TRENDS IN SCREENING MAMMOGRAPHY USE IN UNDERSERVED POPULATIONS BEFORE AND AFTER THE USPSTF 2009 RECOMMENDATION

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Outline
 Background
  • Breast Cancer
  • Screening Mammography
  • USPSTF
 Proposal
  • Prior work
  • Sample population
 Discussion

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Interestingly? Breast Cancer in the United States
 Most common cancer in women after skin cancer
 Second leading cause of cancer death in women
 Leading cause of death in women age 35-54
 2014 estimates: 232,670 new cases and 40,000 deaths*
 1 in 8 women diagnosed in their lifetime

*SEER
USPSTF - 2009 Recommendations

- Against routine SM in women 40-49
  - Individualized decision making encouraged
- Biennial SM in women 50-74
- Insufficient evidence to assess SM benefits/harms in women >=75
  - Not studied in any of the RCTs
- One recommendation fits all?
The Natural History of Untreated Breast Cancer

Lymph Node Metastases as Function of Tumor Size

What is the Mortality Reduction related to Screening Mammography?

- 10 trials, spanning 4 decades:
  - Intention to treat: 19% mortality reduction (95% CI 12%-26%)
  - Adjusted for nonattendance: 25% mortality reduction.
  - Translates to 1% all cause mortality reduction.

Breast Cancer Mortality Risk Ratio

P. Glasziou, N. Houssami. Preventive Medicine 53 (2011) 100–102
Is Mortality Reduction due to Improved Treatment?

- 12-21% breast cancer mortality reduction from improved therapies
- Should've had similar affects in both arms of SM clinical trials

Berry et al. (2005) Effect of Screening and Adjuvant Therapy on Mortality from Breast Cancer.

Five-Year Survival By Stage

- I  2 cm or less, no nodes  98%
- IIa  ≤2 cm with nodes  88%
  2-5 cm, no nodes
- IIb  2-5 cm, axillary nodes  76%
  > 5 cm, no nodes
- IIIa  > 5 cm, ax nodes  56%
  Any size, fixed or IM nodes
- IIIb  Chest wall, skin  49%
- IV  Distant metastases  16%

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Potential Problems

- Length Time Bias
- Lead Time Bias
- Over-diagnosis
- False Positives

Length Time Bias

Lead Time Bias
Over-diagnosis

- Estimates 0-50%


Over-treatment

- Estimates 0-50%


False Positives

- Callback from screening that does not represent cancer
- Results in extra views, follow-up imaging or biopsies
- Cumulative risk of false-positives after 10 rounds of screening 16%-63%\(^1\)

\(^1\)Hofvind, 2004; Hubbard, 2010; Njor, 2007

False Positives (cont.)

- Meta-analysis of 17 studies (n=29,781)
  - Not all effects were negative
  - Influence generalized well-being
    - Limited to breast specific outcomes
    - Small effect on generalize anxiety
    - Some of these measures uncover underlying psychiatric problems unrelated

- Predictors:
  - Sociodemographic factors
  - Clinical factors

Sato, et al. (2009). Meta-analysis of the effect of false-positive mammograms on generic and specific psychosocial outcomes
Patient Perspective

- Most women (62%) view false positives as an acceptable consequence of screening mammography.
- However,
  - Anxiety common
  - Race/ethnicity is important
  - RCT from UK, Canada, Sweden, US
  - Ignored QOL: surgery and chemo

Conclusions - SM

- Breast cancer is common in women
- Untreated breast cancer is deadly
- Treated breast cancer is survivable if detected at an early stage
- There are potential harms associated with screening mammography

United States Preventative Services Task Force Recommendations (USPSTF) - 2009

- Purpose: Effectiveness of screening mammography in average risk women
- Attention to 40-49, >70 y.o.
- Multiple data sources
  - Meta-analysis of 8 RCTs
  - Harms: published studies and clinical data
  - Optimal starting/stopping: CISNET models
USPTF - 2009 Recommendations

- Against routine SM in women 40-49
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- Biennial SM in women 50-74
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Rationale and Controversies: 39-49 y.o.

- Same relative mortality benefit in 39-49 (15%) and 50-59 y.o. (14%)
- “Net benefit in 39-49 small…lower incidence…greater harms”

<table>
<thead>
<tr>
<th>Age</th>
<th>RR Breast Ca Mortality</th>
<th>NNI to Prevent 1 Breast Ca Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>39-49 y.o.</td>
<td>0.85</td>
<td>1904</td>
</tr>
<tr>
<td>50-59 y.o.</td>
<td>0.86</td>
<td>1339</td>
</tr>
<tr>
<td>60-69 y.o.</td>
<td>0.68</td>
<td>377</td>
</tr>
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</table>

USPSTF Rationale

40-49 y.o.
- The harms outweigh the life years gained
- Acknowledge that magnitude and effect of harms are difficult to measure

50-59 y.o.
- Biennial screening will reduce the false positive rate
- Acknowledge that this will result in deaths avoidable by annual screening

Professional Organizations’ Perspective

<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendation</th>
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</thead>
<tbody>
<tr>
<td>American Cancer Society</td>
<td>Every year beginning at age 40</td>
</tr>
<tr>
<td>American College of Radiology</td>
<td>Every year beginning at age 40</td>
</tr>
<tr>
<td>American Medical Association</td>
<td>Every year beginning at age 40</td>
</tr>
<tr>
<td>National Comprehensive Cancer Network</td>
<td>Every year beginning at age 40</td>
</tr>
<tr>
<td>American College of Obstetricians and Gynecologists</td>
<td>Every year beginning at age 40</td>
</tr>
<tr>
<td>Canadian Task Force on Preventative Health Care</td>
<td>Not routinely recommended 40-49</td>
</tr>
<tr>
<td>American Academy of Family Physicians*</td>
<td>Not routinely recommended 40-49</td>
</tr>
<tr>
<td></td>
<td>Every 2-3 years from age 50-74</td>
</tr>
</tbody>
</table>
Median Cost per Life-Year Saved in Women 40-79 Years

<table>
<thead>
<tr>
<th>Screening Test</th>
<th>Median Cost ($/year of life saved)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammography</td>
<td>18,800</td>
</tr>
<tr>
<td>Colorectal</td>
<td>3,000</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>6,000</td>
</tr>
<tr>
<td>Cervical</td>
<td>12,000</td>
</tr>
<tr>
<td>Antihypertensive drugs</td>
<td>35,000</td>
</tr>
<tr>
<td>Automobile seatbelts and airbags</td>
<td>32,000</td>
</tr>
<tr>
<td>Renal Dialysis</td>
<td>46,000</td>
</tr>
<tr>
<td>Cholesterol Treatment</td>
<td>154,000</td>
</tr>
</tbody>
</table>


Trends in Breast Cancer Screening Mammography Among Underserved Populations Before and After the USPSTF 2009 Recommendations

- Modeled after Sprague, et al 2014
  - Vermont screening mammography (SM) registry
  - US census data for women eligible for SM
  - Years: 1997-2011, joint-point modeling
  - Included 150,000 women ≥ 40 years
  - Did not include specific data on underserved populations screening
Trends in the Percent of Vermont Women Who Underwent SMA

Annual | Biennial

Utilization of SM in Vermont According to Screening Interval

Age-adjusted | Annual

Proposed Idea

Purpose: To determine whether the 2009 USPSTF guidelines for breast cancer screening mammography were followed by similar changes in screening utilization by the underserved

Aim:
- To determine the age-specific patterns in SM utilization by underserved populations (2000-2014)

Breast Cancer Surveillance Consortium (BSCS)

- Largest longitudinal collection of mammography data from breast cancer screening in community practice.
- Collaboration of seven mammography registries in US.
- Database (2009):
  - 2.3 million women
  - 9.5 million mammograms
  - 180,000 biopsies
  - 113,000 breast cancer cases (19,000 DCIS)
Participating sites

Patient Demographic and Health History Data

Demographic Variables
- Unique anonymous identification number
- Zip code
- Race (white, black, Asian or Pacific Islander, Native American, other) ethnicity (Hispanic)
- Education (1-11 years, 12, 13-15 years, 16 years, 16+ completed years of education)
- Health insurance (Medicare, Medicaid, other, none)

Health History
- Age at birth of first child (year)
- Personal history of breast cancer (yes, no)
- Personal history of breast biopsy, surgery, or radiation (yes, no)
- Procedure history per breast (implants, needle biopsy, surgical biopsy, lumpectomy, mastectomy, radiation therapy, and reconstruction)

Screening History
- Time since last mammogram (within last year, 1-2 years, 3-4 years, 5 or more years)

Follow-Up Data
- Mammography in normal interval follow-up, additional views, short-term follow-up mammogram
- Additional views, short-interval follow-up mammogram
- Clinical examination, sonography, core biopsy, excisional biopsy

Pathologic Variables
- Carcinoma pathology (as obtained in SEER registries)
- Type of procedure, reporting source, laterality
- Tumor size, histopathology, grade, estrogen receptor status, progesterone receptor status
- Stage of disease, therapy (surgery, radiation, chemotherapy, hormonal, biological therapy)
- Follow-up status: cause of death, last follow-up, vital status

Radiologic History Data

Radiologic Site and Interpreting Mammographer Identification
- Indication for examination
- Screening (asymptomatic), evaluation of breast problem (symptomatic), additional evaluation of lesion mammogram, short interval follow-up

Type of Examination(s) Performed
- Standard screening views, additional diagnostic views, sonography, other breast imaging

Breast Density (American College of Radiology lexicon)
- Entirely fat, scattered fibroglandular densities, heterogeneously dense, extremely dense

Assessment per Woman
- Incomplete assessment, normal, normal with benign finding, probably benign, suspicious abnormality, highly suggestive for malignancy

Recommendation
- Mammography in normal interval follow-up, additional views, sonography, short-interval follow-up, fine-needle aspiration, core biopsy, surgical biopsy or evaluation, clinical evaluation for further diagnostic evaluation

Follow-Up Performed (summarized per woman)
- Date and result (include right versus left breast, additional views, short-interval follow-up mammogram
- Date and laterality required, laterality result recorded if available: clinical examination, sonography, fine-needle aspiration, core biopsy, excisional biopsy

Pathologic Variables
- Benign pathology (as recorded and also categorized into major groups: atypical hyperplasia, ductal hyperplasia, fibroadenoma, phyllodes tumor, lesion, normal, inconclusive
-
- Histopathology (as recorded and also categorized into major groups: atypical hyperplasia, ductal hyperplasia, fibroadenoma, phyllodes tumor, lesion, normal, inconclusive
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