Testing for *BRCA1/2* Mutations

Changes in genes called *BRCA1* and *BRCA2* increase a person's risk of certain types of cancer, especially cancers of the breast and ovaries.

BRCA1 and *BRCA2* are types of **tumor suppressor genes**—genes that produce special proteins needed to repair damaged **DNA** (genetic material) in cells. Certain **mutations** (changes) in these genes prevent the repair of damaged DNA. In turn, the presence of unrepaired DNA increases the risk of acquiring other mutations that contribute to the development of cancer.

If you are a woman, harmful mutations in the *BRCA1* or *BRCA2* genes can greatly increase your risk of developing cancer of the breast or ovaries. Such mutations also can increase your risk of developing cancer of the fallopian tubes, peritoneum (lining of the abdominal cavity), or pancreas. If you are a man, such mutations can increase your risk of developing cancer of the breast, prostate, or pancreas. Some *BRCA1/2* gene mutations, if inherited from both parents, are also associated with the development of certain forms of anemia in both women and men.

What Factors Influence the Chances of Having a Harmful *BRCA1/2* Mutation?

A number of factors can increase your chances of having a harmful *BRCA1* or *BRCA2* mutation. The figure lists some of these factors. Your doctor or a genetic counselor can provide more information and help you understand these risk factors.

Who Should Be Tested for *BRCA1/2* Mutations?

The harmful *BRCA1/2* mutations that can lead to serious medical conditions are not common. If you do not already have cancer, you should consider being tested for such mutations if your personal or family medical history reveals factors such as those listed in the figure that make it likely that you might have a harmful *BRCA1/2* mutation. Your doctor or a genetic counselor can review your personal and family medical histories and help you decide whether to be tested.

What Do the Test Results Mean?

A **positive** test result means that you do have a harmful *BRCA1/2* mutation and your risk of developing certain cancers, especially of the breast or ovaries, is increased. In addition, a positive result suggests that other family members—such as brothers, sisters, or children—might also have a harmful *BRCA1/2* mutation, and they should consider being tested. A positive result does *not* mean that you (or affected family members) definitely will develop cancer—but knowing that you have a harmful *BRCA1/2* mutation can help you and your doctor develop a monitoring plan that helps minimize risks for you and your family members.

A **negative** test result means that you most likely do not have a harmful *BRCA1/2* mutation—but the implications of that information depend on factors such as your personal and family medical histories.

Risk factors for having a harmful *BRCA1* or *BRCA2* mutation

Personal risk factors

- Breast cancer diagnosed at a young age (<50 years)
- History of ovarian cancer, certain types of breast cancer, or both
- Cancer in both breasts
- Breast cancer AND 1 or more relatives diagnosed with breast cancer at a young age (<50 years), 1 relative diagnosed with ovarian cancer, or 2 or more relatives diagnosed with breast or pancreatic cancer
- Ashkenazi Jewish ancestry and at least 1 close relative diagnosed with breast, ovarian, or pancreatic cancer

Family risk factors

- 2 or more relatives diagnosed with breast cancer at a young age (<50 years)
- A male relative diagnosed with breast cancer
- A relative diagnosed with both ovarian cancer and breast cancer or with cancer in both breasts
- A relative diagnosed with ovarian cancer
- A relative identified as having *BRCA1* or *BRCA2* mutations

For example, if your personal or family histories suggest that you might be at risk of having a harmful *BRCA1/2* mutation but no close relatives have been identified as having such a mutation, you might still have a *BRCA1/2* mutation that was not identified by the test *and* that has not yet been identified as harmful. Your negative test result is considered **true negative** only if you also have a close relative identified as having a harmful *BRCA1/2* mutation. However, a true-negative result does *not* mean that you definitely will not develop cancer. You still have an average overall risk of developing a cancer unrelated to *BRCA1/2* mutations.

An **uncertain** (ambiguous) test result means that you do have a *BRCA1/2* mutation, but the particular mutation has not been identified as contributing to cancer risk.

The interpretation of results of mutation testing is complex. Your doctor or a genetic counselor can help interpret results and also recommend specific action you should take, especially if you have received a positive test result.

FOR MORE INFORMATION

- *Mayo Clinic, BRCA gene test for breast and ovarian cancer risk*
- *National Cancer Institute, BRCA1 and BRCA2: cancer risk and genetic testing*

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Author: Philip Sefton, MS

Sources: Mayo Clinic, National Cancer Institute