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Clinicians' Emotions and TeleStroke Use

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ABSTRACT

Telemedicine has been available and in use for over fifty years yet by most accounts it has fallen short of its promised impact on healthcare. While legal and reimbursement issues continue to plague the spread of telemedicine use, the technology has continued to improve. We feel there are additional dimensions that play a key role in the use of telemedicine; in particular, we believe that doctors' and nurses' emotional state during use of a telemedicine system has a significant impact on how telemedicine is used. What are the main drivers that give rise to these emotions? How do they impact the use of telemedicine? What changes in the business process can mitigate the negative impact of these emotions? We investigate these research questions by conducting an embedded case study utilizing interview data and archival documents to gain insight into the emotional components at play during TeleStroke consultations.

Keywords

Telemedicine, IT in Health Care, emotions, business process improvements

INTRODUCTION

How do clinicians feel when using telemedicine to provide medical care under time pressure? Do emotions have any positive or negative impact on the use of a telemedicine system? In this paper we examine how clinicians feel when using telemedicine for clinical tasks that include life-or-death decisions, such as whether to administer thrombolytics (tissue plasminogen activator, or tPA) to stroke patients. There are several challenging aspects to this clinical decision:

- 1) A decision must be made within three hours from onset of symptoms.
- 2) It must be well informed. If the patient does not meet all inclusion criteria or if the patient meets some exclusion criteria (e.g., taking blood thinners), tPA could cause fatal internal bleeding. The doctor making this decision must know what medications the patient is on, whether brain images reveal internal hemorrhaging, and whether the patient's symptoms suggest an acute ischemic stroke.
- 3) Patients and families also need to be informed about the risks of treatment compared with the risks if thrombolytics are not administered (paralysis or other life-threatening conditions).

Does stress impede the use of telemedicine in these situations? Or, do physicians see a telemedicine consultation as a way to reduce risk and emotional distress? How do nurses feel as they carry out their roles before and during the telemedicine consultation? Do features of the telemedicine system add to or reduce doctors' and nurses' feelings of fear or anxiety? We explored these questions in an embedded-case study of a TeleStroke consultation service provided by neurologists at two tertiary-care "hub" hospitals to clinicians at "spoke" hospitals that lack 24x7 neurology coverage.

BACKGROUND: EMOTIONAL ASPECTS OF TELEMEDICINE USE

There are a wide range of telemedicine applications and uses; this study focuses on telemedicine-supported clinical collaboration. Specifically we look at patient-present TeleStroke consultation services that utilize two-way interactive video (from a distance, a specialist can directly observe the patient and talk with doctors and nurses at the spoke), rapid transmission of brain images, and (sometimes) transmission of the patient's medical record (Levine and Gorman, 1999; Demaerschalk, et al., 2009). The particular TeleStroke service in this study uses a hub and spoke design; specialists at two

hub hospitals offer expert consultation for about 27 spoke hospitals. At some spokes the patient is moved to a room with a fixed telemedicine setup; at others portable telemedicine equipment is moved to the patient's bedside for the exam.

Many studies have examined the efficacy of TeleStroke, and the majority have concluded that such a system can help community hospitals – especially in rural areas -- cope with the limited availability of acute stroke specialists who are best able to diagnose and treat stroke patients (Wiberg and Widder, 2003). The consensus among stroke experts is that TeleStroke is an effective mechanism that enables a specialist to quickly review the patient's condition and decide whether tPA should be administered (Schwamm, et al., 2009a and b). Experts have further concluded that once intravenous tPA is given at a spoke hospital, the best course of action (standard of care) is to transfer the patient to a tertiary-care center for close observation, a policy known as “drip and ship” (Pervez, et al., 2010).

Numerous studies have examined technical, regulatory, financial and other factors that impede telemedicine (including TeleStroke) use, but to our knowledge no prior study has examined emotional aspects of TeleStroke. Yet, it seems likely that emotions do play a role, including high levels of anxiety due both to time pressure (the three hour window) and the life-or-death significance of the treatment decision. Prior research in other fields yields clues as to the likely influence of emotions, such as fear and anxiety, on TeleStroke usage. Anxiety and fear are related emotions that are triggered by various stressors. Anxiety can impede the individual's ability to learn new material or to apply previously-learned knowledge (Warr and Downing, 2000). Under stress -- including time pressure -- one's ability to process information is reduced (Baddeley, 1972; Pearson and Clair, 1989), which can cause performance to suffer (Entin and Serfaty, 1990; Wickens, et al., 1991; Van Galen and van Huygevoort, 2000; Staal, 2004). However, highly trained individuals who rehearse their acquired skills can overcome the effects of time pressure and other stressors (Klein, 1993; Kaempf, et al., 1996; Flin, et al., 1997; Lipshitz, 2001; Sniezek, et al, 2002).

Prior studies report that when generalists and specialists use telemedicine to collaborate during pediatric critical-care episodes, anxious spoke generalists are relieved to get help from experts located at hub hospitals (Gogan, et al., 2009). Hub specialists also reported that during telemedicine consultations they felt less anxious than the spoke clinicians, and that they were able to maintain an emotional distance and provide “eye in the sky” perspective, which helped them to take in more clinical information and offer suggestions and reassurance.

It is not known whether the emotional issues identified in the domain of critical-care pediatrics can be generalized to other domains. The purpose of the current paper is to help answer that question by reporting on emotional issues in another domain of telemedicine use for urgent-care consultations: TeleStroke.

METHODOLOGY

Interviews were conducted with 20 clinicians, IT professionals, and administrators at two TeleStroke hubs, their parent organization, and two spokes. Following initial background interviews at HubsParent (parent company of the two hubs) snowball sampling was utilized to identify informants for subsequent rounds of interviews, which explored informants' views regarding the rationale for and against participating in TeleStroke consultations and the experience of participating in these consultations. All interviews were recorded and professionally transcribed. Consistent with grounded theory methodology, our analysis included grouping of findings in themes and sub-themes based on prior theory, thematic comparison with other studies in our broader telemedicine stream of research, open coding (identification of new themes suggested by the data but not anticipated a priori) and interpretation (analysis of the meaning of findings, such as the relationships among clinicians' skills, system usability, time pressure, and feelings of fear or anxiety during TeleStroke episodes).

Institution	Physicians	Nurses	IT Professionals	Administrators
HubsParent	(MDMgr1)*			MDMgr1, Mgr, Admin
UrbanHub1	MDMgr2		ITPro	(MDMgr2)*
UrbanHub2	MDExpert			
RemoteSpoke1	MDspoke1	Spoke1Nurse1, Spoke1Nurse2	ITMgr	
RemoteSpoke2	MDspoke2a, MDspoke2b	Spoke2Nurses 1-8		

*These two informants are specialist physicians who participate in telemedicine consultation services and also hold managerial positions (MDMgr2 oversees the TeleStroke initiative, and MDMgr1 oversees other HubsParent telemedicine services).

Table 1 20 Interviews at Five Institutions

Documents -- such as stroke packets and presentations made to professional associations or other hospitals -- were included in the analysis in order to triangulate on a timeline of key events.

FINDINGS

The TeleStroke Service: Embedded Cases

This TeleStroke consultation service has been in place for more than five years; at the time of the study more than 400 video consultations and 2000 telephone consultations had taken place (a hub specialist reviews a patient's CAT scan or MRI; if these brain images indicate that the patient is a good candidate for tPA, the specialist phones the spoke physician to discuss these findings). Whenever thrombolytics are administered, the patient is immediately transferred to UrbanHub1 or UrbanHub2 ("drip and ship").

HubsPartner's headquarters are in the same US city as the two hubs, each of which is a prominent tertiary-care center with a large neurology department and fellowship program for training acute stroke neurologists (a neurology sub-specialty). A HubsPartner administrative office oversees many telemedicine activities across its partner organizations. During pilot testing this office provided technical resources to TeleStroke, but more recently the service has been managed by its founder, MDMgr2. With 27 participating spoke hospitals the director claimed the service to be financially self-sufficient, thanks to a subscription pricing model (Garfield, et. al., 2009) and a favorable regulatory environment (this state requires that all stroke patients be transported to "primary stroke service" (PSS) hospitals; participation in TeleStroke helps hospitals obtain PSS certification when they lack 24/7 neurology coverage on their own).

Several years ago neurologists at UrbanHub2 decided to provide TeleStroke services in partnership with UrbanHub1. The division of responsibilities aligns with existing referral patterns for the two hospitals. However, if a neurologist is not immediately available at one hub the consultation request will be routed to the other hub. Custom software captures data associated with each consultation (because of state data regulations and to support research on TeleStroke efficacy); UrbanHub1 maintains this software and associated databases.

The two spokes that took part in this study are located within 45 minutes of each other and more than 90 minutes from the two hubs. Nurses play a key role at these spoke hospitals during TeleStroke consultations, by helping to prepare the patient and conducting various tests. For instance, nurses will conduct a swallow test to determine whether the patient can accept oral medications, and the multi-step NIH Stroke Scale to help physicians determine whether their symptoms are consistent with acute ischemic stroke.

The TeleStroke director considers Spoke1 a "success story," with frequent consultations (one or two per month) and well-oiled processes. Nurses helped get Spoke1 ready to participate in the TeleStroke program: a nurse visited another spoke to learn about necessary workflow changes, then adapted their stroke packet to fit Spoke1 conditions. As stroke coordinator she provides training and encouragement to ensure that other nurses can ably assist during consultations. Spoke2 had just joined the TeleStroke service at the time of our study and had experienced only a few telemedicine consultations (with video use).

Anxiety, Stress, and Critical Decisions

The primary emotions we identified were anxiety and fear, which stemmed from two critical stressors in TeleStroke consultations: characteristics of the task that the participants had to engage in (treating the stroke victim) and characteristics of the work processes they utilized during emergency stroke care. As mentioned earlier, for a stroke victim to be treated with tPA they must receive the drug within 3 hours of the onset of the stroke systems. If tPA is administered to a patient when it should not be it, can result in death. Furthermore, only approximately 3-6% of all stroke patients will benefit from tPA. While tPA has been long used for heart attack victims, its use in acute stroke treatment is relatively new. When treating a potential stroke victim emergency medical personnel must effectively work together, follow structured procedures, and in the case of TeleStroke, interact effectively with the TeleStroke technology. Our interviews revealed that all of these characteristics of treating a stroke patient can impact the clinician's emotional state, which in turn affects their ability to most effectively treat the stroke patient.

Anxiety and stress resulting from task characteristics

In the TeleStroke environment, although a specialist offers a consultation, the spoke physician -- usually an emergency room doctor -- must decide whether to administer thrombolytics. This decision can be a source of stress for doctors on both sides of the consultation, in the view of the TeleStroke director:

“As a stroke neurologist ... you are asking someone to perform a set of steps in an environment where they have no time ... Generally within 30 minutes of being contacted they have to make their decision. So that is pretty intense.”

A nurse reflected on the time pressure:

“What makes people nervous ... is that it’s a time frame. Sometimes I am saying ‘We have fifteen minutes to give tPA,’ ‘We have twelve minutes to give tPA.’ When you have the countdown you’re getting anxious.”

Another nurse pointed to how time pressure contributes to anxiety:

“The clock is ticking ... now we’re running out of time. We gotta start this tPA, a very high anxiety thing to do. It’s weight-based. We don’t have a way to weigh the patient; we have to go by what they can tell us is their weight. ... The nurses have to do some calculating ... Nobody is familiar with it; it’s not like giving a dose of a drug you give every day (like) morphine or torridol... With tPA you have no idea what the dose is supposed to be... Nurses want to double and triple check everything; so do physicians, and they all depend on each other to get the dose right. ... You also have to mix this drug. It costs a lot of money, and they’re afraid they’ll drop the vial. People have actually dropped vials because of course you’re shaking! ... There’s a lot of anxiety about using tPA...”

Not only must clinicians work quickly to treat a stroke victim, if they err in the chosen course of treatment the results can be significant. A Spoke1 doctor echoed this view regarding administering tPA: *“There’s a huge downside; it’s death.”*

Furthermore the number of stroke victims that arrive in the ER within the three hour window necessary for tPA treatment is very low, therefore the medical personnel do not often have experience with the situation.

The TeleStroke director commented that

“The fewer the (acute stroke) patients you treat, the more likely you are to inappropriately treat (them). You don’t have the competency.”

While hub specialists definitely believe that scientific evidence supports the use of thrombolytics. A neurologist did explain that since only about 3.5% of stroke patients are good candidates for tPA, ER doctors tend to question its use:

“The ER doctors deal with ... medical diseases where medications which are the standard of care are probably given the vast majority of the time, maybe 90% of the time. I can see their hesitation to call a medication ‘standard of care’ when we are giving it to 3% to 6% of patients for that disease.”

Not only do the ER doctors not use tPA often, the use of tPA for stroke care is relatively new.

“... For ED doctors, this is brand new ... it provides a lot of support to a doctor to know that a (specialized) neurologist is saying ‘with my expertise, I believe that tPA is good.’ That helped a great deal.”

A Spoke1 nurse concurred:

“[before TeleStroke] never would an ER physician ever order this medication, ever.” Another said, *“Yeah, a lot of people still don’t like tPA, so that’s always going to be a big problem.”*

For years tPA was a standard treatment for heart attack, but its use for treating stroke is a recent development. A Spoke1 nurse said it took a while for doctors to get comfortable with tPA:

“Our biggest problem was the emergency department physician ... saying ‘this is not in my comfort zone.’”

The implications of a stroke victim presenting at an ED are very anxiety producing. The medical team must assess the patient’s conditions, determine the onset of symptoms and the applicability of tPA for treatment, and assess the degree of risk they are committing to if their assessment is flawed. If these decisions were ones the team frequently made or if the use of tPA was a longstanding standard of care, the stress and anxiety experienced by the medical team might be less; however this is not the current situation.

Stress and anxiety resulting from work process characteristics

When clinicians are tending to a stroke victim they must ensure that they utilize work processes that will make certain that they do not miss any critical details associated with the patient’s medical condition. Furthermore, the work process entails a wide range of activities requiring a team of people to work effectively and efficiently together. When a TeleStroke consultation is underway these same conditions apply, but the additional factor of the technology is also introduced.

The stroke packet helps clinicians focus on key tasks that need to be quickly accomplished, according to a nurse stroke coordinator:

“When somebody comes in with a stroke you just take that packet and every single piece of paper you need is in there.”

A nurse manager added, *“Everything is step by step.”*

This structured work processes appears to reduce the nurse’s anxiety, but how does the telemedicine system itself figure into clinicians’ experiences of fear or anxiety? The spoke doctors we interviewed did not bring up technical concerns. One stated:

“It was pretty straightforward; ... I had a sense of what was going to happen, so it wasn’t a big surprise.”

Nurses, however, had more to say, largely because they are responsible for establishing the TeleStroke connection with the specialist. For example:

“You turn it on live when a patient’s coming in and you’re like, all right: Do I have all the cords in right? Am I calling the right number? Yeah, your adrenaline goes up a little bit.”

“Very, very, very scared, because you are bringing it into a room of a patient who is critically ill. ... The patient is scared, the family is scared; they definitely have a sense of urgency about what is going on... Everything’s moving very fast, and then we’ve brought this piece of equipment in that has lots of cables. The instructions are there on the machine, but when you’re looking at something you’ve only looked at in training ... everything you knew about it goes out of your head.”

At both spokes, some nurses were trained as TeleStroke “super-users,” and usually one could be called upon to help establish the video connection with the hub hospital. The Spoke1 nursing stroke coordinator commented:

“I say ‘Stay calm, you’re fine, you all can turn on the equipment. It’s just a matter of connecting with [a hub]’... ... I’ve just seen it more times and I can tell you it’s not Input 1; just change it to Input 2 and you’ll be fine... just the itty bitty trouble shooting ... It’s all written down there; they just have to take a step back and relax.”

Some nurses pointed out that since patients who can benefit from thrombolytics are a fraction of the total number of stroke patients,

“We really don’t use it that often. You might have a nurse who’s worked here seven years who’s never even touched the machine except for when you run orientation.”

One nurse felt that individuals should take responsibility for their skills and comfort level. At one point she compared TeleStroke equipment to defibrillators:

“If you’re not comfortable with the defibrillator, you need to play with it when you’re not in a rush, because when you have a doctor screaming and a patient dying, it’s really not the time to try to figure out how to turn on the pacer pad. Not everyone is that proactive. They learn it once and think ‘I’ll be fine’ and then they get in there, the adrenaline is running the patient is sick, you’re worried, you’re anxious, ... the doctor’s barking orders, and you’re trying to figure out how to turn it on. ... I don’t like to get caught behind that eight ball, so I try to be more proactive.... It always seems easy until you get in there and it’s not.”

Some emergency department nurses reflected on their ability to respond to unexpected challenges as well as their desire for control. Expecting that the system should work correctly, one commented on technical glitches:

“When technology doesn’t work, it’s irritating because you’ve practiced it, you’ve tried it and then you go in there and it’s not working! ... We’re the queens of backup plans ... You have to be a little innovative.. if the technology is not working, what are you going to do?”

The CIO for the two spoke hospitals expressed concern that clinicians’ expectations for reliability might be too high:

People in the ER do tend to get a little anxious if the technology doesn’t work ... But the technology does not prevent patient care; we have to be real clear about that up front. ... The video portion only allows the practitioner [at the hub] to basically eyeball the patient... The backup procedure for missing video is to do all the same things that you ordinarily do: Send the CAT scan, order the tests, page [the hub]. If the video isn’t working, the practitioner here is going to get on the phone with the people [at the hub].

Interaction between the hub specialist and spoke personnel can provide a sense of calm (due to the added “eyes in the sky” provided by the specialist) or provoke anxiety among spoke clinicians, who may be concerned about how they appear to the hub specialist:

“It’s a nurse having to perform an exam for a physician that she doesn’t know over a television camera.... It’s just the intimidation, you know?”

A nurse commented that there was additional performance pressure on her when family members are present:

“You’re trying to do this, you don’t normally do it. You’ve got a patient and a family member and you don’t want to look like you don’t know what you’re doing. ... But you’re in the time thing, you’ve got to get this done.”

While the task that TeleStroke is being used for (stroke care in the ED) has significant impacts on the emotional state of the TeleStroke users so too do elements of the work process they invoke during their use of the TeleStroke system. The primary characteristics of the work processes that appear to have the most impact on the emotional state of the TeleStroke users are the range of actions the medical personnel must invoke to diagnose the stroke patients, the stress they experience by needing to “perform” in front of additional individuals (hub specialists and family members of the patient) and the need to effectively use the technology that support the TeleStroke process.

DISCUSSION AND CONCLUSIONS

It is evident that the primary emotion invoked during the use of the TeleStroke system is anxiety, and that this emotion stemmed from two sources of stress: the task the medical personnel were engaged in and the work processes they had to use to care for the stroke victims. Some spoke doctors were anxious when using the TeleStroke system, because of the high-stakes decision they must make, under tight time pressure. The more unexpected finding about the stressful task characteristics that evoked anxiety was the fact that tPA use for stroke care was relatively new and many spoke doctors were not comfortable using it for stroke victims. Furthermore, the infrequent need to use the TeleStroke system reduced clinicians’ comfort with treating stroke patients that were presenting as possible candidates for tPA.

An additional source of anxiety stemmed from the work processes nurses and doctors had to follow to treat stroke patients. We found that by adding structure to the process (i.e. providing stroke packets, TeleStroke procedure steps and taping lists of trouble-shooting steps to the TeleStroke equipment) the medical personnel experienced lower levels of stress when diagnosing potential stroke victims. A less expected finding was the impact of the presence of hub specialists and family members on the stress levels experience by nurses in particular. Nurses indicated that they were anxious because of a desire to not make a poor impression on the hub specialist or to look incapable in front of a patient’s family.

The use and presence of the TeleStroke system seemed to have the greatest impact on nurses. In the highly stressful context of acute stroke care, frustrations brought on by technology usability issues and occasional glitches seemed to have more significant impacts on users’ emotions than in lower stress environments. Consistent with prior studies that report that stress can impede one’s ability to recall previously learned tasks or to process relevant information, our study reveals that clinicians believe this to be the case during many TeleStroke consultations. From a practical standpoint, our findings point to steps that could be taken at spoke hospitals to alleviate some of the technical issues that add to nurses’ stress. For example:

Stressor	Potential Resolution
Patient’s weight is not known, which affects medication mixing.	Use of beds or gurneys with built-in scales
Many steps required to set up portable TeleStroke equipment when needed.	Fixed TeleStroke equipment (non-mobile)
Many steps to connect to a hub specialist	Use of a single-number/ automated call routing system makes it easier to reach the specialist and the machine s/he will use to participate in the TeleStroke consultation.
Number of tasks nurses are responsible for system use (prior to a clinical need)	Assign responsibility for establishing and testing the video connection to a non-clinical employee (such as a unit secretary)
Uncertainty regarding tPA’s clinical efficacy for acute stroke care	TeleStroke sponsors get the message out by publishing research, giving presentations, distributing brochures.

Table 2 Ways to mitigate some stress related to stroke care

We note that critical-care pediatrics (subject of prior research on emotions and telemedicine) and acute stroke are both domains in which telemedicine supports collaboration under time pressure, between specialists with extensive expertise and generalists who lack experience caring for these types of patients. However, there are also important differences between the two domains. Stroke consultations are highly structured: the workflow is well specified (thus checklists and packets are used) and the team of clinicians are aiming in the same direction as they seek to answer one key question: Is this patient a candidate for thrombolytics? Pediatric consultations are less structured, because a great variety of critical-care situations (choking, trauma, seizures, other conditions) can give rise to a telemedicine consultation.

A limitation of this study is that it was conducted in a single domain (acute stroke care) and in only two hubs and two spokes. Further research on the emotional side of telemedicine use in this and other clinical domains and under varying conditions (such as chronic care versus urgent care) is needed, in order to explore how best to overcome these challenges and fulfill telemedicine's promise.

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