

# Use of Endocrine Therapy for Breast Cancer Risk Reduction: ASCO Clinical Practice Guideline Update

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**PURPOSE** To update the ASCO guideline on pharmacologic interventions for breast cancer risk reduction and provide guidance on clinical issues that arise when deciding to use endocrine therapy for breast cancer risk reduction.

**METHODS** An Expert Panel conducted targeted systematic literature reviews to identify new studies.

**RESULTS** A randomized clinical trial that evaluated the use of anastrozole for reduction of estrogen receptor–positive breast cancers in postmenopausal women at increased risk of developing breast cancer provided the predominant basis for the update.

**UPDATED RECOMMENDATIONS** In postmenopausal women at increased risk, the choice of endocrine therapy now includes anastrozole (1 mg/day) in addition to exemestane (25 mg/day), raloxifene (60 mg/day), or tamoxifen (20 mg/day). The decision regarding choice of endocrine therapy should take into consideration age, baseline comorbidities, and adverse effect profiles. Clinicians should not prescribe anastrozole, exemestane, or raloxifene for breast cancer risk reduction to premenopausal women. Tamoxifen 20 mg/day for 5 years is still considered standard of care for risk reduction in premenopausal women who are at least 35 years old and have completed childbearing. Data on low-dose tamoxifen as an alternative to the standard dose for both pre- and postmenopausal women with intraepithelial neoplasia are discussed in the Clinical Considerations section of this article. Additional information is available at [www.asco.org/breast-cancer-guidelines](http://www.asco.org/breast-cancer-guidelines).

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## INTRODUCTION

ASCO first published clinical practice recommendations for the use of pharmacologic interventions for breast cancer risk reduction in 1999.<sup>1</sup> ASCO updated these breast cancer risk reduction guideline recommendations in 2002, 2009, and 2013.<sup>2-4</sup> The current update was undertaken to integrate data from the International Breast Intervention Study-II (IBIS-II) randomized, placebo-controlled trial on the use of anastrozole (1 mg/day orally for 5 years) to reduce the incidence of breast cancer in postmenopausal women at increased risk of developing breast cancer.<sup>5</sup>

This guideline summarizes the results of a literature search and review of new data on breast cancer risk reduction published since 2013 and provides new recommendations for the use of anastrozole in breast cancer risk reduction. These new recommendations supplement the guideline recommendations issued in 2013.

In addition, as a result of discussions of clinical considerations, this update addresses some questions frequently raised by patients and/or providers regarding the use of tamoxifen, raloxifene, or an

aromatase inhibitor for breast cancer risk reduction. The recent placebo-controlled trial of a lower dose of tamoxifen (5 mg/day) for 3 years in women with intraepithelial neoplasia (atypical hyperplasia or in situ cancer) is also reviewed.<sup>6</sup>

## FOCUSED UPDATE GUIDELINE QUESTION

This guideline update addresses the following clinical question: What is the role of anastrozole in reducing the risk of developing breast cancer in women not previously diagnosed with breast cancer?

## METHODS

### Guideline Update Process

ASCO uses a signals approach to facilitate guideline updating.<sup>7</sup> This approach identifies new, potentially practice-changing data (signals) that might translate into revised practice recommendations. The approach relies on targeted literature searching and the expertise of ASCO guideline panel members to identify signals. For this focused update, a single phase III randomized trial provided the signal.

## ASSOCIATED CONTENT

### Appendix

### Data Supplement

Author affiliations and support information (if applicable) appear at the end of this article.

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K.V. and C.J.F. were Expert Panel co-chairs and co-first authors on the update.

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**THE BOTTOM LINE****Use of Endocrine Therapy for Breast Cancer Risk Reduction: ASCO Clinical Practice Guideline Update****Guideline Question**

What is the role of anastrozole in reducing the risk of developing breast cancer in women not previously diagnosed with breast cancer?

**Target Population**

Women without a personal history of breast cancer who are at increased risk of developing the disease.

**Target Audience**

Medical oncologists, surgical oncologists, gynecologists, primary care physicians, and general practitioners.

**Methods**

An Expert Panel was convened to update clinical practice guideline recommendations based on a systematic review of the medical literature.

**Updated Recommendations**

**Recommendation 4.1.** Anastrozole (1 mg/day orally for 5 years) should be discussed as an alternative to tamoxifen, raloxifene, or exemestane to reduce the risk of invasive breast cancer in postmenopausal women at increased risk of developing breast cancer.

**Recommendation 4.2.** Women most likely to benefit from endocrine therapy are those with one of more of the following: a diagnosis of atypical (ductal or lobular) hyperplasia or lobular carcinoma in situ, an estimated 5-year risk (National Cancer Institute Breast Cancer Risk Assessment Tool [BCRAT]) of at least 3%, a 10-year risk (International Breast Intervention Study [IBIS]/Tyrrer-Cuzick Risk Calculator) of at least 5%, or a relative risk of at least four times the population risk for their age group if they are age 40 to 44 years or two times the population risk for their age group if they are age 45 to 69 years.

**Recommendation 4.3.** Clinicians should not prescribe anastrozole, exemestane, or raloxifene for breast cancer risk reduction in premenopausal women

**Recommendation 4.4.** Discussions between patients and health care providers should include both the benefits and risks of anastrozole along with the other approved drugs for risk reduction based on menopausal status.

**Recommendation 4.5.** Prior to initiating an aromatase inhibitor, clinicians should evaluate patients for baseline fracture risk and measure bone mineral density. Multiple studies have reported an increased rate of bone loss in women treated with aromatase inhibitors. Clinicians should use anastrozole with caution in postmenopausal women with moderate bone mineral density loss, and if it is used, they should consider the use of bone-protective agents such as bisphosphonates and receptor activator of nuclear factor kappa-B ligand (RANKL) inhibitors. All patients receiving aromatase inhibitors should be encouraged to exercise regularly and take adequate calcium and vitamin D supplements. A history of osteoporosis and/or severe bone loss is a relative contraindication for the use of anastrozole. In IBIS-II, women with severe osteoporosis (T score < -4 or more than two vertebral fractures) were excluded. Other endocrine preventive therapies that do not reduce bone density, such as tamoxifen or raloxifene, are also available for this group of women.

**Recommendation 4.6.** Clinicians should also inform women of the possibility of joint stiffness, arthralgias, vasomotor symptoms, hypertension, dry eyes, and vaginal dryness while taking anastrozole (Type: evidence based, benefits outweigh harms; Evidence quality: high; Strength of recommendation: strong).

Refer to [Table 1](#) for the full list of recommendations.

**ASCO believes that cancer clinical trials are vital to inform medical decisions and improve cancer care, and that all patients should have the opportunity to participate.**

**Additional Resources**

More information, including a Data Supplement, slide sets, and clinical tools and resources, is available at [www.asco.org/breast-cancer-guidelines](http://www.asco.org/breast-cancer-guidelines). Patient information is available at [www.cancer.net](http://www.cancer.net). The Methodology Manual, available at [www.asco.org/guideline-methodology](http://www.asco.org/guideline-methodology), provides additional information about the methods used to develop this guideline.

This systematic review-based guideline product was developed by a multidisciplinary Expert Panel (Appendix Table A1, online only), which included a patient representative and ASCO guidelines staff with health research methodology expertise. The Expert Panel reviewed the evidence and formulated updated recommendations for practice. The Expert Panel conducted a search of the PubMed database to identify randomized controlled trials that addressed the use of pharmacologic interventions for breast cancer risk reduction for the period from September 30, 2011, through November 10, 2018. The disease and intervention search terms were those used for the 2013 guideline update. A separate literature search was conducted to identify relevant clinical practice guidelines, systematic reviews, and meta-analyses.

Additional information about the results of the updated literature search and search strategy strings and results is available at [www.asco.org/breast-cancer-guidelines](http://www.asco.org/breast-cancer-guidelines) in the Data Supplement (online only). The Data Supplement also includes Quorum diagrams of the updated search and the Clinical Question, as well as a summary of the study quality appraisal. The Methodology Manual ([www.asco.org/guideline-methodology](http://www.asco.org/guideline-methodology)) provides additional information about the methods used to develop this guideline.

The entire Expert Panel contributed to the development of the guideline, provided critical review, and finalized the guideline recommendations. The ASCO Clinical Practice Guidelines Committee reviews and approves all ASCO guidelines. The complete list of recommendations is provided in Table 1, including the updated recommendations. The Expert Panel met via teleconference to consider the evidence identified by the literature search and corresponded through e-mail. The guideline was circulated in draft form to the Expert Panel. All funding for the administration of the project was provided by ASCO.

### Guideline Disclaimer

The clinical practice guidelines and other guidance published herein are provided by the American Society of Clinical Oncology, Inc. (“ASCO”) to assist providers in clinical decision making. The information therein should not be relied upon as being complete or accurate, nor should it be considered as inclusive of all proper treatments or methods of care or as a statement of the standard of care. With the rapid development of scientific knowledge, new evidence may emerge between the time information is developed and when it is published or read. The information is not continually updated and may not reflect the most recent evidence. The information addresses only the topics specifically identified therein and is not applicable to other interventions, diseases, or stages of diseases. This information does not mandate any particular course of medical care. Further, the information is not intended to substitute for the independent professional judgment of the treating provider, as the information does not account for

individual variation among patients. Recommendations reflect high, moderate, or low confidence that the recommendation reflects the net effect of a given course of action. The use of words like “must,” “must not,” “should,” and “should not” indicate that a course of action is recommended or not recommended for either most or many patients, but there is latitude for the treating physician to select other courses of action in individual cases. In all cases, the selected course of action should be considered by the treating provider in the context of treating the individual patient. Use of the information is voluntary. ASCO provides this information on an “as is” basis, and makes no warranty, express or implied, regarding the information. ASCO specifically disclaims any warranties of merchantability or fitness for a particular use or purpose. ASCO assumes no responsibility for any injury or damage to persons or property arising out of or related to any use of this information or for any errors or omissions.

### Guideline and Conflicts of Interest

The Expert Panel was assembled in accordance with ASCO’s Conflict of Interest Policy Implementation for Clinical Practice Guidelines (“Policy,” found at <http://www.asco.org/rwc>). All members of the Expert Panel completed ASCO’s disclosure form, which requires disclosure of financial and other interests, including relationships with commercial entities that are reasonably likely to experience direct regulatory or commercial impact as a result of promulgation of the guideline. Categories for disclosure include employment; leadership; stock or other ownership; honoraria, consulting or advisory role; speaker’s bureau; research funding; patents, royalties, other intellectual property; expert testimony; travel, accommodations, expenses; and other relationships. In accordance with the Policy, the majority of the members of the Expert Panel did not disclose any relationships constituting a conflict under the Policy.

### RESULTS

The PubMed search, spanning September 2011 to November 2018, which was conducted to identify studies of the use of medications for breast cancer risk reduction, yielded 632 publications. A second PubMed search, spanning September 2011 to February 2019, conducted to identify relevant systematic reviews, meta-analyses, and clinical practice guidelines, yielded 274 records. After the identified abstracts from both searches were reviewed, six full-text articles that included one randomized clinical trial<sup>5</sup>, four systematic reviews and/or meta-analyses,<sup>8-11</sup> and one clinical practice guideline<sup>12</sup> were selected for further review by the Expert Panel. Another relevant clinical practice guideline, updated in 2017 by the National Institute for Health and Care Excellence (NICE; <https://www.nice.org.uk/guidance/cg164>), was identified outside the electronic search by a panel member. Just one publication—the 2014 report of the IBIS-II randomized, placebo-controlled trial on the use of anastrozole to reduce

**TABLE 1.** Summary of All Recommendations

| Agent      | Recommendations   | Strength of Recommendation and Strength of Evidence   |
|------------|---|---|
| Tamoxifen  | <p>1.1. Should be discussed as an option to reduce the risk of invasive BC, specifically ER-positive BC, in premenopausal women who are <math>\geq 35</math> years of age with a 5-year projected absolute BC risk <math>\geq 1.66\%</math> or with LCIS. Risk reduction benefit continues for at least 10 years.</p> <p>1.2. Is not recommended for use in women with a history of deep vein thrombosis, pulmonary embolus, stroke, transient ischemic attack, or during prolonged immobilization.</p> <p>1.3. Is not recommended for women who are pregnant, women who may become pregnant, or nursing mothers.</p> <p>1.4. Is not recommended in combination with hormone therapy.</p> <p>1.5. Follow-up should include a timely workup of abnormal vaginal bleeding.</p> <p>1.6. Discussions with patients and health care providers should include both the risks and benefits of tamoxifen in the preventive setting.</p> <p>1.7. Dosage: 20 mg/day orally for 5 years.</p> | Strong, evidence-based recommendation. Strength of evidence: strong, based on five RCTs with a low risk of bias.    |
| Raloxifene | <p>2.1. Should be discussed as an option to reduce the risk of invasive BC, specifically ER-positive BC, in postmenopausal women who are <math>\geq 35</math> years of age with a 5-year projected absolute BC risk <math>\geq 1.66\%</math> or with LCIS.</p> <p>2.2. May be used longer than 5 years in women with osteoporosis, in whom BC risk reduction is a secondary benefit.</p> <p>2.3. Should not be used for BC risk reduction in premenopausal women.</p> <p>2.4. Is not recommended for use in women with a history of deep vein thrombosis, pulmonary embolus, stroke, or transient ischemic attack, or during prolonged immobilization.</p> <p>2.5. Discussions with patients and health care providers should include both the risks and benefits of raloxifene in the preventive setting.</p> <p>2.6. Dosage: 60 mg/day orally for 5 years.</p>  | Strong, evidence-based recommendation. Strength of evidence: strong, based on four RCTs with a low risk of bias.    |
| Exemestane | <p>3.1. Should be discussed as an alternative to tamoxifen and/or raloxifene to reduce the risk of invasive BC, specifically ER-positive BC, in postmenopausal women <math>\geq 35</math> years of age with a 5-year projected absolute BC risk <math>\geq 1.66\%</math> or with LCIS or atypical hyperplasia.</p> <p>3.2. Should not be used for BC risk reduction in premenopausal women.</p> <p>3.3. Discussions with patients and health care providers should include both the risks and benefits of exemestane in the preventive setting.</p> <p>3.4. Dosage: 25 mg/day orally for 5 years.</p>   | Moderate, evidence-based recommendation. Strength of evidence: moderate, based on one RCT with a low risk of bias.* |

(continued on following page)

**TABLE 1.** Summary of All Recommendations (continued)

| Agent       | Recommendations   | Strength of Recommendation and Strength of Evidence  |
|-------------|---|--|
| Anastrozole | 4.1. Anastrozole (1 mg/day orally for 5 years) should be discussed as an alternative to tamoxifen, raloxifene, or exemestane to reduce the risk of invasive BC in postmenopausal women at increased risk of developing BC.  | Evidence based, benefits outweigh harms; Evidence quality: high; Strength of recommendation: strong, based on one RCT with low risk of bias. |
|             | 4.2. Women most likely to benefit from endocrine therapy are those with one or more of the following: a diagnosis of atypical (ductal or lobular) hyperplasia or LCIS, an estimated 5-year risk (NCI BCRAT) of at least 3%, a 10-year risk (IBIS/Tyrer-Cuzick Risk Calculator) of at least 5%, or a relative risk of at least four times the population risk for their age group if their age is 40 to 44 years or two times the population risk for their age group if their age is 45 to 69 years.  |  |
|             | 4.3. Clinicians should not prescribe anastrozole, exemestane, or raloxifene for BC risk reduction in premenopausal women.   |  |
|             | 4.4. Discussions between patients and health care providers should include both the benefits and risks of anastrozole along with the other approved drugs for risk reduction based on menopausal status.  |  |
|             | 4.5. Prior to initiating an aromatase inhibitor, clinicians should evaluate patients for baseline fracture risk and measure bone mineral density. Multiple studies have reported an increased rate of bone loss in women treated with aromatase inhibitors. Clinicians should use anastrozole with caution in postmenopausal women with moderate bone mineral density loss, and if it is used, they should consider the use of bone-protective agents such as bisphosphonates and RANKL inhibitors. All patients receiving aromatase inhibitors should be encouraged to exercise regularly and take adequate calcium and vitamin D supplements. A history of osteoporosis and/or severe bone loss is a relative contraindication for the use of anastrozole. In IBIS-II, women with severe osteoporosis (T score < -4 or more than two vertebral fractures) were excluded. Other endocrine preventive therapies that do not reduce bone density, such as tamoxifen or raloxifene, are also available for this group of women. |  |
|             | 4.6. Clinicians should also inform women of the possibility of joint stiffness, arthralgias, vasomotor symptoms, hypertension, dry eyes, and vaginal dryness while taking anastrozole.  |  |

Abbreviations: BC, breast cancer; BCRAT, Breast Cancer Risk Assessment Tool; ER, estrogen receptor; IBIS, International Breast Intervention Study; LCIS, lobular carcinoma in situ; NCI, National Cancer Institute; RANKL, receptor activator of nuclear factor kappa-B ligand; RCT, randomized controlled trial.

\*The “moderate” strength of recommendation here reflects the 2013 system of characterizing the evidence and recommendation strength.

the incidence of breast cancer in postmenopausal women at increased risk of developing breast cancer—provided a signal for substantively revising the guideline recommendations.<sup>5</sup>

### CLINICAL QUESTION AND UPDATED RECOMMENDATIONS

What is the role of anastrozole in reducing the risk of developing breast cancer in women not previously diagnosed with breast cancer?

#### Recommendation 4.1

Anastrozole (1 mg/day orally for 5 years) should be discussed as an alternative to tamoxifen, raloxifene, or exemestane to reduce the risk of invasive breast cancer in postmenopausal women at increased risk of developing breast cancer.

#### Recommendation 4.2

Women most likely to benefit are those with one or more of the following: a diagnosis of atypical (ductal or lobular) hyperplasia or lobular carcinoma in situ, an estimated 5-year risk (National Cancer Institute Breast Cancer Risk Assessment Tool [BCRAT]) of at least 3%, a 10-year risk (International Breast Intervention Study [IBIS]/Tyrer-Cuzick Risk Calculator) of at least 5%, or a relative risk of at least four times the population risk for their age group if their age is 40 to 44 years or two times that for their age group if their age is 45 to 69 years.

#### Recommendation 4.3

Clinicians should not prescribe anastrozole, exemestane, or raloxifene for breast cancer risk reduction in premenopausal women.

**Recommendation 4.4**

Discussions between patients and health care providers should include both the benefits and risks of anastrozole along with the other approved drugs for risk reduction based on menopausal status.

**Recommendation 4.5**

Prior to initiating an aromatase inhibitor, clinicians should evaluate patients for baseline fracture risk and measure bone mineral density. Multiple studies have reported an increased rate of bone loss in women treated with aromatase inhibitors. Clinicians should use anastrozole with caution in postmenopausal women with moderate bone mineral density loss, and if it is used, they should consider the use of bone-protective agents such as bisphosphonates and receptor activator of nuclear factor kappa-B ligand (RANKL) inhibitors. All patients receiving aromatase inhibitors should be encouraged to exercise regularly and take adequate calcium and vitamin D supplements. A history of osteoporosis and/or severe bone loss is a relative contraindication for the use of anastrozole. In IBIS-II, women with severe osteoporosis (T score < -4 or more than two vertebral fractures) were excluded. Other endocrine preventive therapies that do not reduce bone density, such as tamoxifen or raloxifene, are also available for this group of women.

**Recommendation 4.6**

Clinicians should also inform women of the possibility of joint stiffness, arthralgias, vasomotor symptoms, hypertension,

dry eyes, and vaginal dryness while taking anastrozole. (Type: evidence based, benefits outweigh harms; Evidence quality: high; Strength of recommendation: strong).

**Literature review and analysis.** The literature review conducted for this guideline update identified a single relevant randomized controlled trial that had been published since the 2013 update. Cuzick et al<sup>5</sup> reported on the results of the IBIS-II double-blind, randomized, placebo-controlled trial that assessed the safety and efficacy of the aromatase inhibitor anastrozole (1 mg/day orally for 5 years) to reduce the incidence of breast cancer in postmenopausal women at increased risk of developing breast cancer. Table 2 summarizes trial parameters and the eligibility characteristics for the 3,864 postmenopausal women age 40 to 70 years who were randomly assigned. There were no differences in baseline characteristics between the groups. The median age was 59.5 years (interquartile range [IQR], 55-63.5 years), and 18% of women were older than age 65 years; the median Tyrer-Cuzick model 10-year risk was 7.6% (IQR, 5.1%-10%).

Table 3 summarizes the results of IBIS-II and the adverse events reported. After a median follow-up of 5 years (IQR, 3.0-7.1 years), intention-to-treat analyses revealed that 85 women in the placebo group (4%) and 40 women in the anastrozole group (2%) had developed either breast cancer (hazard ratio [HR], 0.47; 95% CI, 0.32 to 0.68;  $P < .001$ ). After 7 years, the predicted cumulative incidence of all breast cancers was twice as high in the placebo group

**TABLE 2.** Study Characteristics of IBIS-II

| Agent Category      | Interventions/Comparisons                              | Primary Outcomes                                    | Funding | Eligibility Criteria   | No. of Patients                    |                               |                  | Cohort Characteristics  |
|---------------------|--|---|---------|--|------------------------------------|-------------------------------|------------------|---|
|                     |  |   |         |  | Randomly Assigned                  | Accrual Period                | Follow-Up Period |   |
| Aromatase inhibitor | Anastrozole 1 mg/day for 5 years compared with placebo | Incidence of invasive and noninvasive breast cancer | Public  | Postmenopausal women age 40 to 70 years with increased risk of developing breast cancer, including ER-positive DCIS with unilateral mastectomy within prior 6 months, LCIS, atypical hyperplasia, or increased risk by the Tyrer-Cuzick model of at least four times the population risk for women age 40 to 44 years, two times the population risk for women age 45 to 65 years, or 1.5 times the population risk for women age 60 to 70 years and/or having a minimum 10-year estimated risk of 5%. | Anastrozole, 1,920; placebo, 1,944 | February 2003 to January 2012 | 5 years          | Median age, 59.5 years; median 10-year risk, 7.6%; ER-positive DCIS, 8%; LCIS/AH, 9%; two or more first-degree relatives with breast or ovarian cancer, 49%; BMI, 30 kg/m <sup>2</sup> or higher than 33%; prior hysterectomy, 33%; prior HRT, 47%; prior HRT within 12 months, 8%; currently receiving bisphosphonate, 16% |

Abbreviations: AH, atypical hyperplasia; BMI, body mass index; DCIS, ductal carcinoma in situ; ER, estrogen receptor; HRT, hormone replacement therapy; IBIS-II, International Breast Intervention Study II; LCIS, lobular carcinoma in situ.

**TABLE 3.** Results of IBIS-II

| Variable                         | No.   | %   | HR   | 95% CI       | P      | RR   | 95% CI       |
|----------------------------------|-------|-----|------|--------------|--------|------|--------------|
| Breast cancer incidence          |       |     |      |              |        |      |              |
| Sample size                      |       |     |      |              |        |      |              |
| Anastrozole                      | 1,920 |     |      |              |        |      |              |
| Placebo                          | 1,944 |     |      |              |        |      |              |
| All breast cancers               |       |     | 0.47 | 0.32 to 0.68 | < .001 |      |              |
| Anastrozole                      | 40    | 2   |      |              |        |      |              |
| Placebo                          | 85    | 4   |      |              |        |      |              |
| All invasive breast cancers      |       |     | 0.50 | 0.32 to 0.76 | .001   |      |              |
| Anastrozole                      | 32    | 2   |      |              |        |      |              |
| Placebo                          | 64    | 3   |      |              |        |      |              |
| ER-positive                      |       |     | 0.42 | 0.25 to 0.71 | .001   |      |              |
| Anastrozole                      | 20    | 1   |      |              |        |      |              |
| Placebo                          | 47    | 2   |      |              |        |      |              |
| ER-negative                      |       |     | 0.78 | 0.35 to 1.72 | .538   |      |              |
| Anastrozole                      | 11    | 1   |      |              |        |      |              |
| Placebo                          | 14    | 1   |      |              |        |      |              |
| All noninvasive breast cancers   | NR    |     |      |              |        |      |              |
| LCIS                             | NR    |     |      |              |        |      |              |
| DCIS                             |       |     | 0.30 | 0.12 to 0.74 | .009   |      |              |
| Anastrozole                      | 6     | < 1 |      |              |        |      |              |
| Placebo                          | 20    | 1   |      |              |        |      |              |
| Adverse effects                  |       |     |      |              |        |      |              |
| Sample size                      |       |     |      |              |        |      |              |
| Anastrozole                      | 1,920 |     |      |              |        |      |              |
| Placebo                          | 1,944 |     |      |              |        |      |              |
| Death                            |       |     |      |              |        |      |              |
| Anastrozole                      | 18    | 1   |      |              |        |      |              |
| Placebo                          | 17    | 1   |      |              |        |      |              |
| Thrombosis or embolism           |       |     |      |              |        | 1.13 | 0.59 to 2.17 |
| Anastrozole                      | 19    | 1   |      |              |        |      |              |
| Placebo                          | 17    | 1   |      |              |        |      |              |
| Deep vein thrombosis             | NR    |     |      |              |        |      |              |
| Pulmonary embolism               | NR    |     |      |              |        |      |              |
| Cardiovascular                   | NR    |     |      |              |        |      |              |
| Stroke                           | NR    |     |      |              |        |      |              |
| Transient ischemic attack        | NR    |     |      |              |        |      |              |
| Cancers other than breast cancer |       |     |      |              |        | 0.58 | 0.39 to 0.85 |
| Anastrozole                      | 40    | 2   |      |              |        |      |              |
| Placebo                          | 70    | 4   |      |              |        |      |              |
| Endometrial cancer               |       |     |      |              |        | 0.61 | 0.15 to 2.54 |
| Anastrozole                      | 3     | < 1 |      |              |        |      |              |
| Placebo                          | 5     | < 1 |      |              |        |      |              |

(continued on following page)

**TABLE 3.** Results of IBIS-II (continued)

| Variable                                    | No.   | %  | HR | 95% CI | P | RR   | 95% CI       |
|---|-------|----|----|--------|---|------|--------------|
| Fracture                                    |       |    |    |        |   | 1.11 | 0.90 to 1.38 |
| Anastrozole                                 | 164   | 9  |    |        |   |      |              |
| Placebo                                     | 149   | 8  |    |        |   |      |              |
| Hypertension                                |       |    |    |        |   | 1.64 | 1.18 to 2.28 |
| Anastrozole                                 | 89    | 5  |    |        |   |      |              |
| Placebo                                     | 55    | 3  |    |        |   |      |              |
| Musculoskeletal                             |       |    |    |        |   | 1.10 | 1.05 to 1.16 |
| Anastrozole                                 | 1,226 | 64 |    |        |   |      |              |
| Placebo                                     | 1,124 | 58 |    |        |   |      |              |
| Arthralgia                                  |       |    |    |        |   | 1.10 | 1.03 to 1.18 |
| All   |       |    |    |        |   |      |              |
| Anastrozole                                 | 972   | 51 |    |        |   |      |              |
| Placebo                                     | 894   | 46 |    |        |   |      |              |
| Mild  |       |    |    |        |   | 1.01 | 0.89 to 1.15 |
| Anastrozole                                 | 385   | 20 |    |        |   |      |              |
| Placebo                                     | 386   | 20 |    |        |   |      |              |
| Moderate                                    |       |    |    |        |   | 1.18 | 1.04 to 1.33 |
| Anastrozole                                 | 422   | 22 |    |        |   |      |              |
| Placebo                                     | 363   | 19 |    |        |   |      |              |
| Severe                                      |       |    |    |        |   | 1.24 | 0.99 to 1.56 |
| Anastrozole                                 | 151   | 8  |    |        |   |      |              |
| Placebo                                     | 123   | 6  |    |        |   |      |              |
| Joint stiffness                             |       |    |    |        |   | 1.51 | 1.17 to 1.94 |
| Anastrozole                                 | 143   | 7  |    |        |   |      |              |
| Placebo                                     | 96    | 5  |    |        |   |      |              |
| Pain in hand or foot                        |       |    |    |        |   | 1.23 | 0.99 to 1.51 |
| Anastrozole                                 | 178   | 9  |    |        |   |      |              |
| Placebo                                     | 147   | 8  |    |        |   |      |              |
| Carpal tunnel syndrome or nerve compression |       |    |    |        |   | 1.58 | 1.08 to 2.30 |
| Anastrozole                                 | 67    | 3  |    |        |   |      |              |
| Placebo                                     | 43    | 2  |    |        |   |      |              |
| Ocular                                      |       |    |    |        |   | 1.05 | 0.92 to 1.21 |
| Anastrozole                                 | 348   | 18 |    |        |   |      |              |
| Placebo                                     | 335   | 17 |    |        |   |      |              |
| Cataract                                    |       |    |    |        |   | 0.96 | 0.72 to 1.27 |
| Anastrozole                                 | 90    | 5  |    |        |   |      |              |
| Placebo                                     | 95    | 5  |    |        |   |      |              |
| Dry eyes                                    |       |    |    |        |   | 1.45 | 1.04 to 2.01 |
| Anastrozole                                 | 83    | 4  |    |        |   |      |              |
| Placebo                                     | 58    | 2  |    |        |   |      |              |
| Vasomotor                                   |       |    |    |        |   | 1.15 | 1.08 to 1.22 |
| Anastrozole                                 | 1,090 | 57 |    |        |   |      |              |
| Placebo                                     | 961   | 49 |    |        |   |      |              |

(continued on following page)

**TABLE 3.** Results of IBIS-II (continued)

| Variable    | No. | %  | HR | 95% CI | P | RR   | 95% CI       |
|-------------|-----|----|----|--------|---|------|--------------|
| Mild        |     |    |    |        |   | 1.10 | 1.00 to 1.22 |
| Anastrozole | 550 | 29 |    |        |   |      |              |
| Placebo     | 504 | 26 |    |        |   |      |              |
| Moderate    |     |    |    |        |   | 1.20 | 1.05 to 1.37 |
| Anastrozole | 390 | 20 |    |        |   |      |              |
| Placebo     | 330 | 17 |    |        |   |      |              |
| Severe      |     |    |    |        |   | 1.20 | 0.95 to 1.50 |
| Anastrozole | 150 | 8  |    |        |   |      |              |
| Placebo     | 127 | 7  |    |        |   |      |              |

NOTE. Median follow-up, 5 years (range, 3.0 to 7.1 years).

Abbreviations: DCIS, ductal carcinoma in situ; ER, estrogen receptor; HR, hazard ratio; IBIS-II, International Breast Intervention Study II; LCIS, lobular carcinoma in situ; NR, not reported; RR, risk ratio.

(5.6%) versus the anastrozole group (2.8%). Five-year adherence was estimated to be less in the anastrozole group compared with the placebo group (68% v 72%). In multivariable analyses, women randomly assigned to anastrozole and reporting gynecologic symptoms at 6 months were less likely to be adherent at 4.5 years compared with those not reporting these symptoms (HR, 0.69; 95% CI, 0.55 to 0.88).<sup>13</sup>

In subgroup analyses, the reduction in breast cancer risk for invasive cancer was limited to estrogen receptor–positive and/or progesterone receptor–positive tumors (HR, 0.42; 95% CI, 0.25 to 0.71;  $P = .001$ ). Furthermore, there appeared to be little difference in risk reduction by age < 60 years or > 60 years or body mass index. There was a clear risk reduction for women with no prior hormone replacement therapy, but not for women with prior hormone replacement therapy. The investigators reported 35 deaths by the data cutoff: 17 deaths in the placebo group and 18 deaths in the anastrozole group. However, no specific causes were more common in one group than in the other group ( $P = .836$ ). With respect to adverse events, vasomotor symptoms (hot flashes, night sweats) and musculoskeletal symptoms (carpal tunnel syndrome, joint stiffness, moderate arthralgia) were significantly increased with anastrozole. The investigators also reported an increase in frequency of hypertension with anastrozole as well as a greater frequency of dry eyes.

Similar to that for tamoxifen, raloxifene, and exemestane, there is no evidence for a survival advantage for anastrozole given for primary prevention as opposed to breast cancer treatment. It is unclear that we will ever have the ability to detect survival effects due to low numbers of breast cancer events, limited statistical power, and use of preventive agents by women in the placebo group after trial conclusion. However, a reduction in incidence itself is an important end point. Of note, there are no data on the use of anastrozole for breast cancer risk reduction in women

with germ line breast cancer predisposition mutations or in men with breast cancer.

### CLINICAL CONSIDERATIONS FOR USE OF ENDOCRINE PREVENTION PHARMACEUTICAL AGENTS FOR BREAST CANCER RISK REDUCTION

In this section, the Expert Panel provides practical answers to questions frequently raised by patients and/or providers regarding the use of tamoxifen, raloxifene, or an aromatase inhibitor for breast cancer risk reduction based on the best available data. The Expert Panel also summarizes evidence from a recently reported trial of low-dose tamoxifen as an alternative to standard-dose tamoxifen for breast cancer risk reduction in women with intraepithelial neoplasia.<sup>6</sup>

#### Risk Threshold for Considering Endocrine Therapy for Primary Breast Cancer Prevention

There is no single absolute or relative risk threshold for which endocrine therapy should be considered for breast cancer risk reduction. The US Preventive Services Task Force<sup>14</sup> recommends a 5-year risk of at least 3% (based on the National Cancer Institute Breast Cancer Risk Assessment Tool [BCRAT]), and NICE recommends an age-dependent, 10-year risk of  $\geq 5\%$ .<sup>15</sup> Of note, although the eligibility for the Breast Cancer Prevention Trial (P-1) of the National Surgical Adjuvant Breast and Bowel Project trial and the Study of Tamoxifen and Raloxifene (STAR) for the Prevention of Breast Cancer in Postmenopausal Women trial was a 5-year BCRAT of 1.66%, the mean risk among trial entrants was actually higher than that; the mean 5-year breast cancer risk in the STAR trial, for instance, was 4.03% (standard deviation, 2.17%). The two models most frequently used to calculate breast cancer risk in the phase III prevention trials and in clinical practice today are the BCRAT model (<https://bcrisktool.cancer.gov>) and the IBIS/Tyrer-Cuzick model (<http://www.ems-trials>).

[org/riskevaluator/](http://org/riskevaluator/)). The BCRAT model provides absolute 5-year and lifetime risks while the Tyrer-Cuzick model provides 10-year and residual absolute lifetime risk estimates.<sup>16-18</sup> In Version 8 of the Tyrer-Cuzick model, a 5-year risk can also be estimated. Because the BCRAT model does not consider age at onset of cancer in family members or cancer in second-degree relatives, the Tyrer-Cuzick model is more appropriate when these features are present in families. The Expert Panel provides more details on risk models in the Appendix (online only).

Women with atypical hyperplasia (AH) or lobular carcinoma in situ (LCIS) have a four- to 10-fold increase in breast cancer risk compared with those without a precursor lesion or a 5-year risk of 3% to 5% and a 10-year risk of 5% to 10%.<sup>19-21</sup> Given the magnitude of risk for AH and LCIS and the large risk reduction observed with tamoxifen and anastrozole in the NSABP P-1 and IBIS-II trials, respectively, all women with AH or LCIS who are age 35 years or older, have completed childbearing, and who have no medical contraindications should be offered endocrine therapy.<sup>5,22</sup> This also applies to women of African descent, whose risk for breast cancer is increased to an equal degree by atypical lesions, even though their estimated risk using the BCRAT model may be lower than the thresholds discussed earlier in the text.<sup>23-25</sup>

Women age 35 to 59 years with a calculated 5-year risk of  $\geq 3\%$  or with a 10-year absolute risk of  $\geq 5\%$  (based on the BCRAT and IBIS models, respectively) should also have the option of endocrine risk reduction. Women with a calculated 5-year risk of  $\geq 3\%$  who are age 35 to 39 years will have a six- to 10-fold increase in risk; those age 40 to 44 years will have a four-fold increase in risk; and those age 45 to 59 years will have a two-fold increase in risk compared with the average population risk of women in the same age groups. For women age 60 to 69 years with a 5-year absolute risk of 3%, the risks versus benefits are less clear because the relative risk is only 1.5- to 1.8-fold greater than the average population risk, and the risk of serious adverse effects is higher than that in younger women.<sup>5,22,26,27</sup>

Examples of clinical situations that should alert providers to consider endocrine risk reduction therapy include (1) an affected first-degree relative with breast cancer diagnosed before age 45 years, two affected first-degree relatives at any age, or an affected first-degree and an affected second-degree relative; (2) inheritance of a moderate- or high-penetrance gene mutation for breast cancer susceptibility; or (3) receipt of chest wall radiation at age  $< 30$  years.<sup>28-34</sup> At present, high breast density alone is not an indication for endocrine prevention therapy, and it is not considered by all risk assessment models. At present, some risk models, such as Version 8.0 of the IBIS/Tyrer-Cuzick model, incorporate breast density as a risk factor, but BCRAT does not.

Regardless of risk level, all women should be encouraged to practice healthy behaviors. This includes at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise per week, maintaining a healthy weight (ie, body mass index between 18.5 and 24.9 kg/m<sup>2</sup>), and limiting alcohol consumption to  $< 7$  drinks per week (<https://www.cancer.org/cancer/breast-cancer.html>, <http://www.aicr.org>, [https://www.nhlbi.nih.gov/health/educational/lose\\_wt/risk.htm](https://www.nhlbi.nih.gov/health/educational/lose_wt/risk.htm)). In observational studies, healthy behaviors have been associated with at least a 20% to 30% reduction in breast cancer incidence irrespective of risk level.<sup>35-39</sup>

### Low-Dose (5 mg) Versus Standard-Dose Tamoxifen

A recent randomized trial in women with intraepithelial neoplasia suggests that low-dose tamoxifen reduces risk of breast cancer relative to placebo, but there are no data on equivalence of the two dosages. DeCensi et al<sup>6</sup> recently reported results of a trial in 500 women with intraepithelial neoplasia (atypical hyperplasia, lobular carcinoma, or ductal carcinoma in situ [DCIS]) who were randomly assigned to tamoxifen at one quarter of the standard 20 mg dose (5 mg/day) or placebo for 3 years. At a median follow-up of 5 years, those randomly assigned to low-dose tamoxifen had half the neoplastic breast events (DCIS or invasive cancer) as those randomly assigned to placebo. By comparison, in the NSABP P-1 trial, the relative reduction in invasive cancer for full-dose tamoxifen compared with placebo was 49% overall: 86% for women with a prior biopsy of AH and 59% for those with LCIS. Noninvasive cancer was also reduced by half.<sup>22</sup> The reasons for the higher proportional risk reduction for women with AH and LCIS are not entirely clear but may, in part, be related to the combination of higher estrogen receptor density and proliferation in AH and LCIS than in normal breast tissue.<sup>40,41</sup> Results of low-dose tamoxifen are consistent with the effect of 20 mg/day of the NSABP-B24 (A Clinical Trial to Evaluate the Worth of Tamoxifen in Conjunction with Lumpectomy and Breast Irradiation for the Treatment of Noninvasive Intraductal Carcinoma [DCIS] of the Breast) subgroup analysis of hormone-sensitive DCIS, in which the HR was 0.58 (95% CI, 0.42 to 0.81).<sup>42</sup> Low-dose tamoxifen compared with placebo was not associated with an increase in the number of serious adverse effects, including deep venous thrombosis and endometrial cancer. The incidence of hot flashes was slightly higher than with placebo, although trial adherence was similar. Because concern about adverse effects is a major reason for poor uptake of endocrine therapy for breast cancer risk reduction,<sup>4,43-45</sup> low-dose tamoxifen may be an alternative in women with intraepithelial neoplasia.

### Upper Age Limit for Endocrine Risk Reduction Therapy

Women age 70 years or older should not be offered endocrine prevention unless their short-term risk is in the range of 1% or more per year (eg, atypical hyperplasia plus family history or LCIS), they are active, and they have a life

**TABLE 4.** Adverse Effects of Endocrine Therapy

| Postmenopausal Women   |
|--|
| Anastrozole <sup>5,49-51,62</sup>  |
| Reduction in bone density  |
| Musculoskeletal symptoms (ie, arthralgia, carpal tunnel syndrome)                          |
| Vasomotor symptoms   |
| Vaginal dryness, dyspareunia, reduced libido   |
| Hypertension   |
| Dry eyes   |
| Alopecia*  |
| Exemestane <sup>46,52,53</sup>   |
| Reduction in bone density  |
| Musculoskeletal symptoms (ie, arthralgia)  |
| Muscle pain  |
| Vasomotor symptoms   |
| Diarrhea   |
| Fatigue  |
| Insomnia   |
| Raloxifene <sup>54-56</sup>  |
| Lower risk of adverse effects than tamoxifen in the STAR trial                             |
| Thromboembolic events  |
| Cerebrovascular disease (ie, stroke and transient ischemic attack)                         |
| Vasomotor symptoms   |
| Dyspareunia  |
| Pre- and postmenopausal women  |
| Tamoxifen† <sup>57-61</sup>  |
| Endometrial cancer   |
| Thromboembolic events  |
| Other gynecologic conditions (endometrial hyperplasia, vaginal discharge, vaginal dryness) |
| Vasomotor symptoms   |
| Cataracts  |

Abbreviation: STAR, Study of Tamoxifen and Raloxifene (STAR) for the Prevention of Breast Cancer in Postmenopausal Women.

\*Alopecia is likely an underreported adverse effect in clinical trials.

†The incidence for single-agent aromatase inhibitors and selective estrogen receptor modulators seems to be similar at 3% to 4%.

expectancy of 10 or more years. Risk benefit will vary by age, medical circumstances, and the prevention drug.<sup>27</sup>

### Longer Duration of Endocrine Therapy for Breast Cancer Risk Reduction

While the standard duration is 5 years, women who stop endocrine therapy after 3 years for a variety of reasons will likely still derive a benefit. This conclusion is based on the 50% risk reduction observed in the DeCensi et al trial of

3 years of low-dose tamoxifen versus placebo<sup>6</sup> and on the 65% risk reduction reported in the MAP3 (Exemestane in Preventing Cancer in Postmenopausal Women at Increased Risk of Developing Breast Cancer) trial after a median of 3 years of exemestane.<sup>46</sup>

Currently, raloxifene, which is frequently prescribed to postmenopausal women for osteoporosis prevention, is the only drug with clinical trial experience of more than 5 years of use for breast cancer risk reduction.<sup>47</sup> There are no data from randomized trials for tamoxifen, exemestane, or anastrozole to be given for longer than 5 years for women without a prior diagnosis of cancer; therefore, this practice is not advised. Furthermore, in adjuvant cancer treatment trials comparing 10 years versus 5 years of treatment, tamoxifen was associated with an increase in the risk of uterine cancer and pulmonary embolism and exemestane with an increase in the risk of osteoporosis, fracture, and hypertension.<sup>46,48</sup>

### Deciding Between an Aromatase Inhibitor and a Selective Estrogen Receptor Modulator for Endocrine Prevention Therapy in Postmenopausal Women

Decisions about the use of aromatase inhibitors versus selective estrogen receptor modulators are usually made based on age, symptoms, and comorbidities, given that the aromatase inhibitors (exemestane and anastrozole) and the selective estrogen receptor modulators (tamoxifen and raloxifene) both reduce breast cancer incidence compared with placebo. There is no primary prevention trial comparing tamoxifen to the aromatase inhibitors.<sup>26</sup> In women with DCIS, there was no difference in breast cancer incidence in a randomized trial of tamoxifen versus anastrozole. However, as expected, the adverse effect profiles for the two agents differed. There was a higher incidence of osteoporosis, fractures, joint stiffness, carpal tunnel syndrome, hypercholesterolemia, stroke, and vaginal dryness with anastrozole versus tamoxifen, but there was a higher incidence of deep venous thrombosis, pulmonary emboli, and vaginal discharge with tamoxifen than with anastrozole. Table 4 lists adverse effects of endocrine therapy for each of the agents studied. About half the women in both groups had vasomotor symptoms, and these symptoms were slightly more frequent with tamoxifen.<sup>62</sup>

Providers should have a higher threshold for prescribing aromatase inhibitors in women without breast cancer that may exacerbate underlying medical problems such as moderate to severe bone mineral density loss and poorly controlled hypertension. Tamoxifen or raloxifene is likely a better choice than aromatase inhibitors in women with osteoporosis. By contrast, tamoxifen and raloxifene are contraindicated in women with prior history of deep venous thrombosis or pulmonary embolism, and an aromatase inhibitor would a better choice under these circumstances. At least for tamoxifen, a predisposition to

deep vein thrombosis seems to be related primarily to obesity, immobility, and recent surgery.<sup>63,64</sup> Tamoxifen, rather than anastrozole, exemestane, or raloxifene, may also be a better option in a woman who suffers from vaginal dryness. Finally, because tamoxifen is also associated with increased risk of endometrial cancer and cataracts in older women, the benefit-to-risk ratio in women older than age 60 years with a uterus and normal bone density is likely to be greater for aromatase inhibitors than tamoxifen.

### ADDITIONAL RESOURCES

Additional information, including data supplements, evidence tables, and clinical tools and resources, can be found at [www.asco.org/breast-cancer-guidelines](http://www.asco.org/breast-cancer-guidelines). Patient information is available there and at [www.cancer.net](http://www.cancer.net).

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Editor's note: This American Society of Clinical Oncology Clinical Practice Guideline provides recommendations, with comprehensive review and analyses of the relevant literature for each recommendation. More information, including a Data Supplement, additional evidence

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### RELATED ASCO GUIDELINES

- Fertility Preservation in Patients With Cancer (<http://ascopubs.org/doi/10.1200/JCO.2018.78.1914>)
- Interventions to Address Sexual Problems in People With Cancer (<http://ascopubs.org/doi/10.1200/JCO.2017.75.8995>)
- Prevention and Monitoring of Cardiac Dysfunction in Survivors of Adult Cancers (<https://ascopubs.org/doi/10.1200/JCO.2016.70.5400>)
- ACS/ASCO Breast Cancer Survivorship Care Guideline (<http://ascopubs.org/doi/10.1200/JCO.2015.64.3809>)

tables, slide sets, clinical tools and resources, and links to patient information at [www.cancer.net](http://www.cancer.net), is available at [www.asco.org/breast-cancer-guidelines](http://www.asco.org/breast-cancer-guidelines).

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**AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST****Use of Endocrine Therapy for Breast Cancer Risk Reduction: ASCO Clinical Practice Guideline Update**

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## APPENDIX

## Models for Calculating Breast Cancer Risk

There are a number of statistical models that estimate an individual's absolute risk—the probability of developing breast cancer over a given time ([https://epi.grants.cancer.gov/cancer\\_risk\\_prediction/breast.html#absolute](https://epi.grants.cancer.gov/cancer_risk_prediction/breast.html#absolute)). In general, these risk models are well calibrated (ie, they have the ability to determine the proportion of women in the population who will develop cancer), but they have modest discriminatory accuracy (ie, they have the ability to determine whether a woman will or will not develop cancer).

The two most frequently used models in the United States for determining whether endocrine prevention should be discussed are the National Cancer Institute Breast Cancer Risk Assessment Tool (BCRAT) based on the Gail model (<https://bcrisktool.cancer.gov>) and the International Breast Intervention Study (IBIS) Breast Cancer Risk Assessment Tool. The BCRAT provides 5-year and lifetime (up to age 90 years) estimated breast cancer risk and similar estimates for a woman the same age and race/ethnicity who is at average risk of getting breast cancer.

The BCRAT incorporates information on age, race, breast biopsy, atypical hyperplasia reproductive factors, and first-degree relatives to provide a 5-year and a lifetime risk (Gail MH, et al: *J Natl Cancer Inst* 81:1879-1886, 1989). However, it is not the tool of choice in women with the following: an extensive family history of breast cancer, a paternal lineage of cancer, a diagnosis of lobular carcinoma in situ, or inheritance of a germ line variant associated with high cancer risk or atypical hyperplasia. The BCRAT has been validated in a large diverse population of US women (African American, Hispanic, or Asian/Pacific Islander) age 35 years or older, and in some European populations (Banegas MP, et al: *J Natl Cancer Inst* 109, 2016; Costantino JP, et al: *J Natl Cancer Inst* 91:1541-1548, 1999; Decarli A, et al: *J Natl Cancer Inst* 98:1686-1693, 2006; Gail MH, et al: *J Natl Cancer Inst* 91:1829-

1846, 1999; Gail MH, et al: *J Natl Cancer Inst* 99:1782-1792, 2007; Matsuno RK, et al: *J Natl Cancer Inst* 103:951-961, 2011; Rockhill B, et al: *J Natl Cancer Inst* 93:358-366, 2001). The BCRAT may underestimate risk in black women with previous biopsies (Gail MH, et al: *J Natl Cancer Inst* 99:1782-1792, 2007), Hispanic women (Banegas MP, et al: *J Natl Cancer Inst* 109, 2016) born outside the United States, and women with atypical hyperplasia (Pankratz VS, et al: *J Clin Oncol* 26:5374-5379, 2008).

The IBIS Breast Cancer Risk Assessment Tool (<http://www.ems-trials.org/riskevaluator/>) has been validated in both average-risk and higher-risk populations in the United States (Brentnall AR, et al: *JAMA Oncol* 4:e180174, 2018; Amir E, et al: *J Med Genet* 40:807-814, 2003; Terry MB, et al: *Lancet Oncol* 20:504-517, 2019) but not in specific ethnic subgroups. The tool provides both 10-year and lifetime breast cancer risk (for patients up to age 85 years). It requires more time than the BCRAT to complete because it incorporates reproductive factors, body mass index, height, information on affected second- and third-degree relatives, and lobular carcinoma in situ, atypical hyperplasia, hormone therapy, and breast density. IBIS performance is better than BCRAT performance in women with a family history of breast cancer (Amir E, et al: *J Med Genet* 40:807-814, 2003; Terry MB, et al: *Lancet Oncol* 20:504-517, 2019; Warwick J, et al: *Breast Cancer Res* 16:451, 2014). Unlike the BCRT model, it may overestimate breast cancer risk in women with atypical hyperplasia (Boughey JC, et al: *J Clin Oncol* 28:3591-3596, 2010). The concern has been addressed in Version 8 of the model but needs to be validated. To incorporate breast density into the latest version of the model requires the use of [Volpara Volumetric Density](#) (commercial software to calculate mammographic density). Breast Imaging Reporting and Data System (BI-RADS) data can also be entered, but this is based on percent density that was reported before 2013. Additional validation is needed for the latest model that includes breast density.

**TABLE A1.** Pharmacologic Interventions for Breast Cancer Risk Reduction Expert Panel Membership

| Name                       | Affiliation/Institution   | Expertise  |
|----------------------------|---|--|
| Carol J. Fabian (co-chair) | University of Kansas Medical Center, Kansas City, KS  | Medical oncology   |
| Elissa Bantug              | Sidney Kimmel Comprehensive Cancer Center and Johns Hopkins Medicine, Baltimore, MD   | Patient representative   |
| Abenaa M. Brewster         | University of Texas MD Anderson Cancer Center, Houston, TX  | Breast cancer prevention   |
| Nancy E. Davidson          | Fred Hutchinson Cancer Research Center and University of Washington, Seattle, WA  | Medical oncology   |
| Andrea DeCensi             | National Hospital E.O. Ospedali Galliera S.C. Oncologia Medica, Genoa, Italy, and Queen Mary University of London, United Kingdom | Medical oncology   |
| Justin D. Floyd            | Cancer Care Specialists of Illinois, Swansea, IL  | Community medical oncology   |
| Judy E. Garber             | Dana-Farber Cancer Institute, Boston, MA  | Medical oncology/cancer genetics   |
| Erin W. Hofstadter         | Yale Cancer Center, New Haven, CT   | Medical oncology   |
| Seema A. Khan              | Northwestern University Feinberg School of Medicine, Chicago, IL  | Surgical oncology  |
| Maria C. Katapodi          | University of Basel Nursing Science, Faculty of Medicine, Basel, Switzerland  | Oncology nursing   |
| Sandhya Pruthi             | Mayo Clinic Cancer Center, Rochester, MN  | Primary care/internal medicine   |
| Rachal Raab                | Cancer Care of Western North Carolina, Asheville, NC  | Community medical oncology/member of Practice Guideline Implementation Network |
| Carolyn D. Runowicz        | Herbert Wertheim College of Medicine, Florida International University, Miami, FL   | Gynecologic oncology   |
| Mark R. Somerfield         | American Society of Clinical Oncology, Alexandria, VA   | Practice guidelines staff/health research methods                              |