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# The general radiologist's role in breast cancer risk assessment: breast density measurement on chest CT☆

Laurie Margolies [a], Mary Salvatore [a], Corey Eber [a], Adam Jacobi [a], In-Jae Lee [a,b], Mingzhu Liang [c], Wei Tang [d], Dongming Xu [a], Shijun Zhao [d], Minal Kale [a], Juan Wisnivesky [a], Claudia I. Henschke [a], David Yankelevitz [a,*]

[a] Icahn School of Medicine at Mount Sinai, New York, New York
[b] Hallym University College of Medicine, Chuncheon, Korea
[c] Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai, China
[d] National Cancer Center of China & Peking Union Medical College, Cancer Institute & Hospital, Chinese Academy of Medical Sciences, Beijing, China

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ABSTRACT

To determine if general radiologists can accurately measure breast density on low-dose chest computed tomographic (CT) scans, two board-certified radiologists with expertise in mammography and CT scan interpretation, and seven general radiologists performed retrospective review of 100 women's low-dose chest CT scans. CT breast density grade based on Breast Imaging Reporting and Data System grades was independently assigned for each case. Kappa statistic was used to compare agreement between the expert consensus grading and those of the general radiologists. Kappa statistics were 0.61–0.88 for the seven radiologists, showing substantial to excellent agreement and leading to the conclusion that general radiologists can be trained to determine breast density on chest CT.



## 1. Introduction

Breast density is a known risk factor for breast cancer as those with the densest breasts have a sixfold increase in risk compared with those with fatty breasts [1,2]. Until recently, few women who had screening mammography were told of their breast density. The lack of such information coupled with the decreased effectiveness of screening mammography in those with dense breasts has led many states to pass legislation mandating that lay letters to dense-breasted patients include this information.

Yearly mammography screening is recommended by many organizations, but compliance is far from universal [3,4]. Knowing one's breast density may encourage a woman to have a mammogram or encourage her physician to recommend not only mammography but supplemental breast ultrasound or magnetic resonance imaging. Mammographic breast density is most often subjectively classified by a breast imager into one of four categories (grade 1–4) as defined by the fourth edition of the Breast Imaging Reporting and Data System (BI-RADS) developed by the American College of Radiology [5]. The reliability of the classification is important as additional screening, typically ultrasound, may be offered to women with grade 3 or 4 breast density [6,7].

Reader agreement studies have shown that the agreement between breast imagers as to breast density on mammograms is low to moderate [8]. Our initial work compared mammographic breast density grading to computed tomographic (CT) breast density grading in 206 patients who had CT scans and mammograms within 1 year of each other; we found moderate to substantial agreement [9] for radiologists with expertise in mammography. We also demonstrated that a computer algorithm could grade breast density on CT with results comparable to the radiologists' determination. We, therefore, hypothesized that the general radiologist can be trained to report breast density on chest CT examinations, thus providing valuable additional information to women who have chest CTs. This information might assist the individual and her health care provider to more precisely determine breast cancer risk and optimal screening recommendations.

To investigate the consistency between the CT grading by radiologists with expertise in mammography and general radiologists, we performed a pilot study comparing the agreement between consensuses of two radiologists with expertise in mammography to seven general radiologists.

## 2. Methods

From the database of the Mount Sinai Early Lung and Cardiac Action Program, 100 consecutive women were identified who had a low-dose CT scan and who did not have either bilateral mastectomy or bilateral implants. The mean age at the time of CT was 70.4 years (S.D.= 8.6), with ages ranging from 43 to 91 years. Two board-certified radiologists with special expertise in mammography and CT (L.M.: 25 years as

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* Corresponding author. Department of Radiology, Mount Sinai School of Medicine, 1 Gustave Levy Place, New York, New York 10029. Tel.: +1 212 241 2813; fax: +1 212 241 9655.
*E-mail address:* david.yankelevitz@mountsinai.org (D. Yankelevitz).

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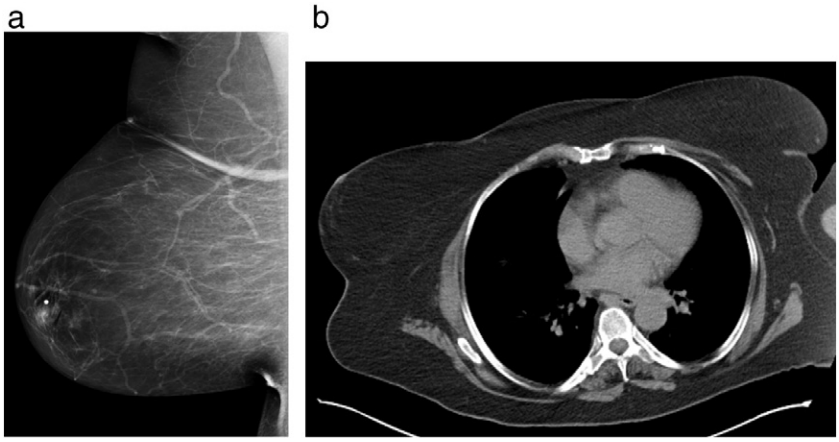


**Fig. 1.** (a) Mammogram of a BI-RADS grade 1 fatty breast. (b) CT of the same person also shows fatty breasts.

mammographer and 20 years of CT experience; M.S.: 14 years of CT experience and 6 years as a mammographer) reviewed the CT images of the breast using mediastinal window settings (window 400 HU and level 40 HU).

Together, the two expert readers generated a consensus and classified the breast density on the CT images into one of the four BI-RADS grades: grade 1 corresponded to fatty breasts with a breast parenchymal density of less than 25% glandular; grade 2 to breasts with scattered fibroglandular elements with a breast parenchymal density of 25%–50%; grade 3 to heterogeneously dense breasts with a breast parenchymal density of 51%–75%; and grade 4 to extremely dense breasts with a breast parenchymal density of over 75%.

A separate training set of 12 cases was chosen by consensus interpretation of the two mammographers and included 3 cases each of BI-RADS grades 1–4 (Figs. 1–4). In a single 15-min training session, one of the two expert mammographers presented this set of images to each of the seven radiologists, either general or with special focus in chest with 2–20 years of experience. The seven general radiologists then independently assigned a CT breast density grade to the same 100 CT scans that had been previously reviewed by the experts. The CT scan training set was available to be viewed during the reading session as a reference standard.

The agreement between the CT breast density grades assigned by the consensus interpretation of two expert readers with each of the general radiologists was assessed using Cohen's kappa coefficient. Interpretation of the kappa values followed a prior classification system: 0.20–0.40, fair; 0.41–0.60, moderate; 0.61–0.80, substantial; and 0.81–1.00, excellent. As the critical distinction for breast density is between the two lower and two higher grades, grades 1 and 2 combined were compared to grades 3 and 4 combined for some of the analyses.

The amount of time it took from initially viewing a CT image to determine breast density was recorded by one of the expert readers for a subset of the radiologists. All statistical analyses were performed using SAS statistical software (Version 9.2, Cary, NC, USA).

Approval for the study was obtained from the Mount Sinai Institutional Review Board which waived the requirement to obtain informed consent for this retrospective study.

## 3. Results

Among the 100 cases, the expert readers assigned grade 1 in 22 (22%), grade 2 in 32 (32%), grade 3 in 32 (32%), and grade 4 in 14 (14%). The CT breast density readings by seven general radiologists

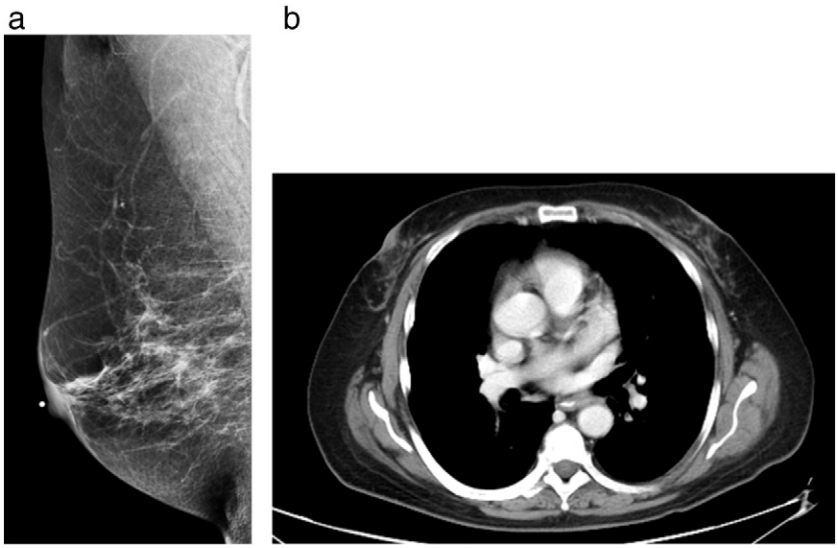


**Fig. 2.** (a) Mammogram of a BI-RADS grade 2 breast with scattered fibroglandular elements. (b) CT of the same person also shows scattered fibroglandular elements.