Medical simulations provide hands-on training at various levels of care and learner expertise. Unfortunately, these simulators are often made from materials that fail to mimic the look, feel and behavior of human tissue. These plastic, silicone and polyethylene vinyl chloride (PVC) materials are typically selected based on the subjective opinions of medical experts. Currently no objective process for selecting and validating simulated human tissues exists. This research intends to change that by investigating the following hypotheses:

- **H1**: Gaps exist between synthetic and human pleura performance.
- **H2**: Human tissue fracture mechanics define desired performance of synthetic tissues.
- **H3**: Synthetic and human tissues with similar stress/strain parameters will behave similarly when blunt punctured.

Human parietal pleura was selected because it contributes critical haptic feedback for the tube thoracostomy procedure. Blunt puncture of the pleura results in a "pop" that informs the trainee that the proper anatomic space has been accessed. A tube is then inserted to drain air and fluid from this space.

This research used stress/strain fracture mechanics from fresh human cadaver pleura to define pleura performance requirements. Synthetic pleura were prototyped and their fracture performances verified. Two commercial simulated pleura were puncture tested to baseline performance. Compliant custom and one off-the-shelf formulations were puncture tested. A non-compliant but common pleura substitute was also puncture tested for comparison. Blunt puncture force and displacement were compared for each of the materials to test the stated hypotheses.

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Approved for distribution by Yuanli Bai, Committee Chair, on November 13, 2017.

The public is welcome to attend.