**Title**

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# 88 Hi-Fi Simulation Doesn't Need to Break the Bank: A Low-cost Homemade Transvenous Pacemaker Insertion Simulator

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**Background:** Transvenous pacemaker insertion (TVPI) is a relatively rare and potentially life-saving procedure that Emergency Medicine residents are expected to learn and perform during their training. Since the procedure is infrequently performed on live patients, simulation provides a means to train residents in proper placement.

**Objectives:** Due to lack of live-patient exposure to TVPI, we set out to design and build a low-cost, stand-alone simulation model for TVPI utilizing the electrocardiogram (ECG) guided technique that automatically changes ECG tracings based on depth of insertion. Importantly, TVPI is a two-part procedure: placement of a central venous line (CVL) and placement of the TVP itself via introducer sheath. Since CVL simulators are commercially available and we already have simulation sessions for CVL, we focused on the simulation of placement of the TVP.

**Design:** Utilizing components purchased online and "borrowed" from the ED (mannequin, pacemaker introducer sheath, tubing, Arduino prototyping platform, breadboard, photo sensors, jumper wires), we were able to build the TVPI simulator for less than $50. Our setup also involved writing code for the Arduino and open-source software, Processing. The coding/design of the simulator is such that as the pacer wire is threaded through the introducer into the mannequin, multiple static ECG images on an attached laptop automatically change based on the distance the wire has been inserted. Proper placement is confirmed when a right ventricle tracing is achieved.

**Impact:** Due to the cost-effectiveness of this simulator, we were able to build three identical simulators. This allows us to run several stations simultaneously during our lab time and provides the residents multiple opportunities to practice the procedure. We have not performed an assessment of the effectiveness of the simulator; however, residents have expressed greater comfort in their skills to perform the procedure.
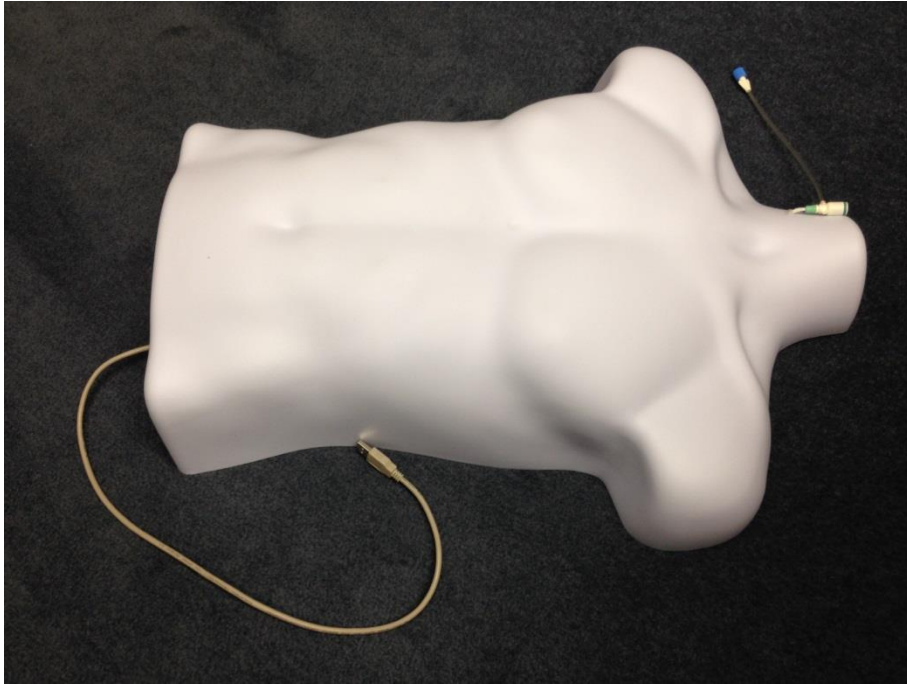
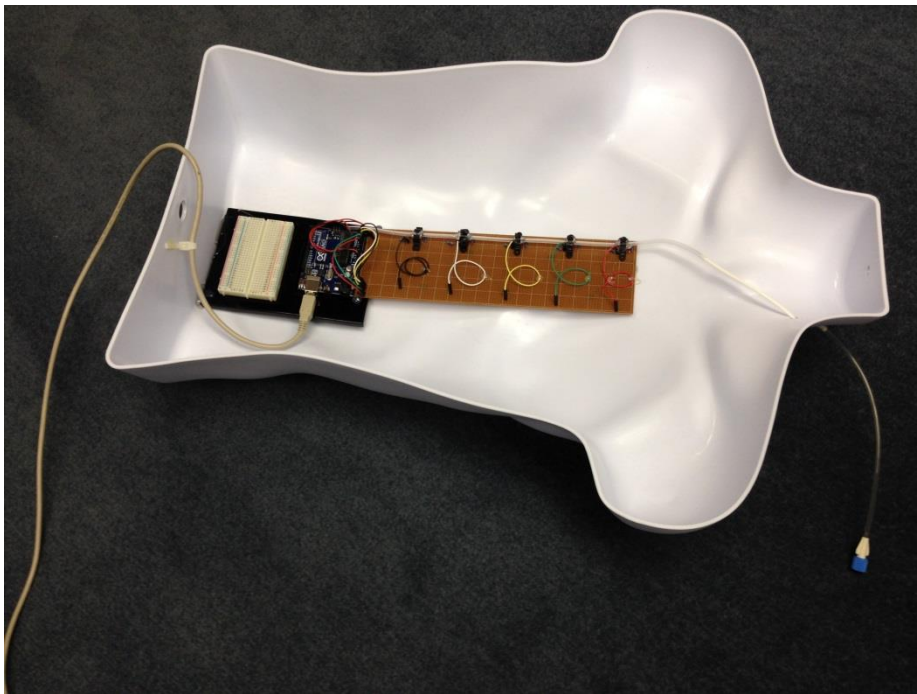**Figure 1.** Front of homemade simulator.



**Figure 2.** Back of homemade simulator.