Breast Cancer Screening 101: Screening Guidelines and Imaging Modalities

Robert Smith, PhD                        Cheryl Herman, MD
American Cancer Society             NAPBC Education Committee

November 23, 2015

American Cancer Society

NATIONAL ACCREDITATION PROGRAM FOR BREAST CENTERS
Webinar Topics

- Burden of disease
- Benefits and harms associated with mammography
- Recommendations for average risk populations
- Recommendations for high-risk populations
- Understanding Imaging Modalities

Breast cancer is the most common cancer overall, and the most common cancer in women

<table>
<thead>
<tr>
<th>Common Types of Cancer</th>
<th>Estimated New Cases 2015</th>
<th>Estimated Deaths 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Breast Cancer (Female)</td>
<td>231,840</td>
<td>40,290</td>
</tr>
<tr>
<td>2. Lung and Bronchus Cancer</td>
<td>221,200</td>
<td>158,040</td>
</tr>
<tr>
<td>3. Prostate Cancer</td>
<td>220,800</td>
<td>27,540</td>
</tr>
<tr>
<td>4. Colon and Rectum Cancer</td>
<td>132,700</td>
<td>49,700</td>
</tr>
<tr>
<td>5. Bladder Cancer</td>
<td>74,000</td>
<td>16,000</td>
</tr>
<tr>
<td>6. Melanoma of the Skin</td>
<td>73,870</td>
<td>9,940</td>
</tr>
<tr>
<td>7. Non-Hodgkin Lymphoma</td>
<td>71,850</td>
<td>19,790</td>
</tr>
<tr>
<td>8. Thyroid Cancer</td>
<td>62,450</td>
<td>1,950</td>
</tr>
<tr>
<td>9. Kidney and Renal Pelvis Cancer</td>
<td>61,560</td>
<td>14,080</td>
</tr>
<tr>
<td>10. Endometrial Cancer</td>
<td>54,870</td>
<td>10,170</td>
</tr>
</tbody>
</table>

Breast cancer represents 14.0% of all new cancer cases in the U.S.

29% of all female cancers

<table>
<thead>
<tr>
<th>Age, y</th>
<th>2011 Population Size (in 1000s)</th>
<th>5-Year Absolute Breast Cancer Risk, 2009-2011, %</th>
<th>Breast Cancer Incidence Rate per 100 000 Population, 2007-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-34</td>
<td>72 049</td>
<td>0.1</td>
<td>5.3</td>
</tr>
<tr>
<td>35-39</td>
<td>98 374</td>
<td>0.3</td>
<td>59.5</td>
</tr>
<tr>
<td>40-44</td>
<td>10 576</td>
<td>0.6</td>
<td>122.5</td>
</tr>
<tr>
<td>45-49</td>
<td>11 211</td>
<td>0.9</td>
<td>188.6</td>
</tr>
<tr>
<td>50-54</td>
<td>11 499</td>
<td>1.1</td>
<td>224.0</td>
</tr>
<tr>
<td>55-59</td>
<td>10 444</td>
<td>1.3</td>
<td>266.4</td>
</tr>
<tr>
<td>60-64</td>
<td>9 271</td>
<td>1.6</td>
<td>346.7</td>
</tr>
<tr>
<td>65-69</td>
<td>6 806</td>
<td>2.0</td>
<td>420.2</td>
</tr>
<tr>
<td>70-74</td>
<td>5 204</td>
<td>2.1</td>
<td>433.8</td>
</tr>
<tr>
<td>75-79</td>
<td>4 155</td>
<td>2.0</td>
<td>443.3</td>
</tr>
<tr>
<td>80-84</td>
<td>3 444</td>
<td>1.9</td>
<td>420.6</td>
</tr>
<tr>
<td>≥85</td>
<td>3 826</td>
<td>2.5</td>
<td>354.4</td>
</tr>
</tbody>
</table>
# Breast Cancer in Younger Women

| Incidence rate per 100,000
diagnosed in the 1 year interval | Probability of being diagnosed in the 1 year interval | % of BC deaths by age at diagnosis |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>35 years 44.9 0.0% 2,212</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>36 years 51.9 0.1% 1,943</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>37 years 61.6 0.1% 1,713</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>38 years 65.9 0.1% 1,440</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>39 years 79 0.1% 1,232</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>40 years 106.3 0.1% 1,076</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>41 years 109.8 0.1% 954</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>42 years 120.9 0.1% 857</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>43 years 130.6 0.1% 774</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>44 years 148.3 0.1% 706</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>45 years 165.9 0.2% 648</td>
<td>2%</td>
<td></td>
</tr>
</tbody>
</table>

a. Delay-adjusted incidence rates, SEER 18, 2008-2012
b. SEER 18, 2010-2012
c. Distribution of BC deaths (2008-2012) from a BC diagnosis up to 15 years prior, SEER 18, 2010-2012

Risk between ages 40-41 is 9 in 10,000. The recall rate is 1,600 – 2,000 per 10,000 (about 1 in 5)
The Evolving Evidence for Mammography Screening—the Randomized Trials

Evaluation of Periodic Breast Cancer Screening With Mammography

Methodology and Early Observations
Sam Shapiro, Philip Straus, MD, and Louis Venet, MD

Mammographic service screening and mortality in breast cancer patients: 20-year follow-up before and after introduction of mammography

Cancer detection programs have for years emphasized the importance of early diagnosis in breast cancer. Proponents of periodic physical

Randomised controlled trial of mammographic screening in women from age 40: results of screening in the first 10 years

Periodic Breast Cancer Screening in Reducing Mortality From Breast Cancer
Sam Shapiro, Philip Straus, MD, Louis Venet, MD

From the Department of Research and Statistics, Health Insurance Plan of Greater New York (Dr. Shapiro); Mt. Sinai School of Medicine and Department of Radiology, Lenox Hill Hospital (Dr. Straus); and New York Medical College and Beth Israel Medical Center (Dr. Venet), New York.

ABSTRACT

Randomised controlled trial of mammographic screening in women from age 40: results of screening in the first 10 years

S Moss**, A Thomas, A. Evans, H Thomas and L John (writing committee) for the In Breast Cancer among women aged 40 to 49 years

Canadian National Breast Screening Study: 1. Breast cancer detection and death rates among women aged 40 to 49 years

Annette M. Milne, MB, FRCP; Cornelia J. Boice, MD, MSc; Teresa Xu, PhD; Claire Wall, MS:

Objective: To evaluate the efficacy of the combination of annual screening with mammography, physical examination of the breasts and the reading of breast films in reducing the rate of death from breast cancer among women aged 40 to 49 years as set by.

Randomised controlled trial.
UK Independent Review of Breast Cancer Screening---Marmot Report

Meta-analysis of 11 RCTs with 13 years of follow-up.

Overall relative risk = 0.80 (0.73, 0.89)

Source: Marmot, MG, et al. BJC, October 2012
The Swedish Two County Trial—the Importance of Long Term Follow-up (29 Years)

**Swedish Two-County Trial: Impact of Mammographic Screening on Breast Cancer Mortality during 3 Decades**

- **133,065 women ages 40-47 randomized to screening or usual care**
- **Screening phase = 7 years**
- **Screening interval**
  - 40-49 = 24 months
  - 50-74 = 33 months
- **Protocol**
  - One view mammography
  - Single reader
  - No physical exam
- **1st mortality results published in 1985**
• **Two important points:**

1. Very long term follow-up is necessary to measure the full benefit of breast cancer screening
2. With long follow-up, the number-needed-to-screen to save one life steadily improves

<table>
<thead>
<tr>
<th>Time between Randomization and Follow-up (y)</th>
<th>RR*</th>
<th>Deaths from Breast Cancer in ASP Group</th>
<th>Expected Deaths in ASP Group†</th>
<th>Deaths Prevented in ASP Group</th>
<th>No. of Women Needed to Screen*</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.74 (0.57, 0.98)</td>
<td>206</td>
<td>277</td>
<td>71</td>
<td>922 (515, 4410)</td>
</tr>
<tr>
<td>15</td>
<td>0.70 (0.56, 0.87)</td>
<td>284</td>
<td>408</td>
<td>124</td>
<td>526 (351, 1055)</td>
</tr>
<tr>
<td>20</td>
<td>0.70 (0.57, 0.85)</td>
<td>324</td>
<td>465</td>
<td>141</td>
<td>464 (316, 871)</td>
</tr>
<tr>
<td>25</td>
<td>0.70 (0.57, 0.85)</td>
<td>347</td>
<td>497</td>
<td>150</td>
<td>436 (297, 815)</td>
</tr>
<tr>
<td>29</td>
<td>0.70 (0.57, 0.85)</td>
<td>351</td>
<td>509</td>
<td>158</td>
<td>414 (286, 748)</td>
</tr>
</tbody>
</table>

* Numbers in parentheses
† Expected deaths if the ASP had the same mortality rate as the PSP, calculated by dividing the observed deaths by the RR (eg, at 10 years, 206/0.7435 = 277 expected deaths).

**31% fewer deaths After 29 years**
UK Independent Review of Breast Cancer Screening—Estimate of Absolute Benefit

• In the UK, women ages 50-70 are invited to screening every 3 years

• Apply the relative mortality of 20% to the observed cumulative absolute risk of breast cancer mortality over the ages 55–79 years

• Results:
  – For every 235 women invited to screening, 1 breast cancer death would be prevented
  – For every 180 women screened, 1 breast cancer death would be prevented

Source: Marmot, MG, et al. BJC, October 2012
Do the RCTs provide us with a good estimate of the **effectiveness of modern mammography**?

- **No!**
- Individual RCTs vary in their results
- Analysis is by intention to treat
- The RCTs are:
  - Older studies
  - Older technologies
  - Older protocols

- The RCTs underestimate the effectiveness of modern mammography.
The Evolving Evidence for Mammography Screening—Beyond the RCTs: Trend Studies, Incidence-Based Mortality Studies, Case Control Studies

Beyond Randomized Controlled Trials
Organized Mammographic Screening Substantially Reduces Breast Carcinoma Mortality

László Tabár, M.D.1,2
Sedrich Vitak, M.D.3
Hsiu-Hsi Tony Chen, M.D.4
Ming-Fong Yen, M.D.5
Stephen W. Duffy, M.D.6
Robert A. Smith, M.D.7

BACKGROUND: The efficacy of mammographic screening in the reduction of breast carcinoma mortality has been demonstrated in randomized controlled trials, but the evaluation of organized screening outside of such trials (service screening) faces unique methodologic and conceptual challenges. This study describes the results of an evaluation of organized mammography in a clinical setting and demonstrates the benefit obtained from service screening.

ORIGINAL ARTICLE

The impact of mammographic screening on breast cancer mortality in Europe: a review of observational studies
Mireille Brouwers, Sue Marsh, Lennart Nyström, Sias Njor, Hakan Jonsson, Ellen Paps, Nathalie Mouest, Stephen Duffy, Elizabeth Lyne and Eugenia Pali, for the EUSCREEN Working Group

Breast cancer mortality after screening mammography in British Columbia women
Andrew Coldman1, Norm Phillips2, Linda Warren2 and Lisa Kan2
1Surveillance and Outcomes Unit, British Columbia Cancer Agency, Vancouver, BC, Canada
2Screening Mammography Program of BC, British Columbia Cancer Agency, Vancouver, BC, Canada

Quantification of the effect of mammographic screening on fatal breast cancers: The Florence Programme 1990–96
Population trend studies are deceptively intuitive, but a weak methodology for measuring the effectiveness of screening.

A. Sweden & Norway
B. Netherlands & Belgium
C. Northern Ireland & Republic of Ireland

BMJ 2011;343:d4411 doi: 10.1136/bmj.d4411
Methodological problems with the evaluation of the effectiveness of screening based on population trends

- No data on exposure to mammography
- Not all women who develop breast cancer are invited to screening or attend screening
- No adjustment for different baseline incidence rates
- No adjustment for incidence rates over time
- No adjustment for time to introduce screening
- No data on the quality of mammography
- Inadequate duration of follow-up (screening & follow-up period are too short)
- **Single biggest problem**—Contamination of mortality trends with deaths due to incidence before screening was introduced
In an IBM study all breast cancer deaths occurring in a population over a period of time are enrolled in the study only if the breast cancer diagnosis occurred in a certain time/age window (taking into account eligibility and opportunity to be screened), and the population is classified by screening or by invitation to screening.
EUROSCREEN Incidence-based mortality estimates for breast cancer mortality reduction in women ages 50-69, *exposed versus not-exposed to screening*

<table>
<thead>
<tr>
<th>Study</th>
<th>RR</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hakama, (1997)</td>
<td>0.71</td>
<td>0.45</td>
<td>1.13</td>
</tr>
<tr>
<td>Olsen, (2005)</td>
<td>0.63</td>
<td>0.50</td>
<td>0.79</td>
</tr>
<tr>
<td>Sarkeala, (2008)</td>
<td>0.65</td>
<td>0.41</td>
<td>1.05</td>
</tr>
<tr>
<td>Paci, (2002)</td>
<td>0.58</td>
<td>0.28</td>
<td>1.22</td>
</tr>
<tr>
<td>Kalager, (2010)</td>
<td>0.82</td>
<td>0.62</td>
<td>1.1</td>
</tr>
<tr>
<td>Ascunce, (2007)</td>
<td>0.47</td>
<td>0.31</td>
<td>0.73</td>
</tr>
<tr>
<td>SOSSEEG, (2006)</td>
<td>0.59</td>
<td>0.52</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Summary (random)</strong></td>
<td><strong>0.62</strong></td>
<td><strong>0.56</strong></td>
<td><strong>0.69</strong></td>
</tr>
</tbody>
</table>

Map of Study and Control Group Areas, and Crude Cumulative Breast Cancer Mortality per 100,000 Person Years

RR = 0.74; 95% CI 0.66 – 0.83

Figure 1. This is a simplified map of the areas that were included in the study group and the control group.

Figure 2. This chart illustrates the crude cumulative breast cancer mortality per 100,000 person-years. Solid line indicates the study group; dashed line, control group.

Cancer 2010; published online: 29 SEP 2010
Crude cumulative breast cancer mortality rates for screened and unscreened cohorts among women invited to the Norwegian Breast Cancer Screening Program, 1996 to 2010.

Fifteen years after the start of the program, the screened cohort had **43% lower breast cancer mortality rate** compared with the unscreened cohort.

Pan-Canadian Study of Mammography Screening

- Comparison of breast cancer screening among exposed (2.8 million) and non-exposed women, 1990-2009
- 7 of 12 Canadian breast cancer programs, representing 85% of the population
- SMRs were calculated comparing observed mortality in participants to that expected based upon nonparticipant rates.
Standardized mortality ratios (SMRs) by Canadian province for ages at entry: Summary estimates are based upon random effects models. All statistical tests were two-sided.

### 40-49

<table>
<thead>
<tr>
<th>Region</th>
<th>SMR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>0.58</td>
<td>0.51 to 0.65</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>0.42</td>
<td>0.26 to 0.59</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>0.66</td>
<td>0.47 to 0.85</td>
</tr>
<tr>
<td><strong>Summary (random)</strong></td>
<td><strong>0.56</strong></td>
<td><strong>0.45 to 0.67</strong></td>
</tr>
</tbody>
</table>

44% fewer deaths

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### 50-59

<table>
<thead>
<tr>
<th>Region</th>
<th>SMR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>0.57</td>
<td>0.51 to 0.64</td>
</tr>
<tr>
<td>Manitoba</td>
<td>0.54</td>
<td>0.44 to 0.63</td>
</tr>
<tr>
<td>Ontario</td>
<td>0.78</td>
<td>0.71 to 0.85</td>
</tr>
<tr>
<td>Quebec</td>
<td>0.57</td>
<td>0.51 to 0.63</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>0.37</td>
<td>0.25 to 0.48</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>0.75</td>
<td>0.57 to 0.92</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>0.65</td>
<td>0.34 to 0.97</td>
</tr>
<tr>
<td><strong>Summary (random)</strong></td>
<td><strong>0.60</strong></td>
<td><strong>0.49 to 0.70</strong></td>
</tr>
</tbody>
</table>

40% fewer deaths
Standardized mortality ratios (SMRs) by Canadian province for ages at entry: Summary estimates are based upon random effects models. All statistical tests were two-sided.

### 60-69

<table>
<thead>
<tr>
<th>Region</th>
<th>SMR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>0.57</td>
<td>0.49 to 0.64</td>
</tr>
<tr>
<td>Manitoba</td>
<td>0.70</td>
<td>0.55 to 0.85</td>
</tr>
<tr>
<td>Ontario</td>
<td>0.69</td>
<td>0.62 to 0.77</td>
</tr>
<tr>
<td>Quebec</td>
<td>0.63</td>
<td>0.56 to 0.71</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>0.39</td>
<td>0.27 to 0.52</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>0.45</td>
<td>0.30 to 0.60</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>0.69</td>
<td>0.30 to 1.09</td>
</tr>
<tr>
<td><strong>Summary (random)</strong></td>
<td>0.58</td>
<td>0.50 to 0.67</td>
</tr>
</tbody>
</table>

**42% fewer deaths**

### 70-79

<table>
<thead>
<tr>
<th>Region</th>
<th>SMR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>0.63</td>
<td>0.49 to 0.76</td>
</tr>
<tr>
<td>Ontario</td>
<td>0.66</td>
<td>0.52 to 0.79</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>0.63</td>
<td>0.30 to 0.96</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>0.84</td>
<td>0.36 to 1.31</td>
</tr>
<tr>
<td><strong>Summary (random)</strong></td>
<td>0.65</td>
<td>0.56 to 0.74</td>
</tr>
</tbody>
</table>

**35% fewer deaths**

JNCI 2014; 106(11)
Disparities in the estimates of benefits and harms from mammography: Are the numbers really that different?

- Recent estimates of the absolute benefit of screening vary as much as 20 – fold
- If most estimates derive from the same studies, why are the differences so great?

Quoted absolute benefits (NNS & NNI) to prevent 1 breast cancer death reveal a ~ 20-fold difference

<table>
<thead>
<tr>
<th>Source</th>
<th>No. needed to screen</th>
<th>Follow-up period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK review (2012)</td>
<td>180*</td>
<td>25</td>
</tr>
<tr>
<td>USPSTF, depending on age (2009)</td>
<td>377-1904†</td>
<td>~ 15</td>
</tr>
<tr>
<td>Nordic Cochrane Review (2011)</td>
<td>2000†</td>
<td>10</td>
</tr>
<tr>
<td>EUROSCREEN (2012)</td>
<td>111*</td>
<td>30</td>
</tr>
</tbody>
</table>

*Number of women needed to screen (NNS) for ten rounds to prevent one breast cancer death
†Number needed to invite (NNI) to screening
### Adjusted absolute risk estimates of the number needed to screen to save one life based on UK Review Standard*

<table>
<thead>
<tr>
<th>Source</th>
<th>No. needed to screen*/invite† (original)</th>
<th>No. needed to screen (adjusted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK review (2012)</td>
<td>180*</td>
<td>180</td>
</tr>
<tr>
<td>USPSTF, depending on age (2009)</td>
<td>377-1904†</td>
<td>193</td>
</tr>
<tr>
<td>Nordic Cochrane Review (2011)</td>
<td>2000†</td>
<td>257</td>
</tr>
<tr>
<td>EUROSCREEN (2012)</td>
<td>111*</td>
<td>96</td>
</tr>
</tbody>
</table>

* Original estimates are adjusted to the same scenario used in the UK Independent Review, i.e., the impact of screening UK women ages 50-51 every 3 years for 20 years on mortality in women ages 55-79.
Harms associated with breast cancer screening (recall, radiation, overdiagnosis, anxiety)
10 Year Probability of a False Positive Exam Based on Age at First Mammogram

**Overall**

- **False-positive recall probability:**
  - 16.3% at first mammogram
  - 9.6% at subsequent exams
- **Probability of false-positive biopsy recommendation:**
  - 2.5% at first mammogram
  - 1.0% at subsequent exams
New data of the rate of False Positive Mammography results from digital mammography. First mammogram not included. Women in their 40s have the highest rate. (Source, BCSC data, Pacific NW EPC, 2015)
Consequences of False Positive Mammograms

**Objective:** To measure the effect of false-positive mammograms on quality of life by measuring personal anxiety, health utility, and attitudes toward future screening.

**Data:** The Digital Mammographic Imaging Screening Trial (DMIST) quality-of-life sub-study of women with positive and negative mammograms.
Consequences of False Positive Mammograms

- False-positive mammograms were associated with increased short-term anxiety but not long-term anxiety.
- There was no measurable health utility decrement.
- False-positive mammograms increased women’s intention to undergo future breast cancer screening, and did not increase their stated willingness to travel to avoid a false-positive result.

Published online April 21, 2014.
Overdiagnosis

- Estimates of overdiagnosis of screen detected breast tumors also vary considerably, ranging from 0 – > 50%

- Overdiagnosis - is diagnosis by screening of cancer that never would have arisen symptomatically in the person’s lifetime, and never would have been detected if screening had not taken place

- To estimate overdiagnosis, we must examine incidence rates over time, and adjust for:
  - Pre-existing trend of increasing incidence
  - Lead time

- Adjusted estimates of overdiagnosis are much lower than unadjusted estimates
Overdiagnosis Estimates Based on Adjustment for Incidence Trends and Lead-time

% Overdiagnosed

Source: Puliti, et al. JMS 2012;19(1)
Screening Recommendations

- Average risk women
- Increased and high risk women
American Cancer Society and American College of Radiology Breast Cancer Screening Guidelines

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>ACR</th>
<th>ACS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE</td>
<td>Not recommended</td>
<td>Not recommended</td>
</tr>
<tr>
<td>CBE</td>
<td>Ages 20-39: Every 3 yrs. Ages 40+: Annual</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Mammography</td>
<td>Annual screening beginning at age 40 End screening when curative therapy would not be offered due to life-limiting co-morbidity</td>
<td>Women 40-44 should have the opportunity to begin annual screening before age 45 Women aged 45 to 54: annual screening Women 55+ should transition to biennial screening, but should have the opportunity to continue screening annually Women should continue screening as long as their overall health is good and they have a life expectancy of 10 years or more</td>
</tr>
</tbody>
</table>
## Current Breast Cancer Screening Guidelines for Average Risk Women: USPSTF (2009)

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>USPSTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast Self Exam (BSE)</td>
<td>Against clinicians teaching BSE (D)</td>
</tr>
<tr>
<td>Clinical Breast Exam (CBE)</td>
<td>Insufficient evidence (I).</td>
</tr>
<tr>
<td>Mammography</td>
<td>Against routine screening in women ages 40-49 (C)</td>
</tr>
<tr>
<td></td>
<td>Ages 50-74: Biennial (B)</td>
</tr>
<tr>
<td></td>
<td>Ages 75+ : <em>Routine</em> screening not recommended (C)</td>
</tr>
<tr>
<td></td>
<td>Ages 85+ Not recommended (D)</td>
</tr>
</tbody>
</table>
Surveillance in Women with known or Suspected Mutations on Breast Cancer Susceptibility Genes

Breast Cancer Risk Evaluation Tool
Developed by
Jonathan Tyrer & Jack Cuzick

Dept. of Epidemiology, Mathematics & Statistics
Institute of Preventative Medicine
Glasgow School of Medicine
Glasgow M 6BQ
# ACS Screening Recommendations for High Risk Women

(Saslow D, et al. CA 2007;57:90-104)

## TABLE 1  Recommendations for Breast MRI Screening as an Adjunct to Mammography

<table>
<thead>
<tr>
<th>Recommendation for MRI Screening (Based on Evidence*)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRCA mutation</strong></td>
</tr>
<tr>
<td>First-degree relative of <em>BRCA</em> carrier, but untested</td>
</tr>
<tr>
<td>Lifetime risk $\sim$20–25% or greater, as defined by BRCAPRO or other models that are largely dependent on family history</td>
</tr>
<tr>
<td>Recommenad Annual MRI Screening (Based on Expert Consensus Opinion†)</td>
</tr>
<tr>
<td>Radiation to chest between age 10 and 30 years</td>
</tr>
<tr>
<td>Li-Fraumeni syndrome and first-degree relatives</td>
</tr>
<tr>
<td>Cowden and Bannayan-Riley-Ruvalcaba syndromes and first-degree relatives</td>
</tr>
</tbody>
</table>

**Insufficient Evidence to Recommend for or Against MRI Screening‡**

| Lifetime risk 15–20%, as defined by BRCAPRO or other models that are largely dependent on family history |
| Lobular carcinoma in situ (LCIS) or atypical lobular hyperplasia (ALH) |
| Atypical ductal hyperplasia (ADH) |
| Heterogeneously or extremely dense breast on mammography |
| Women with a personal history of breast cancer, including ductal carcinoma in situ (DCIS) |

| Recommend Against MRI Screening (Based on Expert Consensus Opinion ) |
| Women at $\leq$15% lifetime risk |
Screening Test

• Definition:
  Application of test to detect potential disease in asymptomatic individuals

• Objectives of screening:
  1. Identify individuals with increased risk so preventive measures can be taken
  2. Early detection when treatment more effective, less expensive or both
Imaging

- Mammography
  
  Since mid-1980’s, breast cancer death rate dropped >30% in US due to screening

  Randomized clinical trials (RCT’s) have shown reduction in breast cancer deaths in women 40-74 (~40%)
Mammography benefits

- “Gold standard”- reducing cancer mortality
- Small lesions
- DCIS
- Low-dose radiation (.4mSv)
  Background radiation = 3mSv
Mammography limitations

- **High False Negative (FN) rate**
  - higher in younger women
  - dense breast tissue
- **High False positive (FP) rate**
  - more common for younger women,
  - women who with prior breast biopsies
  - women with family history
  - women taking estrogen.
Mammography limitations

- False positive results
  - Stress and anxiety
  - Additional expense
  - Time consuming
- Pain
- Compression
• Digital Mammographic Imaging Screening Trial (DMIST) 2005
  49000 women comparing film to digital
  Similar diagnostic accuracy and sensitivity, BUT
• Digital $\rightarrow$ significantly better
  Dense breast tissue
  Women under 50
  Pre/perimenopausal women
Tomosynthesis

- FDA approval 2011
- Improved cancer detection
  *DCIS detection rates remained same
- Lower recall rates
- Increased biopsies, but higher PPV
- Helpful in dense breast tissue
Tomosynthesis

More expensive
Insurers may not cover
Slightly more radiation
Must determine long-term outcomes

“Don’t have to go looking for it”
Breast MRI

- Contrast enhanced
- Preferably performed during days 7-14 of menstrual cycle
- Patient positioned prone
- Study is approximately 20 minutes
- Pre-Post contrast images acquired
- Demonstrates vascularity
Breast MRI

- Increased sensitivity
  - 36% mammo
  - 93% mammo and MRI
- Most cancers found were node negative (80%)
- Range 7-18mm
Breast MRI

- Limitations

  IV contrast injection
  Cost of exam
  Time on scanner
  Not available in all regions
  Must have biopsy capability
Breast MRI

- **Ultrafast MRI (Kuhl)**
  
  Abbreviated protocol
  
  Scan time = 3 minutes
  
  Interpreted quickly
  
  High (99.8%) NPV
Breast MRI

• **Ultrafast MRI**
  
  Spec (94.3% vs 93.9)
  Sens (24.4% vs 23.4%)
  Can detect invasive and DCIS

• **Benefits include**

  Improved patient tolerance
  Possible cost savings
  Additional trials to replicate results
Breast Ultrasound

- Primarily a **diagnostic** exam
  - Palpable masses or focal pain
  - Workup of mammo or MRI finding
  - Initial evaluation <30 y, lactating, pregnant
  - Procedure guidance
  - Radiation therapy planning
  - Axilla evaluation
Breast Ultrasound

• *May* be supplement to screening in certain women (new diagnosis, biopsy, dense)

If MRI *cannot* be performed
Breast Ultrasound

• ACRIN 6666 trial

  Combined US and mammo screening vs mammo alone

  Adding a single screening US to mammo yields additional 1.1-7.2 cancers/1000 women
  Decreased PPV (23% to 11%)
  Increased FP
Breast Ultrasound

- No radiation
- Painless
- Operator-dependent
- Increased FP
- Increased biopsies
Other modalities

- Positron emission mammography (FDG-PEM)
- Breast specific gamma imaging (BSGI)
- MRI without contrast
- Thermography

- Insufficient evidence to support their use
High Risk

• 1. BRCA gene mutation and untested first degree relative
• 2. Chest/mantle irradiation between ages 10-30
• 3. History of genetic syndromes—Li Fraumeni, Cowden’s
• 4. ≥20% lifetime risk: Gail/Claus models
High Risk

• 5. Strong family history:
  2 or more close relatives br/ov cancer
  First degree with premenopausal cancer or >1 breast cancer
  1 or more relative with both br and ov cancer
  Any male relative with breast cancer

• 6. Newly diagnosed breast cancer
  Screening of contralateral breast
Imaging protocols by risk

• High Risk:

  Annual mammography
  Annual contrast enhanced MRI
  (*ultrasound if MRI is contraindicated or unavailable)

  Begin 10 years prior to age when 1\textsuperscript{st} degree diagnosed

  8 years after mantle radiation (not before 25y)
Intermediate Risk

• 1. Personal history of breast cancer
• 2. Prior biopsy resulting in Lobular Neoplasia
• 3. Prior biopsy resulting in Atypical Ductal Hyperplasia (ADH)
• 4. Dense breast tissue on mammography
• 5. 15-20% lifetime risk of breast cancer
Imaging protocols by risk

- Intermediate risk
  
  Annual mammography

  Discussion between physician and patient:
  
  Annual contrast enhanced MRI
  
  (*ultrasound if MRI is contraindicated or unavailable)
Average Risk

- Gender
- Age
- Breast tissue not dense on mammography
- Beginning menstruation at an early age
- <15% lifetime risk of breast cancer
Average Risk

- Older age at birth of first child or never having given birth
- Use of hormones such as estrogen and progesterone
- Obesity
- Consumption of alcoholic beverages
Imaging protocols by risk

• Average Risk

Annual mammography
When to discontinue screening

• No defined upper limit

• If in good health and able/willing
  Diagnostic workup
  Treatment

• 5 or more years of life
Breast Density

• Ratio of fat to fibroglandular tissue on mammography
  - Almost entirely fatty
  - Scattered fibroglandular density
  - Heterogeneously dense
  - Extremely dense

• Subjective assessment
Breast Density

- 24 States have Breast Density laws:
  Patients must be notified of their breast density
  (Connecticut 2009)
  Patients must discuss with their clinicians

BREAST DENSITY AND MAMMOGRAPHY REPORTING ACT---FEB 2015
Breast Density

- 50% hetero or extremely dense

- What is the risk?
  
  Heterogeneous 1.2 times greater
  Extremely 2 times greater
  Density is *not* a major cancer risk factor
Breast Density

• “Masking”
  Obscuration of cancer by density of tissue
  Sensitivity decreased 10-20%
  MRI—high risk pts
  Ultrasound—potential, but high FP
  Tomosynthesis—potential
Summary

• Levels of breast cancer risk
• Imaging protocols for each level of risk
• Background information on imaging modalities
• Breast density
• **Information for Healthcare Professionals**
  - Complete systematic evidence review used in updating the ACS breast screening guideline
  - Downloadable Patient Guide - (also available in Spanish)

• **Overview of the Society's New Breast Cancer Screening Guidelines**
  Dr. Richard Wender, Chief Cancer Control Office, American Cancer Society
  [https://youtu.be/1aw-IxuDJPU](https://youtu.be/1aw-IxuDJPU)

• **Breast Cancer Videos**
  Series of videos covering breast cancer prevention, treatment, and survivorship
Patient & Provider Resources

• IBIS Breast Cancer Risk Evaluation Tool

• Breast360.org
  Patient website sponsored American Society of Breast Surgeons
  [https://breast360.org/en/](https://breast360.org/en/)

• MammographySavesLives.org
  Patient website sponsored by the American College of Radiology, the Society of Breast Imaging, and the American Society of Breast Disease

• Breastdensity.info
  Patient education and resources
  [http://www.breastdensity.info/](http://www.breastdensity.info/)