

Design of Focal Therapy Paradigms for
Breast Cancer-derived Extracellular Vesicle Modulation
(Technical Report)

Responses to Age-Related Shortages of
Healthcare Professionals in the United States
(STS Research Paper)

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by

Nghi Tran

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Preface

Within the past two decades, rapid developments in early cancer detection and cancer therapeutics have improved prognosis for many patients. Focused ultrasound (FUS) is a technology being developed for its potential applications in cancer therapy. By improving patients' health, better cancer therapies can reduce patient loads, but by increasing cancer survivability and extending lifespans, they can stress healthcare provision.

Can FUS technology help with the diagnosis and characterization of breast cancer? FUS uses sound waves concentrated into a focal point to heat target cells. All cell types release small lipid-shelled vesicles containing payloads characteristic of the parent cell, called extracellular vesicles. Under the mentorship of Dr. Sheybani of the University of Virginia's Department of Biomedical Engineering, the project team used FUS to optimize the release of extracellular vesicles from murine breast cancer cells. We also compared the vesicles released from FUS-treated to radiation-treated cells. Nanoparticle tracking analysis was used to measure the concentration and size of vesicles released. We characterized the transcriptomic profile of these vesicles to identify miRNA biomarkers of cancer using RT-PCR.

How is the US healthcare sector responding to age-related stressors? An aging population is subjecting the US healthcare system, especially primary care and nursing, to stresses. Shortages in primary care and nursing have been exacerbated by policies reflecting the historical influence of professional healthcare associations and businesses. However, new policy trends, supported by many participants, may alleviate these shortages. In the US, raising caps on medical residencies, reforming immigration and health insurance policy, and implementing nursing staffing minimums, may help to meet the healthcare needs of an aging population.