**Background**

The AU/UGA medical partnership seeks to utilize realistic simulations for education within the simulation lab. Simulated glucometers allow medical students to perform a procedure vital to patient care without the risk of exposure to bloodborne pathogens. However, currently available simulation models are both expensive and unreliable. Current models:

- Leak from puncture site
- Require fluid mixing
- Have unrealistic finger tips
- Are expensive

**Design Objective and Process**

**Objective:** Design an affordable, reusable glucometer system that will allow procedure performance and will provide a result that can be programmed to fit different scenarios

**Finger**

- Primary challenge: preventing leakage
- Material of choice is silicone
- Elasticity prevents leakage from small hole
- Pressure from procedure forces blood solution out

**Glucometer**

- Initial plan to repurpose OneTouch Verio Flex™ was unsuccessful
- Updated plan:
  - Program ESP32 integrated device (MicroPython)
  - Design device casing to resemble glucometer (Inventor + 3D print)

**Design Requirements**

<table>
<thead>
<tr>
<th>Need</th>
<th>Specification</th>
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<tr>
<td>Compatible with current system</td>
<td>Finger attaches to Pediatric Hal Manikin. Glucometer device is wireless for simulation use.</td>
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<tr>
<td>Realistic</td>
<td>Finger size &amp; color resemble child middle finger. Device resembles functional glucometer.</td>
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<td>Does not leak blood following lance</td>
<td>Able to withstand 810 lances (approx. 1 semester based on sim. schedule) without leakage.</td>
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<td>Allows sim. blood collection on test strip</td>
<td>Able to produce NLT 3µL (1 droplet) of blood solution following lance. Device includes test strip insert.</td>
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<td>Easy to maintain</td>
<td>Allow for NLT 5 procedures before refilling → reservoir capacity NLT 15µL.</td>
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<td>Run sims with little instructor intervention</td>
<td>Display automated series of blood glucose levels based on clinical scenarios. Does not require extensive preparation/blood solution mixing.</td>
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<td>Sufficient battery life</td>
<td>Battery lasts NLT 3 hours (1 simulation block).</td>
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<td>Inexpensive</td>
<td>Unit + startup cost NMT $200.</td>
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<tr>
<td>Durable in case of drop</td>
<td>Casing remains intact following drop from table height (28 in)</td>
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**Design Evaluation**

- Repeated lance testing on finger
- Finger life/ durability
- Procedure performance test with medical students
- Reality
- Ease of use/ coordinator intervention
- Overall satisfaction
- Casing drop test from table height (28 in)
- Durability analysis

**V&V Results:**

- Increase the accessibility of simulated systems
- Enhance medical student training
- Improve healthcare quality on a large scale

**Conclusion & Impact**

Simulation Labs are vital to medical student training, and our design overcomes barriers:

1. Cost
   - Current market cost upwards of $2000
   - Our design cost: ~$50
2. Replicability
   - Our design → simple manufacture
3. Extensive maintenance
   - Low unit cost + simple manufacture → easily replace damaged parts

**Sponsor/Client:** Dr. Aimee Martin, AU/UGA