Thesis Project Portfolio

Quantitative ACL Tibial Guide: Improving Clinical Outcomes of ACL Reconstruction Surgery

(Technical Report)

Disparities in Service and Accessibility for ACL Reconstruction between Medicaid Adolescent Patients and Privately Insured Adolescent Patients

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2023

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Sociotechnical Synthesis

My technical work and STS research both focus on a surgical procedure called anterior cruciate ligament (ACL) reconstruction. This procedure is done when the ACL ligament in the knee is torn and a new ligament must be implanted. While ACL reconstruction is the main topic of both of my works, they look into differing perspectives. The technical portion focuses on redesigning a tool called the ACL tibial guide to potentially improve postoperative clinical outcomes and prevent re-injury of the ligament. The STS portion discusses the differences in ACL reconstruction accessibility between adolescent patients under Medicaid, a type of public health insurance, and patients supported by private health insurance. Even though the two projects approach ACL reconstruction differently, the topic is consistent between both.

As mentioned, my technical report focuses on redesigning the ACL tibial guide, a surgical tool used during ACL reconstruction to guide the new ligament into the knee. My capstone team used CAD to design the guide to be prototyped and 3D printed for testing. We continuously iterated the design based on functionality, aesthetics, and professional feedback. Our design is based on a feature that our advisor patented; the focus of the new design adds a measuring component to the tool. This component measures the anterior-posterior (AP) distance, which would help in placing the guide in a more optimal position in the knee in comparison to current surgical practices. By optimizing the placement of the guide, we hope for reduced failure rates and improved surgical outcomes.

While my technical work focuses on redesigning the tibial guide, my STS work discusses ACL reconstruction from another perspective. My STS research paper explores the power dynamics between ACL reconstruction patients of different health insurance, and it also shows how the difference creates a disparity in patients' access to care. I argue that adolescent patients

under Medicaid are implicitly biased, in comparison to patients who are under private health insurance, because of Medicaid's design. By using the technological politics framework, the paper reveals how those with Medicaid have less access to booking appointments, receive a later diagnosis, and do not receive adequate post-operative care due to biases created by Medicaid. By discussing the topic in this way, people could have a better understanding of the disparity in patient care and how that affects patients in marginalized demographics.

By working on the projects simultaneously, they not only provide an overall context of the topic but also add important context to each project individually. The technical work of the project provides extensive knowledge in designing medical devices, but it also provides essential background information for the STS research portion. In addition, the STS portion also provides the social and legal perspectives of a highly technical field of ACL reconstruction. As a biomedical engineer interested in medical devices, it opened my view to the many factors that an engineer must consider when designing and developing designs, which hopefully I can implement in my future work. In conclusion, the technical and STS portion of the project let me have a better appreciation for the complexity of United States health services by looking at not only the technical side of ACL reconstruction but also its social side.