Can Telemedicine work in America?

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Vikram Seshadri

Approved _____ Date _____
Tsai-Hsuan Ku, Department of Engineering and Society

FABLE OF TOMORROW

To the Citizens of the Appalaichain,

We could have been there sooner.

Something was clearly off. Your days were getting longer. Your jobs were getting harder. But, when you asked for help no one was able to understand your troubles. You were faced with people that didn't understand what keeps you up at night or why it seems that you have lost your drive. And thus the stigma continued to grow. You weren't unwell, you were lazy and reckless. People didn't know about your genetic predisposition to mental illness as you continued to get more and more isolated. There were several opportunities for others to step in, but your friends and family missed all of the signs. If only the information around you was more accurate, but now I hike through your trails alone.

We should have been there sooner.

Over the past few days, you had noticed this severely uncomfortable pressure at the Center of your Chest. Confusing the pain for a muscle pull, especially given the laborious nature of your occupation, you took an Ibuprofen and continued with your daily schedule. But the symptoms persisted and you needed to seek help immediately. You wanted to go to the World Class Center at the University of Virginia, but it was so far away. So, you went to your family's physician. But when they tried to teleconference with other specialist's for further advice, they were unavailable. She offered you a short-term solution for your swelling, but the diagnosis was a bit off. Your health continued to deteriorate. Finally, you decided to get more emergent treatment, but you never met the team at the hospital. If only help was not 50 miles away, but now I gaze at your sunsets alone.

We would have been there sooner.

Fatigue was setting in more frequently than you were used to. You had noticed that your feet were starting to tingle, a sensation that you had never ever experienced before. When you asked someone, they thought you were overreacting. You knew that UVA had a great teleconference service designed to maintain diabetes and related illnesses so you tried to set-up appointments. The website seemed to give simple instructions, but you were struggling to download the Zoom Conferencing Platform. When you finally got something set up, you heard more silence than medical advice. So you turned to social media. Though there were several conflicting sources, you figured it was probably just "Sugar". You tried taking your father's medications, but it didn't really improve your day-to-day health. The consequences seemed insignificant at first, but soon

the ramifications began to take its toll. If only your home had better Broadband access, but now I summitt your peaks alone.

The Appalaicha is truly beautiful, but it’s beginning to feel empty. If only you were here…

INTRODUCTION: CAN TELEMEDICINE WORK?

The ongoing coronavirus pandemic is redefining the practice of public health and the market of personal care. In particular, telemedicine, a digital platform for health service delivery, has been put under the spotlight as a solution of community-wide health under the principle of "social distancing". According to the World Health Organization, telemedicine is holistically considered "the delivery of health care services, using technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers" (World Health Organization, 2010). This program has been widely embraced by China. With the telemedicine industry rapidly growing, anticipated to be an additional 30% of growth by 2025, China's ability to capitalize on it's 5G network to rapidly expand telehealth initiatives to better serve its diverse populations (Collective, 2018; Paul, 2020). In the US, telemedicine is accessed by over 150 facilities and healthcare physicians across Virginia and is essential to impacting a broad variety of community members (Drees, 2019). For rural Virginia, telemedicine has been one of the primary ways of combating various epidemics in these rural communities. Programs, such as the Remote Access Medicine (RAM) clinic, have worked diligently to expand access to these healthcare initiatives and help bridge the gap between the development of such projects and their respective designs.

Amidst the current coronavirus pandemic, telemedicine offers an excellent opportunity to revolutionize treatment for the ongoing epidemic. Despite the reported successes of the program, the experience of the outer community has not been quite as positive, and seems to have left many communities yearning for better results. For instance, local broadband access could impede technological adoption, coupled with regulatory concerns regarding misdiagnoses, and regulatory privacy compliances have impeded the scale of measurable impact with the implementation of these programs.

This project intends to assess the implementation of telemedicine programs in Charlottesville, by addressing the following research questions:

1. Different actors' perception and practice of telemedicine and rural health in Charlottesville: Why or why not is telemedicine perceived as a solution to equalize accessibility for health care across various diverse communities in Charlottesville? Who are the promoters? Who are the opponents?
2. What are the required social and technical infrastructure of telemedicine?
3. How does telemedicine change the future of healthcare, particularly in response to pandemic disease and public health crises?

I will use actor/actant network theory (ANT) to identify the main proponents and opponents for the widespread adoption of telemedicine in the various rural communities across America. ANT will be helpful to exploring how telemedicine has been implemented across America thus far and how the target communities have responded to the various proponents and

opponents of telemedicine's widespread adoption. Two case studies - a international perspective on the successes and failure of telemedicine in China and a local perspective of how telemedicine has been used in the patient population at the University of Virginia - will give us a unique perspective on the types of changes needed to further the growth of this particular network. With the emergence of a new national perspective of healthcare, learning about the various catalysts for change and implementation of telemedicine will offer a unique perspective into the future of telemedicine.

LITERATURE REVIEW

Furthermore, considering the advancement of treatments and incidence of various pathologies, telemedicine plays a key role in broadening the impact of health-care in tackling regional epidemics (Paschall, 2019). A similar impact can be seen within the realm of mental health, a new and burgeoning field in rural medicine (Noguchi, 2019). Physician perspective on the support and access from telehealth is essential to establishing public support.

Since its initial implementation, telemedicine has often been considered the future of primary medicine and health care. As discussed in a breadth of research in medicine, telemedicine has been considered "broadly inconsistent" with an unclear understanding of measurable impact (Ekeland et al., 2010). Though some studies cite accessibility and improved medical compliance as promising signs of a bright future, others cite an underlying lack of broadly applicable evidence to support any consistent and valuable impacts for regional communities. In particular, one area frequently cited as a necessary area for further exploration is the social and cultural presence of telemedicine from the patient perspective (Ekeland et al., 2010; Tachakara & Rajani, 2002).

Currently, the social and cultural presence, several communities that mimic some of the disenfranchised communities of Charlottesville have responded to telemedicine. In some communities, telemedicine has been shown to be an effective way of empowering the patient. In a study exploring the nature of patient interactions through various telemedicine platforms, patients were found to be more engaged and "ask more questions" during the visit to take better advantage of these given initiatives (Tachakara & Rajani, 2002).

One such instance includes the current challenge for many rural community members is the differences in access to the various means of telemedicine. For instance, despite the widespread adoption of healthcare in the rural communities, 660,000 Virginia residents lack broadband access, which leaves them unable to participate in UVA's remote patient monitoring services (Drees, 2019). Likewise, rural communities, such as those in the Midwest, cite a plethora of concerns that have hampered the widespread adoption of telemedicine in many communities (Bareiss, 2001). Despite the presence of broadband challenges, telemedicine and smart health is amongst the various new initiatives destined to advance people's access to healthcare. For instance, a new $100,000,000 pilot program was launched with the goal of improving broadband access, but is still unable to benefit the broader rural community (Drees, 2019).

Furthermore, these initiatives are key to allowing community centers to triage patients to fast-track the administration of life-saving vascular and cardiac healthcare (Wicklund, 2018). By offering opportunities for smaller hospitals to contribute to the administration of healthcare associated with larger research centers, like UVA, increases the span of reach for healthcare programs. Telemedicine is essential for building trust in the healthcare for community hospitals to ensure rural isolated communities can get the help they need with fewer obstacles to success. Accordingly, these programs have allowed for local emergency health care to grow as an industry, which implies room for growth for other community healthcare centers (Batson, 2019).

STS FRAMEWORK

Telemedicine's success relies upon a diverse network of members to ensure a seamless integration into a rural community. As a movement that seems to have galvanized the nation, telemedicine's success is predicated off of its ability To gain further context into the status quo of healthcare in Charlottesville, this project adopts Actor-Network Theory (ANT) as the framework to better understand the interactions between various elements of telemedicine initiatives are employed in rural communities. This framework will focus on how the particular translation processes that have been employed to expand the coverage of telemedicine in rural communities.

ANT explores how networks of actors are created around emergent and innovative technologies. In this analytical framework, actors/actants represent both human and non-human individuals and groups that can act to expand the technology's adopting network (Dudhwala, n.d.; Durepos, 2008). For a given technology, ANT explores "how networks come into being, to trace what associations exist, how they move, how actors are enrolled into a network, how parts of a network form a whole network and how networks achieve temporary stability" (Cresswell et al., 2010; Michael, 2017). Therefore, this framework is helpful in tracing the associations that led to the intrinsic adoption of a given technology and the necessary actions to ensure future adoption by actors/actants not yet integrated into a technology's current network.

Therefore, this analysis will identify the key actors and actants in implementing telemedicine in the rural communities around Charlottesville, and the primary translation processes employed in these communities. The primary key actors that this analysis will focus on are the health-care practitioners, digital platforms, FDA regulations and regional policies, and healthcare administrators. Given the various limitations brought on by patient privacy and Health Insurance Portability and Accountability Act of 1996 (HIPAA) restrictions, the patient perspective will be further explored using a broader scale document analysis better understanding the reception of popular telemedicine platforms commonly applied in America such as Chiron Health and Zoom.

METHODOLOGY

This project will apply the following three methods to collect research data, summarize as follows:

1. Document/Policy analysis: The document analysis will be conducted in a two-prong effort. First, the aforementioned literature review will continue with an added emphasis on the regional impact in Charlottesville and the surrounding affected communities. Better understanding the policies, reports and patient testimonials for its implementation in Virginia, we will be able to illustrate the value embedded in the design implementation of telemedicine through the University and regional healthcare systems. These testimonials will survey patients that participate in not only UVa's Telemedicine program, but also other prominent telemedicine programs in neighboring communities and how their experience has therefore differed from other formats of patient interaction. The focus of this analysis will start with the University's plans to expand telemedicine and transcript from most recent exploratory analysis. To further this analysis, I will compare the outcomes of the current implementation of telemedicine at UVA with the affiliated ECHO project in Virginia that is focused on democratizing the access to healthcare in Virginia. This analysis by being able to interact with the existing video conferencing software provided through the university and the associated artifacts of telemedicine at the University. Finally, it will be important to explore how the various telemedicine platforms that have been developed and launched in the private sector. Exploring how the community has reviewed these platforms across America will elucidate how patients feel about the platform and how widely it has been adopted in communities across America. In fact, UVa's program is built off of the Zoom Health platform that has experienced generally positive reviews from the members of the rural communities. Therefore, this analysis can then be used to create solutions to better address the successes and shortcomings for the various communities in Charlottesville. Document analysis will be conducted using the listed framework below.

2. Case Studies: Two particular case studies, based off of the available resources will be employed to explore application of Telemedicine in Rural Communities. As Charlottesville will be following the model of implementation of telemedicine across other networks and organizations. The focus of these case studies will be to explore how telemedicine initiatives have been implemented in China and accordingly how these strategies can be employed in Charlottesville.

3. Interview with the healthcare workers of the University of Virginia Health System: A series of interviews including health-care providers, technology leaders, and community leaders, will be conducted to both validate the volume of collected literature and gain a

more interpersonal understanding on how telemedicine is viewed in Charlottesville by it's affected base, and further elucidate how the impact of telemedicine is perceived differentially across all of the involved actors within the field of telemedicine. The focus of this analysis will be to explore members from the various communities identified in the preliminary interviews with health care provider Mark Rugarber and health care administrator Yafel Valera such as members from the hispanic community or rural communities (M. Rugarber, personal communication, October 2, 2019; Y. Valera, personal communication, November 20, 2019).

4. Participatory Observations: Over the course of the past three years, I have worked as a medical scribe alongside several of the best doctors and nurses at the University of Virginia where I have direct access to the intricacies of the complexities of the emergent healthcare systems. Through the years, I have been able to observe how various patient populations have responded to the delivery of healthcare, and more importantly the varying range of expectations that tend to arise from these experiences. These experiences are going to help explore the responses of the broader population to the various actors/actants in the ever growing telemedicine networks.

Collectively, both the series of interviews and the expansive policy search will allow us to understand all pertinent actors and their associated problems and solutions from the various applications of telemedicine within the framework of a Actor/Actant Network Theory (ANT).

THE STATUS QUO OF TELEMEDICINE ACROSS RURAL VIRGINIA

Thus far, the University of Virginia health system has been able to point to some immediate successes from the implementation of their telemedicine system as well as exploring the possibility for growth. For instance amidst the current hepatitis C epidemic, UVA has developed a technology-led initiative to establish teleconferences with several members of the rural communities to increase personalized treatment. By setting up this program, "the people that we've gotten all these medicines for, would not have had access to it without having to drive over 300 miles to get it," per a UVA clinical research Manager (Paschall, 2019). The example by the various international leaders has catalyzed a widespread adoption of various initiatives at the UVA health system utilizing these ICTs to create programs for underserved people. This initiative has been crucial for administering healthcare to otherwise isolated communities and has proven how telemedicine can be essential to the betterment of health in Virginia.

Telehealth is slowly becoming more widely adopted by the physician community, however there are still large leaps for communities to make to prioritize the further development. However, there has been a broader breadth of positive reviews as there has been a technological gap that has impeded the rapid growth and adoption of these types of projects. While in full operation, patients have been provided a wide array of healthcare analyses that best explore the

implications of how these technologies have been able to benefit the associated communities in the healthcare space.

Leading the telemedicine charge in rural Virginia, Project ECHO has led the charge to expand telemedicine initiatives across large healthcare providers within the region. Virginia Project ECHO is the overarching project that has supported the growth and adoption of telemedicine in the major health provider systems of the greater Virginia area (*Project ECHO at UVA | UVA Health*, n.d.). They have spearheaded the widespread implementation of several technologies, such as Zoom Conferencing Platform and other EConsult platforms. By working with a wide-scope of both specialists and generalists, ECHO acts as the key actant on the professional aspect of these healthcare initiatives to create the necessary networks between the community leaders of healthcare to get telemedicine beyond the major hospital systems to integrate the surrounding practices as applicable into the greater network. In addition to working hand-in-hand with major healthcare providers of the region, they have also worked hard to establish working relationships with the outer rural communities. ECHO acts as a strong unifying force that will help ease the concerns of several members of the "anti-telemedicine community" thereby expanding the existing telemedicine network. As such, the particular telehealth technologies that either promote or inhibit adoption of these technologies over time.

There is an increasing usage of Zoom across industries as the new gold standard of teleconferencing. Zoom is the most frequently adopted vehicle for pushing these new initiatives, but there have been some challenges in gaining patient buy-in. There is a brand new initiative to bring this technology into the patient healthcare sector in an effort to globalize the impact of these initiatives. Though the ubiquity of this technology coupled with it's associated ease of use, Zoom is not necessarily a proponent for expanding the reach of the telemedicine network.

The optimism has not been well-received in the space of adoption for people looking into telehealth initiatives with a paltry ⅛ star review (*Best Telemedicine Software | 2020 Reviews of the Most Popular Tools & Systems*, 2020; Ekeland et al., 2010). In a society, where data privacy is rising to the forefront of most people's concerns, security limits Zoom's efficacy as a proponent. One of the premier telehealth IT companies, Cliniko, has cited several issues regarding the protection of individual patient information protection that warrant validity concerns. For instance, issues with "Zoom-Bombing" into confidential meetings and leaks of user data, several health care institutions are rightfully exploring alternative means of implementing telemedicine (Heller, 2020). Although Zoom has developed a more HIPAA compliant alternative, critics cite that the company has only been able to offer a simplified solution for an otherwise complex regulatory pathway (DeGrove, n.d.). In addition to missing several desirable features, both physicians and patients abhor how poorly these technologies have been able to transition and interact with existing interfaces on the market. This is a particularly interesting point of interest given the current deficiencies existing in UVA's presented platforms. However, given the average patient population's increasing familiarity with

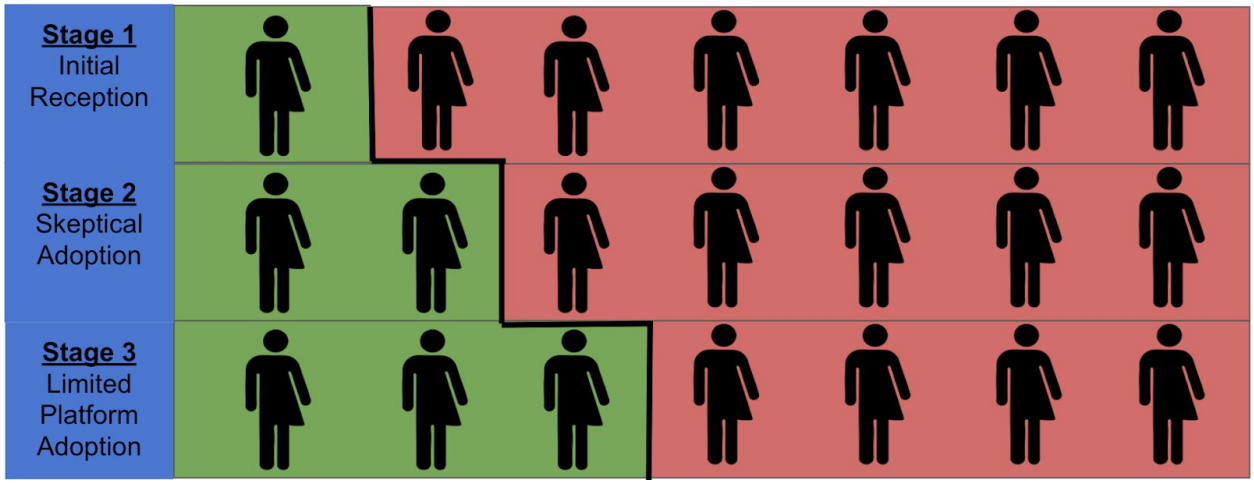
the technology, Zoom represents a promising actor that may expand current healthcare networks exponentially.

Other telemedicine platforms have had greater success in launching their particular platform. New telemedicine platforms have learnt from the growth of several of these initiatives adding several necessary features that are focused on growth and development. For instance, MEND has become one of the most popular telehealth platforms as reviewed by the best advisors for the top telehealth platforms. By creating several features, Mend has ensured long-term health and the facilitation of the necessary groundworks by establishing and creating the platforms with very friendly user interfaces. (*Mend Reviews and Pricing - 2020*, 2020). This interface is the most amenable to patient improvement and is looking stronger as it is developed for best interface with EMR records such as Epic and Sentara. When presented as a means of simplifying healthcare administrative challenges, telemedicine platforms have the strength to excite hospital systems and private practices alike.

Given the growth of information technologies, the need for HIPAA regulations are paramount for a safe and effective implementation of telemedicine nationally. HIPAA is a national act that has established a national standard for protecting the information of sensitive patient data (Health Insurance Portability and Accountability Act of 1996 (HIPAA) | CDC, 2019).

Telemedicine is often heralded as an innovative way for offering primary care for the general population. As seen in Figure 1, telemedicine was able to slowly grow amidst skeptical adoption by both physician and patient communities and limited platform adoption. The incorporation of telemedicine across the community's health system has required a change in not only the way current physicians go about their day-day activities but also how they train the next generation of physicians. Accordingly, understanding the future of Telemedicine necessitates us to better understand the current status in major hospital systems that serve the local communities.

Figure 1: Initial Telemedicine Actant Network



CHALLENGES IMPEDING NETWORK EXPANSION

As suggested by University of Virginia Health System employees, Mark (Nursing) and Yafel (Administration), implementation of new technologies still has multiple hurdles impeding several relationships between various groups of actants. When people come to healthcare providing locations, they are coming with the "expectation of being treated with care and empathy, something that is more difficult to guarantee through a telehealth platform" (M. Rugarber, personal communication, October 2, 2019). With financial, emotional, and social challenges, several actors harbor concerns regarding the nature of access and interactions within the rural communities.

Building off of available university connections, key players of the Emergency room Mark Rugarber (ER Nurse) and Yafel Valera (ER Administrator) offered a great deal of insight into what concerns them about the current status quo of the related technologies. Though they acknowledged the necessity for an alternative for patients that may lose both time and money in the current ED system, they believe that there are still several relevant limitations for the application of telehealth. Focusing on the limitations of the technology, they report a shared concern that telehealth may "be unable to encapsulate the breadth of a clinical evaluation, including physical examinations and lab results". However, they argue the biggest challenge that exists within the current layout of communication is the challenge of being able to explain and communicate nuances of the intricate system. Nowadays, most rural patients harbor several apprehensions about a complex healthcare system with a deficit of information resources. These informational barriers suggest that unfamiliarity and apprehension tend to scare rural communities away from telehealth initiatives. Without the necessary guidance and informational resources, these concerns may continue to impede the expansion of the telehealth community into the rural patient's home (M. Rugarber, personal communication, October 2, 2019; Y. Valera, personal communication, November 20, 2019).

It's clear that some actors, such as emergency health care workers, harbor their doubts about the efficacy of telehealth platforms. According to Mark Rugarber, a registered nurse, while much innovation has been implemented within the health system, the average patient often has difficulty navigating the process. After all, no matter how long someone can speak to a doctor or nurse on the phone, there is "too much valuable information locked away behind physical exams, medical imaging, and lab testing" (M. Rugarber, personal communication, October 2, 2019). Particularly within the realm of healthcare, people struggle to understand what resources are available to them, and often are unfamiliar with telemedicine as a whole. These disparities are further exacerbated with people of lower financial backgrounds who lack access to the necessary resources to adequately navigate this system (M. Rugarber, personal communication, October 2, 2019; Y. Valera, personal communication, November 20, 2019)

Broadband initiatives are essential for growing the telemedicine reach across various communities. Building off of the widescaled expansion of broadband access across rural Virginia has been essential for expanding the clinical reach of several telehealth platforms as they service

the greater rural communities. Utilizing nationally supported initiatives, such as Tim Kaine/Mark Warner's 1.1 Million dollar grant to build out these programs across not only the major health systems of the state, but also prioritize rural communities such as the primary care facilities of the Appalachia. In this statement by the Mark Warner team, they emphasized how the results of this initiative stand in comparison to the opioid epidemic and corresponding Opioid Crisis Act of 2018 (Warner, 2018). However, in spite of many of these initiatives, patients still report challenges with being able to access various resources (Landi, 2019). As highlighted by a recent study, there are still several financial and technological barriers that exist to increasing broadband access in several rural communities. Broadband penetration can be directly correlated with review of clinical performance, frequently prompting physicians to opt to traditional health care initiatives rather than seemingly "high-tech" alternatives. As such, several community members, and accordingly leaders of rural healthcare clinics, are less likely to adopt or even suggest telehealth initiatives as a means of facilitating clinical visitations.

However, there are still plenty of reasons for hope amidst the ongoing pandemic.

CASE STUDY: CHINESE TELEMEDICINE INITIATIVES

"If you look at what China did, it became apparent that one of the things that they did right was making fifty percent of their healthcare implementation virtual" said Dr. John Scott, medical director of digital health at the University of Washington (UW) Medicine in Seattle. Across the past several years, China has adopted and implemented several telehealth initiatives that have focused on expanding clinical access to a variety of populations and has had success reaching it's rural populations. Given the current circumstances, there are lots of exciting technologies that could signal areas of future growth for the greater community as a whole.

Central to the success of the existing telehealth initiatives is the spread of it's existing 5G telehealth system. The current telecom infrastructure has eased the transition to virtually accessible healthcare formats and supplements the essential services. This is perhaps best exemplified by ZTE's remote diagnosis that played a role in aiding with the remote diagnosis of 2,700 people within the country's borders (Paul, 2020). Installation of the necessary platforms is seamless for the average rural patient, and is commonly heralded as a cost-effective alternative to less efficient clinical visits. By truly democratizing internet access, the foundations for an expansive telehealth network were established early on in the role out of several technologies.

Though broad telecom access has been fundamental to the success of Chinese telehealth initiatives, Chinese leadership has been able to capitalize on the network to introduce exciting technologies such as artificial intelligence. Unlike the American telemedicine initiative, many Business-to-Customer (B2C) actors have taken active roles in the installation of the network. WeChat, the focal point of communication for the Chinese, is paramount to the installation of an effective telemedicine initiative within the country (*China Is Building The Ultimate Digital Health Paradise. Or Is It?*, 2019). Tencent, the face of China's Intelligent Healthcare, has streamlined the once onerous processes of the average healthcare experience and has played a

role in facilitating both medical imaging and insurance processes for the average patient. By building off of the WeChat platform, Tencent's technology has a high degree of penetration as it builds off of the ubiquity of China's integrated communication system (Law, 2018). Uniform adoption and implementation of several exciting technologies that aid in several key processes including, but not limited to insurance, administration, and medical imaging. By building off of the shoulders of the most recognizable technologies, networks, and companies in China's infrastructure, telehealth has been able to spread like wild-fire through several of China's communities. People who may be otherwise apprehensive about these unfamiliar technologies or platforms are more at home with the general structures. This is increasing saturation

China has made strides in expanding telehealth initiatives, but are still far from the perfect telemedicine network. Currently, primary care systems are extremely underutilized across China as the gap between available physicians and the expanding chinese population propagates. This is further exacerbated by the tendency for populations to condense in the city paradise, limiting immediate access to healthcare in several rural areas. Furthermore, existing patient-doctor relationships are already strained as can be seen with high rates of violent incidents across rural communities (*China Is Building The Ultimate Digital Health Paradise. Or Is It?*, 2019). China faces the same fundamental issues that America faces in reaching the broader rural communities, resources condensed in urban centers with limited access in broader reaching rural communities.

China offers us an exciting look into the several ways that telemedicine can be implemented to revolutionize healthcare initiatives. By expanding telemedicine initiatives substantially across the nation, China has taken a role of leadership in the expansion of technologies and perhaps more importantly the associated communities.

Figure 2: Chinese Telemedicine Actant Network

Social Distancing, Telemedicine, and COVID 19 pandemic

As mentioned by Dr. John Scott, Medical director of digital health at the University of Washington, "one of the things that [China] did right was [making] 50% of their care virtual" (*Coronavirus*, 2020; Redford, 2020). Given the recent successes of Chinese telemedicine, it would be an excellent case study to explore how their successes can be brought back to Charlottesville. Though skepticism has always limited many actors from buying into the technology, the desire for remote access has come to the forefront of the fight for better healthcare. COVID-19 has proven to be perhaps the most powerful actant in mobilizing the telemedicine network as the infrastructure in a socially distant world would not survive without COVID-19. Prior to the pandemic, most of the providers and patients I worked with were fairly dismissive of the value of a telehealth visit. After all, for most people the quality of a healthcare experience can only be experienced by physically being present in a room with a doctor or nurse. However, having worked on the front lines alongside many of the premier healthcare providers of UVA, it is clear that the desire for telemedicine has started to blossom.

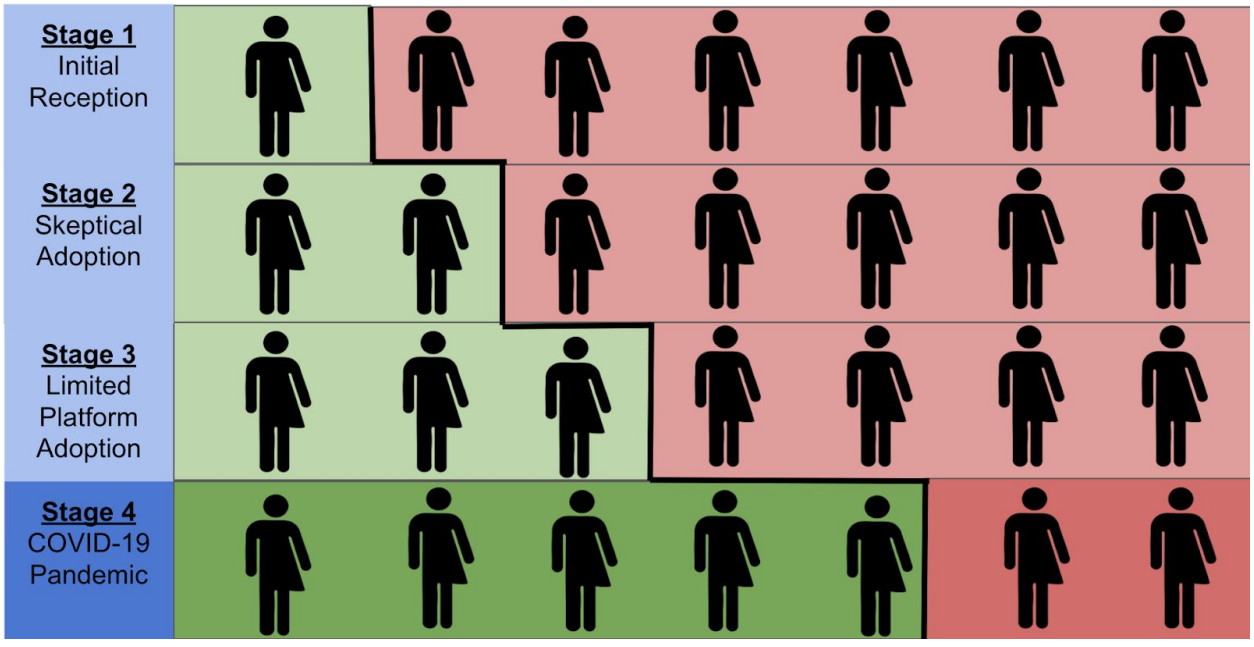
One of the most startling images from the frontlines of healthcare, would be the nearly empty emergency rooms in communities where COVID-19 has not proliferated yet. For instance, at UC Davis healthcare system, traffic in the emergency room has been on average down by as much as 50% (Simoes, 2020). Though with a lockdowned society fewer "emergencies" may be expected, but as Dr. Amitha Sudhi of UVA will admit, she has never felt busier as an Emergency Room physician. Constantly fielding questions from a worried pandemic, Dr. Sudhir talks about how hospital patients' fear of catching COVID-19 has forced many to look to telemedicine as a necessary interface to get the constant healthcare that they desire (Sudhir, n.d.). This need is further enunciated in communities with the older communities who possess more and more risk factors. The respect for social distancing principles have not only allowed emergency departments to brace for larger populations of infected patients, but have forcibly introduced large percentages of the patient population to a more accessible form of healthcare. Speaking to several nurses at UVA, even communities with limited technological access are discovering pathways to telehealth as it provides a simpler screening process with less substantial risk associated. Though most will agree that telehealth is still unable to replace the entire value of the traditional hospital visit, it is a very relevant healthcare alternative for people desperate for a better option. COVID-19 and the desire for improved social distancing measures has been a powerful actant for a myriad of reasons. By embracing the principles of social distancing, much of the infrastructure and community factors have been established to ensure longevity of the platform in the future of healthcare.

Perhaps the most incredible sign of the changing times is the recent changes in policy by the Department of Health and Human Services Office for Civil Rights (OCR). Though a historically strenuous policy with regards to privacy and security compliance HIPAA has taken a more open approach to the regulation of patient security (Parmar, 2020). Over the past 6 weeks, most providers have been able to implement these telemedicine technologies with minimal

regulatory restrictions. Though concerns for privacy still exist, the OCR specifically allows health care providers to use audio or video communication technologies to provide services to patients like examining a swollen ankle or making a medication change, even if the technology isn't fully HIPAA compliant (HIPAA, Telehealth and COVID-19, 2020). Though there are still some important regulations in place to ensure some patient privacy protections are enacted, these loosened restrictions are anticipated to explode the telemedicine network, converting thousands of anti members by the day. Under these new guidelines, physicians have been able to impact the lives of countless patients and have seen a massive uptick in patient appointments. Dr. Ratul Chaturjee of California has reported being able to maintain relationships with as many as 1000 patients, 200 of which are in critical condition. Healthcare providers are advised to notify their patients of the privacy risk and to opt for the strictest privacy settings, like end-to-end encryption and systems that don't store transmissions (Stoller & Alexander, 2020). In short, HIPAA has been essential to expanding the ongoing healthcare network. HIPAA has proven to be a powerful actant in the ongoing telemedicine initiative and proves an excitement for telehealth platforms from policy makers and regulators.

COVID-19 has unified many actors that once resisted the development of the telemedicine infrastructure to grow a more pervasive network in society. Every day, more and more patients, physicians, and administrators are turning to telehealth initiatives as a more viable healthcare provider for the future.

Figure 3: Telemedicine Actant Network Since COVID-19



Conclusions

Personally, the focus of this paper resonates with me as I continue to prepare for a career in medicine myself. With a greater focus towards ensuring the equality of healthcare access, telemedicine seems like an eventuality that will become ingrained in my professional life the

further down this path I go. Particularly in a field where progress can be slowed by the need for repeating trials, telemedicine proves to be a powerful actor that may completely alter how medicine is approached for years to come.

Though there have been some hurdles to encouraging the adoption of these telemedicine technologies in earlier times, the current pandemic seems to be a catalyst for prompting rapid and widespread adoption of the telemedicine initiatives in Virginia. In particular, new social norms, such as social distancing, has brought a diversity of telehealth initiatives to the forefront of healthcare. As such, learning from Chinese initiatives to expand and propagate telehealth technologies offers clarity into several promising solutions that address ongoing telehealth initiatives. Furthermore, the need to adapt rapidly to these circumstances has not only affected COVID-19 related cases, but has led to a breadth of adoption of several distinct initiatives across rural Virginia. Growing from a useful alternative, telemedicine has evolved into a necessary healthcare interface that communities had to rapidly incorporate into their normal social interactions. As such, the Virginia Commonwealth Health system has seen an uptick with as many as 1200 "telehealth visits" within a given day (Kruszewski, 2020).

Are the strides made across telemedicine sufficient to save the rural communities such as the residents of the Appalachia? As the Fable explores, our past is littered with thousands of lives that could have been saved had the access to services such as telehealth were more readily available. Telemedicine platforms have started to disseminate across rural communities of physicians and patients who are eager to offer immediate help for people with limited access and familiarity to the American healthcare system. Unfortunately, the expanse of the network has been otherwise limited due to challenges with limited rural broadband access and platform security and privacy.

With a growing network, China's implementation of telemedicine has taught us much about the potential of these types of infrastructure. Building off of the ubiquity of platforms such as WeChat and the growing adoption by the national healthcare systems, China has had success implementing telemedicine broadly across their country. As such, the Chinese case study offered an advanced perspective on what healthcare may eventually evolve into. Though limited by access to such infrastructure or confidence in it's quality, telemedicine has been proven to be a viable, if not essential, addition to the healthcare field. However, by building off of the urgency of a pandemic, telehealth has rapidly evolved into the future of healthcare. But the ongoing coronavirus pandemic has Patients are slowly gaining access to a plethora of new resources that can assist them in taking care of their own health. Doctors are able to better manage the traffic through their emergent services and better prepare for more severe cases. More importantly, as our society braces for our new reality, all of these initiatives demonstrate that healthcare is embracing the digital era now more than ever.

Though there is much to be excited about, we are constructing a network that still needs to mobilize a large group of unaligned people actors and nonhuman actors. There are still several policies, technologies, and education that must be developed to properly integrate the majority of

the rural community into this growing network. However, to ensure the democratization of healthcare, these types of innovations are the next key steps to building off of the precedent set by COVID-19. Unlike a few years ago where families would be forced to imagine a world with all of their loved ones, these types of innovations in telemedicine could bring us closer to protecting them.

Charlottesville is heading in the direction of slowly evolving into a Smart City. As such, telehealth is a key pillar for the development of Smart Health. The contributing research from this specific initiative will also be evaluated in the scope of the Smart Cities Projects started in STS 4500, this project will be presented to various leaders within Charlottesville that will be able to add their own perspectives and insight to further develop this project. In combination, this framework allows us to better structure and understand the interplay of the various conflicting social groups. Ultimately, this paper has employed the ANT frameworks to better characterize and understand the implementation of telemedicine initiatives in Charlottesville. Accordingly, it will aim to not only explore how it's been successful, but also evaluate the more immediate impacts it has had on the regional communities in Charlottesville. Telemedicine initiatives offer a depth of resources that would democratize healthcare, in particular for rural communities where healthcare institutions are frequently limited. Therefore addressing the various challenges that strain the growth of this network ought to be prioritized to guarantee the growth of a necessary healthcare infrastructure.

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