



AN EASY GUIDE TO UNDERSTANDING IVF



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INTRODUCTION

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**From the Desk of
Dr. Sharon Moayeri**

When it comes to growing families, no single technology has had more of an impact than in vitro fertilization (IVF).

When IVF was introduced in 1978 it was cutting edge, experimental science. Today there are well over 5 million people in the world who were born using IVF. That's equal to the current population of Colorado, and that number is expected to grow significantly.

As new advances in assisted reproductive technology (ART) are introduced, success rates are expected to rise, and the cost and convenience of IVF are also expected to improve.

Because of this, more individuals and couples from every walk of life are turning to IVF as a solution to help them grow their families.

IVF and the technologies surrounding IVF are constantly evolving. Because of this, there is also a great deal of

information available online, as well as misinformation and outdated information.

As a fertility specialist, physician and educator, I believe in working with my patients to make sure that they are working from the most accurate and up to date facts about IVF.

It is this information that I wish to share with you.

The goal of this guide is to answer some of the most common questions about IVF and provide you with information that you can use to guide your discussion with your doctor or a fertility specialist.

I hope you find it informative, and useful as you plan your journey toward growing your family.

Sincerely,

Dr. Sharon Moayeri

WHAT IS IVF?

WHAT IS IVF?

IVF is a method of assisted reproductive technology (ART) in which eggs and sperm are combined outside the womb (uterus) in a specialized laboratory.

If the egg fertilizes and begins cell division, the resulting embryo can be transferred into the woman's uterus where it will hopefully implant in the uterine lining and further develop into a healthy infant.

Because fertilization happens outside of the uterus, IVF can be done using a woman's own eggs and a partner's sperm, or sperm or eggs from a known or anonymous donor.

Additionally, a gestational carrier/surrogate may be used to carry the pregnancy.

Embryos can also be frozen and saved for the future.

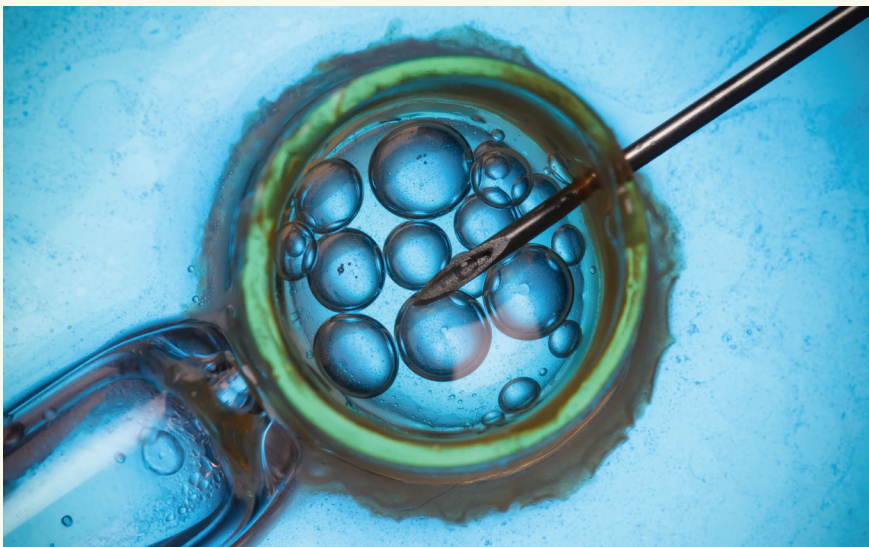
In addition to IVF, other types of assisted reproductive technology (ART) have emerged. When combined with IVF, these technologies can further increase the likelihood of a successful pregnancy.

These technologies include:

ICSI - Intracytoplasmic Sperm Injection

In the case where the sperm cannot penetrate the outer layer, intracytoplasmic sperm injection (ICSI) is a specialized technique used to help fertilize the egg. During ICSI, a single sperm is injected directly into the cytoplasm (fluid center) of the egg. Though this procedure does not guarantee fertilization (creation of an embryo), it can increase the odds of fertilization in many cases.

In addition, new screening technologies allow fertility specialists to combine the healthiest possible sperm and egg. This procedure has greatly improved the chances of a healthy embryo being transferred.



WHAT IS IVF?

PGS - Pre-Implantation Genetic Screening / CCS – Comprehensive Chromosome Screening

CCS/PGS allows us to analyze biopsied cells from an embryo to determine whether there are chromosomal errors present before implantation. This is done to avoid implanting embryos that will not lead to a healthy pregnancy, or often will result in miscarriage or diagnosis later in pregnancy.

The types of chromosome errors increase with frequency and complexity as a woman ages. This explains the lower pregnancy rates and higher miscarriages seen among older women, and can often uncover the cause of “unexplained infertility” in women under 35 years of age.

This technology incidentally identifies gender (by revealing either 2 X-chromosomes for females, or an X and Y chromosome for males). This technology is used for future family building, or embryo banking; as well as for family balancing, or gender selection.

Preimplantation Genetic Diagnosis (PGD)

In addition to testing for chromosome errors, the cells may be analyzed for other known familial hereditary conditions or gene mutations. PGD may be recommended for couples who have or are carriers of a known genetic disorder that may lead to disability or disease in their children, such as cystic fibrosis or muscular dystrophy; as well as balanced translocations that can be inherited. Not only can this treatment identify unaffected, but possible carrier embryos, it may allow a family to eliminate the risk of transmitting a specific mutation to future generations by identifying unaffected non-carrier embryos.

Egg and Embryo Freezing

Cryopreservation of reproductive tissue, allows the freezing of eggs, sperm, or resultant embryos created during IVF to be used in the future. In the case of embryo freezing, an embryo can be thawed and transferred back into the uterine cavity after it is prepared with hormones or at the appropriate time of the menstrual cycle (called a natural cycle protocol).

This procedure leads to high success rates and allows patients to get pregnant at a time of their choosing. Once frozen, eggs, sperm and embryos can remain frozen for years without loss of quality.

CAN IVF
HELP ME?

CAN IVF HELP ME?

Understanding the different technologies that can be paired with IVF helps identify the ways that these technologies can help individuals and couples who wish to grow their families.

The following are some of the key reasons where IVF and other ARTs may be employed.

Female Fertility Loss

Because IVF allows for fertilization outside of the fallopian tubes, it can help women to achieve pregnancy when faced with conditions such as:

- › Age-related infertility
- › Unexplained infertility
- › Anovulation / Polycystic ovary syndrome (PCOS)
- › Endometriosis
- › Fallopian tube damage
- › Tubal sterilization, or tubal removal

While these conditions can be treated with medication or minimally invasive surgery, your physician may recommend IVF if other treatments prove ineffective.

Note: More information on these conditions is available in our guide “[Understanding Common Causes of Infertility](#)”



Male Fertility Loss

IVF can be used in cases where a male patient is dealing with impaired sperm production or function. This may be caused by defects of tubules that transport sperm, infections, spinal cord injuries, tumors and other physical and medical conditions. Often, the cause is undetermined. However, in these cases, IVF can be combined with ICSI or sperm extraction (called TESE or

CAN IVF HELP ME?

PESA) to select and inject sperm into the egg that have the best chances of leading to a viable embryo.

Recurrent Pregnancy Loss

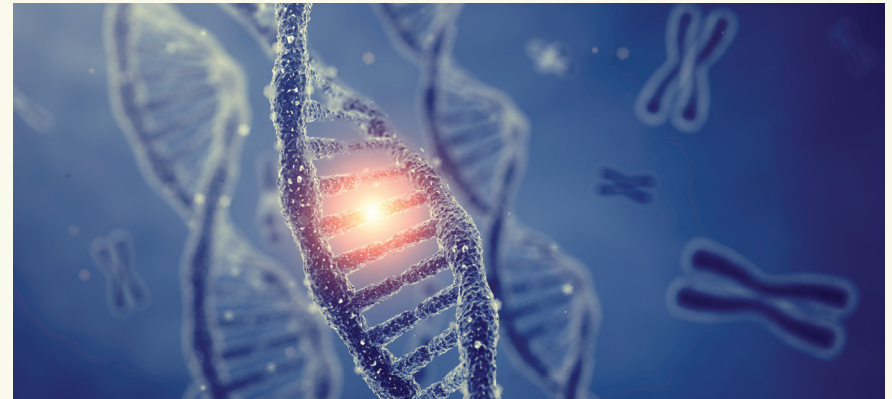
Many women over 35 can achieve a pregnancy, but face recurrent pregnancy loss. This can be due to the natural decrease in the quantity and quality of eggs produced. This is also known as diminished ovarian reserve.

IVF allows patients to harvest and fertilize multiple eggs at once to create embryos. Using PGS, your physician can select and implant embryos that are more likely to result in a successful pregnancy. In the case where there are multiple embryos available, additional embryos can be frozen for future use.

Heredity Genetic Conditions

Couples may be able to achieve pregnancy but have concerns about specific genetic conditions that run in their family, IVF can also be combined with PGD to screen for specific hereditary genetic conditions prior to implantation. A few of the conditions that can be screened for include:

- › Cystic fibrosis
- › Duchennes muscular dystrophy
- › Hemophilia
- › Sickle cell disease
- › Spinal muscular atrophy (SMA)
- › Tay-Sachs disease
- › Thalassemia
- › Cancer gene mutation (BRCA1 or BRCA2)



Fertility Preservation

A growing number of women and couples who want to grow their family are opting to use IVF to harvest eggs and/or create embryos to freeze for the future. This allows them to

CAN IVF HELP ME?

preserve healthy eggs or embryos that they can use to get pregnant when they're ready to grow their family. By preserving their eggs and embryos for the future, they may reduce the risk of miscarriage due to diminished ovarian reserve, or the need for donor eggs.

Also, many who work in high-risk careers (fields such as chemistry, heavy industry or the military) are turning to IVF as a means of preserving their fertility in case of an unexpected loss of fertility.

Oncofertility Preservation

Advances in medicine have led to remarkable cancer survival rates, especially for conditions such as breast cancer and prostate cancer. Unfortunately, radiation and chemotherapies often have a negative impact on both the female and male reproductive systems.

For women, IVF can be used to harvest and freeze healthy eggs prior to treatments. These can be combined with a partner's sperm to create embryos.

For male patients who may have impaired fertility due to treatments, they can freeze sperm prior to treatment and ICSI technology may improve the chances of a normal pregnancy.

LGBT Couples

Growing legal and social acceptance has made it easier for LGBT couples to become parents through reproductive medicine. For LGBT/same-sex couples, IVF has allowed them to successfully have families of their own.

For gay couples, IVF can be combined with egg donation and surrogacy with a gestational carrier to help grow their families.

One newer option that is available for lesbian couples is reciprocal IVF. Using IVF, eggs from one partner can be fertilized with donor sperm and implanted in the uterus of the other partner.



HOW DOES IVF WORK?

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IVF involves several steps:

1. Ovarian Stimulation
2. Retrieval of Eggs
3. Sperm Retrieval
4. Fertilization
5. Embryo Transfer.

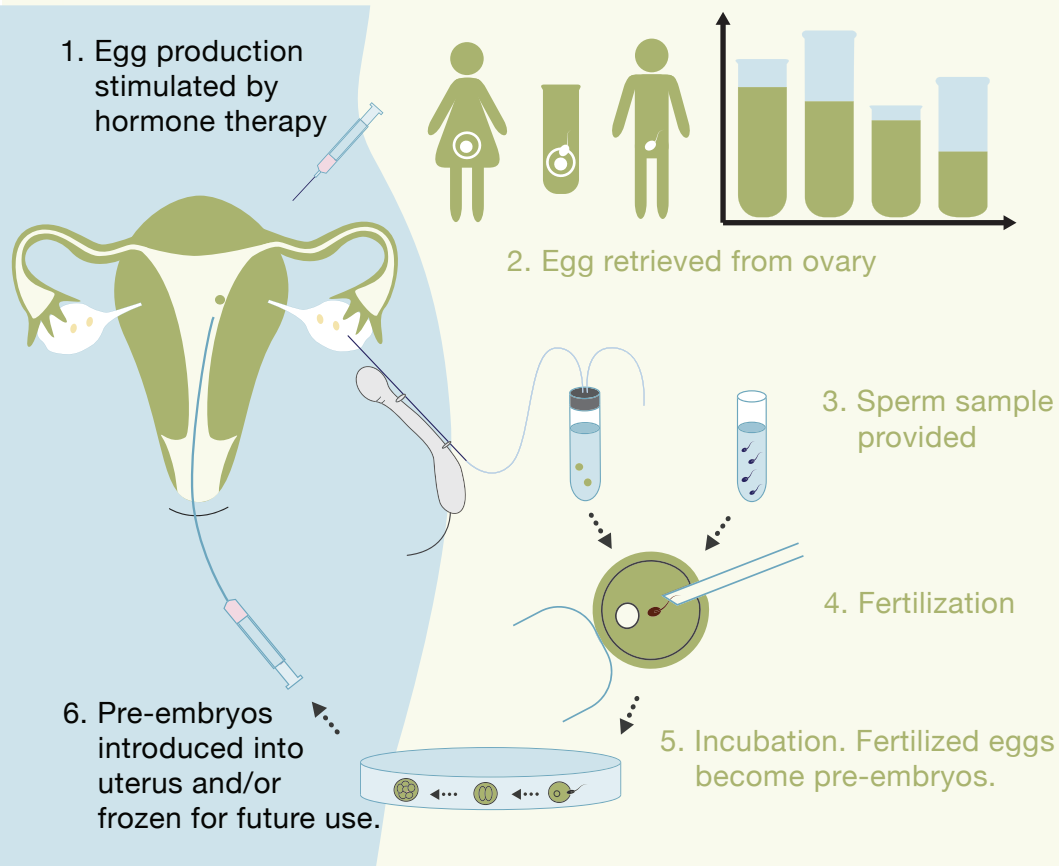
1. Ovarian Stimulation

Typically synchronized with the beginning of the menstrual cycle, a patient begins treatment that involves injecting daily hormone medications designed to stimulate the ovaries to mature multiple eggs instead of the single egg that normally ovulates each month. This therapy does not take away from the future pool of eggs but recruits eggs that would otherwise have dissolved without reaching maturity.

Luckily for us, eggs are contained within the ovary in a fluid-filled cyst or sac called a follicle. This follicle is visible by pelvic ultrasound and provides a method to monitor ovulation progression, and consequently treatment response. Follicles that are immature and incapable of being fertilized typically measure less than 10mm; whereas mature follicles that would normally be ovulated and potentially fertilized grow to approximately 20mm in size.

During treatment, patients frequently return for follow-up visits where the patient's fluid-filled ovarian follicles are monitored by ultrasound to determine their number, size, and rate of growth. Blood tests are also used to measure a woman's hormonal response to the medications. This process of monitoring eggs until maturity usually takes 10-14 days. When the follicles are ready for egg retrieval based on the

IN VITRO FERTILIZATION INFOGRAPHIC



HOW DOES IVF WORK?

information gathered at monitoring appointments, an injection of human chorionic gonadotropin, Lupron®, and/or Ovidrel® is administered to finalize the egg maturity process within a specified time. This is a very time-sensitive injection and determines the timing of the procedure to remove the eggs.

2. Retrieval of Eggs

The egg retrieval is necessarily done at a specific time when most of the eggs have predictably reached maturity, but haven't yet been released into the pelvis (where they can't be easily accessed). During the retrieval process, a pelvic ultrasound probe is inserted into the vagina to identify follicle cysts (each measures about 20mm). Using the ultrasound as a guide, a thin needle is then traced through the back of the vagina and into each ovary and follicle to puncture and drain each follicle cyst and retrieve the egg contained within it. At the time of surgery and under a microscope the embryologist identifies the eggs from within the follicular fluid.

Not every follicle will necessarily contain an egg or a healthy egg. Additionally, not every egg that is retrieved is viable. Those eggs that are mature can be frozen, or combined with sperm to create embryos.



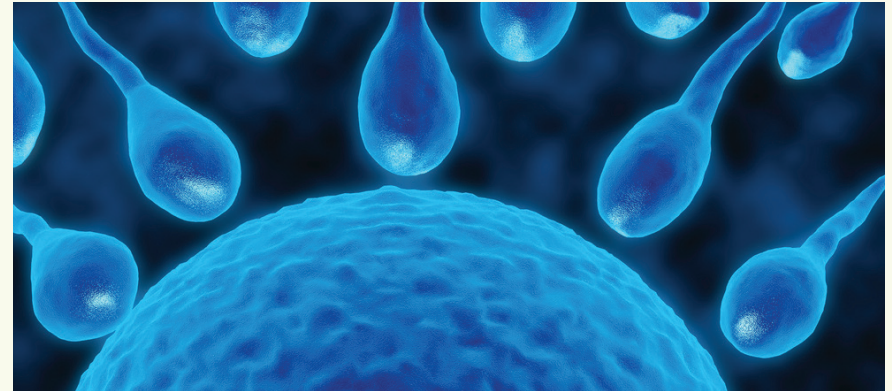
3. Sperm Retrieval

If using a partner's sperm, then he can provide a semen sample by ejaculation on the morning of the egg retrieval, or an earlier frozen sample may be used if needed. In cases where there may not be enough or any sperm in the ejaculate, then a testicular sperm aspiration procedure (such as TESE or PESA) may be required by a Urologist. Donor sperm may also be frozen in advance and then prepared for use. In either case, sperm are separated from the semen fluid and washed in the lab prior to use. This helps ensure the best chances for fertilization.

HOW DOES IVF WORK?

4. Fertilization

Fertilization can occur through two main techniques. Either healthy sperm and mature eggs are combined in a culture dish (traditional IVF); alternatively, one sperm is inserted into one egg using a technique called ICSI. After one day, the eggs are checked to see how many have successfully fertilized (combined their DNA).



A portion of the fertilized eggs that result in embryos will develop in culture and may be transferred after they develop for three (cleavage stage) to five or six days (blastocyst). They may also be biopsied for genetic testing and/or frozen for future use. There is the possibility of having excess embryos remaining after treatment and those can be stored (banked in the frozen state) for future pregnancies.

In certain situations, your doctor may recommend preimplantation genetic screening (PGS)/ Comprehensive chromosome screening (CCS) and/or preimplantation genetic diagnosis (PGD). Both require biopsy of embryo cells to analyze the DNA contained within the cells. In the former, cells are evaluated for the correct chromosome number (euploidy) – 23 pairs for humans; and the latter identifies specific hereditary genetic mutations on chromosomes that may result in disease in the offspring, such as cystic fibrosis.

5. Embryo Transfer

Embryo transfer, either fresh or frozen, usually takes place at the blastocyst stage (an embryo that has grown for five to six days after egg retrieval and fertilization). With ultrasound guidance, a long, thin, flexible tube (called a catheter) is passed through the cervix. A syringe that contains the embryo(s) is attached to the end of the catheter. Using the syringe, the doctor will place the embryo(s) between the upper and lower uterine lining.

At CCRM OC Fertility, we use transvaginal ultrasound guidance to provide the clearest view of the embryo(s) placement within the uterine lining, which is essential to optimize the likelihood of pregnancy.

HOW DOES IVF WORK?

If successful, the embryo will begin to implant in the lining of the uterus about six to 10 days after egg retrieval, or a few days after the embryo transfer procedure. The embryo takes weeks to fully implant itself in the uterus.

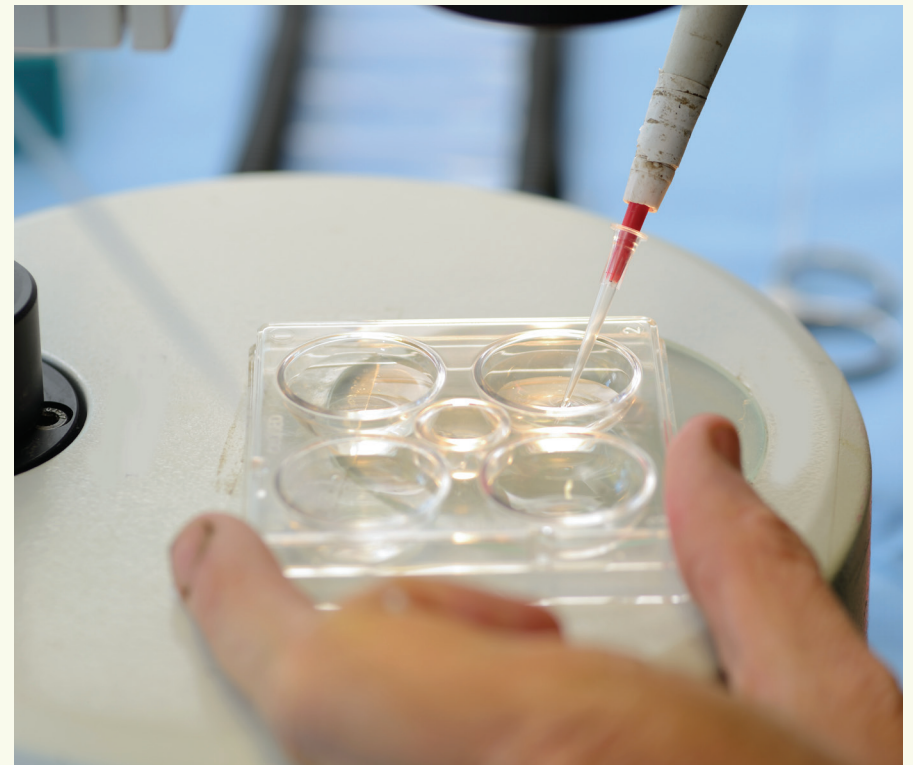
6. After the Transfer

After the embryo transfer, we advise women to limit their activity for a few days and leading up to their pregnancy test. We will provide detailed instructions on the “do’s and don’ts” during this time. If doing a fresh embryo transfer, the ovaries may still be enlarged, and more restrictions may be recommended.

One cycle of IVF takes at least two to three weeks from the time of starting injection medications to the time of an egg retrieval procedure. It is possible that more than one cycle may be required to obtain enough eggs to optimize your outcome.

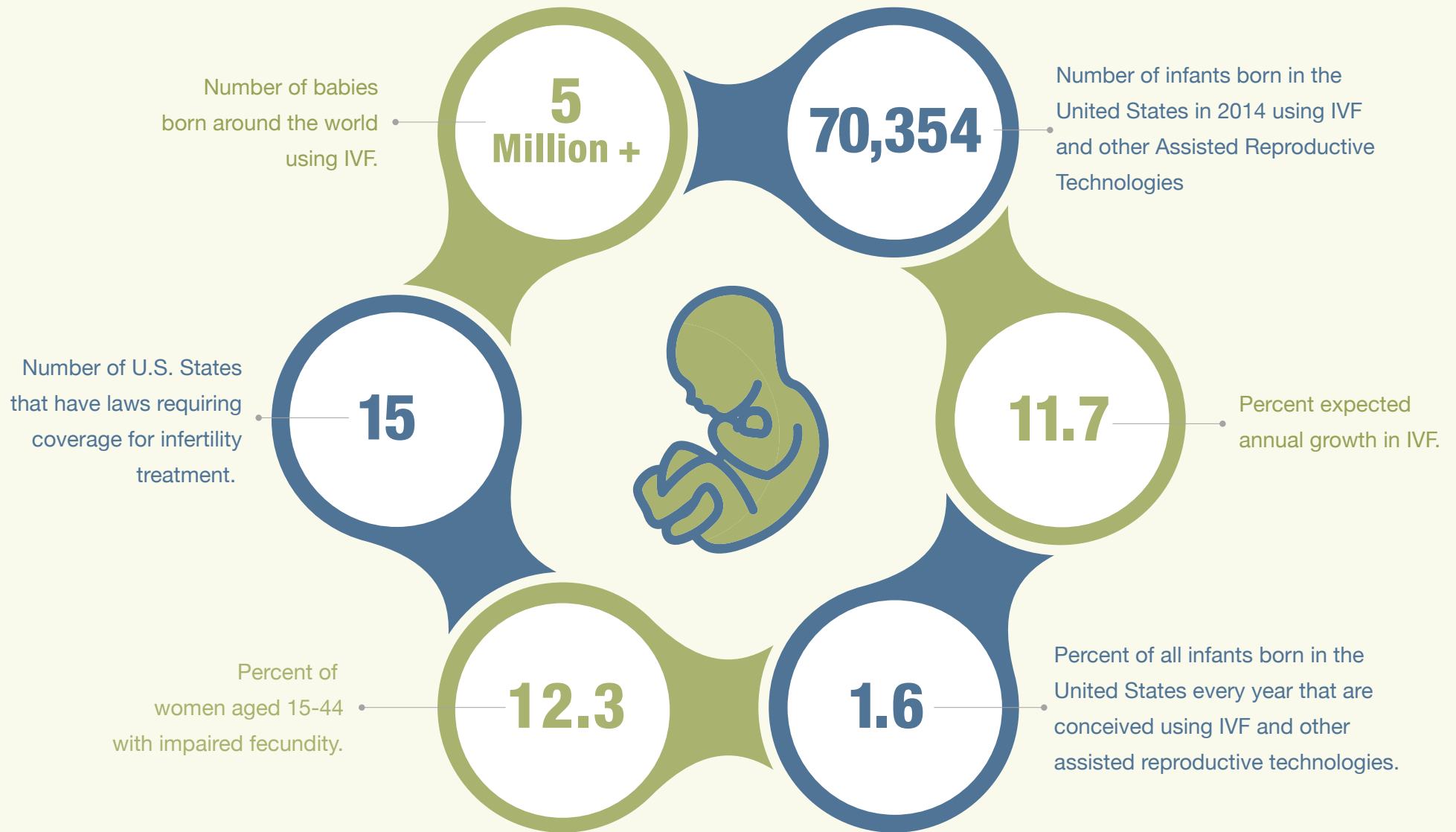
Increasingly, research supports the decision in many instances to cryopreserve (freeze) embryos and perform a frozen versus fresh embryo transfer. Results suggest healthier placental implantation, fetal development, and infant outcomes. Additionally, freezing embryos rather than

performing a fresh embryo transfer allows adequate timing to complete embryo biopsy for accurate genetic testing on all potentially viable blastocysts, rather than limiting the option to only those that are developed to the blastocyst stage by day-5 of embryo culture.



IVF BY THE NUMBERS

IVF BY THE NUMBERS



ANSWERS TO COMMON QUESTIONS ABOUT IVF

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1. Can I Afford IVF?

IVF treatments can be expensive, but that doesn't mean that they are out of reach. There is a greater understanding of the benefits of IVF, especially as more and more people are waiting until later in life to start their family.

A growing number of U.S. states require some insurance coverage for fertility treatment, and more employers and insurance providers are seeing the value in including fertility coverage as a part of their benefits package.

In addition, other options exist including IVF financing and grants.

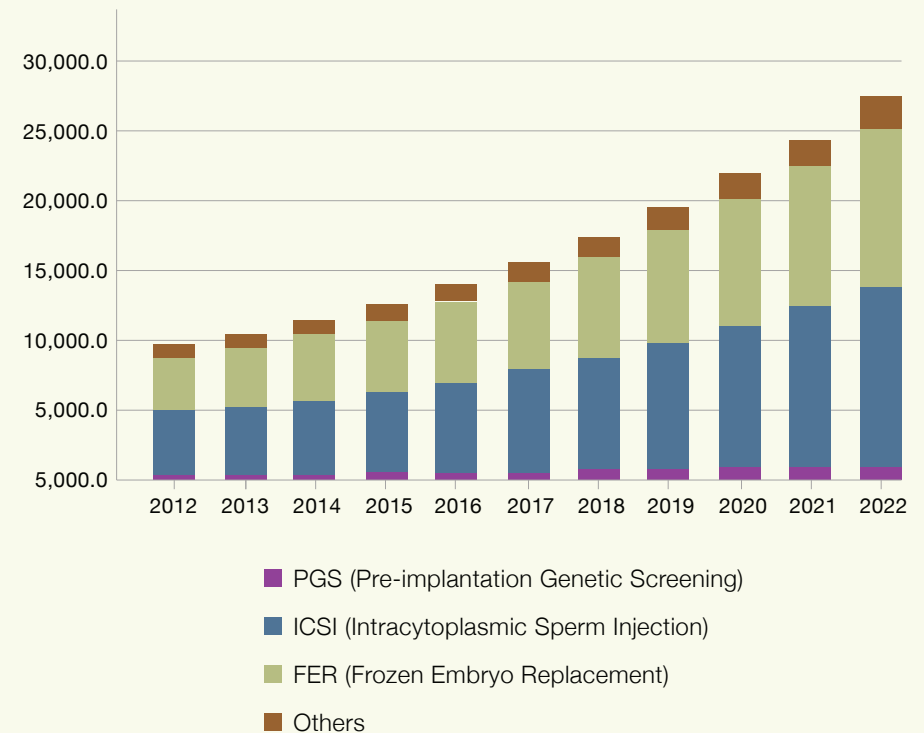
Before you make a decision, it never hurts to check with your insurance plan and talk with a fertility specialist. They can often provide advice on how to find a solution that you can afford.



2. Will IVF Become More Affordable?

The global IVF market is expected to grow at a rate of over 11.7% per year between now and 2022. As demand grows and treatments become more efficient, prices will go down, and more businesses and insurance plans are likely to offer full or partial coverage.

U.S. In Vitro Fertilization (IVF) market by procedures, 2012 - 2022 (USD Million)



ANSWERS TO COMMON QUESTIONS ABOUT IVF

3. Does IVF Lead to Twins and Multiple Births?

In the past, physicians recommended transferring multiple embryos to improve the chances of fertility. This sometimes led to multiple births.

However, new advances like extended embryo culture and PGS/CCS have made this less necessary. In fact, due to the potential health risks related to multiple births, most fertility specialists advise against implanting more than one embryo at a time unless indicated. Instead, excess viable embryos can be frozen and stored for future use. This may actually improve the overall chances of a healthy live-born in the end.

4. Aren't Frozen Eggs or Embryos Less Effective Than Fresh Eggs or Embryos?

Historically, success rates with fresh embryos were higher than frozen because of the risk of damage in the thawing process. However, vitrification (egg or embryo freezing) technology leads to about 99% embryo survival, which means that success rates with frozen embryos is comparable to fresh embryos.

Also, a pregnancy using frozen embryos may lead to healthier long-term fetal outcomes. This is because freezing allows for Comprehensive Chromosome Screening (CCS) / Preimplantation Genetic Screening (PGS) and Preimplantation Genetic Diagnosis (PGD), which can allow for healthier embryos with a greater chance of leading to a live birth.

Another benefit is that freezing lets a woman's hormone levels to "cool off" after egg retrieval and stimulation. That means that fertility specialists can transfer embryos at a time when a woman's hormone levels are stable and may improve implantation of the embryo and pregnancy development.

Vitrification technology has also led to significant improvements in egg freezing outcomes, giving women the chance to preserve fertility for the future.

5. Does IVF Mean That I Need to Take Time Off Work?

Most IVF procedures are minimally invasive and are performed on an outpatient basis. While it is recommended that patients not over-exert themselves, most patients return to work the next day after egg extraction and can

ANSWERS TO COMMON QUESTIONS ABOUT IVF

return to their regular exercise routine within a few days. Typically, a few days of bed rest is advised after an embryo transfer.

6. Am I Too Old for IVF?

Among women older than 35, the success of IVF treatments may diminish, since with age comes declining ovarian reserve and egg quality. However, advanced ART regimes, such as PGS/CCS may expedite treatment and improve the likelihood of a successful pregnancy by identifying and replacing only viable embryos into the uterus.

Women who pursue these treatments have implantation rates (pregnancy per embryo transferred) comparable to younger women, since the biggest barrier to success is often the identification of a healthy embryo.

Similarly, if an older woman uses a donor egg, she has a high likelihood of success, since younger eggs are more likely to be viable and the age of the uterus does not significantly alter pregnancy rates. Women can successfully conceive a child through IVF treatment up to age 50 years

using donated eggs. They then have the same chances of success as those women younger than 35 years.

7. Do I Need IVF? I'm Not Trying to Get Pregnant Right Now.

A growing number of women are choosing to preserve their fertility for the future. By harvesting eggs when they are still in their early-to-mid thirties, they improve their chances of having children.

ABOUT DR. MOAYERI

ABOUT DR. MOAYERI

Dr. Sharon Moayeri, a leading Orange County fertility specialist, is admired for her knowledge and clinical expertise, as well as her warm bedside manner. She has achieved the highest level of training in her specialty and is double-board certified in Obstetrics and Gynecology, as well as Reproductive Endocrinology and Infertility. Her many accomplishments include a three-year Fellowship at Stanford University Hospital and Clinics, one of the nation's leading IVF centers.

Dr. Moayeri has been growing her private practice since 2007, upon return to her hometown of Newport Beach. In 2014, she partnered with the best in the industry, Dr. William Schoolcraft, to create CCRM Orange County. Her goal being to establish the leading IVF Center in Orange County and advance her already excellent IVF success rates. Our IVF Center, CCRM Orange County, is a culmination of Dr. Moayeri's vision to create a patient-centered approach while providing patients with the most advanced fertility technologies in the Country.

To further strengthen her belief in continuous learning, Dr. Moayeri served as Assistant Professor at the University of California Irvine Medical Center. She continues to enjoy teaching obstetricians and gynecologists in her community about topics including polycystic ovary syndrome, advances in assisted reproductive technologies (e.g., egg freezing, PGS / CCS) and endometriosis.

Additionally, she is a reviewer for the prestigious American Journal of Obstetrics and Gynecology (AJOG) and Fertility & Sterility (F&S).

CONCLUSION

CONCLUSION

We hope you've found this guide to IVF helpful.

If you have further questions, or would like to learn more about how IVF and other assisted reproductive technologies can help you to achieve your dreams and grow your family, contact us today.

We have the answers you need.



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Resources:

American Society for Reproductive Medicine

American College of Obstetricians and Gynecologists

Centers for Disease Control and Prevention

Eunice Kennedy Shriver National Institute of Child Health and Human Development

Mayo Clinic

Grandview Research – Industry Analysis of In Vitro Fertilization Market.

National Institutes of Health – US National Library of Medicine

The National Infertility Association

U.S. Department of Health and Human Services - Office on Women's Health