



**Pre-Conference Workshop: Digital Breast Tomosynthesis  
Wednesday, April 11, 2018**

**SAM Materials**

**SAM QUESTION #1 (DBT 1: Basic Principles – Technical Considerations)**

**AUTHOR:** Margarita Zuley, MD

Which of the following regarding FFDM compared to screen film mammography is true?

- A. FFDM is better at demonstrating masses than screen film mammography.
- B. FFDM has a lower recall rate than screen film mammography.
- C. FFDM is more sensitive for detection of calcifications than screen film mammography.
- D. FFDM is more accurate in characterizing asymmetries than screen film mammography.

**ANSWER: C**

**REFERENCE:**

Skanne, P. Studies comparing screen-film mammography and full-field digital mammography in breast cancer screening: updated review. *Acta Radiol.* 2009 Jan; 50(1):3-14

**SAM QUESTION #2 (DBT 1: Basic Principles – Technical Considerations)**

**AUTHOR:** Margarita Zuley, MD

Tomosynthesis acquisitions vary by vendor. Which statement below is most accurate?

- A. The tomosynthesis acquisition always follows the 2D acquisition.
- B. Wide angle acquisition has been shown to be superior to narrow angle acquisition.
- C. Continuous tube motion allows for shorter tomosynthesis acquisition times.
- D. Filtered back projection is superior to iterative reconstruction in reducing metal artifacts.
- E. The different spatial resolutions across vendors has been shown to significantly impact detection rates.

**ANSWER: C**

**Rationale:** Continuous motion of the tube during tomosynthesis acquisition is faster than the step and shoot method of acquisition and so there is theoretically less overall patient motion. However step and shoot

acquisition has no focal spot blur as continuous motion does. There is no clinical data showing a diagnostic difference for a cohort of patients in the two methodologies.

**REFERENCE:**

Skanne, P. Studies comparing screen-film mammography and full-field digital mammography in breast cancer screening: updated review. *Acta Radiol.* 2009 Jan; 50(1):3-14

**SAM QUESTION #3 (DBT 2: Approach to Interpretation: Masses and Distortion)**

**AUTHOR:** Steven P. Poplack, MD

Which of the following statements about masses is true?

- A. Screening with DM is more accurate than DM/DBT for masses.
- B. Diagnostic evaluation with DM is more accurate than DBT.
- C. DBT detected masses may require fewer mammography views for diagnostic evaluation.
- D. Masses are less visible on DM/DBT than DM only.

**ANSWER: C. The use of DBT in screening may decrease the number of additional views needed for diagnostic evaluation.**

**RATIONALES:**

- A. Incorrect: In ROC analyses DM/DBT is more accurate than DM alone for non-calcified abnormalities.
- B. Incorrect: Studies demonstrate equal or increased accuracy of DBT over spot DM views.
- C. Correct: Studies suggest the characterization of masses afforded by DBT may preclude or decrease additional DM diagnostic evaluation.
- D. Incorrect: In general masses are more conspicuous on DBT than on DM alone due to lack of superimposed fibroglandular tissue.

**REFERENCES:**

Rafferty et al. *AJR* 2014; 202:273–281

Morel et al. *Clin Radiol.* 2014;69:1112-1116

Noroozian et al. *Radiology.* 2012;262:61-68

Brandt et al. *AJR.* 2013;200:291-298

**SAM QUESTION #4 (DBT 3: Approach to Interpretation: Calcifications)**

**AUTHOR:** Michael Linver, MD

Tomosynthesis is considered less helpful in identification and evaluation of calcifications than it is for masses because:

- A. The relatively poor resolution of tomosynthesis compared to 2D digital mammography hampers its ability to demonstrate calcifications as well as 2D does.
- B. The CAD system used with tomosynthesis is more accurate in finding masses than it is in finding calcifications.
- C. The algorithms used to create the tomosynthesis images eliminate most calcifications from the images completely.
- D. The lower contrast of tomosynthesis makes calcifications less visible.

**ANSWER: A. The relatively poor resolution of tomosynthesis compared to 2D digital mammography hampers its ability to demonstrate calcifications as well as 2D does.**

**RATIONALES:**

- A. The intrinsic decreased resolution of the tomosynthesis images greatly degrades the detail required to create the crisp appearance of calcifications seen on 2D. This issue is not as much of a problem with masses, as the increased contrast of the tomosynthesis images allows for increased conspicuity of masses, even in the face of decreased resolution.
- B. Although CAD is not yet approved for tomosynthesis in the US, CAD with tomosynthesis is reported to be much better at finding calcifications than masses, just as it is when used on 2D mammography.
- C. This statement is false. The algorithms do not eliminate calcifications.
- D. This statement is false. Tomosynthesis has slightly higher contrast.

**REFERENCES:**

Spangler ML, Zuley ML, Sumkin JH et al. Detection and Classification of Calcifications on Digital Breast Tomosynthesis and 2D Digital Mammography: A Comparison. AJR 2011, 196: 320-324.

**SAM QUESTION #5 (DBT 4: Tomosynthesis – What are the data?)**

**AUTHOR:** Steven P. Poplack

How does the addition of DBT to DM effect screening mammography performance?

- A. DBT improves detection of ductal carcinoma in situ (DCIS)
- B. DBT has no effect on invasive cancer detection
- C. DBT decreases the recall rate and increases cancer detection rate.
- D. DBT decreases the time of interpretation of DM/DBT exams.

**ANSWER: C. DBT significantly decreases the recall rate and increases cancer detection rate.**

**RATIONALES:**

- A. Incorrect: DBT significantly increases overall cancer detection rate and detection of invasive cancer, but appears to have little or no effect on the detection of DCIS.
- B. Incorrect: DBT decreases the recall rate and also increases cancer detection rate.
- C. Correct: In general, studies show benefit in both recall reduction and increased cancer detection. One of these effects usually predominates over the other, depending on study conditions, e.g. baseline RR or CDR.
- D. Incorrect: The addition of DBT to DM approximately doubles interpretation time. Only single view DBT interpretation may be less time intensive than two view DM.

**REFERENCES:**

Rafferty et al. *Radiology*. 2013; 266: 104-113.

Friedewald et al. *JAMA*. 2014;311(24):2499-2507.

Rafferty et al. *AJR*. 2014; 202:273–281

Skaane et al. *Radiology*. 2013;267:47-56

Lang et al. *Euro Radiol* 2016.

**SAM QUESTION # 6: (DBT 5: Workflow and Practical Issues)**

**AUTHOR:** Margarita Zuley, MD

Which of the following is true regarding time to interpret combination screening mammograms?

- A. Time to interpret is the same as 2D alone
- B. Time to interpret is approximately 10% higher than 2D alone
- C. Time to interpret is approximately 50 higher than 2D alone
- D. Time to interpret is at least 150% higher than 2D alone

**ANSWER: C. Time to interpret is approximately 50 higher than 2D alone.**

**REFERENCE:**

Bernardi D, Ciatto S, Pellegrini M, Anesi V, Burlon S, Cauli E, Depaoli M, Larentis L, Malesani V, Targa L, Baldo P, Houssami N. Application of breast tomosynthesis in screening: incremental effect on mammography acquisition and reading time. *BRJ*. 2012;85;1174-78.

**SAM QUESTION # 7 (DBT 5: Workflow and Practical Issues)**

**AUTHOR:** Margarita Zuley, MD

Which of the following is false?

- A. Tomosynthesis increases invasive cancer detection over digital mammography.

- B. A tomosynthesis view is approximately the same radiation dose as a 2D mammogram
- C. Evaluation of calcifications is better with magnification views than tomosynthesis.
- D. Recalls from tomosynthesis based screening require additional views typically.

**ANSWER: D. Recalls from tomosynthesis based screening require additional views typically.**

**REFERENCES:**

Rose SL, Tidwell AL, Bujnoch LJ, Kushwaha AC, Nordmann AS, Sexton R Jr. Implementation of breast tomosynthesis in a routine screening practice: an observational study. *AJR Am J Roentgenol*. 2013 Jun;200(6):1401-8.

Skaane P, Bandos AI, Gullien R, et al. Comparison of Digital Mammography Alone and Digital Mammography Plus Tomosynthesis in a Population-based Screening Program. *Radiology*. 2013 Apr;267(1):47-56

Haas, BM, Kalra V, Geisel J, Raghu M, Durand M, Philpotts L. Comparison of tomosynthesis plus digital mammography and digital mammography alone for breast cancer screening. *Radiology*. 2013 Jul 30. [Epub ahead of print]

**SAM QUESTION #8: (DBT 8: Review Cases)**

**AUTHOR:** Michael Linver, MD

One of the areas where tomosynthesis is superior to 2D mammographic imaging alone is in the unequivocal diagnosis of:

- A. Sclerosing adenosis
- B. Fibrocystic changes
- C. Skin calcifications
- D. Calcified papilloma's

**ANSWER: C. Skin calcifications**

**RATIONALES:**

- A. This is false. The calcifications associated with sclerosing adenosis require a tissue biopsy for definitive diagnosis.
- B. This is false. The calcifications associated with fibrocystic changes require a tissue biopsy for definitive diagnosis.
- C. Because the location of calcifications can be made precisely with the evaluation of the individual one mm slices produced with tomosynthesis, skin calcifications can be shown to lie completely within the skin. Further, since essentially all skin calcifications are related to benign causes, no further evaluation is therefore needed, once the tomosynthesis images demonstrate the calcifications to lie entirely within the skin. This degree of certainty regarding skin calcifications can almost never be achieved on a screening 2D mammogram.

- D. This is false. The calcifications associated with calcified papilloma's require a tissue biopsy for definitive diagnosis.

**REFERENCES:**

Nees, AV. Digital breast tomosynthesis. In: Digital Mammography: a practical approach, Whitman GJ and Haygood TM, eds., Cambridge University Press, Cambridge, England UK, 2013, pp. 109-124.

**SAM QUESTION #9: (DBT 9: Review Cases)**

**AUTHOR:** Michael Linver, MD

When comparing the current mammogram performed with 2D and tomosynthesis to a 2D mammogram performed 2 years ago, it is MOST difficult to distinguish a new invasive breast cancer from:

- A. A scar due to surgery performed in the past year
- B. A scar due to surgery in the distant past
- C. Sclerosing adenosis
- D. Diabetic mastopathy

**ANSWER: A. A scar due to surgery performed in the past year**

**RATIONALES:**

- A. Because the intervening surgery has caused new changes since the mammogram performed two years ago that may be indistinguishable from a new invasive breast cancer, this situation is often the most difficult in which to diagnose a new invasive breast cancer, even with the addition of tomosynthesis.
- B. A new invasive cancer in or around an old scar will show some change as compared to the previous study of two years ago, especially with the addition of tomosynthesis to the current mammogram. Thus, it is much easier to diagnose a new invasive breast cancer in this situation.
- C. The typical benign appearance of the calcifications of sclerosing adenosis present no problem in being distinguished from a new invasive breast cancer mass.
- D. The mass created by diabetic mastopathy grows relatively slowly, allowing any new mass which has developed since the previous mammogram of two years ago to be more easily distinguished as a possible new invasive breast cancer.

**REFERENCES:**

D'Orsi CJ. Emerging X-Ray Based and Nuclear Technologies. In: Breast Imaging, Bassett Lw, Mahoney MC, Apple SK, D'Orsi CJ, eds. Elsevier Saunders, Philadelphia, PA, 2011, pp. 743-751.

**SAM QUESTION #10: (DBT 6: Review Cases)**

**AUTHOR:** Michael Linver, MD

When should the performance of breast ultrasound be considered?

- A. When patient has fatty breast tissue and multiple round smooth nodules are seen bilaterally on both 2D mammograms and tomosynthesis.
- B. When patient has fatty breast tissue and a single stable round smooth mass is seen on both 2D mammograms and tomosynthesis.
- C. When patient has dense breast tissue and equivocal findings are seen on both 2D mammograms and tomosynthesis.
- D. When patient has fatty breast tissue and no abnormality is seen on both 2D mammograms and tomosynthesis.

**ANSWER: C. When patient has dense breast tissue and equivocal findings are seen on both 2D mammograms and tomosynthesis.**

**RATIONALES:**

- A. The likelihood of a cancer being present when multiple round smooth nodules are seen bilaterally on mammography with a fatty breast pattern has been shown to be essentially zero. Therefore, no ultrasound should be performed here, making A incorrect.
- B. The likelihood of a cancer being present when a stable round smooth nodule is seen on mammography with a fatty breast pattern has been shown to be essentially zero. Therefore, no ultrasound should be performed here, making B incorrect as well.
- C. Ultrasound has proven invaluable in confirming or refuting the presence of a true mass when there are equivocal mammographic findings in dense breast tissue. Therefore C is the correct answer.
- D. The likelihood of a cancer being present when the patient has fatty breast tissue and no abnormality seen on mammography has been shown to be essentially zero. Therefore, no ultrasound should be performed, making D also incorrect.

**REFERENCES:**

Peppard HR, Nicholson BE, Rochman CM et al. Digital Breast Tomosynthesis in the Diagnostic Setting: Indications and Clinical Applications. Radiographics 2015;35: 975-990.

**SAM Question #11 (Multimodality Challenging Cases)**

**AUTHOR:** Christopher Comstock, MD

The most sensitive combination of imaging modalities in breast cancer detection for screening of high risk patients is:

- A. Mammography and MRI
- B. Mammography and ultrasound
- C. Ultrasound and MRI
- D. MRI alone

**ANSWER: A. Mammography and MRI**

**REFERENCES:**

Prospective multicenter cohort study to refine management recommendations for women at elevated familial risk of breast cancer: the EVA trial. Kuhl C, Weigel S, Schrading S, Arand B, Bieling H, König R, Tombach B, Leutner C, Rieber-Brambs A, Nordhoff D, Heindel W, Reiser M, Schild HH. J Clin Oncol. 2010 Mar 20;28(9):1450-7

### **SAM Question #12 (Challenging Cases with Focus on MR)**

**AUTHOR:** Christopher Comstock, MD

The next step after identifying an area of suspicious clumped, non-mass enhancement in a linear distribution on screening breast MRI is:

- A. To recommend a 6 month follow up MRI
- B. To schedule a MRI guided biopsy
- C. To perform a targeted ultrasound
- D. To correlate with recent mammogram

**ANSWER: D**

**REFERENCE:** MRI for diagnosis of pure ductal carcinoma in situ: a prospective observational study. Kuhl CK, Schrading S, Bieling HB, Wardelmann E, Leutner CC, Koenig R, Kuhn W, Schild HH. Lancet. 2007 Aug 11;370(9586):485-92.

### **SAM QUESTION #13 (DBT 8: Diagnostic Tomosynthesis)**

**AUTHOR:** Michael Linver, MD

**Screening tomosynthesis when utilized as a diagnostic tool is NOT helpful in which one of the following?**

- A. Better characterizing and improving visibility of masses and architectural distortions.
- B. Better characterizing and improving visibility of suspicious calcifications.
- C. Tumor staging.
- D. Localizing a lesion seen in only one view.

**ANSWER: B. Better characterizing and improving visibility of suspicious calcifications.**

**RATIONALES:**

- A. Screening tomosynthesis is indeed helpful in improving visibility on invasive cancers, and therefore functions as a valuable diagnostic tool. Studies have shown that only 3% of invasive cancers were occult on tomosynthesis, as compared to 16% on conventional 2D mammography. Therefore, A is incorrect.
- B. The relatively poor resolution of tomosynthesis images cannot provide the fine detail needed to properly analyze suspicious calcifications, and is likewise not recommended for this purpose. Spot compression 2D magnification views should instead be utilized. Therefore, B is correct.

- C. Screening tomosynthesis as a diagnostic tool is very helpful in better evaluating the size of a known cancer, the number of cancer sites present, the total span of disease, and the possible presence of contralateral cancer, especially if breast MR is not going to be performed prior to treatment of the known cancer. Therefore, C is incorrect.
- D. Screening tomosynthesis as a diagnostic tool is extremely helpful in localizing an abnormality, even if it is visualized in only one projection. Therefore, D is incorrect.

**REFERENCES:**

Dang PA, Humphrey KL, Freer PE et al. Comparison of lesion detection and characterization in invasive cancers using breast tomosynthesis versus conventional mammography [abstr]. In: Radiological Society of North America Scientific Assembly and Annual Meeting Program. Oak Brook, IL: Radiological Society of North America, 2013; 156.

Mun HS, Kim HH, Shin HJ et al. Assessment of extent of breast cancer: comparison between digital breast tomosynthesis and full-field digital mammography. Clin Radiol 2013; 68(12): 1254-1259.

**SAM QUESTION #14 (DBT 8: Diagnostic Tomosynthesis)**

**AUTHOR:** Michael Linver, MD

What percentage of cancers would be missed if only the MLO tomosynthesis view were obtained, rather than both the CC and the MLO tomosynthesis views?

- A. 1-2%
- B. 5-9%
- C. 10-14%
- D. 15-20%

**ANSWER: B. 5-9%**

**RATIONALES:**

- A. This number is incorrect for mammograms performed with the MLO only tomosynthesis view. 1-2% is the correct number if only the CC tomosynthesis view is obtained.
- B. Numerous studies have shown that 5-9% of cancers are missed if only the MLO tomosynthesis view is obtained. Therefore, B is correct.
- C. This number is incorrect.
- D. This number is incorrect.

**REFERENCES:**

Beck N, Butler R, Durand M et al. One-view versus two-view tomosynthesis: a comparison of breast cancer visibility in the mediolateral oblique and craniocaudad views. Presented at the annual meeting of the American Roentgen Ray Society, Washington, DC, April 14-19, 2013.

Baker JA, Lo JY. Breast tomosynthesis: state-of-the-art and review of the literature. Acad Radiol 2011;18(10): 1298-1310.

**SAM QUESTION #15 (DBT 8: Diagnostic Tomosynthesis)**

**AUTHOR:** Michael Linver, MD

As compared to diagnostic 2D spot compression views, approximately how many times more effective is screening tomosynthesis at visualizing and differentiating true lesions from summation artifacts?

- A. 2 times
- B. 3 times
- C. 4 times
- D. 6 times

**ANSWER: A. 2 times**

**RATIONALES:**

- A. Screening tomosynthesis has a sensitivity of 94% in finding and differentiating true lesions from summation artifacts. Diagnostic 2D spot compression views have a sensitivity of only 50% in this setting. Therefore, A is correct.
- B. This number is incorrect.
- C. This number is incorrect.
- D. This number is incorrect.

**REFERENCES:**

ElMaadawy MM, Seely JM, Doherty G et al. Digital breast tomosynthesis in the evaluation of focal mammographic asymmetry: do you still need coned compression views? [abstr]. In: Radiological Society of North America Scientific Assembly and Annual Meeting Program. Oak Brook, IL: Radiological Society of North America, 2012; 158.

**SAM QUESTION # 16: (Multimodality Case Challenge: Interventional)**

**AUTHOR:** Margarita Zuley, MD

Which of the following is considered to be one of the primary reasons that tomosynthesis has higher detection of cancer over digital mammography?

- A. Better inclusion of the inframammary crease
- B. More frequent inclusion of the pectoralis muscle on the CC
- C. Reduced number of cancers that are obscured by overlapping tissue
- D. Improved spatial resolution

**ANSWER: C. Reduced number of cancers that are obscured by overlapping tissue.**

**REFERENCES:**

Rafferty EA, Park JM, Philpotts LE, et al. Assessing radiologist performance using combined digital mammography and breast tomosynthesis compared with digital mammography alone: results of a multicenter, multireader trial. *Radiology*. 2013 Jan; 266(1):104-13.

**SAM QUESTION #17: (Multimodality Case Challenge: Interventional)**

**AUTHOR:** Margarita Zuley, MD

Regarding synthetically generated 2D mammograms, which is true?

- A. They are significantly better than FFDM for masses.
- B. They are not superior to mammography.
- C. Their creation requires an additional tomosynthesis image
- D. They are not yet FDA approved.

**ANSWER: B. They are not superior to mammography.**

**REFERENCES:**

Gur D, Zuley ML, Anello MI, et al. Dose reduction in digital breast tomosynthesis (DBT) screening using synthetically reconstructed projection images: An observer performance study. *Acad Radiol*. 2012;19:166-71.