



Young Adult Cancer: The Mystery of Fertility

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“That's all any of us are: amateurs. We don't live long enough to be anything else.”

–Charles Chaplin

Who to talk to:

- ✦ Oncologist
- ✦ Surgeon
- ✦ Gynecologist
- ✦ Nurse
- ✦ Reproductive Endocrinologist
- ✦ Fertility Specialist

Why focus on fertility?

- ❖ Cancer - and cancer treatments - can affect fertility. How cancer treatment will affect your fertility depends on:
 - ❖ Type of cancer
 - ❖ Age and overall health
 - ❖ Type of treatment and response to treatment
- ❖ Affects a relatively large group

Impacts emotional well-being

- ❖ Infertility, miscarriage and achieving a successful pregnancy outcome
- ❖ Risks to offspring
- ❖ Risks of cancer reoccurrence



Educating patients

- ❖ Receiving counseling about reproductive loss and options to preserve fertility before treatment begins is important to cancer survivors.
- ❖ Women with cancer are less likely to be given information about preserving their fertility than men.
- ❖ Education has impacts on pregnancy termination.

What is infertility?

- ❖ For a woman, it means that she either can't become pregnant or that she can't carry a baby full-term. Women are infertile if:
 - ❖ Their ovaries don't make mature eggs
 - ❖ Damage to the reproductive system keeps eggs from being fertilized
 - ❖ A fertilized egg cannot implant and grow inside the uterus
- ❖ Male infertility is an inability to produce healthy sperm or to ejaculate sperm.

How does chemotherapy affect fertility?

- ✦ Effects depend on:
 - ✦ Woman's age
 - ✦ Types of drugs and drug doses
 - ✦ Chemotherapy drugs most likely to cause egg or sperm damage and infertility: Busulfan, Carboplatin, Carmustine (BCNU), Chlorambucil, Cisplatin, Cyclophosphamide (Cytoxan®), Dacarbazine, Doxorubicin (Adriamycin®), Ifosfamide, Lomustine (CCNU), Mechlorethamine, Melphalan, Procarbazine, Temozolomide
 - ✦ Chemotherapy drugs that have a low risk of damaging fertility: 5-fluorouracil (5-FU), Bleomycin, Cytarabine, Dactinomycin, Daunorubicin, Fludarabine, Gemcitabine, Idarubicin, Methotrexate, Vinblastine, Vincristine
- ✦ Premature menopause
- ✦ Periods don't always mean fertility

How does radiation affect fertility?

- ✦ Radiation treatments use high-energy rays to kill cancer cells. In women, high doses can destroy some or all of the eggs in the ovaries and might cause infertility or early menopause.
- ✦ Radiation to the uterus can cause scarring in women, which restricts flexibility and blood flow to the uterus.
- ✦ In men, radiation therapy can slow down or stop sperm cell production if the testicle is in or near the target area for the radiation.
- ✦ Radiation to the brain can affect the pituitary gland.

How do targeted and biologic (immune) therapies affect fertility?

- ✦ Bevacizumab (Avastin®)

- ✦ Studies have found that this drug can cause ovarian failure, and some women's ovaries never recover.

- ✦ Tyrosine kinase inhibitors (TKIs) such as imatinib (Gleevec®)

- ✦ Have been found to cause birth defects in lab animals. Women should talk to their doctors before becoming pregnant while taking TKIs.

How does surgery affect fertility?

- ❖ Hysterectomy - Removal of uterus
- ❖ Oophorectomy - Removal of the ovaries
- ❖ Trachelectomy - Used in some women with small cervical cancers to remove the cervix but leave the uterus behind
- ❖ Sometimes surgery can cause scarring in the fallopian tubes.
- ❖ Surgery to treat prostate or bladder cancer removes the prostate and seminal vesicles.

How do hormone therapies for

How do hormone therapies for breast cancer affect fertility?

- ✦ The selective estrogen receptor modulator tamoxifen has not typically been associated with cessation of ovulation, however, it may cause irregular or absent menses in some patients.
- ✦ Tamoxifen use during pregnancy or while attempting to conceive is discouraged.



Cancer itself can affect fertility

- ❖ Testicular cancer
- ❖ Newly-diagnosed Hodgkin's disease, lymphoma or leukemia - Recent surgery, fever or physical stress experienced by survivors may affect the quality of semen.

Symptoms of infertility

- ✦ For women:
 - ✦ Your menstrual cycles are not regular.
 - ✦ You are having hot flashes.
 - ✦ It hurts when you have sex.
 - ✦ You have been trying but have not been able to get pregnant.
 - ✦ You have had several miscarriages.



Courtesy funny-joke-pictures.com

Fertility testing for women

- ❖ If you are not menstruating or have irregular menstrual cycles you should be evaluated for premature ovarian failure. (Still, ovarian dysfunction could be temporary.)
- ❖ If you are having regular menstrual cycles but still suspect you might be infertile you may undergo assessment of ovarian reserve.
- ❖ Testing for menopause
- ❖ Damage to ovaries
- ❖ Trouble carrying a baby to full term

Fertility testing for men

- ✦ Semen analysis

- ✦ The sperm count - The number of sperm present
- ✦ The motility - The percentage of sperm that are actively swimming around
- ✦ The morphology - The shape of the sperm (It is considered normal if at least 14 to 30 percent of the sperm have an ideal shape - depending on the lab.)
- ✦ If repeated semen analyses demonstrate low sperm counts then the basal serum follicle stimulating hormone (FSH), luteinizing hormone (LH), and testosterone should be measured.

Fertility preservation

- ❖ Preserving one's fertility before treatment is ideal - but not always possible.
- ❖ Sometimes fertility can be protected during treatment.
- ❖ After treatment, there may still be options.

Before treatment: Egg freezing

(oocyte cryopreservation)

- ❖ Egg freezing is an established method of preserving fertility in women, although it has not been used as long as embryo freezing.
- ❖ Mature eggs are removed and frozen before being fertilized with sperm. When the woman is ready to become pregnant, the eggs can then be thawed, fertilized, and implanted in the uterus.
- ❖ Collecting the eggs typically takes several weeks. Hormones can be used to ripen several eggs at once. In most women, this means starting a cycle of hormone shots 3 days before their menstrual cycle and continuing them for 2 to 3 weeks until many eggs are mature (often about 12 eggs in a woman under age 35). The eggs are then collected during outpatient surgery, usually with a light anesthetic. An ultrasound is used to guide a needle through the upper part of the vagina and into the ovary to collect the eggs.

- ❖ Because younger women have more eggs, and the eggs are likely to be healthier, some facilities cut off the age for egg freezing in the mid-thirties. This varies by facility.
- ❖ Egg freezing is ideally done before treatment, but can be done after as well.



Before treatment: Freezing immature eggs

Before treatment: Freezing immature eggs

- ✦ Some experts believe immature eggs might freeze better. (They are less developed and less fragile, so they might stand up to the freezing and thawing processes better than mature eggs.)
- ✦ Immature eggs can be collected at any time – no hormone stimulation is needed.
- ✦ Like mature eggs, immature eggs are also removed through a needle that's put through the vagina and into the ovary. Ultrasound is used to guide the needle. Immature eggs are sucked into the needle and then frozen or matured and frozen. When the woman is ready, her immature eggs are thawed, matured in the lab (if not done before freezing), fertilized, and then implanted in her uterus.

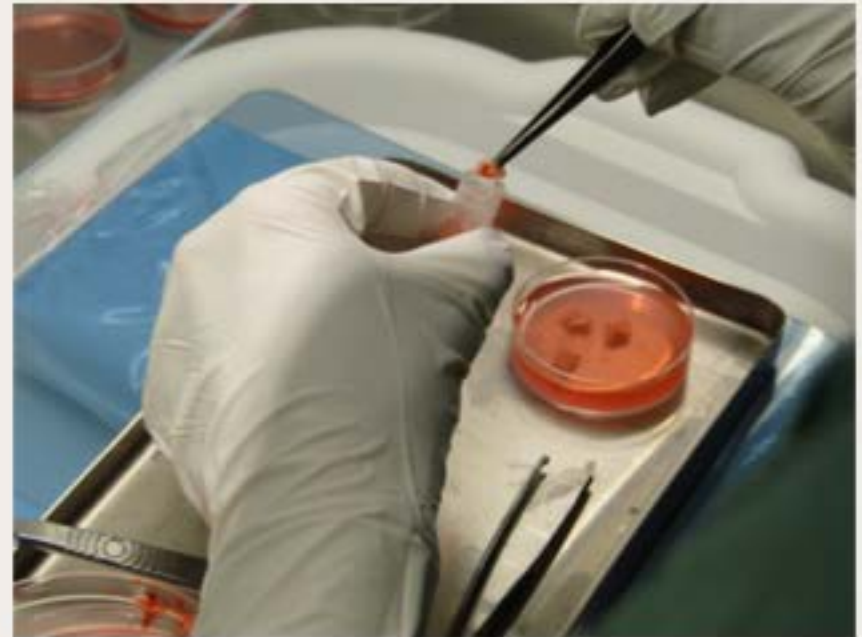
Before treatment: Embryo freezing

(embryo cryopreservation)

- ✦ Embryo freezing is the most common and successful method of preserving a woman's fertility today. Mature eggs are removed from the woman's ovaries and fertilized in the lab. This is called in vitro fertilization (IVF). The embryos are then frozen to be used after cancer treatment.
- ✦ The process of collecting eggs for embryo freezing is much the same as for egg freezing, however after the eggs are collected they are fertilized, then frozen and stored.
- ✦ Egg and embryo freezing can be expensive and are not always covered by insurance. Through LIVESTRONG Fertility, qualified individuals can access financial assistance.

Before treatment: Ovarian tissue freezing

- ❖ Ovarian tissue freezing is experimental and can be done in young girls who have not reached puberty. All or part of one ovary is removed by laparoscopy. The ovarian tissue is usually cut into small strips, frozen, and stored.
- ❖ After cancer treatment, the ovarian tissue can be thawed and replaced in the body. Once the transplanted tissue starts to function again, the eggs can be collected and fertilized in the lab.



Courtesy Wikipedia

- ❖ Ovarian tissue is considered experimental and has produced only a small number of live births so far.
- ❖ At this time, ovarian tissue freezing and transplant is not recommended for women with blood cancers (such as leukemias or lymphomas) or ovarian cancer due to the risk of putting cancer cells back in the body with the frozen tissue.
- ❖ Costs may vary: freezing, annual storage costs and tissue removal and transplant expenses.
- ❖ Eggs, embryos and ovarian tissue can be frozen indefinitely.

Before treatment: Ovarian transposition

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- ❖ Ovarian transposition means moving the ovaries away from the target zone of radiation treatment. Surgeons will usually move the ovaries above and to the side of the central pelvic area.
 - ❖ The success rates for this procedure have usually been measured by the percentage of women who regain their menstrual periods, not by being able to have a live birth. Typically, about half the women start menstruating again.

Before treatment: Sperm banking

Before treatment: Sperm banking

- ✦ Sperm banking is a simple, well-established way to preserve fertility in men.
- ✦ Sperm banks are accessible across the country by appointment. At the sperm bank, you will be escorted to a private room to produce a semen specimen that will be analyzed, frozen and stored for future use.
- ✦ Donations can be made every 24–48 hours.
- ✦ Sperm can be frozen indefinitely.
- ✦ The average cost of sperm banking is \$1,000 for analysis and freezing, plus \$300–\$500 per year for storage. However, costs vary greatly from center to center. Insurance coverage for sperm banking is variable, with some private companies covering the cost of sperm banking. Through LIVESTRONG Fertility, qualified individuals can access discounted rates for sperm banking.

Before treatment: Testicular tissue

freezing

- ❖ Testicular tissue, including the cells that produce sperm, is surgically removed, frozen, analyzed and stored.
- ❖ The average cost of testicular tissue freezing is approximately \$2,500 for surgery, plus \$300–\$500 per year for storage.

During treatment: Fertility-sparing
surgical procedures (various cases)

surgical procedures (ovarian cancer)

- ✦ This type of surgery might be an option in young women with ovarian cancer in only one ovary. The cancer must be one of the types that's slow-growing and less likely to spread, like borderline, low malignant potential, germ cell tumors, or stromal cell tumors (typically grades 1 and some grade 2 epithelial ovarian cancers).
- ✦ In this case, the surgeon can remove just the ovary with cancer, leaving the healthy ovary and the uterus in place. Studies have found that this does not affect long-term survival, and allows future fertility. If there's a risk of the cancer coming back, the remaining ovary may be removed later, after the woman has finished having children.

During treatment: Gonadotropin-releasing hormone (GnRH) agonist treatment (ovarian suppression)

(GnRH) agonist treatment (ovarian suppression)

- ✦ GnRH agonists are long-acting hormone drugs that can be used to make a woman go into menopause for a short time.
- ✦ The goal of this treatment is to shut down the ovaries during cancer treatment to help protect them from the damaging effects of treatment.
- ✦ Studies suggest that this method might help prolong fertility in some women, especially those 35 and younger, but results are not clear and more research is needed to prove it works.
- ✦ This treatment costs a lot and the drugs can weaken a woman's bones if used for more than 6 months.

During treatment: Oral
contraceptive treatment

contraceptive treatment

- ✦ Some oncologists prescribe oral contraceptives (birth control pills) before and during cancer treatment, hoping they will reduce activity in the ovary and save eggs.
- ✦ Oral contraceptives may also help control menstrual bleeding when a woman's blood counts are low and help reduce the risk of accidental pregnancy during treatment.
- ✦ Note: Hormones in birth control pills are not recommended for women with cancers that could be fueled by hormones, such as breast cancer. Oral contraceptives can also increase the risk of blood clots, which may already be high because of the cancer and its treatment effects.

During treatment: Ovarian/
Testicular shielding

Testicular shielding

- ✦ During total body radiation a lead barrier, or shield, is placed over the patient's lower abdomen to help keep radiation from directly affecting the ovaries or testicles.
- ✦ A few small studies have found that ovarian shielding preserves ovarian function and does not appear to increase the risk of cancer relapse. But it does decrease the radiation dose to the pelvis, and it has been suggested that shielding not be done in women with active leukemia.
- ✦ More studies are needed to know if ovarian shielding works and if it's safe.

During treatment: Radical
trachelectomy (cervical cancer)

Trachelectomy (Cervical Cancer)

- ❖ Radical trachelectomy is an option for cervical cancer patients who have very small, localized tumors. The cervix is removed but the uterus and the ovaries are left, and the uterus is connected to the upper part of the vagina. A special band or stitch is wrapped around the bottom of the uterus to act as the cervix. A small opening allows blood from your period to flow out and sperm to enter the uterus to fertilize an egg.



Courtesy American Cancer Society

- ❖ Trachelectomy appears to be just as successful as

- ❖ Trachelectomy appears to be just as successful as radical hysterectomy (removal of the uterus and cervix) in treating cervical cancer in certain women. Women can become pregnant after the surgery, but are at risk for miscarriage and premature birth because the opening to the uterus may not close as strongly or tightly as before.
- ❖ This is done during the surgery to treat cervical cancer, so insurance should cover some of the costs.

After treatment: Adoption

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- ✦ Adoption can take place within your own country through a public agency or by a private arrangement, or internationally through private agencies.
 - ✦ Adoption agencies often require a letter from your doctor stating that you are cancer-free and can expect a healthy lifespan and a good quality of life.
 - ✦ There's a lot of paperwork to complete during the adoption process, and at times it can seem overwhelming.
 - ✦ The process takes different lengths of time depending on the type of adoption you choose. Most adoptions can be completed in 1 to 2 years.
 - ✦ Costs of adopting vary greatly, from less than \$4,000 to up to \$50,000.

After treatment: Natural pregnancy

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- ✦ After cancer treatment, a woman's body may recover naturally and produce mature eggs that can be fertilized.
 - ✦ Your medical team may recommend waiting anywhere from 6 months to 5 years before trying to get pregnant based on:
 - ✦ Risk of the cancer coming back (recurring) - usually highest in the first 2 to 5 years after treatment
 - ✦ Type of cancer
 - ✦ Treatment used
 - ✦ Women who have had chemotherapy or radiation to the pelvis are also at risk for sudden, early menopause even after they start having menstrual cycles again.
 - ✦ Most fertility specialists recommend that cancer survivors who recover fertility should try to conceive naturally with the eggs they are producing rather than using frozen eggs or embryos. There's no proof of an increased risk of birth defects in children born after cancer treatment.





*After treatment: Using donor eggs
or embryos*

- ✦ Any woman who has a healthy uterus and can maintain a pregnancy can have in vitro fertilization (IVF).
- ✦ Donated eggs come from women who have volunteered to go through a cycle of hormone stimulation and have their eggs collected. Embryos often come from couples who have had fertility treatments and are left with extra embryos.



Courtesy Independent UK

- ✦ The success of the egg or embryo donation depends on carefully timing hormone treatment (to prepare the lining of the uterus) with the removal and fertilization of the donor's eggs or the thawing and transfer of donor embryos. If the woman receiving the donor eggs has ovarian

donor embryos. If the woman receiving the donor eggs has ovarian failure (she's in permanent menopause), she must take estrogen and progesterone to prepare her uterus for the embryo(s). The eggs are taken from the donor and fertilized with the sperm. Embryos are then transferred to the recipient to produce pregnancy. After the transfer, the woman will continue to need hormone support until the placenta develops and can produce its own hormones.

- ✦ The entire process of donating eggs, fertilizing them with sperm, and implanting them usually takes 6 to 8 weeks per cycle. The major health risk with donor eggs or embryos for cancer survivors and babies is the risk of having twins or triplets. Responsible programs may transfer only 1 or 2 embryos to reduce this risk, freezing extras for a future cycle.
- ✦ The price of IVF using donated eggs or embryos can vary significantly.

After treatment: Surrogacy

- ✦ Surrogacy is an option for women who cannot carry a pregnancy, either because they no longer have a working uterus, or would be at high risk for a health problem if they got pregnant.
- ✦ There are 2 types of surrogate mothers:
 - ✦ A gestational carrier is a healthy female who receives the embryos created from the egg and sperm of the intended parents. The gestational carrier does not contribute her own egg to the embryo and has no genetic relationship to the baby.
 - ✦ A traditional surrogate is usually a woman who becomes pregnant through artificial insemination with the sperm of the man in the couple who will raise the child. She gives her egg (which is fertilized with his sperm in the lab), and carries the pregnancy. She is the genetic mother of the baby.
- ✦ Surrogacy can be a legally complicated and expensive process. Surrogacy laws vary, so it's important to have an attorney help you make the legal arrangements with your surrogate.

After treatment: Testicular sperm extraction

- ✦ Testicular sperm extraction (TESE) is possible for men before or after cancer treatments who have reached puberty and who do not have mature sperm in their semen.
- ✦ If you did not bank your sperm prior to starting cancer treatments and currently have no sperm in your ejaculate, there may still be sperm in your testicular tissue that can be used with in vitro fertilization (IVF) to try to have a child.
- ✦ Testicular tissue is usually obtained by open biopsy and examined for sperm cells. If sperm cells are found, they are removed and used immediately or frozen for future use with IVF and ICSI.
- ✦ Success rates vary but range from 30–70 percent. Studies have shown the presence of live sperm up to 45 percent of the time in men who had no sperm in their ejaculate after cancer treatment.
- ✦ This is an experimental procedure in prepubescent boys but a common procedure for adult men.
- ✦ The average cost of testicular sperm extraction is \$6,000–\$16,000. Some insurance companies pay for the procedure if it is performed in conjunction with other treatments.

After treatment: In Vitro Fertilization using Intracytoplasmic Sperm Injection

- ✦ When less than two million sperm cells are available for infertility treatment, the usual choice is to use them in In Vitro Fertilization with Intracytoplasmic Sperm Injection (IVF-ICSI).
- ✦ How it works: The woman who will carry the child must undergo hormone shots for several weeks to stimulate her ovaries to ripen more than one or two eggs. The woman's eggs are harvested or collected through a minor outpatient surgery. The harvested eggs are cleaned in the laboratory and stored in individual dishes to be ready for fertilization. The embryologist uses a special microscope to choose a healthy-looking sperm and injects it into an egg. If all goes well, several embryos can be created. Usually just one or two embryos are placed into the uterus of the female partner in the hopes that they will implant and start a pregnancy.
- ✦ IVF-ICSI is expensive and involves some medical risks for the woman. However, it's often successful, especially if the woman has normal fertility and is younger than 35.
- ✦ Only a few sperm are needed for IVF-ICSI, so it is a good option for men who have poor semen quality or have sperm with poor motility.

After treatment: Intrauterine Insemination

- ✦ Intrauterine Insemination is an option for men with semen quality that is closer to normal.
- ✦ How it works: A man's semen sample is purified and concentrated to contain as many active sperm as possible. In a health care provider's office, the sample is put in a thin catheter (tube) and slipped directly through the woman's cervix into her uterus to give the sperm a head start on fertilizing the egg. Sometimes the woman is given extra hormones to ripen more than one egg, but not in the high doses used in IVF. If an ultrasound shows that too many eggs are ripening, the insemination should either be canceled or the woman should have her eggs gathered and used for IVF instead.
- ✦ There is a high risk of a multiple pregnancy with Intrauterine Insemination.
- ✦ Donor sperm may also be used in Intrauterine Insemination.

Should I have children after cancer?

- ✦ Genetic factors - Will you pass a cancer gene on to your children?
 - ✦ Only about 5% to 10% of cancers have a strong link to a gene that is passed on from parent to child.
- ✦ Birth defects/Health problems - Will your chemotherapy or radiation treatments cause birth defects or other health problems for your future children?
 - ✦ Many studies have found that babies conceived after cancer treatment don't have birth defects or health problems any more often than babies whose parent didn't have cancer.
 - ✦ Women should avoid getting pregnant during chemotherapy because many chemotherapy drugs can hurt a developing fetus, causing birth defects or other harm.
- ✦ Reoccurrence - What if your cancer comes back?
 - ✦ People with cancer may be concerned about the cancer coming back, how long they can expect to live now that they've had cancer, and the costs of raising a child while undergoing cancer

cancer, and the costs of raising a child while undergoing cancer treatment.



Is pregnancy safe after cancer?

- ❖ Despite concerns that pregnancy could cause cancer to return, studies to date have not shown this to be true for any type of cancer. But this issue is still being studied. Every cancer is different, so it's not possible to say for sure that it's safe for all cancer survivors to become pregnant.
 - ❖ In general, as the highest risk for cancer recurrence is in the first two years after completing treatment, most experts suggest waiting this time period before attempting conception.
 - ❖ Pregnancy could be a problem if cancer treatment has damaged your heart, lungs, or other organs. When organs are damaged, the added physical stress of a pregnancy can lead to serious health problems for the mother and the growing fetus.
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- ❖ Radiation that reaches the uterus, especially if it was done when the woman was a child, can limit the ability of the uterus to stretch as the fetus grows. This creates an increased risk of a premature or low birth-weight baby, or even having a miscarriage.

- ✦ A few early studies suggested a link between some fertility drugs and cancer, but recent studies suggest there's no direct link between the use of fertility drugs and breast, uterine, ovarian, or any hormone-related cancer.
- ✦ Breastfeeding after treatment for breast cancer need not be discouraged except from the irradiated breast. Most women who have undergone irradiation for breast cancer are able to produce milk on the affected side, but the amount of milk produced may be less than that in a non-irradiated breast. Even when breast milk is produced, breastfeeding from the irradiated breast is not advised because mastitis will be difficult to treat if it occurs.

Insurance and financial concerns

- ✦ The costs of infertility treatments are a major barrier for most patients. Still, there are options available for some people, even if they cannot get insurance to cover it.
- ✦ Many of the tests that diagnose fertility are covered by insurance, but treatment costs are often not covered. Some states have laws that require varying amounts of coverage for infertility and IVF treatments. But many patients are not covered by these laws and many more live in states with no or limited coverage.
- ✦ To get your insurance plan to help pay for infertility treatments, you must first call them and ask about the steps you need to take to petition for coverage. Some patients have been able to get infertility treatment covered when they explained or had their doctor show that the infertility was a side effect of a necessary cancer treatment.

- ✦ Figure out which treatment might be an option for you, where you can get it, and what the costs are. It helps to speak with a financial counselor in the fertility practice and ask for details about the treatment, its costs, and even specific insurance codes

about the treatment, its costs, and even specific insurance codes for the services you might need.

- ❖ The Fertile Hope financial assistance program, called “Sharing Hope,” reduces the costs of fertility preservation for qualifying patients.

Legal considerations

- ✦ You might want to talk to an attorney about the fertility options you are considering and possible legal issues that may arise.
- ✦ For example, if a spouse or partner dies after embryos are fertilized, would he or she be willing for the surviving partner to use them anyway? If you do not use all your fertilized embryos, what will you do with them? Would you be willing to donate them to others who need them?
- ✦ There are also specialized lawyers who work with adoption services. They can help the birth parents give up their legal rights to the child and handle the adoption process. This can help ensure a smoother adoption with less fear and anxiety.

Mental health services

- ✦ Dealing with your cancer treatment and fertility issues may stir up strong emotions. You might feel overwhelmed, discouraged, or depressed.
- ✦ Some of the drugs women take for in vitro fertilization or to preserve fertility can have emotional side effects, too. These feelings are normal.
- ✦ A mental health professional can help you adjust to your cancer diagnosis and help you deal with your feelings about your fertility. This expert can also help you deal with feelings of guilt, anger, loss, and disability.
- ✦ You may be able to find an infertility support group through your fertility specialist's office. Couples who share their unique experiences often find a special bond and strength. Infertility can be a roller coaster of highs and lows. It helps to go through that with others who understand.





“I wanted a perfect ending. Now I've learned, the hard way, that some poems don't rhyme, and some stories don't have a

clear beginning, middle, and end. Life is about not knowing, having to change, taking the moment and making the best of it, without knowing what's going to happen next.

Delicious Ambiguity.”

—Gilda Radner