

Estimating Breast Cancer Risk

Key Points

- The risk of breast cancer increases as women get older (see Question 1).
- Risk factors include personal history of breast abnormalities, current age, age at first menstrual period, age at first live birth, breast cancer history of close relatives, whether a woman has had a breast biopsy, obesity, physical inactivity, and race (see Question 3).
- The Breast Cancer Risk Assessment Tool (<http://www.cancer.gov/bcrisktool>) estimates a woman's risk of developing breast cancer for two time periods: over the next five years and over her lifetime (see Question 2).
- Recently published research shows that a woman's risk of developing breast cancer is also affected by breast density and whether she has used hormone therapy; including these additional risk factors in a breast cancer risk assessment tool might increase its accuracy, but researchers still need to validate these additional factors with data from independent studies (see Questions 4 and 6).

1. Who develops breast cancer?

Breast cancer is the most frequently diagnosed non-skin cancer in American women. An estimated 213,000 American women will be diagnosed with breast cancer in 2006. The risk of breast cancer increases as women get older. Over the years, researchers have identified certain characteristics, usually called risk factors, which influence a woman's chance of getting the disease. Still, many women who develop breast cancer have no known risk factors other than growing older, and many women with known risk factors do not develop breast cancer.

2. What is the Breast Cancer Risk Assessment Tool?

The Breast Cancer Risk Assessment Tool is a computer program that was developed by scientists at the National Cancer Institute and the National Surgical Adjuvant Breast and Bowel Project (NSABP) to assist health care providers in discussing breast cancer risk with their female patients. The tool allows a health professional to project a woman's individual estimate of breast cancer risk over a 5-year period of time and over her lifetime and compares the woman's risk calculation with the average risk for a woman of the same age. The Breast Cancer Risk Assessment Tool can be found at: <http://www.cancer.gov/bcrisktool>.

3. What are the risk factors used to estimate breast cancer risk in the Breast Cancer Risk Assessment Tool?

The risk factors included in the tool are:

- **Personal history of breast abnormalities.** Two breast tissue abnormalities—ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS)—are associated with increased risk for developing invasive breast cancer.
- **Age.** The risk of developing breast cancer increases with age. The majority of breast cancer cases occur in women older than age 50.



- **Age at menarche (first menstrual period).** Women who had their first menstrual period before age 12 have a slightly increased risk of breast cancer.
- **Age at first live birth.** Risk depends on age at first live birth and family history of breast cancer, as shown in the following table of relative risks.

Relative Risk of Developing Breast Cancer*

Age at first live birth	# of affected relatives		
	0	1	2 or more
20 or younger	1	2.6	6.8
20–24	1.2	2.7	5.8
25–29 or no child	1.5	2.8	4.9
30 or older	1.9	2.8	4.2

For women with 0 or 1 affected relative, risks increase with age at first live birth. For women with 2 or more first degree relatives, risks decrease with age at first live birth.

* Adapted from Table 1, Gail MH, Brinton LA, Byar DP, Corle DK, Green SB, Shairer C, Mulvihill JJ: Projecting individualized probabilities of developing breast cancer for white females who are being examined annually. J Natl Cancer Inst 81(24):1879–86, 1989. [[PubMed Abstract](#)]

- **Breast cancer among first-degree relatives (sisters, mother, daughters).** Having one or more first-degree blood relatives who have been diagnosed with breast cancer increases a woman's chances of developing the disease.
- **Breast biopsies.** Women who have had breast biopsies have an increased risk of breast cancer, especially if the biopsy showed a change in breast tissue, known as atypical hyperplasia. These women are at increased risk because of whatever prompted the biopsies, not because of the biopsies themselves.
- **Race.** White women have greater risk of developing breast cancer than Black women (although Black women diagnosed with breast cancer are more likely to die of the disease).

4. Why are some other risk factors left out of the Tool?

Other risk factors for breast cancer have been identified or proposed but are not included in the Breast Cancer Risk Assessment Tool for several reasons: because evidence that these factors contribute to breast cancer risk is not conclusive, because researchers cannot determine whether these factors add useful information to factors already in the model, or because data on other risk factors was not available in the research data used to develop the model. Such risk factors include: age at menopause, use of birth control pills, high body mass index, a high-fat diet, alcohol, radiation exposure, and environmental pollutants. Recently published research indicates that breast tissue density, measured from mammograms, can add useful information, but risk models with breast tissue density measurement still need to be validated with additional independent studies. Research also indicates that other risk factors, such as use of hormone therapy, might improve the tool.

5. Is the Breast Cancer Risk Assessment Tool useful for all women?

The Breast Cancer Risk Assessment Tool was developed for women in the United States population age 35 years or older. It should not be used for women with a previous diagnosis of breast cancer, women exposed to breast radiation for treatment of Hodgkin lymphoma, or women who reside in, or recently migrated from,

regions with low breast cancer risk, such as rural China or Japan. More accurate methods to project risk may be available for women with certain rare identified mutations, such as alterations in the breast cancer susceptibility genes BRCA1 and BRCA2. The Breast Cancer Risk Assessment Tool was developed and has been validated in populations consisting mainly of non-Hispanic white women. More research is needed to validate or refine the model for other racial and ethnic groups.

6. What are some of the latest research findings on breast cancer risk?

Two studies in the September 6, 2006, issue of the *Journal of the National Cancer Institute* identified breast density as an important risk factor.* In one, a study of 11,638 women diagnosed with breast cancer, researchers identified different sets of risk factors in pre- and post-menopausal women. For pre-menopausal women, the risk factors included age, breast density, family history of breast cancer, and prior cancer diagnosis. For post-menopausal women, the risk factors included ethnicity, body mass index, age at natural menopause, use of hormone therapy, and a prior false-positive mammogram, in addition to all the risk factors for pre-menopausal women. The two separate models in this study for predicting breast cancer in pre- and post-menopausal women may be particularly helpful in identifying women at high risk for breast cancer.

The other study adds breast density and weight to the Gail model, a model that is the basis for the Breast Cancer Risk Assessment Tool (see Question 2). As before, the new model can be used to project risk over 5, 10, 20 and 30 year intervals. The new model predicted higher risks than the previous model in women with high breast density, and previous analyses indicated that the new model had modestly higher accuracy. Independent validation studies are needed before this model should be used for counseling, and before making a permanent change to the Breast Cancer Risk Assessment Tool.

7. Are there ways to decrease the chance of developing breast cancer?

Launched in April 1992, the Breast Cancer Prevention Trial (BCPT) was designed to see whether the drug tamoxifen could prevent breast cancer in women with an increased risk. Data reported in 1998 showed that both pre- and post-menopausal women taking tamoxifen had 49 percent fewer diagnosed cases of breast cancer. These results were also the first clear indication that a chemopreventive agent could be effective in preventing cancer in a high-risk population. For women over 50, tamoxifen was associated with serious side effects, such as endometrial cancer and blood clots (<http://www.cancer.gov/clinicaltrials/noteworthy-trials/bcpt/Page1>).

Starting in 1999, post-menopausal women ages 35 or older at increased risk for breast cancer participated in the Study of Tamoxifen and Raloxifene (STAR). The study compared tamoxifen with raloxifene, an osteoporosis drug. The initial results of the trial were announced on April 17, 2006 (see <http://www.cancer.gov/newscenter/pressreleases/2006/starresultsapr172006>), and showed that the drug raloxifene works as well as tamoxifen in reducing breast cancer risk for post-menopausal women at increased risk of the disease. In STAR, both drugs reduced the risk of developing invasive breast cancer by about 50 percent. In addition, within the study, women who were prospectively and randomly assigned to take raloxifene daily, and who were followed for an average of about four years, had 36 percent fewer uterine cancers and 29 percent fewer blood clots than the women who were assigned to take tamoxifen. Uterine cancers, especially endometrial cancers, are a rare but serious side effect of tamoxifen. Both tamoxifen and raloxifene are known to increase a woman's risk of blood clots. Data from STAR continue to be analyzed (<http://www.cancer.gov/clinicaltrials/noteworthy-trials/star/Page1>).

8. How did BCPT and STAR use the Breast Cancer Risk Assessment Tool to add to our knowledge of breast cancer risk?

Both breast cancer prevention studies, BCPT and STAR, explored ways of reducing the risk of developing breast cancer; their findings have increased our knowledge of risk. Both trials involved women who have not had breast cancer, but were at high risk of developing it. BCPT used the Breast Cancer Risk Assessment Tool to determine eligible participants by projecting each woman's individualized estimate of breast cancer risk. The projections were accurate; thus the BCPT results validated the Breast Cancer Risk Assessment Tool. STAR researchers used the Breast Cancer Risk Assessment Tool for determining eligibility for enrollment. All STAR participants had to have an increased risk of breast cancer equivalent to or greater than that of an average 60- to 64-year-old woman.

9. What else can a woman do about breast cancer?

NCI recommends that women in their 40s and older get screening mammograms every one to two years. Women who are at higher than average risk of breast cancer should talk with their health care providers about whether to have mammograms before age 40 and how often to have them. Women also can take an active part in the early detection of breast cancer by having regular clinical breast exams (breast exams performed by health professionals).

Advances in screening have provided new tools for detection. In September of 2005, preliminary results from a large clinical trial of digital vs. film mammography found no difference in detecting breast cancer for the general populations of women in the trial. However, the Digital Mammographic Imaging Screening Trial (DMIST) found that women with dense breasts, who are pre- or perimenopausal (women who had a last menstrual period within 12 months of their mammograms), or who are younger than age 50, may benefit from having a digital rather than a regular film mammogram. More information about DMIST can be found at <http://www.cancer.gov/clinicaltrials/noteworthy-trials/dmist>.

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* Barlow WE, White E, Ballard-Barbash R, Vacek P, Titus-Ernstoff L, Carney PA, Tice JA, Buist, DSM, Geller BM, Rosenberg R, Yankaskas BC, Kerlikowske K. Prospective Breast Cancer Risk Prediction Model for Women Undergoing Screening Mammography. *Journal of the National Cancer Institute* September 6, 2006; 17:Vol. 98.

Chen J, Pee D, Ayyagari R, Graubard B, Schairer C, Byrne C, Benichou J, Gail, MH. Projecting Absolute Invasive Breast Cancer Risk in White Women With Model That Includes Mammographic Density. *Journal of the National Cancer Institute* September 6, 2006; 17:Vol. 98.

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Related NCI materials and Web pages:

- Breast Cancer Home Page (<http://www.cancer.gov/cancertopics/types/breast>)
- Prevention, Genetics, Causes Home Page (<http://www.cancer.gov/cancertopics/prevention-genetics-causes>)
- *What You Need To Know About™ Breast Cancer* (<http://www.cancer.gov/cancertopics/wyntk/breast>)

How can we help?

We offer comprehensive research-based information for patients and their families, health professionals, cancer researchers, advocates, and the public.

- **Call** NCI's Cancer Information Service at 1-800-4-CANCER (1-800-422-6237)
- **Visit** us at <http://www.cancer.gov/> or <http://www.cancer.gov/espanol>
- **Chat** using LiveHelp, NCI's instant messaging service, at <http://www.cancer.gov/livehelp>
- **E-mail** us at cancergovstaff@mail.nih.gov
- **Order** publications at <http://www.cancer.gov/publications> or by calling 1-800-4-CANCER
- **Get help** with quitting smoking at 1-877-44U-QUIT (1-877-448-7848)

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