

Understanding and Optimizing Patient Flow in the UVA Health System
The Implications of the COVID-19 Pandemic on Telehealth Usage Within Rural Areas

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By
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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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Introduction

As a result of the COVID-19 pandemic, patient flow throughout health systems in the United States has been significantly disrupted with extreme staff shortages and an overflow of patients. Healthcare providers across the nation have had to make major adjustments in ensuring the safety and well-being of their patients and stakeholders through their system. There has been a median reduction rate of 37% in overall health care service utilization throughout the country (Moynihan et al., 2021). Overall, Outpatient clinic visits have dramatically been impacted due to the pandemic with providers converting a majority of in person visits to tele-visits when possible as well as many patients wanting to avoid in person visits to limit potential exposure (Mehrotra et al., 2020).

Hospitals have reported that telehealth practices have been beneficial stemming from the pandemic and something that they want to maintain long term despite some challenges faced such as lack of technological access for patients (Grimm, 2021). Specifically, within rural areas of the United States there are significant challenges regarding the wide implementation of telemedicine such as lack of internet service as well as low-income individuals who are unable to afford the necessary technology (Turner-Lee et al., 2020). Many rural hospitals in the United States currently also simply lack the technological capability of implementing telemedicine (Ftouni et al., 2022). Looking forward, the COVID-19 pandemic has shown the healthcare industry that telemedicine implementation in rural areas of the United States has a bright future with barriers that must be overcome for long term success.

At the University Physicians Clinic in Charlottesville Virginia, the COVID-19 pandemic has wreaked havoc by disrupting patient flow and causing throughput issues. The main issues in the clinic that have been exacerbated by the pandemic include extreme staffing shortages and

long patient appointment times that have been caused from a lack of cohesion within the clinic (Dozier et Al., 2021). The goal of my research team is to conduct a thorough quantitative data analysis using provided cadence data along with user collected observational data to implement data driven recommendations that will provide key structured insights to stakeholders of the clinic to improve throughput processes within the UPC clinic. The overarching plan of the technical research team is to improve the UPC patient clinic experience overall by decreasing the currently extremely long appointment times, recommending additional nursing staff to be hired, and increasing overall clinic patient throughput to optimize the clinics flow processes.

Technical Description

UVA Health's overall mission is to “To be the nation’s leading public academic health system and a best place to work — while transforming patient care, research, education, and engagement with the diverse communities we serve” (UVA Health, 2022b). Currently, the UVA University Physicians Clinic in Charlottesville is located at 415 Ray C. Hunt Drive Suite 3200 and offers personalized primary care for adults and geriatric patients (UVA Health, 2022c). Once inside of the building, patients of the clinic must sign in at two different locations. First, the patients do a general check in on the first floor to provide general information such as their insurance provider. Then, they go up to the third floor of the building and enter the primary care clinic suite to check in for their scheduled appointment. This often leads to confusion among patients, so one of the main initial recommendations the research team plans to make to the clinic stakeholders is to consolidate the check-in locations within the building to optimize the patient flow and decrease the amount of time spent in waiting areas.

The initial goal of this technical project is to shadow the healthcare nurse providers at the UPC clinic to record and verify key timestamps. Currently, the UVA health system utilizes an electronic medical records system named Epic that records the useful patient important information as well as key timestamp data for the patient flow such as check in, sign in, and room times (UVA Health, 2022a). Prior research has shown that the timestamp data within Epic is unreliable and not trustworthy on a large scale (Korte et al., 2021). Data mining and cleaning will need to be done on the provided Epic dataset to ensure that it is adequate for future use by our research team. Once our data collection process is completed and the Epic dataset has been cleaned, my team will match our observational data with the Epic generated cadence data to ensure they align. Next, my research team will use the combined observational and Epic generated cadence data to perform data analysis using statistical software such as R, Python, and Minitab to make actionable and data-driven recommendations to the UVA health UPC clinic to improve the Epic systems database processing and their overall current patient flow processes. These recommendations will be aimed to solve the clinics most troublesome problems of extremely long patient waiting times, staffing shortages, and confusing clinic layout for patients while also adhering to UVA health's overall vision.

The overall research process will be split into three overall phases before completion of the study. This process is fluid and can be changed due to weekly input from clinic stakeholders advising our research team's project. First, the research team will each observe providers at the UPC clinic to record key quantitative observations for collection into a usable dataset such as when each observed patient was roomed by the nurse and the time between the patient being roomed and the doctor entering the room to begin the visit. Next, the team will conduct a thorough quantitative statistical analysis to provide key summary statistics and possible

improvement recommendations to the clinic's stakeholders. Lastly, the technical team's data analysis will be compiled into a comprehensive technical report to be submitted for publication at the annual Systems and Information Design Symposium (SIEDS).

After initial analysis, expanded telemedicine implementation with the UVA Health UPC clinic appears to be a viable recommendation for improvement.

Telemedicine Implementation in Rural Areas of the United States

Telemedicine can be defined as the use of medical information exchanged from one site to another via electronic communications for the health and education of the patient or healthcare provider and for the purpose of improving patient care (Roh, 2008). As a result of the COVID-19 pandemic, telemedicine's usage has drastically gone upward. Due to the COVID-19 emergency crisis, Congress, the administration, and states were allowed to temporarily eliminate many historical barriers to telemedicine thus allowing for unprecedented telemedicine utilization (Bhatnagar, 2022). A year after the pandemic, it is estimated that 30% of overall outpatient visits are telemedicine visits (Freehling, 2021).

Telemedicine usage due to the COVID-19 pandemic has created a viable alternative for outpatient clinic patients in rural areas of the United States. In West Virginia it was found that during the height of the pandemic telemedicine increased completion of patient appointments by 20% for all ages with working age patients between 18-49 being affected the most by the change (Haggerty et al. 2022). Individuals who live within rural areas tend to be older and sicker with more pre-existing health conditions than individuals who live within urban areas (Hirko et al., 2020). Individuals who live in rural areas also tend to be lower income and live further away from clinics and hospitals than urban residents so having a telemedicine option can be especially vital.

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The STS framework of technical momentum will be used to analyze telemedicine implementation within rural areas of the United States. Telemedicine implementation in rural areas of the United States can be broadly seen and connected to a large technological system. Summarized from Thomas Hughes, technological systems are “both socially constructed and society shaping” (Hughes, 1987). The specific properties of innovation and growth within the technological system of healthcare will be used to analyze telemedicine

implementation within rural areas. The technological system property of innovation can be described as an improvement to an ongoing system that does not disrupt or create an entirely new system (Hughes, 1987). The effects of the pandemic resulted in significant disruptions to healthcare systems which has resulted in a significant increase in telemedicine usage. Thus, ensuring rural patients within the United States can be afforded the same technological healthcare delivery access as those who live within urban areas is crucial. The technological system property of growth can be defined as the expansion of a technological system due to the drive for high diversity and load factors (Hughes, 1987). As a result of the COVID-19 pandemic, the healthcare industry has been forced to grow and expand to unprecedented levels with telehealth expansion being among the leading categories of overall growth.

Research Question and Methods

What have the implications of the COVID-19 pandemic been on the rise of telemedicine in rural areas of the United States?

Rural Americans face significant barriers in terms of access to healthcare which include far geographic distance from hospitals, lack of public transportation, and a lack of overall healthcare providers (Ralls & Moran, 2020). At a federal level, the CARES Act was passed which included additional funding of \$29 million towards the Telehealth Network Grant Program which currently awards 8.7 million dollars a year for telehealth technologies specifically within rural medically underserved areas (Weigel et al., 2020). Therefore, the viability of telemedicine implementation for rural areas has support from the federal level in the United States.

Multiple research methods will be used to reach the goal of completing a thorough research analysis on the rise of telemedicine in rural areas of the United States. First, the research

process will begin with a review of secondary sources such as research journals relating to telemedicine implementation and the effect of the COVID-19 pandemic on telemedicine in rural areas of the United States. Agency reports will be researched primarily from credible government agencies such as the US Department of Health and Human Resources, the National Institute of Health, and the Center for Disease Control. Once the initial background research has been completed, the method for evidence collection will shift towards interviews with primary care providers in rural areas of Appalachia to understand first-hand how the pandemic has affected patients visits and how telemedicine is being used in the present day post pandemic world.

Conclusion

This paper provides background information regarding the effect of the COVID-19 pandemic on hospital systems within the United States. One of the big prominent technological changes to come out of the pandemic was the rise of telemedicine usage for outpatient primary care patients. At Suite 3200, the University Physicians Clinic in Charlottesville Virginia the effect of the pandemic has been magnified . For multiple years now, the clinic has struggled with issues exacerbated by the pandemic such as lack of nursing providers to room patients and extreme patient waiting times. Our research team will conduct a nine-month quantitative study to provide the clinic with the necessary solutions to tackle their longstanding issues of patient flow within the clinic. Implementing more telemedicine visits for patients could be seen as one of the potential recommendations to the patient flow issues found within the UPC clinic. Improving healthcare systems in the United States remains a challenge we are facing everyday as the COVID-19 pandemic proved. Implementing telemedicine access in all possible outpatient clinics to the 14% of the United States population who live in rural areas will allow the rural residents to

have more equitable access to healthcare that they deserve. Telemedicine should not be substituted for a doctor's visit but needs to remain a viable alternative to higher risk and lower income rural citizens (Anderson & Singh, 2022). The expected results of the research paper should concur that each outpatient clinic in these rural areas needs to consider telemedicine as a viable alternative to implement whenever possible.

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