Understanding Pelvic Organ Prolapse: A Comprehensive, Biofidelic
Computational Model of the Pelvic Floor

(Technical Report)

The Struggle to Reduce Maternal Mortality in the U.S.

(STS Research Paper)

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
School of Engineering and Applied Science
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Biomedical Engineering

by

Mary-Jean Rowson

May, 10, 2023

Preface

Women in the U.S. are more likely to have chronic conditions, use prescription medication, and need comprehensive healthcare throughout their lives than men but disparities in healthcare means women struggle to receive sufficient care. How are inequalities in women's healthcare addressed in the U.S.?

Pelvic organ prolapse (POP) occurs when pelvic organs descend into the vagina, causing painful symptoms. POP afflicts 50% of women over the age of 50, over 20 million women will be affected by 2030. Pessaries are a class of medical devices that provide mechanical support to treat POP non-surgically, but are inefficient in treating rectocele (posterior wall prolapse). The pathology of rectocele is understudied in the field of computational modeling for biomedical systems. To address this issue, healthy female MRI data was used to develop a novel computational model. Differences in pressure, force, and wall thickness were studied using finite element analysis simulations. Interpretation of displacement of the posterior vaginal wall was quantified using FEBio software. Simulation output suggests weakened mechanical properties of the vagina to be the cause of rectocele. These results may be applied in future pessary designs to improve patient outcomes.

Maternal mortality in the United States (U.S.) is the highest amongst industrialized countries, yet two of three maternal mortalities are preventable. Improvements to this crisis are slow and are hindered by racial and socioeconomic disparities. Pregnant and postpartum women and the advocacies that represent them, healthcare professionals, and professional societies are developing initiatives that reduce MM.