

Sensor Technology in Assessments of Clinical Skill

Infographic created by the Technology Enabled Clinical Improvement (T.E.C.I.) Center at Stanford Medicine

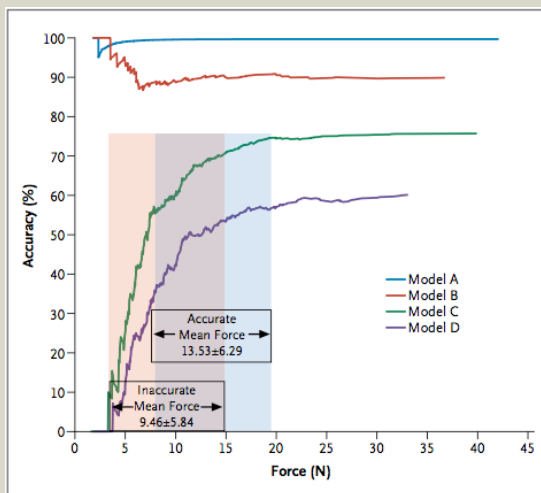
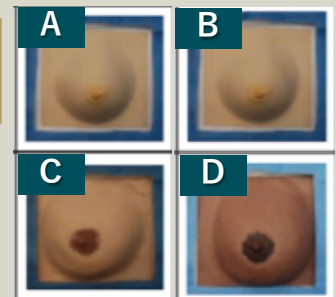


Dr. Carla Pugh, Professor of Surgery and Director of the T.E.C.I. Center, launched a study in 2013 to collect data from practicing physicians on their clinical breast exam (CBE) skills.

553 physicians were recruited to participate in the study.

Participants were asked to perform simulated CBE under conditions that mimic an office visit for a symptomatic patient on **four different** sensor-enabled breast models.

Model A: dense left breast with a soft, well-circumscribed 2cm × 2cm spherical mass, superficially located in the upper outer quadrant. **Model B:** same as A except that the mass was half a sphere (2cm × 1cm). **Model C:** dense right breast with a 2cm, irregular border, hard mass located near the chest wall in the lower outer quadrant. **Model D:** same as C except the 2cm mass was molded from a softer silicone derivative instead of hard clay.



Relationship Between Palpation Force & Accuracy in Clinical Breast Exam

Shown is a plot of accuracy in correctly identifying a breast lesion as a function of the mean (\pm SD) force in newtons (N) that the participant applied during palpation in the examination of a simulated breast model.

Analysis of sensor data reveals a significant relationship between the force used during palpation and the accuracy of the assessment of the deep-tissue lesions in models C and D

Reduced palpation forces (<10 newtons) were noted to place physicians at significant risk for missing deep-tissue lesions near the chest wall

Laufer S, Cohen ER, Kwan C, D'Angelo AL, Yudkowsky R, Boulet JR, McGaghie WC, **Pugh CM**. Sensor technology in assessments of clinical skill. *New England Journal of Medicine*. 2015 Feb 19; 372(8): 784-6.

Laufer S, D'Angelo AD, Kwan C, Ray RD, Yudkowsky R, Boulet JR, McGaghie WC, **Pugh CM**. Rescuing the clinical breast examination: advances in classifying technique and assessing physician competency. *Annals of Surgery*. 2017 Dec;266(6):1069-1074

Promoting Breast Health Awareness: Can Haptic Technology Help?

*Brought to you by the Technology Enabled Clinical Improvement (T.E.C.I.) Center
at Stanford Medicine in collaboration with the Stanford Cancer Institute*



Based on the data collected from practicing physicians on their clinical breast exam (CBE) performance, Dr. Carla Pugh created a sensor-enabled breast simulator to teach women breast self-exam skills (BSE).

The hands-on BSE Learning Experience is called **BEST Touch**
Breast **E**xam **S**ensory **T**raining

**43% of women detect breast cancer themselves, either
by self-examination (25%) or by accident (18%)**

The goal is to attend women's health events where
BEST Touch can be used to teach women about their
breast health and give women hands-on BSE training.



Framework for Community-Based Educational Events:



▶ Step 1: Haptic interaction with items that
simulate the different types of lesions that
can be found in a breast



▶ Step 2: Engage in the BEST Touch
training experience and receive feedback
on breast exam skills



▶ Step 3: Participate in a survey that seeks to
collect demographic data, breast health
behavior data & BEST Touch user data

**Photos courtesy of the 2019 BCAA event*