Infertility 101
Your Guide to Understanding Fertility
What is **Infertility**?

Infertility is the *inability* to get pregnant.

- **<35** After 1 year of regular, unprotected intercourse
- **>35** After 6 months of regular, unprotected intercourse

Infertility is *more common* than you think.

- 1 in 8 couples *experiences difficulty conceiving* (or about 7.3 million American women)
- According to the CDC, **11% of women** of childbearing age struggle with infertility
Infertility is a condition that impairs the body’s ability to perform the function of reproduction.¹

In general, infertility is defined as the inability to conceive after a year of regular, unprotected sex when a woman is under the age of 35, and after 6 months if a woman is 35 or older.¹

ADDENTIAL POINTS

- Infertility is more common than you think: 1 in 10 women, and 1 in 8 couples, in the United States has difficulty conceiving¹,²
- The more you know about infertility, the more in control you may feel

¹ According to the CDC, 1 in 8 couples experiences difficulty conceiving (or about 7.3 million American women)
What is Infertility?

Due to Female Factors

Due to Male Factors

Due to Mixture of Unknown Factors

85% of couples with normal fertility will conceive within 1 year of trying

Chances of naturally conceiving for a healthy woman:

- 20s to early 30s: 25-30%
- 40 years old: 10% or less
What is Infertility?

Due to Female Factors

Due to Male Factors

Due to Mixture of Unknown Factors

85% of couples with normal fertility will conceive within 1 year of trying

Chances of naturally conceiving for a healthy woman:
- 20s to early 30s: 25-30%
- 40 years old: 10% or less

The United States Office on Women’s Health estimates that about 1/3 of infertility cases are due to female factors, 1/3 are due to male factors, and the remaining 1/3 are due to a mixture of both or unknown (or idiopathic) factors.

ADDITIONAL POINTS

- Age is not an absolute barrier to conception, there are other biological factors to consider.
- Female fertility peaks during the 20s, then declines gradually during the 30s.
- Conceiving may be difficult over the age of 40, but help is available.
Understanding Human Reproduction

The Menstrual Cycle

<table>
<thead>
<tr>
<th>MENSES</th>
<th>PROLIFERATIVE</th>
<th>SECRETORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>21</td>
<td>28</td>
</tr>
</tbody>
</table>

FOLLICULAR  LUTEAL
What is infertility?

Human reproduction understanding evaluation treatment ways to save

Your menstrual cycle plays a large role in conception. The hormones released during the menstrual cycle control the sequence of events leading to pregnancy. The typical menstrual cycle lasts for about 28 days and is divided into 3 distinct phases.

**FOLLICULAR PHASE—DAY 1 TO 13**
The hypothalamus and pituitary glands release follicle-stimulating hormone (FSH)

► FSH helps develop a follicle—a tiny fluid-filled sac in the ovary containing a maturing egg
► Follicles also secrete estrogen to produce mid-cycle changes in cervical mucus
► The pituitary gland decreases FSH levels to help prepare the cervical mucus to receive and nourish sperm

**OVULATORY PHASE—APPROXIMATELY 14 DAYS BEFORE YOUR NEXT CYCLE STARTS**
A woman usually releases a single mature egg each month—a process known as ovulation

► The ovulatory phase begins when luteinizing hormone (LH) levels drastically increase
  ▶ LH causes the follicle to break open and release the mature egg into the fallopian tube
  ▶ At this time, the cervical mucus is most receptive to sperm
► The best chances of conceiving are right before and during ovulation

**LUTEAL PHASE—DAY 15 TO 28**
During this phase, the follicle that produced the egg becomes the corpus luteum

► The corpus luteum produces progesterone, which prepares the lining of the uterus for implantation of the fertilized egg
Understanding Human Reproduction
Female Reproduction
The ovaries contain a woman’s lifetime supply of immature eggs—approximately 2 million eggs. They also produce the hormones estrogen and progesterone. The sperm and egg meet for fertilization in the fallopian tubes. A fertilized egg then attaches itself to the lining of the uterus and begins to develop. The vagina is the passage that leads from the outside of the body to the cervix—the opening to the uterus.4

**THERE ARE 3 LAYERS TO THE UTERUS THAT ARE IMPORTANT. THEY INCLUDE5:**

**Endometrium**
- Lines the uterine cavity
- Thickens in response to hormonal stimulation
- Sheds if no pregnancy occurs

**Myometrium**
- Middle muscular wall
- Forms the main mass of the uterus
- Source of muscular contractions during labor

**Perimetrium**
- Outermost wall of the uterus
Understanding Human Reproduction

Male Reproduction
THE HORMONES THAT REGULATE FEMALE REPRODUCTIVE FUNCTIONS ALSO REGULATE PRODUCTION OF SPERM IN MALES

- FSH stimulates sperm production
- LH stimulates testosterone to help maintain sperm production

SPERM ARE HIGHLY COMPLEX CELLS

- 23 chromosomes (haploid) are stored in the head; the tail enables movement
- Sperm are produced in the scrotum, which maintains a lower-than-normal body temperature to help sperm development
- Sperm pass from the testes to the epididymis—an organ that stores and nourishes sperm as they mature
- Sperm stored in the epididymis combine with fluid from the seminal vesicles and prostate gland to create semen

DURING INTERCOURSE

- A man releases semen from his penis into a woman’s vagina
- Sperm can live for 48 to 72 hours within the female reproductive tract, while retaining the ability to fertilize an egg
Understanding Infertility

Female Factors

- Uterine Septum
- Blockage of Fallopian Tube
- Polycystic Ovaries
- Polyps
- Fibroids
- Adhesions
- Other Causes
  - Infection
  - Endometriosis or Endometrioma
What is infertility?

Human reproduction understanding evaluation diagnosis ways to save

OVULATORY ISSUES\(^9,10\)

Approximately a quarter of infertility in women is caused by ovulation issues. Most of the time, it’s due to hormonal imbalances, caused by faulty communication between the brain and the glands responsible for releasing hormones. Sometimes, abnormal ovulation may also be associated with significant changes in weight, including extremely low body weight or being overweight.

PHYSICAL ISSUES\(^9\)

There are some physical problems that can cause fertility issues in women:

- **Blocked fallopian tubes** prevent the sperm and egg from unifying or they can prevent embryo implantation. There are many causes for this, including past infections or sexually transmitted diseases (STDs)
- **Cervical disorders** can prevent the sperm from entering the uterus
- **Endometriosis** causes cells that normally line the uterine cavity to also implant outside the uterus on the ovaries or other pelvic organs, and is found in about 35% of women who have no other diagnosable infertility problem
- **Polycystic Ovary Syndrome (PCOS)** is a condition in which cysts develop in the ovaries due to abnormal hormone levels, sometimes causing the ovaries to enlarge. It’s one of the leading causes of infertility in women
- **Uterine septum** is a congenital malformation in which the uterine cavity is partitioned
- **Fibroids** are noncancerous growths in the uterus that can develop during childbearing years
- **Polyps** are growths attached to the inner wall of the uterus that extend into the uterine cavity
- **Adhesions**, or scarring, are caused by surgery, endometriosis, or pelvic inflammatory disease

There are a number of biological issues that can cause infertility in women.

The **most important factor** in female infertility is the woman’s age. Fertility can decrease as much as 95% in women ages 40 to 45 years.
Understanding Infertility

Male Factors

Sperm Factors
Physical Factors
Other Factors
There are a number of biological issues that can cause infertility in men.

**SPERM ISSUES**

During intercourse, millions of sperm are deposited into the vagina, but only a few hundred will get close to the egg and have a chance to fertilize it. Many factors play a role in determining whether or not the sperm will succeed:

- Sperm count (number of sperm)
- Motility (ability to move, quality of movement, forward progression)
- Morphology (size and shape)

**PHYSICAL ISSUES**

There are some physical problems that can cause fertility issues in men:

- **Erectile dysfunction**: inability to get or sustain an erection
- **Undescended testis**: testis has not reached its normal position in the scrotum, causing it to function abnormally and potentially not produce sperm
- **Retrograde ejaculation**: ejaculate containing the sperm flows backward into the bladder instead of leaving the penis
- **Scrotal varicocele**: similar to varicose veins in the leg, this common testicular condition may hinder sperm production and lower sperm quality

**OTHER FACTORS**

- Environmental factors (such as heat, radiation, or chemicals) and/or medications can impact sperm
- Genetic (Klinefelter Syndrome, absence of vas deferens, etc.)
- Endocrine disorders
- Idiopathic
**Evaluation**

Female Evaluation—Cycle-Specific Blood Tests

**HORMONAL CYCLE**

- **LH or FSH (mIU/mL)**
  - LH levels rising in days prior to ovulation
  - Progesterone levels high 1 week after ovulation

- **ESTROGENS (pg/mL)**
  - LH or FSH (mIU/mL)
  - Progesterone levels high 1 week after ovulation

- **PROGESTERONE (ng/mL)**
  - LH or FSH (mIU/mL)
  - Estrogens
  - Progesterone

**DAY 1**

- Follicular phase
- Ovulation
- Luteal phase

**28**

- Follicular phase
- Ovulation
- Luteal phase
ANTI-MULLERIAN HORMONE (AMH) TESTING

AMH is produced by the follicles early in their development
- Lower AMH indicates decreased ovarian reserve
- Low AMH or high FSH do not mean there is no chance of successful conception; success rates may be lower

CYCLE-SPECIFIC TESTING

A number of tests can be performed at specific points in the hormonal cycle to confirm the physiologic changes characteristic of a healthy reproductive cycle. These tests include:
- LH levels in urine: LH levels rise in the days prior to ovulation; testing can reveal the LH surge
- Measuring progesterone levels: testing progesterone 1 week after ovulation should reveal high levels characteristic of the luteal phase
- Other tests include: FSH, E2, P4, HCG, TSH, and prolactin testing levels
**Evaluation**

Female Evaluation—Uterine Evaluation

*Hysterosalpingography*

*Laparoscopy*
Imaging tests can be used to examine the reproductive system to find the cause of infertility. Some of these tests allow indirect viewing of structures.

**UTERINE EVALUATION**

**Hysterosalpingography (HSG):** A procedure that uses radiography to visualize the openness of the uterine cavity and fallopian tubes
- Dye that appears opaque on x-ray is injected into the uterus
- If the image shows spillage, the fallopian tube is open
- If it does not show spillage, the fallopian tube is blocked

**Saline Infusion Sonohysterogram (SIS):** SIS is an ultrasound test to evaluate the uterus
- A catheter is placed within the cervix or lower part of the uterus
- A small amount of sterile fluid (saline) is injected
- A vaginal ultrasound is done, and abnormalities such as uterine polyps and small fibroids can be evaluated
- This test cannot determine if the fallopian tubes are open

**Office Hysteroscopy (OH):** OH involves inserting a small fiber-optic camera through the cervix and into the uterine cavity
- The uterine cavity is expanded by infusing a small amount of sterile fluid (saline) through a small channel in the hysteroscope
- Test provides information about the uterine cavity, lining, and can evaluate for polyps and fibroids inside the uterus
- OH cannot determine if the fallopian tubes are open

**Laparoscopy:** A procedure that allows a physician to view the outside of the uterus, ovaries, and fallopian tubes
- Used to diagnose conditions such as endometriosis, uterine fibroids, ovarian cysts, adhesions, ectopic pregnancy, and other structural abnormalities
- If an abnormality is detected, it can be corrected at that time by converting the laparoscope into an operative laparoscopy to avoid a second procedure

**UP NEXT:**
Male Evaluation
**Male Evaluation**

**Semen Analysis Example**

<table>
<thead>
<tr>
<th>WHO* LOWER REFERENCE LIMITS (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semen volume (amount):</strong></td>
</tr>
<tr>
<td><strong>Sperm concentration:</strong></td>
</tr>
<tr>
<td><strong>Total sperm number:</strong></td>
</tr>
<tr>
<td><strong>Total motility (rapid, slow, or nonprogressive movement):</strong></td>
</tr>
<tr>
<td><strong>Progressive motility (purposeful forward movement):</strong></td>
</tr>
<tr>
<td><strong>Normal morphology (structure):</strong></td>
</tr>
</tbody>
</table>

*World Health Organization.*
**Male Evaluation**

Semen Analysis Example

---

**ADDITIONAL SEMEN TESTS THAT MALES MIGHT UNDERGO INCLUDE:12**

- Testing for antibodies that bind to sperm
- Semen culture to check for infections
- Biochemical tests of sperm function
- Sperm deoxyribonucleic acid (DNA) fragmentation assay to determine the percentage of DNA fragmentation

---

The cornerstone of male evaluation is **semen analysis.**

As you can see in the following table, a semen analysis includes an evaluation of the **volume, concentration, number, motility, and morphology.**

Commonly used criteria for semen analysis published by the WHO* in 2009 are presented in the table. Note that these criteria reflect the lower limits of normal.

*World Health Organization.*
Diagnosis

Ovulation Disorders

- Diminishing Ovarian Reserve (DOR)
- Primary Ovarian Insufficiency (POI)
- Functional Hypothalamic Amenorrhea (FHA)
OVULATION DISORDERS
The most important factor in female infertility is the woman’s age.

DIMINISHED OVARIAN RESERVE (DOR)
- Women are born with a finite number of oocytes (1 to 2 million at birth)
- The ovarian reserve decreases through reproductive years
- Fertility in women peaks between the ages of 20 and 24
- Fertility can decrease as much as 95% in women aged 40 to 45 years

PRIMARY OVARIAN INSUFFICIENCY (POI)
- POI is the dysfunction of ovaries before age 40
- Amenorrhea (the absence of menstruation)
- Hypoestrogenism (lack of estrogen)
- Elevated serum gonadotropin levels in women younger than 40 years
- Most women with POI have intermittent ovarian function, and pregnancy may occur

FUNCTIONAL HYPOTHALAMIC AMENORRHEA (FHA)
- FHA is a form of chronic anovulation (when the ovaries don’t release an oocyte during the menstrual cycle) due to impairment of gonadotropin-releasing hormone (GnRH)
- Often associated with stress, weight loss, excessive exercise, or a combination of these
- May be reversed with a multidisciplinary approach, including dietary, medical, and mental health support
Diagnosis (continued)

Ovulation Disorders—Polycystic Ovary Syndrome (PCOS)

Enlarged Follicle in Normal Ovary

Cysts on Polycystic Ovary
CAUSE
Polycystic ovary syndrome (PCOS) causes the ovaries to secrete abnormally high amounts of androgens (male hormones) that often cause problems with ovulation. Women with PCOS have enlarged ovaries that contain small cysts.

SYMPTOMS
PCOS can be completely asymptomatic. More often, the following symptoms are present:
▶ Weight gain or obesity
▶ Excessive hair and/or abnormal hair growth patterns
▶ Irregular periods or a complete absence of menstruation (amenorrhea)
▶ Acne
▶ Oily skin
▶ Enlarged ovaries or multiple ovarian cysts on the outermost edge of the ovary as seen by ultrasound

TREATMENT
In mild cases, your healthcare provider may suggest a reduced-fat and carbohydrate diet, along with aerobic exercise
▶ If PCOS is severe, healthcare providers will prescribe drug therapies
  ▶ Ovulation-inducing drugs can help the ovaries release eggs
  ▶ Insulin-regulating drugs may correct ovulatory problems
Almost 40% of women with infertility have endometriosis. Endometriosis occurs when tissue forms outside of the uterus. Endometriosis may grow on the outside of your uterus, ovaries, and fallopian tubes. The tissue growth can cause pain and adhesions.
Pelvic Inflammatory Disease (PID)
A condition in which the upper reproductive organs in a woman become infected. The disease can affect the lining of the uterus, ovaries, and fallopian tubes.

Endometriosis
Endometriosis results when menstrual bleeding flows backwards through the fallopian tubes and grows outside the uterus. It can block the fallopian tubes and prevent the sperm from reaching and fertilizing the egg.

PID SYMPTOMS INCLUDE
- Excessive bleeding, pain, cramps, and fever

PID CAUSES
- Older types of intrauterine devices have been associated with PID, fallopian tube scarring, and uterine damage
- May be caused by introduction of bacteria into the uterus when IUD is inserted
- Sexually transmitted diseases (STDs) have also been linked to PID

PID TREATMENT
- Antibiotic therapy is the preferred treatment for PID
- Some scar tissue (adhesions) may be removed by laparoscopy or laparotomy
- If the uterus has been affected, a hysteroscopy may be performed to correct the damage

ENDOMETRIOSIS SYMPTOMS
Soreness during intercourse and painful, heavy menstrual periods. Some cases are totally without symptoms.

ENDOMETRIOSIS CAUSE
The cause is not clear, but a leading theory is retrograde menstruation. Researchers also think that it could be genetic, since female family members sometimes share the condition.

ENDOMETRIOSIS TREATMENT
- Drug treatment: The least-invasive treatment uses drugs or other gonadotropin-releasing hormone (GnRH) agonists to suppress the pituitary gland and the secretion of hormones that may cause endometriosis
- Surgery: A laparoscopy or laparotomy can surgically remove endometrial implants or adhesions that result from endometriosis
- Assisted Reproductive Technology (ART): In vitro fertilization (IVF) is recommended when the fallopian tubes have been damaged. However, the more severe the endometriosis, the lower the chance of conception
Diagnosis (continued)

Hypothalamic/Pituitary Disorders

- **GONADOTROPIN-RELEASING HORMONE**
- **HYPOTHALAMUS**
- **CEREBRAL CORTEX**
- **PITUITARY**
- **PITUITARY**
- **PITUITARY**
- **POSITIVE FEEDBACK**
- **NEGATIVE FEEDBACK**
- **OVARY**
- **OVARY**
- **OVARY**
- **UTERUS**
- **UTERUS**
- **UTERUS**

- **LH**
- **FSH**
- **ESTROGEN + PROGESTERONE**
- **ESTROGEN**

**WHAT IS INFERTILITY?**

**HUMAN REPRODUCTION UNDERSTANDING EVALUATION TREATMENT WAYS TO SAVE**
Hyperprolactinemia is the excessive production of the hormone prolactin (responsible for milk production). An excess of prolactin can suppress ovulation and be symptomatic of hypothyroidism (when the body lacks thyroid hormone) or luteal phase defects.13

SYMPTOMS13
Symptoms include production of breast milk by non-nursing women and anovulation, or lack of ovulation.

CAUSES13
- Tumors on the pituitary gland (known as prolactinomas)
- Thyroid gland disorder
- Surgical scars on the chest wall, and other chest wall irritations (such as shingles)
- Medications including some tranquilizers, blood pressure medications, and anti-nausea drugs
- Oral contraceptives and recreational drugs

TREATMENT13
A blood test can detect elevated prolactin levels. An MRI of the head may be necessary to rule out a pituitary tumor. Both drug-based and surgical methods are used to treat hyperprolactinemia:
- Bromocriptine is used to reduce excessive prolactin levels
- Clomiphene is used to induce ovulation
- Surgery is used to remove tumors

UP NEXT:
Treatment Options
Most infertility cases—85% to 90%—are treated with conventional medical therapies such as medication or surgery.
What is infertility?

Human reproduction understanding infertility evaluation treatment ways to save

IN THE CASE OF FEMALE INFERTILITY, MEDICATIONS ARE USED TO HELP STIMULATE OVULATION

Surgery may be necessary in order to:

- Remove uterine fibroids, polyps, or scarring
- Repair a uterine septum
- Repair fallopian tubes (however, success rates are usually low)
- Repair patches of the endometrium

IN THE CASE OF MALE INFERTILITY, MEDICATIONS ARE USED TO HELP WITH HORMONE IMBALANCES AND ERECTILE DYSFUNCTION

- Hormone injections may also be used to increase testosterone and sperm

Surgery may be necessary in order to:

- Repair blockages of male reproductive tract
- Repair a varicocele
- Percutaneous epididymal sperm aspiration (PESA), or testicular sperm aspiration (TESA), or testicular sperm extraction (TESE)

Where the treatment options overlap is something called assisted reproductive technologies, or ART. Types of ART procedures include:

- Intrauterine insemination (IUI)
- In vitro fertilization (IVF)
- Third-party-assisted (donor sperm) ART

Most infertility cases—85% to 90%—are treated with conventional medical therapies such as medication or surgery.
Treatment Options (continued)

Ovulation Induction (OI)

- Stimulation
- Control
- Egg Release
**Ovulation Induction (OI)** is the process of administering drugs to help induce ovulation.

---

**THERE ARE 3 PHASES TO THIS:**

- **Stimulation:** The ovaries are stimulated with medication to promote the growth of follicles.
- **Control:** The response of the ovaries is monitored with ultrasounds and/or blood tests, to control the size and quantity of follicles.
- **Egg release:** To assist with the final maturation of the egg and loosening of the egg from the follicle wall, an injection of human chorionic gonadotrophin (hCG) is sometimes administered.

After OI, a pelvic ultrasound is performed near ovulation time to show developing follicles. The appropriate days to have sexual intercourse to maximize the chance of fertilization are then determined.

Your healthcare provider will recommend either timed intercourse or other methods of conception, depending on your history, evaluation, and diagnosis.
Insemination can happen 2 ways:

- **Insemination (fresh sperm)**
- **Insemination (frozen sperm)**

**Artificial Insemination—Intrauterine Insemination (IUI)**
SPERM COLLECTION

If your partner’s sperm is used:
- An optimal sample can be collected after abstaining for 2 to 4 days
- Sample is analyzed and processed to concentrate the motile sperm and to remove debris and immotile sperm

If a donor sperm is used:
- Sperm is obtained from either a recipient-recruited donor (known donor) or a patient/clinic-recruited donor (unknown donor)
- Donated sperm is required for couples who are unable to achieve pregnancy due to male infertility

Once sperm is collected:
- A concentrated, washed sample of motile sperm is used for insemination
- The final sperm preparation is gently inserted into the uterine cavity using a speculum and a disposable catheter to bypass the cervix

Your healthcare provider may recommend *intrauterine insemination, or IUI*, based on your medical history, evaluation, and diagnosis.

*IUI* is a medical procedure in which *sperm is placed into the woman’s uterus* to facilitate fertilization.
Treatment Options (continued)

In Vitro Fertilization (IVF)

Fertilization through IVF involves:

- Egg retrieval
- Insemination
- Fertilization (IVF or ICSI)
- Incubation
- PGD/PGS (optional)
- Embryo transfer
- Vitrification
ANOTHER TREATMENT OPTION IS IN VITRO FERTILIZATION

From there, the IVF process includes:

- **Insemination:**
  - **Microdrop**: The sperm sample is washed and concentrated, then added to the eggs
  - **Intracytoplasmic Sperm Injection (ICSI)**: A single sperm is injected directly into each egg

- **Fertilization**: The dishes are placed in an incubator and checked for fertilization 16-18 hours after insemination

- **Culture**: Embryos are grown in a lab for 3-6 days, but can vary depending on the lab

- **Preimplantation Genetic Diagnosis (PGD) or Preimplantation Genetic Screening (PGS)**: Tests to identify genetic defects within embryos prior to implantation. A genetic counselor can tell you more

- **Embryo transfer**: The embryo chosen for transfer is loaded into a transfer catheter which is passed through the cervix into the uterus, and gently released. Generally, only 1 embryo is transferred; in exceptional cases 2 are transferred

- **Vitrification**: The good quality embryos that are not transferred are frozen and stored. Frozen embryos can be used in subsequent cycles if the first cycle is not successful

After the embryo transfer, your healthcare provider may recommend a period of limited activity post transfer. Two weeks after embryo transfer, a blood test will determine whether you are pregnant or not.
Treatment Options (continued)

Third-Party Reproduction

- Donor Sperm
- Donor Egg (Fresh or Frozen)
- Shared Donor Egg
- Gestational Carrier
WHAT IS INFERTILITY?

HUMAN REPRODUCTION UNDERSTANDING INFERTILITY EVALUATION DIAGNOSIS TREATMENT

IF YOU DECIDE TO GO THROUGH THIRD-PARTY REPRODUCTION, YOU HAVE MANY OPTIONS. THESE INCLUDE:

- **Donor sperm**: Commonly used by single women, same-sex female couples, and couples with severe male factor infertility. Donor sperm treatment can offer options for conception.
- **Donor egg**: If unable to become pregnant with your own eggs, donor eggs can help you conceive and grow your family.
- **Shared donor egg**: By sharing an egg donor's cycle with another recipient, this program can help reduce the cost of donor egg treatment.
- **Gestational carrier**: Some may find themselves unable to carry a pregnancy to term. An arrangement could be made in which a woman carries and delivers a baby for another person or couple.
REFERENCES


WHAT IS INFERTILITY?

HUMAN REPRODUCTION UNDERSTANDING INFERTILITY VALUATION DIAGNOSIS TREATMENT

©2017 EMD Serono, Inc.
US/GON/0817/0030