Thesis Project Portfolio

Provably Clean: A Formal Analysis of Hand Hygiene During Anesthesiology Induction
(Technical Report)

How Telemedicine Can Influence the Healthcare Access Disparities in Rural Areas of the United States

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The first medical procedure using anesthesia was performed in 1846. In the years since, anesthesia has become widely used and is much safer for patients with current regulations. But anesthesia inductions can still lead to infections, especially if hand hygiene is not prioritized. This puts patients undergoing medical procedures at an additional risk. Hand hygiene is important in the induction process, as it's a major contributor to healthcare associated infections. These infections can lead to sepsis, which accounts for around 270,000 annual deaths in the US. Standardizing the safest induction procedure will reduce the probability of infection, from hand hygiene or otherwise, and increase overall patient safety.

To address this problem, my team and I will use a novel computational method to study the different steps in the induction process and track the transmission of pathogens. Model checking (an automated approach to performing proofs) with a program called PRISM will be performed to understand if anesthesia induction process models exhibit any desirable characteristics or contamination. This analysis will include non deterministic factors, such as skipping steps and accidentally touching hands together.

While anesthesia inductions are performed in person, virtual medicine has grown extremely especially during and after the COVID-19 pandemic. Telemedicine encompasses virtual visits and remote monitoring. It's essential to consider the human and social dimensions of this technology because not everyone has access to the necessary technology and not everyone has the same opinion on telemedicine. There are a lot of socioeconomic factors that play a role in telemedicine usage.

One framework relating to telemedicine is infrastructure. Telemedicine is a large infrastructure completely transparent to us. The computers, tablets, and smartphones we already own can support virtual meetings with medical providers. Not everyone has access to this technology, for example rural areas in the US are less likely to have this technology compared to urban areas. Also, the telemedicine infrastructure is learned by membership. As patients continue to use telemedicine, they become more comfortable with the technology as well as find more of the benefits.

Surveys of rural areas on telemedicine before and after the COVID-19 pandemic will be analyzed to come to conclusions on rural opinion of telemedicine use. I expect to find trends relating to rural respondents' opinions as they become more comfortable with telemedicine as well as relating to age. I also expect to see trends in positive views of telemedicine before and after the pandemic begins. In general, trust towards the health care system is very important, whether that is for telemedicine, a procedure requiring anesthesia induction, or anything else. Any research to improve trust in the US healthcare system is beneficial as there are healthcare disparities that need to be addressed.