METHOD OF DETECTION

From the ACR Breast Commission, Screening and Emerging Technology Committee
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INTRODUCTION: The American College of Radiology (ACR), U.S. Preventive Services Task Force (USPSTF) and American Cancer Society (ACS) agree that annual screening mammography beginning at age 40 will save the most lives.[1–4] However, the same organizations disagree over the balance of risks and benefits of screening mammography and recommend different frequencies and ages to initiate early detection of breast cancer in the U.S. The results of randomized controlled trials (RCTs), conducted between 1963 and 1990 from multiple international sources, provide strong evidence that screening mammography significantly reduces deaths from breast cancer. [5,6]

Shortly after the data from RCTs confirmed the benefits of early detection, many developed nations instituted population-wide breast cancer screening programs. Administrators of those programs had the foresight to track the initial method of detection (MOD), such as mammography screening or clinical examination, for every patient with a new diagnosis of breast cancer for decades. Administrators and physicians actively review patient-specific data from international programs, linking outcomes directly to MOD, to understand and adapt breast cancer care in those countries. The U.S., lacking a centralized screening program or ability to link MOD to patients, cannot.

KNOWLEDGE GAPS: Many national, state, and local databases in the U.S. such as the National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) program, the Centers for Disease Control's National Program of Cancer Registries the American College of Surgeons' National Cancer Database (NCDB) and the ACR's National Mammography Database (NMD) collect specific data for every patient with a new diagnosis of breast cancer, but MOD has never been included. The North American Association of Central Cancer Registries (NAACCR) does not require registries to MOD. Thus, among developed nations with high rates of breast cancer, the U.S. critically lacks the fundamental ability to directly link breast cancer outcomes to MOD and address the ongoing debate over screening. Without patient specific data on initial MOD, national organizations, such as the USPSTF, ACS, and American College of Physicians (ACP), when examining the impact of screening, still turn to models based on historic data and variable assumptions that are subject to bias. [1,2,7] The lack of contemporary, patient specific information has permitted ongoing speculation and fostered disagreement about the risks and benefits of screening in the U.S. leading to conflicting recommendations, that confuse patients and providers and missed opportunities to save lives. [7,8]

DEFINING AND DETERMINING MOD: The initial MOD of breast cancer is defined as the first test or clinical event to trigger the work-up leading to the histologic diagnosis of breast cancer. When national service-screening programs and registries were built in the 1980s and 1990s, the choices for initial MOD were limited. Screen-film mammography was the only image-based screening test. Today, initial MOD can include multiple other image-based screening modalities.

Screening with FFDM, digital breast tomosynthesis (DBT), ultrasound, MRI and other tests can now provide the earliest evidence of breast cancer. Self-examination and clinical breast examination (CBE), which detect lumps, thickening or tenderness, can also be the initial MOD leading to a diagnosis. Patients may also trigger detection of breast cancer when they seek care for nipple discharge, erythema, pain, dimpling or skin ulceration. In addition, other imaging or laboratory tests not designed to evaluate the breast, such as abdominal CT or brain MRI, may also offer the initial findings of metastases that lead to a diagnosis of breast cancer.

BENEFITS OF COLLECTING MOD: If MOD can be assigned and collected accurately and without bias for each patient, we could have new primary data, rather than models based on historic data that may no longer accurately represent the diversity of our screening-eligible population or advances in screening technologies. Concrete, patient-specific data could bring the ACR, USPSTF and ACS to consensus recommendations for screening. We could employ the MOD-inclusive data to answer numerous national population-based questions about how screening relates to efficacy, equity, treatment, and breast cancer, such as:

1. What are the relative contributions of screening and treatment to reducing mortality from breast cancer?
2. Should the treatment of stage 1 cancers detected by screening be the same as stage 1 cancers detected clinically?
3. Do patients with screen-detected cancers have different treatment or mortality outcomes compared to patients whose cancers are detected clinically?
4. Do tumors that are screen-detected have different molecular signatures compared to tumors that are detected clinically?
5. Are there racial disparities in screening that impact outcomes?
6. What percentage of breast cancers are not initially detected on screening, and how does this vary by personal risk, breast density, age, or other factors?
7. Are there differences in initial staging for breast cancers initially detected with image-based screening vs clinical or self-examination?
8. Do MOD and outcomes vary with geographic location, and can we use that information to improve access to screening at the local level?
9. Are supplemental screening options (MRI, ultrasound, etc.) improving treatment, morbidity, or mortality from breast cancer?

BARRIERS TO NATIONAL COLLECTION OF MOD: The U.S. health care system provides cutting edge care with comparatively brief wait times and less regard to cost, but data collection is a patchwork of public and private entities funded by numerous private and public payors competing at the local and regional levels stitched together with different electronic medical records of heterogeneous patient populations. Nearly every state has a tumor registry responsible for tracking valuable information such as incidence, stage, race, and mortality for every case of cancer diagnosed. Currently, patient data from some state registries are de-identified and then sent to SEER.

CATEGORIES OF MOD:

MOD Category S: Detection of Breast Cancer from an Image Based Screening Examination
MOD Category S includes imaging-based screening examinations performed specifically to detect breast cancer in an *asymptomatic* population. Screening involves the binary decision of recommending action before the next routine screening versus recommending no action until the next routine screening. When the initial finding of a possible breast cancer is detected on an image-based screening examination and additional action is recommended (i.e. BI-RADS 0), then the MOD is category S. Subcategories are defined so that the first specific screening modality allowing the radiologist to detect the cancer can be captured and abstracted.
Category S: work-up triggered by a finding on an image-based screening examination in an *asymptomatic* patient

- Category Sma: screening full field 2D film or digital mammography (no synthetic views or DBT)
- Category Sdbt: screening with DBT with full field 2D or synthetic 2D
- Category Sus: screening ultrasound
- Category Smri: screening MRI
- Category Scem: screening contrast enhanced mammography
- Category Snuc: screening PEM or MBI
- Category So: other screening modality (CT, etc)

MOD Category P: Patient or Provider Detected
MOD Category P includes all types of clinical presentations. When a patient discovers and seeks care for a lump or other breast concern or a provider detects the initial finding of a possible breast cancer on physical examination prompting orders for diagnostic imaging evaluation, then the appropriate MOD is category P.
Category P: patient symptom or finding or provider detected finding triggers a diagnostic examination and work-up

- Category Pat: patient reported self-examination finding and/or symptom
- Category Pro: provider detected finding on physical examination of asymptomatic patient
- Category Ppp: if it is impossible to determine if the patient or the provider detected it first

MOD Category N: All other means by which a diagnosis of breast cancer is first detected.
MOD Category N includes other pathways by which the diagnosis of breast cancer initially comes to clinical attention.
Category N: Not detected with image-based screening; not detected by provider or patient.

- Category N: other/incidental finding on non-breast imaging test (chest CT PET/CT thoracic MRI)
- Category N: other/incidental finding on prophylactic mastectomy or reduction surgery
- Category N: search for unknown primary cancer site

ASSIGNING MOD ACCURATELY: Abstractors employed by state, local and hospital registries currently gather information related to a new cancer diagnosis from clinical reports. Most of the

information regarding cancer type, size, grade, and receptor status is quickly abstracted from succinct and standardized pathology reports. However, abstractors may turn to the tedious and time-consuming strategy of sifting through other clinical notes. We cannot expect abstractors to retrospectively read multiple radiology and pathology reports to recreate the clinical history to determine the MOD. In addition, if abstractors already know the patient has breast cancer, will they be able to avoid unconscious bias when assigning MOD? It is imperative that assignment of initial MOD be accurate, unbiased, easily discoverable by abstractors, and correctly transferred to registries for future scientific investigation.

We propose to have radiologists prospectively add a single MOD to the diagnostic imaging report for each patient who is recommended for biopsy and does not have an active diagnosis of breast cancer. The diagnostic radiologist will need to review recent prior imaging, which is part of the standard clinical process during the work-up, to determine the MOD. The diagnostic radiologist will have the expertise to understand the subtle nuances of the complete imaging, history and clinical information and be uniquely suited to accurately assign the initial MOD at the time of patient evaluation and report creation. We propose to have the diagnostic radiologist add a line at the end of the radiology report that reads:

The MOD for the right/left breast is Sma/Sdbt/Sus/Smri/Scem/Snuc/So/Pat/Pro/Ppp/N.

The radiologist signs the report as usual and patient care follows standard protocols. Placing a single initial MOD at the bottom of a diagnostic report is designed to facilitate discovery of the MOD by the abstractor. Rather than ask the abstractor to retrospectively sift through multiple radiology reports and recreate the sequence of events with clinical history to determine the MOD, we prospectively supply it in a single consistent location: after the impression of the diagnostic breast imaging report. This approach maximizes accuracy and minimizes the added burden on the abstractor.

ADDITIONAL METHODS OF DEMONSTRATION: It is essential to distinguish initial MOD from additional methods of demonstration (AMOD). AMOD are defined as any additional method, *following initial detection*, which further characterizes or redemonstrates a cancer. A cancer may be additionally demonstrated by any of the same classifications found in the MOD listed above. Initial MOD must be distinguished from subsequent AMOD. For example, a cancer initially may be detected on screening mammography and then further characterized on ultrasound and MRI. Ultrasound and MRI would be considered AMOD.

GUIDANCE:
MOD is assigned at the level of the patient. MOD is not specific to a breast or a targeted finding.

<u>MOD Category S Guidance</u>:
Category S includes several additional and important scenarios:

1. Two screening examinations are performed on the same day (e.g. screening mammogram and screening ultrasound) and *reported separately* and only one exam is coded as BI-RADS 0, prompting a recall and recommendation for biopsy, then the MOD would specify

the modality prompting the recall. Example: if a screening DBT mammogram and US are performed on the same day and a finding on the screening mammogram is given a BI-RADS 0 assessment and the US is given a BI-RADS 1 or 2 assessment, and biopsy is recommended at the subsequent work up, then the MOD in the diagnostic BI-RADS 4/5 report is Sdbt.

2. Two screening examinations (e.g. screening mammogram and screening MRI) are performed on the same day and the finding is equally and independently identified on both examinations and both examinations are classified as BI-RADS 0 in *separate reports*. A biopsy is recommended at subsequent work-up. In this case, the primary screening examination should be recorded as the MOD. Because screening mammography is the primary screening exam and ultrasound is considered supplemental, the mammogram would be the MOD. Example: A 2D mammogram and MRI are performed on the same day and a BI-RADS 0 is assigned to a finding seen equally on both modalities. The subsequent work-up with ultrasound and mammography confirms a suspicious finding. The MOD in the diagnostic BI-RADS 4/5 report should be Category Sma rather than Smri.
3. Two screening examinations are performed on the same day and *reported together but the finding is initially seen only on one of them*. Example: A suspicious mass is seen on screening US first and seen in retrospect on the DBT screening mammogram. A single report recommending additional imaging is issued. Subsequent work-up confirms a suspicious mass. The MOD in the diagnostic BI-RADS 4/5 report is Category Sus.
4. If two screening examinations are performed on separate days, the MOD is assigned for the modality on which the cancer was *initially* identified chronologically, regardless of whether the finding is identified on both exams or how it is seen at the time of diagnostic work-up.
5. Other types of special screening examinations, such as those described as “diagnostic” but performed on *asymptomatic* women following a clinical history of breast cancer or benign breast biopsy or breast augmentation, are included in the screening group for audit purposes. This is consistent with the audit guidelines in the BI-RADS atlas. Findings detected initially on these examinations in asymptomatic women should also be categorized as screening for the purposes of MOD. Example: A suspicious finding is initially detected on a yearly 2D mammogram in an *asymptomatic* woman with an indication of prior history of breast cancer treated 3 years ago. The subsequent work-up confirms a suspicious finding. The MOD in the diagnostic BI-RADS 4/5 report is Category Sma.
6. BI-RADS 3: If a BI-RADS 3 finding is stable and benign and never progresses to BI-RADS 4/5 assessment, and tissue sampling is never recommended, the MOD will never be assigned. But if a BI-RADS 3 is reassessed as BI-RADS 4/5 on diagnostic surveillance imaging, then the radiologist would code the MOD on that BI-RADS 4/5 diagnostic report. MOD is based on complete review of imaging history back to initial screening or diagnostic examination that detected the finding and triggered the follow-up. Example: If the initial examination related to this finding was a BI-RADS 3 when a 24 year old patient presented with a palpable lump characterized as oval, parallel, circumscribed and homogeneously hypoechoic (presumed fibroadenoma), that grew at 12 month follow-up, then it is coded Pat. If the baseline screening tomosynthesis mammogram with synthetic views was a BI-

RADS 0 for calcifications, followed by BI-RADS 3 on the immediate recall diagnostic examination, and then BI-RADS 4 at the 6-month short interval follow-up, then initial MOD is coded Sdbt for the first examination that triggered the workup and follow-up.

7. Initial MOD should be assigned to *screening* MRI or targeted ultrasounds after screening MRI only in patients without an active diagnosis of cancer. If a finding on screening MRI is assessed as BI-RADS 4 or 5 and tissue sampling and targeted ultrasound are recommended, an MOD of Smri should be assigned on the MRI. If the targeted ultrasound is negative (BI-RADS 1) and MR-guided breast biopsy is recommended because the MRI finding is suspicious, the MOD will already have been assigned on the MRI (MOD could be carried over to the ultrasound as Smri but it is not required). If a finding on screening MRI is assessed as BI-RADS 0 because it could be benign or suspicious on targeted ultrasound, MOD is *not* assigned to the MRI. If the final assessment from the targeted ultrasound is BI-RADS 4 or 5 and tissue sampling is recommended, then MOD should be assigned in the ultrasound report as per usual guidelines which would be Smri.
8. MOD should not be assigned to examinations after tissue sampling has established the diagnosis of cancer. Any mammogram, ultrasound, MRI or other imaging modality employed to further evaluate the extent of disease does not require an MOD. The diagnosis of cancer has already been established and MOD is no longer prospective.
9. MOD should not be assigned to an MRI performed to evaluate the extent of disease. The diagnosis of cancer has already been established and the assignment of MOD is no longer prospective. In the vast majority of cases, MOD will have been assigned on prior diagnostic examinations when tissue sampling was recommended.
10. To remain consistent, MOD should not be assigned to targeted ultrasound examinations recommended after MRI for extent of disease. The diagnosis of cancer has already been established and the assignment of MOD is no longer prospective. In the vast majority of cases, MOD will have been assigned on prior diagnostic examinations when tissue sampling was recommended.

<u>MOD Category P Guidance</u>:

Detection of Breast Cancer from a Clinical Presentation

1. If a patient presents with clinical signs and symptoms of breast cancer such as a palpable lump or nipple discharge, and the imaging test shows a suspicious finding, then the MOD in the diagnostic BI-RADS 4/5 report is Pat.
2. If a patient presents with signs and symptoms of breast cancer and the imaging test shows an *incidental* finding that is completely distinct from the symptom (i.e. contralateral breast or clearly different location in the ipsilateral breast) and it is suspicious, then the MOD would still be Category Pat because the patient's symptom triggered the work-up and the objective of tracking MOD is to understand the impact of screening mammography. The examination in this scenario is not a screening examination. Example: A woman presents with a palpable mass in the right breast which turns out to be a cyst. Diagnostic mammography shows a suspicious finding in the

asymptomatic left (contralateral) breast, then the MOD in the BI-RADS 4/5 report for the left breast is category Pat.

3. If a provider performing a clinical examination detects a sign (lump, retraction, ridge) in an asymptomatic patient, that prompts diagnostic work-up and tissue sampling is recommended, then MOD is Pro.
4. If it is unclear if the patient presented to a provider with a symptom or a provider first detected something on clinical exam or questioning, then the MOD, when the patient undergoes subsequent diagnostic imaging with a BI-RADS 4/5 result, is Ppp.

MOD Category N Guidance:
If, after careful review of imaging and clinical data, MOD is Neither S nor P, then N should be assigned. Based on existing practice patterns, N should be assigned for a very small fraction of cases. Such cases might include work-up for cancer of unknown primary after presentation with bone pain or incidental liver mass on CT.

AUDITING MOD?

DATA DICTIONARY
Method of Detection Appendix

1. Category Sma: screening full field 2D film or digital mammography (no synthetic views or DBT)
2. Category Sdbt: screening with DBT with full field 2D or synthetic 2D
3. Category SmaNOS: screening full field 2D film or digital mammography; with or without synthetic views and/or DBT, but not specified (corresponds to the basic Sma descriptor)
4. Category Sus: screening ultrasound
5. Category Smri: screening MRI
6. Category Scem: screening contrast enhanced mammography
7. Category Snuc: screening PEM or MBI
8. Category So: image-based screening modality other than mammography, US, MRI, CEM, PEM or MBI (CT, etc)
9. Category SoNOS: image-based screening modality that is not mammography (corresponds to the basic So descriptor)
10. Category Sunk: cancer was detected by image-based screening, but the specific modality is unknown.
11. Category Pat: patient reported self-examination finding and/or symptom
12. Category Pro: provider detected finding on physical examination of asymptomatic patient
13. Category Ppp: patient and/or the provider detected the cancer first; impossible to determine whether patient or provider
14. Category N: Not image-based screening, Not patient or provider detected
15. Category U: Unknown how cancer was detected

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