Breast Imaging Technologies:
Cancer Detection & Personalized Medicine



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Director of Breast Imaging
Associate Professor of Radiology
University of North Carolina

Learning Objectives

- List 3 new developments in breast imaging

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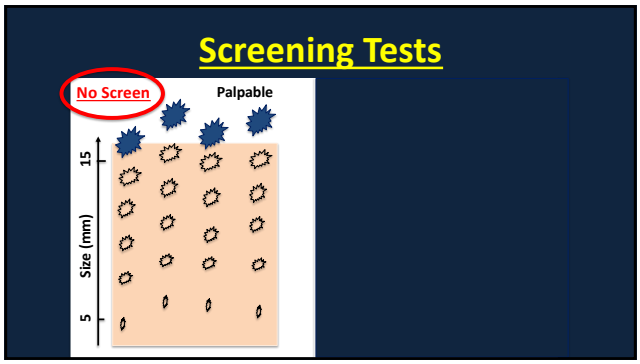
- Discuss the advantages & disadvantages of the advances in breast imaging & cancer detection
- Describe how the advances in breast imaging & cancer detection can be applied to your practice patterns to benefit your patients!

Why Screen for Cancer?


Screening Tests
No Screen
Palpable
Size (mm)
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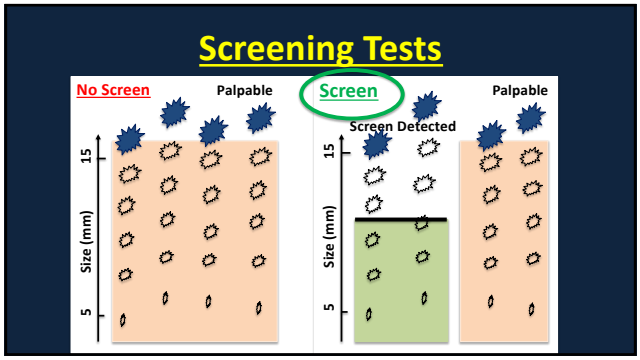
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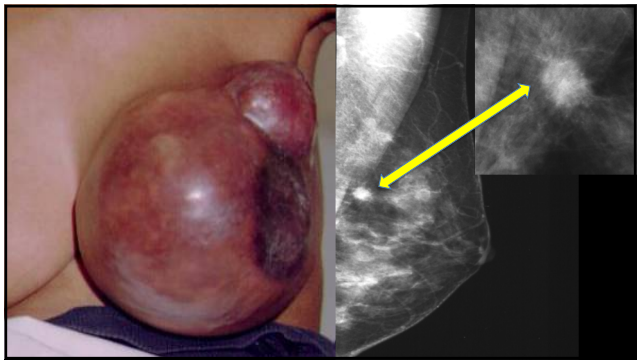

Why Screen for Cancer?

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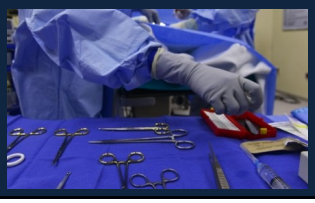
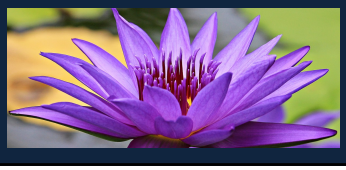


Why Screen for Cancer?

- Small treatable lesions
- Improved prognosis & survival of the patient



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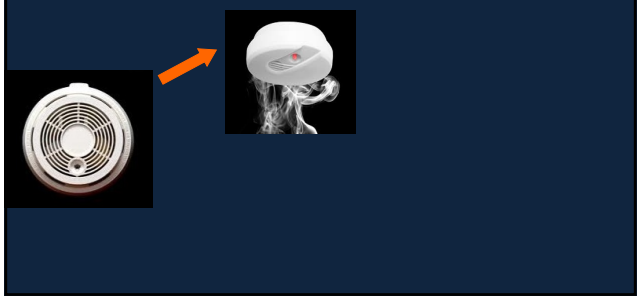

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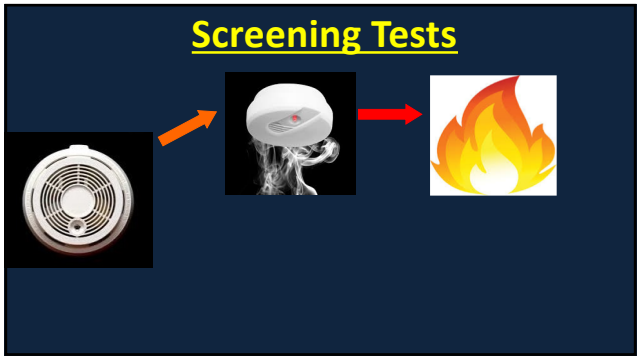

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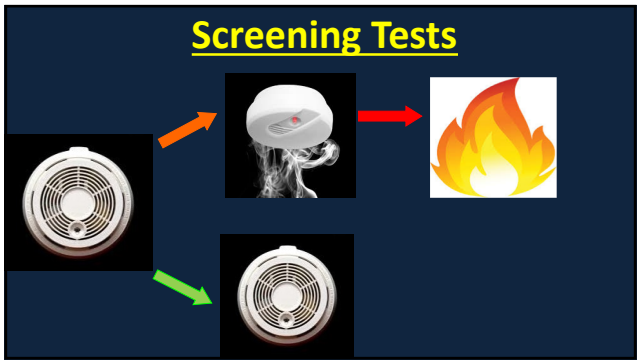

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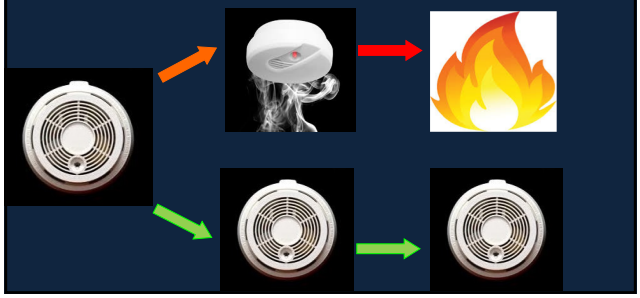

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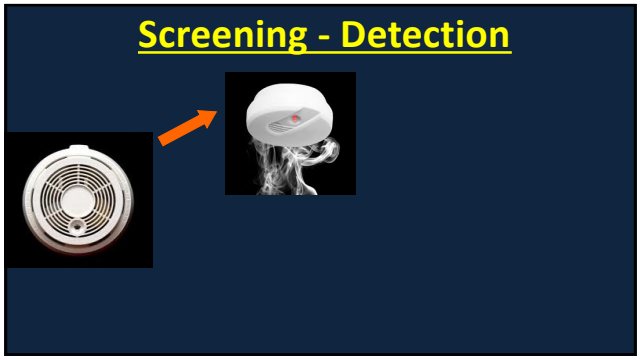

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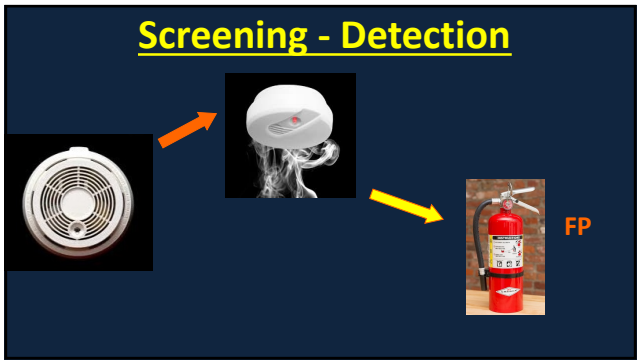

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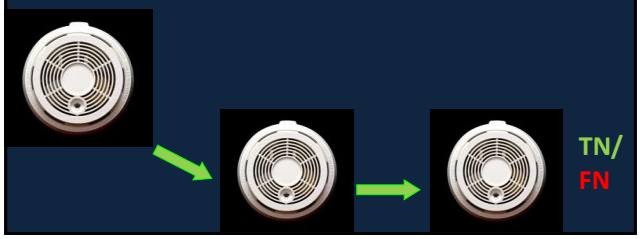
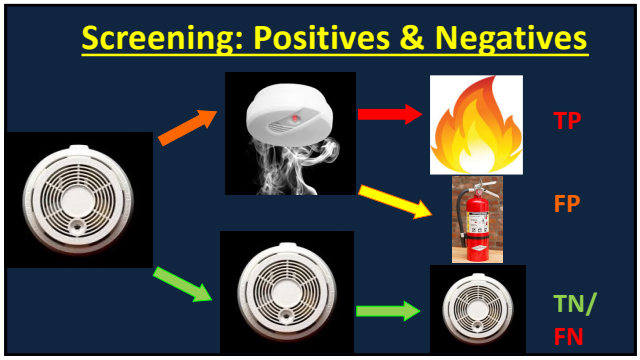


Screening: Positives & Negatives



Breast Cancer

Poll Question 1:

- Breast cancer is the _____common cancer in the world?
  - a. most
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  - c. 5th most
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Breast Cancer

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https://www.wcrf.org/int/cancer-facts-figures/data-specific-cancers/breast-cancer-statistics

Breast Cancer

- 2nd most common cancer in the world
- Most frequent cancer among women
  - 1.7 million new cases each year

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    - Mortality: Highest in less developed regions

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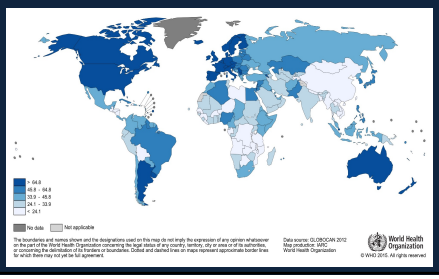
Incidence: World Health Organization



Mortality: World Health Organization

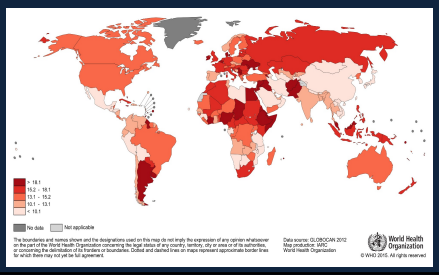


Table 1. Estimated New Female Breast Cancer Cases and Deaths by Age, US, 2017

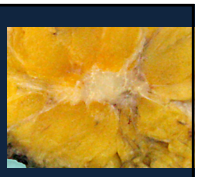
	In Situ Cases		Invasive Cases		Deaths	
Age	Number	%	Number	%	Number	%
<40	1,610	3%	11,160	4%	990	2%
40-49	12,440	20%	36,920	15%	3,480	9%
50-59	17,680	28%	58,620	23%	7,590	19%
60-69	17,550	28%	68,070	27%	9,420	23%
70-79	10,370	16%	47,860	19%	8,220	20%
80+	3,760	6%	30,080	12%	10,910	27%
All ages	**63,410**		**252,710**		**40,610**	

Estimates are rounded to the nearest 10. Percentages may not sum to 100 due to rounding.

https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/breast-cancer-facts-and-figures/breast-cancer-facts-and-figures-2017-2018.pdf

Breast Cancer

- Heterogeneous disease



Breast Cancer

- Heterogeneous disease
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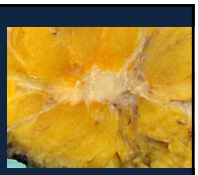

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- 1 in 8 women affected

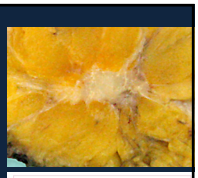

Table 2. Age-specific Probability of Developing Invasive Breast Cancer for US Women

Current age	10-year probability:	or 1 in:
20	0.1%	1,567
30	0.5%	220
40	1.5%	68
50	2.3%	43
60	3.4%	29
70	3.9%	25
Lifetime risk	12.4%	8

Note: Probability is among those free of cancer at beginning of age interval. Based on cases diagnosed 2012-2014. Percentages and "1 in" numbers may not be numerically equivalent due to rounding.

https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/breast-cancer-facts-and-figures/breast-cancer-facts-and-figures-2017-2018.pdf

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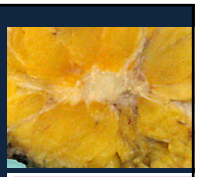
- 1 in 8 women affected
- +80% will not have a family history!



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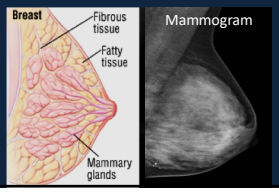
  - Personal
  - High-risk lesion on prior biopsy
  - Family

Mammography

What is a Mammogram?

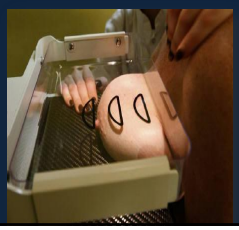
- A specific type of breast imaging that uses low-dose x-rays to detect cancer

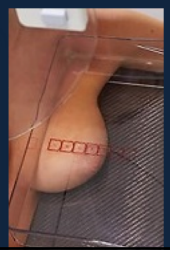


How is a Mammogram Performed ?

- 2 views of each breast

Craniocaudal – CC View





Medial Lateral Oblique – MLO View

How is a Mammogram Performed ?

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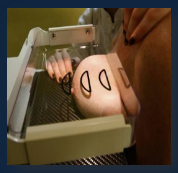
- Breast compression is necessary



Screening Mammography

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- Frequency:
  - Annual mammogram at **age 40 and up**
  - Most benefit if screened yearly
    - Confusion with different recommendations
    - Read the disclaimers/articles carefully

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

Mammography

- Intermediate Risk: 15-20% lifetime risk
  - Personal history of breast cancer
  - Atypia ductal hyperplasia
  - Lobular neoplasia

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  - Annual mammography starting 8 years after radiation therapy but not before age 25

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Mammography

- BRCA mutation
  - If MRI is unavailable, mammogram beginning at age 25
    - Annual breast MRI with contrast beginning at age 25
  - Annual mammogram & MRI with contrast at ages 30-75

https://www.nccn.org/
ACR Appropriateness Criteria 2017:
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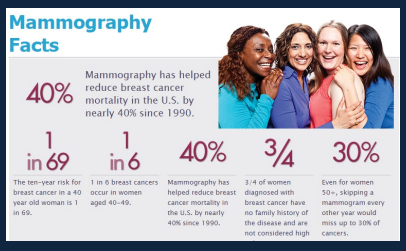
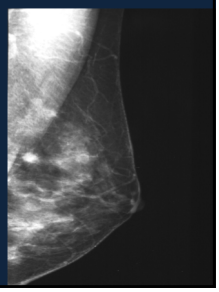
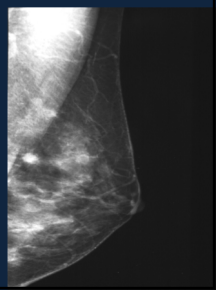
Mammography Advantages





Mammography Advantages

- Acceptable technique for breast cancer screening



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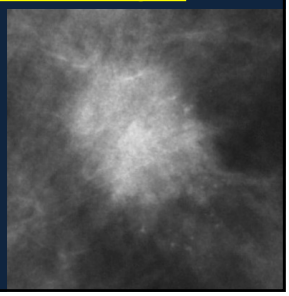

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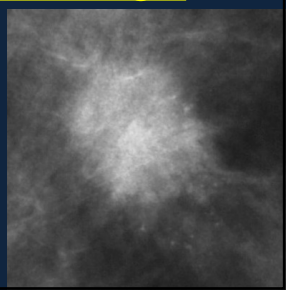

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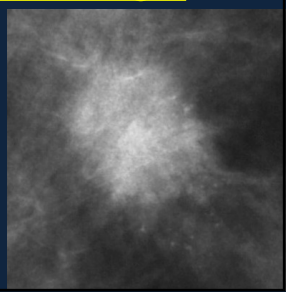

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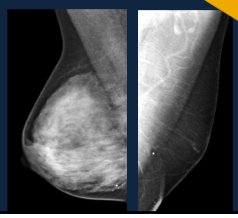

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- Sensitivity
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    - False Negatives -> [5-15%]
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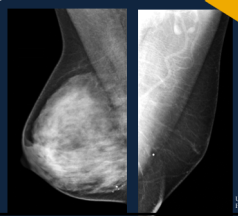
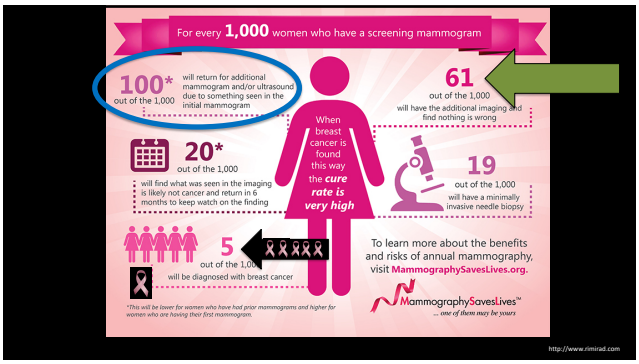


U.S. Preventive Services Task Force. Ann Intern Med. 2009



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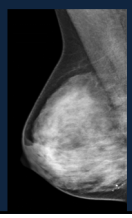

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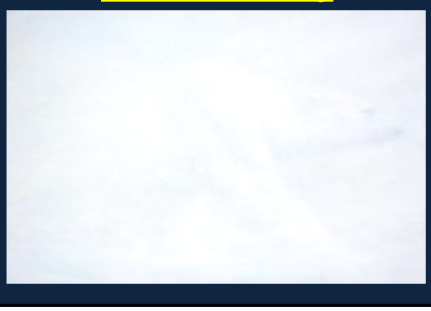
Breast Density



Breast Density

http://chaforthefinest.com/product/against-all-odds-original/

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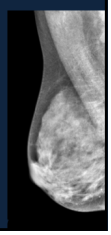

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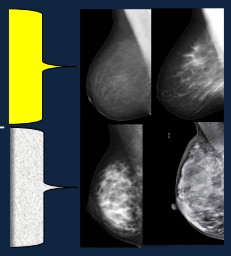
  - **Decrease lesion conspicuity!**
    - Limits the sensitivity of the screening test
- **Sensitivity**:
  - Lower in dense breasts
- Interval cancer (up to 17x) & cancer risk (4-6x)

Boyd NF, *et al.* NEJM 2007

Breast Density Distribution

- Fatty: *10.5% (10%)*
- SFG: *42.9% (40%)*

- HG: *38.7% (40%)*
- ED: *7.3% (10%)*



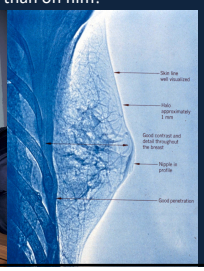
Pisano E, *et al*. NEJM. 2005

1900's ->

UNC-CH

Xeromammography

- Image recorded on paper rather than on film!



Mammography

- Film-screen

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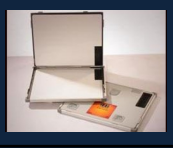

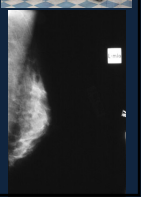

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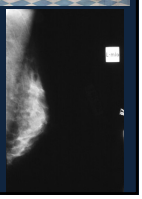
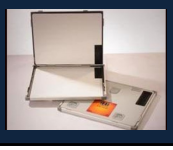
    - Less radiation than industrial film
    - Higher contrast





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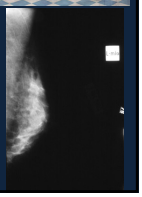

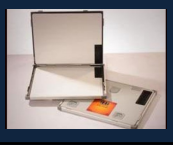

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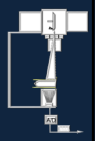
  - FDA-approved 2000
  - Lower radiation dose than SFM
  - Electronic image
    - Stored as a computer file
    - No longer a single film – only copy
  - Digital information can be manipulated for further evaluation

DMIST - Diagnostic Performance

- The accuracy of digital was significantly higher than film mammography for 3 subpopulations:



Pisano E, *et al*. NEJM. 2005

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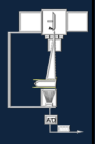

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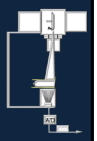
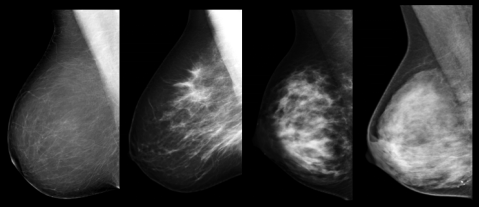
  - Pre- or Peri-menopausal women



Pisano E, *et al*. NEJM. 2005

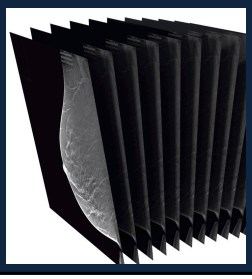
ACR BI-RADS Breast Patterns

Fat ⟷ Glandular



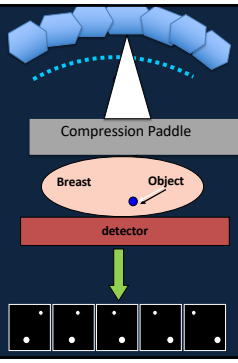
Almost Entirely Fatty | Scattered Areas of Fibroglandular Density | Heterogeneously Dense | Extremely Dense

Digital Breast Tomosynthesis (DBT)



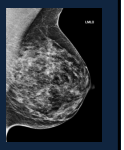
Digital Breast Tomosynthesis

Objects at different heights in the breast project differently for each angle!



Digital Breast Tomosynthesis

- Individual images are reconstructed



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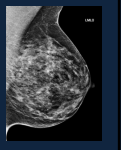
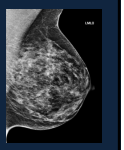
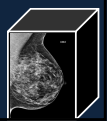
- Individual images are reconstructed
  - Series of thin high-resolution slices



Digital Breast Tomosynthesis

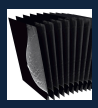
- Individual images are reconstructed
  - Series of thin high-resolution slices
  - Can be displayed individually, "thick slabs" or in a dynamic ciné mode

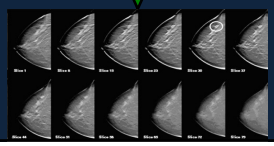




Viewing by Layers of Interest

- Ability to see beyond & into the dense parts of the breast





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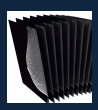
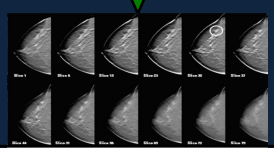
- **Removing overlap of the tissue!**





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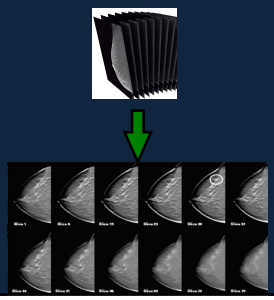
- **Removing overlap of the tissue!**
- The user can interactively select the layer of interest



Interpretation

- FFDM (2D) + DBT (3D) images are reviewed together as one study
  - FDA-approved 2011

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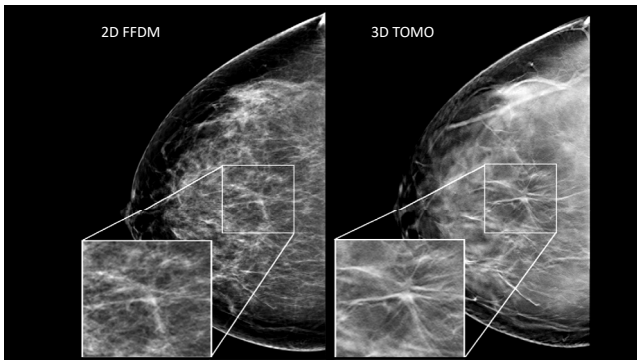
2D FFDM
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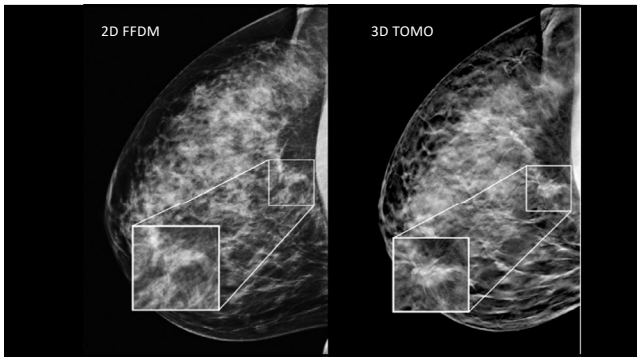
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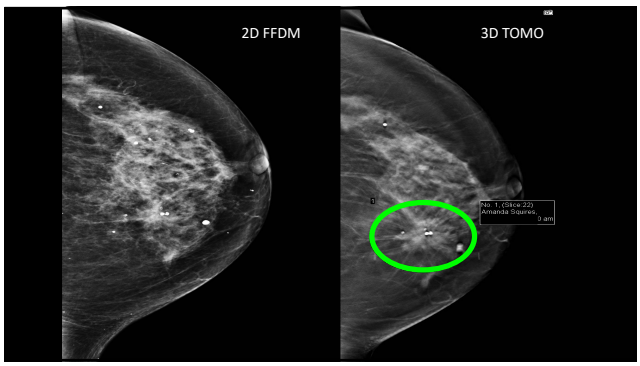
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41% increase in the detection of invasive breast cancers
No significant change in the detection of DCIS

29% increase in the detection of all breast cancers

49% increase in Positive Predictive Value (PPV) for a recall

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  - **Up to 40% decrease** in women recalled for additional imaging after screening
  - **$1200+ reduction** in costs per recall due to avoidance of follow-up services after screening

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Hooley RJ, *et al.* AJR 2017

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  - Although the DBT images are low in dose, a combination 2D & DBT study increases patient radiation exposure by approximately two-fold

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  - Radiation dose is cumulative over time, so it is prudent to limit DBT exposure
  - Larger the breast - more slices; therefore, more radiation dose
  - Synthetic images
    - Synthetic 2D from the 3D data
    - Decrease dose
    - Need to continued to be developed

Hooley RJ, *et al.* AJR 2017

Disadvantages of DBT

- Not all cancers seen with tomo either…..occult!
- No test is 100 %

DBT Questions to be Answered

- Does it detect more lethal/advanced cancers than 2D FFDM?

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  - "TMIST Clinical Trial"
    - Digital mammography
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    - Liquid biomarkers
    - Personalized imaging
- Is it worth the trade off of radiation?
- Should we use it only to screen "dense breast" patients?

Poll Question 2

- All of the following regarding screening mammography are true, except:
  - a. Has an overall low specificity in 2D & 3D imaging
  - b. Has a low sensitivity in "dense" breast tissue
  - c. DBT decreases the limitation of tissue overlap
  - d. DBT has higher radiation dose than 2D

Poll Question 2

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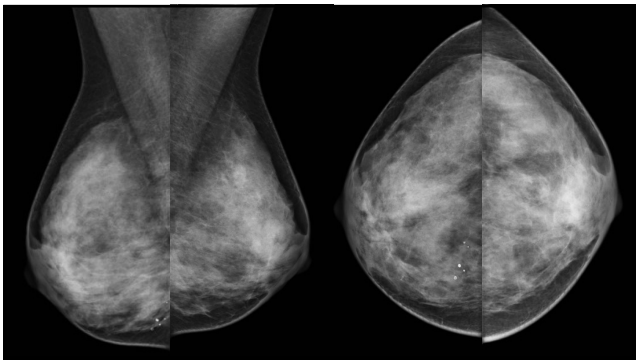
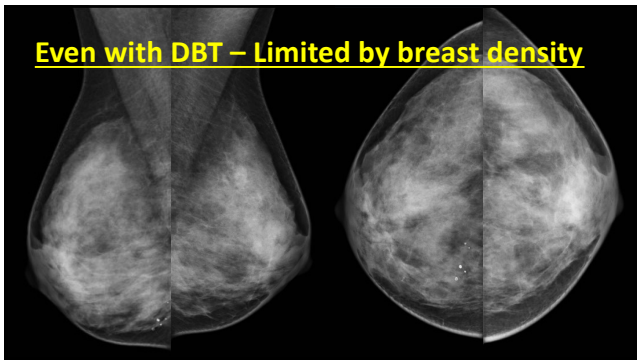
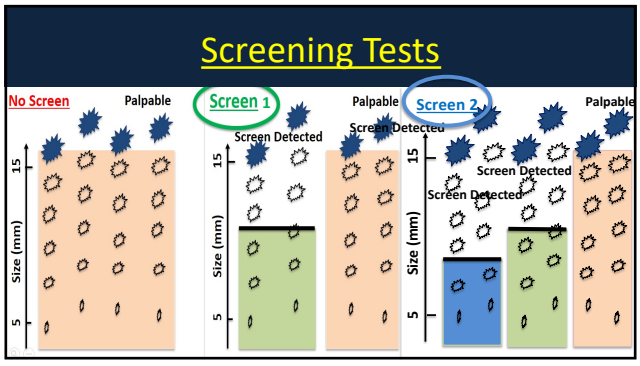




Supplemental Screening



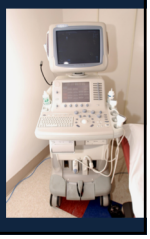
Supplemental Screening

- General patient population
  - Breast density
- High-risk patient

Ultrasound

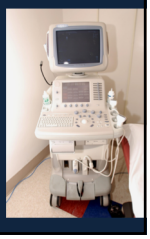
Ultrasound

- **Alternative technology that is not limited by breast density**



Ultrasound

- **Alternative technology that is not limited by breast density**
- **Small hand-held transducer**:
  - Significant amount of operator subjectivity
  - Variation in breast ultrasound exams
  - Time to perform exam can vary



Ultrasound

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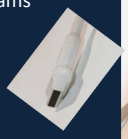
- **Small hand-held transducer**:
  - Significant amount of operator subjectivity
  - Variation in breast ultrasound exams
  - Time to perform exam can vary
- **Limitations**:
  - Missed lesions
  - False-positive findings



Ultrasound Dense Breast

- Increased cancer detection (yield) by 3.5/1000 screened

Kolb T, et al. *Radiology* 1998
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  - Can depict small, early-stage, occult cancers similar in size & stage to mammographically identified nonpalpable cancers
- Increases detection of node-negative invasive breast cancer in women in the 1st prevalence screen

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ACRIN 6666: Ultrasound Study

- 2809 high-risk women with dense breasts @ 21 sites

Berg W, et al. JAMA 2012.

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- 3 annual screens with mammography & US
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ACRIN 6666: Ultrasound Study

- 2809 high-risk women with dense breasts @ 21 sites
- 3 annual screens with mammography & US
  - 612 also underwent MRI at end of study
- 110 subjects had 111 breast cancer events
  - 33 (30%) Mammo detected only
  - 32 (29%) US only
  - 26 (23%) by both
  - 9 (8%) by MRI
  - 11 (10%) not detected by any modality

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- **Additional cancer detection rate:**
  - US 4.3 cancers/1000 screens
  - MRI 14.7 cancers/1000 screens ←

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- **Additional cancer detection rate:**
  - US 4.3 cancers/1000 screens
  - MRI 14.7 cancers/1000 screens ←
- 30/32 US detected only cancers were invasive
  - Range 2-40mm (median size 10mm)
  - 26 out of 27 staged were node negative

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- 30/32 US detected only cancers were invasive
  - Range 2-40mm (median size 10mm)
  - 26 out of 27 staged were node negative
- **US Biopsy rate = 5% (242 of 4814)**
  - **18/242 (7.4%) were cancer**

Berg W, et al. JAMA 2012.

ACRIN 6666: Ultrasound Study

Conclusion: Addition of screening US or MRI to mammography in women at increased-risk of breast cancer resulted in not only a higher cancer detection yield but also an **increase in false-positive findings**

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Screening US in Patients with Mammographically Dense Breasts: Initial Experience with CT Public Act 09-41

- Retrospective study
- Single center - Yale
- Technologists scanned with hand-held transducers

Hooley et al. *Radiology* 2012

Screening US in Patients with Mammographically Dense Breasts: Initial Experience with CT Public Act 09-41

- Retrospective study
- Single center - Yale
- Technologists scanned with hand-held transducers
- **935 patients**
  - 614 low risk
  - 149 intermediate risk
  - 87 high-risk

Hooley et al. *Radiology* 2012

CT Public Act 09-41: Results

- **BIRADS**
  - 1 (Negative) or 2 (Benign): 75% (701)
  - 3 (Probably Benign): 20% (187) – only 82% (145) returned for F/U
  - 4 (Suspicious): 5% (47)

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  - **3 cancers!**
    - < 1 cm
    - All post-menopausal, low risk patients

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- 63 aspirations or biopsies
  - **3 cancers!**
    - < 1 cm
    - All post-menopausal, low risk patients
  - **4.7% (44) false-positive**
  - **PPV = 6.5%**
  - **Cancer Detection Rate = 3.2/1000**

Hooley et al. *Radiology* 2012

CT Public Act 09-41: Conclusion

- Technologist-performed hand-held screening breast US offered to women in the general population of dense breasts can aid detection of small mammographically occult breast cancers, although the overall PPV is low.

Hooley et al. *Radiology* 2012

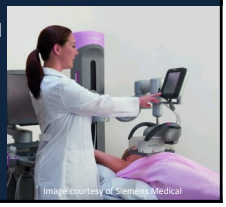
Automated Whole Breast Ultrasound

- Breast ultrasound scanning requires a small hand-held transducer

Automated Whole Breast Ultrasound

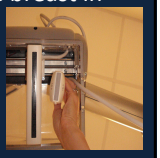
- Breast ultrasound scanning requires a small hand-held transducer

- Recent advances in technology have lead to the development of automation
  - Eliminates operator variation with improved technique standardization



Automated Whole Breast Ultrasound

- Provides a volume data set of the whole breast in a **standardized manner**



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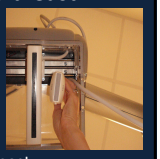
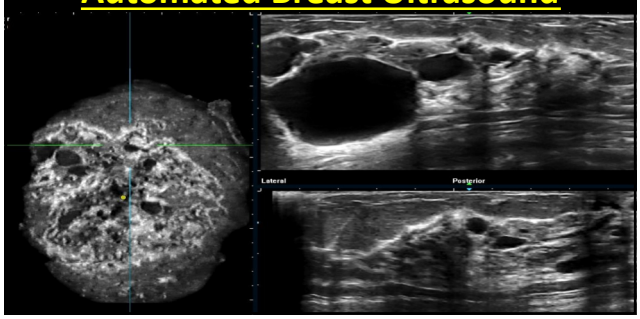


- **Short scanning times**
  - 1 minute per scan projection
    - May have AP, lateral & medial views of one breast
    - Extra scan projections may be needed for a larger breast

Automated Whole Breast Ultrasound

Automated Breast Ultrasound



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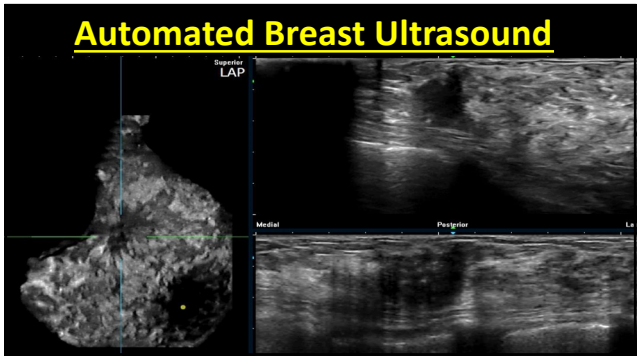

Breast Cancer Detection Using Automated Whole Breast Ultrasound & Mammography in Dense Breasts

- 4,419 pts with dense breasts &/or high-risk
  - 3.6 cancers/1000 mammo
  - 7.2 cancers/1000 mammo + AWBU

Kelly et al. Eur Radiol 2010

Breast Cancer Detection Using Automated Whole Breast Ultrasound & Mammography in Dense Breasts

- 4,419 pts with dense breasts &/or high-risk
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- AWBU PPV = 38.0%

Kelly et al. Eur Radiol 2010

Ultrasound Screening

- Average Risk: < 15% lifetime risk

Lee C, et al. JARC 2010
ACR Appropriateness Criteria 2017:
https://acsearch.acr.org/docs/70910/Narrative/

Ultrasound Screening

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  - No data to support the use with "non-dense breasts"

Lee C, et al. JARC 2010
ACR Appropriateness Criteria 2017:
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Ultrasound Screening

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  - No data to support the use with "non-dense breasts"
  - Can be considered in women with dense breast tissue as an adjunct to mammography
    - Balance between increased cancer detection & the increased risk of a false-positive examination should be considered in the decision

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  - Can be considered in women with dense breast tissue as an adjunct to mammography
    - Balance between increased cancer detection & the increased risk of a false-positive examination should be considered in the decision
  - Some states mandate insurance companies to pay for it

Lee C, et al. JARC 2010
ACR Appropriateness Criteria 2017:
https://acsearch.acr.org/docs/70910/Narrative/

Ultrasound Screening

- Intermediate Risk: 15-20% lifetime risk

Lee C, et al. JARC 2010
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Ultrasound Screening

- Intermediate Risk: 15-20% lifetime risk
  - With dense breasts, supplemental US screening is an option

Lee C, et al. JARC 2010
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Ultrasound Screening

- Intermediate Risk: 15-20% lifetime risk
  - With dense breasts, supplemental US screening is an option
  - Increase cancer detection
    - False positive rates are also substantially increased

Lee C, et al. JARC 2010
ACR Appropriateness Criteria 2017:
https://acsearch.acr.org/docs/70910/Narrative/

Ultrasound Screening

- High-Risk: > 20% lifetime risk

Lee C, et al. JARC 2010
ACR Appropriateness Criteria 2017:
https://acsearch.acr.org/docs/70910/Narrative/

Ultrasound Screening

- High-Risk: > 20% lifetime risk
  - Can be considered for whom MRI screening may be appropriate but who cannot have MRI for any reason

Lee C, et al. JARC 2010
ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

Supplemental Ultrasound Screening

- Reality:
  - As tomosynthesis becomes more readily available it continues to replace screening US

Poll Question 3

- All of the following are associated with whole breast screening ultrasound, except:
  - a. Not limited by breast density
  - b. High false positive rate
  - c. Cancer detection rate similar to mammography
  - d. High positive predictive value (PPV)

Poll Question 3

- All of the following are associated with whole breast screening ultrasound, except:
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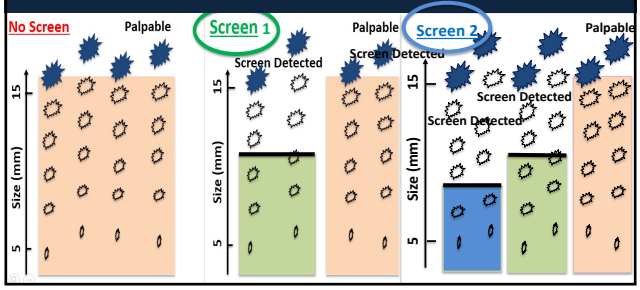
  - d. High positive predictive value (PPV) - correct

Breast MRI

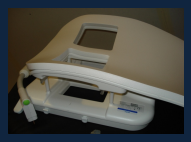
Screening Tests



Magnetic Resonance Imaging

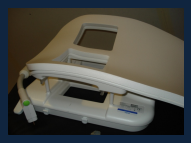
Breast MRI

- Breast coil

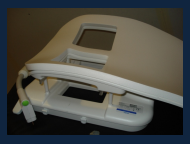


Breast MRI

- Breast coil
- Gadolinium-based contrast agent



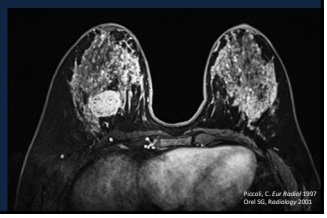
Breast MRI



- Breast coil
- Gadolinium-based contrast agent
- Different sequences
  - Exam time approximately 30 minutes

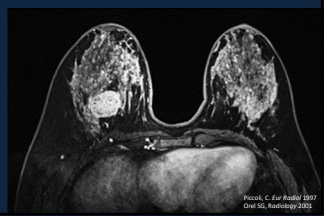
Breast MRI - Advantages

- Superior soft tissue visualization
  - Multiplanar



Breast MRI - Advantages

- Superior soft tissue visualization
  - Multiplanar
- High sensitivity
  - >90%



Breast MRI - Disadvantages

- Variable Specificity -> False positives

Piccoli, C. *Eur Radiol* 1997
Orel SG, *Radiology* 2001

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  - Background parenchymal enhancement
  - Technical methods
  - Criteria for interpretation

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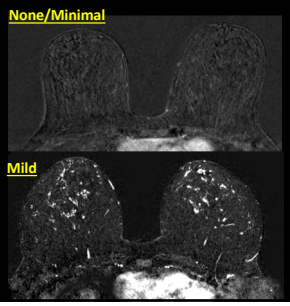
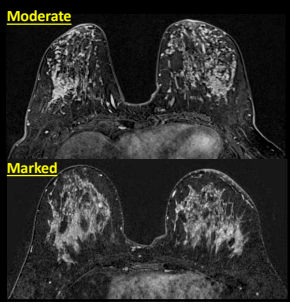
Breast MRI - Disadvantages

- Variable Specificity -> False positives
  - Differences in study populations
  - Background parenchymal enhancement
  - Technical methods
  - Criteria for interpretation
- Background parenchymal enhancement (BPE)
  - Normal breast tissue
  - Microenvironment

Piccoli, C. *Eur Radiol* 1997
Orel SG, *Radiology* 2001

MRI BPE





Breast MRI - Disadvantages

- High cost
  - > $1000

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Breast MRI - Disadvantages

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  - > $1000

- Long exam times & thousands of images
  - >25 minutes

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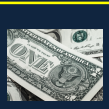

- Long exam times & thousands of images
  - >25 minutes
- Contrast reaction

Piccoli, C. *Eur Radiol* 1997
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Breast MRI - Gadolinium

- Nephrogenic Systemic Fibrosis (NSF)

https://www.insideradiology.com.au/gadolinium-contrast-medium/

Breast MRI - Gadolinium

- Nephrogenic Systemic Fibrosis (NSF)
  - Rare condition associated with gadolinium contrast medium given to patients with severe renal (kidney) disease

https://www.insideradiology.com.au/gadolinium-contrast-medium/

Breast MRI - Gadolinium

- **Nephrogenic Systemic Fibrosis (NSF)**
  - Rare condition associated with gadolinium contrast medium given to patients with severe renal (kidney) disease
  - Debilitating disease resulting in skin contractures & internal organ damage
  - Onset occurs days, weeks or months after receiving gadolinium - most all cases occurring within 6 months of the last dose

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- **Gadolinium retention**
  - Very small amounts of at least some forms of gadolinium contrast (about 1% of the injected dose) are retained in the tissues
    - Mostly in the bones
    - Tiny amounts in the brain

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  - Very small amounts of at least some forms of gadolinium contrast (about 1% of the injected dose) are retained in the tissues
    - Mostly in the bones
    - Tiny amounts in the brain
  - Currently, there are no known adverse effects from these very small amounts of retained gadolinium.

https://www.insideradiology.com.au/gadolinium-contrast-medium/

Breast MRI

- Request for the MRI exam must be originated by a physician or other appropriate licensed health care provider.

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  - Stable benign masses
  - Asymmetric breast tissue

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- Mammogram & report should be available for review
  - IM lymph nodes
  - Stable benign masses
  - Asymmetric breast tissue
- **Recommended to scan during 2nd week of the menstrual cycle!!**
  - To decrease background

Screening Breast MRI

- Who to Screen?

Screening Breast MRI

- Who to Screen?
- Not recommended at the current time in the asymptomatic general population of women
  - False positives

MRI Screening

- Average Risk: <15% lifetime risk

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- Average Risk: <15% lifetime risk
  - There is insufficient evidence to support the use of MRI for screening women of average risk

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- Intermediate Risk: 15%-20% lifetime risk

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- Intermediate Risk: 15%-20% lifetime risk
  - ACS: insufficient evidence for or against MRI as an adjunct to mammography

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- Intermediate Risk: 15%-20% lifetime risk
  - ACS: insufficient evidence for or against MRI as an adjunct to mammography
  - Recent studies support the use in certain populations:
    - Personal history of breast cancer
    - Lobular carcinoma in situ/atypical ductal hyperplasia

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- High-Risk: >20% lifetime risk
  - Has a higher sensitivity than mammography

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- High-Risk: >20% lifetime risk
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ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- High-Risk: >20% lifetime risk
  - Has a higher sensitivity than mammography
  - Combination of mammography & MRI has the highest sensitivity in this population
  - MRI & mammography combined sensitivity = 92.7%
  - US & mammography combined sensitivity = 52.0%

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- High-Risk: >20% lifetime risk
  - BRCA gene mutations & their untested first-degree relatives

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

MRI Screening

- High-Risk: >20% lifetime risk
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  - Lifetime risk of breast cancer of 20% or greater

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MRI Screening

- High-Risk: >20% lifetime risk
  - BRCA gene mutations & their untested first-degree relatives
  - Other genetic syndromes that increase the risk of breast cancer
  - Lifetime risk of breast cancer of 20% or greater
  - Radiation therapy to the chest between 10 to 30 years of age

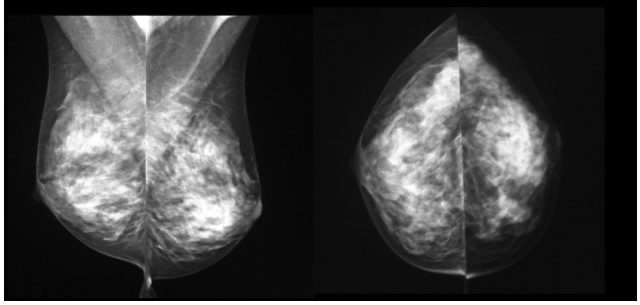
ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

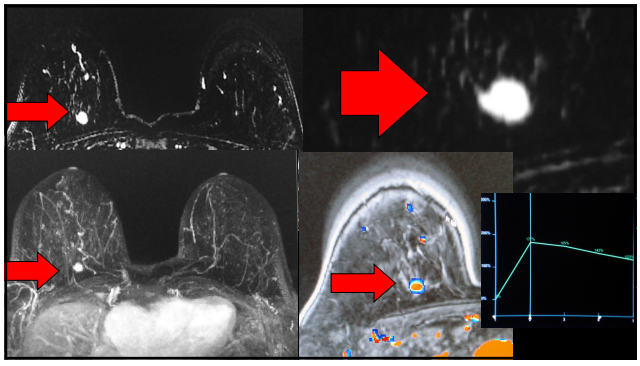
MRI Screening

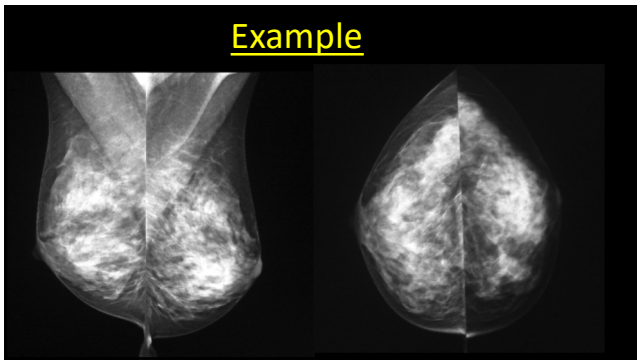
- High-Risk: >20% lifetime risk
  - BRCA mutation:
    - Annual breast MRI beginning at Age 25
    - Then, annual mammography & MRI stating at age 30

ACR Appropriateness Criteria 2017: https://acsearch.acr.org/docs/70910/Narrative/

Example



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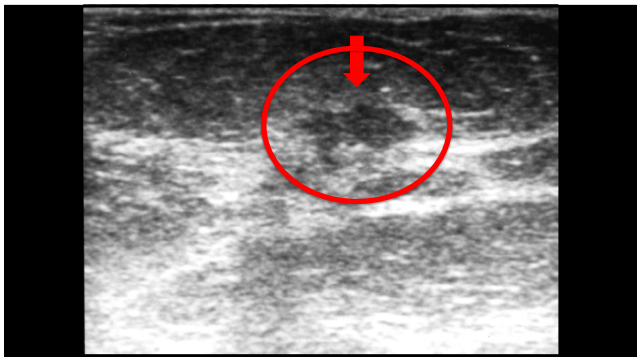

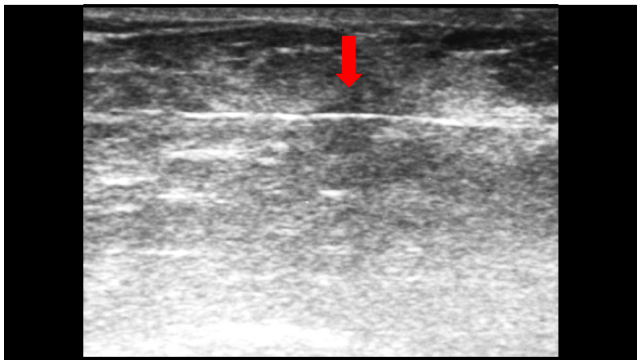

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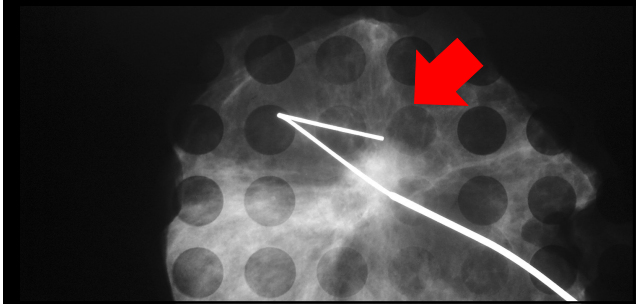

Breast MRI

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- If MRI is negative, still need a mammogram
  - MRI is a supplemental exam, it does not replace the mammogram

Breast MRI

- Performs better at detecting invasive cancer & high grade DCIS
- No test 100%
- If MRI is negative, still need a mammogram
  - MRI is a supplemental exam, it does not replace the mammogram
- High sensitivity and lower specificity
  - False positives

Abbreviated Breast MRI (ABBI)

- Standard breast MRI protocols time-consuming & expensive

Kuhl K. Br J Radiology 2017
Kuhl K, et al. JCO 2014
Chhor C. AJR 2017

Abbreviated Breast MRI (ABBI)

- Standard breast MRI protocols time-consuming & expensive
- **ABBI**
  - 3-5 minutes
  - Increase efficiency
  - Less images to interpret
  - Lower the cost
  - Diagnostic accuracy comparable to that of the conventional full MRI protocol in some studies
  - ? Use for general population?

Kuhl K. Br J Radiology 2017
Kuhl K, et al. JCO 2014
Chhor C. AJR 2017

Poll Question 4

- The screening recommendation for a 45-year-old, BRCA positive, high-risk patient is:
  - a. annual mammography & screening breast ultrasound
  - b. annual mammography, screening ultrasound & MRI
  - c. annual mammography & screening breast MRI
  - d. screening MRI only

Poll Question 4

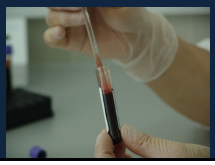
- The screening recommendation for a 45-year-old, BRCA positive, high-risk patient is:
  - a. annual mammography & screening breast ultrasound
  - b. annual mammography, screening ultrasound & MRI
  - c. annual mammography & screening breast MRI - correct
  - d. screening MRI only

Future

- Personalized medicine

Future

- Personalized medicine
- Liquid biomarkers



Screening for Breast Cancer

- In the absence of a known preventable cause, the single most important factor in reducing death & extent of treatment is

Screening for Breast Cancer

- In the absence of a known preventable cause, the single most important factor in reducing death & extent of treatment is early detection through screening.

Thank You!

- Cherie_kuzmiak@med.unc.edu