interventions and their expected impacts, and to develop a theory of change which sets out these implicit "if…then" pathways. … In order to do this we used "if…then" reasoning to deduce in what order outcomes needed to occur for these to then lead to the intended impact. Four studies, across a broad spectrum of HIT applications, used

case studies or surveys to develop a narrower set of factors to consider as CSFs (Maris et al., 2017) (Sidek and Martins, 2017) (Misra and Bisui, 2018) (Nguyen, Meredith and Burstein, 2018).

Data Collection and Analysis

Three data collection rounds - Round 1 (prior to go live), Round 2 (go-live) and Round 3 (5-year reflective lookback) occurred during the 7-year longitudinal study in a Midwest telemedicine network with two hub hospital sites .This study used multiple methods including 27 semi-structured interviews, observation, and focus groups. Inductive and deductive coding methods identified a universe of "important factors", grouped important factors by level, and applied an outcome-driven meaning of criticality to the resultant lists and associated quotes to discern "critical" ones. The questions in Round 3 were framed such that the interviewees revisited the factors identified as critical in the previous interview rounds and their perception about the importance of those factors was recorded. The corroborated findings were then grouped into the final list of key challenges and critical factors. The last step involved revisiting extant literature of the CSF construct to evolve a meaning and labels as well as a process for identifying CSFs that could carry across to other HIT contexts.

Results



Industry Structure

U.S. healthcare delivery is a complex process and the telestroke program was confronted with multiple industry challenges. First, telestroke required the introduction of multiple ***evidence-based guidelines*****,** particularly related to stroke assessment in the form of the National Institute of Health's stroke scale and HealthCorp's desire to enhance evidence based best practice as described below:

"I actually think we've been able to take best practice from NIH, as well as the tele-stroke protocol from [leading health system], modify it slightly. We have incorporated some of our learnings, actually into our transfer center process. So I think we've actually been able to incorporate a lot of evidence-based best practice protocol type stuff into our workflow." [T3-Administrative].

Second, telemedicine by its nature seeks to address issues of access to care, often specialists, such as vascular neurologiststs, who are in short supply. Our results indicated that these ***shortages*** are exacerbated when coverage from specialists, such as vascular neurologists are needed 24/7. Another major industry challenge that Healthcorp had to overcome to provide telestroke was ***potential reimbursement challenges*** as stated by an administrative informant: "I think the reimbursement is going to be key, too. I think with any healthcare entity, and if we can work with our private payers and our Medicaid and bill for what we're actually rendering, that would be pretty exciting, and I think would be, would help with the sustainability long term." [T3 Administrative]

Strategic Context

Given the pace at which technology is moving and given the involvement of diverse stakeholders in the telestroke program, respondents recognized that ***alignment with the corporate vision*** can be a major challenge– *"And now you have some of the upper leaders on the executive steering committee, including financial people and vice presidents saying, you know, we really do need to reevaluate this financial model."* For the Telestroke program to be successful, it was imperative for the organization members to address challenges emerging in the health organization's strategic context regarding stroke care and telemedicine.

Strategically, health system leaders felt that that the health system had a foothold in telemedicine and could go beyond just matching existing offerings, but strengthening their position through telestroke. This also came at a time when enhancing stroke care, particularly in rural areas, was growing in interest due to the pervasively high health indicators that stroke was a major public health concern. This opportunity to ***lead in a competitive market place*** also introduced challenges. While telemedicine services allowed HealthCorp to expand their geographic reach and reputation, telemedicine also resulted in increasing competition as expressed by the administrative staff – *" I travel around many of these hospitals and the resources are not just there to care for their patients and their community. And obviously telemedicine is certainly the most logical path to get there and honestly if we don't do it somebody else will, because people are moving with that pace. So people from other states are moving in and making offerings to not only our regional partners but to our sister facilities."*

The shortage of specialists and limited reimbursement also raised concerns over program ***sustainability***. At

the forefront of one of these challenges was sustainability in a way that was not dependent on grant funding. A member expressed the organization's concerns over sustainability "*We knew that at some point that if we accept grant money or get a grant money, then in order for us to continue to exist, we were going to have to make a viable program out of it, and that's what I think has been key. We had to figure out a way and formulate a business model that would be sustainable."* It was recognized that strategies would have to leverage existing equipment and have the spoke sites take some ownership for the provision and sustenance of the telestroke service line.

Environment

One of the major challenges posed by the environment for the successful implementation of telestroke network was found to be the ***limited mastery of telemedicine***, as described by a top management member "*That may sound strange, but I don't know that there's a lot of awareness, throughout our organization and outside the organization".* The other major challenge would be to improve the ***poor health outcomes*** related to – "*Well, in [state], we have about 2.5 neurologists for 100,000 people, according to the Academy of Neurology, [our state] has got one of the bleakest demographics for neurology, so that's one factor. The other is stroke is the fourth leading cause of death in [our state], and it is the leading cause of adult disability, the morbidity and mortality from stroke is pretty devastating. So we've got several things going against us that makes this solution a very attractive one for the state of"*

Temporal

Fragmented health system
tPA guidelines (3 hrs)
Tethered hub connectivity (call)

Role

~~Professional roles, especially in healthcare, have varying degrees of power and influence. Getting a role, especially influential ones, to support telestroke requires concentrated effort. People in influential roles have to be able to earn the buy in from different stakeholders to achieve the desired outcomes.~~ ***Earning the buy-in from different stakeholders*** to achieve the desired outcomes was found to be a major challenge. This challenge was explained in detail by one of the administrative leaders –*"I think a big challenge was getting community hospitals, ERs, and administrative nursing to buy in the fact that tele neurology is effective and works and we are working with their hospital and have really buy in to it."*

Preparing stakeholders both inside (e.g., end users, clinical staff, IT, spoke sites) and outside (community, and potential spoke sites in outside systems) of the organization ***for telestroke*** was identified as a major challenge – "*I think we have not had network problems. We have had end user problems. So I'm saying the training and education has been such a huge burden, not burden, but challenge for our project." and "that's a challenge, ongoing training and education to ensure the protocols are adhered to." And " So when it comes to challenges within specific units, specifically looking at the spoke, those units it is really moving them over to tele medicine into their work flow and also making sure that we have contract thing in place that is going to encourage them to actually fully utilize the service and not just back off in the full extension in the use of the service in order to save some money?"*

Interim Outcomes

Industry Level

NIH stroke scale development

Telestroke protocols

Aligned mentors`

Organization Level

Strong telestroke business plan

Single-system network approach

Board of Directors telestroke support

Potential for site downstream revenue

Sub-Organization Level -

Seven of the nineteen interim outcomes were identified at the sub-organization level. According to our results, efforts were made to standardize the majority of architecture and infrastructure resulting in minimal IT customization which addressed the implementation challenges as explained by one of the program leaders - *"Probably it will be a standard. We have a standard architecture, we have standard protocols, we are developing a standard implementation plan. So hopefully we get to more or less of a cookie cutter approach as we go into a new facility hopefully 80, 90% of what we do is standard. And the other 20% would be unique to that facility."*

The developed ***clinical or process standards and norms*** across the hub and spoke network was discovered to be another interim outcome in the study. An administrative member at hub explained –"*we will have one set of protocols so that no matter where you practice here in the city this is how you'll do TeleStroke."We've had to get our order sets to their medical quality committee at their respective hospitals."*

A management leader at hub site recognized the significance of establishing ***extendible technological infrastructure*** in the network by saying – *"making sure that the equipment we have is not only standard across the board but what is going to be beneficial for them in long run. So that it is something that is down the road if they want to add another service line for tele medicine they can use our equipment to do that as well." In addition to the standardization and provision of extendible infrastructure,*

The administration recognized the seriousness of spoke sites which resulted in ***spoke sites' empowerment***

which emerged as an important interim outcome of the telestroke program – A hub leader provided the following account -- "*We have to stop taking so much, stop looking at the focus of the hub hospital and put the emphasis and the focus and the drive on the community hospitals and empowering them."*

Respondents expressed the need for continuous forward planning and analysis of operations. ***Telemedicine operations growth plan*** was therefore identified as another interim outcome. A top management member explained -- "*You know, in our business plan, we've basically allotted to bring up three facilities a year… So, there's certainly some decision-making that has to go on, outside of IT, to determine.. what provides us a greater allegiance and alignment?"*

An administrative member at the hub stated -- *"I think continuing to, physician manpower definitely, we've got to make sure that our physicians don't get burned out. Since we started out with such a small number we hope to continue adding physicians".* The statement highlights how important it is to the program the ***retention and growth plan for human capital***.

When asked to comment on the activities and action items that made the program successful, a hub member said – "*Oh I think definitely going out to actual location [spoke site] and meeting with them ahead of time to make sure that were comfortable with it that there were familiar with what the requirements were from a technological and clinical stand point. I think that was very beneficial and also just ensuring that they are able to meet the minimum requirements".* Therefore, ***the hub and spoke site management commitment*** was identified as the final interim outcome.

<u>Individual Level</u>

A number of interim outcomes have emerged at the individual level which were found to have an immediate impact on addressing the challenges faced. Firstly, our results indicated that the presence of ***adequate number of telemedicine physician staff*** is important to ***meet the increasing program demand*** and one of the administrative staff confirmed the importance of adding new physicians by stating : "*physician manpower- we've got to make sure that our physicians don't get burned out. Since we started out with such a small number we hope to continue adding physicians."*

Additionally, the ***telepersonable clinicians*** were found to have driven the program toward success. One of the Top management member described the importance of clinicians being telepersonable as -- "*But there's some other skills because your whole impression of that person is based on your TV impression."*

The ***medical staff's use of and satisfaction*** with the telestroke service was found to be another important outcome of the program as the physicians are the ones that drive the program resulting in its success and this can be illustrated by the following statement- "*Another success I think is going to be, has been just the buy in from the doctors in the hospitals because they understand the reason that they need to have this coverage."*

Further, patients as consumers play the primary role in ascertaining the success of a healthcare technology initiative like telemedicine in this competitive healthcare market and our results indicated that ***patients' use of and satisfaction with the telestroke service*** was found to be a critical interim outcome. One administrative informant detailed the importance of this interim outcome -- *"And we've identified metrics like our customer and patient satisfaction, or patient safety"*

Telemedicine being a transformative initiative, change management strategies at multi levels and from different perspectives (IT, clinical and administrative) were found to have a tremendous impact on the long-term success of the telestroke program. The importance of ***multi-level change management strategies*** was described in detail as "*We have a steering committee. Well, we actually just divided into two committees. We have had one large committee, and as our Telestroke work team, and we all have weekly meetings, so that we're all on the same page, and we know what needs to happen next, and we can communicate with those rural facilities if needed during those meetings. And we work through all the different protocols and getting the standard forms ready and making sure we've got the contracts. We also look at the strategy on who would be the most appropriate organization or hospital to bring up next, and what needs to happen in order for that to be done. We have just divided into two committees, and we'll have a project work team, which will be primarily responsible for the technology implementation and the clinical training. And then we're going to have an executive steering team, which will be responsible, which will meet monthly. The project work team will continue to meet weekly. The executive steering team will begin meeting monthly and will really work on the strategy and the financials and the overall objectives and the mission of the program, and then report to the project work team on what they need to have done in order to meet those goals."*

Challenges

<u>Industry Structure</u>

U.S. healthcare delivery is a complex process and the telestroke program was confronted with multiple industry challenges. First, telestroke required the introduction of multiple ***evidence-based guidelines*****,** particularly related to stroke assessment in the form of the National Institute of Health's stroke scale and HealthCorp's desire to enhance evidence based best practice as described below:

"I actually think we've been able to take best practice from NIH, as well as the tele-stroke protocol from [leading health system], modify it slightly. We have incorporated some of our learnings, actually into our transfer center process. So I think we've actually been able to incorporate a lot of evidence-based best practice protocol type stuff into our workflow." [T3-Administrative].

Second, telemedicine by its nature seeks to address issues of access to care, often specialists, such as vascular neurologiststs, who are in short supply. Our results indicated that these ***shortages*** are exacerbated when coverage from specialists, such as vascular neurologists are needed 24/7. Another major industry challenge that Healthcorp had to overcome to provide telestroke was ***potential reimbursement challenges*** as stated by an administrative informant: "I think the reimbursement is going to be key, too. I think with any healthcare entity, and if we can work with our private payers and our Medicaid and bill for what we're actually rendering, that would be pretty exciting, and I think would be, would help with the sustainability

long term." [T3 Administrative]

Strategic Context

Given the pace at which technology is moving and given the involvement of diverse stakeholders in the telestroke program, respondents recognized that ***alignment with the corporate vision*** can be a major challenge– *"And now you have some of the upper leaders on the executive steering committee, including financial people and vice presidents saying, you know, we really do need to reevaluate this financial model."* For the Telestroke program to be successful, it was imperative for the organization members to address challenges emerging in the health organization's strategic context regarding stroke care and telemedicine.

Strategically, health system leaders felt that that the health system had a foothold in telemedicine and could go beyond just matching existing offerings, but strengthening their position through telestroke. This also came at a time when enhancing stroke care, particularly in rural areas, was growing in interest due to the pervasively high health indicators that stroke was a major public health concern. This opportunity to ***lead in a competitive market place*** also introduced challenges. While telemedicine services allowed HealthCorp to expand their geographic reach and reputation, telemedicine also resulted in increasing competition as expressed by the administrative staff – *" I travel around many of these hospitals and the resources are not just there to care for their patients and their community. And obviously telemedicine is certainly the most logical path to get there and honestly if we don't do it somebody else will, because people are moving with that pace. So people from other states are moving in and making offerings to not only our regional partners but to our sister facilities."*

The shortage of specialists and limited reimbursement also raised concerns over program ***sustainability***. At the forefront of one of these challenges was sustainability in a way that was not dependent on grant funding. A member expressed the organization's concerns over sustainability "*We knew that at some point that if we accept grant money or get a grant money, then in order for us to continue to exist, we were going to have to make a viable program out of it, and that's what I think has been key. We had to figure out a way and formulate a business model that would be sustainable."* It was recognized that strategies would have to leverage existing equipment and have the spoke sites take some ownership for the provision and sustenance of the telestroke service line.

Environment

~~Environment in this study refers to the context in which telemedicine takes place not "going green" or sustainable energy.~~ One of the major challenges posed by the environment for the successful implementation of telestroke network was found to be the ***limited mastery of telemedicine***, as described by a top management member "*That may sound strange, but I don't know that there's a lot of awareness, throughout our organization and outside the organization".*

The other major challenge would be to improve the ***poor health outcomes*** related to – "*Well, in [state], we have about 2.5 neurologists for 100,000 people, according to the Academy of Neurology, [our state] has got one of the bleakest demographics for neurology, so that's one factor. The other is stroke is the fourth*

leading cause of death in [our state], and it is the leading cause of adult disability, the morbidity and mortality from stroke is pretty devastating. So we've got several things going against us that makes this solution a very attractive one for the state of [state] ."

Temporal

Fragmented health system
tPA guidelines (3 hrs)
Tethered hub connectivity (call)

Role

~~Professional roles, especially in healthcare, have varying degrees of power and influence. Getting a role, especially influential ones, to support telestroke requires concentrated effort. People in influential roles have to be able to earn the buy-in from different stakeholders to achieve the desired outcomes.~~ ***Earning the buy-in from different stakeholders*** to achieve the desired outcomes was found to be a major challenge. This challenge was explained in detail by one of the administrative leaders –*"I think a big challenge was getting community hospitals, ERs, and administrative nursing to buy in the fact that tele neurology is effective and works and we are working with their hospital and have really buy in to it."*

Preparing stakeholders both inside (e.g., end users, clinical staff, IT, spoke sites) and outside (community, and potential spoke sites in outside systems) of the organization ***for telestroke*** was identified as a major challenge – "*I think we have not had network problems. We have had end user problems. So I'm saying the training and education has been such a huge burden, not burden, but challenge for our project." and "that's a challenge, ongoing training and education to ensure the protocols are adhered to." And " So when it comes to challenges within specific units, specifically looking at the spoke, those units it is really moving them over to tele medicine into their work flow and also making sure that we have contract thing in place that is going to encourage them to actually fully utilize the service and not just back off in the full extension in the use of the service in order to save some money?"*

Interim Outcomes

Industry Level

NIH stroke scale development

Telestroke protocols

Aligned mentors`

Organization Level

Strong telestroke business plan

Single-system network approach

Board of Directors telestroke support

Potential for site downstream revenue

Sub-Organization Level - Spurthy to work on

Seven of the nineteen interim outcomes were identified at the sub-organization level. According to our results, efforts were made to standardize the majority of architecture and infrastructure resulting in ***minimal IT customization*** which addressed the implementation challenges as explained by one of the program leaders - *"Probably it will be a standard. We have a standard architecture, we have standard protocols, we are developing a standard implementation plan. So hopefully we get to more or less of a cookie cutter approach as we go into a new facility hopefully 80, 90% of what we do is standard. And the other 20% would be unique to that facility."*

The developed ***clinical or process standards and norms*** across the hub and spoke network was discovered to be another interim outcome in the study. An administrative member at hub explained –"*we will have one set of protocols so that no matter where you practice here in the city this is how you'll do TeleStroke."We've had to get our order sets to their medical quality committee at their respective hospitals."*

A management leader at hub site recognized the significance of establishing ***extendible technological infrastructure*** in the network by saying – *"making sure that the equipment we have is not only standard across the board but what is going to be beneficial for them in long run. So that it is something that is down the road if they want to add another service line for tele medicine they can use our equipment to do that as well." In addition to the standardization and provision of extendible infrastructure,*

The administration recognized the seriousness of spoke sites which resulted in ***spoke sites' empowerment*** which emerged as an important interim outcome of the telestroke program – A hub leader provided the following account -- "*We have to stop taking so much, stop looking at the focus of the hub hospital and put the emphasis and the focus and the drive on the community hospitals and empowering them."*

Respondents expressed the need for continuous forward planning and analysis of operations. ***Telemedicine operations growth plan*** was therefore identified as another interim outcome. A top management member explained -- "*You know, in our business plan, we've basically allotted to bring up three facilities a year… So, there's certainly some decision-making that has to go on, outside of IT, to determine.. what provides us a greater allegiance and alignment?"*

An administrative member at the hub stated -- *"I think continuing to, physician manpower definitely, we've got to make sure that our physicians don't get burned out. Since we started out with such a small number we hope to continue adding physicians".* The statement highlights how important it is to the program the ***retention and growth plan for human capital***.

When asked to comment on the activities and action items that made the program successful, a hub member said – "*Oh I think definitely going out to actual location [spoke site] and meeting with them ahead of time to make sure that were comfortable with it that there were familiar with what the requirements were from a technological and clinical stand point. I think that was very beneficial and also just ensuring that they are able to meet the minimum requirements".* Therefore, ***the hub and spoke site management commitment*** was identified as the final interim outcome.

Individual Level

A number of interim outcomes have emerged at the individual level which were found to have an immediate impact on addressing the challenges faced. Firstly, our results indicated that the presence of ***adequate number of telemedicine physician staff*** is important to ***meet the increasing program demand*** and one of the administrative staff confirmed the importance of adding new physicians by stating : "*physician manpower- we've got to make sure that our physicians don't get burned out. Since we started out with such a small number we hope to continue adding physicians."*

Additionally, the ***telepersonable clinicians*** were found to have driven the program toward success. One of the Top management member described the importance of clinicians being telepersonable as -- "*But there's some other skills because your whole impression of that person is based on your TV impression."*

The ***medical staff's use of and satisfaction*** with the telestroke service was found to be another important outcome of the program as the physicians are the ones that drive the program resulting in its success and this can be illustrated by the following statement- "*Another success I think is going to be, has been just the buy in from the doctors in the hospitals because they understand the reason that they need to have this coverage."*

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Facilitators

Industry Level

One of the Clinical staff members explained how the healthcare organization members' commitment and passion to set up a telestroke network and ***establish the value of tPA*** facilitated the successful implementation of the service in a [state] where other hospitals were scared of offering telestroke because it was a big and important diagnosis – *"It's just the reason we did stroke was the technology of, the value of TPA is so important and so underused and so scary for the little hospitals, that we just didn't think it was going to happen in [state] without someone holding your hands, and this is the way to do it. [name of organization] had a good experience using telemedicine and [name] has been doing that for a number of years. That after Dr. [name]' visit with Dr. [name], you said, yeah, this works. We can do it and [name] says, yes, yes, I've been saying that for 20 years, let's do it. So we did stroke because it was a big diagnosis, it was an important diagnosis. It scared the little hospitals. [name] had the passion to do it. I had the passion to do it. [name of organization] made the commitment to do it. I think it would be equally easy to do, maybe easier to do acute MI, and it's a lot less complex."*

Lobby payers' reimbursement for the telestroke service was found to be a key factor that not only facilitated the long-term sustainability of the program but also financially benefited the organization. An administrative staff member and a top management member highlighted the importance of reimbursement policy at different instances by stating – *"I think the reimbursement is going to be key, too. I think with any healthcare entity, and if we can work with our private payers and our Medicaid and bill for what we're actually rendering, that would be pretty exciting, and I think would be, would help with the sustainability long term."* And *"for Integris and for IT, there's been a lot of benefit just from some of the grants and things that are out there, around having Telemedicine, and providing reimbursement, through state and federal funds, for our connectivity to our hospitals. So, that's been a benefit, financially, to the organization."*

Organization Level

A top management administrative staff member drew attention to the importance of effectively ***articulating the strategic value*** (financial, marketing and clinical) of the telestroke program for achieving a cohesive group of diverse stakeholders at the organizational level. He stated -- *"Our steering committee is made up of a number of positions, we have got position stakeholders and legal, marketing, IT, specific services I mean, specific IT from eHealth, position that represents different service lines, strategy, so we have, what we tried to do is create a cohesive group of stakeholders that are best fitted in this solution or see a solution… with their engagement that often lends us business support"*

The respondents at the organization also asserted the significance of ***aligning the telestroke project with***

their vision by stating – *"We certainly still would be doing within our own facilities, and the reason we would be doing it within our own facilities is that we believe as a part of just the core of who we are, that we need to deliver the care that's needed in the community."*

A technical member highlighted how ***leveraging existing knowledge*** and technological infrastructure facilitated the telestroke project success by enhancing both the long-term sustainability and quality of the product – *"So I think knowledge and education is important as well, and I think continuing to update the technology is going to be beneficial in sustaining it as well so that we make sure we've got that technological capacity…And, as long as you're building on solid foundations and solid technologies, then you've got a good infrastructure, and you can deliver a quality product."*

Another facilitator that was identified to have significantly facilitated the program success was ***conducting careful cost-benefit analysis and financial planning*** consistently at the organization level – "*But I know there are things that they look at what are the resource needs with the program, what are the resources needed to build the program, what are the expenses of the program, what is the benefit of that. So."*

The respondents indicated that their state has got one of the bleakest demographics for neurology and stroke where the rural hospitals and consumers are medically underserved and have provider shortages. This ***identification of imperative for system change*** helped facilitate the operationalization of telestroke program as described by one of the staff members – "*So it's mainly our rural hospitals and consumers in those areas that are medically under-served or have provider shortages. " At a higher level, yes. I think they want this to happen for [organization name]. Yeah, I think that they are on the same page. Because it's the right thing to do. It's the first disease state that we really are trying to have a standard of care across our system."*

In addition to identifying imperative for system change, ***assessing the market environment*** for its readiness and demand for a telestroke service was found to have facilitated the successful implementation of the program as detailed by one of the administrative member – " *And so the main purpose of having Telestroke is so that these hospitals in rural settings can become primary stroke centers, because they need 24/7 neurology coverage. And we are supplying that with the Telestroke. So it's silly to be a Telestroke hospital and not attest to be primary."*

<u>Sub-Organization Level</u>

The healthcare organization members at the hub site recognize the gravity of ***developing a robust IT network*** at the sub-organizational level for facilitating the connectivity among all of the hospitals in their network. A member emphasized the same by stating "*that part has been able to help us establish a robust network and connectivity points between all of our hospitals."* Our results indicated that ***leveraging on the existing architecture*** further facilitated the development of a robust IT network as explained by one of the technical staff members -- *"We're familiar with the technology. We're familiar with the networking capabilities. We're familiar with the networks that are provided around the state, and the types of bandwidth that we can get…And, as long as you're building on solid foundations and solid technologies, then you've got a good infrastructure, and you can deliver a quality product."* Another factor that was found to have facilitated the development of a robust IT network and IT integration among all the hospitals

in the network is the ***direct spoke infrastructure***. The importance of provision of access to the hub equipment and procedures to the members at spoke site was reported by one of the members at the hub site – "*we setup there where IT integrate, where they are able to get into our system, so they can access it and they can fix it a lot of times or they can see whether it is on our site or there site because we have had problems with their side when we are setting up hey it is not working, so we are working through these challenges, they have their key to the back door and they can look at that equipment and access it."*

Periodic ***monitoring and evaluating system performance*** was acknowledged as a major facilitator for the long term sustainability of the program and ultimately the program success by organization members at different instances –*"we continue to monitor our clinical and technical and discuss business, new business opportunity every two weeks we do that.." and "The first week of every 3 months and we bring to the table from the eHealth department, we have a list of all of our service lines. So, every tele medicine offering that we have for Integris, and we follow trending matrix, statistics, we ask for those services lines managers to send in to us each month, we graph that out and produce the data for the board, the eHealth advisory committee board to look and make sure those programs are sustainable for Integris."*

In addition to monitoring and evaluating system performance, the incorporation and ***usage of evidence-based best practices*** obtainable in the field of telemedicine into the current project was found to have positively impacted the program success by facilitating the operational workflow and to make certain that the program stays updated as asserted by a top management member –*"but yeah we still continue to use evidence-based guidelines for stroke. We update our order sets and everything that has changed to make sure that the entire tele stroke program is up to date on everything."*

The members also stress how the ***provision of process documentation*** in the form of telestroke order sets and DVDs by the hub members was found to have facilitated the spoke sites with a clear understanding about the telestroke processes in addition to ensuring the quality of care. This was expressed by the members as – "*OK, for the order sets we have decided that we would provide the telestroke order sets. So by agreeing to be part of this telestroke program they need to agree to use those order sets and the content in that….. we do not want to change the order sets because they're based on what needs to happen, based on the evidence and the literature, and they're written by the experts. So that is decided by the hub." "We do have an DVD we produce couple of years ago on what tele stroke is itself, what is expected and kind of process itself too"*

Our results suggest that the incorporation of evidence-based guidelines and providing process documentation supported the ***development of clear operational workflow*** for telestroke which was recognized as another facilitator for the successful implementation of the program. This was highlighted by one of the administrative members as – " *we developed a strategic plan that the leadership of IT on how to deal with those issue when they arrive, who do we need to call, how to do we need to address this you know technology concerns, and when you have that close relationship with those small group of teams that can take care of these matters then it makes it a successful program." and "what sequence and in what order, and then having the people doing the work around the table in the design. & Another critical is for us to work through the details of how it is actually going to be delivered & workflow and we build around the workflow for maximum efficiency."*

Some of the respondents affirmed the significance of ***communicating strategic goals*** to all of the involved stakeholders and elucidated that communication facilitates a program success by stating – "*We worked hard to have our organizations in departments within each other coincide and communicate and have the team work necessary to make this a successful program and successful patient care."*

An administrative member noted the criticality of ***developing collaborative hub and spoke relationships*** at the sub-organization level for the success of the program -- *"I think the buy-in from the spoke sites and bringing them all together is something that we need to do to keep it going. A good informational feedback loop…. I think that's critical."*

Individual Level

Our results found that ***developing informal professional alliances*** with others engaged in telemedicine not only facilitated learning but also collaboration, networking and brainstorming. These relationships developed in the stroke consortiums and conferences which were basically informal in nature provided the administration and top management a pathway to further develop the telestroke network. One among the administrative staff highlighted the importance of these relationships – " *We, Dr. [name] emailed me, one of the girls, OK, he wanted me to research what they were doing, because he sat on a stroke council meeting And then I went to the International Stroke Conference. Dr. [name], she invited Dr. [name] to dinner with them in [city] at the conference, and he couldn't go, because he had another event that night. And I went in his place and met their team and just, I was amazed at what they were doing, had a lot of questions for the nurses who were going out and doing the trainings and the PI portion of it, and just collaborated, just networking and brainstorming."*

The growth and expansion of telemedicine initiative greatly depended on physician led activities and the importance of the ***recruitment of administrative and clinical champions*** , found to be an important facilitator, was considerably emphasized – "*I think having physician champions is going to continue to be key."*

Telemedicine being relatively new, ***engaging individuals in training*** and education was found to have facilitated the success of the program – "*And the education piece is huge. That has, not only in hospitals, training the nurses, training the doctors, training our call center, even, with the technology and the Code Stroke process, the clinical process, national benchmarks, meeting those standards, the evidence based practices."* In addition to adequate training and experience, the presence of staff ***persistent in their efforts*** and who are willing to invest extra time and effort was found to be crucial for the success of the program – *"In the beginning one always has to invest a lot more time and more and more capital than what I wanted to invest, but I would say that's basically it."*

Our results indicated that direct end ***user involvement*** from the clinical staff at all the facilities facilitated the success of the telestroke initiative as described by an administrative informant –" *user involvement is one of the high ones, you have to have direct user involvement from your clinical staff at your facilities".* ***Continuous communication with the stakeholders*** was found to be another important facilitator for the successful implementation of the program and was described in detail by one of the staff members at the

hub – "*Continued communication, not just we implemented the site, it's up and running, see you later and they don't hear from us again. So letting them know we're an ally, we're there for them in whatever they need."* Another important facilitator of the success for the program was found to be the ***clarification of different roles*** and responsibilities taken up by the staff members both at the hub and spoke sites –*"It's critical that they know their responsibilities, again, at the hub site, and then those at the spoke site being an extension of the hub*

Conclusion

Telemedicine diffusion has gathered momentum during the pandemic and the trend seems to extend well into the future of healthcare delivery.

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Appendices

Evidence Trace Table - Challenges

Challenges	Quote	Representative
Industry structure		
Instituting evidence-based guidelines	*" I actually think we've been able to take best practice from NIH, as well as the tele-stroke protocol from Mass General, modify it slightly. We have incorporated some of our learnings, actually into our transfer center process. So, I think we've actually been able to incorporate a lot of evidence-based best practice protocol type stuff into our workflow."* -------- *"pushing for evidence-based care, or has that been part of the process?* *SUBJECT: I think that has always part of the process when you are looking at adding new service lines for patients to make sure that with in addition to your service that you have it is going to benefit the patients that you don't have the evidence to back up, why this program should be implemented, why it is needed by the patient then you can't make a sustainable for yourself and for the patient care. You can't put something out without knowing itself that this is something that you would use if you were at the same position as that patient. You would feel like it is benefitting you."*	Top Management - Administrative (Hub)-T3-Patricia Dysinger ---------- RL
Specialist shortage	*"one of the weaknesses at our flagship hospital is not having a full-time neurologist and neuro intensivist in our ICU"* *"this is another kind of telehealth initiative we are doing with Mass general is having access 24/7 to neuro intensivist and we have tried hard to recruit neuro intensivist unsuccessfully for variety of reasons"*	Dr. M PF
Limited reimbursement	*"SUBJECT: Internal barriers or you want external barriers about.* *SUBJECT: Reimbursement is one thing because it is consistent across all spectrums and I mean what is paid for and what is*	*RL*

Challenges	Quote	Representative
	not and year after can someone you add Medicare won't reimburse and then sometimes medication, so I mean reimbursement certainly is a factor that may or may not necessarily be that way with stroke but it is just only adoption and for other health care solution." *"I think the reimbursement is going to be key, too. I think with any healthcare entity, and if we can work with our private payers and our Medicaid and bill for what we're actually rendering, that would be pretty exciting, and I think would be, would help with the sustainability long term."*	Administrative (Hub)-T3- Pam Forducey
Strategic Context		
Program sustainability	*"are there any industry level challenges that you have had to overcome, so the things going on in the general medicine climate or just the general health care industry.* *SUBJECT: I think in general the technology is changing, so when technology changes you always have the factors of is our technology systems going to work the same as their newer equipment providers in the market like that's always something that are thinking about and you are worrying about whenever it comes down to our equipment is doing its job, is our program sustainable with what we have out there, can we expand from that equipment, can we do other things and make it beneficial for the spoke sites or hospitals to continue the program with the services that we provide."*	*WH*
Aligning with corporate vision	*"And now you have some of the upper leaders on the executive steering committee, including financial people and vice presidents saying, you know, we really do need to reevaluate this financial model. Is this, because we know the competition's great in Oklahoma, and we really do want to get as many strong relationships with rural communities as we can, and this is a great marketing, and it's a great thing for their community. So, we met with legal yesterday, Cathy Calbone, who's the, well, she's actually the president of Heart Hospital, but she's soon to be a vice president of a different division but will stay involved in telemedicine. And we met with legal saying, hey, can we legally do this and not, is it a neuroment? Is it violating the start that we can actually provide this without charging? So legal is looking at that now? Because meaningful used money and funds from the ARRA is pushing IT so heavily that the legal ramifications of what you can do with physicians and what you can't, or with hospitals, is totally being reevaluated. And so that's, we're meeting with legal to say, hey, can we just say, hey, we're going to offer this, because it's the right thing to do? We have the resources. And*	Administrative-T3-Pam Forducey -------

Challenges	Quote	Representative
	we want to help you, small rural hospital in Oklahoma, have success." ------ *"I mean, yes they are going to, they have their benchmarks and we figured it out like that those changed across 4 months ago, off course our hospitals had to adopt that also so those things yes we adopt them and then it is something that we want to try for that is different then we internally can do that."*	AW
Leading in a competitive telemecicine marketplace	*"I travel around many of these hospitals and the resources are not just there to care for their patients and their community. And obviously tele medicine is certainly the most logical path to get there and honestly if we don't do it somebody else will, because people are moving with that pace. So, people from outer state are moving in and making offerings to not only our regional partners but to our sister facilities."* --------- *"one of our venture partners was purchased by a for profit company that owned a competitive hospital, so we lost 5 telestrokes sites about 2 years ago."*	*RL* ---------- PF
Environment		
Limited mastery of telemedicine	*That may sound strange, but I don't know that there's a lot of awareness, throughout our organization and outside the organization"* *"and the guy at the top is an IT guy he is not clinician and he doesn't have a breadth of knowledge that you need, so IT slows us down a lot."*	Top Management - Administrative (Hub)- T1- John Delano Dr.Morgan

Evidence Trace Table - Facilitators

Evidence Trace Table – Interim Outcomes