

An Effective Multimodal Curriculum to Teach Internal Medicine Residents Evidence-Based Breast Health

JENNIFER CORBELL, MD, MS
RACHEL BONNEMA, MD, MS
DORIS RUBIO, PhD
DIANE COMER, BS
MELISSA McNEIL, MD, MPH

Abstract

Background Breast health is an area fraught with controversy and missed opportunities to meet women's needs, and the state of internal medicine residency training in this area is inadequate.

Objective Our objective was to develop, implement, and evaluate a curriculum to equip internal medicine residents with the knowledge and skills to deliver high-quality, comprehensive breast health care.

Methods We developed a 4-hour curriculum for internal medicine interns. It incorporated a team-based learning format and used MammaCare breast model software to teach and evaluate the clinical breast examination. We compared interns' precurriculum and postcurriculum test results to a historical comparison group of postgraduate year (PGY)-2 interns who did not complete the curriculum. We retested interns as PGY-2s to assess knowledge retention.

Results A total 41 of 52 interns (79%) completed the curriculum. Their average MammaCare scores improved from 63% to 91%. Scores on a knowledge-based assessment improved from 47% on the pretest to 85% on the posttest ($P < .001$). Comparison PGY-2s who did not complete the curriculum averaged a score of 52% ($P < .001$). When retested 9 months after exposure to the curriculum, participants' mean score was 63% (compared to historical comparison PGY-2 group, $P < .001$). Only 9% of interns who retook the test as PGY-2s reported having received any breast health training subsequent to curriculum completion.

Conclusions A targeted half-day, low-cost breast health curriculum significantly improved knowledge and skills in multiple domains, and these improvements were retained in subsequent assessment despite minimal reinforcement in residency training.

Editor's Note: The online version of this article contains the assessment test used in the study, a photo of the MammaCare model software used to teach and evaluate the clinical breast examination, and curriculum details.

Jennifer Corbelli, MD, MS, is Assistant Professor of Medicine, Division of General Internal Medicine, University of Pittsburgh; Rachel Bonnema, MD, MS, is Associate Professor of Medicine, Division of General Internal Medicine, University of Nebraska; Doris Rubio, PhD, is Professor of Medicine, Biostatistics, Nursing and Clinical and Translational Sciences, Division of General Internal Medicine, and Director of the Data Center, Center for Research on Health Care, University of Pittsburgh; Diane Comer, BS, is Data Analyst, Center for Research on Health Care, University of Pittsburgh; and Melissa McNeil, MD, MPH, is Professor of Medicine, Division of General Internal Medicine, University of Pittsburgh.

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Corresponding author: Jennifer Corbelli, MD, MS, 200 Lothrop Street, 9W-33 Montefiore, Pittsburgh, PA 15213, 585.781.4177, fax 412.692.4838, corbellija@upmc.edu

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Introduction

Few issues in general medicine are surrounded by more controversy than breast health. With the 2009 US Preventive Services Task Force (USPSTF) recommendations¹ for less frequent breast cancer screening than recommended by most other major national organizations,^{2,3} and the intense media frenzy that followed,⁴⁻⁸ confusion continues to exist as to optimal breast cancer screening. USPSTF guidelines recommend initiation of routine mammography at age 50, and a biennial screening interval.¹ These guidelines now conflict with those of other major organizations, which recommend annual mammography at age 40.^{2,3} Despite the widespread national attention paid to screening, tools for breast cancer prevention remain underutilized.⁹⁻¹²

Women's health issues have been shown to be among the most common chief complaints in resident continuity clinics.¹³ Yet data show that residents have poor adherence to guidelines for screening mammography (at a time when guidelines did not conflict)¹⁴ and lack proficiency in the clinical breast examination.¹⁵ Internal medicine attending physicians and residents rarely use the Gail score to assess breast cancer risk and rarely discuss breast cancer chemoprevention with eligible patients.⁹ Physicians have

also been shown to underutilize referral to genetic counseling for high-risk women, and overutilize it for average-risk women.¹⁶ Furthermore, national guidelines^{17,18} recommend that physicians offer to prescribe chemoprevention for appropriate women at increased risk for breast cancer. Training programs as a whole face the problem of how to train residents to appropriately identify and manage women at increased breast cancer risk.

We describe a curricular innovation in which our objective was to quantify the extent to which performance in breast health knowledge and skills can be improved among internal medicine residents.

Methods

Curriculum Design

This curriculum took place from September 2012 to June 2013 at the University of Pittsburgh, a university-based urban tertiary care hospital. Participation was mandatory for interns during their required ambulatory rotation. The half-day curriculum was delivered monthly, by 1 faculty member to between 3 and 5 interns. No faculty time was required in addition to this monthly half-day.

This study was granted exemption status by the Institutional Review Board at the University of Pittsburgh.

This assessment test consisted of 5 sections (provided as online supplemental material), 3 of which (excluding sections on demographics and attitudes) were analyzed for a total percentage correct score for each intern. We also included a question which read: "Please share any thoughts that you have on this quiz or the curriculum in general." The knowledge assessment was developed by the authors who are content experts in this area. The session started with interns taking the 15-minute pretest. Each participant then used the MammaCare software¹⁹ (a self-directed learning tool that simulates the breast examination; provided as online supplemental material) to generate a score for percentage of breast tissue examined. Cost for the MammaCare Simulator-Trainer is \$6,500. No additional materials were required other than a projector and a computer with Microsoft PowerPoint.

Next, interns participated in a team-based learning session, with 7 subsections: mammography guidelines, additional screening issues including the impact of breast density, identification of high-risk women, management of high-risk women, breast cancer prevention, lifestyle factors, and approach to breast complaints. Interns then retok the MammaCare and knowledge-based assessments to end the session. Further curriculum details are provided as online supplemental material.

Postgraduate year (PGY)-2 interns who had not completed the curriculum served as a comparison group. In

What was known

Breast health is inadequately taught in internal medicine residencies.

What is new

First-year residents who completed a breast health curriculum outperformed a comparison group.

Limitations

Small sample and single institution study limit generalizability.

Bottom line

A low-cost breast health curriculum significantly improved knowledge and skills, with improvements retained on follow-up 9 months later despite minimal reinforcement in residency training.

September 2012, this group took the same knowledge-based assessment that the interns completed as part of the curriculum. To assess for knowledge retention, in October 2013, new PGY-2s who had completed the curriculum the year before retok the same knowledge-based test that they took as part of the curriculum. On this retest, we asked whether respondents had received additional education in breast health, and if so, how much.

The PGY-2s who participated in this study in both 2012 and 2013 did so voluntarily. No identifying information was collected, and all participants were eligible to win a \$250 Amazon.com gift card.

Data Collection and Analysis

Data were collected and managed by using REDCap (Research Electronic Data Capture), a secure web-based application hosted at the University of Pittsburgh.²⁰

We used paired *t* tests to compare pretest and immediate posttest scores for interns and 2013 PGY-2s' posttest scores to their intern immediate posttest scores. We used a *t* test to compare 2012 PGY-2s' (comparison group) scores to interns' posttest scores. Retest scores were obtained 4 to 12 months after interns took the curriculum, depending on when in their intern year their ambulatory rotation took place. To test the differences in test scores for the 3 time points (pre, immediate post, and 9 months post), we used repeated measures analysis of variance with PROC MIXED. No identifying information was collected. We used SAS statistical software version 9.3 (IBM Corp) and considered a *P* value of $< .05$ to be significant.

Results

Forty-one of 52 eligible interns (79%) completed the curriculum between September 2012 and June 2013. Eleven interns who did not participate had excused absences such as illness or vacation. Thirty-seven PGY-2s (69% response rate) completed the knowledge-based

TABLE 1 POSTGRADUATE YEAR (PGY)-1 KNOWLEDGE ASSESSMENT PERCENTAGE CORRECT: IMMEDIATE CURRICULUM POSTTEST VERSUS PRETEST SCORES AND PGY-2 HISTORICAL COMPARISON

	PGY-1 (Pretest)		PGY-1 (Posttest)		PGY-2 (Comparison)	
Measure	<i>g</i> N	<i>e</i> Mean/SD	N	Mean/SD	N	Mean/SD
Percentage correct	42	46.6 ± 10.4 ^a	41	85.1 ± 9.6	37	51.8 ± 11.1 ^b

^a *P* value compared to posttest ≤ .001.

^b *P* value compared to posttest ≤ .001.

assessment in September 2012. Of the 41 interns who completed the curriculum, 22 (54% response rate) retook the assessment as PGY-2s in October 2013. The mean number of days between the posttest and retest was 268 (SD ± 78), approximately 9 months. Of the interns who completed the curriculum, 46% were women and 15% were international medical graduates. Sixty-six percent indicated that they plan to subspecialize, and 21% included free text comments, all of which were favorable.

Interns' scores significantly improved from a mean of 47% correct (SD, ± 10%) on the pretest to 85% (± 10%) on the immediate posttest ($P < .001$). Interns' immediate posttest scores were significantly higher at 85% (± 10%) than those of the comparison PGY-2 group who did not complete the curriculum (52% ± 11%; $P < .001$; TABLE 1).

When interns retook the test as PGY-2s an average of 9 months after completing the curriculum, scores were significantly higher (63% ± 11.8%) than those of the comparison group (PGY-2s in September 2012) who did not complete the curriculum (52% ± 11%; $P < .001$; TABLE 2).

Of the 22 interns who retook the 9-month posttest as PGY-2s, their intern pretest and immediate posttest scores were not significantly different from the pretest and immediate posttest scores of the total intern sample (TABLE 3).

Although time to 9-month posttest from immediate posttest had a significant effect in the model, post hoc comparisons using Bonferroni adjustments showed that test scores for the retest remained significantly higher than pretest scores ($P < .001$).

Of participants who completed the 9-month posttest, 2 of 22 reported that they had received additional education in breast health since curriculum completion. Total time of education received was 2 hours or less.

MammaCare scores (percentage total breast tissue examined) improved from 63% on the pretest (± 14%) to 91% on the immediate posttest (± 9%).

Discussion

Our results demonstrate that after a targeted breast health curriculum, interns' breast health knowledge scores significantly improved, and this improvement persisted 9 months after completion of the curriculum. The PGY-2s who did not complete the curriculum scored significantly lower (52% correct versus 63% correct, $P < .001$) than interns who did complete it.

The controversies and challenges surrounding breast health have not diminished since the 2009 publication of USPSTF guidelines. USPSTF guidelines caused widespread confusion and concern among patients, and many women do not expect either mammography timing or frequency to change to comply with USPSTF recommendations.²¹ Interestingly, the Swiss Medical Board has recently generated a report that goes far beyond USPSTF's guidelines: it recently recommended that no new mammography programs should be introduced, and that a time limit be placed on programs already in existence.²² In light of this ongoing controversy, it is more imperative than ever for physicians to develop a framework to counsel patients on this issue in an evidence-based manner. Our curriculum was deliberately not designed to advocate for one set of

TABLE 2 POSTGRADUATE YEAR (PGY)-1 KNOWLEDGE ASSESSMENT PERCENTAGE CORRECT: 9 MONTHS AFTER CURRICULUM VERSUS PGY-2 HISTORICAL COMPARISON

	PGY-2 2013 (9-Month Posttest)		PGY-2 2012 (Comparison)		
Measure	N	Mean/SD	N	Mean/SD	<i>P</i> Value (<i>t</i> Test)
Percentage correct	22	62.6 ± 12.0	37	51.8 ± 11.1	.001

TABLE 3 KNOWLEDGE ASSESSMENT PERCENTAGE CORRECT, 22 PARTICIPANTS COMPLETING 9-MONTH POSTTEST (AS POSTGRADUATE YEAR [PGY]–2s) VERSUS TOTAL SAMPLE OF PARTICIPANTS COMPLETING CURRICULUM				
Time Point	N	Mean/SD	N	Mean
Pretest (PGY-1)	22	49.4 ± 11.2	42	46.6 ± 10.4
Immediate posttest (PGY-1)	22	86.1 ± 9.3	41	85.1 ± 9.6
9-Month posttest (as PGY-2s, October 2013)	22	62.6 ± 12.0	N/A	N/A

Abbreviation: N/A, not applicable.

mammography guidelines over another. Rather, we outlined the evidence that drove USPSTF to change its recommendations and included test questions to assess understanding of this evidence and of the conflicts among guidelines. Our results demonstrate that interns who completed our curriculum have a stronger knowledge base from which to provide this challenging patient counseling.

To our knowledge, this is the first curriculum specifically developed with the goal of improving breast health skills and knowledge for internal medicine residents. Related prior studies²³ include a weeklong intervention among internal medicine, family medicine, and pediatrics attending physicians, residents, and nurses, with a focus on communication skills about the treatment of breast diseases. Another curriculum used observed structured clinical examinations to evaluate a curriculum that taught breast clinical examination skills to surgery residents and fourth-year medical students.²⁴ Both curricula found that their intervention resulted in improvements in their desired domains. Our intervention is unique with respect to the scope of material covered, the limited time required for the curriculum, and the follow-up assessment to evaluate knowledge retention. It is also unique in that it was designed to respond to current challenges and controversies in breast health. Furthermore, the use of team-based learning, as opposed to didactics or web-based formats, is an important component of our curriculum. Team-based learning is a technique gaining increasing traction in medical education,^{25–27} and evidence suggests it may be more effective than both traditional lecture formats²⁸ and other interactive formats such as problem-based learning.²⁹ Use of multiple-choice questions and focused didactics using PowerPoint slides also facilitates easy transferability of the curriculum to other institutions. Furthermore, the standardized format of the curriculum is such that an experienced small group facilitator, even if not a content expert, would be readily able to deliver it.

Our results showed that interns who completed the curriculum scored significantly higher on a knowledge test as PGY-2s than a control PGY-2 group who did not

complete the curriculum (52% correct versus 63% correct, $P < .001$). This significant difference, given the low cost and faculty time investment (1 half-day per month), suggests the results justify the necessary investment to sustain the curriculum. Future research should assess how to maximize and reinforce knowledge retention. Next steps should include focused faculty development in breast health to facilitate their ability to regularly discuss topics covered in the curriculum with trainees. Another next step will be periodic reinforcement of information delivered in the curriculum. This could use online didactics or modules, which are both low cost, and have been shown to be effective.^{30,31} Added future steps include extension of the curriculum to family medicine and obstetrics-gynecology residents.

Several limitations deserve mention. Our response rate was 69% for the PGY-2 comparison group, and 54% for the 9-month posttest. We do not know if respondents' knowledge differed from nonrespondents. An added limitation is the fact that the knowledge assessment was not subjected to formal validity testing. Finally, this is a single institution study, in an internal medicine division with many dedicated women's health faculty, which decreases the generalizability of our results. This faculty presence further underscores the universal need for targeted breast health training, given our respondents' poor baseline knowledge.

Conclusion

Breast health is an issue of primary importance of women, yet it is also an area in which physicians appear to be falling short. Curricular interventions are necessary to train future generations of physicians to meet the needs of women. Our findings show that a targeted half-day, low-cost curriculum significantly improves breast health knowledge and skills, and that these improvements persist in 9-month follow-up despite minimal reinforcement elsewhere in residency training.

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