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# Improving diagnosis in healthcare: Local versus national adoption of recommended guidelines for the clinical breast examination

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## ABSTRACT

**Background:** This study explores the long-term effectiveness of a newly developed clinical skills curriculum.

**Methods:** Students (N = 40) were exposed to a newly developed, simulation-based, clinical breast exam (CBE) curriculum. The same students returned one year later to perform the CBE and were compared to a convenience sample of medical students (N = 15) attending a national conferences. All students were given a clinical vignette and performed the CBE. CBE techniques were video recorded. Chi-squared tests were used to assess differences in CBE technique.

**Results:** Students exposed to a structured curriculum performed physical examination techniques more consistent with national guidelines than the random, national student sample. Structured curriculum students were more organized, likely to use two hands, a linear search pattern, and include the nipple-areolar complex during the CBE compared to national sample ( $p < 0.01$ ).

**Conclusions:** Students exposed to a structured skills curriculum more consistently performed the CBE according to national guidelines. The variability in technique compared with the national sample of students calls for major improvements in adoption and implementation of structured skills curricula.

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## 1. Introduction

While recognized as essential in patient work up, major deficiencies in performance of physical examination skills from the medical student to the staff physician level have been identified.<sup>1</sup> Two, recent studies found that staff physicians do not follow national guidelines for the clinical breast examination (CBE).<sup>2,3</sup> For example, recent work relating to the CBE found that disregarding national guidelines can result in unacceptable mass detection rates.<sup>2</sup> Furthermore, studies exploring quality and frequency of teaching physical examinations have identified an overall decrease in prevalence, with time dedicated to teaching being as low as 14% while rounding on patients.<sup>4–6</sup>

The medical community has recently pushed for direct assessments of physical examination skills in order to ensure delivery of safe and competent patient care. In response to this push, the National Board of Medical Examiners added a physical exam assessment to the United States Medical Licensing Examination Step 2.<sup>7,8</sup>

and the Education Commission for Foreign Medical Graduates now requires skills testing for medical licensure.<sup>9</sup> This emphasis on formal evaluation of physical examination technique has fueled motivation at the medical school level to develop and introduce formalized physical examination curricula.<sup>8</sup>

Studies exploring proper teaching of physical examination emphasize the importance of having a formal lecture component complimented by a hands-on component.<sup>10,11</sup> In addition to using a hands-on component in teaching, the use of simulated, silicone breast models have been widely tested and accepted as mediums for teaching physical examination.<sup>10,12–14</sup> Based on our own literature search, we have developed a structured, hands-on physical examination curriculum based on previous literature findings for teaching the CBE.

The purpose of this study was to investigate whether medical students adhere to national guidelines for the Clinical Breast Examination after having been exposed to a newly developed, structured curriculum. We hypothesize that a random sample of medical students at national meetings would perform the CBE differently compared to students exposed to a structured curriculum.

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## 2. Methods

### 2.1. Students from mid-western medical school

Medical students at a mid-western medical school were introduced to the clinical breast exam as part of their clinical skills curriculum during their first and second years of medical school. Students rotated through stations for breast anatomy, pathology and physical exam technique station:

**Anatomy station:** focused on an overall review of breast anatomy, using illustrations and photographs of the relevant soft tissue structures and lymphatic drainage of the breast and axilla. Two physical models of healthy breasts were presented to allow students to appreciate normal breast densities.

**Pathology station:** exposed students to abnormal exam findings using a variety of interchangeable materials in silicone breast models to simulate various pathologies such as fibroadenoma, cysts, and malignant disease.

**Technique station:** consisted of two silicone breast models with no pathological findings in addition to a third wearable breast model with palpable supraclavicular nodes. Students were taught physical examination methods with special emphasis placed on performance of the examination adhering to current guidelines.<sup>2,15</sup> Visual aid cards provided pictorial directions for performing the exam. Students were first instructed to perform visual examination. Students were instructed to use the middle three fingers for palpation and were introduced to three techniques: circular, up-and-down, and radial search patterns. Palpation was to occur at three depths. Teachers observed students during practice and provided feedback and correction on technique elements when indicated in order to follow current, national guidelines.

During their third year of medical school (one year after initial teaching), video data was collected from the same students during their Objective Structured Clinical Examination (OSCE) as they performed a physical examination using a breast simulator with a palpable mass during an objective, structured clinical examination.

### 2.2. National medical students

A convenience sample of medical students were recruited from two national medical specialty meetings: the American Congress of Obstetricians and Gynecologists (ACOG) and American Academy of Family Physicians (AAFP). Students were given a clinical vignette and asked to perform the clinical breast exam using a breast simulator that contained a solitary, deep, hard mass 2 cm in size.<sup>2</sup> Video data was collected at designed exhibit booths equipped with a breast simulator, a dedicated laptop computer, one primary webcam (either Logitech C920 or Logitech Webcam Pro 9000) positioned directly above and focused on the simulator, and a secondary webcam on standby in case of data corruption or fragmentation.

### 2.3. Video data

Each video was reviewed by two blinded raters who separately coded physical examination techniques based on the criteria mentioned below, including a systematic approach, search pattern, search technique, number of hands used, amount of fingers used, and whether the nipple-areolar complex was included.

Systematic refers to participants who performed the CBE in a predictable, ordered and methodical manner. Search pattern was classified as a) linear, b) circular, c) radial, or d) other. Search technique described the finger movements of the participant, independent of the search pattern used, and was categorized as a) circular rubbing, b) linear rubbing, c) up and down or “button

pushing”, d) piano fingers in which each finger separately performs an up and down motion, and e) mixed technique.<sup>2</sup> Hand number assessed the number of active hands used during the exam. Amount of fingers categorized the use of fingers as either finger tips only, 50% full fingers, full fingers or mixed. Finally, coding included whether or not the nipple-areolar complex was incorporated into the physical examination. Inter-rater reliability was assessed using Cohen’s kappa (k).

### 2.4. Data analysis

A Pearson chi-square test was used to compare national and mid-western medical students in the categories of systematic approach, search pattern, search technique, number of hands used, amount of fingers used, and nipple-areolar palpation. Statistical analysis was performed using SPSS 23.<sup>16</sup> The study was approved by University of Wisconsin IRB panel. Involvement in the study was voluntary and students had the opportunity to opt out.

## 3. Results

40 medical students (58% female) from a single mid-western medical school and 15 medical students (67% female) recruited from national conferences completed the video-recorded structured CBE. Mid-western medical students were all in the third year of medical school while those from national conferences ranged from the first to fourth year of medical school (Median = 3, SD = 1) (Table 1). Inter-rater reliability was calculated ( $k = 0.79$ ).<sup>2</sup>

### 3.1. Assessment of mid-western medical school students during OSCE

95% were very systematic while performing the exam. 93% of students used a linear search pattern. 73% used a circular rubbing search technique. 75% of students used two hands. 83% used their fingertips to palpate the breast. 90% of students included the nipple-areolar complex in the physical exam. Medical students exposed to the physical examination curriculum had an 83% pathology detection rate (Fig. 1).

### 3.2. Assessment of national medical students

67% were very systematic while performing the exam. 73% used a circular search pattern. 40% used a circular rubbing search technique. 66% of students used one hand while performing the exam. 93% used their fingertips to palpate the breast. 33% included the nipple-areolar complex in the physical examination. National

**Table 1**  
Demographics for students who participated in the study.

	Mid-western Medical Students (n = 40)	National Conference Medical Students (n = 15)	Total (n = 55)
<b>Gender:</b>			
Female	23 (58%)	10 (67%)	33 (60%)
<b>Number of exams performed per week:</b>			
0–5	11	12	23
6–10	8	1	9
11–15	4	1	5
16–20	10	0	10
21–25	0	1	1
26+	4	0	4
<b>Year in medical school:</b>			
1	0	2	2
2	0	1	1
3	40	7	47
4	0	5	5

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