Published in final edited form as:

Am J Surg. 2015 October ; 210(4): 618–623. doi:10.1016/j.amjsurg.2015.05.013.

Use of Simulators to Explore Specialty Recommendation for a Palpable Breast Mass

Shlomi Laufer, PhD^{1,2}, Rebecca D. Ray, PhD¹, Anne-Lise D. D'Angelo, MD¹, Grace F. Jones¹, and Carla M. Pugh, MD, PhD¹

¹University of Wisconsin, School of Medicine and Public Health, Department of Surgery

²University of Wisconsin, College of Engineering, Department of Electrical and Computer Engineering

Abstract

Background—The study aim was to evaluate recommendation patterns of different specialties for the work-up of a palpable breast mass using simulated scenarios and clinical breast examination (CBE) models.

Methods—Study participants were a convenience sample of physicians (n=318) attending annual surgical, family practice and obstetrics and gynecology (OB/GYN) conferences. Two different silicone-based breast models (superficial mass vs chest wall mass) were used to test CBE skills and recommendation patterns (imaging, tissue sampling, and follow-up).

Results—Participants were more likely to recommend mammography ($p<.001$) and core biopsy ($p<.0001$) and less likely to recommend needle aspiration ($p<.043$) and 1-month follow up ($p<.001$) for the chest wall mass compared to the superficial mass.

Family practitioners were less likely to recommend ultrasound ($p<.001$) and OB/GYNs were less likely to recommend mammogram ($p<.006$) across models. Surgeons were more likely to recommend core biopsy and less likely to recommend needle aspiration across models ($p<.001$)

Conclusions—Recommendation patterns differed across the two models in line with existing practice guidelines. Additionally, differences in practice patterns between primary care and specialty providers may represent varying clinician capabilities, health care resources, and individual preferences. Our work shows that simulation may be used to track adherence to practice guidelines for breast masses.

Keywords

Clinical Breast Examination; Breast Cancer; Palpable Breast Mass; Simulation; Sensors; Validity; Assessment

Corresponding Author: Shlomi Laufer, PhD 600 Highland Drive K6/135 CSC Madison, WI 53792 Slaufer2@wisc.edu 608-262-5507.

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Introduction

Identifying a palpable breast mass is a challenging clinical task.¹⁻³ Benign and malignant masses present with a variety of signs and symptoms. The clinical breast examination (CBE) is the first step in evaluating symptomatic breast patients.⁴ Following the CBE, the diagnostic tests selected by the clinician can influence time to diagnosis, diagnostic accuracy, patient anxiety, and time to treatment.^{3,5,6} There is a wide range of practitioners that are involved in the evaluation and workup of patients with palpable breast masses, including family medicine, internal medicine, obstetrics and gynecology (OB/GYN), surgery, and radiology. Additionally, there are a wide variety of evaluation protocols for patients presenting with palpable breast masses.^{4,7-10} A lack of uniformity may create a spectrum of practice patterns influenced by clinician specialty and capabilities, patient characteristics and preferences, and health care resource availability.

Existing research evaluating patterns of breast symptom presentations and physician recommendations are typically based on retrospective chart reviews within a single practice community or relatively small number of physicians.^{1,11} However, this work does not capture what a large number of clinicians from different clinical specialties would recommend when presented with a particular patient scenario involving the workup of a palpable breast mass. We are interested in what practicing physicians recommend for workup of a palpable mass during a simulated clinical scenario after performing a clinical breast examination.

Our prior work in the design of medical and surgical simulators has allowed us to fabricate CBE models that present differing clinical and pathologic scenarios.¹²⁻¹⁵ This work provides us with the unique opportunity to present specific and consistent clinical scenarios to assess physical examination skills and clinical decision making.¹²⁻¹⁵ Additionally, through the use of simulation, we can assess clinical skills of a large number of practitioners without risk to the patient. In this study, we sought to evaluate recommendation patterns for the work-up of a palpable breast mass using simulated scenarios and CBE models.

Our hypothesis was that physician specialty would significantly affect the type of workup modality (imaging, tissue sampling, and follow up) used to further evaluate a patient presenting with a palpable mass.

Methods

Setting and Participants

Physicians' CBE skills and recommendation patterns were assessed using silicone-based breast models. Data were collected from a convenience sample of physicians (N=623) at three national meetings: The American Society of Breast Surgeons (ASBS) 14th annual meeting, Chicago, IL, 2013 (n=136); the American Academy of Family Physicians (AAFP) assembly, San-Diego, CA, 2013 (n=306); and the American College of Obstetricians and Gynecologists (ACOG) annual clinical meeting, Chicago, IL, 2014 (n=181). The study was approved by the University of Wisconsin Institutional Review Board.

Protocol

Data were collected from participants at designated conference exhibit hall booths containing two to four sensorized breast models. Participants completed a demographic survey, read through a clinical scenario and then performed the CBE on the breast models. After performing the CBE, participants completed the clinical findings diagram and recommendation form. This process was repeated for each model. Station to station progress proceeded in a randomized fashion.

Measurements

Using a demographic survey, all participants indicated sex, years of practice, clinical specialty, number of CBEs performed per week (0-5, 6-10, 11-20, >20), experience with teaching CBEs (Y/N), and experience using models (Y/N). After performing the CBE, all participants indicated whether they found a mass and documented the location of the mass on the clinical findings diagram. The participants gave their recommendations for further evaluation of the mass on the recommendation form. They could choose from five options: ultrasound, mammogram, 1 month follow-up, needle aspiration and core biopsy. Participants were not limited in the number of recommendations they could give.

Breast Models

At the first data collection (ASBS conference), participants were presented with two models. Based on the data from this meeting additional models were designed for the following two meetings (AAFP and ACOG). In this manuscript, only the two models common to all meetings are analyzed. This provides the ability to perform a complete analysis and compare between the specialties.

Two clinical scenarios were presented to the participants. The first scenario described an 18 year old female, who presents with symptoms of a breast mass but does not remember the location of the mass. The corresponding breast model, designated *Model 1-Superficial mass*, consisted of a dense left breast with a rubbery, well-circumscribed 2-cm spherical mass. The mass was superficially located in the upper outer quadrant (UOQ). This model was designed to represent a benign breast lesion, fibroadenoma. The second scenario described a 35 year old female who presents with symptoms of a breast mass but does not remember the location of the mass. The corresponding breast model, designated *Model 2-Chest wall mass*, consisted of a dense right breast with a 2-cm hard mass with irregular borders. The mass was located at the level of the chest wall in the lower inner quadrant (LIQ). This model was designed to represent a malignant breast lesion.

All models were integrated with force sensors and all CBEs were video recorded using a top view camera. Additionally, these practice

Exclusion Criteria

Out of the total participants (N= 623) who participated in our study, we selected a subset of participants (n =401) who performed the CBE on both *Model 1-superficial mass* and *Model 2-chest wall mass*. Of those participants additional exclusions were made. First, participants that were not attending physicians or practiced in a specialty other than surgery, family

practice or OB/GYN were excluded. Following this exclusion, 318 participants remained for analysis. Further, CBEs were excluded if the participant did not find the mass (n=81) or failed to fully complete the survey (n=40). Following exclusion, 293 CBEs on the *Model 1-superficial mass* and 222 CBEs on *Model 2-chest wall mass*, remained.

Data Analysis

Demographic data were compared between data collection meetings using Chi-Square for categorical data and ANOVAs for continuous data to assess for significant differences between each clinical group. Generalized estimating equations (GEEs) and Chi-Square tests were performed to examine whether recommendations differed by physician specialty and model controlling for number of exams per week and number of years in practice. Specialty and model were both entered as factors in the model as well as the interaction. All statistics were performed using IBM SPSS statistics version 22 (Armonk, NY: IBM Corp.). A p-value less than 0.05 was considered significant. All data were stored using a REDCap™ database.¹⁷

Results

Participant Demographics

Participant demographics are detailed in Table 1. More female than male physicians participated in the study (57%, $\chi^2=8.24$, $p<.004$). The physicians averaged 15.6 (SD=10.7) years of experience. Surgeons had more years in practice than family practitioners ($t(229)=4.42$ $p<.05$). Most of the surgeons reported “> 20 exams per week”, whereas half of the family practitioners reported “0-5 exams per week” ($\chi^2=136.32$, $p<.001$). There were no differences between the specialties in teaching the CBE or having previous experience with simulation models ($p>.05$).

Clinical recommendations

Participant recommendations are detailed by model and by specialty in Figure 1. The GEEs consistently demonstrated differences in recommendations by specialty and model type.

Ultrasound

Almost all physicians (85%) recommended an ultrasound to be performed on *Model 1-Superficial mass* ($\chi^2_{(1)}=143.37$, $p<.001$). Fewer physicians (69%) recommended an ultrasound for *Model 2-Chest wall mass* ($\chi^2_{(1)}=20.45$, $p<.001$). Surgeons were more likely to recommend an ultrasound on both models than family practitioners or OB/GYNs ($\chi^2_{(1)}=21.85$, $p<.001$). On *Model 1-superficial mass*, surgeons recommended ultrasound most followed by OB/GYNs and least by family practitioners ($\chi^2_{(2)}=24.71$, $p<.001$). For *Model 2-Chest wall mass*, family practitioners were less likely than surgeons to recommend an ultrasound ($\chi^2_{(1)}=5.07$, $p=.024$).

Mammogram

Only 10% of physicians recommended a mammogram for *Model 1-Superficial mass*, compared to 75% percent who recommended a mammogram for *Model 2-Chest wall mass*

($\chi^2_{(1)}=41.67$, $p<.001$). OB/GYNs were less likely to recommend mammograms than either the surgeons or family practitioners across models ($\chi^2_{(1)}=7.50$, $p<.006$). Family practitioners more than the other two specialties were more likely to recommend a mammogram for *Model 1-Superficial mass* ($\chi^2_{(2)}=15.02$, $p<.001$).

Needle Aspiration

There was a trend for *Model 1-Superficial mass* to receive more recommendations for needle aspiration than *Model 2-Chest wall mass* ($\chi^2_{(1)}=3.54$, $p<.060$). Surgeons uniformly did not recommend needle aspiration. Following the removal of surgeons, *Model 1-Superficial mass* received more recommendations for needle aspiration than *Model 2-Chest wall mass* ($\chi^2_{(1)}=4.10$, $p<.043$). Family practitioners were more likely than OB/GYN to recommend needle aspiration on both models ($\chi^2_{(2)}=12.10$, $p<.002$).

Core Biopsy

Physicians recommended that *Model 2-Chest wall mass* receive a core biopsy more often than *Model 1-Superficial mass* ($\chi^2_{(2)}=10.94$, $p<.0001$). Surgeons were more likely to recommend a core biopsy for both models than either family practitioners or OB/GYN ($\chi^2_{(2)}=21.51$, $p<.001$).

Follow-up

Recommendation for a 1 month follow-up was more likely for *Model 1-Superficial mass* compared to *Model 2-Chest wall mass* ($\chi^2_{(1)}=10.82$, $p<.001$). For both models, family practitioners were more likely than surgeons to recommend a 1 month follow-up ($\chi^2_{(2)}=14.66$, $p<.001$). Whereas, OB/GYNs recommended a 1-month follow-up more than either the surgeons or family practitioners for *Model 2-Chest wall mass* ($\chi^2_{(2)}=7.54$, $p<.023$).

Discussion

This study collected data on the evaluation of a palpable breast mass using CBE simulators. Over 300 attending physicians from three specialties, surgery, family practice, and OB/GYN participated in this study. We found significant differences for imaging (ultrasound and mammogram), tissue sampling (needle aspiration and core biopsy), and follow-up recommendations. These differences were observed for specialty as well as clinical scenario.

Our first model, *Model 1-Superficial mass* presented an 18 year old patient with a rubbery, 2-3cm, superficial mass designed to represent a benign mass, fibroadenoma. For a young patient with a palpable breast mass, current published imaging recommendations include ultrasound evaluation.⁹ Mammography is considered inappropriate in this scenario.⁹ In our current study, greater than 80% of participants recommended ultrasound evaluation for *Model 1-Superficial mass*, while less than 10% recommended mammography. In contrast, our second model, *Model 2-Chest wall mass* presented an older patient, 35 year old, with a 2-cm, hard chest wall mass with irregular borders that was fabricated to represent malignancy. The American College of Radiology (ACR) Appropriateness Criteria state that both ultrasound and mammography are appropriate for this scenario.⁹ There was a significant increase in the number of participants recommending mammography for *Model*

2-Chest wall mass compared to *Model 1-Superficial mass*. There was also a significant decrease in the number of participants recommending ultrasound for *Model 2-Chest wall mass* compared to *Model 1-Superficial mass*. The difference in imaging recommendations for the models is consistent with the ACR appropriateness criteria for the initial evaluation of a palpable mass. Thus, this shift in recommendations for imaging workup is consistent with participants having different perceptions of the clinical presentations of the simulated breast models scenarios.

In addition to differences in imaging recommendations, participants also had different recommendations for tissue sampling by model. Participants from all three specialties were more likely to recommend core needle biopsy for *Model 2-Chest wall mass* than *Model 1-Superficial mass*. When malignancy is suspected, core needle biopsies are often preferred over needle aspiration as they sample surrounding tissue architecture allowing for a more definitive histologic diagnosis.¹⁸ The number of non-surgeons recommending needle aspiration were significantly higher for *Model 1-Superficial mass* than *Model 2-Chest wall mass*. This is consistent with the use of needle aspiration to differentiate between cystic and solid lesions in an office setting.^{3,4,7} In addition, there were more practitioners recommending 1-month follow up for *Model 1-Superficial mass*, which is consistent with an evaluation of a benign mass that may be hormonally regulated.^{3,4,7} As with the imaging recommendations, the shift in tissue sampling and follow up recommendations are in line with practitioners suspecting a benign mass for *Model 1-Superficial mass* and a malignant mass for *Model 2-Chest wall mass*.

In our hypothesis we predicted a difference in recommendations by specialty, which our findings support. We found differences in recommendations by specialty for imaging, tissue sampling and follow-up. The number of exams per week and practitioner experience did not affect recommendations when controlling for specialty. Surgeons tended to recommend ultrasound imaging more than the other two specialties for the benign and malignant clinical scenarios presented in this study. Interestingly, almost 20% of family practitioners recommended mammography for the 18 year old patient in the *Model 1-Superficial mass* scenario, which is not in agreement with the ACR Appropriateness Criteria.⁹ This may represent a disconnect between the breast imaging studies ordered by providers and those actually performed by Mammography Quality Standard Act (MQSA) certified imaging centers.¹⁹ These differences in imaging preferences are likely related to a number of factors including geographic location, health care accessibility, and clinician capabilities. Additionally, they represent the variability in patient care for the workup of a palpable breast mass.

There were also differences in the method of tissue sampling recommended by specialty for *Model 1-Superficial mass*. Family practitioners and OB/GYNs were more likely to recommend needle aspiration while surgeons were more likely to recommend core needle biopsy. This may reflect the comfort level of the different practitioner types to use particular diagnostic approaches in their clinic. Surgeons may be more comfortable with core needle biopsies, and therefore, select this as their primary mode for tissue sampling. Additionally, these practice patterns may be reflective of the differences in workup and recommendations in the surgical^{20,21} versus medical^{3,4,7,22} literatures. The medical literature recommends use

of needle aspiration to evaluate a benign breast mass for distinguishing between a solid and cystic lesion. This approach can decrease the need to further referral to surgical specialists in the instance of a benign lesion. The participants in this study were not requested to describe which procedures they do in their clinic and which they refer to a specialist. Therefore further work is required to understand whether these findings represent what practitioners perform in their own clinic versus differences between what the referring physician orders and the specialist performs.

Moreover, surgeons were less likely to recommend 1-month follow-up than family practitioners and OB/GYNs. This may be related to the fact that surgeons typically see patients after they have first been initially evaluated by another provider.

Study limitations relate to the use of simulated models and data collection conditions. Participants may have performed differently in the simulated setting compared to the clinical setting. However, participants' recommendations changed with the different clinical scenarios of the models that were consistent with the designed pathologic presentations. This provides validity evidence for the use of our simulators to represent realistic clinical scenarios. Additionally, our prior work has demonstrated the ability to distinguish practitioner CBE performance using CBE models.^{13,16} Lastly, CBE models are widely accepted as a method for training and performance assessment.²³ Other limitations include the use of a convenience sample of participants and collection of data in the exhibit hall of national conferences. This method was selected to allow for a large number of participants with a wide range of clinical specialties, experience levels, and institutions.

This study demonstrates a method for assessing current practice patterns that goes beyond retrospective studies using chart review for a single practitioner or practice network. The benefits of this method are the ability to collect data from a large number of physicians not limited to a specific region or specialty. Additionally, the integration of simulation provides a greater context for assessing clinicians practice and recommendations that may not be possible with survey methods alone. Our findings are informative by demonstrating a variety of evaluation approaches for two specific clinical scenarios. This may represent an underlying difference by specialty in terms of practice patterns, clinician capabilities, and knowledge base. These differing practice patterns may create confusion for patients between what their primary provider recommends and what is performed by an imaging or surgical specialist. Additionally, there may be a lack of communication between primary providers and specialists. This approach of using simulation to assess clinician recommendations provides a means for evaluating clinician decision making and understanding differing practice patterns. Our findings may facilitate doctor patient communication and help to close the gap in patient expectations for care and follow-up.

Acknowledgements

This work was supported by the National Institutes of Health R01EB011524 Grant titled "Validation of Sensorized Breast Models for High Stakes Testing" and by the National Institutes of Health F32EB017084 Grant titled "Automated Performance Assessment System: A New Era in Surgical Skills Assessment."

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Summary

The study aim was to evaluate recommendation patterns of different specialties for the work-up of a palpable breast mass using simulated scenarios and clinical breast examination (CEB) models. Our findings demonstrate that recommendation patterns differed across models in line with existing practice guidelines. Additionally, differences in practice patterns between primary care and specialty providers may represent varying clinician capabilities, health care resources, and individual preferences. Our work shows that simulation may be used to track adherence to practice guidelines for breast masses.

Figure 1. Summary of recommendations (A) by model and by specially for (B) *Model 1 – Superficial mass* and (C) *Model 2 – Chest wall mass*

Table 1

Participant demographics by specialty

Characteristic ^I	Mean (SD or Frequency (%))			
	Surgeons (n = 88)	Family Practice (n = 107)	OB/GYN (n = 123)	Total (n = 318)
Gender				
Female	50 (57.5%)	59 (55.1%)	75 (61.0%)	184 (57.7%)
Years of practice	17.4 (10.0)	13.2 (10.6)*	16.5 (11.0)	15.6 (10.7)
CBEs per week				
0-5	1 (1.1%)	45 (42.8%)*	20 (16.4%)	66 (20.8%)
6-10	11 (12.5%)	28 (26.6%)	19 (15.6%)	58 (18.2%)
11-20	6 (8.8%)	25 (23.8%)	37 (30.3%)	68 (21.4%)
>20	70 (79.5%)*	7 (6.6%)	46 (37.7%)	123 (38.7%)
Teach CBE				
Yes	55 (62.5%)	57 (53.2%)	70 (56.9%)	182 (57.2%)
Experience with models				
Yes	29 (33.0%)	33 (30.8%)	52 (42.3%)	115 (36.2%)

CBE – Clinical Breast Examination; OB/GYN – Obstetrics and Gynecology

^I Groups compared using independent samples *t*-test and chi square test of independence, and Fisher's exact test, as appropriate.