Thesis Project Portfolio

Force Sensing Interventional Radiology Device

(Technical Report)

The Impact of New Medical Devices on Role Boundaries Between Different Healthcare Occupations

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

As the medical device market continues to grow, it is paramount that we consider the training systems needed to gain proficiency in using a novel device as well as how a device changes a clinician's job responsibilities. When new devices are introduced into a hospital setting, the clinicians must quickly learn how to use these technologies that commonly lack feedback software. This deficit in immediate feedback elongates the training process and could result in patient injury. New technology can also alter clinicians' networks as they begin to interact with employees from other disciplines during the training process.

While the minimally invasive nature of interventional radiology (IR) procedures decreases recovery time and the risk for infection, it also limits the amount of visual feedback that surgeons receive. To address this problem, my technical thesis involved designing a device that is capable of detecting the force that IR tools exert on blood vessels. To construct our device, my group and I designed a thin and low-cost force sensor that could be wrapped around existing IR tools. To determine if our sensor was capable of detecting force in a vessel-like structure, we modeled and 3D-printed an anatomically accurate abdominal aorta (AA) out of a material with similar properties to that of a real vessel. Our results demonstrated that when our sensor was wrapped around an IR device called a Cook Aortic Endograft, it was able to detect changes in force applied to the AA model. We also determined that our sensor was more sensitive to force changes than a commercial FlexiForce sensor. By providing IR surgeons and residents with numerical force feedback, our sensor could improve training and decrease the incidence of vessel rupture.

My STS thesis investigated how the introduction of new medical devices into a hospital setting can alter clinicians' role boundaries. By examining a clinical pharmacy case study where

new IV pumps expanded the pharmacists' technical and interdisciplinary network, I found that values and value conflicts were the primary drivers for role boundary changes. Through the use of Actor Network Theory and Value Sensitive Design, I discovered that the key actors and stakeholders in this case study were the IV pumps, nurses, pharmacists, and hospital executives. I also found that the greatest difference in values existed between the hospital executives and the clinical staff. Lastly, I suggested training strategies and device integration methods that promote the values of all stakeholders in order to avoid value conflicts and ensure a positive reception of a new technology.

The medical device market should move towards creating devices with embedded feedback technologies that uphold the clinical values of healthcare workers and can be used to train clinicians. This shift will minimize the effect of novel technologies on role boundaries and protect patients.

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