Prostate Biopsy Gun Strength Assessment

Overview
Prostate cancer is the most prevalent type of cancer affecting men in developed countries. A trans-rectal, ultrasound-guided prostate biopsy is the gold standard for diagnosing prostate cancer. Currently, quantitative metrics of the Bard Magnum and Gallini Evolution, biopsy guns used at Geisinger Health System’s Department of Urology, are unknown. Knowing these metrics offers physicians a better understanding of the quality and condition of their devices and helps to improve patient care. Thus, the goal of this project was to measure the needle velocities and forces of the Bard Magnum and Gallini Evolution biopsy guns.

Objectives
- Obtain accurate needle force and velocity measurements of the Bard Magnum and Gallini Evolution biopsy guns
- Understand the internal firing mechanism of the Bard Magnum biopsy gun
- Analyze and present data to Geisinger urologists

Approach
- After discussing the project problem with Geisinger urologists, it was determined that a comparative analysis of the Bard Magnum and Gallini Evolution biopsy guns would serve as the project deliverable.
- After modelling the design concept in SolidWorks, an adaptable testing rig was constructed with borrowed materials and scrap metals and plastics.
- A force gauge and high speed camera were used to acquire the needle forces and velocities, respectively.
- A spring force analysis was used to verify the method for calculating needle force.
- ImageJ was used in the post-processing of the velocity images.
- The needle force and velocity data were analyzed for statistical significance.

Outcomes
- There is a significant difference between the needle forces of the Bard Magnum and the Gallini Evolution biopsy guns.
- There is a statistical difference between the needle forces of the two identical Bard Magnum biopsy guns.
- The Bard Magnum fires with a higher needle velocity than the Gallini Evolution.
- It is recommended that Geisinger urologists record what biopsy gun is used during each procedure.