Thesis Portfolio

Three-Dimensional Modeling of Lung Volume in Applications to Scoliosis

(Technical Report)

Impact of Implicit Bias on Healthcare Outcomes for Women of Color in The United States

(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, 2020

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Sociotechnical Synthesis

Introduction

This portfolio contains two projects, a technical project and an STS research paper. The STS research paper focuses on the impact of implicit bias on healthcare outcomes for women of color in the United States. The technical project aims to create a computational model for calculating lung volume from x-ray images for adolescent scoliosis patients. While the connection between these two projects may not be immediately apparent, there are many threads that connect the motivations behind each project. First, both projects are in the healthcare space, and second, they both focus on the relationship between doctor and patients. Specifically, both of these projects aim to improve patient outcomes that are dependent on physician-patient interactions. Reducing variability and standardizing healthcare procedures is the ultimate goal of both projects. In this way, the STS research paper and the technical project are directly related. Standardizing healthcare procedures can reduce the impact of implicit bias in the same way that standardizing lung volume calculation can reduce the uncertainty of physician decision making for scoliosis patients.

Technical Project Summary

Idiopathic scoliosis is an abnormal curvature of the spine that can cause visible deformity, emotional distress, back pain, and respiratory impairment. To correct spine curvature and allow proper development of the chest wall, the main approach is surgical in nature and involves a procedure called “spinal fusion” that fuses the vertebrae to prevent further curvature of the spine and correct deformity. The fusion of the spine's vertebrae into a single, solid bone stunts the growth of lungs in growing children. For children with scoliosis that are in an intermediate age range in which they may have developed enough lung volume to have sufficient pulmonary

function after spinal fusion, it is necessary to know the stage of lung development that the children have reached. Currently, total lung capacity (TLC) is measured through CT scans. This is a problem because CT scanners use 100 to 500 times more radiation than conventional X-rays. Most doctors choose not to use CT scans to calculate TLC and instead use their judgement based on factors such as the child's age or build to determine whether surgery is appropriate. Thus, there is a need for a method of gathering accurate TLC measurements from children with scoliosis without radiative effects so that physicians may determine the safest and most effective plan of treatment for these patients. The technical project aims to develop a method to calculate lung volume from X-ray scans.

STS Project Summary

The medical profession aims for equal treatment of all patients. Nevertheless, disparities in healthcare are prevalent. One of the most vulnerable groups in the United States healthcare system are women of color. African American women are three to four times more likely to die during or after delivery than white women. In fact, African American women's odds of surviving childbirth are comparable to those of women in countries such as Mexico and Uzbekistan. To better understand why the American healthcare system is failing women of color, this research asks the question: "What is the impact of implicit bias on healthcare outcomes for women of color in America?" Furthermore, this question is contextualized in the STS framework of co-production to examine the impact of implicit bias on coproductivity between patients and clinicians. Lastly, the foundations of coproduction, as well as its use in healthcare policy in other countries, are used to suggest improvements in patient-centered care in American healthcare. This research aims to create a novel connection between the ideology of coproduction and implicit bias. Through examining the negative impact of implicit bias on the coproduction of

outcomes between patients and physicians, this paper aims to produce tangible and specific ways in which implicit bias impacts women of color. Lastly, implementing healthcare practices that promote coproduction are reviewed as a solution to reduce the impact of implicit bias.

Reflection

By working on the technical project and the STS research paper at the same time, I gained valuable insight into ethical considerations that I would have missed otherwise. When my group first learned about our technical project, the impact of physician bias never came to mind. We were simply told that the common practice was for the physician to determine whether a child was eligible for final fusion surgery based on metrics such as age. However, by doing research for the STS project, I realized that physician bias certainly had a role in our technical project as well. Inversely, the solution for our technical project, to create a mathematical model that standardizes physician decision making, contributed to my STS research project. I was able to use the idea of standardization to examine how the impact of implicit bias can be ameliorated in the healthcare system.