The New 2012 (5th Edition)
BI-RADS, with Emphasis on Asymmetries

Edward A. Sickles, M.D.

BI-RADS
Breast Imaging Reporting And Data System

BI-RADS — Objectives
Standardize mammographic reporting
Reduce confusion in interpretation
Facilitate outcome monitoring
**BI-RADS — Components**

Lexicon of descriptive terms & definitions

Standardized reporting language

Medical audit and outcome monitoring

1993

63 pages

1995

77 pages
Overall Changes

Web-based format (hard copy on demand)

Compatibility of mammo/US/MRI sections

Substitute more mammo images for all the line drawings (at least half being digital)
Overall Changes

Web-based format (hard copy on demand)
Compatibility of mammo/US/MRI sections
Substitute more mammo images for all the line drawings (at least half being digital)
Evidence-based justification for everything

Hyperlinks to reference citations

Lexicon Changes

Correct errors
Lexicon Changes

Correct errors

Resolve inconsistencies:

("grouped" vs. "regional" calcifications:
the 1 cm to 2 cm "gap")
Lexicon Changes

Correct errors
Resolve inconsistencies
Delete/consolidate/revise/expand/add terms

("intermediate concern" and "higher probability of malignancy" calcifications)

Lexicon Changes

Correct errors
Resolve inconsistencies
Delete/consolidate/revise/expand/add terms

("lucent-centered" & "eggshell" → "rim", "lobular" → "oval" masses)
Lexicon Changes

Correct errors
Resolve inconsistencies
Delete/consolidate/review/expand/add terms
("grouped or clustered" →
"grouped – historically, clustered")

Lexicon Changes

Correct errors
Resolve inconsistencies
Delete/consolidate/review/expand/add terms
("asymmetry")

Lexicon Changes

Correct errors
Resolve inconsistencies
Delete/consolidate/review/expand/add terms
("developing asymmetry")
Lexicon Changes

Correct errors
Resolve inconsistencies
Delete/consolidate/revise/expand/add terms
Clarify management for selected terms

(solitary dilated duct: ? BI-RADS 4)

(all 4 types of asymmetry)
**Four Types of Breast Asymmetry**

- Asymmetry: BI-RADS 1
- Global asymmetry: BI-RADS 2
- Focal asymmetry: BI-RADS 3
- Developing asymmetry: BI-RADS 4

**Reporting System Changes**

Provide PPV cut points for 4A / 4B / 4C

Eliminate percent ranges for breast density
USA Use of BI-RADS Density Descriptors

- Data from 2,547,731 BCSC screening mammography exams, 1996-2003

USA Use of BI-RADS Density Descriptors

- Data from 3,865,070 BCSC screening mammography exams, 1996-2008

Reporting System Changes

- Provide PPV cut points for 4A / 4B / 4C
- Eliminate percent ranges for breast density
- Clarify terms used for lesion location
Describing Lesion Location

Laterality (right or left breast)
Quadrant vs upper/lower/outer/inner central
Clock-face location (orthogonal views)
Depth (anterior/middle/posterior third)
Distance from the nipple

Reporting System Changes

Provide PPV cut points for 4A / 4B / 4C
Eliminate percent ranges for breast density
Clarify terms used for lesion location
Separate assessment and management

Separate Assessment and Management

• Resolve BI-RADS 3 / follow-up 1 yr issue
Separate Assessment and Management

- Resolve BI-RADS 3 / follow-up 1 yr issue
- Provide flexibility for discordances between assessment and management

Assessment - Management Concordance

Use of standard BI-RADS assessment categories should lead the radiologist to concordant recommendations for subsequent management.

Assessment - Management Discordance

- Palpable mass, no imaging findings
- Focal pain caused by a simple cyst
- Ruptured silicone implant, abscess, new hematoma, unexplained edema, etc.
**Assessment - Management Discordance**

- Assessment reflects imaging findings
- Concordant mgmt for this assessment
- Add sentence for additional management

**Auditing Changes**

- No category 3 assessments at screening

**Auditing Changes**

- No category 3 assessments at screening
- “Positive truth” interval = screening interval
<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>0</td>
<td>Incomplete</td>
<td>Additional imaging</td>
</tr>
<tr>
<td>1</td>
<td>Negative</td>
<td>Routine screening</td>
</tr>
<tr>
<td>2</td>
<td>Benign</td>
<td>Routine screening</td>
</tr>
<tr>
<td>3</td>
<td>Probably benign</td>
<td>Short-interval follow-up</td>
</tr>
<tr>
<td>4</td>
<td>Suspicious</td>
<td>Consider biopsy</td>
</tr>
<tr>
<td>5</td>
<td>Highly suggestive of malignancy</td>
<td>Appropriate action</td>
</tr>
<tr>
<td>6</td>
<td>Known biopsy-proven malignancy</td>
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**BI-RADS 4 Management Terminology**

Tissue diagnosis: “Biopsy should be performed in the absence of clinical contraindication.”
BI-RADS Assessment and Management

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BI-RADS Assessment Category 0

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<tbody>
<tr>
<td>0</td>
<td>Incomplete</td>
<td>Additional imaging work-up</td>
</tr>
<tr>
<td>1</td>
<td>Negative</td>
<td>Routine screening</td>
</tr>
<tr>
<td>2</td>
<td>Benign</td>
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Category 0: use when additional imaging is required to make a final assessment (primarily for screening exams)
### BI-RADS Assessment Category 0

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Category 0: also use when prior mammograms are not available for comparison ("awaiting prior films"), but re-assessment must be made within 30 days, preferably sooner. Note that this approach increases medicolegal exposure.

### BI-RADS Final Assessment Category 1

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Category 1: use only when mammography report describes no specific benign findings (standard "normal" report)

### BI-RADS Final Assessment Category 2

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Category 2: use only when mammography report describes specific benign imaging findings (also a "normal" report)
Clinical scenario: palpable mass but no imaging findings at either diagnostic mammography or ultrasound. What should be the BI-RADS assessment (negative, suspicious, incomplete)?

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<td>4</td>
<td>Suspicious</td>
<td>Tissue diagnosis</td>
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</table>

Assessment in imaging report should reflect imaging findings, not management based on clinical breast exam. OK to add sentence that clinical exam may appropriately suggest biopsy.

Likelihood of cancer is only 0.1% - 4% for symptomatic patients if mammography and ultrasound are both negative.

Sample “Tailored” Disclaimer

There is no mammographic or sonographic correlate to the reported symptom of _____ in the _____ breast. Management of this symptom should be based on findings at clinical breast examination.

BI-RADS Final Assessment Category 3

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<tbody>
<tr>
<td>3</td>
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<td>Short-interval follow-up</td>
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Category 3: ≤ 2% risk of malignancy; use only after full diagnostic imaging evaluation. Group of tiny round / oval calcifications, noncalcified circumscribed solid mass, focal asymmetry. Almost never used if previous exams are available for comparison.
Clinical scenario: probably benign finding at imaging but patient requests biopsy rather than follow-up. What should be the BI-RADS assessment (probably benign, suspicious)?
### BI-RADS Assessment – Probably Benign

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Assessment in imaging report should reflect imaging findings, not management based on patient’s preference. OK to add sentence that patient declines follow-up and requests biopsy.

### BI-RADS Final Assessment Category 4

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Category 4: Includes all findings that are between Categories 3 (probably benign) and 5 (classic cancer): > 2% to < 95% risk. Most recommendations for tissue diagnosis are Category 4, ranging from aspiration of new complicated cysts to surgical excision of very suspicious masses and calcifications.

### BI-RADS Final Assessment Category 4

- **Category 4A** Low suspicion (upper limit for likelihood of cancer is 10%)
- **Category 4B** Moderate suspicion (upper limit for likelihood of cancer is 50%)
- **Category 4C** High suspicion (more likely malignant than not, but < 95%)

Subdivision of Category 4 is optional in BI-RADS, and not yet covered by FDA regulations.
**BI-RADS Final Assessment Category 4**

| Category 4A | Low suspicion  
<table>
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| Category 4C | High suspicion  
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<td></td>
<td>(more likely malignant than not but &lt; 95%)</td>
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**BI-RADS Assessment – Work-up Before Bx**

Clinical scenario: suspicious finding at standard imaging but you want more imaging to decide how to do the biopsy. Should be the BI-RADS assessment be suspicious or incomplete?

**BI-RADS Assessment – Work-up Before Bx**

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Many radiologists prefer to use category 0 for all abnormal screening assessments, even if the imaging findings at screening are sufficiently abnormal to prompt biopsy.
Clinical scenario: developing asymmetry but history of recent trauma suggests the possibility that the lesion is a hematoma. You recommend follow-up in 1 month.

Should BI-RADS assessment be incomplete, probably benign, or suspicious?
**BI-RADS Final Assessment Category 5**

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Category 5: ≥ 95% probability of cancer (i.e., classic cancer). Cases in which a benign diagnosis at core biopsy would automatically be considered discordant. No single imaging feature justifies Category 5; combination of features is needed.

**BI-RADS Final Assessment Category 6**

- Findings already confirmed malignant by biopsy
- Imaging is performed prior to surgical excision
- Imaging evaluates response to neoadjuvant chemotherapy
- Category 4 or 5 lesions supersede Category 6 lesions
- Should not be confused with post-lumpectomy imaging, for which typical post-surgical changes should be assigned a Category 2 (benign) assessment
- Category 6 cases should be excluded from medical audits

**BI-RADS Assessment and Management**

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**BI-RADS Overall Assessment (Mam/US)**

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Findings from each examination in one report with a single final assessment based on the most important findings from both. Each examination should be described in a separate paragraph.

**BI-RADS Overall Assessment (Mam/US)**

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Generally the assessment for the more abnormal examination prevails, unless the findings for the other examination are characteristically benign (e.g., fat-containing mass, simple cyst).

**BI-RADS Breast Imaging Descriptors**

Use of standard BI-RADS terminology to describe breast imaging findings can lead the radiologist to a concordant assessment of these findings and hence to concordant recommendations for subsequent management.
### PPV by Calcification Morphology

<table>
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<tr>
<th>Category</th>
<th>Ca</th>
<th>Bx</th>
<th>PPV</th>
</tr>
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<tbody>
<tr>
<td>Coarse heterogeneous</td>
<td>3</td>
<td>24</td>
<td>13%</td>
</tr>
<tr>
<td>Amorphous</td>
<td>53</td>
<td>266</td>
<td>21%</td>
</tr>
<tr>
<td>Fine pleomorphic</td>
<td>24</td>
<td>84</td>
<td>29%</td>
</tr>
<tr>
<td>Fine linear / FLB</td>
<td>52</td>
<td>74</td>
<td>70%</td>
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</tbody>
</table>

Combined data from 4 studies, published 1998-2010

### PPV by Calcification Morphology

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### PPV by Calcification Distribution

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<tbody>
<tr>
<td>Regional</td>
<td>6</td>
<td>23</td>
<td>26%</td>
</tr>
<tr>
<td>Grouped</td>
<td>126</td>
<td>411</td>
<td>31%</td>
</tr>
<tr>
<td>Linear</td>
<td>35</td>
<td>58</td>
<td>60%</td>
</tr>
<tr>
<td>Segmental</td>
<td>17</td>
<td>23</td>
<td>74%</td>
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Combined data from 3 studies, published 1998-2010
**PPV by Calcification Distribution**

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<td>4B  31%</td>
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<tr>
<td>Linear</td>
<td>4C  60%</td>
</tr>
<tr>
<td>Segmental</td>
<td>4C  74%</td>
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Combined data from 3 studies, published 1998-2010

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**BI-RADS Descriptors**

- Asymmetry
- Global asymmetry
- Focal asymmetry
Asymmetry

- Frequency: 2,023 / 61,273 (3.3%)
- Follow-up: at least 24 months
- Real lesions: 350 / 2,023 (17.3%)
- Biopsy done: 102 / 2,023 (5.0%)
- Malignancy: 36 / 2,023 (1.8%)

Sickles E.A. Radiology 1998; 208:471-475

- Potential mass, seen in only one projection
- Three-dimensionality not confirmed
- May represent superimposition of normal structures (summation artifact)
Global Asymmetry

Global asymmetry is judged relative to the corresponding area in the contralateral breast and represents a greater volume of breast tissue over a significant portion (at least a quadrant) of the breast. There is no mass, architectural distortion, or suspicious calcifications.
Global Asymmetry

Global asymmetry usually represents a normal variant, but may be significant when it corresponds to a palpable abnormality.

Global Asymmetry

Frequency: 221 / 8048 (3%)
Follow-up: 36-42 months
Palpable mass / thickening: 40
Biopsy performed: 20
Malignancy: 3 (2 IDC, 1 lymphoma)


Focal Asymmetry

This is a confined asymmetry with a similar shape on two views but completely lacking borders and the conspicuity of a true mass. It could represent an island of normal breast tissue, particularly when there is interspersed fat, but its lack of specific benign characteristics may warrant workup.
Mass

• Space-occupying lesion, seen in two different projections
• Convex-outward contour
• Denser in center than at periphery
Focal Asymmetry

- Space-occupying lesion, seen in two different projections
- Concave-outward contours
- Usually interspersed with fat

Focal Asymmetry

- Space-occupying lesion, seen in two different projections (<one quadrant>)
- Concave-outward contours
- Usually interspersed with fat
**Focal Asymmetry**

Frequency: 741 / 85188 (0.9%)
Follow-up: 24-36 months
All studied cases were nonpalpable
Malignancy: 5 / 741 (0.7%)
All cancers were T₁N₀ (stage I)


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**Developing Asymmetry**

This is a focal asymmetry that is either new or increased in size when compared with a previous examination. Its interval progression requires further workup.
Developing Asymmetry

Frequency: 281 / 180801 (0.2%)
Follow-up: 12 + mos (median 5 yrs)
All studied cases were nonpalpable
Malignancy: 36 / 281 (12.8%)
All cancers were T<sub>1</sub>N<sub>0</sub> (stage I)

Leung JWT, Sickles EA. Am J Roentgenol 2007; 188:667-675

Breast Asymmetries

Asymmetry
Global asymmetry
Focal asymmetry
Developing asymmetry

Assessment at Screening Mammography

Review provided medical history
Assessment at Screening Mammography

- Review provided medical history
- Review previous examinations

- Diagnosis of summation artifact
Assessment at Diagnostic Mammography

? Diagnosis of summation artifact

Vary the View Where Seen Well

Repeat the same view
Vary the View Where Seen Well

Repeat the same view
Change beam obliquity slightly
Vary the View Where Seen Well

- Repeat the same view
- Change beam obliquity slightly
- Change breast obliquity (roll view)
Repeat the same view
Change beam obliquity slightly
Change breast obliquity (roll view)

The change in obliquity of exposure is controlled more precisely by changing beam obliquity than by roll views.

Use spot-compression technique
Vary the View Where Seen Well

- Repeat the same view
- Change beam obliquity slightly
- Change breast obliquity (roll view)
- Use spot-compression technique
- Use magnification technique
Assessment at Diagnostic Mammography

- Diagnosis of summation artifact
- Spot-compression ± magnification
- Targeted ultrasound examination

Breast Asymmetries

- Summation artifact
- Global asymmetry
- Focal asymmetry
- Developing asymmetry

Work-Up of Global Asymmetry

Benign unless underlying:
- Solid mass or masses
- Architectural distortion
- Grouped microcalcifications
Look for “shrinking breast sign”
**Breast Asymmetries**
- Summation artifact
- Global asymmetry
- Focal asymmetry
- Developing asymmetry

**Work-Up of Focal Asymmetry**
Probably benign unless underlying:
- Solid mass or masses
- Architectural distortion
- Grouped microcalcifications
Benign if stable for ≥ 2-3 years
**Work-Up of Developing Asymmetry**

Suspicious unless proved to be:
- Simple cyst

If not, additional imaging work-up for multifocal or multicentric lesions

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**Breast Asymmetries**

- Asymmetry: BI-RADS 1
- Global asymmetry: BI-RADS 2
- Focal asymmetry: BI-RADS 3
- Developing asymmetry: BI-RADS 4