DEVELOPMENT OF A RELIABLE DRIVE SYSTEM FOR MEDICAL ULTRASOUND IMAGING

HOW DO DIFFERENT ACTORS IN THE MEDICAL NETWORK CONTRIBUTE TO OVER-IMAGING?

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A SOCIOTECHNICAL SYNTHESIS

The integration of diagnostic imaging is both appreciated for the advancements it brings to patient care and frowned upon because its overuse leads to increased patient risk and waste. From a medical device perspective, the technical research focuses on designing ultrasound imaging technology that is more accessible and safer for patients. It is imperative to also consider if prioritizing the accessibility of a medical device during design contributes to the overuse of its technology. The science, technology, and society (STS) topic provides a framework through which medical actors are analyzed as contributors and curbing agents with respect to how their relationships impact the overutilization of imaging. The technical and STS topics are tightly coupled in the way that they analyze different perspectives of diagnostic imaging use. The former focuses on the optimization of device accessibility while the latter studies how the use of those technologies are abused in the medical network.

The spectrum for ultrasound imaging procedures ranges from no guidance to full intervention; the former typically results in less accuracy and more pain while the latter is more expensive and less accessible. Developing an intermediary device will produce robust 3D images that improve patient diagnoses without over-exhausting resources or money. With Rivanna Medical, the capstone team is testing different subsystems for the reliability and efficacy to optimize the overall device design.

Formal quality tests for the actuator and flex management system were developed and executed. Factors such as noise, force, and flex resistance were measured and analyzed. The subsystems performed as expected and the results either closely resembled prior tests or resided within the predetermined acceptance criteria. Therefore, next steps for Rivanna

would be redesigning the subsystems into the device's design for better manufacturability and application.

The STS research was motivated in understanding why there has been a drastic increase in rate of diagnostic imaging over the past twenty years and what has contributed to that. Through preliminary research, a thesis was developed around identifying actors in the medical network as contributors or curbing agents. Callon, Latour, and Law's Actor Network Theory was used as a framework to analyze how curbing agents counter contributors to reduce imaging overuse. Identification and analysis were completed by reading multiple medical publications, case studies, and expert opinions from imaging specialists.

Physicians were identified as the most significant contributors to over-imaging and are heavily influenced by their working relationships with radiologists, the US legal climate, and financial motivations. Additionally, due to medical ignorance and anxiety, increased patient involvement and poorly disseminated imaging standards have contributed to imaging overuse. On the contrary, insurance companies' policies, proactive campaigns by medical societies, and legislation have worked to curb imaging by targeting financial incentives for imaging along with its burden on healthcare costs. The curbing agents interacted with the contributors through campaigns and policies such as reduced insurance coverage and legislation that targeted opportunities for financial return. In conclusion, this research highlighted current shortcomings in curbing agents and a more holistic approach was proposed on ways to reduce over-imaging such as harsher legislation and more aggressive integration of campaigns.

Diagnostic imaging technologies are incredibly useful for patient diagnoses, especially in more severe cases such as cancer biopsies. However, improving their accessibility should

only mean that more of those in need receive it. It is imperative to develop a healthcare system that allows patients to receive the appropriate and most effective amount of care.

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