Module 2: Supplemental Screening

• Intended Learning Outcomes
  – Differentiate between supplemental screening technologies and their relative ability to increase cancer detection
    • Ultrasound
    • MRI
  – Counsel women considering testing about the benefits and risks of supplementary screening
Supplemental Screening

• Ultrasound
• MRI
• Tomosynthesis
• Molecular Breast Imaging

• ALL can increase cancer detection
• NONE proven to decrease mortality or morbidity
• None recommended by major organizations for density alone

NCCN Breast Cancer Screening and Diagnosis Version 1.2014
Friedewald, Berg, Hooley, Parris, Weigert, Rhodes– See references
Tomosynthesis

Digital x-ray mammogram
Multiple projections in an arc

Park J M et al. Radiographics 2007;27:S231-S240
Tomosynthesis

**Benefits**
- Increase cancer detection in all densities (41%)
- Decreased recall rate (15%)
  - Removes superimposition of tissue

**Risks**
- Radiation dose initially 2x regular mammogram
  - can synthesize 2-D images from the 3-D images to decrease the dose
- Increased interpretation time

Friedewald, SM JAMA 2014;311(24):2499–2507
Screening Ultrasound

- 5.3 additional cancers/1000 women in year 1
- 3.7/1000 in years 2 and 3

<table>
<thead>
<tr>
<th></th>
<th>False +</th>
<th>PPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammo alone</td>
<td>4.4</td>
<td>22.6 %</td>
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<tr>
<td>US alone</td>
<td>8.1</td>
<td>8.9 %</td>
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<tr>
<td>Mammo + US</td>
<td>10.4</td>
<td>11.2 %</td>
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</tbody>
</table>


Image courtesy of R.W. Pinsky, MD
Used with permission
## Connecticut Experience

<table>
<thead>
<tr>
<th></th>
<th>Hooley</th>
<th>Weigert</th>
<th>Parris</th>
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<tbody>
<tr>
<td># of patients</td>
<td>935</td>
<td>8647</td>
<td>5519</td>
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<tr>
<td># of Cat 4 or 5</td>
<td>5%</td>
<td>5%</td>
<td>3.3%</td>
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<tr>
<td># of incremental cancers</td>
<td>3.2/1000</td>
<td>3.25/1000</td>
<td>1.8/1000</td>
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<tr>
<td>Size of cancer</td>
<td>0.5 - 0.9 cm</td>
<td>0.4 - 8 cm</td>
<td>0.4 - 1.5 cm</td>
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<tr>
<td>PPV</td>
<td>6.5%</td>
<td>6.7%</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

>50% dense  
All risk levels  
Hand held whole breast ultrasound

Hooley et al, Radiology, 2012  
Weigert et al, Breast Journal 2012  
Parris et al, Breast Journal 2013
Screening Ultrasound

- Computer model study of cost/benefit of supplemental screening US
  - Aged 50–74 years
  - Heterogeneously or extremely dense breasts
  - Per 1000 women:
    - 0.36 additional deaths averted
    - 1.7 QALYs (Quality Adjusted Life Years) gained
    - 354 biopsy recommendations
    - Cost effectiveness ratio: $325,000 per QALY gained

Automated Ultrasound

- Automated high frequency linear transducer
- ~1000 images acquired
- Can scroll through images
- Limited outcome studies to date
- May become more widely used with further study
MRI

- Powerful magnetic field
- No radiation
- IV gadolinium required
- Not recommended
  - Pregnancy
  - Pacemaker
  - Incompatible implanted metal
  - Impaired renal function
  - Severe claustrophobia
MRI

Dense, negative mammogram

Diagnosis: Invasive Ductal CA

Expanded ACRIN trial: Higher risk AND dense
Added MRI screening after 3 rounds of M/US

58% accepted offer of study MRI
612 women in MRI-added group

**Supplemental cancer yield of MRI: 14.7/1000**

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>Recall Rate</th>
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<tbody>
<tr>
<td>Mammo alone</td>
<td>56%</td>
<td>89%</td>
<td>29%</td>
<td>11%</td>
</tr>
<tr>
<td>Mammo + US</td>
<td>94%</td>
<td>74%</td>
<td>11%</td>
<td>16%</td>
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<tr>
<td>MRI</td>
<td><strong>100%</strong></td>
<td><strong>70%</strong></td>
<td><strong>19%</strong></td>
<td><strong>31%</strong></td>
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Berg WA JAMA 2012; 307:1394-1404
Molecular Breast Imaging-MBI

- Technitium-99m sestamibi radio isotope– IV injection
  - Dose similar to mammography
  - Higher resolution than whole body imaging

- 8.8 additional cancers/1000 women vs mammography alone
- Increased recalls up to 17%
- No difference in PPV3 vs mammography alone
- NO MORTALITY REDUCTION DATA

Rhodes DR. AJR 2015; 204:241-251