

Thesis Project Portfolio

Exploring Discrepancies: Analyzing Electronic Medical Records Data Against Direct Observations

(Technical Report)

Understanding the Effect of Real Time Location Systems (RTLS) on Nurse Workloads and Retention Rates In Healthcare Systems

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The technical project was conducted with a team of students and focuses on Electronic Medical Records, or EMR, which is a digital way to keep track of patient information. EMRs are used by healthcare providers for diagnosis, treatment, and clinic decisions which can heavily impact the daily operations of the clinic. There are several factors that impact the accuracy of EMRs, including data entry accuracy, backend configuration, and the time of documentation. This project aims to improve the patient and worker experience in primary care clinics, focusing on the influence of EMR. In-person observations at the University of Virginia's University Physicians Primary Care Clinic were conducted alongside nurses, and appointment milestones were recorded to create a dataset for comparison with the raw EMR dataset. Discrepancies between in-person observations and EMR data were noted through analysis using Excel and Tableau. Metrics were applied to analyze decision implications based on each dataset for the clinic's daily operations. This project underscores the importance of accommodating discrepancies for reliable healthcare information and decision-making.

The STS project is centered around analyzing the history and current state of Real Time Location Systems, or RTLS, technology on healthcare systems, as well as discusses the future potential of this technology to address challenges brought about by the COVID-19 pandemic. Issues such as increased patient demand, staffing shortages, and risk of infectious exposure have forced many healthcare institutions to restructure aspects of their organization to ensure that patients and employees remain safe both physically and mentally. RTLS technology has the capability to improve patient care and provider experiences through a variety of methods that accurately determine an asset or individual's location. Time and location based data can be captured through various techniques, with this project focusing on Radio Frequency

Identification (RFID) tags, which can be incorporated into nurse badges, patient wristbands, or medical equipment.

In this project, I will explore the beginnings of RTLS technology in healthcare spaces, such as hospitals or clinics, as well as the innovations made due to the COVID-19 pandemic. The project will also discuss future uses for RTLS technology to address nursing staffing shortages and burnout rates across the healthcare industry. I will discuss the employment and retention trends of the nursing profession before the pandemic, as well as address the specific challenges brought on by COVID-19 to the professional and personal lives of nurses globally. Feelings of isolation, mixed with fears over the virus and exhaustion from working understaffed shifts heavily contributed to the current and future nursing shortage. Incorporating more RTLS technology into healthcare spaces can help minimize the effects of these challenges for nurses, as well as the entire healthcare industry. Lastly, I will discuss challenges and controversies that arise with the incorporation of this technology into existing systems, such as implementation costs, privacy risks, and inaccurate data collection. The project will conclude with a discussion on the next steps for RTLS technology to increase its positive impact on the healthcare industry.

Both the technical project as well as the STS project focus on the use of RTLS technology in a healthcare setting. The focus of the technical project is on the data collected through RTLS and EMR technology and how that information can affect decision making for the clinic. The implications for the broader healthcare industry are discussed; however, the analysis and findings are applicable to the particular clinic and its implemented RTLS design. The topic for the STS project was inspired by the work with the University of Virginia's University Physicians Primary Care Clinic for the technical project, but focuses on the technology's impact on the individuals within the system. These individuals interact with the systems on a daily basis,

but rarely, if ever, see the backend EMR data analyzed in the technical project. Additionally, while the technical project considers data from 2023 and 2024, the STS project discusses topics from before, during, and after the lockdown associated with the COVID-19 pandemic. The STS project serves to give a holistic view of the healthcare industry and the people within it. Both topics are essential for utilizing the full effectiveness of RTLS technology in healthcare spaces.