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Survey of the Senologic International Society (SIS) on the Use of Preoperative Breast MRI in Early-Stage Breast Cancer: A Global Perspective on Current Practice

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ABSTRACT

Objective: To map global practice patterns and disparities in the use of preoperative breast magnetic resonance imaging (MRI) for early breast cancer (EBC) among members of the Senologic International Society (SIS) and SIS Working Group.

Materials and Methods: A cross-sectional, web-based survey was distributed to SIS members worldwide. The questionnaire captured respondent demographics, center characteristics, local/national breast MRI use, guideline perceptions and personal practice, specific indications for MRI, and decision-making influences.

Results: We analyzed 114 responses from 17 countries. Significant variations were observed. While 36/46 (78.3%) of Japanese respondents perceived national guidelines as recommending preoperative MRI, only 18/60 (30%) of Europeans did. Overall, 96/114 (84.2%) of all respondents believed preoperative MRI provided a patient benefit, with none believing it caused harm. The most frequent indications in the total cohort were invasive lobular carcinoma (106/114, 93.0%), mammographic/sonographic suspicion of multifocality/multicentricity (96/114, 84.2%) and planned neoadjuvant therapy (89/114, 78.1%), while in Japan ductal carcinoma *in situ* (DCIS) or accompanying DCIS component was the most frequent indication (45/46, 97.8%). Half of respondents stated that national guidelines recommend preoperative breast MRI for EBC (57/114, 50%). Furthermore, 30/57 (52.6%) of these "guideline-positive" respondents reported performing more MRIs than advised while most guidelines recommending only selected preoperative indications such as invasive lobular histopathology, dense breasts, suspicion of multifocality/multicentricity or imaging inconsistencies. Key influencing factors included specialty, reimbursement, and time to access preoperative MRI.

Conclusion: This SIS-based international survey revealed heterogeneous global adoption of preoperative breast MRI for EBC, highlighting a significant gap between evidence-based guidelines and real-world practice. Clinical decisions are heavily influenced by geography, culture and resources, and belief in patient benefit. These findings highlight the need to tailor guidelines to local contexts, and strengthen awareness and dissemination efforts, together with further research to clarify the role of MRI in the modern multidisciplinary management of EBC.

Keywords: Early breast cancer; magnetic resonance imaging; preoperative staging; practice patterns; guidelines; international survey

KEY POINTS

- Early breast cancer
- Magnetic resonance imaging
- Preoperative staging
- Practice patterns
- Guidelines
- International survey

Introduction

The preoperative assessment of early breast cancer (EBC) aims to achieve complete tumor resection with optimal cosmetic outcomes. EBC represents stage I and stage II invasive cancers according to a narrow definition and includes ductal carcinoma *in situ* (DCIS) and stage IIIA or even operable stage IIIB according to a broader oncological definition. While mammography and ultrasound are standard imaging modalities to assess disease extent, breast magnetic resonance imaging (MRI) offers superior sensitivity, with a median incremental cancer detection rate of 16% compared to conventional imaging (1). This has fueled a rising trend in preoperative MRI use, particularly in the United States, where preoperative breast MRI application rates in EBC reached 60% for women under 65 years of age in 2020 (2-4).

The clinical benefit of routine preoperative MRI, however, remains controversial. While it improves surgical planning, randomized trials have shown it can increase mastectomy rates by 8% without demonstrating a significant improvement in local relapse-free or overall survival (5-8). Other studies suggest this initial increase in mastectomies may be balanced by a reduction in reoperation rates (9-12). The largest and most recent meta-analysis demonstrated both improved recurrence-free survival (hazard ratio = 0.77) and better overall survival (hazard ratio = 0.89) with the use of pre-operative contrast-enhanced MRI

Table 1. Summary table comparing national and international key guidelines on preoperative breast MRI in early breast cancer, with a focus on routine breast MRI in EBC and recommended selected indications

Organization/ country	Routine breast MRI recom-mended?	Recommended indications for preoperative use of breast MRI	Notes/latest update
ACR (USA)	No	Ipsilateral and contralateral DCIS and invasive carcinoma, particularly invasive lobular carcinoma (ILC), invasion of underlying fascia and muscle, neoadjuvant treatment response assessment	American College of Radiology 2025
AGO (Germany)	No	ILC, dense breasts, multifocal or contralateral suspicion, discrepancy Mx/ultrasound and histologic tumor extent	Arbeitsgemeinschaft Gynäkologische Onkologie (AGO). Breast Committee of the AGO 2024
ASBrS (USA)	No	ILC, young women, dense breasts, inconclusive imaging	The American Society of Breast Surgeons (ASBrS). ASBrS Resource Guide 2023
CACA (China)	No	Find multifocal and multicentric tumors, and evaluate the tumor's infiltration of the skin, pectoralis fascia, pectoralis major muscle, and chest wall	China Anti-Cancer Association (CACA). CACA Guidelines for Holistic Integrative Management of Breast Cancer 2022
EUSOBI (Europe)	No	ILC, dense breasts, multifocal/ multicentric suspicion	European Society of Breast Imaging (EUSOBI). EUSOBI 2008
ESMO (Europe)	No	ILC, imaging discrepancy, high-risk patients	European Society for Medical Oncology (ESMO). ESMO Early Breast Cancer Guidelines 2023
German S3 Guidelines (Germany)	No	ILC, dense breasts, multifocal suspicion	Evidence-based Guideline for the Early Detection, Diagnosis, Treatment and Follow-up of Breast Cancer. German S3 Guideline 2025*
INCa (France)	No	ILC, young women, dense breasts, inconclusive findings	Institut National du Cancer (INCa). INCa 2023
JBCS (Japan)	No	MRI is recommended in determining diagnosis and treatment policies for intra-breast lesions	Japanese Breast Cancer Society. Clinical Practice Guidelines for breast cancer screening and diagnosis 2022
NCCN (USA)	No	ILC, high-risk patients, inadequate conventional imaging	National Comprehensive Cancer Network (NCC). NCCN Breast Cancer Guidelines 2025
NICE (UK)	No	ILC, diagnostic uncertainty	National Institute for Health and Care Excellence (NICE). NICE NG101 2025
SBI (USA)	No	ILC, dense breasts, diagnostic uncertainty	Society of Breast Imaging (SBI). SBI Position Statements 2024

*Note: ILC: Invasive lobular cancer; DCIS: Ductal carcinoma *in situ*; MRI: Magnetic resonance imaging; EBC: Early breast cancer

(13), though some of this benefit may reflect patient selection (with healthier women having MRI). This conflicting evidence is reflected in heterogeneous national and international guidelines, which largely advise against routine use, reserving it for specific scenarios, such as histologically-proven invasive lobular carcinoma, dense breasts, suspicion of multifocality/ multicentricity or imaging inconsistencies (Table 1). This creates clinical ambiguity. While national trends for preoperative MRI are documented for the United States, comprehensive data on global practice patterns are lacking. The present study aimed to map current global practices, perceived benefits, and challenges associated with preoperative breast MRI in EBC among members of the Senologic International Society (SIS) and SIS Working Group to identify key drivers and areas for improvement.

Materials and Methods

Study Design and Survey Distribution

This study was performed according to the principles of the Declaration of Helsinki. After reviewing several international guidelines, a cross-sectional, web-based survey was conducted. The authors developed a 20-question English-language questionnaire, designed to be completed within 10 minutes. The questionnaire was distributed via email to members of the SIS and its working groups. A total of 120 recipients at an expert level were asked to answer and to forward the survey to other experienced colleagues. Communicative hubs among the experts helped to extend the reach of the survey. However, due to data protection regulations, we were not given information

on the number or identities of the experts contacted, making it impossible to calculate an exact response rate. The SIS is a worldwide federation of over 100 societies devoted to breast care, and its associated SIS working group comprise groupings of individual experts.

Data Collection

The survey was hosted online using a survey and feedback platform named PM+ (Performance Management Plus), and responses were collected over 14 days (October 28-November 11, 2024).

Statistical Analysis

Data from 114 respondents were analyzed using SPSS, version 31 (IBM Inc., Armonk, NY, USA). Analyses included descriptive statistics, chi-square test, Kruskal-Wallis tests, cross-tabulation and ordinal logistic regression (PLUM, Polytomous Universal Model). The threshold for significance was $p<0.05$.

Survey Content

The survey was divided into five sections: Section A: Respondent demographics (specialty, continent, country). Section B: Affiliation and center characteristics (certification status, type of institution, annual breast cancer operation volume). Section C: Local and national MRI use (annual MRI volume, national infrastructure, reporting, reimbursement, access times). Section D: MR policy and guidelines (guideline recommendations, personal adherence, perceived patient benefit, comparison with other modalities, eg CEM). Section E: Specific indications (patient characteristics, risk factors, and planned treatment options qualifying for MRI). All questions included in the questionnaire are shown in Table 1 of the Supplementary Material.

Results

Guideline Recommendation

Several international guidelines have been reviewed and judged whether they recommend routine preoperative breast MRI. The summarized results are shown in Table 1. All guidelines were judged to indicate that preoperative MRI was appropriate but only in specific circumstances with none recommending routine use in all patients. These guidelines suggest preoperative MRI for specific conditions, where conventional mammographic and ultrasound imaging is limited, and/or the risk for additional cancers is increased, such as in invasive lobular carcinoma, dense breasts, suspicion of multifocality/multicentricity, or larger size on ultrasound than mammography. Further, most guidelines require that centers should also have the facilities to perform correlation with prior breast imaging, to offer MRI-guided biopsy, and to have the capacity for multidisciplinary discussion and assessment of imaging-pathology concordance. We did not review protocol specifications such as abbreviated MRI or inclusion of diffusion-weighted imaging.

Respondent Characteristics, Heterogeneous Distribution

Of 114 respondents, 50.0% ($n = 57$) were radiologists and 46.5% ($n = 53$) were breast surgeons and 3.5% ($n = 4$) oncologists (Table 2). Most participants were from Europe (52.6%, $n = 60$) or Asia (40.4%, $n = 46$), all of whom were from Japan. The countries with the highest numbers of respondents were Japan (40.4%, $n = 46$), Germany (28.9%, $n = 33$), Belgium (9.6%, $n = 11$), the USA (3.5%, $n = 4$) and Türkiye (3.5%, $n = 4$). The majority (89.5%, $n = 102/114$) worked in certified breast centers, distributed across community-based hospitals (33.3%, $n = 38$), university hospitals (31.6%, $n = 36$), and private

Table 2. Respondent characteristics-specialty, continent, breast center certification

Characteristic	Surgical specialties ($n = 53$)	Radiology ($n = 57$)	Others ($n=4$)	Total cohort* ($n = 114$)
Continent				
Europe	10 (18.9%)	47 (82.5%)	3 (100%)	60 (52.6%)
Asia (all from Japan)	41 (77.4%)	5 (8.8%)	-	46 (40.4%)
North America	1 (1.9%)	3 (5.3%)	-	4 (3.5%)
Latin America	1 (1.9%)	2 (3.5%)	-	3 (2.6%)
No answer	-	-	1 (33.3%)	1 (0.9%)
Certified breast center				
Yes	50 (94.3%)	49 (86.0%)	3 (100%)	102 (89.5%)
No	3 (5.7%)	8 (14.0%)	-	11 (9.6%)
No answer	-	-	1 (33.3%)	1 (0.9%)

*Note: Total cohort represents all responding specialties including medical oncology, radiation oncology. Three gynecological breast surgeons are classified under surgical specialties

institutions (29.8%, *n* = 34) or other institutions (5%, *n* = 5, and one missing answer). In general, the answers to all questions were significantly heterogeneously distributed (all $p<0.05$).

Center Volume, Breast MRI Turnaround Times and MRI Infrastructure

Center Volumes: The mean number of annual breast cancer operations per center was 355. The mean number of annual breast MRI examinations was 514. In Europe and North America, MRI use was concentrated in fewer centers with high annual examination volumes ("high-volume, concentrated use"). In contrast, Asia (Japan) showed broader diffusion, with more centers adopting preoperative MRI but each performing fewer examinations ("low-volume, diffuse adoption") (Table 2 of the Supplementary Material).

MRI Turnaround Times: 98% (*n* = 112/114) of total respondents reported a significant variation across continents in timespan between request of the breast MRI to the MRI report (Kruskal-Wallis $p = 0.002$). Rapid access to MRI results (within 7 days) was reported by 67.5% (*n* = 77/114) of respondents, with 19.6% (*n* = 9/46) in Japan having access on the same day.

MRI Infrastructure: The knowledge about national MRI infrastructure was limited, with 38.6% (*n* = 44/114) of respondents not answering this question. Reimbursement by the public health system was more comprehensive in Japan (79.5%, *n* = 35/44 public health coverage) than in Europe (64.4%, *n* = 58/90).

Indications for Preoperative MRI

Indications are detailed in Table 3. Overall, the most common indications based on patient characteristics were invasive lobular carcinoma (93.0%, *n* = 106/114) and suspicion of multifocality/multicentricity on conventional imaging (84.2%, *n* = 96/114). For risk factors, family history of breast cancer (76.3%, *n* = 87/114)

Table 3. Preoperative patient characteristics that qualify for preoperative breast MRI in early breast cancer in daily routine (following to non-invasive biopsy and after imaging by other modalities than breast MRI)

Preoperative patient characteristics	Absolute numbers and percentual frequency (total cohort *n* = 114)*
Lobular invasive cancer histology	106/114 (93.0%)
Multicentricity at imaging	96/114 (84.2%)
Multifocality at imaging	96/114 (84.2%)
DCIS or accompanying DCIS component	77/114 (67.5%)
Other invasive histology than lobular invasive cancer	62/114 (54.4%)
Additional B3 lesions at non-invasive biopsy	42/114 (46.8%)
T2 stage at basic complimentary imaging	50/114 (43.9%)
T3 stage at basic complimentary imaging	46/114 (40.4%)
T1 stage at basic complimentary imaging	45/114 (39.5%)
Lymph node metastasis at biopsy	37/114 (32.5%)
Grading at biopsy	18/114 (15.8%)
Systemic metastasis at imaging	10/114 (8.8%)
Additional risk factors	
Family breast cancer history	87/114 (76.3%)
High breast density	84/114 (73.7%)
Previous breast cancer	71/114 (62.3%)
Age <50	67/114 (58.8%)
Age ≥50	16/114 (14.0%)
Age >75	8/114 (7.0%)
Planned treatment options	
Planned neoadjuvant therapy	89/114 (78.1%)
Planned breast conservative therapy	81/114 (71.1%)
Planned oncoplastic surgery	59/114 (51.8%)
Planned modified radical mastectomy	21/114 (18.4%)

DCIS: Ductal carcinoma *in situ*; MRI: Magnetic resonance imaging

and high breast density (73.7%, *n* = 84/114) were the most cited. In terms of treatment planning, neoadjuvant therapy (78.1%, *n* = 89/114) and breast-conserving therapy (71.1%, *n* = 81/114) were the primary drivers. Significant variation was seen for T1 staging, supported by 76.1% (*n* = 35/46) of Japanese respondents but only 13.3% (*n* = 8/60) of Europeans ($p<0.001$). Detailed cross calculations are included in the Supplementary Material.

Guideline Perceptions and Personal Practice

Guideline Perception: Half of the respondents (50.0%, *n* = 57/114) reported that their national guidelines recommend preoperative MRI for EBC. This perception was more frequent among breast surgeons (67.9%, *n* = 36/53) than radiologists (31.6%, *n* = 18/57). Further, this perception was stronger in Japan (78.3%, *n* = 36/46) compared to Europe (30.0%, *n* = 18/60) (Table 4), a remarkable contrast to the actual guideline positions shown in Table 1. The practice guidelines of the American College of Radiology (ACR) and the Japanese are liberal in evaluating the extent of disease with newly diagnosed breast cancer and both include DCIS as an indication. However, most guidelines at the time of the survey suggest limiting the use of preoperative MRI to only a few select patient populations.

Personal Practice: Strikingly, among those 57 respondents who perceived guidelines as supportive, 52.6% (*n* = 30/57) reported performing more MRIs than guidelines recommend, 36.8% (*n* = 21/57) reported strictly following the guideline indications and 8.8% (*n* = 5/58) performed fewer MRIs than recommended (Table 5). These liberal or restrictive personal practice patterns could not systematically be explained by continent, specialty, payer, institution type or MR examination numbers in logistic models.

Personal Judgement: A majority (84.2%, *n* = 96/114) believed preoperative MRI provided patient benefit, with none believing it caused harm. This belief was positively correlated with the perception of positive guideline support for the practice ($p<0.05$) (Table 6). This divergence between widespread perception of guideline endorsement in daily practice and restrained guideline content (Table 1) was a key finding.

Associations with perceived positive guidelines recommendations: Centers in countries where guideline endorsement was perceived for preoperative EBC MRI demonstrated shorter MRI turnaround times compared to those without such ($p<0.02$). This association between perceived guideline endorsement and

Table 4. Perceived national guideline recommendations for preoperative breast MRI

Do national guidelines recommend preoperative breast MRI for early breast cancer?	Japan (*n* = 46)	Europe (*n* = 60)	Total cohort* (*n* = 114)
Yes	36 (78.3%)	18 (30.0%)	57 (50.0%)
No	10 (21.7%)	42 (70.0%)	57 (50.0%)

*Note: Total cohort represents all respondents; MRI: Magnetic resonance imaging

Table 5. Strict adherence, liberal or restrictive application of national guidelines in a subgroup perceiving positive guidelines on preoperative breast MRI for EBC

Compared to indications of national guidelines, how restrictive or liberal do you request preoperative breast MRI? (Filter: positive national guidelines recommendation)	Japan (*n* = 36)	Europe (*n* = 18)	Subgroup* (*n* = 57)
Strictly following the guidelines	15 (41.7%)	5 (27.8%)	21 (36.8%)
Performing more MRIs than recommended	18 (50.0%)	11 (61.1%)	30 (52.6%)
Performing fewer MRIs than recommended	3 (8.3%)	2 (11.1%)	5 (8.8%)
No answer	0 (0.0%)	0 (0.0%)	1 (1.8%)

*Note: Subgroup represents respondents (*n* = 57) from countries with positive guidelines that makes 50% of total cohort (*n* = 114). MRI: Magnetic resonance imaging; EBC: Early breast cancer

Table 6. Subjective perceived patient benefit of preoperative MRI among all respondents

According to your subjective opinion, is the patient benefit by preoperative MRI the same, better than or worse than without preoperative MRI?	Japan (*n* = 46)	Europe (*n* = 60)	Total cohort* (*n* = 114)
Better	43 (93.5%)	48 (80.0%)	96 (84.2%)
Same	3 (6.5%)	10 (16.7%)	15 (13.2%)
Worse	0 (0.0%)	0 (0.0%)	0 (0.0%)
No answer	0 (0.0%)	2 (3.3%)	3 (2.6%)

*Note: Total cohort represents all respondents. MRI: Magnetic resonance imaging

reporting efficiency does not imply causality because structural or resource-related factors may also contribute.

Availability of Preoperative Staging Tools

The availability of staging tools is detailed in Table 7. Overall, ultrasound (97.4%, *n* = 111/114) and mammography (93.9%, *n* = 107/114) were nearly universally available. Digital breast tomosynthesis (DBT) was less often available (58.8%, *n* = 67/114) and contrast-enhanced mammography (CEM) was even less often available (21.9%, 25/114). Among the Japanese respondents, more than half reported availability of dedicated breast CT (54.3%, *n* = 25/46) compared to the whole collective (26.3%, *n* = 30/114), while CEM was not used for preoperative staging at all in Japan. For the small subgroup of 25 (21.9% of all respondents) CEM users in Europe, USA and Latin America, preoperative MRI was judged to be more beneficial than CEM by 56% (*n* = 14/25), equal to CEM in 32% (*n* = 8/25) and worse in 12% (*n* = 3/25).

Discussion and Conclusion

Preoperative breast MRI consistently detects additional cancers that remain occult on mammography and ultrasound. Whether these additional findings translate into improved clinical outcomes in EBC had been a matter of debate until 2024. In that year, the largest metaanalyses available to date reported improved recurrence-free and overall survival associated with the use of preoperative MRI (1, 12, 13). Our SIS global survey was performed in 2024 and reveals both striking variation and notable consensus. The most prominent finding was the profound interdisciplinary and intercontinental disparity in guideline perception and practice: 50% of respondents reported that guidelines in their region positively recommended preoperative MRI in EBC. At the same time, more than four fifths (84.2%, 96/114) of all respondents expressed belief in a patient benefit, a sentiment transcending geography and specialty. Clinical decisions appear to be driven not only by the reported survey indications and the traditional guideline interpretation, but also by local culture and resources, health system organization, and deeply held personal conviction that often diverge in our survey respondents from the guidelines recommendations, which were out of date after the publication of the 2024 meta-analysis (13).

The Evidence-Guideline-Practice Gap: The observed global heterogeneity underscores a fundamental disconnect between guideline recommendations and clinical practice. Most international guidelines advise against routine preoperative MRI, citing historical concerns about increased mastectomy rates and the absence of level-1 evidence for a survival benefit if they do not respect newest evidence (13). The American Society of Breast Surgeons (ASBrS) Choosing Wisely® Campaign is the most explicit, stating: “Don’t routinely order breast MRI in new breast cancer patients” (14). In contrast, responses from Japan suggest a different picture. A majority (78.3%, 36/46) of Japanese respondents reported that national guidelines recommend preoperative breast MRI in EBC, compared with 30% (18/60) of European and 50% (2/4) of U.S. respondents. What do the Japanese guidelines actually say? The 2013 Japanese Breast Cancer Society guidelines do not advocate routine use of MRI and do not mention EBC at all but recommend (Grade B) MRI for three scenarios: to determine diagnosis and treatment policies for intra-breast lesions, to diagnose the extent of breast cancer and to detect multifocal breast cancer undetectable by mammography and ultrasound (15). The Japanese breast cancer society clinical practice guidelines for breast cancer screening and diagnosis, 2022 edition, adds: “For MRI-detected lesions that are suspected to be malignant on preoperative contrast-enhanced breast MRI, histological examination should be performed if there is an impact on the surgical procedure”. The rationale has been outlined; the decision on the surgical approach should not be based on preoperative MRI findings alone (16). This recommendation to perform additional biopsy prior to surgery is shared by all current guidelines. Today, in Japan, treatment policies for T1 stage cancers include radiofrequency ablation (RFA). MRI is required not only to select and monitor patients for RFA versus breast-conserving therapy (BCT), but also as a prerequisite for reimbursement under public health insurance (17).

Table 7. Frequency of imaging tools for preoperative staging among all respondents

Modality	Absolute numbers and percentual frequency (total cohort *n* = 114)*
Ultrasound	111/114 (97.4%)
Mammography	107/114 (93.9%)
Digital breast tomosynthesis (DBT)	67/114 (58.8%)
Dedicated breast CT	30/114 (26.3%)
Contrast enhanced mammography (CEM)	25/114 (21.9%)
Positron emission tomography (PET)	18/114 (15.8%)
Single photon emission computed tomography (SPECT)	5/114 (4.4%)

*Note: Total cohort represents all respondents. CT: Computed tomography

This is the reason for widespread acceptance of MRI in EBC in Japan. This national context likely explains the sharp contrast in acceptance of T1 stage as an indication for preoperative MRI, observed in 76% (35/46) of Japanese respondents compared with only 13% (8/60) of Europeans.

The 2026 published German S3-Guidelines emphasize the better recurrence-free and overall survival after preoperative MRI according to the latest meta-analysis (13) and justify the routine use of MRI, or alternatively CEM in all patients with newly diagnosed, locally limited breast cancer in the setting of dense beasts or difficult assessment with mammography and ultrasound (18).

Reported clinical practice across continents exceeds the authors' expectations. Clinical adoption of preoperative MRI in EBC appears more liberal than guideline recommendations, as reflected in our survey for Japan 50% (18/36), Europe 61.1% (11/18), and reported real-world rates in the literature of 60% preoperative breast MRI of EBC in USA for women under 65 years of age (2-4).

The Drivers for Use of Preoperative MRI beyond Guideline Recommendations: Firstly, although our survey answers do not provide a clear explanation for the overuse of preoperative MRI compared to guideline intentions, it is reasonable to assume that general resources, financial aspects and rapid access to MRI may encourage the willingness to perform a preoperative MRI examination.

Secondly, the evidence base continues to evolve and is open to interpretation. While early trials raised concerns, recent meta-analyses by Eisen et al. (13) indicate that preoperative MRI significantly reduces re-operation rates (odd ratio = 0.73), re-excisions (odd ratio = 0.63), and increases recurrence-free survival (hazard ratio = 0.77) and overall survival (hazard ratio = 0.89). The benefit in preventing re-excisions may outweigh the initial increase in mastectomy rates, particularly in invasive lobular carcinoma and non-calcified DCIS (13, 19-21). Moreover, improved detection of synchronous contralateral breast cancers has been associated with a reduction in metachronous contralateral disease (hazard ratio = 0.71) (13).

Thirdly, this nuanced benefit where the outcome metric has shifted from survival to surgical precision and patient burden resonates strongly with clinicians, as reflected in the 84.2% (96/114) belief in patient benefit reported in our survey. Historically, pioneers of BCT achieved survival outcomes equivalent to mastectomy through wider excisions and radiotherapy, relying solely on mammography for breast staging (22). Contemporary surgical paradigms, however, favor smaller excisions to optimize cosmesis and multimodal preoperative breast staging. In this context, MRI is increasingly perceived as a modern tool to offset reduced surgical margins, enabling "first-pass" clear margins in an era of precision surgery. Combined with advances in systemic therapy that improve overall survival, this reframes the value of MRI not as a determinant of survival, but as a tool of enhancing surgical quality and reducing patient burden, a rationale not fully captured by traditional evidence hierarchies (12, 13).

Fourthly, emerging data on molecular subtypes further complicate a one-size-fits-all guideline approach. For example, MRI has been shown to reduce mastectomy rates in HER2-positive disease (21). Respondent comments and recent publications emphasize that the indication for preoperative MRI in hormone-negative HER2+ and triple-negative cancers is driven more by planned neoadjuvant systemic therapy than by biological aggressivity alone (23-25). Both subtypes are prone to multiple occult ipsilateral invasive lesions, higher local recurrence rates and nearly all patients with HER2+ or triple-negative disease, as well as those with invasive lobular carcinoma, are potential guideline candidates to undergo preoperative breast MRI in U.S. centers. Currently the Alliance A11104/ACRIN 6694 phase III trial is examining the hypothesis that preoperative breast MRI improves staging and selection of stage I and II patients with ER/PR- negative tumors for BCT, thus lowering rates of local regional recurrence (26).

The Drivers of Decision-Making: Survey Indications and "Fast Thinking": Our data show that the decision for preoperative breast MRI in EBC varies by the traditional patient and tumor characteristics, but now also depends on medical specialty, subjective beliefs and local infrastructure. The strong contrast between Japan (predominantly surgeon respondents) and Europe (predominantly radiologist respondents) suggests the perceived value of MRI is viewed through different professional lenses. The reliance on risk factors such as previous history of breast cancer, despite their limited evidence base for preoperative planning, illustrates the influence of intuitive "fast thinking" in clinical decision-making. Nobel laureate Kahneman (27) examined this "fast thinking mode" in economic contexts and demonstrated that it is prone to several systematic biases, including optimism bias and a tendency to overestimate benefits while underestimating costs. Breast MRI remains the most sensitive modality for detecting breast cancer in high-risk women and as supplemental screening in those with extremely dense breasts (28-30). Given this sensitivity, it is understandable that breast surgeons may favor MRI in a proven cancer; to determine tumor size, identify additional foci in either breast, and assess potential extension to the chest wall or lymph nodes. In the absence of precise risk stratification for preclinical and clinical scenarios, surgeons and radiologists seem to intuitively prioritize the anticipated individual benefit for the patient over restrictive guideline recommendations. Practical factors further reinforce this decision pattern, including rapid access to

breast MRI, reimbursement policies, and the ease of achieving interdisciplinary consensus for performing preoperative MRI (30). We hypothesize that intuitive reasoning and contextual facilitators shape practice beyond the boundaries of still valid guidelines that are not adapted to the latest evidence.

The Continent-Specific Context: The underlying geographic differences are shaped by the distinct ways in which guidelines are interpreted, contextualized, and implemented across continents (31).

Japan represents a model where perceived guideline support, favorable reimbursement, rapid MRI access, and a strong belief in technological advancement converge. The frequent application of preoperative MRI may explain the moderate use of DBT (26.1%, 12/46) and absence of CEM in our survey.

Europe embodies a more restrictive approach, more closely aligned with the intention of the guidelines, likely influenced by cost-control and a higher reliance on radiologists as gatekeepers. Overall availability of ultrasound (100%, 60/60) and high dissemination of DBT (80%, 48/60) and to a lesser degree CEM (31.7%, 39/60) substituting breast MRI may explain this pattern. In Europe, a milestone survey conducted by the European Society of Breast Imaging on the use of clinical breast MRI has reported a restrictive approach of north European countries as far back as 2016 (32). In Southern European countries, preoperative breast MRI was more frequently performed in all breast cancer patients rather than being limited to those with invasive lobular carcinoma (32.1% versus 6% in northern Europe) (32). A similar pattern has been observed for patients with DCIS, where 50.9% of respondents in southern Europe reported routinely using preoperative MRI, compared with 22.2% in northern European countries (32).

United States: Although our U.S. survey data remain limited, the reported studies provide a coherent picture. In the United States, preoperative breast MRI continues to be used at comparatively high rates in EBC, despite divergent professional recommendations (2-4). The ACR quite generously supports preoperative MRI for evaluating disease extent, characterizing additional ipsilateral and contralateral lesions including DCIS and invasive lobular carcinoma and assessing chestwall involvement or response to neoadjuvant therapy (33). In contrast, surgical guidelines from the ASBrS strictly has argued against any routine use of preoperative MRI dating back to 2018 (14). Today MRI is most frequently requested for women with dense breasts in Australia (34). To the best of our knowledge, none of the major U.S. studies or registries (SEER, NCDB, Medicare datasets) report a national percentage of preoperative MRI use stratified by breast density. In the U.S., however, levels of public and provider awareness is high regarding the masking effect of dense breast tissue and its associated increased cancer risk. This awareness has been actively shaped by scientific societies, advocacy groups, and dedicated educational platforms, exemplified by DenseBreastInfo.org, which disseminate information on breast density, supplemental screening, and statelevel legislation (35). The recent Food and Drug Administration National Dense Breast Reporting requirement, mandating that all mammography facilities inform patients whether their breast tissue is “dense” or “not dense” and include an official density assessment in clinician reports, has further institutionalized this awareness (36). The authors hypothesize that these expectations on supplemental imaging in women with dense breasts may extend beyond screening and influence decisionmaking in the preoperative setting, contributing to higher preoperative MRI use in the United States compared with other countries. Realworld surveys suggest that feeforservice reimbursement structures, defensive medical practices, and a strong emphasis on individualized surgical planning further contribute to this persistent utilization pattern (2-4).

Guidelines themselves are complex instruments balancing evidence, harm, benefit, and socio-economic factors aiming to provide support for physicians and patients to utilize shared decision making (31, 33). When evidence for a clear survival benefit is weak, as is the case with preoperative MRI before the time of the 2024 survey, recommendations naturally lean towards case-by-case discussion. This inherent ambiguity creates space for “instinctive judgement”, as described above (27). A clinician’s perspective can shift the historic calculus from “no survival benefit” (arguing against MRI) to “prevents reoperations and optimizes cosmesis” (arguing for MRI), especially for subtypes like invasive lobular carcinoma or in patients planned for neoadjuvant therapy. This survey confirms that in practice, the indications often extend beyond the core scenarios incorporating best subjective intentions (assumed patient benefit), risk factors such as dense breasts, planned neoadjuvant therapy and a desire for comprehensive pre-surgical mapping.

Implications for Future Guidelines and Research

Scientifically, such ambiguity can be resolved and nuanced by subgroup analysis with reference to metanalysis or new trial data, such as the current phase III Alliance A011104/ACRIN 6694 study, which to date does not suggest an oncologic benefit from routine preoperative MRI in early-stage hormone-negative cancers, i.e. HER2+ and triple negative disease (13, 26). This is not surprising in the era of powerful radiation oncology and improving adjuvant/neoadjuvant therapy, both of which can eliminate residual malignant lesions in patients without preoperative MRI. Future trials need to focus on stage-specific surgical endpoints as re-resection and conversion from breast-conservative surgery to mastectomy, and whether deescalation of surgical therapy will progress further with improvement in

systemic therapy. The Breast Imaging Reporting and Data System (BI-RADS) 2025 manual represents a major step forward to obtain up-scaled real-world data (37). By recommending audits of breast MRI examinations after cancer diagnosis (BI-RADS MR 6), it provides a unified framework to define and validate expected performance parameters of preoperative MRI (38). Those data are needed for more nuanced, international guidelines that explicitly address stage dependent specific clinical scenarios (e.g., molecular subtypes) for oncoplastic planning. The final goal will be harmonizing preoperative imaging guidelines with preexisting treatment guidelines, updated evidence on survival benefit for early and advanced breast cancer within an integrated holistic concept (39-41).

Study Limitations

This study has several limitations. All data are self-reported, and the survey format primarily captures "fast-thinking" clinical judgments. As the term EBC was not explicitly defined in the questionnaire, respondents may have interpreted it differently. A standard definition of EBC shared by most guidelines refers to invasive breast cancer confined to the breast and/or axillary lymph nodes without distant metastases (stage I to IIIA). However, some experts favor broader or narrower borders divergent to the mainstream and include DCIS (stage 0) or operable stage IIIB or restrict EBC to nodenegative or small T1 or T2 tumors. These divergent definitions complicate international comparisons and may influence how clinicians interpret survey questions related to EBC.

Although international, the sample size is too small to be representative for most countries, and a selection bias toward clinicians using breast MRI in certified centers is likely. A substantial proportion of respondents came from Japan and Europe. This uneven geographic distribution limits the global generalizability of the results, particularly for less developed regions. Imbalances in respondent specialties between Japan and Europe, together with low participation from other continents, may further skew the findings. All statistical analyses assess associations only; they do not establish causation. For example, a positive perception of guidelines may correlate with faster reporting, but structural factors such as resources, workflow, or infrastructure could equally account for this difference. Another limitation is that, unlike therapy guidelines with stage- or subtype-specific recommendations, most preoperative breast MRI guidelines remain broad and do not differentiate between early and advanced disease. Our survey did not attempt to define a universal standard for what constitutes the presence or absence of preoperative MRI guidance in EBC, acknowledging differing interpretive traditions. A more holistic reading, common in some Asian contexts, may treat broad recommendations as implicitly inclusive of early-stage disease, whereas a more selective, scenario-driven interpretation, typical of Western scientific traditions, may conclude that no explicit recommendation exists. This distinction aligns with established findings in cultural psychology, which demonstrate that East Asian cognition tends to be more holistic and context-oriented, whereas Western cognition is typically more analytic and object-focused (42).

In conclusion, this SIS survey maps the current global practices and demonstrates that the use of preoperative breast MRI is shaped more by geography, different cultural approaches and resources, and clinical interpretation of evolving evidence than by strict adherence to the current guidelines. Overall, 84.2% of all respondents believed preoperative MRI provided a patient benefit, with none believing it caused harm. The most frequent overall indications were invasive lobular carcinoma (93.0%, 106/114), mammographic/sonographic suspicion of multifocality/multicentricity (84.2%, 96/114), and planned neoadjuvant therapy (78.1%, 89/114), and in Japan, assessing the extent of DCIS (97.8%, 45/46). Among respondents who reported using positive guidelines, 52.6% (30/57) performed more MRI examinations than the guidelines advised. Key influencing factors included specialty reimbursement, and rapid access to MRI. These findings highlight the need for standardized guidelines including the newest evidence and further research to clarify the role of MRI in the modern multidisciplinary management of EBC. Functional and abbreviated MR specifications and CEM should be integrated in future international guidelines updates (42, 43).

Ethics

Ethics Committee Approval: Not necessary.

Informed Consent: No personal patient data were used for this survey. No informed consent necessary.

Footnotes

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Supplementary Material Table 1: https://d2v96fxpocvxx.cloudfront.net/ae2c7771-39a2-40bf-a837-aa639bcdd123/content-images/3e14feb4-d21b-48e1-b7fd-8b2a16b2eb7c.pdf

Supplementary Material Table 2: https://d2v96fxpocvxx.cloudfront.net/58770459-5a06-4076-a747-5b73e24cd7c0/content-images/ce826b1e-0fe6-4712-9dcc-152da729ec03.pdf

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