

Thesis Portfolio

Computational Modeling of Esophageal Stricture

(Technical Report)

Understanding the Influence of Healthcare Systems on the spread of Medical Tourism

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Introduction

Differential medical techniques across the world, including diagnostic measures, device regulation policies, and a country's inherent medical insurance policy influences whether individuals will look to engage in a certain medical treatment locally or abroad. Understanding these factors that contribute to the medical system is incredibly important for healthcare professionals, clinical research teams, and medical device and drug companies. Gaining insight into the migration habits of medical patients around the world will allow research advancements to be more patient and region specific, improving overall long-term treatments.

The technical project is oriented around finding a new treatment to esophageal stricture, a surgical complication arising from the birth defect of esophageal atresia. This new diagnosis and treatment method is designed to reduce required hospital visitations of individuals with esophageal stricture by providing a long-term treatment method. Insight on medical travel patterns, regulations of medical devices, and insurance policies around the world will highlight where a clinical technique, such as the one studied in the Capstone Research Paper, will be most effective and clinically available. For this reason, the STS research topic focuses on the important factors that influence the medical tourism industry and how the industry will have lasting implications on the approval rating and public acceptance of medical insurance policy. Learning about the effects of medical tourism will affect the actions of hospital managers, physicians, and medical research teams looking to advance the state of clinical care.

Computational Modeling of Esophageal Stricture

Esophageal atresia is a congenital birth defect resulting in a discontinuity between the lower segment of the esophagus and the stomach. Corrective surgery to treat esophageal atresia

has a high success rate, but results in the common future complication of Esophageal stricture, or narrowing at the esophageal correction site. This study provides a detailed analysis of patients with esophageal stricture, including information about respiratory complications, form of corrective surgery, and other unique characteristics. With the patient's information, individual computational modeling of esophageal images, primarily x-rays, was conducted to obtain vital quantitative information regarding the flow dynamics of strictured esophagi. This information includes contours of the esophagus illustrating regions of the greatest stress, dynamic pressure, and velocity profiles. This study presents a thorough, individual analysis for each patient highlighting the unique characteristics of esophageal stricture. The results of this study will provide key information for designing an implantable device into specific patients with esophageal stricture.

Understanding the Influence of Healthcare Systems on the Spread of Medical Tourism

Medical tourism is a growing phenomenon around the world. Today, patients from all around the world are exercising their autonomy in selecting their health care options by obtaining information from outside their usual health care providers and electing to pursue medical alternatives outside their domestic system. This study assesses which healthcare factors play a role in the spread of medical tourism to and from first-world countries. Specifically analyzed are the cost of procedures, timeliness of operations, drug and device regulations, and the standard of care within countries. Also, the study addresses the potential of medical tourism to influence public and private healthcare policy as individuals will now consider domestic insurance coverage against the greater potential industry of medical tourism.

Reflection

Working simultaneously on the year-long Capstone Research Project and the STS Research Paper required that the societal impact of the Capstone project never be overlooked. Technology has and will continue to have a lasting effect on society. Being able to step back from the innovation of the Capstone Research Project and analyze how this product will influence society was a takeaway that would not have been so clear if the projects were not simultaneous. The constant assessment of medical ethics was a requirement of the Capstone Research Project, given that specific patient information was utilized. Doing the project alongside STS research, however, ensured that the broader societal and engineering ethics also be considered. The understanding that engineering work always requires honesty, impartiality, and adherence to the highest principles of ethical conduct was ingrained by analyzing the controversial societal topics of medical tourism and healthcare insurance. Constantly assessing this important ethical code allowed for an effective application to the Capstone Research project, ensuring the broader impact to benefit society was always at the forefront of our thought. Thus, conducting the STS research alongside the Capstone Research Project helped ensure that we understand the role and duties of engineers within society.