



PATIENT & CAREGIVER EDUCATION

Fertility Preservation: Options for Women Who Are Starting Cancer Treatment

This information describes fertility preservation options for women who are starting cancer treatment. It explains:

- How cancer treatment may affect your fertility (ability to get pregnant).
- How you may be able to preserve your fertility before beginning treatment.

Basic Reproductive Biology

Understanding basic reproductive biology can be helpful as you make decisions about your fertility.

Ovulation

The female reproductive system has several parts (see Figure 1).

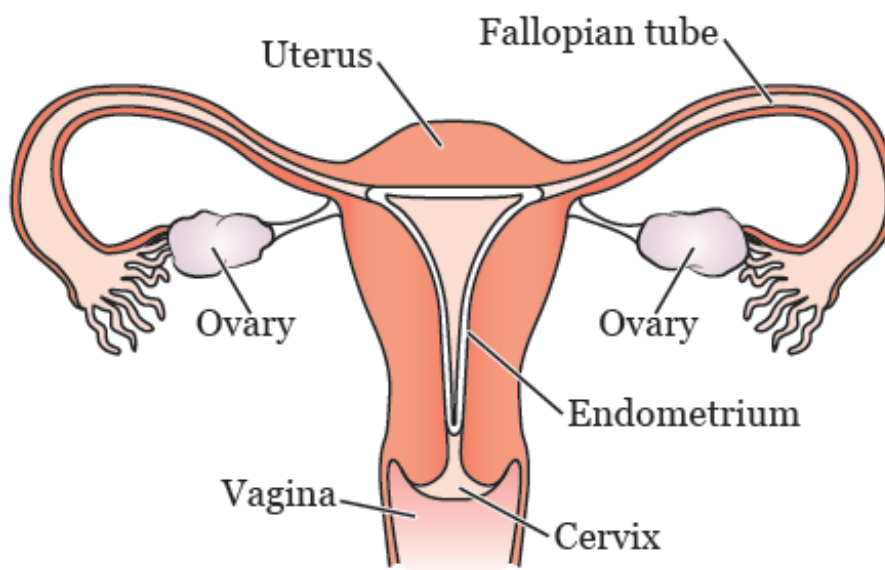


Figure 1. Female reproductive system

Your ovaries have 2 functions:

- They produce hormones (estrogen and progesterone).
- They hold your eggs (oocytes). Each egg is contained in a sac called a follicle.

When you start puberty, your pituitary gland (located in your brain) releases hormones that cause a group of follicles to grow each month. The egg inside each growing follicle starts to mature. As the follicles grow, the ovary releases hormones that cause the lining of your uterus (endometrium) to thicken and prepare for a pregnancy.

One egg from the growing follicles fully matures each month. It's released from one of your ovaries into the fallopian tube. This process is called ovulation. The other follicles growing that month break down and the eggs are cleared from the body.

Pregnancy

If you're not using birth control and you have vaginal sex with a male partner around the time you're ovulating, a single sperm may fertilize the egg. The fertilized egg begins to divide, forming an embryo. If the embryo implants in your endometrium, you become pregnant. The cells of the embryo continue to divide, becoming a fetus. During pregnancy, your uterus expands to hold the fetus as it grows.

Menstruation

If the egg released during ovulation doesn't become fertilized, or if the embryo doesn't implant in the endometrium, hormone levels drop and cause the lining of the uterus to shed. This bloody discharge forms your monthly menstrual period. The cycle then begins again, with new eggs maturing each month.

Ovarian reserve

Women are born with about 1 million eggs. During a woman's lifetime, only 400 to 500 eggs are released during ovulation. The other eggs die naturally over time, so the number of eggs in the ovaries (called the ovarian reserve) gradually gets lower (see Figure 2). With fewer eggs, it's harder to become pregnant. Eventually, there are so few eggs that a woman becomes infertile (unable to get pregnant).

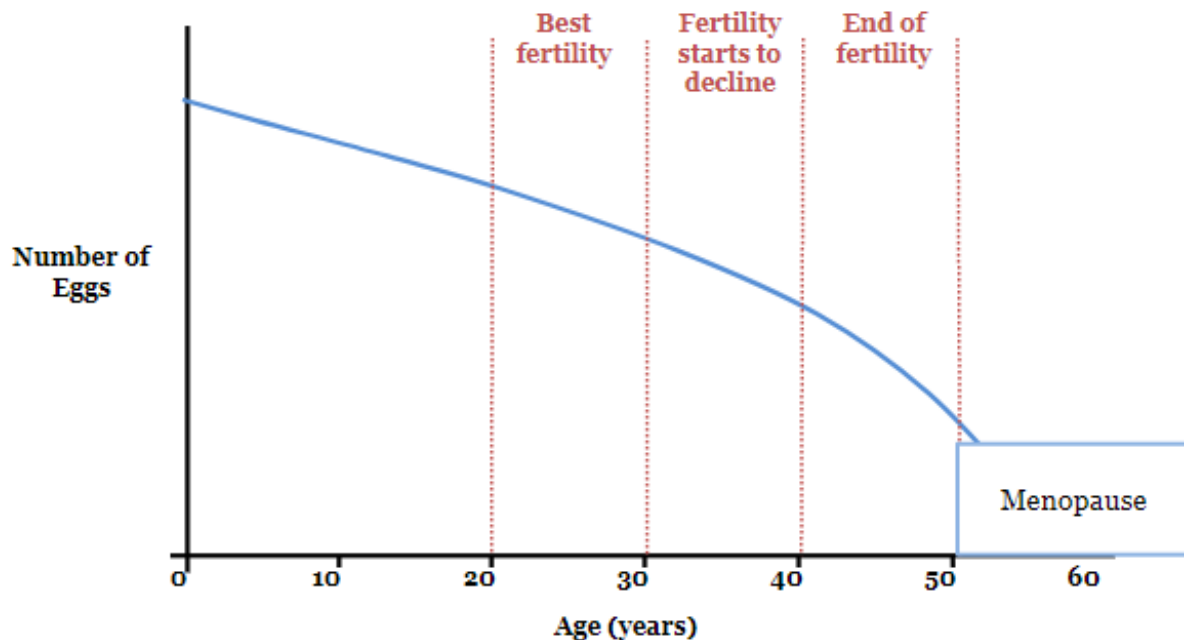


Figure 2. Ovarian reserve and age

Menopause

With the loss of eggs, the ovaries stop producing hormones. This causes monthly menstrual periods to stop. When a woman's menstrual periods stop, this is called menopause. Most women lose their fertility 5 to 10 years before menopause.

Effects of Cancer Treatment on Fertility

Cancer treatments can impair fertility in a number of ways.

- Some chemotherapy medications destroy eggs. This may lead to infertility after treatment.
 - The risk of infertility depends on the medications used, the doses given, and the age of the woman at the time of treatment. Older women have fewer eggs when they start treatment. This means they are more likely to become infertile after treatment.
 - This loss of eggs in the ovaries from chemotherapy can “age” the ovaries, reducing the chance of pregnancy in the same way that natural aging does. Some women lose so many eggs that they become infertile and begin menopause immediately after treatment. Some women still have eggs remaining after treatment and continue to have monthly menstrual periods after treatment. However, they may develop infertility and

menopause at a young age. This narrows the window of time that a woman can become pregnant.

- Radiation therapy to the pelvis or whole abdomen (belly) destroys eggs in a similar way to chemotherapy. Radiation may also damage the uterus, causing fibrosis (scarring).
 - Women who receive high doses of radiation to the uterus will not be able to become pregnant.
 - Women who receive lower doses of radiation to the uterus may become pregnant, but their uterus may not be able to fully expand as the fetus grows. These women are more likely to have a miscarriage or premature labor. It's recommended that they see a maternal fetal medicine specialist (a doctor who specializes in high risk pregnancies).
- Surgery or radiation therapy to the brain may affect the pituitary gland, which releases hormones that stimulate egg maturation and ovulation. However, this doesn't damage the eggs in the ovaries, and medications that replace these hormones may allow the woman to become pregnant.
- Surgery may require removal of the ovaries, uterus, or all 3.

Because of the many factors that can affect fertility, it's hard to know how you may be affected by your treatment. We can't know for sure who will still be able to get pregnant after treatment is finished and who will not. We also can't know for sure how long a woman will be fertile after treatment. If you have questions about your risk of infertility based on the treatment you will receive, speak with your oncologist (cancer doctor).

Fertility Preservation Options

A number of options are available that may preserve your fertility and increase the chance you will be able to have a biologic child in the future. Not all women starting cancer treatment will need or want to consider these options.

The decision whether to pursue fertility preservation is a personal one. We want you to know what options are available. This will allow you to have all the information that you need to make the best decision for yourself so that you have no regrets in the future.

Fertility preservation options for women include:

- Egg or embryo freezing
- Ovarian tissue freezing
- Ovarian suppression
- Ovarian transposition
- Alternative treatment for certain early stage gynecologic cancers

Egg or embryo freezing

Egg and embryo freezing are procedures in which mature eggs are removed from your ovary to be frozen and stored for possible use in the future. They can be frozen as unfertilized eggs or fertilized with sperm and frozen as embryos. These procedures are performed by specially trained gynecologists, called reproductive endocrinologists (RE). We don't have REs at Memorial Sloan Kettering (MSK) but we can make a referral for you.

The process of egg or embryo freezing takes about 2 weeks. There are several steps involved, including:

- **Evaluation:** Your RE will do a number of tests to help determine how successful egg or embryo freezing may be for you. They will also want to speak with your oncologist to make sure it's safe for you to undergo egg or embryo freezing. The tests that you have may include:
 - A transvaginal ultrasound, in which a thin wand is placed in your vagina. Sound waves from the wand create pictures of your ovaries and uterus. With this test, your doctor can examine your ovaries and count the number of large growing follicles in your ovaries. This is called the antral follicle count. If you've never had a gynecologic exam or vaginal sex, your RE may be able to perform the ultrasound using a wand placed on your abdomen rather than in your vagina.
 - Blood tests to measure the levels of hormones related to fertility, including follicle stimulating hormone (FSH) and anti-mullerian hormone (AMH).
- **Ovarian stimulation:** If you decide to proceed, you will start giving yourself hormone injections each day for about 10 days. A nurse at the fertility center

will teach you how to do this. These hormones will stimulate multiple eggs in your ovaries to mature. You don't need to be at any particular phase in your menstrual cycle to begin.

- During this period of stimulation, you will see the RE almost every other day for blood tests and ultrasounds. These tests show how your ovaries are responding to the hormones. If needed, your RE may change the doses of the hormones. Once your eggs are fully mature, the egg retrieval will be scheduled.
- Egg retrieval: This is an outpatient procedure, done with anesthesia (medication to make you sleep), so you won't feel pain. You don't need an incision (surgical cut).
 - Once you're asleep, an ultrasound wand is placed in your vagina so your RE can see your ovaries. A very thin needle is passed through the wall of your vagina up to your ovary to collect the mature eggs (see Figure 3).
 - The entire procedure takes about 20 minutes and most women are discharged within 1 hour.



Figure 3. Egg retrieval

- Fertilization (if you are freezing embryos): Your mature eggs are fertilized with sperm in the laboratory to create embryos. This is called in vitro fertilization, or IVF. The laboratory will use sperm from your male partner or from a sperm donor.
- Freezing (cryopreservation): Your embryos or unfertilized eggs are frozen. They can be stored for as long as you want.

Before beginning egg or embryo freezing, talk with your oncologist to be sure you can take the time to do this and that the procedure is safe for you. Most patients only do 1 cycle of stimulation before their cancer treatment. However, the more eggs you're able to freeze, the greater the chance that you will be successful in having a baby using these eggs in the future. Depending on how many mature eggs or embryos you're able to freeze, your RE may suggest you undergo a second cycle. If you are considering a second cycle, speak with your oncologist first to be sure this will not delay your cancer treatment longer than is safe for you.

Deciding between freezing eggs and freezing embryos

Many women wonder if they should freeze eggs, embryos, or a combination of both. When making this decision, one thing to think about is your age. In younger women, the success rate with frozen eggs is generally the same as with frozen embryos. In older women (after age 35 to 38), eggs don't survive the process of freezing and thawing as well as in younger women, and freezing embryos may be more successful.

Embryo freezing is a good option for a woman in a stable, long-term relationship. However, keep in mind that you won't be able to use the embryos in the future without your partner's permission. This could be a problem if the relationship comes to an end.

Egg freezing is a good option for single women who don't want to use donor sperm to fertilize their eggs. Egg freezing may also be a good option for people with religious or ethical concerns about freezing embryos. Talk with your RE to help you make this decision.

Considerations for women with breast cancer

The hormone medication needed to stimulate your eggs to mature will cause your estrogen levels to rise for 2 to 3 weeks. To lower estrogen levels, we generally recommend that women with breast cancer take a medication called letrozole during stimulation, and for 1 to 2 weeks after the eggs are collected. Your RE will discuss this with you and prescribe the medication.

We can't say for certain if this short period of estrogen exposure is safe, but there have been no reports that women with breast cancer who undergo egg or embryo freezing are more likely to have the cancer return. Everyone's situation

is different and we encourage you to speak with your oncologist if you are considering this.

Also, women with estrogen receptor positive breast cancer often need to take endocrine therapy for up to 10 years after finishing chemotherapy or radiation therapy. It isn't safe to become pregnant while on this treatment because there is a risk of birth defects. Most women with estrogen receptor positive breast cancer are advised to wait 10 years before attempting pregnancy. If you are considering interrupting endocrine therapy to try to get pregnant before 10 years are up, discuss this with your oncologist.

Cost of egg and embryo freezing

Freezing eggs and embryos is expensive, and unfortunately, most health insurance plans don't cover the cost. Every fertility center charges a different amount, but most centers offer discounted rates to patients starting cancer treatment. The cost for egg freezing is generally \$5,000 to \$8,000 and for embryo freezing \$8,000 to \$11,000. This usually includes all the monitoring visits, egg retrieval under anesthesia, fertilization of the eggs (if creating embryos), freezing, and at least 1 year of storage.

There are additional costs of about \$5,000 for the hormone medication needed for ovarian stimulation. If your prescription plan doesn't cover the medications, there are 2 programs that may help:

- LIVESTRONG Fertility works with a pharmaceutical company to provide free medication to patients being treated at participating fertility centers. Eligibility is based on your income.
 - To learn more go to www.livestrong.org/we-can-help/livestrong-fertility
 - To get an application, go to <https://livestrongfertilityportal.unicentric.com/Login/Index#>. You must submit the application and obtain approval before you start ovarian stimulation. To speak directly with one of their navigators, call 855-844-7777.
- Heartbeat is a program that offers free medication through a pharmaceutical company and Walgreens. To learn more, go to: www.walgreens.com/images/adaptive/pharmacy/specialty-pharmacy/Preserving+the+Future-Patient_WEB+09-05-12.pdf. Ask your RE

if you are eligible and if they can apply for you.

Future egg and embryo storage fees are about \$1,000 per year. There are additional costs when you're ready to thaw and use the eggs or embryos to attempt pregnancy. A financial specialist at the fertility center can determine what if anything will be covered by your health insurance and what you will have to pay yourself.

How frozen eggs and embryos are used to attempt pregnancy

If you use your frozen eggs or embryos in the future, they will be thawed when you're ready to attempt pregnancy. If you froze eggs, they will be fertilized with sperm to create embryos.

If you no longer have regular periods, or are in menopause from your treatment, you will need to take hormones for several weeks to prepare the lining of your uterus for pregnancy. The embryos will be transferred into your uterus. The embryos are drawn up into a very thin, soft catheter that is passed through your vagina and cervix into your uterus. The embryos are released and the catheter is taken out. The procedure is done in an exam room. It does not hurt, so you will not need anesthesia.

If you're not able to carry a pregnancy yourself, the embryos can be transferred to the uterus of another woman to carry the pregnancy for you. This is called surrogacy with a gestational carrier.

About 2 weeks after the embryo transfer, a blood test is done to see if you, or your gestational carrier, have become pregnant. If the pregnancy test is positive, an ultrasound will be done several weeks later to see if the embryo has implanted to confirm the pregnancy. You will then schedule an appointment with an obstetrician (a doctor who specializes in pregnancy and childbirth) who will care for you during the pregnancy. You may need to continue taking hormones for several months to support the pregnancy.

If the embryo did not implant, and you have other embryos being stored, your RE can perform another embryo transfer when you're ready.

Success rates with frozen eggs and embryos

The chance that you will be successful in having a baby using frozen eggs or

embryos depends on a number of factors. These include your age at the time of egg retrieval, your current ovarian reserve, the number of mature eggs obtained from the procedure, and the experience of the fertility center where you are being treated.

Not every egg collected can become a baby. For example, if 10 eggs are collected, some will not survive the freeze-thaw cycle, some will not fertilize and develop into embryos, and some may not implant after the transfer. Women under 35 years of age generally have a higher chance of success. Discuss your personal chance of success with your RE after your initial evaluation.

Ovarian tissue freezing

Ovarian tissue freezing is an experimental procedure in which an entire ovary, or pieces of an ovary, are removed during a surgery. The ovarian tissue is brought to a special laboratory to be processed. The outer layer of the ovary, which holds the eggs, will be removed, cut into small pieces, and frozen. A small amount of the tissue will be used for research to find the best way to help women have children using ovarian tissue. The rest of the tissue will be stored for your personal use.

One option for using this tissue in the future is to re-implant it into your body, with the hope that eggs in the tissue will mature and be released with ovulation. As of 2017, about 90 babies have been born after re-implantation of ovarian tissue. Another option for using this tissue is to stimulate the eggs to mature in the laboratory (in vitro maturation), The mature eggs could then be fertilized to create embryos for transfer to your uterus. No babies have yet been born using this technique. To learn more about ovarian tissue ask your nurse for the resource freezing [Fertility Preservation: Ovarian Tissue Freezing for Girls and Young Women With Cancer](#) or search for it on www.mskcc.org/pe

Ovarian tissue freezing may not be an option for all women. If you would like to learn more, ask your oncologist to refer you to a RE who performs ovarian tissue freezing.

Ovarian suppression

Ovarian suppression involves taking monthly injections of a medication called leuprolide to block hormones that stimulate your ovaries. This prevents eggs from maturing, with the hope that this will protect them from the effects of

chemotherapy.

The injections usually start 1 to 2 weeks before the first chemotherapy treatment and continue until your treatment is completed. Side effects of the medication may include symptoms similar to those of menopause, such as hot flashes, mood changes, difficulty sleeping, and vaginal dryness. If it is safe for you to take hormones, low-dose birth control pills can be prescribed to prevent these symptoms.

Ovarian suppression has been studied mostly in women with breast cancer and lymphoma. Based on the results of these studies, it is not certain that this medication preserves fertility. We don't know if ovarian suppression will be helpful for you. Some doctors feel it may help; others feel that it has no benefit. If you are interested in this option, speak with your oncologist.

Ovarian transposition

Ovarian transposition may be an option if you are receiving radiation therapy to the pelvis. This is an outpatient surgical procedure that moves your ovaries out of the field of treatment. This will lower the amount of radiation your ovaries are exposed to during your treatment and may help your ovaries keep working properly after treatment. The surgery is done through several small incisions in your abdominal wall. For more information ask your nurse for the resource [About Your Ovarian Transposition Surgery](#) or search for it on www.mskcc.org/pe. If you are interested in ovarian transposition, ask your radiation oncologist to refer you to a gynecologic surgeon here at MSK.

Even when your ovaries are moved, they may still be exposed to some radiation, possibly destroying some of your eggs. If you will also be getting chemotherapy, this may add to the loss of eggs. If having a biologic child is important to you, you may want to undergo egg or embryo freezing before your ovaries are repositioned. If you are interested in egg or embryo freezing, ask your radiation oncologist to refer you to one of our Fertility Nurse Specialists.

Alternative treatment for certain early-stage gynecologic cancers

For women with certain early-stage gynecologic cancers, it may be possible to do limited surgery, or in some cases take medication to preserve fertility. This means your doctor may be able to leave one or both of your ovaries, your uterus,

or all 3 intact.

For example, some women who have early-stage cervical cancer can have their cervix removed but have their uterus left in place. This procedure is called radical trachelectomy and may enable you to carry a pregnancy. To learn more about radical trachelectomy, ask your nurse for the resource [About Your Radical Trachelectomy](#) or search for it www.mskcc.org/pe

Not all women are eligible for these limited surgeries. It depends on the location and size of your tumor. If you are interested, ask your gynecologic surgeon if you are a candidate.

Other Options for Building a Family

Some women will not be able to preserve their fertility before treatment and some may choose not to for personal reasons. This does not shut the door on having children in the future. Some women will be able to get pregnant naturally without medical help. Some may have a low ovarian reserve but will be able to get pregnant with fertility treatment provided by a RE. If you're unable to have a biological child in the future, there are other ways of building a family after cancer treatment.

- You can use donor eggs or embryos. Donor eggs are given by young women who undergo a cycle of ovarian stimulation and egg retrieval. These are fertilized with sperm from your partner or a donor to create embryos for transfer into your uterus. Donor embryos are usually given by couples who had infertility treatment, have completed building their families, and do not want to discard their remaining embryos. The cost of using donor embryos is much lower than that of donor eggs.
- You can adopt. Having a history of cancer doesn't prevent you from being able to adopt as long as you're healthy and have been cancer-free for several years.

To learn more about these options, ask your doctor or nurse for the resource [Building Your Family after Cancer Treatment: Information for Women](#) or search for it on www.mskcc.org/pe

Making a Decision about Fertility

Preservation

It can be difficult to make a decision about fertility preservation because there is a lot of uncertainty. We can't predict exactly how or if treatment will affect your fertility. If you do pursue fertility preservation, there are no guarantees that it will be successful. There is also pressure to make a decision quickly, before treatment begins.

Some women are very clear about whether or not they want to pursue fertility preservation. Others have a harder time making this decision. Below are some things to consider as you make a decision for yourself:

- Your oncologist's opinion about the risk of infertility from your treatment.
- Your oncologist's opinion about the safety of your undergoing egg or embryo freezing.
- Your comfort with receiving hormones to stimulate your ovaries.
- How important it is to you to have a biological child (from your own eggs).
- The chance of success in having a baby if you freeze eggs or embryos.
- Your feeling about being able to cope with the effort it will take to undergo egg or embryo freezing.
- Your religious, ethical, and personal beliefs about using reproductive technology.
- Your financial resources.
- Your comfort with the possibility of having a child using donor eggs, a gestational carrier, or adoption.
- Your comfort with the possibility of having no (more) children.
- Your partner's thoughts and wishes.
- The opinions of your friends and family.

There is no "right" decision. Our goal is for you to have all the information you need to make the best decision you can for yourself. Many women find it helpful to see a RE to be evaluated and learn more to help them make a decision.

Additional Resources

A number of resources are available to help you learn more and make a decision about fertility preservation. First, speak with your oncologist to make sure that it is safe for you to pursue fertility preservation. If you would like more information about the options available, or support as you consider these issues, ask your oncologist to refer you to one of our Fertility Nurse Specialists.

In addition, the organizations listed below have information about fertility preservation that may be helpful to you.

American Cancer Society

Fertility and Women with Cancer

www.cancer.org/treatment/treatmentsandsideeffects/physicalsideeffects/

CancerNet

Fertility Preservation

www.cancer.net/coping-and-emotions/sexual-and-reproductive-health/fertility-concerns-and-preservation-women

LIVESTRONG/Fertility

www.livestrong.org/we-can-help/livestrong-fertility

Oncofertility Consortium of Northwestern University

MyOncofertility

www.myoncofertility.org

Save My Fertility

www.savemyfertility.org

If you have any questions, contact a member of your healthcare team directly. If you're a patient at MSK and you need to reach a provider after 5:00 PM, during the weekend, or on a holiday, call 212-639-2000.

For more resources, visit www.mskcc.org/pe to search our virtual library.

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