Telemedicine Adoption and Sustainability in Extreme Resource Poor Countries

Full papers

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Abstract

The value and importance of telemedicine and adoption in developed countries is growing, especially due to an increase in m-health applications. In resource poor communities and developing countries often telemedicine is adopted because it is the only available option. The scarcity of medical professionals and equipment, distances between care centers, and the high cost for obtaining medical care makes telmedicine an increasingly attractive solution. This paper reports on the need for a new model for telemedicine adoption in extreme resource poor countries. The authors made several service and research trips to Haiti between 2014 and 2015. We observed that the adoption theories used in developed countries like the US do not adequately describe the adoption process in Haiti. Based on our findings and experience in Haiti we propose a new adoption model for extreme resource poor countries.

Keywords

Adoption, Telemedicine, Resource-Poor, countries

Introduction

The focus on telemedicine as a means of providing medical care to patients in remote locations has gained significant attention (Askari et al. 2014). The value and importance of telemedicine has been stressed by several authors (Glinkowski and Ciszek 2007; Kifle et al. 2010). In this research, the term telemedicine is used broadly to include any application of medical care through the use of technology over a distance.

Telemedicine adoption in developed countries is growing especially due to an increase in m-health applications. The adoption of telemedicine has increased both in developed and developing countries based on the number of manuscript submissions to journals from both developed and developing countries on telemedicine (Glinkowski and Ciszek 2007). In resource poor communities and developing countries telemedicine is often adopted because it is the only available option. The scarcity of medical professionals and equipment, distances between care centers, and the high cost for obtaining medical care make telemedicine an increasingly attractive solution.

Service centered research and medical trips implemented by Universities and none-for-profit agencies often use telemedicine to support the lack of medical expertise in developing countries. Telemedicine mediated consultation and education programs can promote delivery of high quality patient care. Telemedicine can connect medical personnel and scarce diagnostic and monitoring equipment from well-equipped medical centers in developed countries to distant patients in developing countries.

This paper reports on the challenges faced in the adoption of telemedicine for improving diabetic foot care in Haiti. The authors made several service and research trips to Haiti between 2014 and 2015. They were actively involved in the telemedicine implementation at the case hospital. One key outcome of this study was that the theories that have been used to analyze technology adoption in the US are not directly

applicable in the case of Haiti. In Extreme Resource-Poor (ERP) countries like Haiti the adoption theories used in developed countries like the US do not adequately describe the adoption process and are in need of revision. This is in line with the findings of Kifle et al. (2010) in Ethiopia. Based on our findings and experience in Haiti we propose a new adoption model for extreme resource poor countries.

Telemedicine

Terms such as e-health and mhealth are increasingly being used to describe systems with telemedicine functionality (Sood et al. 2007). Yet there remains no consensus as to the distinction between meanings (Oh et al. 2005). Wootton (1998) describes telemedicine as a broad term that can encompass others such as telehealth, telecare and others that use the "tele" prefix. Most definitions of telemedicine shared four main contexts that included medical, technological, spatial and benefits (Sood et al. 2007).

Research on telemedicine has stressed the following advantages – improving access to information, enhance education and training, assist in providing care where previously unavailable, improved access to services and the delivery of care, greater control over the quality of screening programs, and reduced costs for care (Hailey et al. 2004; Hailey et al. 2002; Saliba et al. 2012; Weinstein et al. 2014) .

Hailey et al. (2002) examined the literature between 1966 and 2000 to compare telemedicine to non-telemedicine alternatives. 56% of the studies examined reported advantages for telemedicine over non-telemedicine alternatives. Avoidance of travel and delays were cited as some of the biggest advantages of telemedicine over non-telemedicine alternatives. Hailey et al. (2004) observed that telemedicine had a higher efficacy and effectiveness in areas such as geriatric and home care. Saliba et al. (2012) reviewed studies on cross-border telemedicine implementations and reported that telemedicine improved access to services in low and middle income countries that lacked medical specialists and professionals.

Telemedicine and Adoption

Although telemedicine may have some advantages over traditional approaches there are still barriers that can prevent its widespread adoption (Christensen and Remler 2009; Nazi 2010). Adoption can vary based on context and the implementing organization. For example a study by Devore et al. (2007) shows that the adoption of interactive video for medical services is relatively slow. They suggest that reimbursement issues, age, and habit limit provider usage. Similarly difficulties in adoption were shown in the adoption of telemedicine by providers in Uganda (Isabalija et al. 2011). The authors show that a lack of policy, limited knowledge and skill, along with resistance to change can minimize the adoption and sustainability of telemedicine initiatives. Martin et al. (2012) found that knowledge and readiness were also reasons for the differences in adoption between rural hospital and primary care providers.

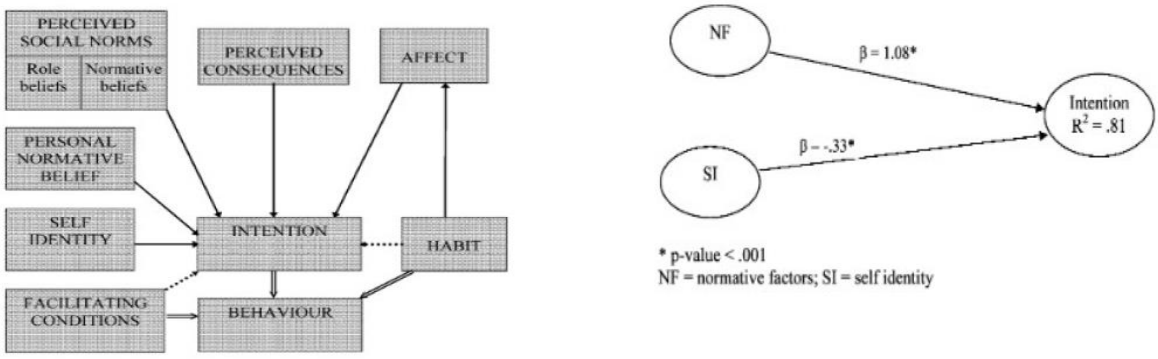

Figure 1: Theory of Interpersonal Behavior (TIB) and resulting model (Gagnon et al. 2003)

Even in cases where telemedicine adoption is high different factors can reduce the extent to which the intention to adopt diffuses. Kahn et al. (2014) surveyed hospitals using telemedicine in intensive care units between 2003 and 2010. While they found an increase in telemedicine adoption in the studies first four years, they note that the growth began to taper off in the last several years. The views of adopters vary and their intentions to continue using telemedicine can differ based on their experiences. A study conducted of 365 physicians in the US state of Kansas shows the differing views of adopters and non-

adopters (Spaulding et al. 2005). Only 53% of adopters expected to continue using telemedicine at the same frequency or more. 45% of non-adopters did not expect to use it at all.

Some researchers have attempted to describe the adoption of telemedicine using behavioral models but the results vary based on the research. Using the Technology Acceptance Model (TAM), Hu et al. (1999) studied adoption of telemedicine by physicians. Their findings showed mixed results. While the usefulness construct was able to explain some of the variation in intention to adopt, the ease of use construct did not appear to be a determining factor. The results by Chau and Hu (2002a) also suggest that providers may consider usefulness above ease of use. Chau and Hu (2002b) use TAM, the Theory of Planned Behavior (TPB) and modified TPB to examine telemedicine acceptance. The modified TPB performed the best and explained 42% of the variance in behavioral intention. But the results did not show perceived ease of use to be a significant factor in any of the models. A study of TAM for the adoption of teledermatology however, showed that both usefulness and perceived ease of use were significant for explaining the variation in behavioral intention (Orruño et al. 2011). Yet the authors found that other variables such as training, infrastructure and support were considered more important factors for explaining the intention to adopt.

Yet adoption models may also be impacted by different adopter groups (Whitten and Love 2005). Menachemi et al. (2004) show how variations in factors from the Diffusion of Innovations theory may influence decisions between different adopter groups such as patient, providers and administrators. Croteau and Vieru (2002) showed differences between the importance of different variables for the intentions of providers from rural areas and providers in a large urban healthcare institution. Groups differed on views of the importance of perceived ease of use, voluntariness of use, and intention to adopt. Unlike other groups technology controls and peer influences are regarded as not playing a role in influencing opinions about telemedicine adoption by providers (Chau and Hu 2002a).

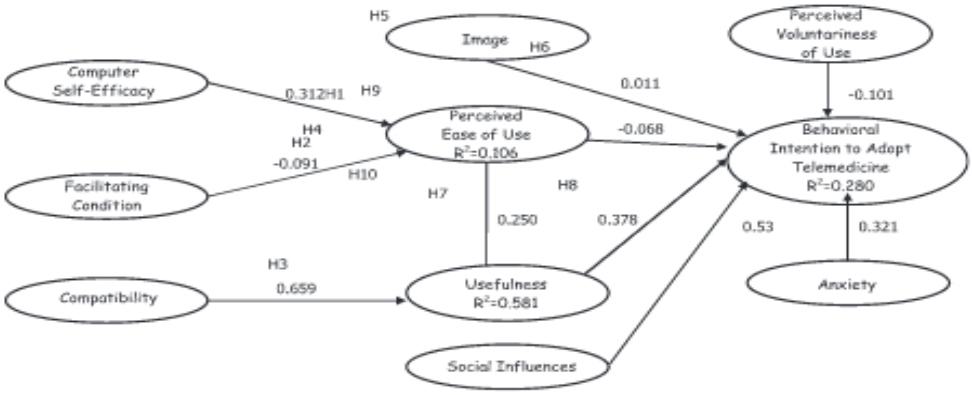

Figure 2: Adoption model based on results by Kifle et al. (2010)

Venkatesh et al. (2003) found that a modification of the Unified Theory of Acceptance and Use of Technology (UTAUT) was able to explain 44% of the variation in behavioral intention to adopt. The low rate matches those of similar studies using other models. Still a number of moderating constructs were shown not to have any impact at all on behavioral intention. Chau and Hu (2002b) noted that there exists a need for new models and instruments for examining the views of telemedicine providers. Factors such as the impact of technology on outcomes along with the way that telemedicine integrates with existing medical practices may not be adequately considered (Chau and Hu 2002a; Miller 2002). To address this researchers have attempted to create new models that attempt to describe the adoption of telemedicine.

Why a New Model for Extreme Resource Poor Countries?

Gagnon et al. (2003) modified the Theory of Interpersonal Behavior (TIB) to examine the adoption of telemedicine for the provincial telemedicine network of Quebec. According to their findings the model was able to explain 81% of the variance in physician intention to adopt. Their model utilized personal norms and social factors. The findings show that these were the strongest predictors. The remaining constructs in the model however were shown not to have significant influence on telemedicine acceptance.

Other researchers have attempted to create custom models that specifically examine the adoption of telemedicine in specific contexts. For example, Kifle et al. (2010) create a model that combines poignant factors with constructs from other models to explain the adoption of telemedicine in Ethiopia. Poignant factors include image, computer self-efficacy, and anxiety in addition to moderating variables such as experience. Unlike other research however, their goal was to examine the adoption of telemedicine in extreme research poor countries. The model was only able to explain 28% of intention to adopt. But most of the constructs were shown to be statistically significant suggesting that there may be other additional factors that were not considered but still influenced the intention to adopt.

We initially determined the model by Kifle et al. (2010) would be a good fit for technology adoption in Haiti for few reasons. Firstly, the Kifle model was designed for Ethiopia which, like Haiti, is a resource poor country. Ethiopia shares a lot of similarities with Haiti such as the resource scarcity and need for telemedicine. Kifle et al. (2010) noted that the ratio of doctor to people in East Africa of sub-Sahara was as low as 10 doctors to 100,000 people. Secondly, the model was based on well-validated constructs from the literature on telemedicine adoption (e.g. Croteau and Vieru 2002; Hu et al. 1999). Thirdly, Kifle's model was tested and validated to assess the adoption of new telemedicine systems in Ethiopia.

	Country name	2011	2012	2013	2014
1	Malawi	369.6	270.1	239.9	255
2	Burundi	240.6	244.2	259.4	286
3	Central African Republic	484.6	469.7	326.4	358.5
...	...	...	...	...	...
9	Ethiopia	355.6	469.8	503.9	573.6
10	Somalia			521.2	542.6
11	Guinea	447.8	487.3	521.5	539.6
...	...	...	...	...	...
23	Haiti	740.9	766.9	810.3	824.2
24	Benin	799	807.7	882.6	903.5
25	Zimbabwe	768.6	850.8	905.5	931.2

Table 1: Poorest Countries by World bank (Source: World bank web site on 2/29/2016)

However, Kifle et al. (2010) identified some of the limitations of the model. One, they identify the significant cultural differences among extreme resource poor countries. Sometimes there are important cultural differences within a single extreme resource poor country. Yet cultural differences were not accounted for in Kifle's model. Two, they recognized that "cost and technology availability were not tested as one of the primary factors that would influence technology acceptance in Ethiopia". Kifle et al. (2010) explain that cost was not considered as an antecedent construct that impacts users' intentions to accept a new technology because the previous literature and theories on diffusion do not include cost as an antecedent. Cost was perceived in the literature as a determinant of the acquisition decision.

We argue that cost should be included in the adoption model for extreme resource poor countries for a few reasons. One, the literature was historically created for developed countries where cost was not a major factor influencing adoption or lack of adoption of new technologies. It is well established knowledge that frameworks developed for developed countries don't work very well in developing countries without significant modification. Two, based on our experience in Haiti cost is a major influence in extreme resource poor countries. The behavioral intention to accept and adopt a new technological innovation (e.g. in Haiti) will be influenced by the availability of funds and the commitment of the international medical partners (e.g. the Chicago medical team).

In this paper we group cost/fund availability and commitment of experts to the telemedicine project as a sustainability factor. Therefore, we proposed that telemedicine adoption will be influenced by the "perceived sustainability" of the project. Sustainability factors are important because medical stakeholders in extreme resource poor countries are spread thin and they are in high demand (10 doctors to 100,000 people). To focus on telemedicine means they have to change many of their existing activities to accommodate such a new program. Needless to say that they understand the benefits of telemedicine but they also understand that it is to some degree a destructive innovation. Innovation literature points out that destructive innovation could bring significant improvement if well implemented. The problem is that the few medical stakeholders in extreme resource poor countries often see many innovative projects

abandoned due to lack of funding. Our empirical experience described below shows that the sustainability factor will highly influence behavioral intention to adopt or not.

We define sustainability as the ability to see the project to its successful completion, or in our case, until the knowledge transfer was completed. Adoption of telemedicine by other clinics in Haiti beside the main partner site in this research will be slowed if the sustainability factor is missing. Sustainability simply means the ability (competent and committed medical professional) and capabilities (bundle of resources e.g. money, time and equipment) needed to complete the project as planned.

Methodology

The results of this study are based on a case study of a project between University and medical partners in the United States and in Haiti. The study utilized various qualitative methods including direct observations and interviews with Hatian medical staff. Some quantitative data was collected for evaluating the benefits of telemedicine procedures over traditional methods. Data collected included demographic information as well as length of follow up, number of visits, outcome, and medical procedures.

The case study in Haiti was selected for examination of adoption theory due to its unique status as an extreme resource poor country and the potential to further diffuse the program's successes throughout the country. The examination of extreme cases can help extend existing theory by providing unique insight given the limited number of cases which can be studied (Eisenhardt and Graebner 2007; Pettigrew 1990). The researchers used within-case analysis to examine data collected from interviews, observations and medical outcomes (Eisenhardt 1989). This analysis provided insight on factors that could influence adoption. Researchers then performed a cross case pattern search using some of the potential factors from collected data and existing models and studies from the telemedicine literature. This process was performed iteratively in an attempt to explain what was being observed in the case project.

The Case of Haiti

The earthquake of January 2010 in Haiti destructed an already fragile medical infrastructure. Haiti was listed by World Bank as among the world's poorest countries (table 1). The significant lack of medical expertise, clean water, and medical equipment contributes to the medical crisis in Haiti. Like in many resource poor countries the majority of the people live in the capital city. 30 percent of the population lives in Port-au-Prince, the capital of Haiti. This makes scarce resources even more difficult to share. Most people rely on motorcycle and walking as their primary means of transportation. The narrow and poor road conditions that are also very hilly make road accidents very frequent. Transportation of sick people to clinics is extremely challenging. We observed several car accidents and breakdowns on the road every time the researchers visited Haiti.

A research trip financed by partner universities led to a pilot grant on telemedicine in Haiti in 2014/15. The team visited four hospitals and two medical universities in Haiti in January of 2014. The trip quickly revealed that one of the most important priorities for the medical establishments in Haiti is telemedicine. The two universities visited in January 2014 clearly indicated that the most important collaboration they wanted with the Chicago group was telemedicine for anatomy related education. This could be in the form of sharing of high resolution anatomy images, high definition video lectures and surgical operation instructional videos. Three of the four hospitals need a variety of assistances. One of the podiatric doctors on our team has a relationship with several surgeons in Haiti. Having such a relationship made it easy for the group to decide to use telemedicine to support the podiatry program in Haiti as a pilot test in one leading hospital. If the outcome was successful the team would expand the use of telemedicine to other areas and clinics within the country. Therefore, we followed Kifle et al. (2010) as well the diffusion of innovations by Rogers (2010) to guide our telemedicine and knowledge transfer process in Haiti.

The Telemedicine Program Design

Here are the research goals decided by the research team:

Aim 1. To measure the rate of chart documentation for patients presented with diabetic foot ulcers at partner site in Haiti before and after implementation of a formal telehealth educational program. That is, we will examine whether diabetic foot ulcer outcomes can be improved at our primary partner site in Haiti (HBMPM) after live telemedicine consultations with US professionals are implemented

Aim 2. To measure the rate of wound healing (e.g., time to heal and proportion healed) among patients with diabetic foot ulcers at partner site in Haiti before and after implementation of a formal telehealth educational program.

Aim 3. To measure the rate of lower extremity amputation among patients with diabetic foot ulcers at partner site in Haiti before and after implementation of a formal telehealth educational program.

Aim 4. To assess qualitative barriers to the use of telemedicine for professional continuing education for the prevention of lower extremity amputation

Aim 5. To examine provider satisfaction and acceptance of the telemedicine services implemented in Haiti.

The Telemedicine Intervention Design

We designed a hybrid telemedicine program. A medical nurse practitioner from wound clinic in the US went to Haiti twice a month. While there, the nurse joined the Haiti medical team to connect via tele-conferencing to Chicago wound care doctors to go over the patient's case. The Haiti staff would present the case and the Chicago team would collaborate with the Haitian medical team to manage each case. The onsite wound care nurse from Chicago provided hands-on support. Central to this arrangement was the use of WebEx to connect to Chicago twice a week to go over the cases and report on progress.

The lead author in this paper was responsible for all the technological component of the telemedicine design and intervention. The doctors were responsible for delivering the medical care and knowledge transfer. One member of the team specialized in tele-health delivery. The lead author in this paper was charged with collecting data on telemedicine satisfaction and adoption. The core technology was based on WebEx. WebEx is a web platform that provides secure patient data transfer over the internet. WebEx was used for teleconferencing and it allowed us to share different kinds of medical documents. CISCO WebEx was selected because we planned to scale it up to Cisco TelePresence VX. Cisco's TelePresence VX is a full scale telemedicine platform. After the internet infrastructure was installed there was a 3 day educational seminar for the Haitian staff and physicians from March 27-29, 2015 to cover basic concepts in diabetic ulcer care and how to use WebEx for teleconferencing when connecting to the Chicago team.

The Challenges with Telemedicine Intervention

One of the main challenges in extreme resource poor countries is the lack of equipment. All the technological equipment used for this project was transported from Chicago to Haiti. The equipment ranges from data cables to UPS power generator, laptop for the wound clinic, network routers, computer speakers and high resolution camera. On one of the trips to Haiti a router was bought from a local store, however it did not work very well for our purpose so we decided not to buy any more equipment locally if we could avoid it.

The second problem for telemedicine is poor internet bandwidth or lack of stable internet connectivity. Even though we partnered with the leading network provider in Haiti, the stability and reliability of the internet bandwidth could not be guaranteed when needed. This is a factor that most researchers in developed countries will take for granted. It was difficult to carry out the planned teleconferences within the allocated time due to internet connectivity issues. Often doctors on the US side would spend much of their time waiting to be connected to the Haiti team.

The third problem is lack of stable electricity. On several occasions we will lose electricity power during the teleconferencing session. Often the Chicago team will have no idea what happened. We would often have to reschedule or hope the power returns in time. The electrical power generator for the hospital was not connected to the tele-center building because it was mostly for the intensive care unit.

While many studies have reported on the lack of technical human resources, we didn't experience any issues with the technical human resource. The technician at the main hospital was very competent. However, we realized this is not the case at other locations. One of the universities we partner with in Haiti has no technical person on site. Had we managed to diffuse telemedicine to others sites we know we would run into technical human resources challenges.

Lastly, one factor that in our experience could shape the adoption of telemedicine in resource poor countries is availability of donors (cost) and commitment of the foreign medical partners. We grouped these two items as the sustainability factor. Our grant money ran out at the end of 2015 and we have not been able to renew it. We submitted proposals to several granting organizations but we were not funded. While for researchers on the US side this is not much of a problem, as we can pick another research project or wait until we get funded again, for the people in Haiti it is a matter of life and death. As the research funding runs out, many programs are discontinued, leaving patients without adequate alternatives. Therefore, we are proposing that future adoption models should include a sustainability factor. We propose that: The behavioral intention to adopt telemedicine will be influenced by the "perceived sustainability" of the telemedicine program.

Results of Telemedicine Intervention as of December 2015

Between January 2014 and 2015 while funds were available to setup the telemedicine pilot program we were able to use telehealth methods to supplement on the ground training of Haitian staff and physicians involved in diabetic foot ulcer care at our partner site in Haiti. Diabetic patient wounds are much more difficult to cure than patients without diabetes. While this issue can be relatively easily managed in the US it presents serious challenges in Haiti. This project achieved three major outcomes 1) baseline rates of diabetic-foot outcomes at primary site was collected 2) we partnered with a local ISP to setup an internet infrastructure at the clinic for teleconferencing using Cisco Secure WebEx platform 3) regular bi-weekly telehealth sessions, each 90 to 120 minutes in length, to emphasize best practices and discuss patient care. During our baseline data collection which encompassed the 12 months leading up to the telehealth program, it became apparent that staff charting at the primary site, and in particular the recording of ulcer measurements, was lacking. Therefore, we made an effort to train local staff members at the clinic to improve patient documentation for the center.

There were 44 patients with a diabetic foot ulcer (DFU) in cohort 1 accounting for 1226 total visits from April 1, 2014 to March 31, 2015 and 32 patients in cohort 2 with 290 total visits from April 1, 2015 to June 30, 2015. Mean age of the study population (cohorts 1 and 2) was 59.8 ± 10.9 yrs (range 40 to 90 yrs), 60% (46/76) were women. Length of follow up and number of visits was higher for cohort 1. Mean number of visits to the wound care center for a patient in cohort 1 was 28.5 ± 34.5, and cohort 2 was 9.06 ± 8.1 ($p=0.002$). Median number of visits for cohorts 1 and 2 were 15 and 6, respectively. Ulcers in cohort 1 tended to be bigger than those seen in cohort 2. Nearly one third of the diabetic foot ulcers at the main site were located on the dorsal foot (28%, 21/76). In summary all the three medical aims were achieved and presented in a paper titled "Early results of a US-based telehealth program to improve diabetic foot outcomes in Haiti" (Fleischer et al 2016).

Four Aim 4 surveys were completed at the end of each session asking participants about the relevancy of the content and barriers to participating. All participants answered that they felt the content of the sessions improved their general knowledge of wound care and most (90%) felt the sessions allowed them to take specific information away that will help with managing their patients.

The limitations to participating fully in each session are provided by frequency of response in Figure 4. Technical difficulties including loss of power, loss of internet, and/or poor bandwidth were estimated to affect 5% of the total time we had for our sessions together. Only one session had to be rescheduled altogether due to technical issues. Overall, technical issues did not seem to adversely affect the value of the program. Rapid and efficient language translation (English to Creole and vice versa) was recognized as the biggest obstacle to this point by the Haitian staff. Teleconferences sessions were used to verify adoption of newly proposed methods and suggest corrective action without having to be physically present.

The Impact of Funding on Adoption

During the research work in Haiti it became apparent that funding provided a number of benefits that helped push the initial adoption of telemedicine. On the initial visitations to Haiti, researchers were able to observe and directly interact with Haitian counterparts in their environment. The background and familiarity of the researchers that visited Haiti allowed them to serve as "funded" change agents. While the initial visitations were not designed to spread telemedicine, the familiarity of researchers with telemedicine and their connections to resources in the United States, allowed them to become "enablers" of the technology. The growing communication channels between Haitian professionals and their US counterparts who were accustomed to the technology provided an increased influence. Even more, once the initial funding was obtained, equipment was purchased that allowed medical professionals in Haiti to directly observe the characteristics of the telemedicine innovation through observation and trialability (Rogers 2010). The trial program also allowed Haitian professionals to directly evaluate the relative advantage, complexity and compatibility of telemedicine. This is likely not something they would have experimented with without the link to US professionals. This is due both to the financial cost of the project, along with the additional resources and training provided from personnel in the US.

The same way that funding could begin to seed the adoption of the project, a lack of sustainable funding caused issues that diminished the adoption of telemedicine. If funded for a second year (2016), we would have been able to continuing to refine our delivery (and content) of the current telehealth sessions, while expanding the telehealth sessions to other wound care sites and begin the work of "virtual clustering" of talents in Haiti. We will also have been able to examine whether telemedicine consultations could impact wound healing rates by adding the minimal necessary equipment for performing basic consultations. These consultations were set to be supplemented by surgical mission trips, when appropriate between Haitian and US professionals and gradually expanded to Haitian-Haitian professionals.

The future and sustainability of this project was put in jeopardy due to the diminishing funding. Although the Haiti team has attempted to continue parts of the program, the lack of funding from their US partners has decreased their ability to maintain the effort. The medical team has resorted to low cost alternatives to continue their work but the resulting efforts raise several questions and concerns. Can we share medical data over a none secured internet network; who will continue to pay for the very expensive bandwidth in Haiti if there is no funding left to pay for it; Will the partners in Haiti still trust the Chicago team, and lastly will lack of funding issue have a negative impact of the intention to adopt telemedicine by the remaining three clinics? Considering the administrative changes at the trial site, will other sites want to go through this process if sustainability cannot be guaranteed?

A New Telemedicine Adoption Model

Based on our experience in Haiti, we concluded that any new technological intervention to resource poor country should consider if the intervention is sustainable. While the Kifle et al. (2010) model serve as a good starting point and a working model for us, the additional variable "perceived sustainability" should be included in the model for Haiti and many of the resource poor countries. As it is, any future work in Haiti will have to wait until additional funding is secured. Meanwhile, diabetic foot wound-patients in Haiti probably can't wait. More importantly, other clinics may be reluctant to work with us considering the amount of work the Haitians' medical team and partner put into this effort only to be cut off after about 1.5 years. Therefore ability to sustain telemedicine until the local people are fully trained in our case should be another factor in the adoption model. Sustainable factors will include the availability of funding for the planned program duration as well as a commitment from their international medical partners. If medical clinics and partners in extreme resource poor countries perceive an intervention as not sustainable, they may not support it. It may also lead to resistance and lack of willingness to change from the old way to the new way because the intervention is perceived to be unsustainable. Unfortunately, there is a history of abandoned projects in resource poor countries that impact the trust and willingness of partners to take risks on novel projects.

We observed this frustration with one of the Universities in Haiti. They were slowly giving up on the virtual anatomy e-delivery program because of multiple problems related to technical, financial, stable internet bandwidth needed to make the program work via the internet. They therefore concluded that the program is not sustainable and showed signs of disinterested. We suggested moving from a web base

delivery to local server on site. However, this strategy raised other issues, such as if the server can be monitored and controlled from Chicago; and how do we assure the integrity of the anatomy software application and data if we can't have full control of the server? There were questions of some proprietary medical images in the software. We therefore concluded that "Perceived Sustainability" may positively or negatively influence adoption of telemedicine in resource poor countries. Table 3 illustrates the modified model which included the "perceived sustainability" factor.

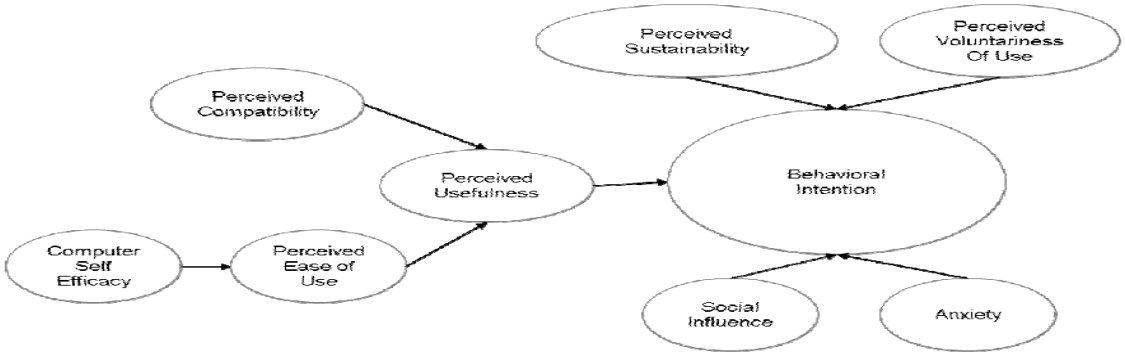

Figure 5: Modified Adoption Model based on Kifle et al (2010).

Conclusion

We have shown in this paper that telemedicine is a high priority for resource poor countries. It is also the only option in many cases. The adoption models developed for Ethiopia seems to be applicable to other resource poor countries like Haiti. However, the model should include "Perceived Sustainability" Sustainability will include availability of continuous funding during the intervention period as well as commitment from the international medical partners. Future work will test the new model with real data. We should point out here that the medical team members on this project from Chicago have always been very committed and continuously look for alternative technologies to continue the project. The service component (medical care) of this research is just as important to the US team as the Haitian partners. We believe what keeps this project alive (sustainable) is the commitment from both side but we also think that the it will be hard to sustain the positive behavioral intention to adopt the telemedicine project in the long run if funding remains too hard to get or comes in very late.

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