OPTIMIZING OUTPATIENT CANCER INFUSION CENTER THROUGHPUT USING A SYSTEMS-BASED APPROACH

CREATING HEALTHCARE EQUITY THROUGH SAFER SCHEDULING ALGORITHM PRACTICES

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SOCIOTECHNICAL SYNTHESIS

Patients of all races and backgrounds should receive efficient and equitable treatment within the American healthcare system, especially regarding life threatening diseases like cancer. The technical portion of this product aims to optimize the current workflow in the studied oncolytic infusion center with regards to patient throughput, while keeping safety and patient satisfaction constant. Leadership was initially unaware of the center's performance and preliminary analysis showed the center ranked poorly compared to other centers nationally. The sociotechnical thesis analyzes prior technical scheduling improvements used in infusion centers across the country and discusses ways in which these algorithms can be used without increasing racial bias in healthcare. Thus, the two projects are connected by finding new ways to optimize infusion care and refining prior improvements to be more equitable for all patients.

Cancer cases are expected to increase in the next few decades, but proper chemotherapy through infusion treatments is necessary to make increased survivorship a reality. Outpatient infusion centers arose across the United States in the past two decades to provide such care without requiring a prolonged stay in the hospital, but such centers still have operating flaws. The research team conducted an iterative qualitative and quantitative assessment focused on direct observations, clinician interviews, process mapping, exploratory analysis, and statistical modelling at an infusion center. Through these steps, the current infusion system state was determined and leverageable solutions were identified to improve the utilization deficiency.

The initial qualitative assessment showed three main themes: standardized scheduling, linked appointment struggles, and a lack of understanding of pharmacy operations within the center. Baseline quantitative findings showed that the center ranked in the second quartile nationally in utilization, but the center also had heightened median times for idle time and drug

preparation time. Two identified solutions include creating specialized buffer times for first time versus follow up appointments to increase scheduled time and pre-mixing several candidate drugs to reduce idle time attributed to waiting for drug preparation. These solutions are expected to increase utilization by at least 5%. However, a linear regression modelling utilization showed nurses could still be a bottleneck due to a 1.13:1 ratio between nurse hours and utilization hours.

The sociotechnical project analyzed improved communication structures can influence how these new software affects existing racial disparities. Improved communication practices directed towards adding context to these complex algorithms can help prevent new racial disparities and lessen racial inequity from human practices. Research focused on current data collection practices, confounding data relationships, and the effect of these two areas on patient experience. Actor Network Theory was used to illustrate the connection between human and non-human actors in the system, as well as showing the faulty non-human negotiation space.

Scheduling and risk modelling software create racial bias due to objective functions that are based on variables that are highly related to race. Unreliable data collection and automatic data syncing allows these models to consume a large amount of poor data without any context. Thus, confounding relationships unintentionally enter the underlying algorithms through this poor data. Increased meetings between hospital analysts and outside software engineers can reduce the unintentional confounding and create safer, more equitable healthcare algorithms.

In conclusion, these projects aim to make healthcare, specifically infusion care, more efficient and equitable. The technical project showcased how an iterative qualitative and quantitative assessment can uncover leverage areas within an infusion center to improve efficiency. Lastly, the sociotechnical project displayed how improvements to healthcare communication structures can improve equity from new algorithm-driven technologies.

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