

Improving Patient Flow in a Healthcare Clinic Post COVID-19: A Data Validation and Exploratory Analysis Approach

(Technical Paper)

User-Friendliness of Epic Technology in Healthcare Clinics

(STS Paper)

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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.

Introduction

My technical project is the Optimization of Patient Flow and Process for a Primary Care Clinic during the Covid-19 Pandemic. The primary care clinic is the University Physicians of Charlottesville (UPC) and it is located in Suite 2100 at the UVA Fontaine Research Park. In this project, my team and I aim to improve the patient experience in the clinic and appointment process while also reducing the stress placed on staff, nurses, and providers.

On the other hand, my STS project focuses on the Use of Epic Technology within a Local Charlottesville Healthcare Clinic. This clinic also refers to the UPC, and Epic technology is an electronic medical record software application focused on functions related to patient care such as MyChart (Day, 2016). The research questions I target include 1) do the primary care providers and nurses have enough similar training and experience of the technology being used? 2) Is the Epic chart, that keeps track of patient health during every doctor visit, easy to navigate through? 3) Does the dotting system, used to keep track of patient progress during the appointment, timely and accurately capture the stage the patient is in? And finally, 4) Is the data generated from Epic easy to interpret and reflect everything it needs to? These questions are important because it helps us to break down the problem into more simpler parts so that we can thoroughly understand where the problem lies and ensure no possible issue is left untouched. It will also give us a better understanding of what solutions to implement so it's a more targeted solution.

My STS project stems from my technical project because it takes a more filtered look at the possible areas to focus on when improving the overall efficiency of the clinic's processes. My overall capstone project encompasses a broader scope of the clinic's difficulties. It also places emphasis on the steps the nurse follows to room the patient, the staff's and providers' availability as well as the signage system throughout the clinic. However, my STS project will solely pay

attention to Epic and its use. In a way, the results and findings I obtain from my STS project, can be useful in interpreting and influencing results of my capstone project as well, making them well-connected but distinct enough to have their own relevance. To establish a full understanding of my approach towards Epic's use in the clinic, I will first elaborate my technical project to offer a broad overview of my project, then I'll explain what I want to discuss in my STS project, followed by the research question I'm investigating, the relevant social groups, frameworks and methods that support my research, my project's timeline and finally, important texts that help strengthen my work.

Technical Project

My technical project holds a lot of value in the healthcare field because it aims to combine qualitative observations with quantitative data analysis to develop a methodology for understanding the UPC's processes and produce structured insights for stakeholders. The qualitative analysis will look into a typical patient's journey through qualitative clinic observations: pre-registration, check-in and rooming. On the other hand, for the quantitative analysis, we hope to concentrate on the data collected in the Epic technology as well as Cadence reports which contains information on appointment scheduling of patients (Dozier, 2022).

My team and I shadowed different nurses over a span of 2 weeks and took notes of any differences in time stamps. The time stamps we collected were of the following instances: when the nurse picked the patient from the waiting room, entered the room, logged into the Epic system, logged out of Epic, left the room, when the doctor entered the room and finally, when the doctor exited the room. However, we also wanted to understand if all the nurses were following the same process when logging in and out of Epic since there was discrepancy in the time stamps. We found that some nurses logged into Epic before they received the patient to get their

chart on Epic ready, while other nurses only logged into Epic after they retrieved the patient. This, along with other areas where nurses might be following contrasting steps in relation to Epic are of interest to us.

Another technical aspect to explore is the appointment lengths and the process of determining how patient appointment lengths are assigned. The two different ones include 20-minute appointments, which are for follow-up or sick visits, and 40-minute appointments, for new patient screenings, adult preventive care and extended follow-up visits (Dozier, 2022). But our team is still unsure how the scheduling staff determines the length because we have noticed some patients with follow-ups having longer appointments. It could be interesting to explore if patients are discussing other problems with their provider during these visits, or if the nurses are delaying the rooming process. To provide more clarity, the rooming process involves greeting the patient from the waiting room, checking their weight, asking if they want a flu or a covid-19 shot, and finally leading them into the room. In the room, the nurse asks for the patient's intake of medications and if they are experiencing any pain. The last step of the rooming process involves checking for vitals such as blood pressure and updating MyChart on Epic (Keerthana, 2020).

While this provides a description of the quantitative approach, the qualitative outlook is to interpret the signage system implemented in the clinic. Any clinic's layout needs to be straightforward enough that disabled as well as older patients have no difficulty in finding the exit. Our team identified the main cause for disruption in patient flow as mislocated exit signs. Firstly, the exit sign at the end of the hallway points in the wrong direction, and even if the patients do turn in that direction, there is no other sign to indicate where they need to leave from. This confuses patients and results in failure to follow the complete patient visit procedure, which

also includes a check-out form located at the exit side of the front desk. Furthermore, the staff at the clinic are aware of this problem and often end up walking the patient out the exit door to avoid any uncertainty.

Another qualitative point of view to give importance to in this project is the staffing schedule of nurses and providers. In the event that there is a lack of nurses on a day at the clinic, the nurse that is supposed to focus on rooming the patient, is also compelled to manage imparting injections to other patients. This can cause a disruption in the timeliness of the patient's progress through their appointment and can increase the stress upon nurses. Along the same lines, a shortage of certain providers on specific days, also results in an imbalance in the number of patients for each doctor. For instance, if provider A is absent, and only provider B is present, the patients that are supposed to visit provider B will have to wait longer to get their turn because provider B will tend to be busier and face delay in transferring from one patient to another. Hence, understanding such scheduling systems can avoid crucial disorganization in the clinic and provide more relief.

STS Project

Epic is the platform used to record data from UVA Health's electronic medical record (EMR) system. It supports functions related to registration and scheduling, clinical systems for doctors, nurses, emergency personnel, and other care providers (Day, 2016). It is a shared server with data centralized in a single location that everyone working in the clinic has access to. Since this technology carries so much relevance in the patient's clinic experience, it is crucial that all aspects of it assist the care providers and nurses.

Within Epic, the dotting system is also of focus in my STS project. Doctors and nurses use colored dots to indicate what stage of the appointment the patient is (Hauptman, 2012). The

yellow dot represents that the patient has checked in and is in the waiting room. Green dot means that the nurse has completed checking vitals and medications with the patient, and the patient is ready to be seen by the provider. A black dot indicates the patient's completion of appointment. White dot means that the patient has missed their appointment, blue dot means there are some pending orders to be expected from the nurse, and finally red dot indicates that the patient needs radiology care. The use of this dotting system is key to Epic and both are areas of focus.

Research Question

Due to the importance of the dotting system, my overarching research question is does the dotting system accurately and timely capture what stage of the appointment the patient is in? Even though every change in the color of the dot has a timestamp associated with it, our in-person observations revealed that these instances of time stamps vary across the different nurses. Sometimes, nurses would change the color of the dot to green before they are done giving injections for the flu or Covid-19 booster. But now that the color has been changed to green, the provider is under the impression that the nurse is finished with the patient. Thus, this results in inaccuracy of what stage of the appointment the patient is in and could lead to delays in healthcare service as well. Even in larger settings, such as hospitals, inaccuracy in the dotting system will cause confusion between the providers and nurses leading to inefficient patient care. Hospitals deal with more serious emergencies which cannot be delayed, hence this should be the focus.

When it comes to checking if the information is timely captured, it could be that Epic only captures the time for the initial check-in into the system and the final check-out or vice

versa. For instance, different nurses would swipe in and out of Epic multiple times for a specific patient. Some nurses only swiped into Epic after they roomed a patient, while some swiped in before. It is still unclear to the team what the Epic data depicts which makes it hard for us to help staff to solve their confusion. Gaining a more clearer understanding of this by comparing our observational data with Epic data as well as making sure the headings in Epic are descriptive enough to signify what time stamp they are capturing, are of importance.

Relevant Social Groups

Since this is a clinic related project, the relevant social groups for this project include nurses, doctors, scheduling staff and patients. Recognizing these groups is simple because they are the ones in almost direct contact with either using the Epic technology or being impacted by it. While some clinics and hospitals may not have issues with Epic, I hope this project can highlight underlying problems in others.

Nurses are defined as individuals who room the patient, check their vitals and review medication to update their chart information so that their records are up to date for future purposes. Doctors are care providers who address the patient's specific health condition and recommend what medicine or procedure will make them feel better. They are also most aware of their patient's medical history and keep in mind their past medical conditions to ensure that they aren't prescribing anything harmful to them. Scheduling staff never really comes in direct contact with patients, but they are responsible for communicating to patients their appointment time and details based on the provider's availability on that day. They are an important target group in my paper as well because they are the first dot change that happens in the system when the patient enters the waiting room. Additionally, it would be critical to learn their interaction with Epic and to see how much access they have to the technology besides just the dot system.

Patients are those who are in need of health assistance and have pain or discomfort in their body. Since the Epic technology is used to provide a more streamlined process of care to patients, understanding them and what they feel about the duration of their visit can be useful too.

While these aforementioned groups are in direct relationship with Epic, there could be more doctors and practitioners who are included in this network as well. Radiologists, translators, cardiologists, etc are also significant people who interact with patients and maybe even Epic. In my personal clinic observations, I have noticed these professionals enter patient's rooms but so far have no evidence if they use Epic. Collecting knowledge on their experience can allow our team to make better recommendations on how Epic can be improved, which will make the overall health system more reliable and smooth.

Framework and Methods

The STS framework that is most closely related to my healthcare technology project is the Actor Network Theory (ANT). ANT is defined as a theoretical and methodological approach to social theory that delves into the interactions and relationships humans have with inanimate objects (Cresswell, 2010). In my project, I can look at the relationship humans have with technology specifically. Since Epic is a technology that makes transfer of information convenient between the different social groups, the way these social groups interact with Epic is key to proving its relevance. The relationship between the social groups and Epic is a two-way road and thus Epic is able to demonstrate different information to each of the constituents of the social group based on what they want to view. Nurses view the patient's chart and input information related to their vitals and medication, while doctors use this information to understand their

history and also update it with what prescriptions they need. Even though both groups use the same technology, their interaction with Epic is only limited to their role and thus, it plays a role in shaping the influence Epic has.

As for what methods are important for this project, ethnography or talking to people, will be of most influence (NPS, 2022). Even though this project deals with technology, people are ultimately the ones using this technology and getting their perspective will help find loopholes in Epic's functions. The goal of our project is to ensure that Epic is proving useful to its users and since its usefulness is subjective to the user's purpose, conducting open-ended interviews with these users will help us form a more cohesive picture. Interviews can only be beneficial if they contain unbiased specific questions that are easily understood to those answering it. We want to emphasize the efficiency of Epic's use and any insight we can obtain from these conversations will give us a better grip on the problem to be solved. The humans working at the clinic are our best resource since they have undergone training and are daily users of Epic.

I also think that having a different set of questions depending on who we are interviewing will be important to capture all user cases. My team and I were able to establish trust with the nurses and providers and believe that our curiosity will enable them to share their concerns with us. Due to this, we hope to obtain truthful comments from all the social groups working at the clinic and are excited to use this method to develop our research.

Project Timeline

Even though this project has been completed in a timeline of 8 months before, the duration of the project largely depends on the extent of work the team wants to undertake. For our iteration of the project, we want to be able to get a deeper statistical view of the data, instead of just performing preliminary analysis, and create a model that can depict where the delay is the

largest. This way, we can provide the clinic with a more step by step solution of what specific changes they should implement.

The data collection part, even though it's complete, took about two weeks. Next, the team needs to sit together to understand if our observations match the data being recorded by Epic. Creating matches between the observational and Epic data using excel can give us confidence in using the Epic data. I anticipate that it will take about a week. Once we have determined the discrepancies in the data and find specific values that seem out of the ordinary, we hope to have a check-in with the client to discuss our questions and findings. After about another half week of back and forths with the client, the data analysis shouldn't take longer than 3 weeks because our team is very familiar with using R or Python. The analysis will consist of creating regression models to find the strongest correlators for delay in appointment procedures and compare which predictors are significant for the model. In total, by the beginning of December, we expect to have our initial analysis complete.

Key Texts

While this project is highly technical and has a lot of niche aspects to it, there are a lot of key texts that have arguments to back up the approach and the problem our team is solving. For instance, Porter in *Trust In Numbers* states that experimental setups are fickle, and there is no way to entirely replicate an experiment artificially (Porter, 1995). This statement holds value to my analysis because while Epic plays a role in helping nurses and doctors provide care to patients, there is no set of specific changes we can provide to Epic to expect it to improve the situation in other healthcare settings as well. Each experiment is unique and even if the conditions of it seem similar, they are not interrelated.

Additionally, Winner in *Do Artifacts have Politics* gives technologies a positive or negative personality. He believes that they can either contribute to the productivity of the social setting they are in, or they can have environmental side effects that degrade society (Winner, 1980). In my project, the health setting Epic is embedded in, gives it a positive personality. Its contribution towards making data collection and patient history retrieval smoother is a benefit to healthcare clinics.

Another argument that accurately fits the scenario I am tackling is in Cathy's *Weapons of Math Destruction* where she states that any statistical model encodes human prejudice into the software systems that we use daily in our lives (O'Neil, 2016). While we may think that Epic is a technology and is only taking an objective approach to providing health care, it is still a man-made software that could inherently reflect bias in its actions. I believe this is an interesting field to explore because our team could benefit from understanding if the language, terminology and descriptions of care mentioned in Epic are representative of the population at large, or if it is only applicable to certain demographics.

Finally, a last key text that serves to support my analysis is Brey's *Technology as Extension of Human Faculties* wherein the argument revolves around technology being an extension of human will. The technology is present to simply showcase human intention (P, 2000). Epic, in this case, displays the amount of precision and organization clinics want to have when offering care. They want to ensure that they have a record of all the medical care the patient has received, what their medications are, as well as their logistical information, so doctors can give more holistic care.

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