

Optimizing Outpatient Cancer Infusion Center Throughput Using a Systems-Based Approach

(Technical Paper)

The Prevalence of Health Literacy in Cancer Care

(STS Paper)

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Anna M. Bustamante

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Technical Project Team Members

Devon M. Zavacky

Hayden C. Ratliff

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

Technical Advisor

Rupa S. Valdez, Department of Systems and Information Engineering

STS Advisor

Richard 'Doc' Jacques, Department of Engineering and Society

Introduction

Chemotherapy treatment is one of the most common methods for battling cancer. This is largely completed with IV therapies that work to deliver medication to the body through the vein or under the skin. Historically, these infusions were administered by hospitals, but due to large demands for infusion services, outpatient infusion centers were stood up to help mitigate the growing need for such drug deliveries and have now become common place as cancer care providers (Spencer, 2021). The UVa Infusion Center was constructed for these reasons exactly; they saw a demand among patients needing infusions in the Charlottesville and surrounding area and built the center to support the overall patient need (Paschall, 2019).

Even though it's a relatively new facility, UVA Health is still observing increased demand of their infusion services they cannot meet. It is believed that between 2015 and 2050, the "total number of cancer cases [will] increase by almost 50%" due to increasing exposure to risk cancer factors, helping us understand the new facility isn't meeting infusion demands (Weir, 2021). Not only are medical institutions like UVA's Infusion Center expected to handle this increasing need of their services, but more individuals than ever, will be responsible for navigating the healthcare system to treat their cancer. The societal issue of low health literacy — not being knowledgeable enough to make informed decisions regarding your healthcare — will get compounded as more and more people are forced to navigate the complex system that is healthcare (Holden, 2021). Low health literacy can be associated to poorer outcomes in treatments and only 12% of the United States adult's population are proficiently health literate (Lopez, 2022). Therefore, it is vital to not only improve access to cancer care but to also provide patients across the industry the best chance possible to understand their healthcare options.

On top of these demand and more societal difficulties with cancer and healthcare, UVA Health is also struggling to understand their processes and capabilities with their infusion services at a more actionable level. Because management is unsure of how the center is performing or where improvements can be made to start meeting the demand observed, the high impact change necessary is not feasible. The technical project will work towards bettering UVA Health's understanding of the infusion center through multidimensional analysis of data, mapping key infusion center flows, and eventually piloting some solutions to improve throughput of the center. The STS research will focus on understanding the impact and reach of poor health literacy, as well as diving into what practices should be implemented to improve health literacy so patients can set themselves up to get the most positive outcomes possible.

Technical Topic

The University of Virginia unveiled their 54-chair infusion center in 2019 which specializes in chemotherapy infusions, allowing cancer care demands to be better met and accessible to a larger population of Virginia and surrounding areas (University of Virginia, n.d.). Like any other infusion center, UVA's has hundreds of moving parts so it becomes incredibly complex for both practitioners and patients to understand, manage, and most essentially, improved. It is so complicated to understand the root issues affecting efficiency of the system because the center must see a wide range and variability of patients, treatment plans, at different points during their treatment cycles, and mixes of medication. Simply expanding number of chairs will not increase the throughput of patients; other factors affect ability to meet demand when patient need of cancer and infusion services increase (Tempels, 2018).

Before examining and analyzing these complex internal processes, it is important to consider the areas of external difficulties that may act as constraints to the work being completed

by the technical project. Nurse shortages are just about the biggest issue in patient care and limit the maximization of throughput in an infusion center as they are the essential link in the handling of patients and administration of chemotherapy drugs. This is a national problem which was predicted back in 2001 by the Oncology Nursing Society Position, who posited that in 10-15 years, demand for nurses will rapidly outpace available number of nursing positions (ONF, 2001). This prediction was exacerbated in 2020, when the COVID-19 pandemic emerged. Because of the pandemic, Virginia reported 31% of its nursing facilities reported one or more staff shortage and 200,000 COVID-19 deaths were recorded among nursing residents and staff, severely reducing the ability to meet the growing rates of cancer care (Chidambaram, 2022).

This challenge is only confirmed within the UVa infusion center itself. Their expected capacity planning schedule depends on the staffing of 15 nurses, but they frequently run at as low as 13 with the same capacity demands, due to call outs and just general lack of hires. On top of that, on overbooked days the UVa nursing staff must flex up to handle 3 or 4 infusion chairs at once when the normal should be closer to an average of 2 at a time, causing burn out and reduced satisfaction among nurses. This problem of too many patients, not enough nurses, is occurring everywhere, not just UVa, so adding nurses to the rotation is an unactionable solution, just like how adding chairs to the facility doesn't improve the utilization rates or process in general. The technical project must look toward identifying more internal factors to alleviate these major external ones, like the nursing shortage. By focusing on modeling the infusion center's environment in various ways and performing analyses that can test sensitivity of key levers, partially identified as elements in Table 1, this can be accomplished. The overall goal is to understand and better the infusion process to ideally increase the utilization rates of the 45 available chairs given the demand and issues UVa health has no control over.

Like previously mentioned, even though they want to, UVa Health management teams do not currently have a good picture of how to improve their infusion center to reach the throughput of patients and/or utilization of infusion chairs they need. As a first step in eventually implementing meaningful change given the constraints of the center, this project is designed to help understand who is in the system, the steps of the system, and how long each segment takes. This project can be outlined according to the SEIPS model. It helps organize systems by viewing processes at a broad level and breaking it down into 3 groups: work structure, process, and outcomes, with no specific guidance on which elements are critical (Carayon, 2006).

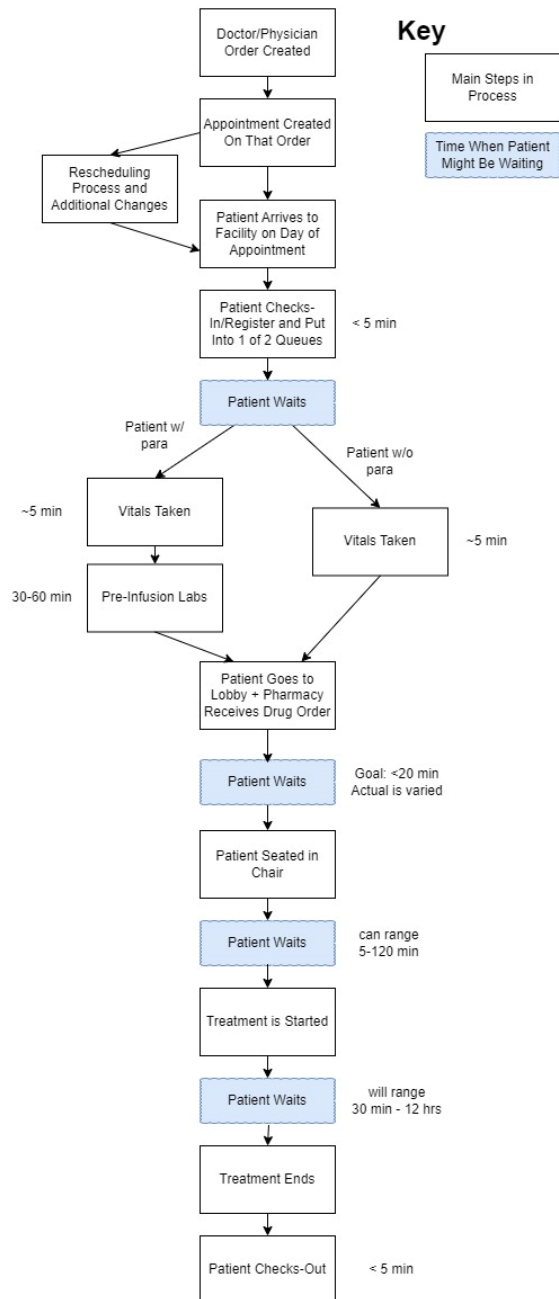
Table 1: Components and elements of the SEIPS model for the UVa Infusion Center from Carayon, 2006 and edited by Anna Bustamante

	Components	Elements (examples)
Work system or structure	Person	Motivation (cancer care, infusion needs) Education, skills (nursing school, health literacy) Physical characteristics
	Organization	Teamwork Organizational culture and patient safety culture Work schedules (nurses, call outs) Management (Cancer Center, UVa Health) Performance evaluation and incentives
	Technologies and tools	Medical devices (infusion pumps, pharmacy machines) Information technology (health records, scheduling alerts, data keeping, signed orders, treatment plans) Human factor characteristics (usability)
	Tasks	Variety of tasks Job control and participation in tasks Job content and challenge Demands (patient capacities, workload, areas of active attention needed)
	Environment	Layout Chairs and pod design Noise and lighting
Process	Care and other processes	Care processes (pharmacy, labs) Information flow Cleaning and maintenance
Outcomes	Employee and organizational outcomes	Job satisfaction or burnout Employee safety and health Turnover Profitability (utilization of chairs)
	Patient outcomes	Patient safety Quality of care

Table 1 above depicts how the infusion center’s system can begin to be laid out to understand key processes and potential challenges that may limit utilization of services upon closer examination. From this table the UVa’s infusion center can begin to be illuminated across multiple levels. outlining key components and flows of the infusion center like seen in the SEIPS model of work system and patient safety table and the Patient Flow Map in Figure 1 to the right.

Figure 1 to the right, this is another mapping method for taking into account how the infusion center functions specifically with patients at the center, but like the SEIPS model, it is only a start. Value mapping, observations, literature review, and sensitivity analyses are key parts in being able to analyze the whole process and understanding where and what levers can be pulled to increase throughput in the clinic, what UVa management is most concerned with. Because the technical project involves such observations in an actual clinic, they will be completed by the team as fully disclosed spectators with a broad focus, to not only get as much information as possible, but to also adhere to sensitivity when it comes to observing a healthcare process with patient treatment occurring during the

Figure 1: Patient Flow Map of the UVa Infusion Center with Expected Times created by Anna Bustamante (and team)



period of observation (Patton, 2015). By examining infusion center data, holding interviews, and performing multidimensional analysis, measurements of improvement and eventually high-level changes can be identified and incorporated into the system and operational practices to mitigate UVa's capacity problems.

STS Topic

Cancer treatments in general are incredibly complicated process with many groups of stakeholders involved: patients, administration, care providers, support groups, etc. As patients are expected to assume more and more responsibility for their own care and decisions regarding their care, health literacy has become key to a treatment's positive outcome (Samoil, 2021).

Health literacy is the ability to comprehend and use such information to make informed decisions in their own healthcare (Fox Chase Cancer Center, 2022). Lacking a good understanding of the system is proven to negatively affect a treatment's outcome. A study conducted in 2016, found the limited cancer health literacy rate to be 18% among cancer patients and discovered that those with limited health literacy struggle to adhere to medication regimens and effectively communicate with providers (Dumenci, 2015). They therefore suffer a lower quality of care and increasing risks of adverse health outcomes because of this.

Poor health literacy isn't limited to patients who may need cancer care services, but also reaches into general medical services everywhere. It includes any other healthcare system that requires navigation and understanding of in order to get better and improve quality of treatment. It is also important to note that health literacy is a predictor of health status for a diverse group of people, ranging from different ages, education levels, income, racial, and ethnic backgrounds; this means not one group is affected by poor health literacy and are quite possibly affected differently based on these factors (Fox Chase Cancer Center, 2022). Additionally, the

generational growth of cancer case rates previously discussed, compounds the issue of poor health literacy. As more and more people are forcefully entering due to negative diagnoses, they have to actively participate in their healthcare, but don't have the know-how to navigate the medical system they just entered, increasing numbers of people with poor health literacy.

One way to further examine this topic is using the Social Construction of Technology framework (SCOT). The SCOT approach illuminates how social structures can influence the development of technology and therefore will be applied to this STS topic (Klein, 2002). By considering health literacy a technology, it can help pinpoint areas and groups of people where health literacy may be poor and then improved. SCOT is made up of four components that are key in understanding the current state of health literacy and its artifacts: interpretive flexibility, relevant social groups, closure and stabilization, and the wider context. Interpretive flexibility suggests that technology outcomes depend on the social circumstances in which they were developed. The relevant social group component breaks down the working system into definable groups that use the technology in accordance with their characteristics. Closure and stabilization refer to design and modifying the technology until conflicting images of the artifact are resolved and no group has a problem with it anymore. The last component, a wider context, is a more minor concept in the SCOT framework but involves considering when and the environment in which the artifact development occurred (Klein, 2002). All together SCOT will outline a view of health literacy and how groups developed and used this technology, to understand the issues in health literacy rate and find areas for improvement.

Limitations of the SCOT framework includes observing society as composed of groups but because of this it fails to show inequalities and may even prevent participation, especially if they must be broken down into a diverse collection of subgroups (Klein, 2002). For this STS topic,

we will use SCOT to recognize structures within the health literacy system, but we will make note of power differences that may present throughout that would otherwise be overlooked by the SCOT framework.

This STS research paper will show how limited patient health literacy has a direct association to poor understanding of care, preventive care, and access to such services, as well as the risks it may pose to the UVa Infusion Center system (Benjamin, 2010).

Research Question and Method

The STS related research question I will be investigating in relation to my technical project is: what practices should be implemented to improve health literacy across the healthcare system to better treatment outcomes both across the board and in cancer care and are there specific groups of patients that can be targeted for best deployment of practices discovered?

The primary methodology I will use to pursue this research question is through literature review and synthesis of their findings into my own conclusion. As I currently don't have the resources, connections, or experience to conduct a proper assessment or survey of health literacy rates in patients, particularly those with a cancer diagnosis, using academically sound work to back up my investigation and conclusions is the most feasible method at my disposal. Current literature collected comes from reputable health organizations or published case studies on current health literacy rates and its effects on patient outcomes to understand how prevalent of an issue health literacy, starting with the recent Milken Institute health literacy, which reported that only 12% of adults living in the US have proficient health literacy (Lopez, 2022).

The following research will focus on understanding the breadth of the issue to dive deeper into which groups have disproportionately low health literacy and eventually I can quantify and scope how many people are affected, and the potential opportunity in improve

quality of care and outcomes that comes with good health literacy. Additionally, literature review will focus on techniques the healthcare system can employ or practices made accessible that can improve health literacy across the board and improve the low rates of literacy found. There will be an emphasis on cancer care, but this may be too narrow of a view later as I continue the research to answer the question. I will consider the application of general techniques to improve literacy in healthcare overall and which populations should be targeted across the board to best reduce gaps in education and understanding and create a targeted approach for cancer literacy from the broader evidence and trusted literature.

Conclusion

The technical project will work toward outlining and understanding UVa's infusion center from a holistic standpoint to identify levers that can be pulled within the center. Once this is completed, the team can improve the success of the system by pulling these levers and allowing more patients to be seen and treated to meet the infusion service demand which is putting a strain onto the current capabilities of UVa. Piloted solutions can be implemented from this analysis and success will be quantified. The STS research will discover and report on how big of a problem poor health literacy is among patients. It will help identify the biggest areas of change and practical solutions that increase good health literacy for stakeholders in the system. Once these methods can be identified, the impact of improving health literacy can be quantified across the industry and even more specifically, in the improvement of cancer care outcomes.

These two topics will work together to increase accessibility and knowledge of cancer care services to patients, giving them the best opportunity possible to get the best health outcomes from their treatments.

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