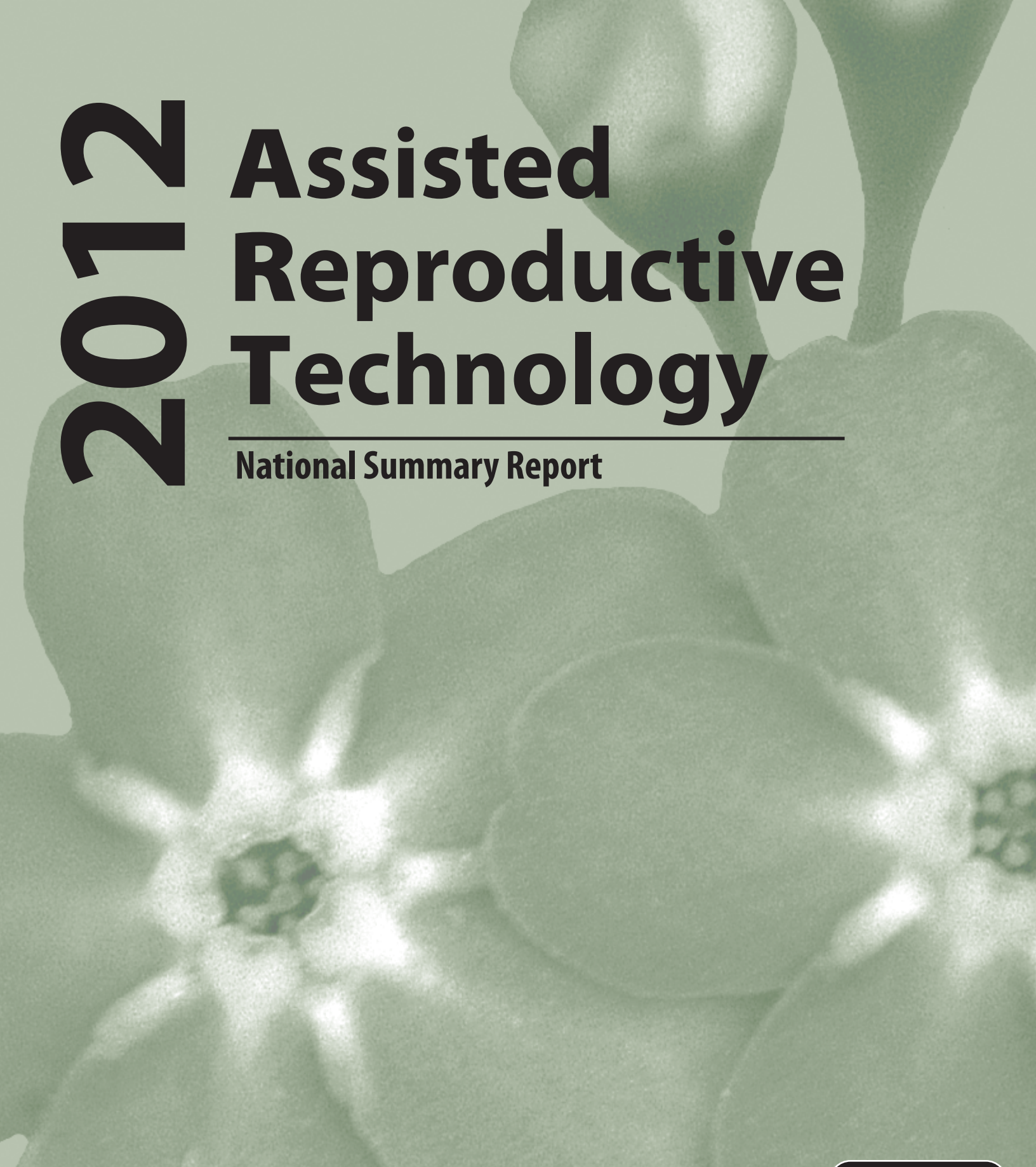
2012

Assisted Reproductive Technology

National Summary Report



National Center for Chronic Disease Prevention and Health Promotion
Division of Reproductive Health

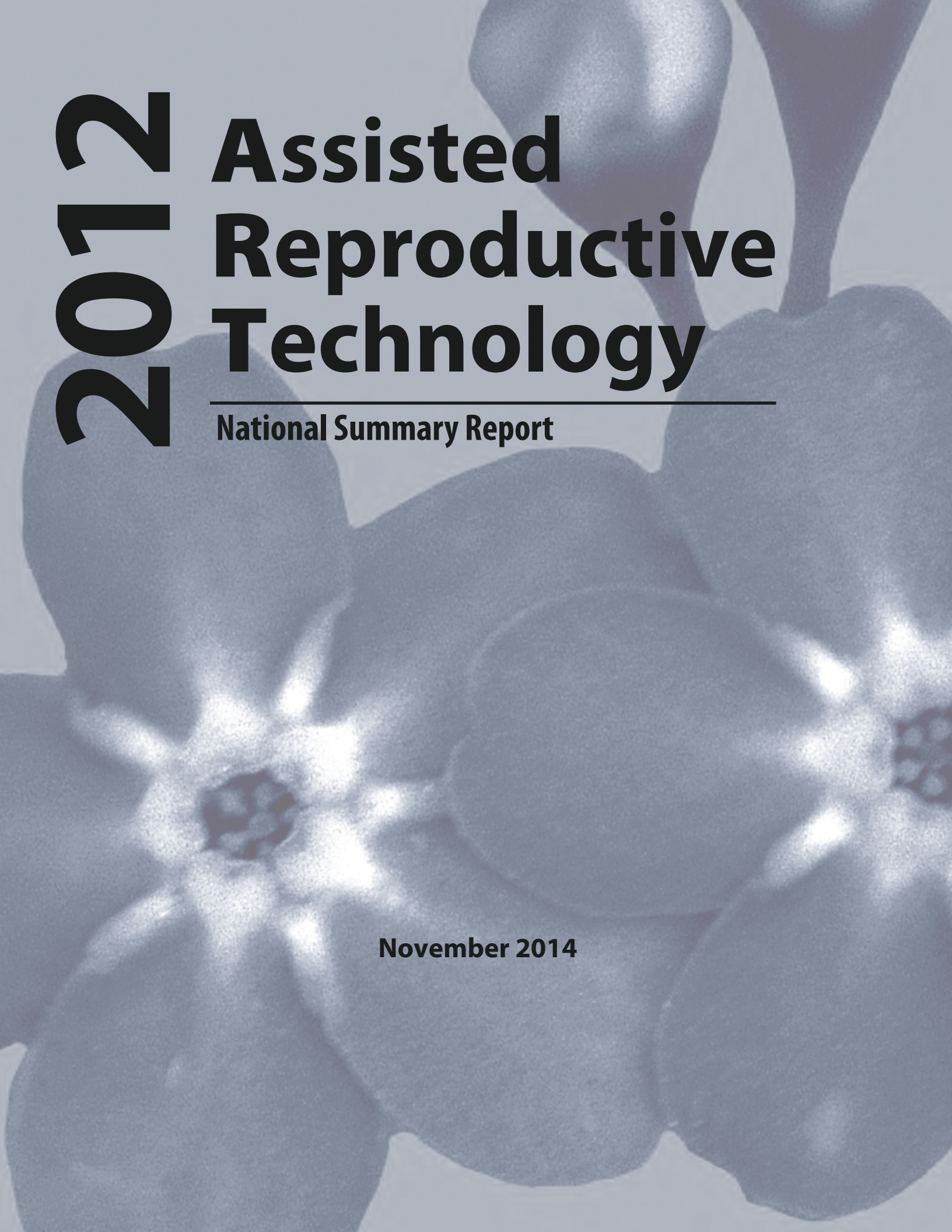
Updates to this report will be posted on the CDC Web site at the following address:

http://www.cdc.gov/art/ART2012

For additional information, send an e-mail to cdcinfo@cdc.gov (Subject: ART)

Or write to CDC, ATTN: ART Surveillance and Research Team

4770 Buford Highway, N.E.; Mail Stop F-74; Atlanta, GA 30341-3717.



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November 2014

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2012

National Report

INTRODUCTION TO THE 2012 NATIONAL REPORT

Data provided by United States clinics that use assisted reproductive technology (ART) to treat infertility are a rich source of information about the factors that contribute to a successful ART treatment—the delivery of a healthy live-born infant. Pooling the data from all reporting clinics provides an overall national picture that could not be obtained by examining data from an individual clinic.

A woman's chances of having a pregnancy and a live birth when using ART are influenced by many factors, some of which are patient-related and outside a clinic's control (e.g., the woman's age, the cause of infertility). Because the national data set includes information on many of these factors, it can give potential ART users an idea of the average chances of success. Average chances, however, do not necessarily apply to a particular individual or couple. People considering ART should consult their physician to discuss all the factors that apply in their particular case.

The data for this national report come from the 456 fertility clinics in operation in 2012 that provided and verified data on the outcomes of all ART cycles started in their clinics. Of the 176,247 ART cycles performed in 2012 at these reporting clinics, 157,662 cycles were performed with the intent to transfer at least one embryo. These 157,662 cycles resulted in 51,267 live births (deliveries of one or more living infants) and 65,160 infants. Of the 176,247 cycles performed in 2012, 18,585 cycles were started with the intent of cryopreserving (freezing and banking) all resulting eggs/embryos for potential future use. However, because these cycles did not result in an embryo transfer, they are not included in the majority of this national report. The 176,247 total cycles performed in 2012 excludes 27 cycles started in which a new treatment procedure was being evaluated.

The 2012 National Summary table on page 5 combines data from all 176,247 ART cycles reported by the 456 clinics included in the *2012 Assisted Reproductive Technology Fertility Clinic Success Rates Report* (hereafter called the *2012 Fertility Clinic Success Rates Report*). For an explanation of how to read this table, see pages 11–22 of the *2012 Fertility Clinic Success Rates Report* available at http://www.cdc.gov/art/ARTReports.htm.

The national report consists of graphs and charts that use 2012 data to answer specific questions related to ART success rates. These figures are organized according to the type of ART procedure used. Some ART procedures use a woman's own eggs, and others use donated eggs or embryos. (Although sperm used to create an embryo also may be either from a woman's partner or from a sperm donor, information in this report is presented according to the source of the egg.) In some procedures, the embryos that develop are transferred back to the woman (fresh embryo transfer); in others, the embryos are frozen (cryopreserved) for transfer at a later date. This report includes data on embryos that might have been frozen in previous years, but were thawed and transferred in 2012.

The national report has five sections:

- Section 1 (Figures 1 through 5) presents information from all ART procedures reported with the intention to transfer at least one embryo (157,662 cycles of the 176,247 total ART cycles performed in 2012). Figures 1 through 3 (and Figure 44 in Section 5) are the only figures in this report that include data for ART cycles started with the intention of freezing and banking all resulting eggs or embryos (18,585 cycles of the 176,247 total). Figure 2 is the only figure in this report that includes additional cycles in which a new treatment procedure was being evaluated (27 total new treatment procedures in 2012 that are not counted as part of the 176,247 total ART cycles performed in 2012).
- Section 2 (Figures 6 through 34) presents information on the ART cycles that used only fresh nondonor eggs or embryos from nondonor eggs or, in a few cases, a mixture of fresh and frozen embryos from nondonor eggs (99,665 cycles resulting in 80,783 transfers).
- Section 3 (Figures 35 through 37) presents information on the ART cycles that used only frozen embryos from nondonor eggs (38,150 cycles resulting in 35,508 transfers).
- Section 4 (Figures 38 through 42) presents information on the ART cycles that used only donated eggs or embryos (19,847 cycles resulting in 18,154 transfers).
- Section 5 (Figures 43 through 56) presents trends in the number of ART procedures and success rates over the past 10 years, from 2003 through 2012.

2012 NATIONAL SUMMARY

For more information on how to interpret the statistics in this table, see pages 11–22 in the *2012 Assisted Reproductive Technology Fertility Clinic Success Rates Report.*

2012 ART CYCLE PROFILE

Type of ART and Procedural Factors[a]

IVF	>99%	With ICSI	68%
Unstimulated	1%	Used PGD	5%
Used gestational carrier	<1%		

Patient Diagnosis[b]

Tubal factor	14%	Uterine factor	6%	*Multiple Factors:*	
Ovulatory dysfunction	14%	Male factor	34%	Female factors only	12%
Diminished ovarian reserve	31%	Other factor	15%	Female & male factors	17%
Endometriosis	9%	Unknown factor	12%		

2012 ART SUCCESS RATES[c]

Total number of cycles performed:[d] 176,247 (includes 18,585 banking cycle(s))

Type of Cycle	Age of Woman <35	35–37	38–40	41–42	43–44	>44
Fresh Embryos from Nondonor Eggs						
Number of cycles	41,798	20,920	19,556	10,740	5,050	1,601
Percentage of cancellations	6.1	9.0	12.4	15.5	20.5	22.4
Average number of embryos transferred	1.9	2.1	2.4	2.8	3.0	2.7
Percentage of embryos transferred resulting in implantation	37.1	27.5	18.3	9.7	4.1	2.2
Percentage of elective single embryo transfer (eSET)	15.3	9.6	3.3	1.4	0.6	1.4
Outcomes per Cycle						
Percentage of cycles resulting in singleton live births	28.0	23.1	17.5	10.0	4.0	1.6
Percentage of cycles resulting in triplets or more live births	0.5	0.2	0.2	0.1	0.0	0.0
Percentage of cycles resulting in live births	40.5	31.3	22.2	11.7	4.5	1.8
Percentage of cycles resulting in pregnancy	46.6	37.8	29.6	19.6	9.6	4.6
Outcomes per Transfer						
Number of transfers	36,110	17,332	15,263	7,786	3,351	941
Percentage of transfers resulting in singleton live births	32.4	27.9	22.4	13.8	6.1	2.8
Percentage of transfers resulting in triplets or more live births	0.5	0.3	0.2	0.1	0.0	0.0
Percentage of transfers resulting in live births	46.9	37.8	28.4	16.1	6.7	3.1
Percentage of transfers resulting in pregnancy	54.0	45.6	37.9	27.0	14.5	7.8
Outcomes per Pregnancy						
Number of pregnancies	19,483	7,903	5,790	2,104	487	73
Percentage of pregnancies resulting in singleton live births	60.1	61.2	59.2	51.2	41.9	35.6
Percentage of pregnancies resulting in triplets or more live births	1.0	0.6	0.5	0.5	0.2	0.0
Percentage of pregnancies resulting in live births	86.8	82.8	74.9	59.7	46.2	39.7
Frozen Embryos from Nondonor Eggs						
Number of cycles	17,828	9,040	6,588	2,727	1,204	763
Number of transfers	16,804	8,397	6,041	2,508	1,078	680
Estimated average number of transfers per retrieval	1.4	1.2	0.9	0.7	0.5	0.4
Average number of embryos transferred	1.8	1.8	1.8	1.9	2.0	1.8
Percentage of embryos transferred resulting in implantation	34.3	31.7	26.7	20.1	14.4	12.1
Percentage of transfers resulting in singleton live births	31.9	31.2	26.7	22.0	15.3	10.1
Percentage of transfers resulting in triplets or more live births	0.4	0.2	0.2	0.1	0.1	0.0
Percentage of transfers resulting in live births	42.0	39.3	33.4	25.9	18.3	13.5
Percentage of transfers resulting in pregnancy	51.4	48.6	44.4	37.5	28.2	19.4

Donor Eggs	All Ages Combined[e] Fresh Embryos	Frozen Embryos
Number of cycles	10,954	8,893
Number of transfers	9,946	8,208
Average number of embryos transferred	1.8	1.8
Percentage of embryos transferred resulting in implantation	47.8	29.5
Percentage of transfers resulting in singleton live births	37.2	28.6
Percentage of transfers resulting in live births	56.4	37.0
Percentage of transfers resulting in pregnancy	66.0	46.7

CURRENT CLINIC SERVICES AND PROFILE

Number of reporting clinics: 456

Percentage of clinics that offer the following services:

Donor egg	93%	Gestational carriers	85%
Donor embryo	69%	Embryo cryopreservation	>99%
Single women	96%		

Clinic profile:

SART member	83%
Verified lab accreditation	
Yes	92%
No	7%
Pending	<1%

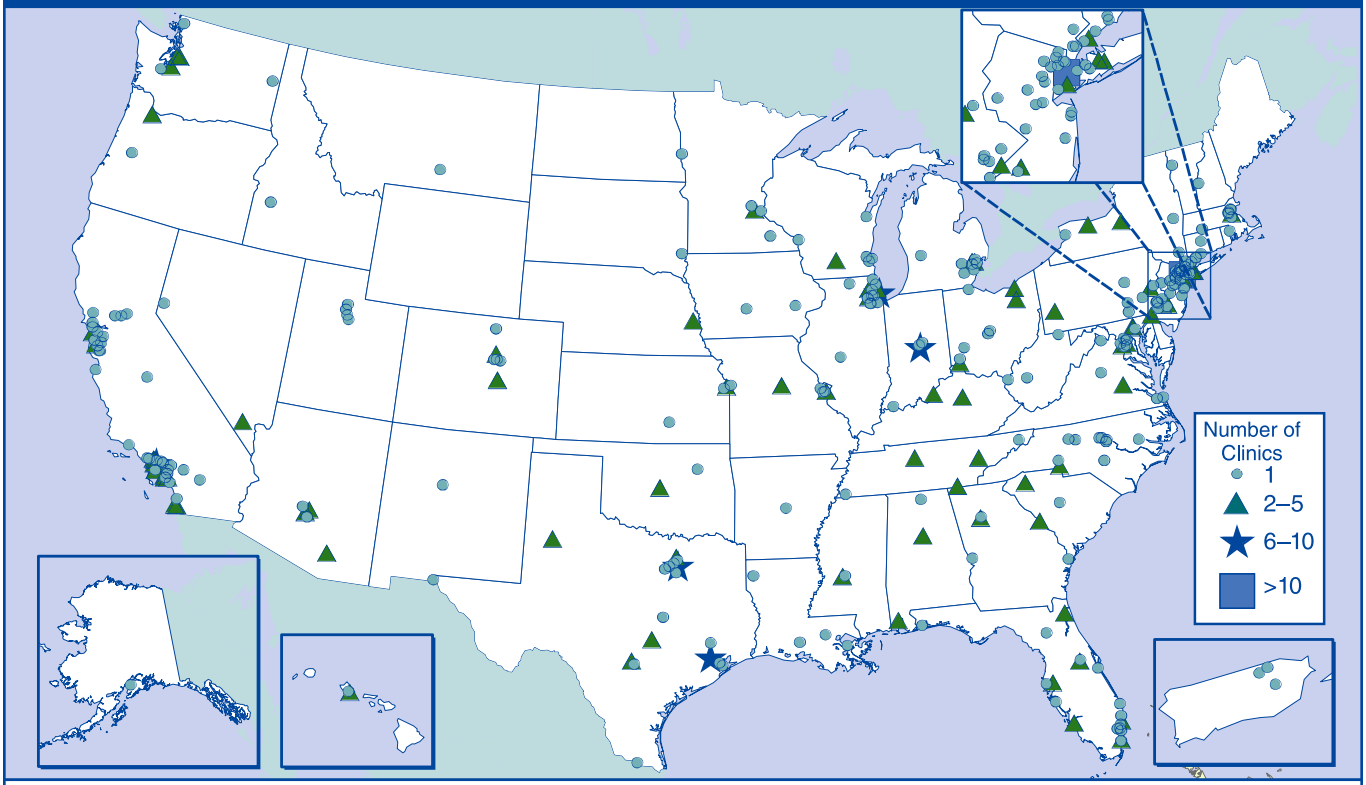
[a] Reflects features of fresh nondonor cycles. If IVF is <100%, the remaining cycles are GIFT, ZIFT, or a combination of these procedures with IVF.
[b] Total patient diagnosis percentages may be greater than 100% because more than one diagnosis can be reported for each cycle.
[c] A multiple-infant birth is counted as one live birth if at least one infant is live born.
[d] Number of cycles excludes 27 cycle(s) in which new procedures were evaluated.
[e] All ages are reported together because previous data show that patient age does not materially affect success with donor eggs.

SECTION 1: OVERVIEW

Where are United States ART clinics located, how many ART cycles did they perform in 2012, and how many infants were born from these ART cycles?

Although ART clinics are located throughout the United States, generally in or near major cities, the greatest number of clinics is in the eastern United States. Figure 1 shows the locations of the 456 reporting clinics. Individual clinic tables with success rates and clinic profiles are published in the *2012 Fertility Clinic Success Rates Report,* arranged in alphabetical order by state, city, and clinic name. The number of clinics, cycles performed, live-birth deliveries, and infants born as a result of ART all have increased steadily since CDC began collecting this information in 1995 (see Section 5, pages 49–62). Because in some cases more than one infant is born during a live-birth delivery (e.g., twins), the total number of infants born is greater than the number of live-birth deliveries. CDC estimates that ART accounts for slightly more than 1% of total US births.

Figure 1
Locations of ART Clinics in the United States and Puerto Rico, 2012



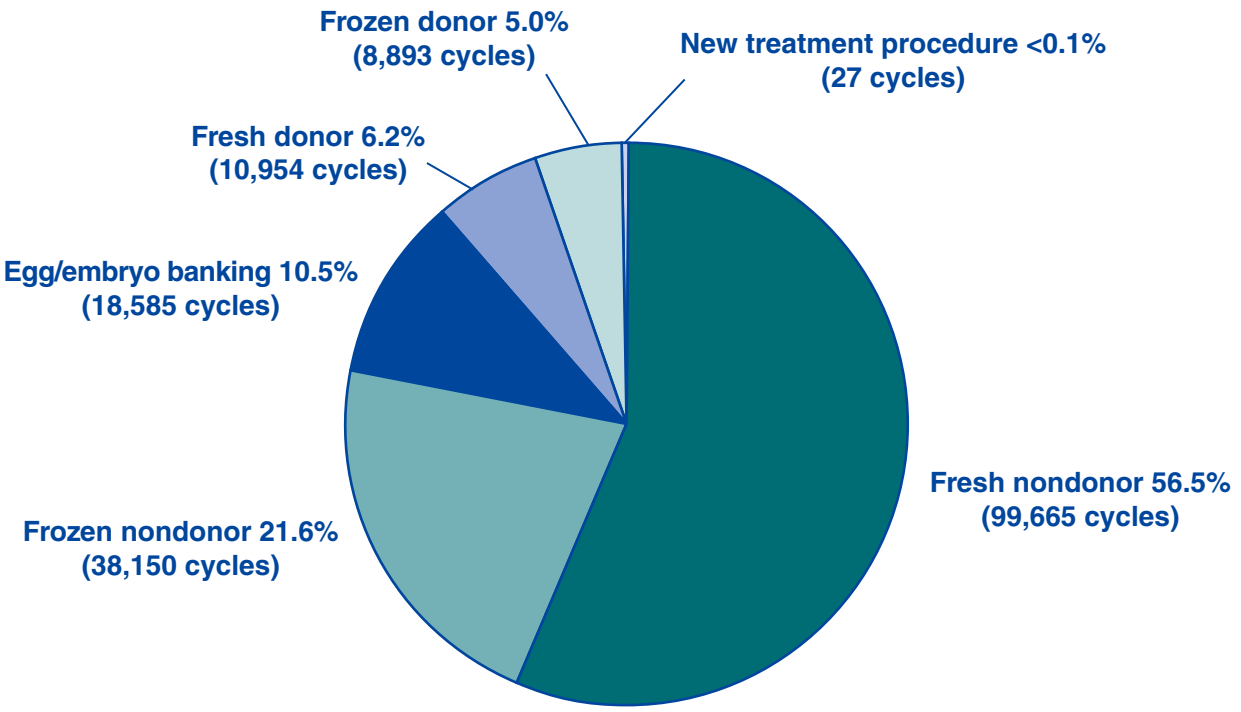
Number of ART clinics in the United States in 2012	486
Number of ART clinics that submitted data in 2012	456
Total number of ART cycles started in 2012 at clinics reporting data	176,247*
Number of live-birth deliveries resulting from ART cycles started in 2012	51,267
Number of infants born as a result of ART cycles started in 2012	65,160

* This number includes 18,585 cycles started with the intent to freeze and bank all resulting eggs/embryos. The remaining 157,662 cycles in 2012 were performed with the intent to transfer at least one egg/embryo, and this is the number of cycles from which data for live-birth deliveries and infants born are based. The 176,247 total cycles in 2012 does not include 27 cycles in which a new treatment procedure was being evaluated.

What types of ART cycles were performed in the United States in 2012?

Figure 2 shows the types of ART cycles performed in the United States in 2012. For approximately 57% of ART cycles performed, fresh nondonor eggs or embryos were used. ART cycles that used frozen nondonor embryos were the next most common type, accounting for approximately 22% of the total. In more than 11% of cycles, eggs or embryos were donated by another woman or couple. Almost 11% of cycles were performed with the intent of freezing and banking (cryopreserving) all resulting eggs/embryos for potential future use. A very small number of cycles (less than 1%) involved the evaluation of a new treatment procedure. Cycles in which a new treatment procedure was being evaluated are included only in this figure and are not included in the total number of cycles presented in this report or the *2012 Fertility Clinic Success Rates Report*. Cycles performed with the intent of banking all resulting eggs/embryos are included only in this figure, Figures 3 and 44 (see pages 9 and 50), and in the National Summary table (see page 5) of this report, and in a small number of clinic table statistics in the *2012 Fertility Clinic Success Rates Report*. Thus, data for 2012 presented in other figures in this report are based on 157,662 cycles performed with the intent to transfer at least one embryo (including fresh nondonor, frozen nondonor, fresh donor, and frozen donor cycles).

Figure 2
Types of ART Cycles—United States,* 2012

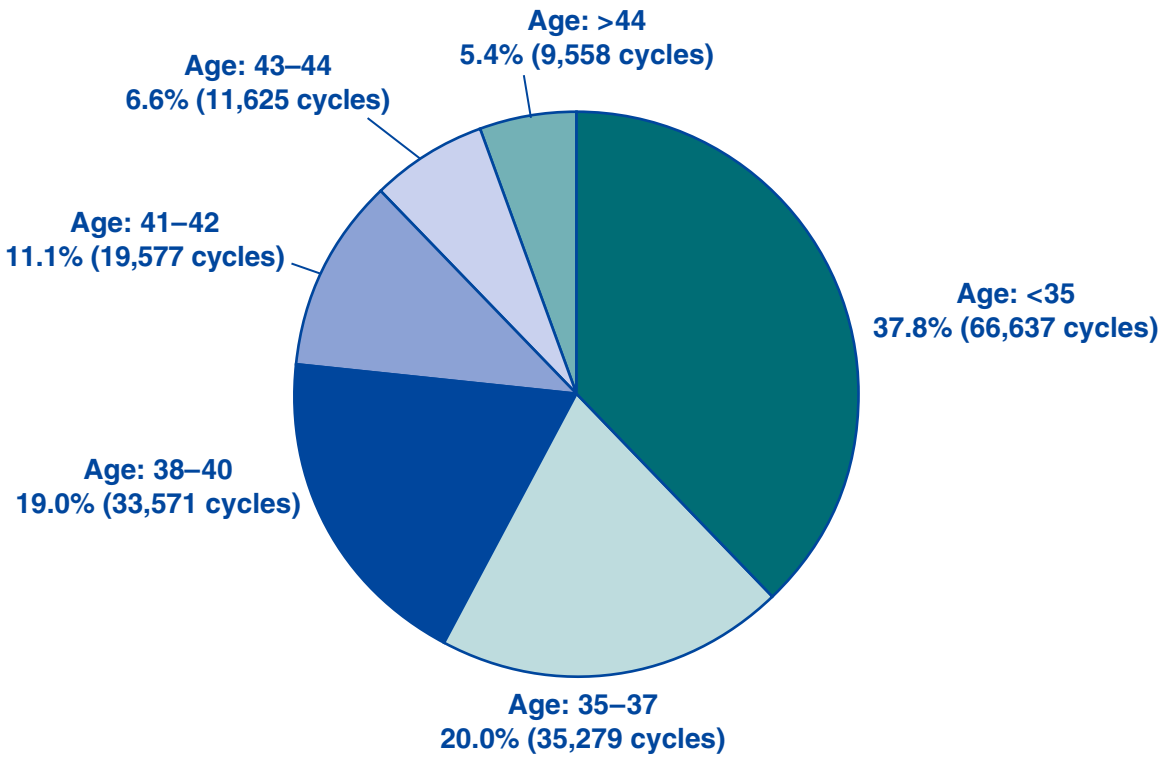


* Total does not equal 100% due to rounding.

How old were women who used ART in the United States in 2012?

Figure 3 presents ART cycles performed in the United States in 2012 according to the age of the woman who had the procedure. The average age of women using ART services in 2012 was 36. The largest group of women using ART services were women younger than age 35, representing approximately 38% of all ART cycles performed in 2012. Twenty percent of ART cycles were performed among women aged 35–37, 19% among women aged 38–40, 11% among women aged 41–42, 7% among women aged 43–44, and 5% among women older than age 44. Cycles performed with the intent of banking all resulting eggs/embryos are included only in this figure, Figures 2 and 44 (see pages 8 and 50), and in the National Summary table (see page 5) of this report, and in a small number of clinic table statistics in the *2012 Fertility Clinic Success Rates Report*. Thus, data for 2012 presented in other figures in this report are based on 157,662 cycles performed with the intent to transfer at least one embryo (including fresh nondonor, frozen nondonor, fresh donor, and frozen donor cycles).

Figure 3
ART Use by Age Group—United States,* 2012

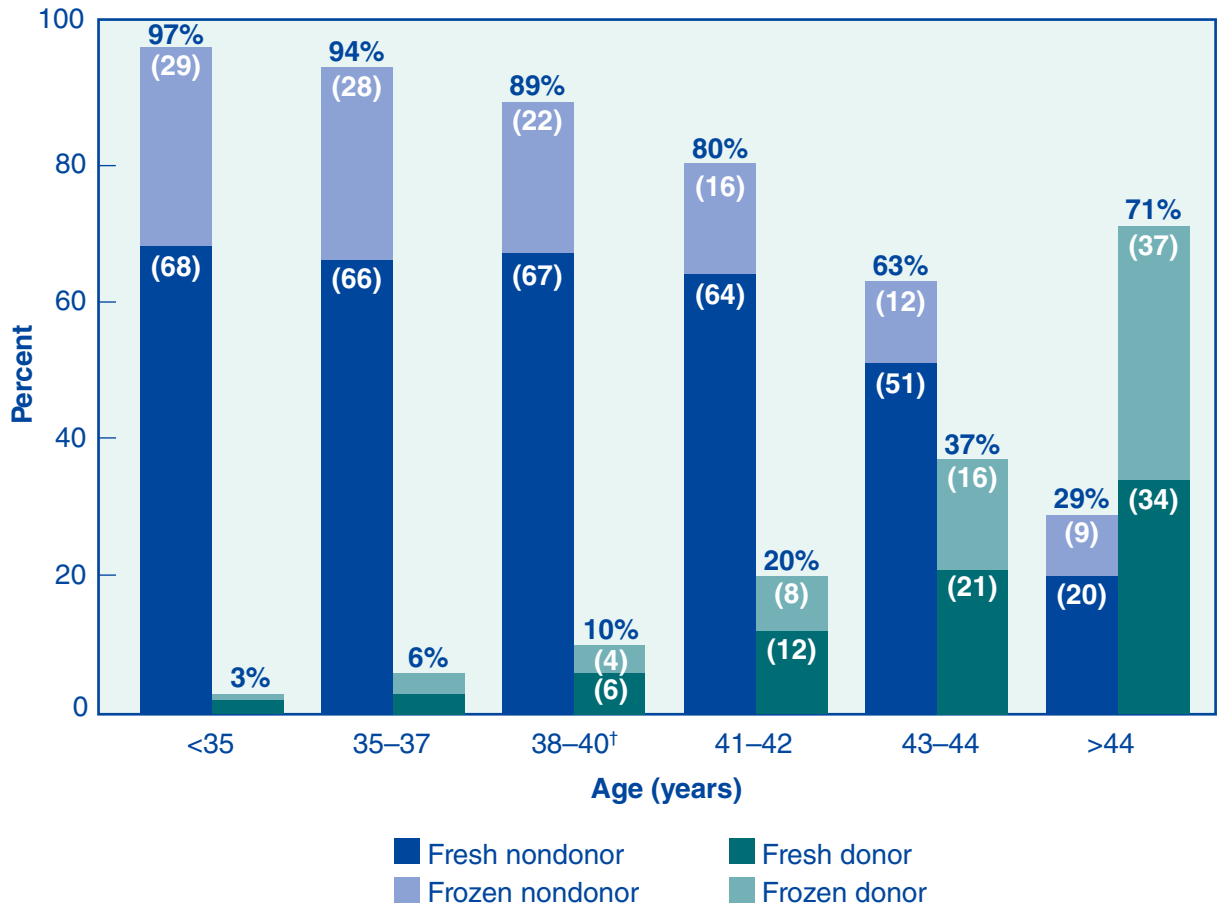


* Total does not equal 100% due to rounding.

How did the types of ART cycles performed in the United States in 2012 differ among women of different ages?

Figure 4 shows that, in 2012, the type of ART cycles varied by the woman's age. The vast majority (97%) of women younger than age 35 used their own eggs, whereas about 3% used donor eggs. In contrast, 37% of women aged 43–44 and 71% of women older than age 44 used donor eggs. More ART cycles using fresh eggs or embryos were performed than cycles using frozen embryos in all age groups.

Figure 4
Types of ART Cycles by Age Group—United States,* 2012



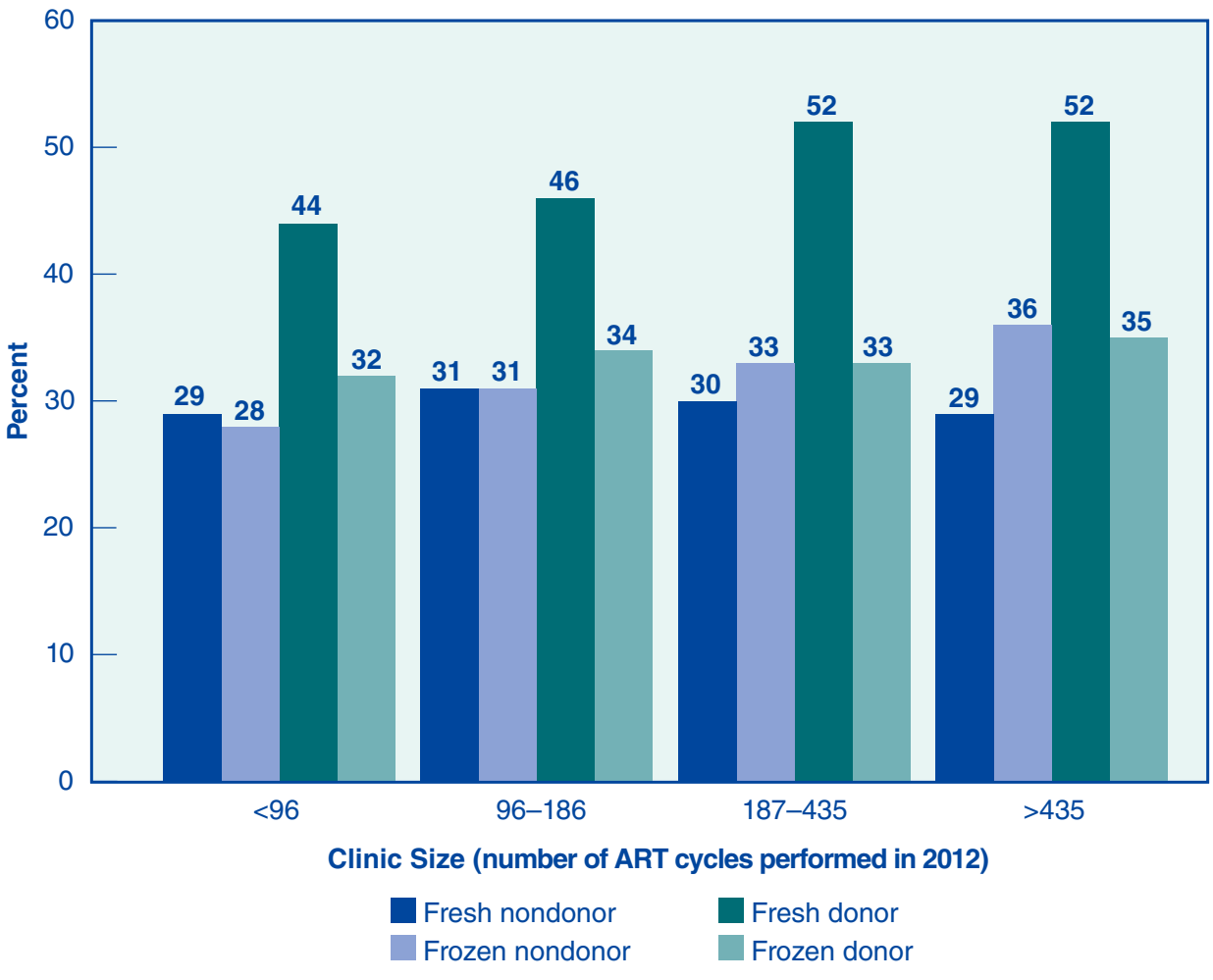
* Percentages of ART cycles that used fresh or frozen embryos from nondonor or donor eggs are in parentheses.
† Total does not equal 100% due to rounding.

How is clinic size related to percentages of ART cycles performed in the United States in 2012 that resulted in live births?

The number of ART procedures performed every year varies among fertility clinics in the United States. For Figure 5, clinics were divided equally into four groups (called quartiles) based on the number of ART cycles they performed in 2012. The percentage for each quartile by type of ART represents the average percentage of ART cycles that resulted in live births for clinics in that quartile.

In 2012, percentages of ART cycles that resulted in live births using frozen nondonor or fresh donor eggs or embryos generally increased as the clinic size increased from the lower to upper quartiles. Less variation is observed in the percentage of cycles resulting in live births by clinic size for fresh nondonor and frozen donor cycles.

Figure 5
Percentages of ART Cycles That Resulted in Live Births, by Type of ART and Clinic Size—United States, 2012



SECTION 2: ART CYCLES USING FRESH NONDONOR EGGS OR EMBRYOS

What are the steps for an ART cycle using fresh nondonor eggs or embryos?

Figure 6 presents the steps for an ART cycle using fresh nondonor eggs or embryos and shows how ART users in 2012 progressed through these stages toward pregnancy and live birth.

An ART **cycle is started** when a woman begins taking medication to stimulate the ovaries to develop eggs or, if no drugs are given, when the woman begins having her ovaries monitored (using ultrasound or blood tests) for natural egg production.

If eggs are produced, the cycle then progresses to **egg retrieval**, a surgical procedure in which eggs are collected from a woman's ovaries.

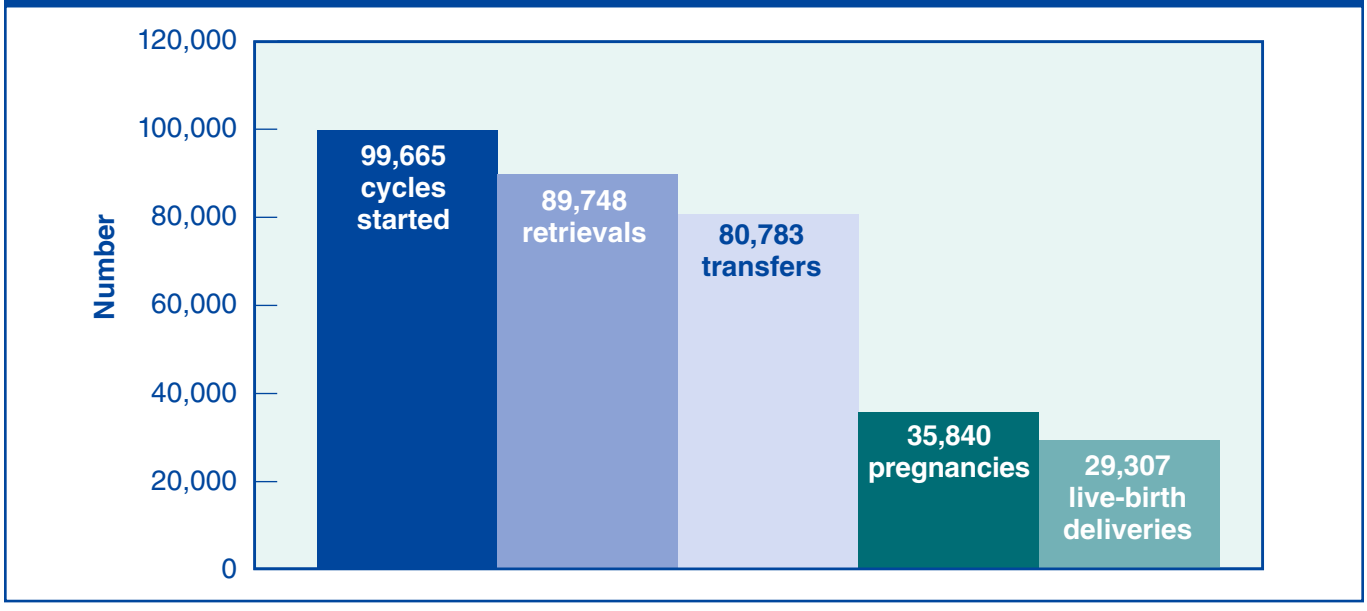
Once retrieved, eggs are combined with sperm in the laboratory. If fertilization is successful, one or more of the resulting embryos are selected for **transfer**, most often into a woman's uterus through the cervix (IVF), but sometimes into the fallopian tubes (GIFT or ZIFT) (see Appendix B: Glossary of Terms on pages 72–73 for descriptions of IVF, GIFT, or ZIFT).

If one or more of the transferred embryos implant within the woman's uterus, the cycle then may progress to clinical **pregnancy**.

Finally, the pregnancy may progress to a **live birth**, the delivery of one or more live-born infants. (The birth of twins, triplets, or more is counted as one live birth.)

A cycle may be stopped at any step for specific medical reasons (e.g., no eggs are produced, the embryo transfer was not successful) or by patient choice.

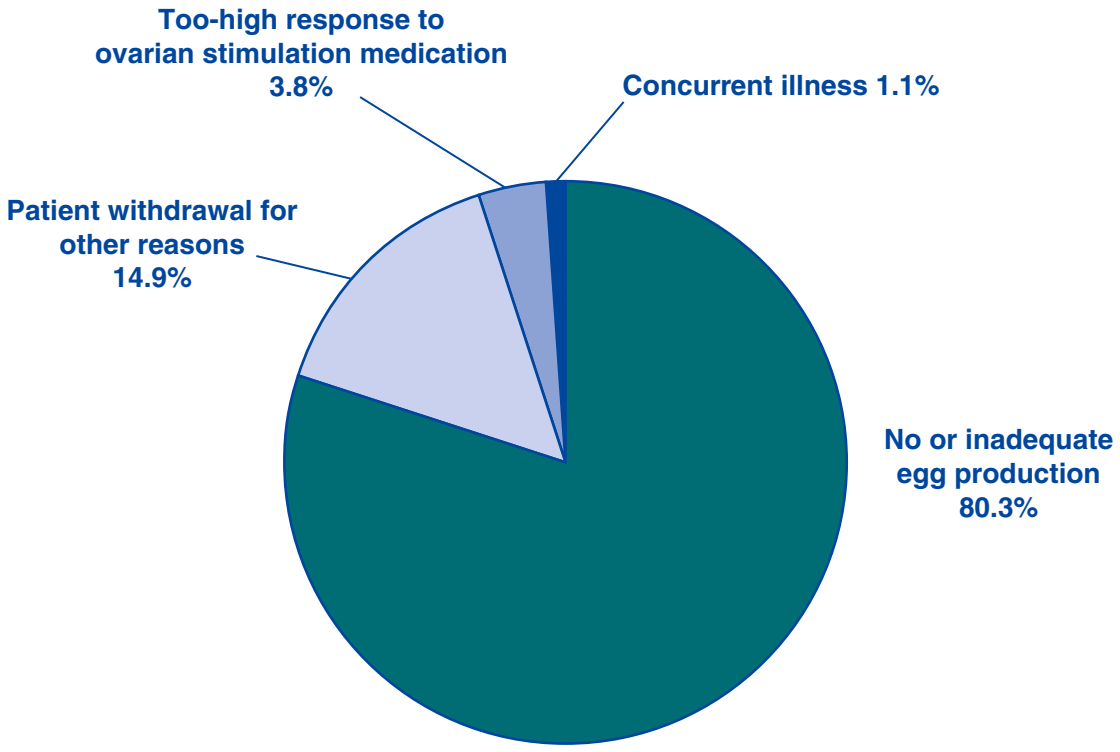
Figure 6
Outcomes of ART Cycles Using Fresh Nondonor Eggs or Embryos, by Stage, 2012



Why are some ART cycles canceled?

In 2012, a total of 9,917 ART cycles (about 10% of all 99,665 cycles using fresh nondonor eggs or embryos) were canceled before the egg retrieval step (see Figure 6, page 12). Figure 7 shows the reasons that the cycles were canceled. For approximately 80% of these cycles, there was no or inadequate egg production. Other reasons included a too-high response to ovarian stimulation medications (i.e., potential for ovarian hyperstimulation syndrome), concurrent illness, or patient withdrawal for other reasons.

Figure 7
Reasons ART Cycles Using Fresh Nondonor Eggs or Embryos Were Canceled,*† 2012



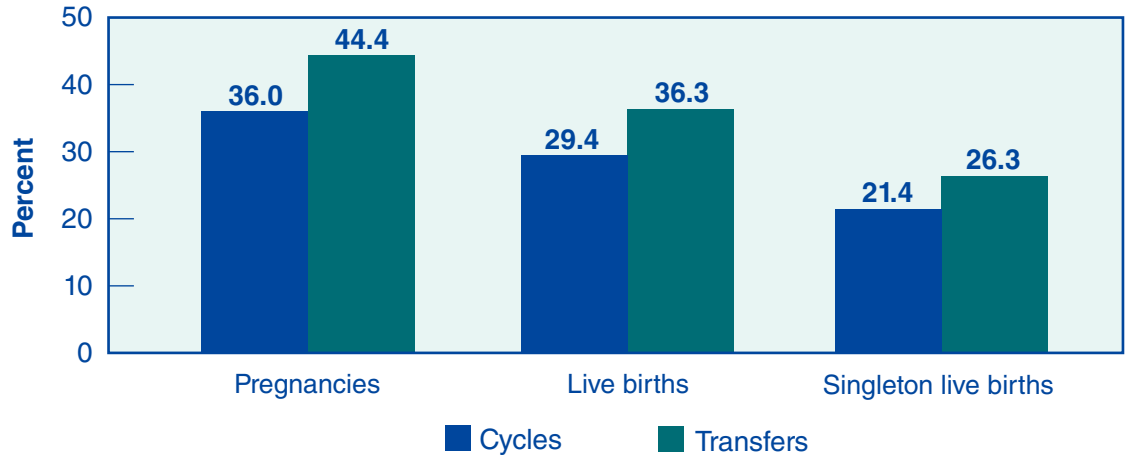
* Based on 9,917 ART cycles.
† Total does not equal 100% due to rounding.

How are success rates of ART measured?

Figure 8 shows success rates using six different measures for ART cycles using fresh nondonor eggs or embryos in 2012, each providing slightly different information. The majority of success measures have increased slightly since CDC began monitoring them in 1995 (see Section 5, pages 49–62).

- **Percentage of cycles that resulted in a pregnancy:** This is higher than the percentage of cycles that resulted in a live birth because some pregnancies end in miscarriage, induced abortion, or stillbirth (see Figure 10, page 16).
- **Percentage of transfers that resulted in a pregnancy:** This is higher than the percentage of cycles that resulted in a pregnancy because not all cycles proceed to transfer.
- **Percentage of cycles that resulted in a live birth (delivery of one or more live-born infants):** This represents the average chance of having one or more live-born infants by using ART. This is referred to as the basic live birth rate in the Fertility Clinic Success Rate and Certification Act of 1992.
- **Percentage of transfers that resulted in a live birth:** This is higher than the percentage of cycles that resulted in a live birth because not all cycles proceed to transfer.
- **Percentage of cycles that resulted in a singleton live birth:** This is important because singleton live births have a much lower risk than multiple-infant births for adverse infant health outcomes, including prematurity, low birth weight, disability, and death.
- **Percentage of transfers that resulted in a singleton live birth:** This is higher than the percentage of cycles that resulted in a singleton live birth because not all cycles proceed to transfer.

Figure 8
Percentages of ART Cycles and Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Pregnancies, Live Births, and Singleton Live Births, 2012

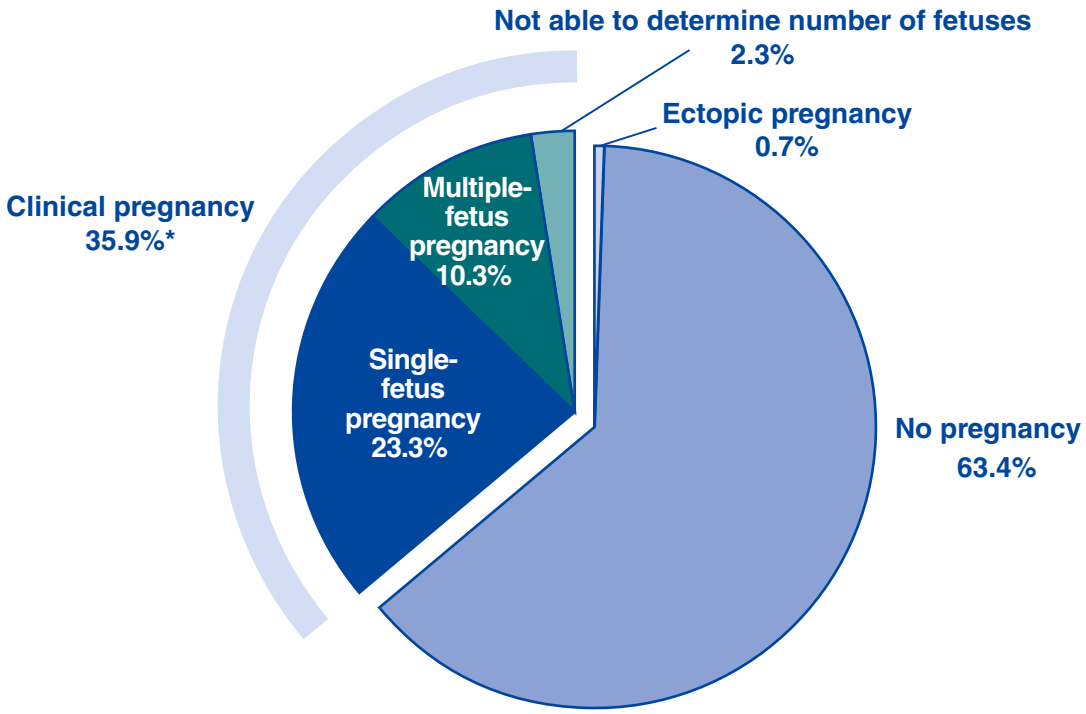


What percentage of ART cycles result in a pregnancy?

Figure 9 shows the outcomes of ART cycles in 2012 that used fresh nondonor eggs or embryos. Most of these cycles (approximately 63%) did not produce a pregnancy, a very small proportion (less than 1%) resulted in an ectopic pregnancy (the embryo implanted outside the uterus), and about 36% resulted in clinical pregnancy. Clinical pregnancies can be further subdivided as follows:

- 65% of clinical pregnancies resulted in a single-fetus pregnancy.
- 29% resulted in a multiple-fetus pregnancy.
- 6% ended before the number of fetuses could be accurately determined.

Figure 9
Outcomes of ART Cycles Using Fresh Nondonor Eggs or Embryos, 2012



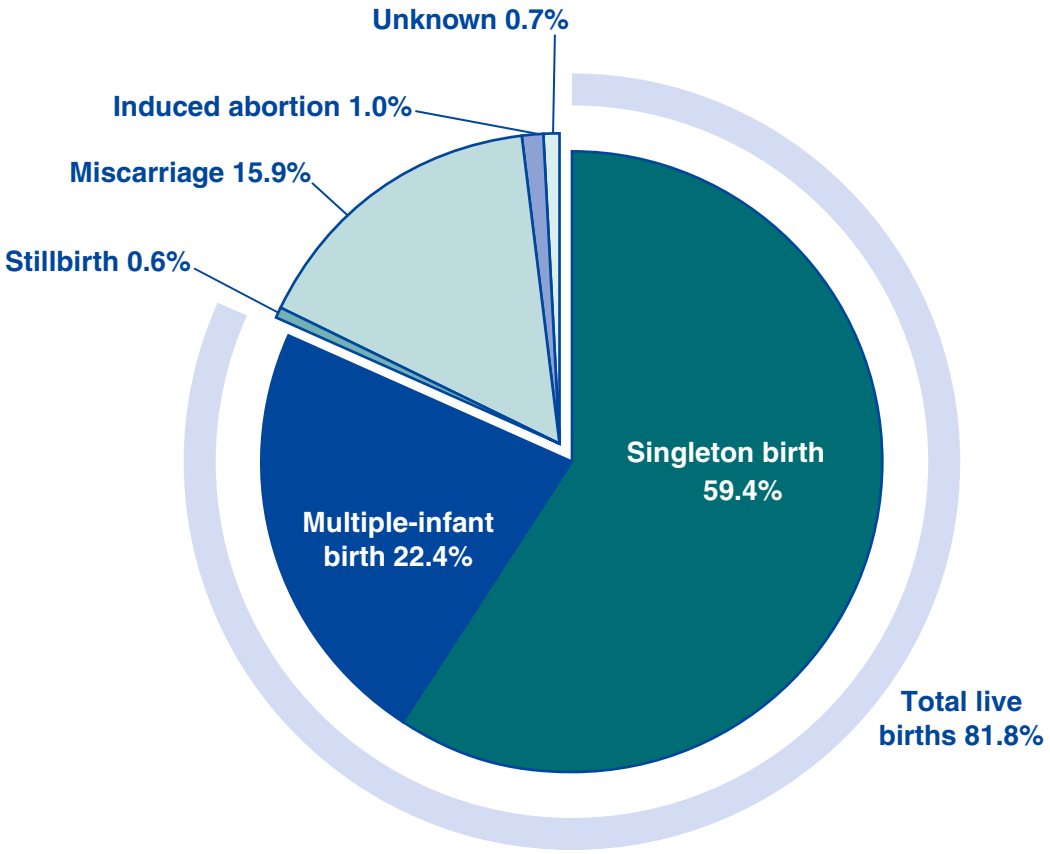
* The percentage of clinical pregnancies in Figure 9 is a result of summing rounded data, while the percentage of clinical pregnancies shown in Figure 8 (page 14) was calculated using raw data.

Using ART, what percentage of pregnancies result in a live birth?

Figure 10 shows the outcomes of pregnancies resulting from ART cycles using fresh nondonor eggs or embryos in 2012. Approximately 82% of the pregnancies resulted in a live birth (59% in a singleton birth and about 22% in a multiple-infant birth). About 18% of pregnancies resulted in miscarriage, stillbirth, induced abortion, or maternal death prior to birth. For less than 1% of pregnancies, the outcome was unknown.

Although the birth of more than one infant is counted as one live birth, multiple-infant births are presented here as a separate category because they often are associated with problems for both mothers and infants. Infant deaths and birth defects are not included as adverse outcomes because the available information for these outcomes is incomplete.

Figure 10
Outcomes of Pregnancies That Resulted from ART Cycles Using Fresh Nondonor Eggs or Embryos,* 2012



* Maternal deaths prior to birth are not displayed due to small number (n = 4).

What is the risk of a pregnancy with multiple fetuses or giving birth to multiple infants among ART pregnancies and live births resulting from fresh nondonor embryos?

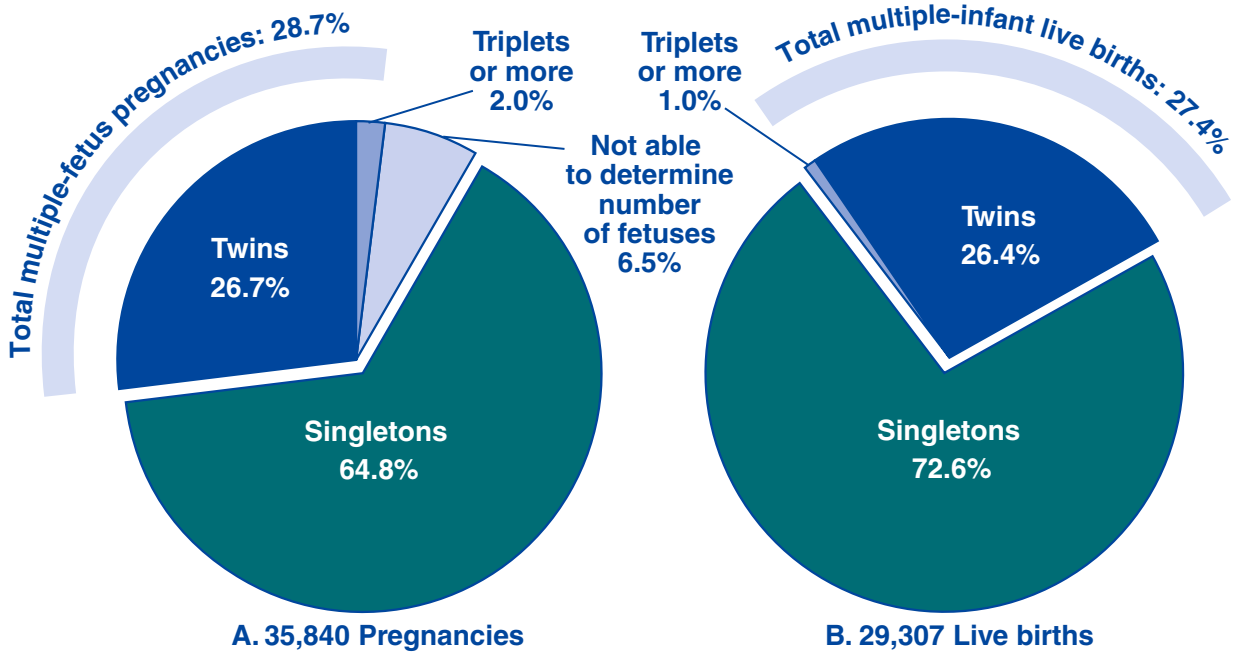
Multiple-infant births are associated with greater health problems for both mothers and infants, including higher rates of caesarean section, prematurity, low birth weight, and infant disability or death.

Part A of Figure 11 shows that among the 35,840 pregnancies that resulted from ART cycles using fresh nondonor eggs or embryos in 2012, approximately 65% were singleton pregnancies and 29% were multiple-fetus pregnancies. Approximately 7% of pregnancies ended before the number of fetuses could be accurately determined. Therefore, the percentage of pregnancies with more than one fetus might have been higher than what was reported.

In 2012, a total of 6,271 pregnancies resulting from ART cycles ended in either miscarriage, stillbirth, induced abortion, or maternal death, and 262 pregnancy outcomes were not reported. The remaining 29,307 pregnancies resulted in live births. Part B of Figure 11 shows that about 27% of these live births resulted in more than one infant (26% twins and about 1% triplets or more). This compares with a multiple-infant birth rate of slightly more than 3% in the general US population.

Although total percentages for multiples were similar for pregnancies and live births, there were more triplet or higher order pregnancies than births. Triplet or higher order pregnancies may be reduced to twins or singletons by the time of birth either naturally (e.g., fetal death), or if a woman and her doctor decide to reduce the number of fetuses through a procedure called multifetal pregnancy reduction. CDC does not collect information on multifetal pregnancy reductions.

Figure 11
Distribution of Multiple-Fetus Pregnancies and Multiple-Infant Live Births Among ART Cycles Using Fresh Nondonor Eggs or Embryos, 2012

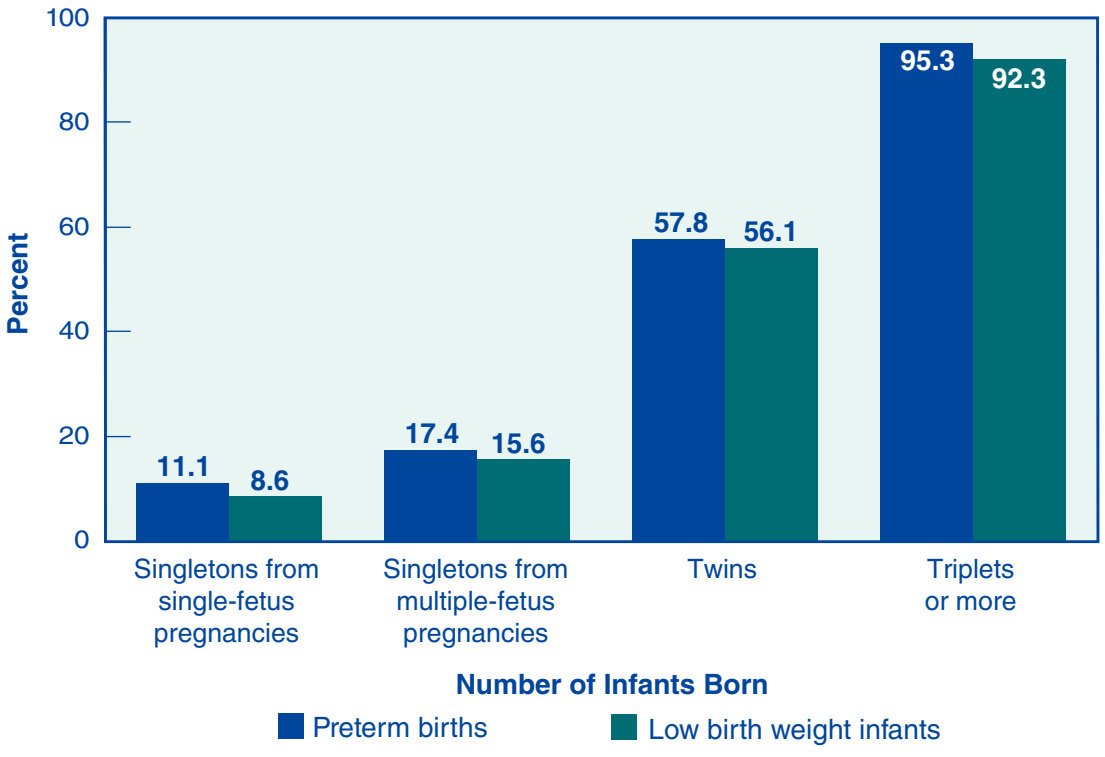


Using ART, what are the risks of having a preterm birth and low birth weight infant?

Preterm birth occurs when a woman gives birth before 37 full weeks of pregnancy. Low birth weight infants are born weighing less than 2,500 grams or about 5 pounds, 8 ounces. Infants born preterm or with low birth weight are at greater risk of death in the first few days of life, as well as other adverse health outcomes, including visual and hearing impairments, intellectual and learning disabilities, and behavioral and emotional problems throughout life. Preterm births and low birth weight infants also cause substantial emotional and economic burdens for families.

Figure 12 shows percentages of preterm births and low birth weight infants resulting from ART cycles that used fresh nondonor eggs or embryos in 2012, by number of infants born. For singletons, it shows separately the percentage of preterm birth and low birth weight among infants born from pregnancies that started with one fetus (single-fetus pregnancies) and with more than one fetus (multiple-fetus pregnancies). Among singletons, the percentage of preterm births and low birth weight infants was higher for those from multiple-fetus pregnancies. In the general US population, where singletons are almost always the result of a single-fetus pregnancy, 10% of singleton births were preterm and 6% of singleton infants had low birth weight.

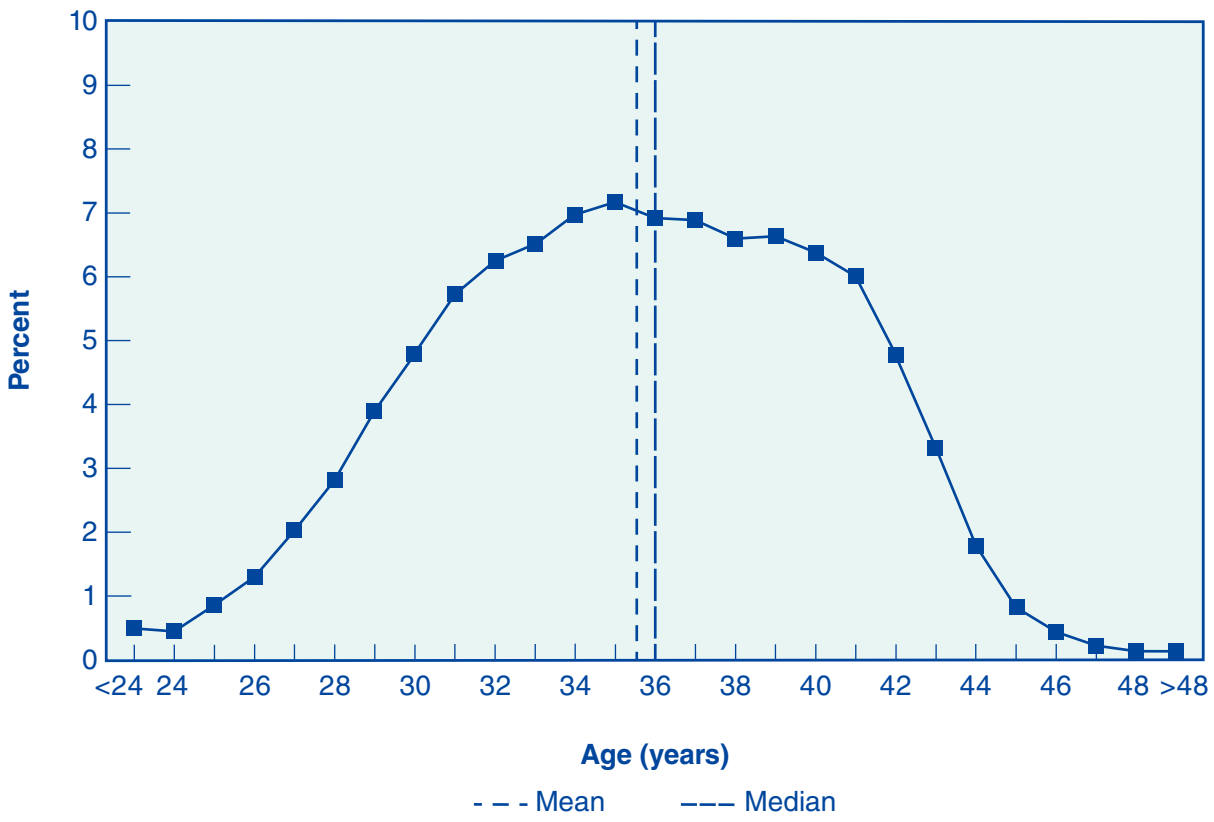
Figure 12
Percentages of Births That Were Preterm or Infants with Low Birth Weight from ART Cycles Using Fresh Nondonor Eggs or Embryos, by Number of Infants Born, 2012



What are the ages of women who use ART?

Figure 13 presents ART cycles using fresh nondonor eggs or embryos in 2012 according to the age of the woman who had the procedure. About 12% of these cycles were among women younger than age 30, 64% were among women aged 30–39, and almost 24% were among women aged 40 or older. The mean age of women who had ART cycles using fresh nondonor eggs was slightly less than 36 and the median age was 36.

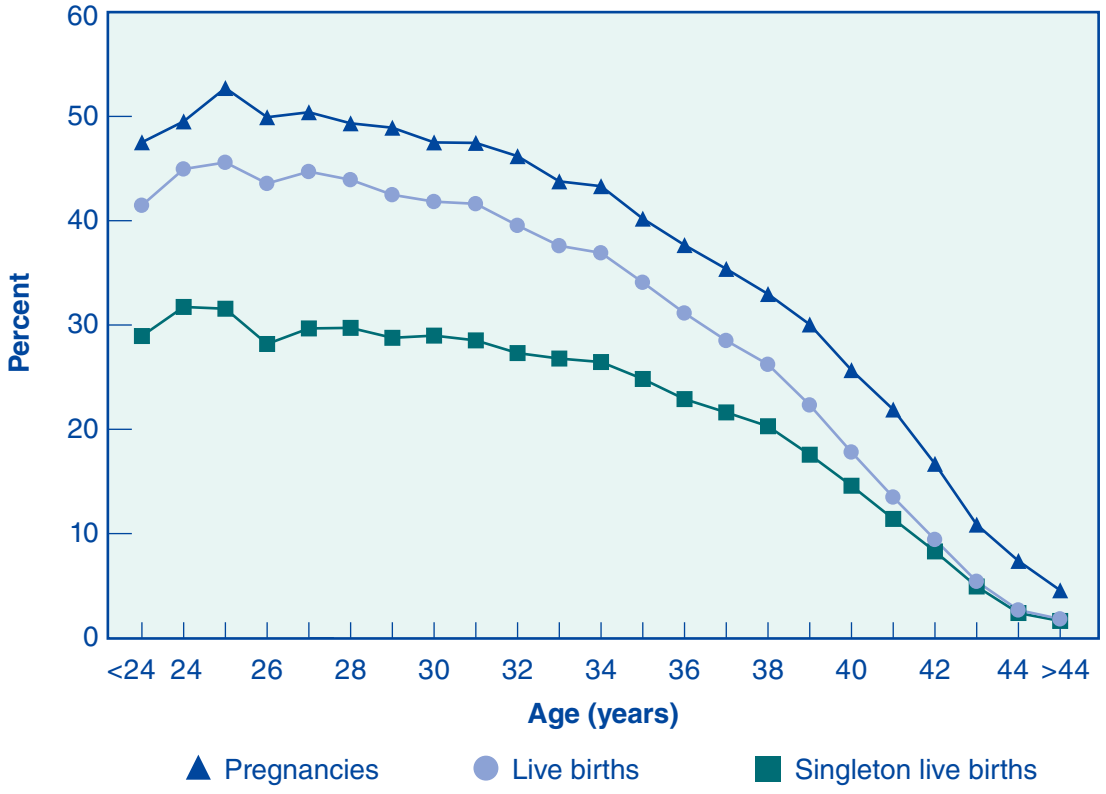
Figure 13
Age Distribution of Women Who Had ART Cycles Using Fresh Nondonor Eggs or Embryos, 2012



Do percentages of ART cycles that result in pregnancies, live births, and singleton live births differ among women of different ages?

A woman's age is the most important factor affecting the chance of a live birth when her own eggs are used. Figure 14 shows percentages of pregnancies, live births, and singleton live births among women of different ages who had ART procedures using fresh nondonor eggs or embryos in 2012. Percentages of ART cycles resulting in live births and singleton live births are different because of the high percentage of multiple-infant deliveries counted among the total live births. The percentage of multiple-infant births is particularly high among women younger than age 35 (see Figure 28, page 34). Among women in their 20s, percentages of ART cycles resulting in pregnancies, live births, and singleton live births were relatively stable; however, percentages declined steadily among women in their mid-30s onward. For additional detail on percentages of ART cycles that resulted in pregnancies, live births, and singleton live births among women aged 40 or older, see Figure 15 on page 21.

Figure 14
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Pregnancies, Live Births, and Singleton Live Births, by Age of Woman,* 2012

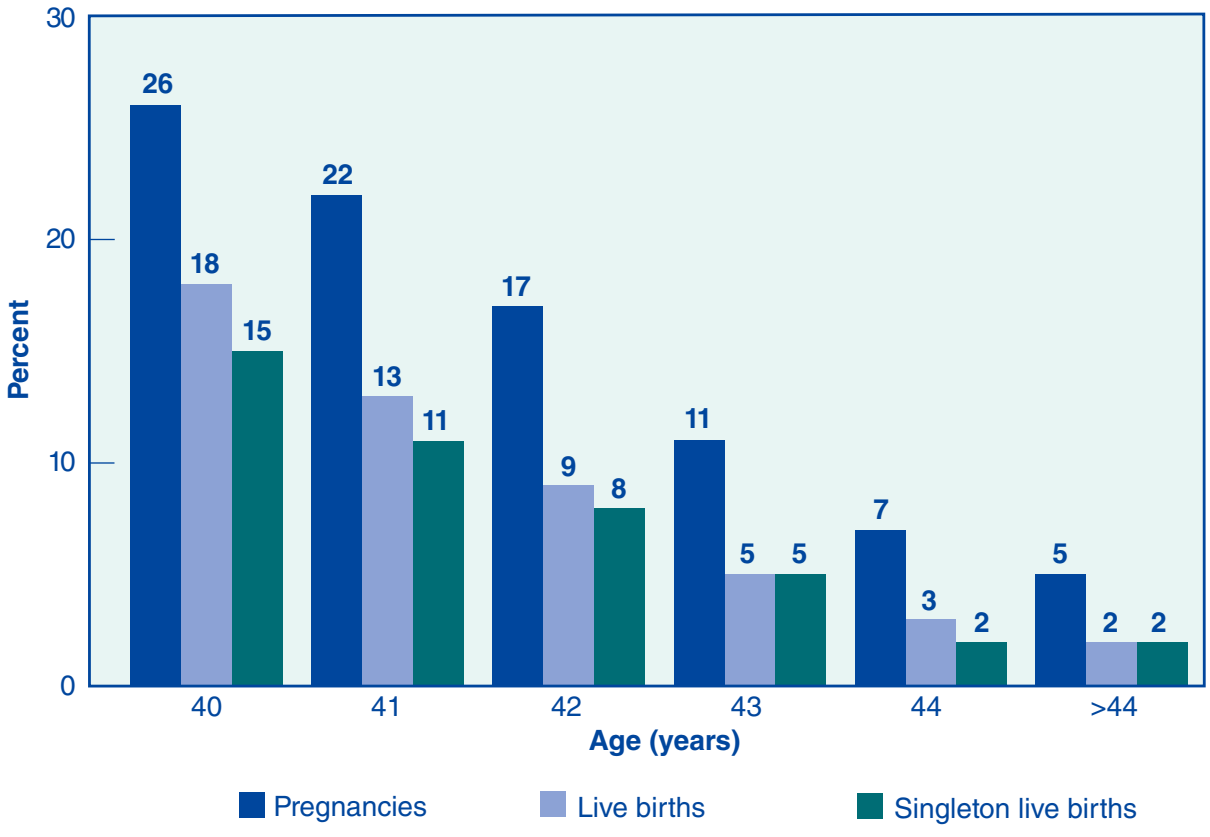


* For consistency, all percentages are based on cycles started.

How do percentages of ART cycles that result in pregnancies, live births, and singleton live births differ among women aged 40 or older?

Figure 15 shows percentages of pregnancies, live births, and singleton live births among women aged 40 or older who used fresh nondonor eggs or embryos in 2012. The percentage of ART cycles resulting in pregnancy was 26% among women age 40, the percentage of ART cycles resulting in live births was about 18%, and the percentage of ART cycles resulting in singleton live births was 15%. The majority of percentages dropped steadily with each 1-year increase in age. Among women older than age 44, percentages of live births and singleton live births were both about 2%. Women aged 40 or older generally have much higher percentages of live births using donor eggs (see Figure 39, page 45).

Figure 15
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Pregnancies, Live Births, and Singleton Live Births Among Women Aged 40 or Older,* 2012



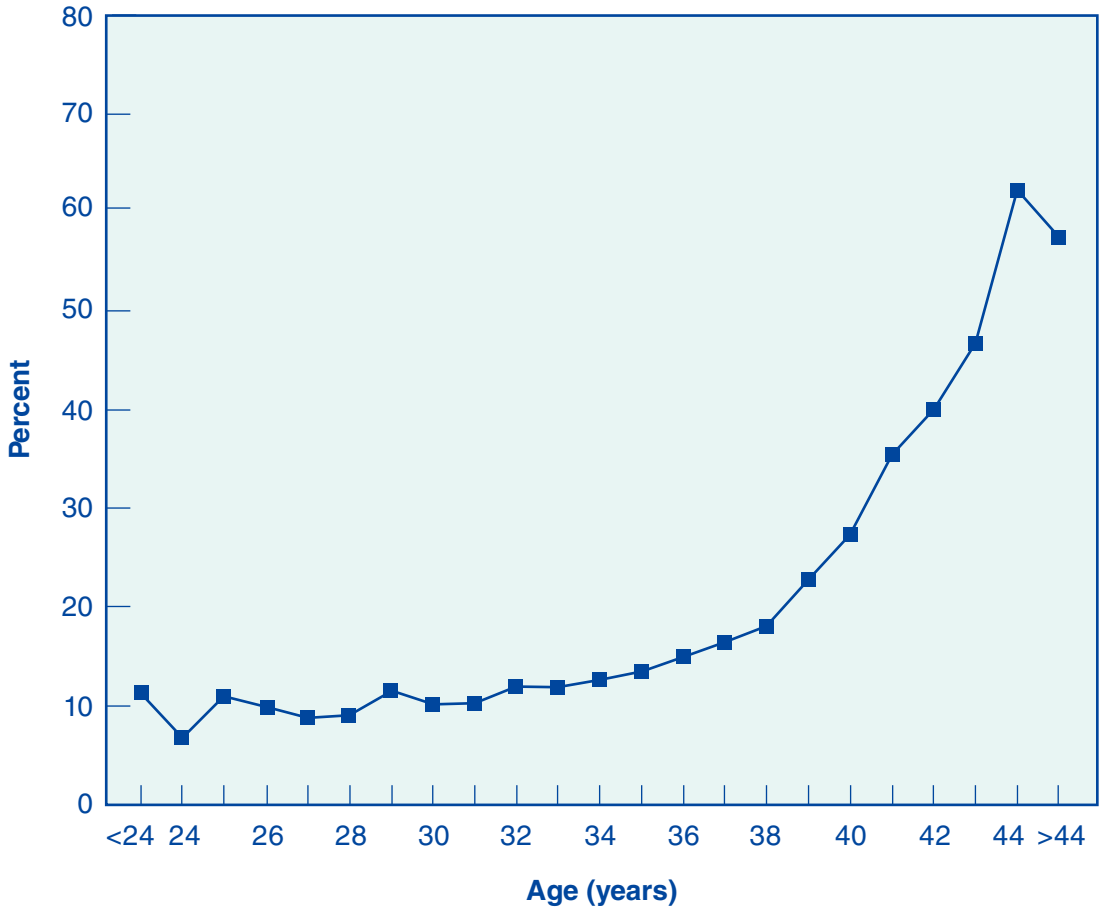
* For consistency, all percentages are based on cycles started.

How does the risk of miscarriage differ among women of different ages?

A woman's age not only affects the chance for pregnancy when her own eggs are used, but also affects her risk of miscarriage. Figure 16 shows percentages of ART cycles using fresh nondonor eggs or embryos in 2012 that resulted in miscarriage for women of different ages. Percentages of ART cycles that resulted in miscarriage were below 15% among women aged 35 or younger. The percentage of ART cycles that resulted in miscarriages began to increase rapidly among women in their mid- to late 30s and continued to increase with age, reaching more than 25% at age 40 and over 50% among women aged 44 or older.

Previous data show that most miscarriages occur before week 14 (i.e., during the first trimester) among women of all ages undergoing ART. The risk of miscarriage among women undergoing ART procedures using fresh nondonor eggs or embryos appears to be similar to those reported in various studies of other pregnant women in the United States.

Figure 16
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Miscarriage, by Age of Woman, 2012



How does a woman's age affect her chances of progressing through the various stages of ART?

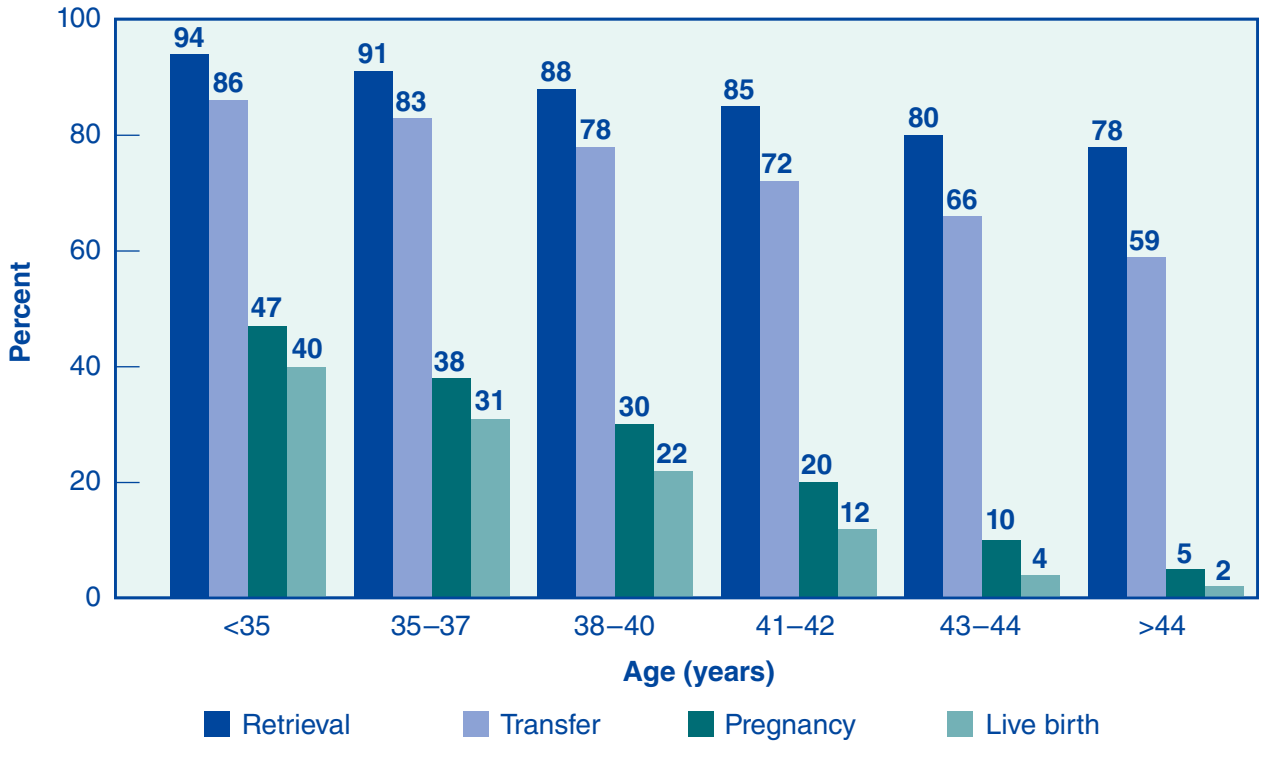
Figure 17 shows that a woman's chance of progressing from the beginning of ART to pregnancy and live birth (using her own eggs) decreases at every stage of ART as her age increases.

As women get older:

- The likelihood of a successful response to ovarian stimulation and progression to **egg retrieval** decreases.
- Cycles that have progressed to egg retrieval are less likely to reach **transfer**.
- The percentage of cycles that progress from transfer to **pregnancy** also decreases.
- Cycles that have progressed to pregnancy are less likely to result in a **live birth** because the risk of miscarriage is greater (see Figure 16, page 22).

Overall, 40% of cycles started in 2012 among women younger than age 35 resulted in live births. This percentage decreased to 31% among women aged 35–37, 22% among women aged 38–40, 12% among women aged 41–42, 4% among women aged 43–44, and 2% among women older than age 44.

Figure 17
Outcomes of ART Cycles Using Fresh Nondonor Eggs or Embryos, by Stage and Age Group, 2012

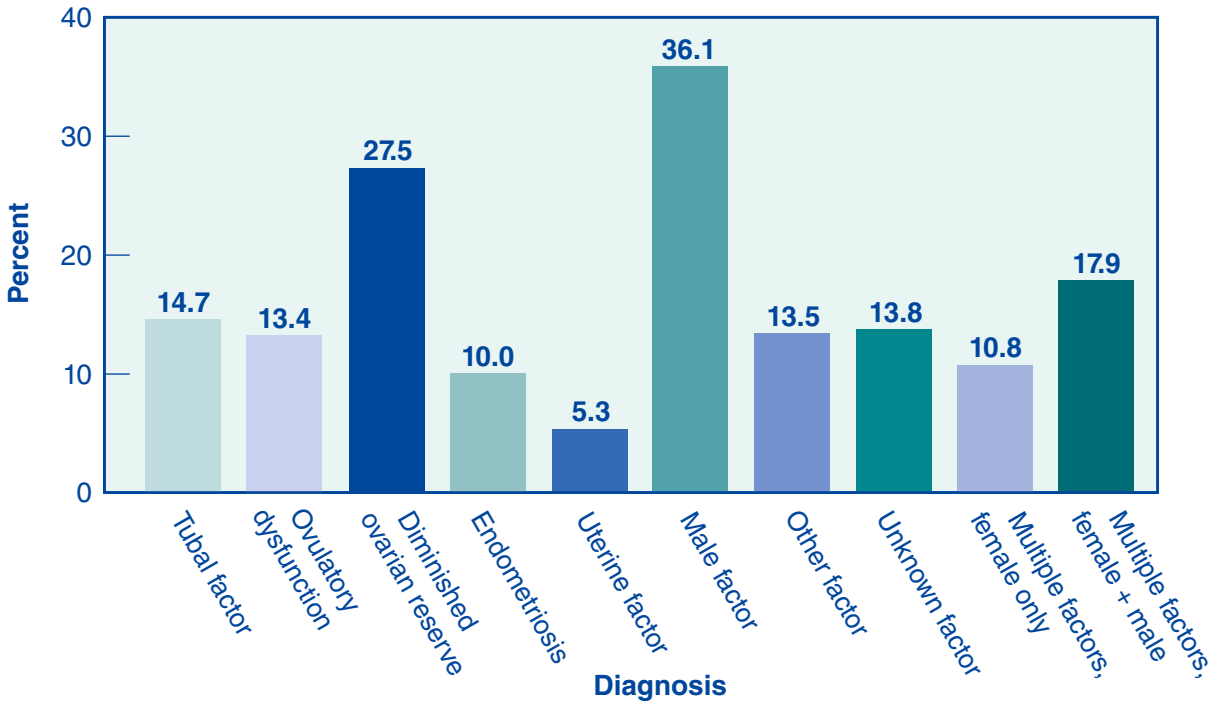


What are the causes of infertility among users of ART?

Figure 18 shows infertility diagnoses reported among patients who had ART using fresh nondonor eggs or embryos in 2012. Diagnoses range from one infertility factor in the patient or partner to multiple infertility factors in either one or both. However, diagnostic procedures may vary among clinics, so the categorizations also may vary.

- **Tubal factor**—fallopian tubes are blocked or damaged, making it difficult for the egg to be fertilized or for an embryo to travel to the uterus.
- **Ovulatory dysfunction**—ovaries are not producing eggs normally. Reasons include polycystic ovary syndrome and multiple ovarian cysts.
- **Diminished ovarian reserve**—the ability of the ovary to produce eggs is reduced. Reasons include congenital, medical, or surgical causes or advanced age.
- **Endometriosis**—the presence of tissue similar to the uterine lining in abnormal locations. This condition can affect both fertilization of the egg and embryo implantation.
- **Uterine factor**—a structural or functional disorder of the uterus that results in reduced fertility.
- **Male factor**—a low sperm count or problems with sperm function that make it difficult for a sperm to fertilize an egg under normal conditions.
- **Other factor**—includes immunological problems, chromosomal abnormalities, cancer chemotherapy, and serious illnesses.
- **Unknown factor**—no cause of infertility is found in either the woman or the man.
- **Multiple factors, female only**—more than one female cause of infertility.
- **Multiple factors, female and male**—one or more female causes and male factor infertility.

Figure 18
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos, by Infertility Diagnosis,* 2012

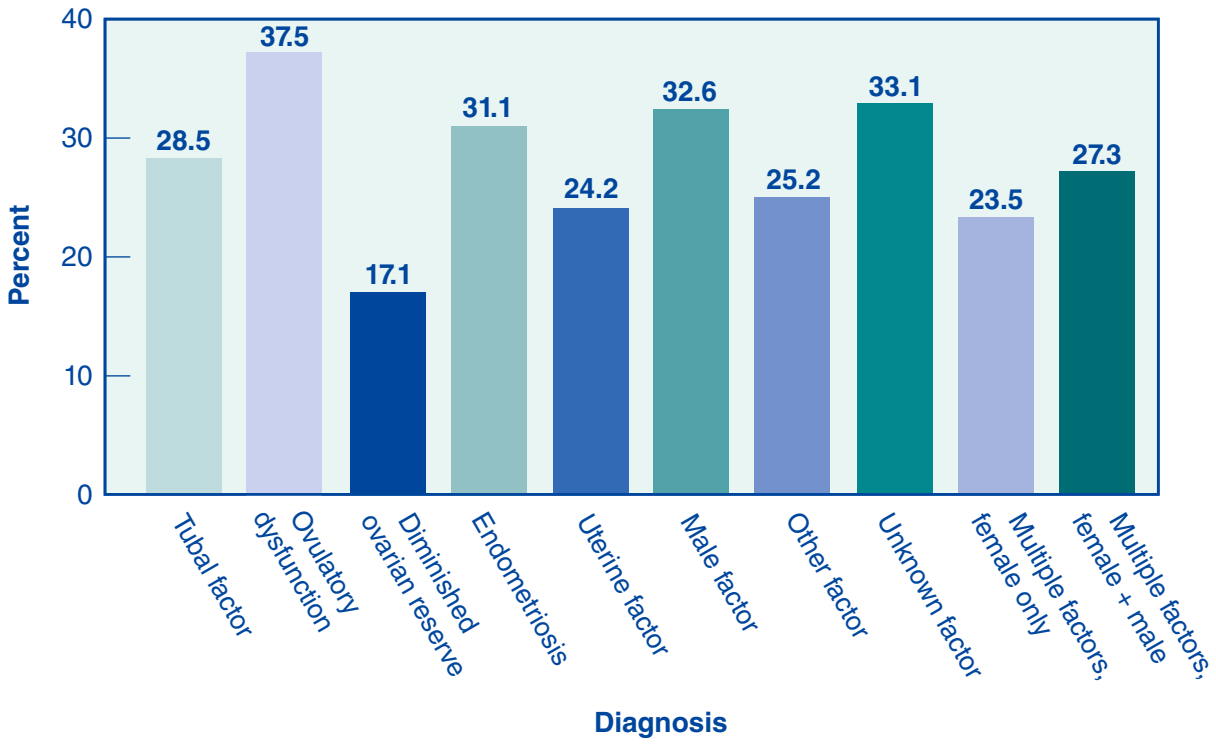


* Total percentages are greater than 100% because more than one diagnosis can be reported for each cycle.

Does the cause of infertility affect the percentage of ART cycles that result in live births?

Figure 19 shows the percentage of ART cycles using fresh nondonor eggs or embryos that resulted in live births according to the causes of infertility. (See Figure 18, page 24, or Appendix B: Glossary of Terms on pages 71–73 for an explanation of the diagnoses.) Although the national average was 29% in 2012 (see Figure 8, page 14), the percentage of ART cycles that resulted in live births varied somewhat depending on the patient's diagnosis. In 2012, the percentage of ART cycles resulting in live births was higher than the national average for patients with ovulatory dysfunction, endometriosis, male factor, or unknown factor infertility; it was lower for patients with tubal factor, diminished ovarian reserve, uterine factor, "other" factor, or multiple infertility factors. Please note, however, that the definitions of infertility diagnoses may vary among clinics and that a review of select clinical records revealed that reporting of infertility causes may be incomplete. (See Appendix A: Validation on pages 65–68 for additional information.) Therefore, differences in success rates by causes of infertility should be interpreted with caution.

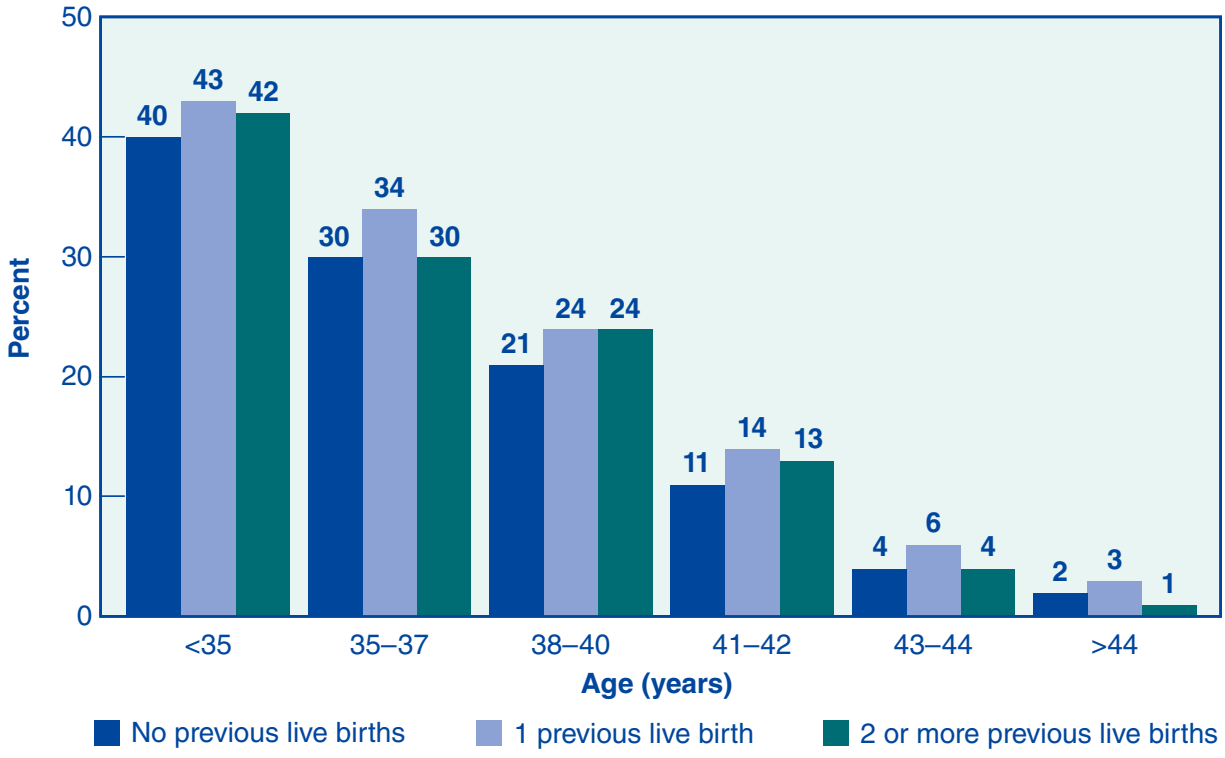
Figure 19
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Infertility Diagnosis, 2012



Do women who have previously given birth have higher percentages of ART cycles that result in live births?

Most ART procedures performed in 2012 using fresh nondonor eggs or embryos (71%) were among women who had no previous live births, although they may have had a pregnancy that resulted in a miscarriage or an induced abortion. Figure 20 shows the relationship between the success of ART cycles performed in 2012 using fresh nondonor eggs or embryos and a history of previous births. Previous live-born infants may have been conceived naturally or through ART. Overall, percentages of ART cycles that resulted in live births decreased with age regardless of number of previous live births. For women of all age groups except older than age 44, percentages of ART cycles that resulted in live births were slightly higher or equal among women who had one or more previous live births compared with those who had no previous live births.

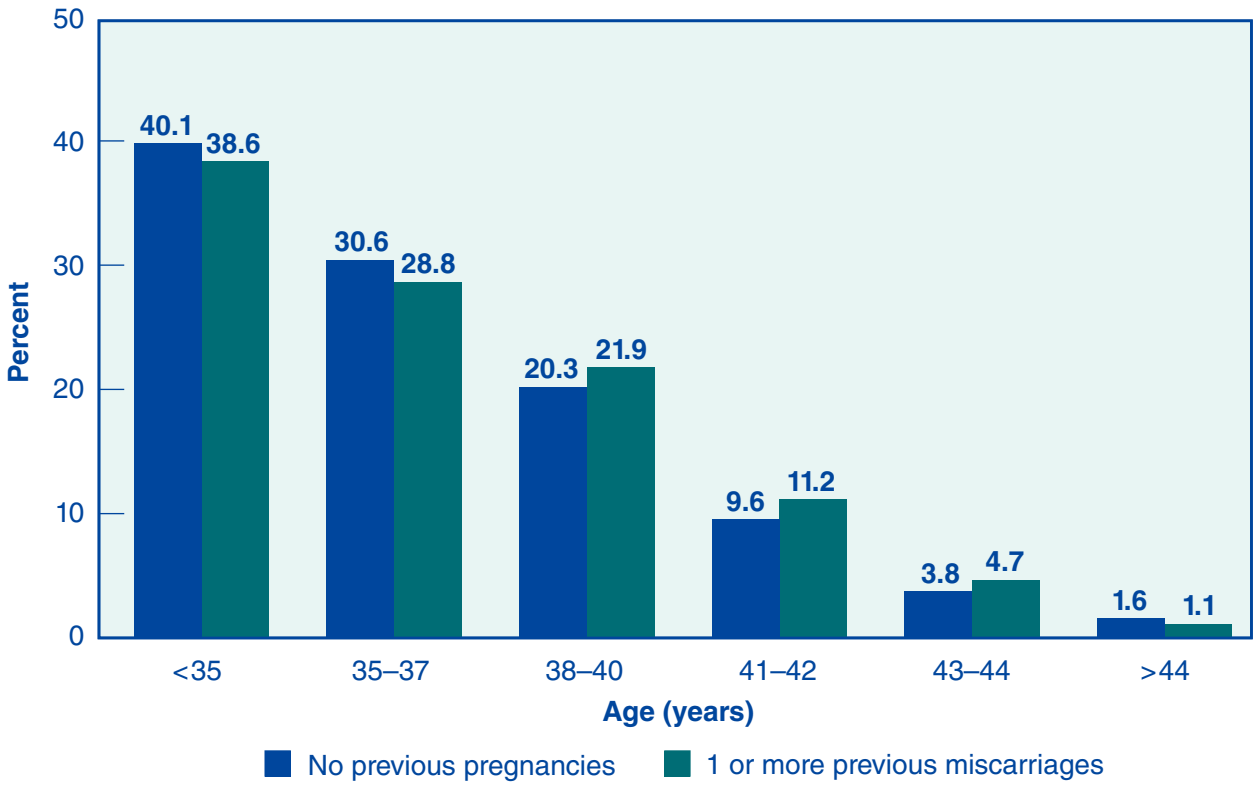
Figure 20
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Age Group and Number of Previous Live Births, 2012



Is there a difference in percentages of ART cycles that result in live births between women with previous miscarriages and women who have never been pregnant?

In 2012, a total of 70,999 ART cycles using fresh nondonor eggs or embryos were performed among women who had not previously given birth. However, about 26% of those cycles were reported by women with one or more previous pregnancies that had ended in miscarriage. CDC does not have information on whether the pregnancies ending in miscarriage were the result of ART or were conceived naturally. Figure 21 shows the relationship between the success of an ART cycle in 2012 and the history of previous miscarriage. In all age groups, percentages of cycles that resulted in live births were similar among women who had one or more previous miscarriages and women who never were pregnant. Thus, a history of unsuccessful pregnancy does not appear to be associated with lower chances for success using ART.

Figure 21
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Age Group and History of Miscarriage, Among Women with No Previous Births,* 2012

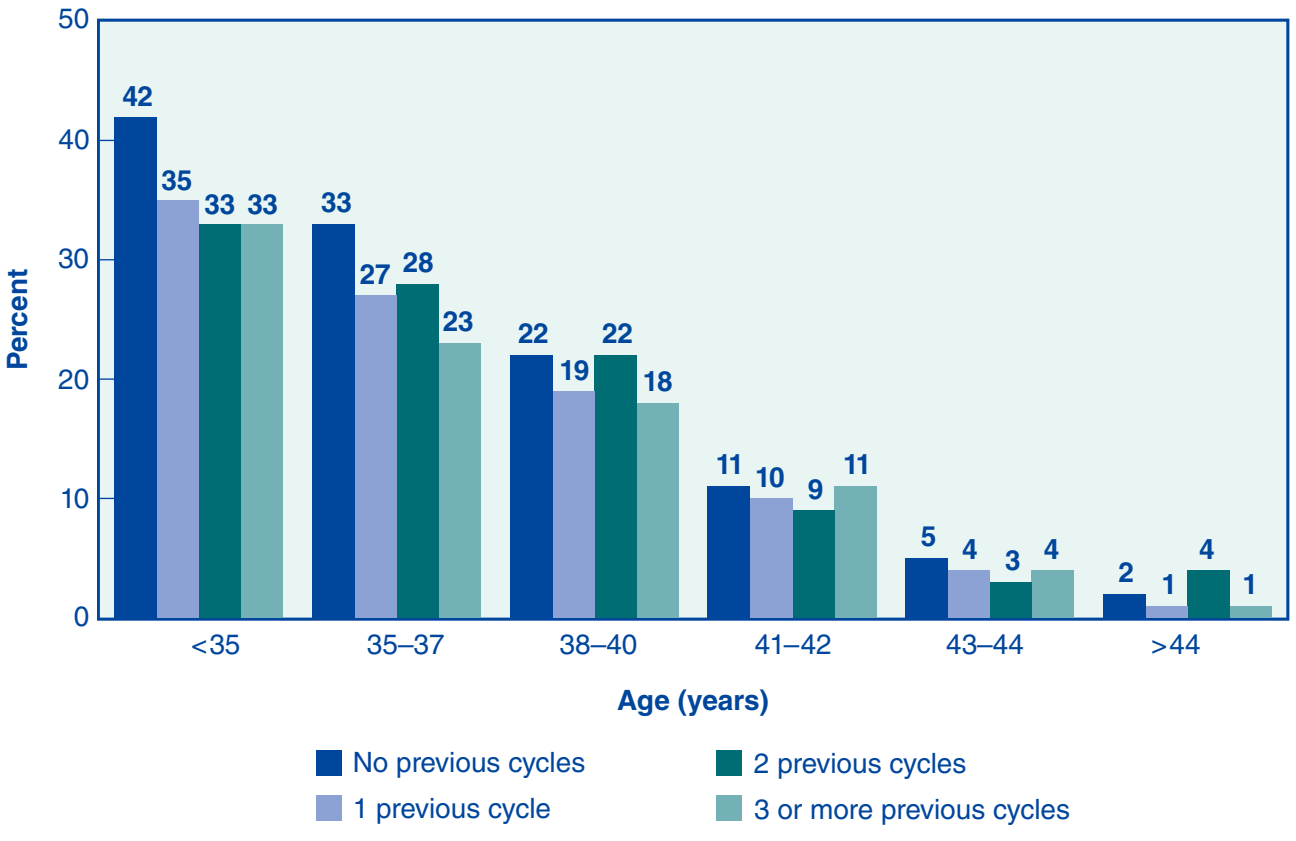


* Women reporting only previous ectopic pregnancies or pregnancies that ended in induced abortion are not included.

Do percentages of ART cycles that result in live births differ for women who use ART for the first time compared with women who previously used ART but did not give birth?

Figure 22 shows the relationship between the success of ART cycles performed in 2012 using fresh nondonor eggs or embryos and a history of previous ART cycles among women with no previous births. For about 42% of ART procedures performed in 2012, one or more previous ART cycles were reported (this percentage includes previous cycles using either fresh or frozen embryos). In the majority of age groups, percentages of ART cycles that resulted in live births among women who previously had one or more unsuccessful ART cycles were lower or similar to those among women who had no previous ART cycles and no previous births.

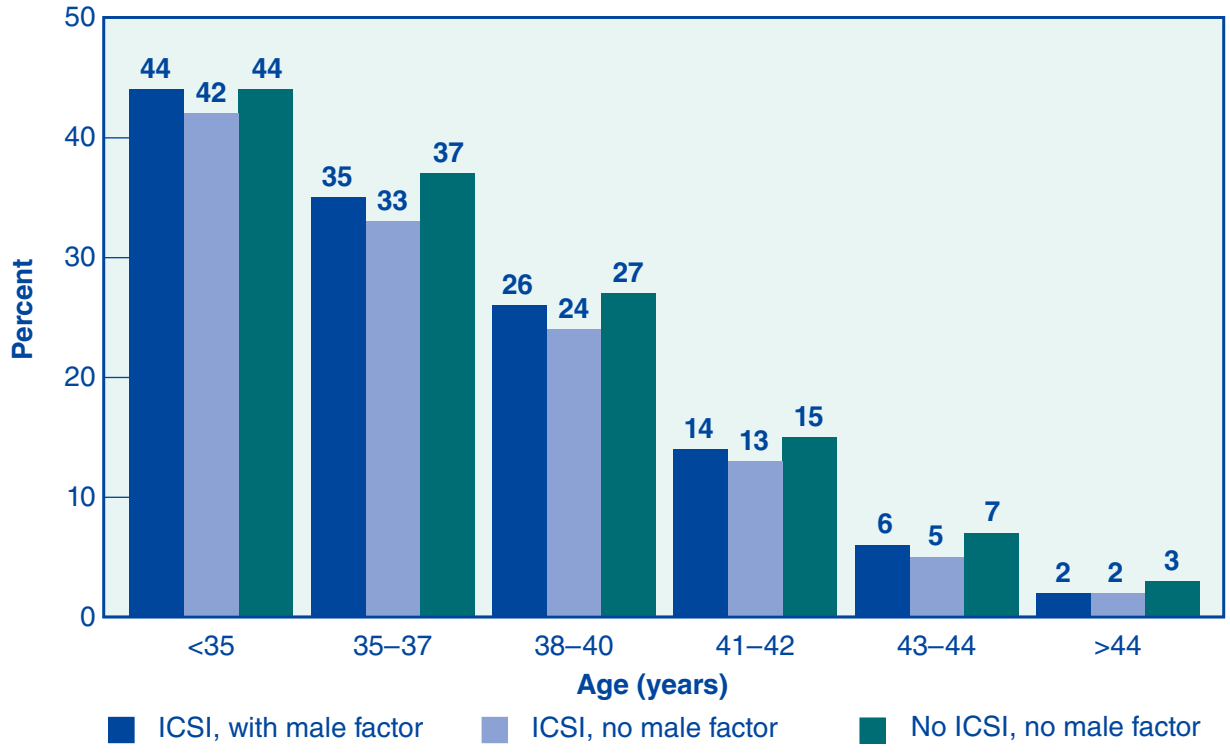
Figure 22
Percentages of ART Cycles Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Age Group and Number of Previous ART Cycles, Among Women with No Previous Live Births, 2012



Do percentages of retrievals that result in live births differ among patients who do or do not use ICSI with or without diagnosed male factor infertility?

Intracytoplasmic sperm injection (ICSI) was developed to overcome problems with fertilization that sometimes occur with a diagnosis of male factor infertility. In 2012, a total of 86% of cycles with a diagnosis of male factor infertility used IVF with ICSI, but slightly more than half (55%) of all ICSI procedures were performed without a diagnosis of male factor infertility. Figure 23 presents percentages of retrievals that resulted in live births using ICSI with or without a diagnosis of male factor infertility compared with not using ICSI and no diagnosis of male factor infertility. For all age groups, when ICSI was used for patients with male factor infertility, percentages of retrievals that resulted in live births were similar to those without ICSI and no diagnosis of male factor infertility. In most age groups, for retrievals where ICSI was used, procedures were less successful if there was no diagnosis of male factor infertility. Please note, however, that the definitions of infertility diagnoses may vary among clinics, and no information was available to determine whether this finding was a direct effect of the ICSI procedure or whether the patients' characteristics were different among those who used ICSI compared with those who used IVF without ICSI. Therefore, differences in success rates should be interpreted with caution.

Figure 23
Percentages of Retrievals That Resulted in Live Births Among Patients with or Without Diagnosed Male Factor Infertility by Age Group and Use of ICSI,* 2012

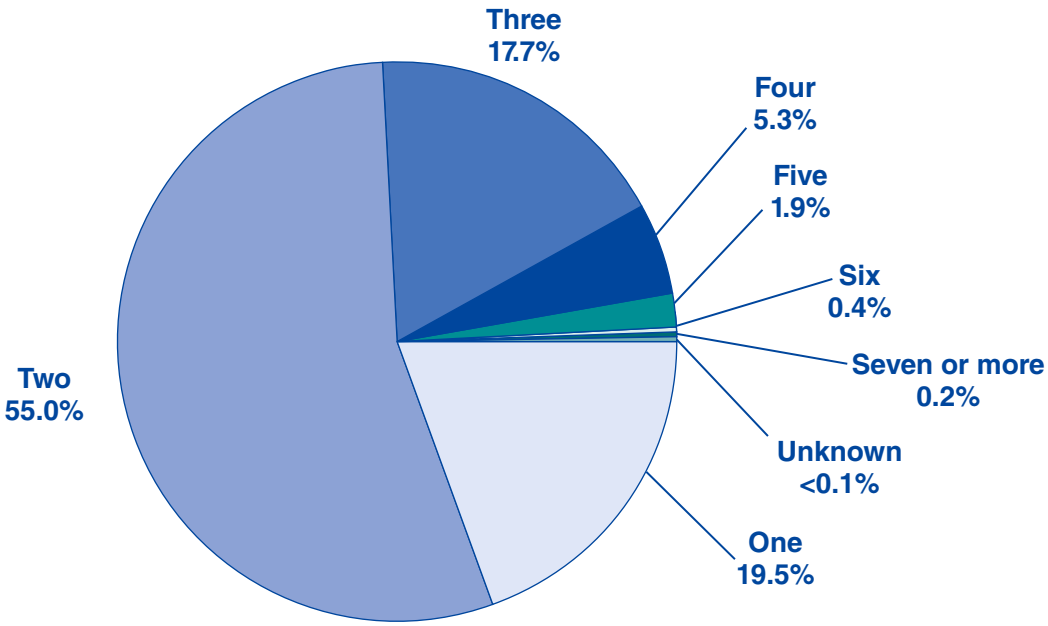


* Cycles using donor sperm and cycles using GIFT or ZIFT are excluded.

How many embryos are transferred in an ART procedure?

Figure 24 shows that in 2012, the majority (75%) of ART cycles that used fresh nondonor eggs or embryos and progressed to the embryo transfer stage involved the transfer of one or two embryos. Almost 26% of transfers involved three or more embryos, about 8% of transfers involved four or more embryos, and approximately 3% of transfers involved five or more embryos.

Figure 24
Numbers of Embryos Transferred Among All Transfers Using Fresh Nondonor Eggs or Embryos,* 2012

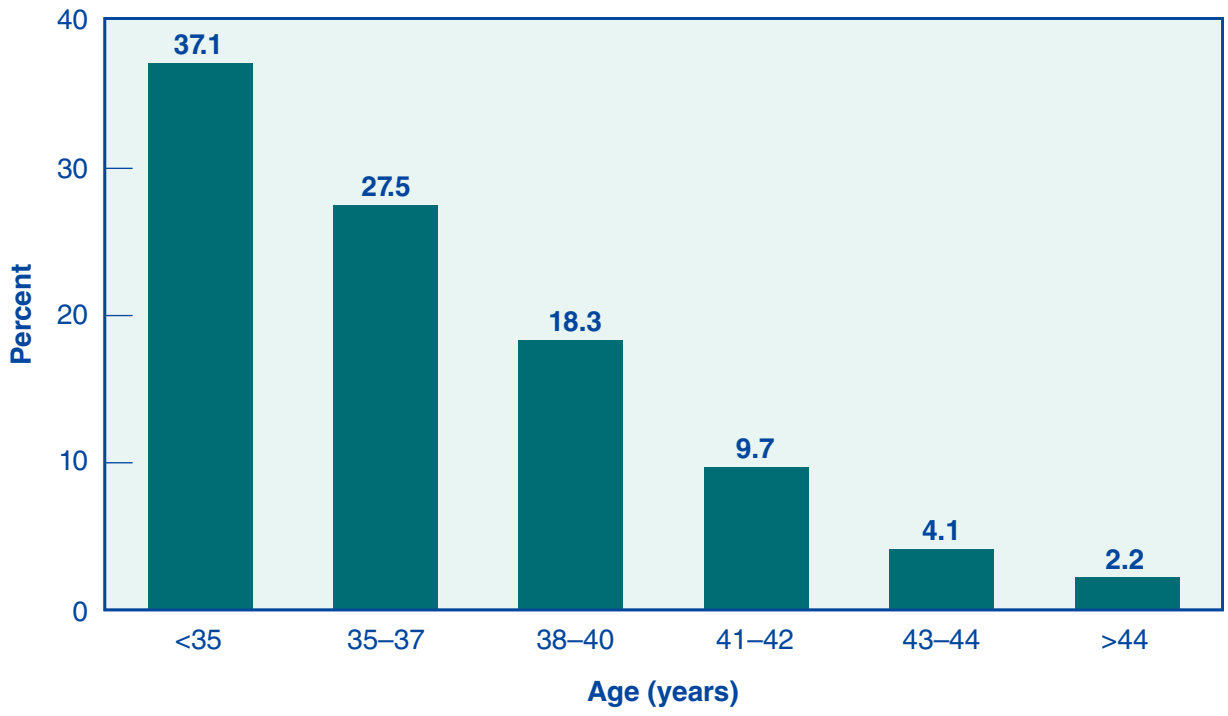


* Total does not equal 100% due to rounding.

How do percentages of embryos transferred that result in implantation for fresh nondonor embryos differ among women of different ages?

Figure 25 presents the relationship between the implantation percentage (see Implantation rate in Appendix B: Glossary of Terms on page 72) for fresh nondonor embryos transferred and a woman's age. In 2012, the percentage of embryos transferred that resulted in implantation was highest (approximately 37%) among women younger than age 35. However, the implantation percentage decreased steadily as the age of the woman increased. Specifically, the implantation percentage was lowest (about 2%) among women older than age 44 compared with the implantation percentage among women in each of the other age groups.

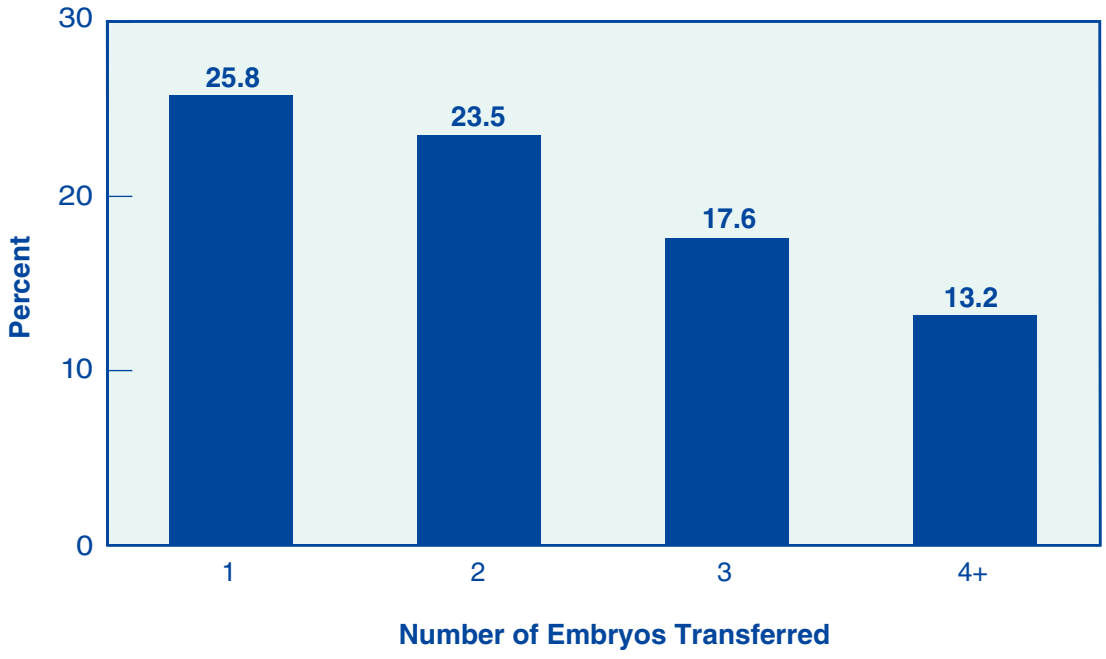
Figure 25
Percentages of Embryos Transferred That Resulted in Implantation for Transfers Using Fresh Nondonor Eggs or Embryos, by Age Group, 2012



Is the percentage of transfers that result in a good perinatal outcome affected by the number of embryos transferred?

Figure 26 shows the relationship between the number of fresh nondonor eggs or embryos transferred and a good perinatal outcome among ART cycles performed in 2012 that resulted in the transfer of one or more embryos. A good perinatal outcome is defined as the live birth of a singleton infant at 37 or more full weeks of pregnancy and with a normal birth weight of at least 2,500 grams (about 5 pounds, 8 ounces). The percentage of transfers resulting in a good perinatal outcome decreased as the number of embryos transferred increased, from approximately 26% among cycles that involved the transfer of one embryo to 13% among cycles that involved the transfer of four or more embryos. Transferring more embryos increases the chance for a multiple-fetus pregnancy. Multiple-fetus pregnancies are associated with increased risk of adverse outcomes for mothers and infants, including higher rates of prematurity, low birth weight, and pregnancy complications. See Figure 28 on page 34 for more details about percentages of transfers that resulted in live births and multiple births, by number of embryos transferred, among younger patients with a prognosis for a good perinatal outcome.

Figure 26
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in a Good Perinatal Outcome, by Number of Embryos Transferred, 2012

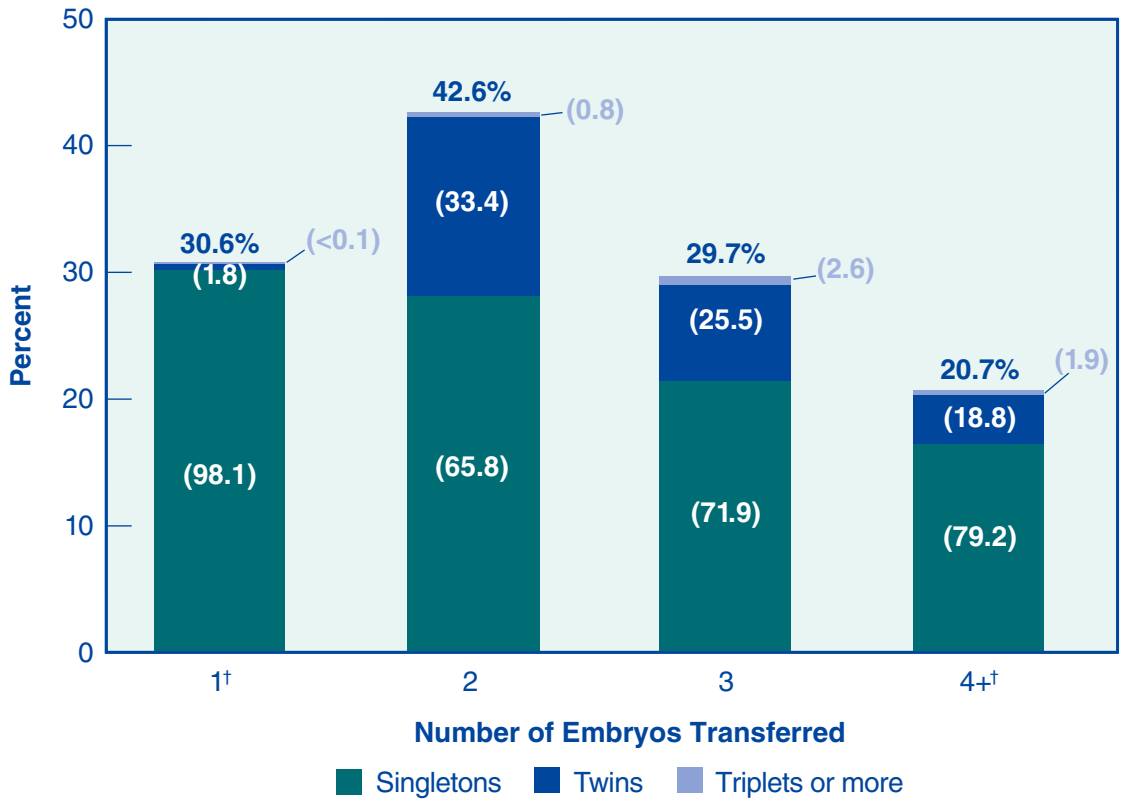


Is an ART transfer more likely to be successful if more embryos are transferred?

Figure 27 shows the relationship between the number of fresh nondonor eggs or embryos transferred, the percentage of transfers resulting in live births, and the percentage of multiple-infant live births for these cycles. In 2012, the percentage of transfers that resulted in live births increased when two embryos were transferred; however, transferring multiple embryos also poses a risk of having a multiple-infant birth. Multiple-infant births cause concern because of the additional health risks they create for both mothers and infants.

Interpretation of the relationship between the number of embryos transferred, the percentage of transfers resulting in live births, and the percentage of multiple-infant births is complicated by several factors, such as the woman's age and embryo quality. See Figures 28 and 32 (pages 34 and 38) for more details on women using fresh nondonor eggs or embryos who are most at risk of multiple births.

Figure 27
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births and Distribution of Number of Infants Born, by Number of Embryos Transferred,* 2012



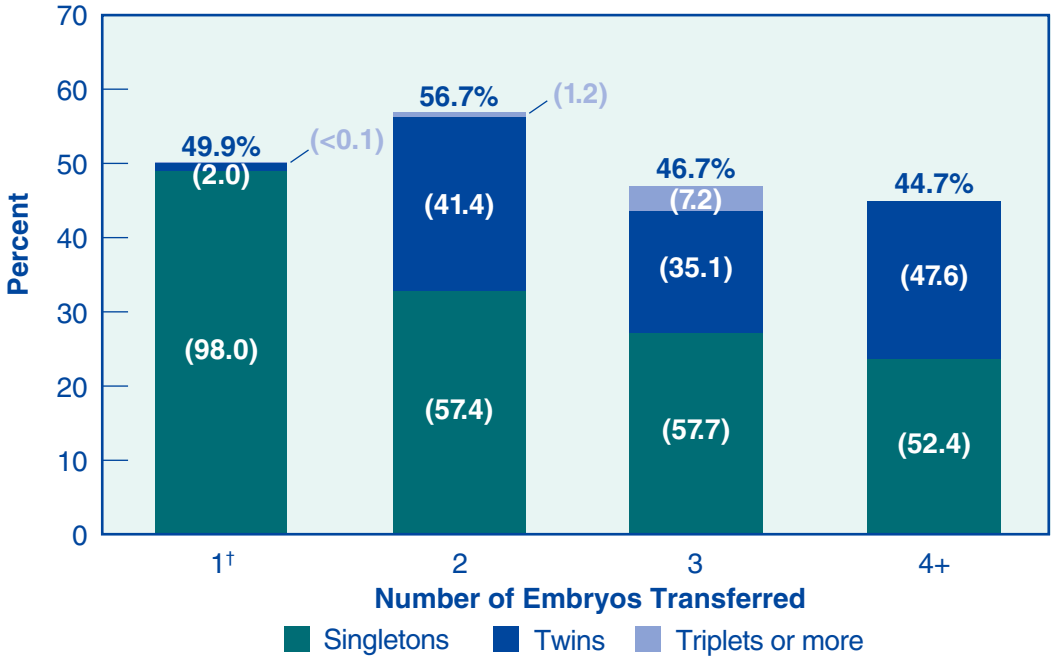
* Percentages of live births that were singletons, twins, and triplets or more are in parentheses.
Note: In rare cases a single embryo may divide and thus produce multiple-infant births. For this reason, small percentages of twins and triplets or more resulted from a single embryo transfer, and a small percentage of triplets or more resulted when two embryos were transferred.
† Totals do not equal 100% due to rounding.

Are percentages of transfers that result in live births affected by the number of embryos transferred for women who have more embryos available than they choose to transfer?

Figure 28 shows the relationship between the number of fresh nondonor eggs or embryos transferred, the percentage of transfers resulting in live births, and the percentage of multiple-infant births for ART procedures in which the woman was younger than age 35 and chose to set aside extra embryos for future cycles rather than transfer all available embryos at one time.

In 2012, the percentage of transfers that resulted in live births was the highest (57%) when two embryos were transferred; however, the highest percentage of singleton live births was observed with the transfer of one embryo.

Figure 28
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births and Distribution of Number of Infants Born Among Women Younger Than Age 35 Who Set Aside Extra Embryos for Future Use, by Number of Embryos Transferred,* 2012

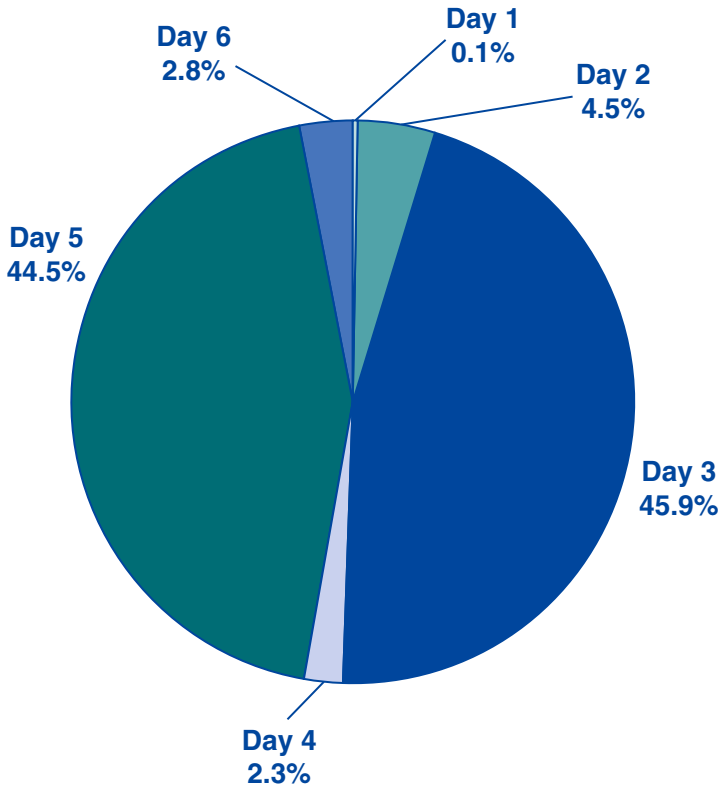


* Percentages of live births that were singletons, twins, and triplets or more are in parentheses.
Note: In rare cases a single embryo may divide and thus produce multiple-infant births. For this reason, small percentages of twins and triplets or more resulted from a single embryo transfer, and a small percentage of triplets or more resulted when two embryos were transferred.
† Total does not equal 100% due to rounding.

How long after egg retrieval does embryo transfer occur?

Once an ART cycle has progressed from egg retrieval to fertilization, the embryo(s) can be transferred into the woman's uterus in the subsequent 1 to 6 days. Figure 29 shows that in 2012 approximately 46% of embryo transfers occurred on day 3. Day 5 embryo transfers were almost as common, accounting for about 45% of ART procedures that progressed to the embryo transfer stage.

Figure 29
Day of Embryo Transfer* Among All ART Transfers Using Fresh Nondonor Eggs or Embryos,†‡ 2012

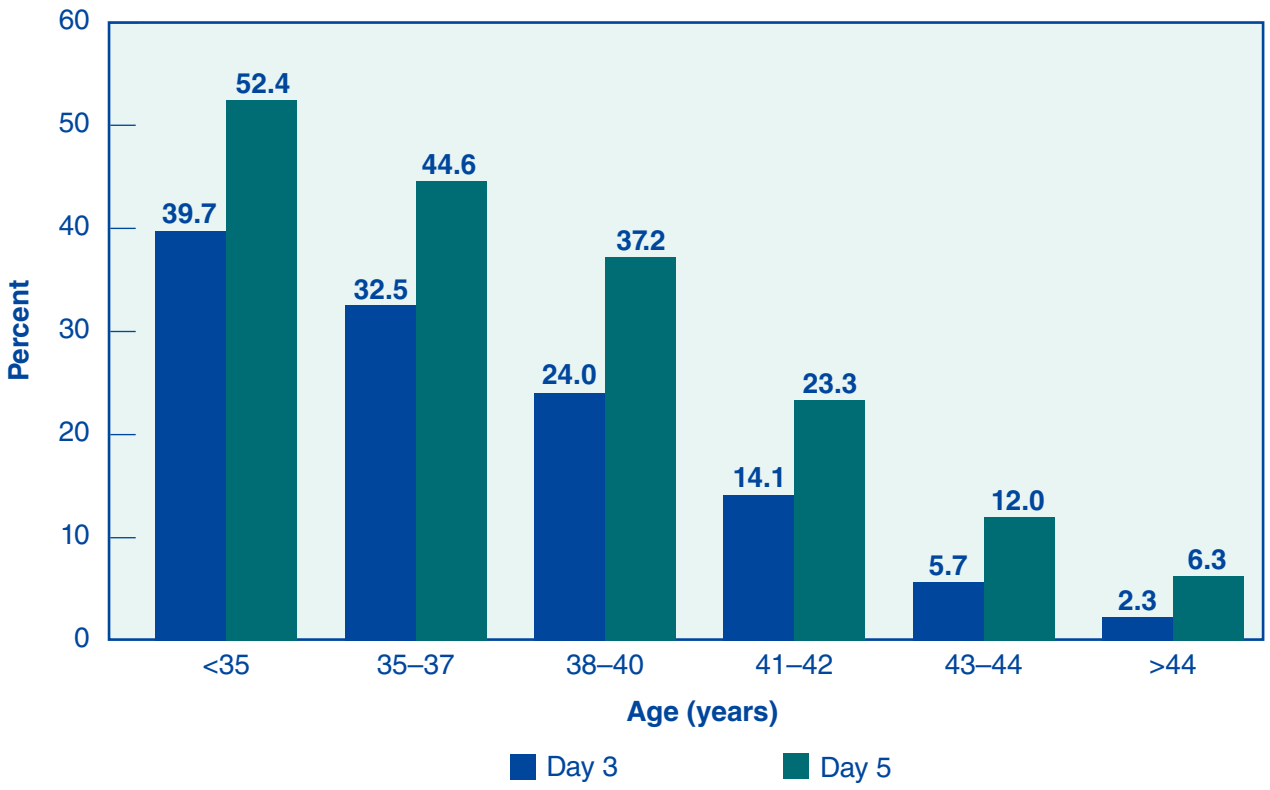


* Number of days following egg retrieval.
† Cycles using GIFT or ZIFT are excluded. Missing or implausible values for day of embryo transfer (i.e., 0 or >6) are not included.
‡ Total does not equal 100% due to rounding.

Is an ART transfer more likely to be successful if embryos are transferred on day 5?

As shown in Figure 29 (page 35), in the vast majority of ART transfers using fresh nondonor embryos, embryos were transferred on day 3 (46%) or day 5 (45%). Figure 30 compares percentages of day 3 embryo transfers that resulted in live births with those for day 5 embryo transfers. In 2012, for all age groups, percentages were higher for day 5 embryo transfers than for day 3 transfers. However, some cycles do not progress to the embryo transfer stage because of embryo arrest (interruption in embryo development) between day 3 and day 5. These cycles are not accounted for in percentages of day 5 transfers that resulted in live births. Therefore, differences in percentages of day 3 and day 5 transfers that result in live births should be interpreted with caution.

Figure 30
Percentages of Day 3 and Day 5 Embryo Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Age Group,* 2012

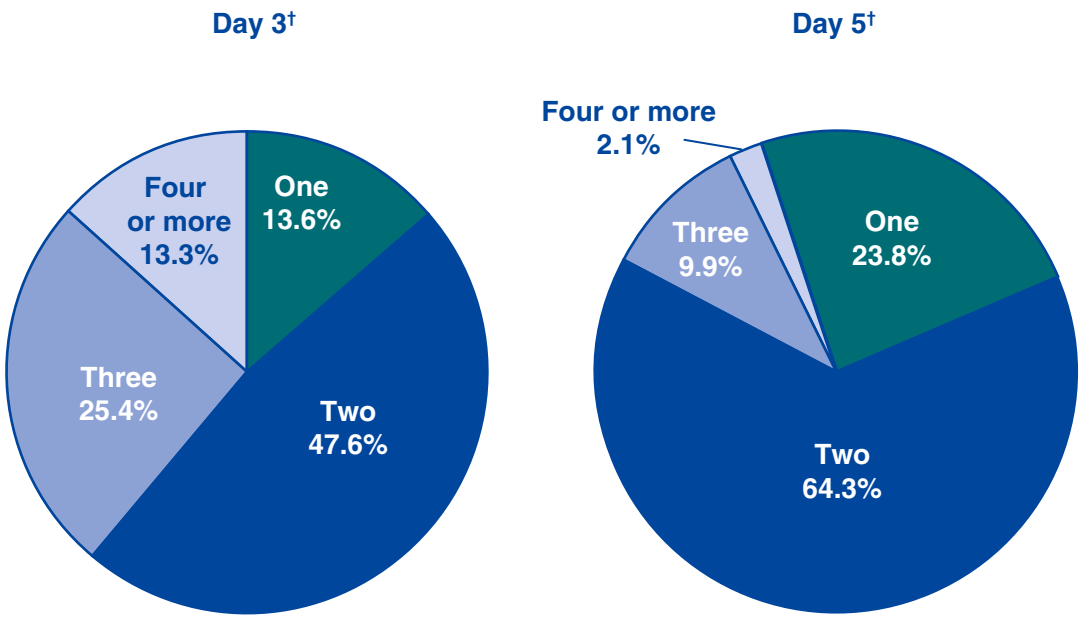


* Cycles using GIFT or ZIFT are excluded. Embryo transfers performed on days 1, 2, 4, and 6 are not included because each of these accounted for a small proportion of procedures.

Does the number of embryos transferred differ for day 3 and day 5 embryo transfers?

Figure 31 shows the distribution of the number of fresh nondonor embryos transferred on day 3 and day 5. Overall, fewer embryos were transferred on day 5 than on day 3. Approximately 39% of day 3 embryo transfers and 12% of day 5 embryo transfers involved the transfer of three or more embryos. The decrease in the number of embryos transferred on day 5, however, did not translate into a lower risk of multiple-infant births. See Figure 32 (page 38) for more details on the relationship between multiple-infant birth risk and day of embryo transfer.

Figure 31
Numbers of Embryos Transferred on Day 3 or Day 5 Among All Transfers Using Fresh Nondonor Eggs or Embryos,* 2012



* Cycles using GIFT or ZIFT are excluded. Embryo transfers performed on days 1, 2, 4, and 6 are not included because each of these accounted for a small proportion of procedures.
† Totals do not equal 100% due to rounding.

How does the multiple-infant birth risk vary by the day of embryo transfer among fresh nondonor transfers?

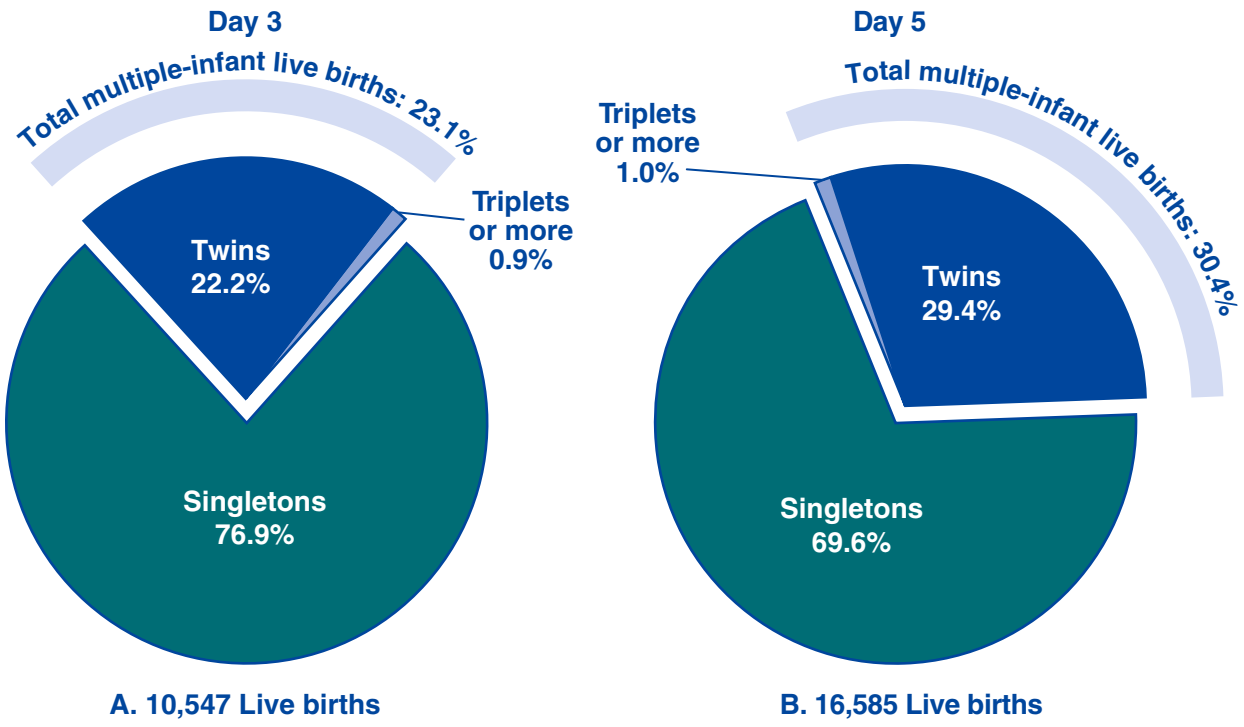
Multiple-infant births are associated with greater problems for both mothers and infants, including higher rates of caesarean section, prematurity, low birth weight, and infant disability or death.

Part A of Figure 32 shows that among the 10,547 live births that occurred following the transfer of day 3 fresh nondonor embryos, about 77% were singletons, 22% were twins, and 1% were triplets or more. Thus, approximately 23% of these live births produced more than one infant.

In 2012, a total of 16,585 live births occurred following the transfer of day 5 fresh nondonor embryos. Part B of Figure 32 shows that approximately 30% of these live births produced more than one infant.

As shown in Figure 31 (page 37), fewer embryos were transferred on day 5 than on day 3. However, the proportion of live births resulting in twins is higher among transfer procedures performed on day 5 than on day 3. Thus, the risk of having a multiple-infant birth was higher for day 5 embryo transfers.

Figure 32
Distribution of Number of Infants Born Among Day 3 and Day 5 Embryo Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births,* 2012



* Cycles using GIFT or ZIFT are excluded. Embryo transfers performed on days 1, 2, 4, and 6 are not included because each of these accounted for a small proportion of procedures.

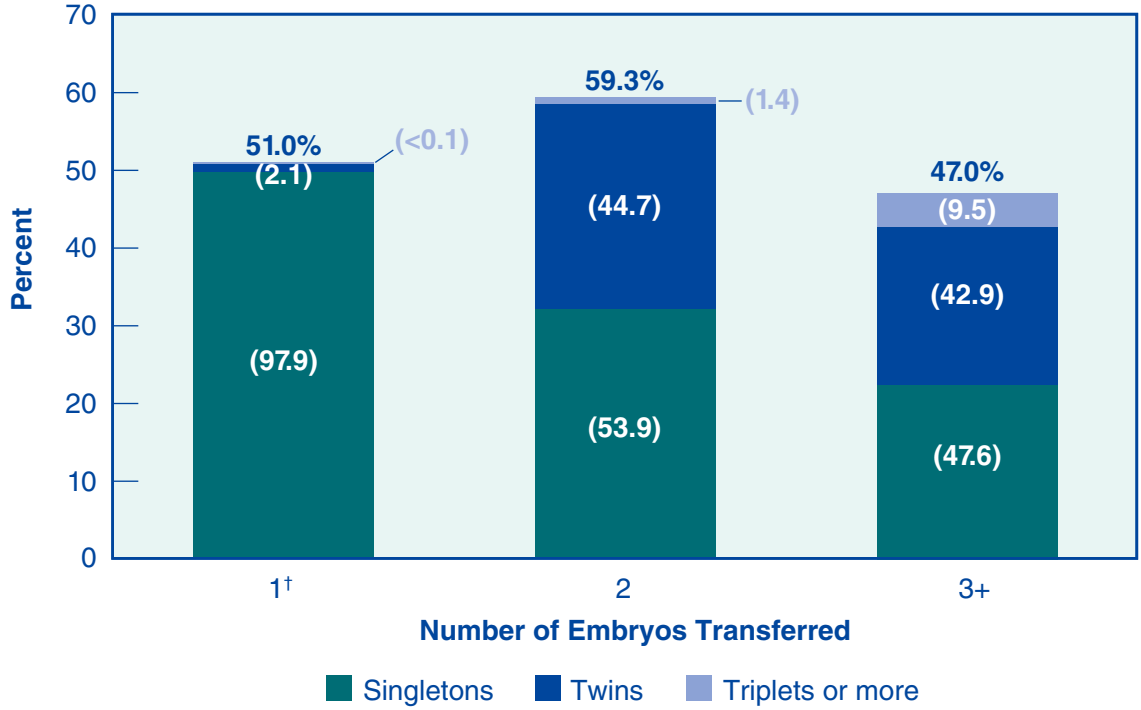
Are percentages of day 5 transfers that result in live births affected by the number of embryos transferred for women who have more embryos available than they choose to transfer?

As shown in Figure 32 (page 38), the transfer of fresh nondonor embryos on day 5 resulted in a higher percentage of multiple-infant births compared with embryos transferred on day 3. Figure 33 shows the relationship between the number of embryos transferred, the percentage of transfers resulting in live births, and the percentage of multiple-infant births for day 5 transfers among women who were younger than age 35 and set aside extra embryos for future cycles rather than transfer all available embryos at one time.

In 2012, the percentage of transfers resulting in live births was the highest (about 59%) when two embryos were transferred; however, the proportion of live births that were multiples (twins or more)—which present a higher risk of poor health outcomes—was about 46%. The percentage of live births that were higher-order multiples (triplets or more) was much higher when three or more embryos were transferred on day 5 (approximately 10%) than when two embryos were transferred on day 5 (approximately 1%).

If one measures success as the percentage of transfers resulting in singleton live births, the highest percentage (51%) resulted from the transfer of a single embryo on day 5.

Figure 33
Percentages of Day 5 Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births and Distribution of Number of Infants Born Among Women Younger Than Age 35 Who Set Aside Extra Embryos for Future Use, by Number of Embryos Transferred,* 2012



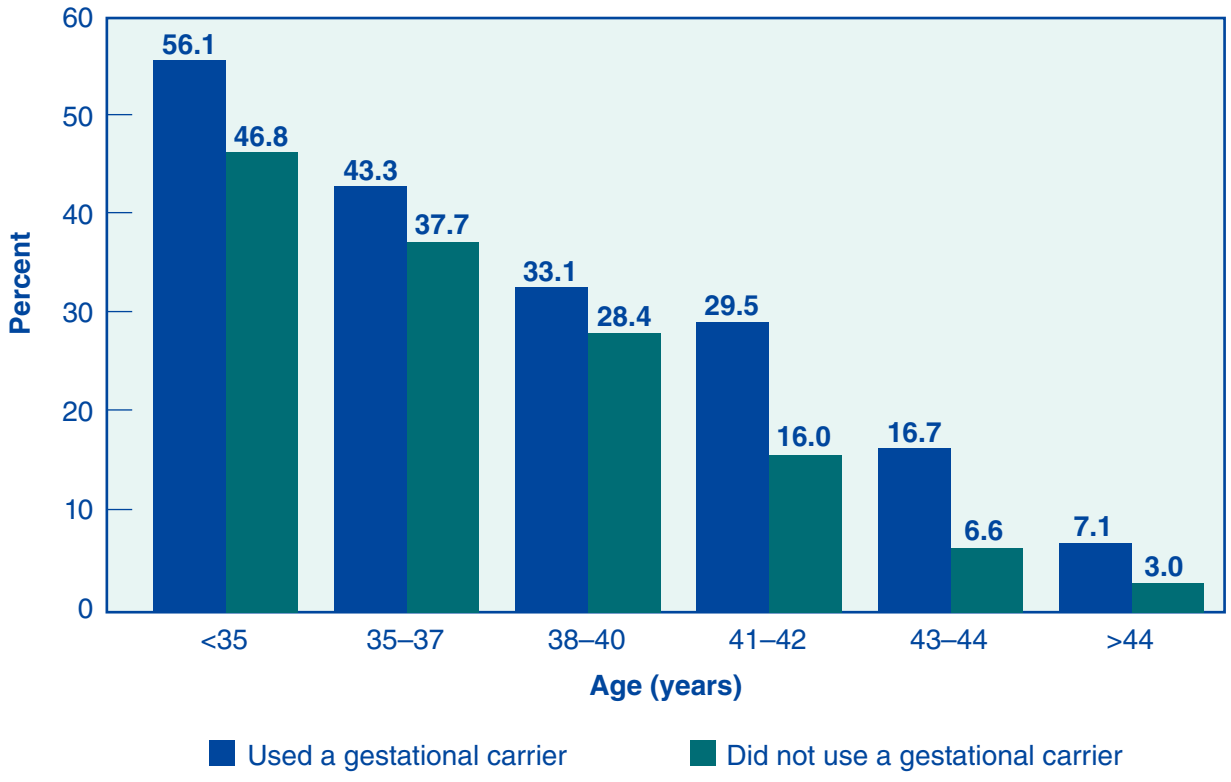
* Percentages of live births that were singletons, twins, and triplets or more are in parentheses. Cycles using GIFT or ZIFT are excluded. Note: In rare cases a single embryo may divide and thus produce multiple-infant births. For this reason, a small percentage of twins and triplets or more resulted from a single embryo transfer, and a small percentage of triplets or more resulted when two embryos were transferred.

† Total does not equal 100% due to rounding.

How do percentages of transfers using gestational carriers that result in live births compare with those that do not use gestational carriers?

A gestational carrier is a woman who agrees to carry the developing embryo for others. Gestational carriers were used in about 1% of ART cycles using fresh nondonor embryos in 2012 (901 cycles). Figure 34 compares percentages of transfers using a gestational carrier that resulted in live births with transfers that did not. In 2012, for all age groups, percentages of transfers that resulted in live births when using gestational carriers were higher than those that did not.

Figure 34
Comparison of Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births Between ART Cycles That Used Gestational Carriers and Those That Did Not, by Age Group,* 2012



* Age categories reflect the age of the ART patient, not the age of the gestational carrier.

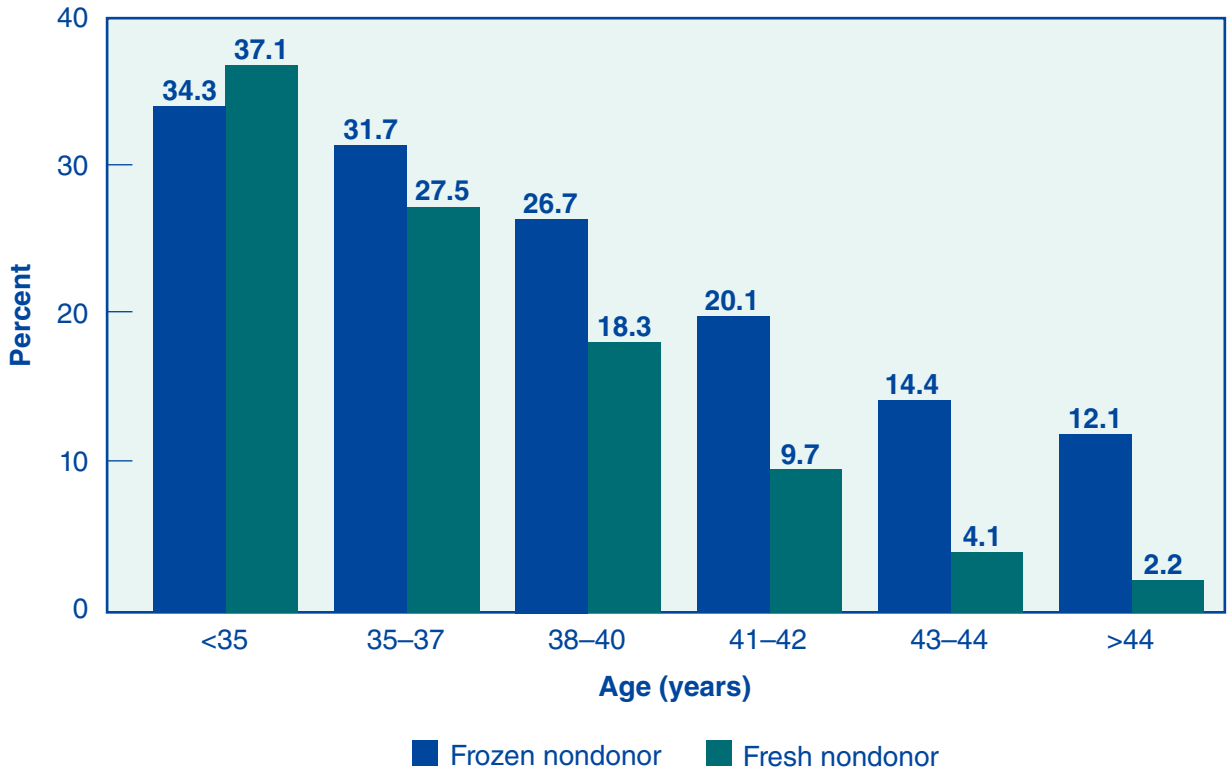
SECTION 3: ART CYCLES USING FROZEN NONDONOR EMBRYOS

How do percentages of embryos transferred that result in implantation for frozen nondonor embryos differ among women of different ages?

As shown in Figure 25 (page 31) among women using fresh nondonor eggs or embryos, the percentage of embryos transferred that resulted in implantation decreased as the age of the woman increased. Figure 35 shows the same relationship between implantation percentage and the age of the woman when frozen nondonor embryos were transferred; the percentage of frozen nondonor embryos transferred that resulted in implantation decreased as the age of the woman increased (from about 34% among women younger than age 35 to 12% among women older than age 44).

In 2012, the percentage of embryos transferred that resulted in implantation among women using frozen nondonor embryos was higher compared with the implantation percentage among women using fresh nondonor embryos in all age groups except among women younger than age 35.

Figure 35
Percentages of Embryos Transferred That Resulted in Implantation for Transfers Using Frozen Nondonor Embryos, Compared with Transfers Using Fresh Nondonor Embryos, by Age Group, 2012

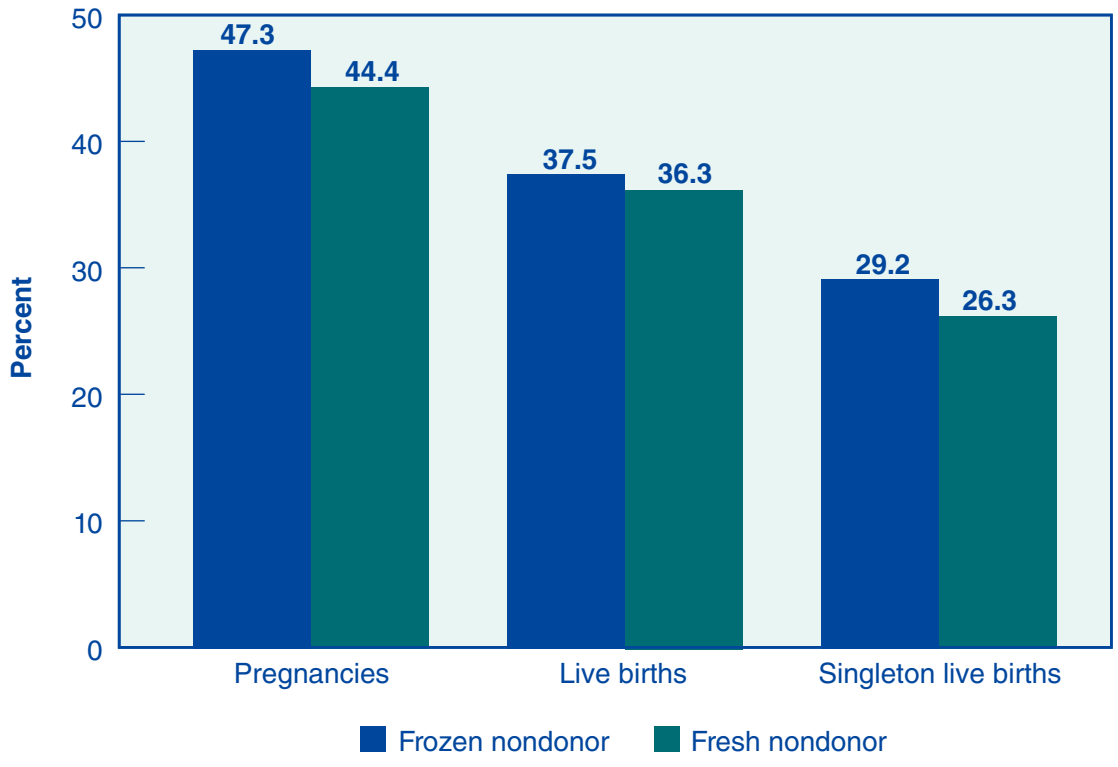


What is the percentage of transfers using frozen nondonor embryos that result in pregnancies, live births, and singleton live births?

Frozen nondonor embryos were used in 38,150 ART cycles performed in 2012. Figure 36 shows different measures of success for transfers using frozen nondonor embryos compared with transfers using fresh nondonor embryos. In 2012, percentages of transfers using frozen nondonor embryos that resulted in pregnancies, live births, and singleton live births were similar to those for fresh nondonor embryos.

The average number of embryos transferred was lower for transfers using frozen nondonor embryos than for those using fresh nondonor embryos in all age groups. (See the National Summary table on page 5 for information on the average number of embryos transferred by age group and cycle type.) Cycles using frozen nondonor embryos are both less expensive and less invasive than those using fresh nondonor embryos because the woman does not have to go through the fertility drug stimulation and egg retrieval steps again.

Figure 36
Percentages of Transfers Using Frozen or Fresh Nondonor Embryos That Resulted in Pregnancies, Live Births, and Singleton Live Births, 2012



What is the risk of a pregnancy with multiple fetuses or giving birth to multiple infants among ART pregnancies and live births resulting from frozen nondonor embryos?

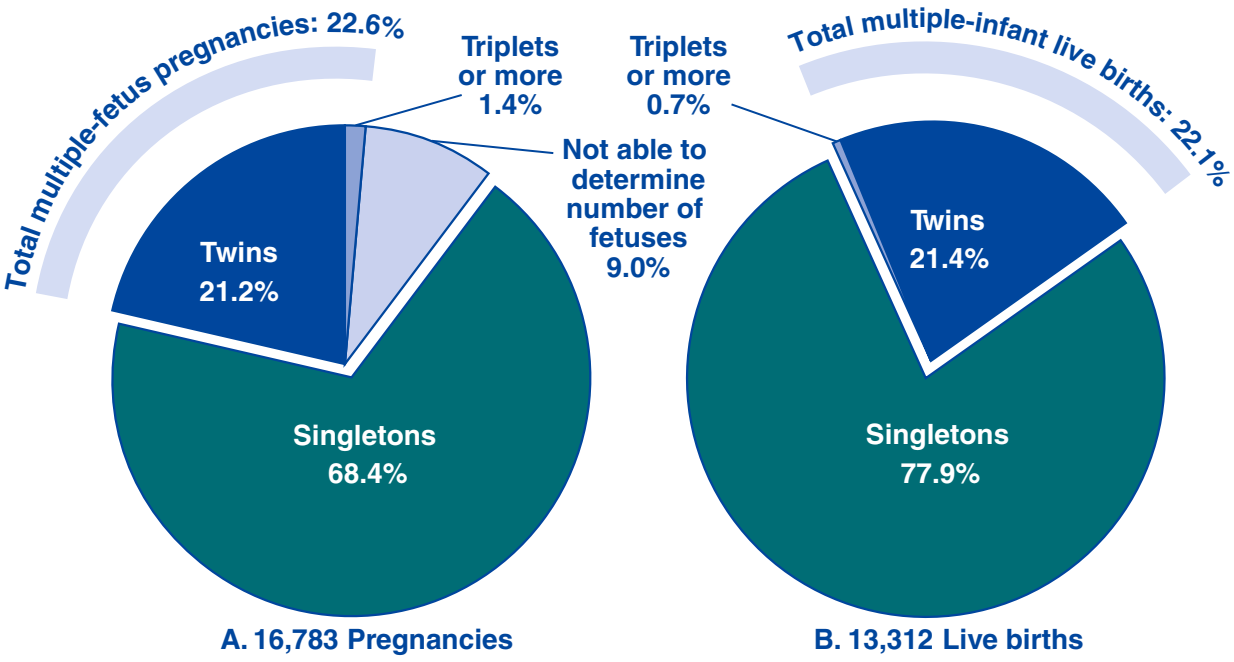
Multiple-infant births are associated with greater problems for both mothers and infants, including higher rates of caesarean section, prematurity, low birth weight, and infant disability or death.

Part A of Figure 37 shows that among 16,783 pregnancies that resulted from ART cycles using frozen nondonor embryos, approximately 68% were singleton pregnancies, 21% were twins, and 1% were triplets or more. Approximately 9% of pregnancies ended before the number of fetuses could be accurately determined. Therefore, the percentage of pregnancies with more than one fetus might have been higher than what was reported (approximately 23%).

Part B of Figure 37 shows 13,312 live births in 2012 resulted from ART cycles that used frozen nondonor embryos. Approximately 22% of these live births produced more than one infant. This compares with a multiple-infant birth rate of slightly more than 3% in the general US population.

Although total percentages for multiples were similar for pregnancies and live births, there were more triplet or higher order pregnancies than births. Triplet or higher order pregnancies may be reduced to twins or singletons by the time of birth. This can happen naturally (e.g., fetal death), or a woman and her doctor may decide to reduce the number of fetuses through a procedure called multifetal pregnancy reduction. CDC does not collect information on multifetal pregnancy reductions.

Figure 37
Distribution of Multiple-Fetus Pregnancies and Multiple-Infant Live Births Among ART Cycles Using Frozen Nondonor Embryos, 2012

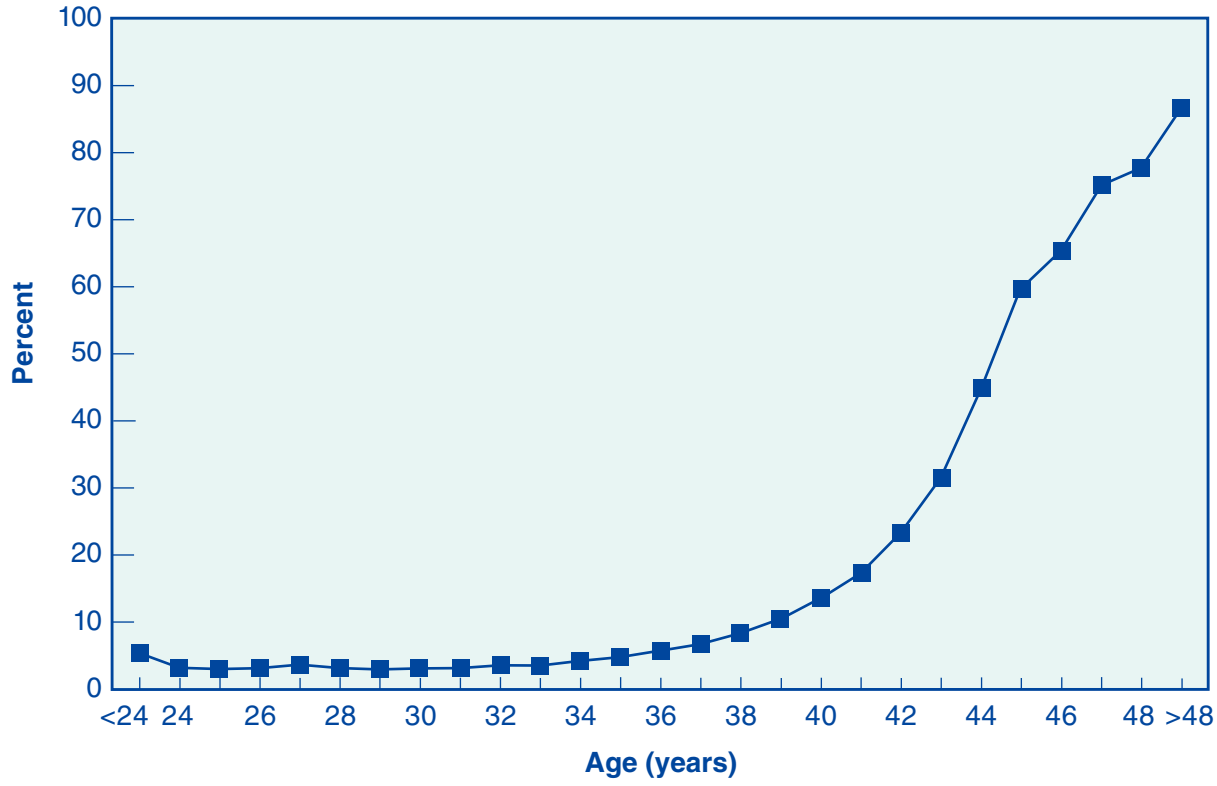


SECTION 4: ART CYCLES USING DONOR EGGS

Are older women undergoing ART more likely to use donor eggs or embryos?

As shown in Figures 16 and 35 (pages 22 and 41), eggs produced by women in older age groups form embryos that are less likely to implant and more likely to result in miscarriage if they do implant. As a result, ART using donor eggs is much more common among older women than among younger women. Donor eggs or embryos were used in 19,847 ART cycles performed in 2012. Figure 38 shows the percentage of ART cycles using donor eggs in 2012 according to the woman's age. Few women younger than age 40 used donor eggs; however, the percentage of cycles performed with donor eggs increased sharply after age 40. Among women older than age 48, for example, 87% of all ART cycles used donor eggs.

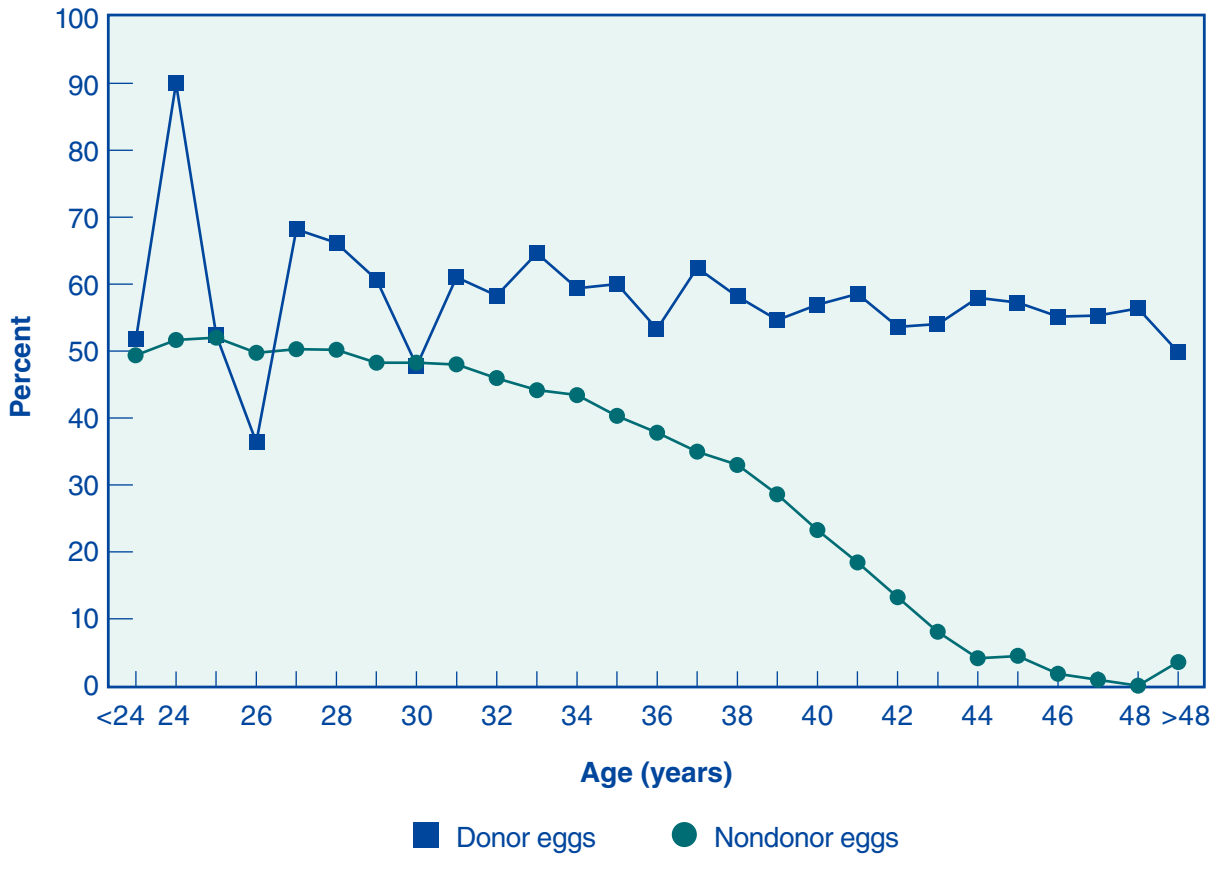
Figure 38
Percentages of ART Cycles Using Donor Eggs, by Age of Woman, 2012



Do percentages of transfers that result in live births differ by age between ART transfers using fresh donor eggs and those using fresh nondonor eggs?

Figure 39 compares percentages of transfers using fresh embryos from donor eggs that resulted in live births with those using fresh embryos from nondonor eggs among women of different ages, in 2012. The likelihood of a fertilized egg implanting is related to the age of the woman who produced the egg. Thus, the percentage of transfers using fresh nondonor embryos resulting in live births declines as women get older. In contrast, since egg donors are typically in their 20s or early 30s, the percentage of transfers using embryos from donor eggs that resulted in live births remained consistently above 50% among women of most ages.

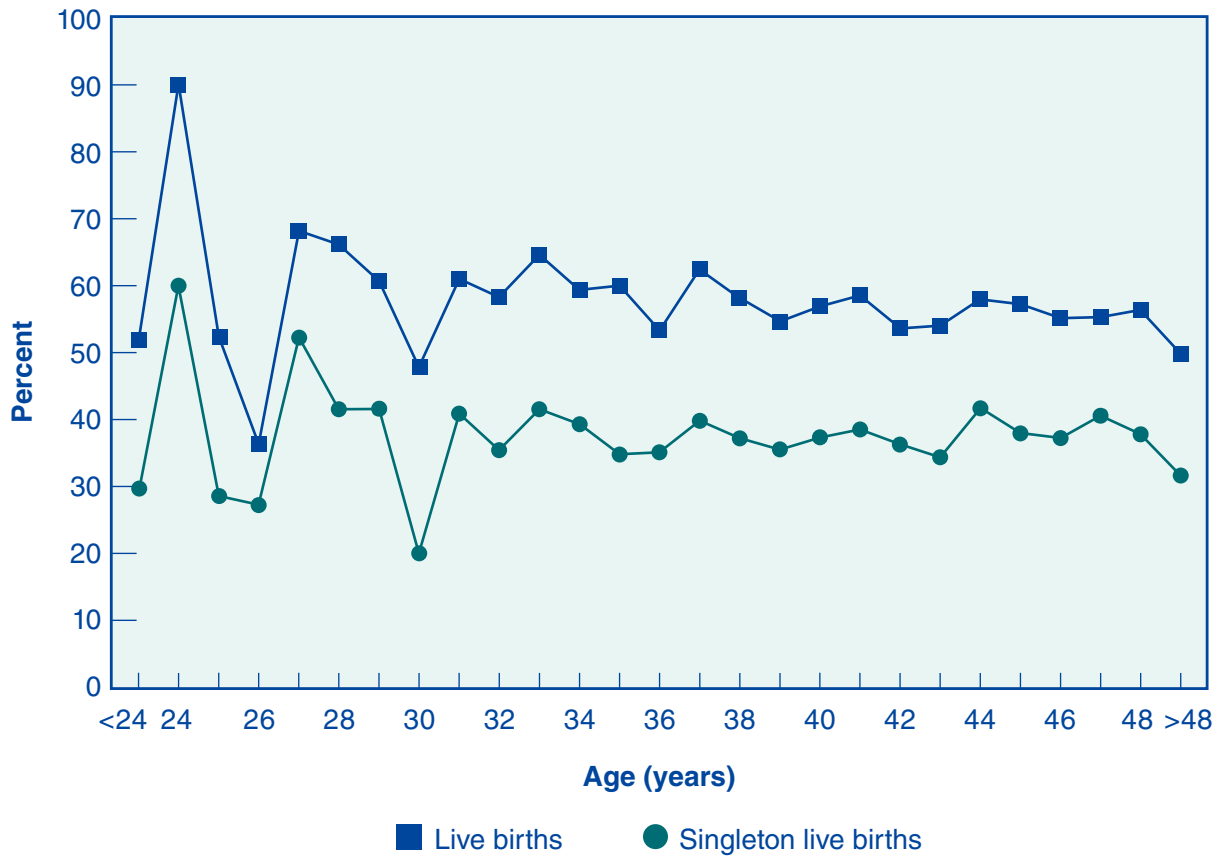
Figure 39
Percentages of Transfers Using Fresh Embryos from Donor or Nondonor Eggs That Resulted in Live Births, by Age of Woman, 2012



How successful is ART when donor eggs are used?

Figure 40 shows percentages of transfers using fresh embryos from donor eggs that resulted in live births and singleton live births among women of different ages, in 2012. For all ages, an average of 56% of transfers resulted in live births while 37% of transfers resulted in singleton live births. Singleton live births are an important measure of success because of a much lower risk than multiple-infant births for adverse infant health outcomes, including prematurity, low birth weight, disability, and death.

Figure 40
Percentages of Transfers Using Fresh Embryos from Donor Eggs That Resulted in Live Births and Singleton Live Births, by Age of Woman, 2012



What is the risk of a pregnancy with multiple fetuses or giving birth to multiple infants among ART pregnancies and live births resulting from fresh donor eggs?

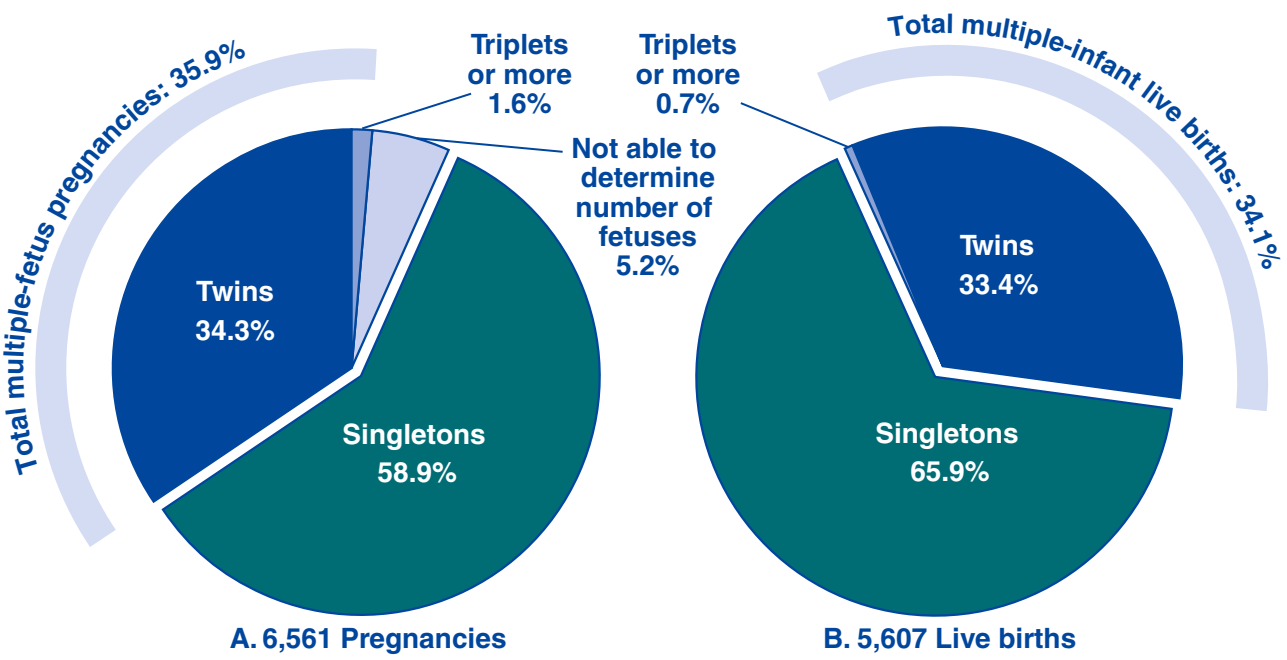
Multiple-infant births are associated with greater problems for both mothers and infants, including higher rates of caesarean section, prematurity, low birth weight, and infant disability or death.

Part A of Figure 41 shows that among the 6,561 pregnancies that resulted from ART cycles using fresh embryos from donor eggs, approximately 59% were singleton pregnancies, 34% were twins, and 2% were triplets or more. About 5% of pregnancies ended before the number of fetuses could be accurately determined. Therefore, the percentage of pregnancies with more than one fetus might have been higher than what was reported (approximately 36%).

Part B of Figure 41 shows 5,607 live births in 2012 resulted from ART cycles that used fresh embryos from donor eggs. Approximately 34% of these live births produced more than one infant. This compares with a multiple-infant birth rate of slightly more than 3% in the general US population.

Although total percentages for multiples were similar for pregnancies and live births, there were more triplet or higher order pregnancies than births. Triplet or higher order pregnancies may be reduced to twins or singletons by the time of birth. This can happen naturally (e.g., fetal death), or a woman and her doctor may decide to reduce the number of fetuses through a procedure called multifetal pregnancy reduction. CDC does not collect information on multifetal pregnancy reductions.

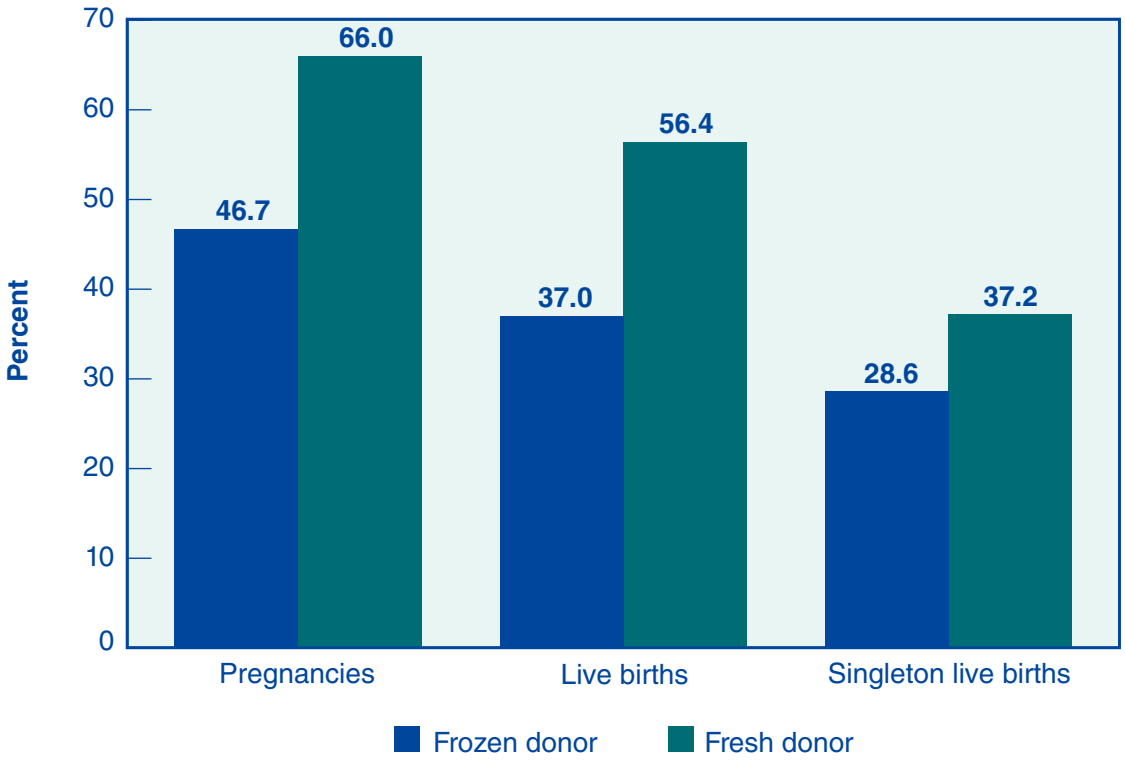
Figure 41
Distribution of Multiple-Fetus Pregnancies and Multiple-Infant Live Births Among ART Cycles Using Fresh Embryos from Donor Eggs, 2012



How do percentages of transfers resulting in pregnancies, live births, and singleton live births differ between ART transfers using frozen donor embryos and those using fresh donor embryos?

Figure 42 shows that percentages of transfers using frozen donor embryos that resulted in pregnancies, live births, and singleton live births were substantially lower than transfers using fresh donor embryos in 2012. The average number of embryos transferred was the same (1.8) for transfers using frozen donor embryos and those using fresh donor embryos.

Figure 42
Percentages of Transfers Using Frozen or Fresh Donor Embryos That Resulted in Pregnancies, Live Births, and Singleton Live Births, 2012



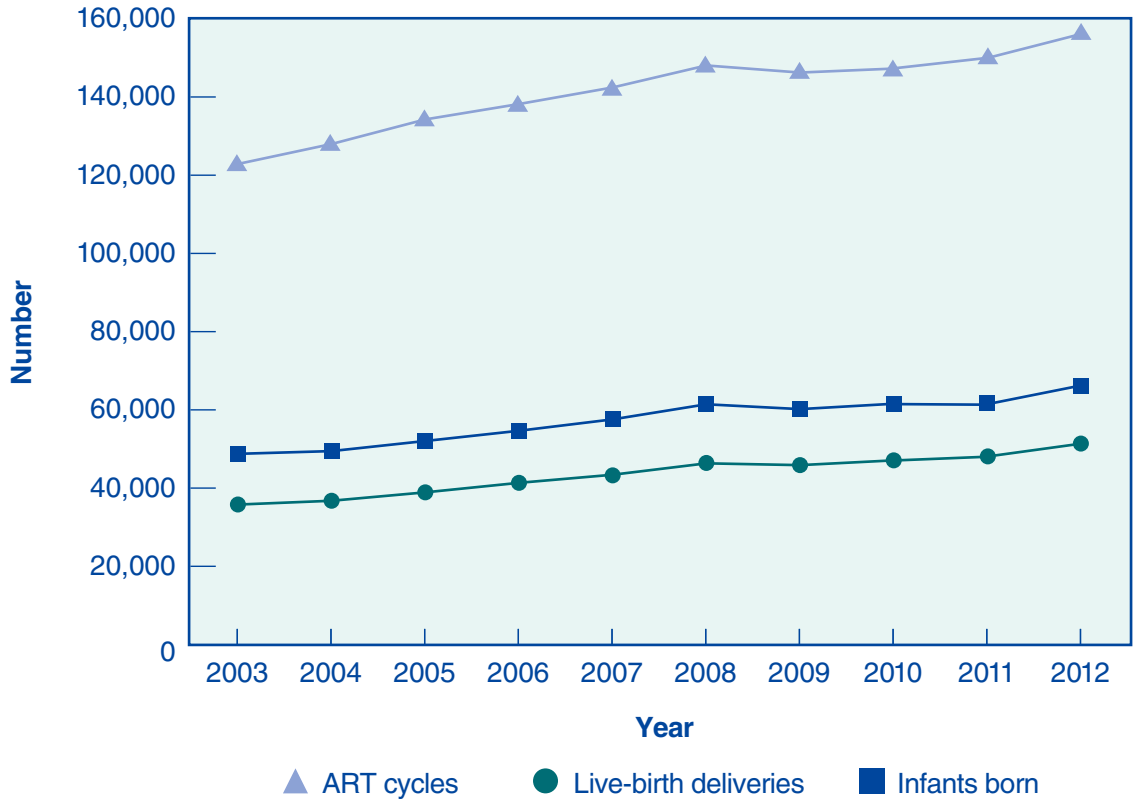
SECTION 5: ART TRENDS, 2003–2012

This report marks the eighteenth consecutive year that CDC has published an annual report detailing the success rates for ART clinics in the United States. Having many years of data provides us with the opportunity to examine trends in ART use and success rates over time. This report features an examination of trends for the most recent 10-year period, 2003–2012. Statistics for earlier years are available in previous annual publications of the *Assisted Reproductive Technology Success Rates: National Summary and Fertility Clinic Reports* and the *Assisted Reproductive Technology National Summary Report* for more recent years.

Is the use of ART increasing?

Figure 43 shows the number of ART cycles performed, live-birth deliveries, and infants born using ART from 2003 through 2012. The number of ART cycles performed in the United States has increased 28%, from 122,872 cycles in 2003 to 157,662 in 2012. The number of live-birth deliveries in 2012 (51,267) was almost one and a half times higher than in 2003 (35,785). The number of infants born who were conceived using ART also increased from 2003 through 2012. In 2012, a total of 65,160 infants were born, as compared with the 48,756 infants born in 2003. Because more than one infant is born during a live-birth delivery in some cases (e.g., twins), the total number of infants born is greater than the number of live-birth deliveries.

Figure 43
Numbers of ART Cycles Performed, Live-Birth Deliveries, and Infants Born Using ART, 2003–2012

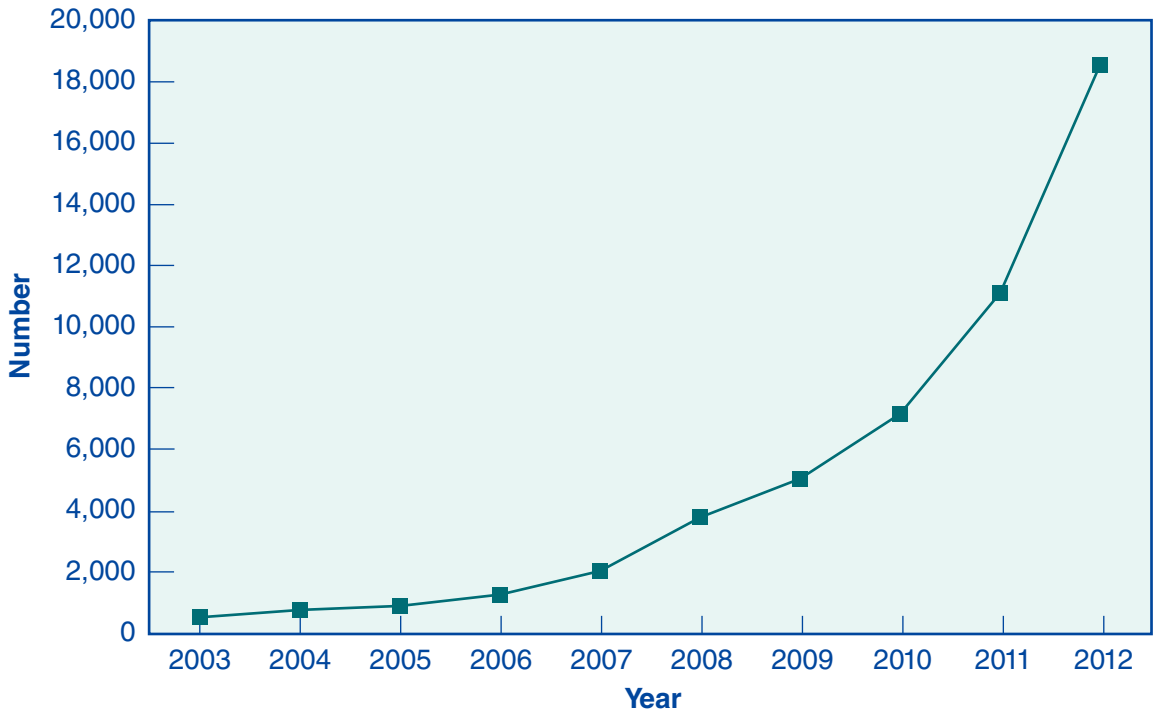


What are egg/embryo banking cycles and are they increasing?

An egg/embryo banking cycle is an ART cycle started with the intention of cryopreserving (freezing) all resulting eggs/embryos for potential future use, when they may be thawed, fertilized (if eggs), and transferred. This may be performed to avoid potentially negative effects of stimulation, or when it is necessary to wait for results of genetic testing. Egg/embryo banking may also be used when only a small number of eggs/embryos develop during one cycle. In this case, women may undergo several banking cycles to improve availability of good-quality eggs/embryos for transfer. In other situations, patients may choose to freeze eggs/embryos because the patient or partner needs to undergo medical treatment that may be harmful for their future reproduction capabilities or to delay childbearing for other reasons. These cycles are referred to as fertility preservation cycles.

Figure 44 shows that the number of cycles performed for banking all fresh nondonor eggs or embryos increased dramatically from 2003 through 2012.

Figure 44
Numbers of ART Cycles Performed for Banking All Fresh Nondonor Eggs or Embryos, 2003–2012

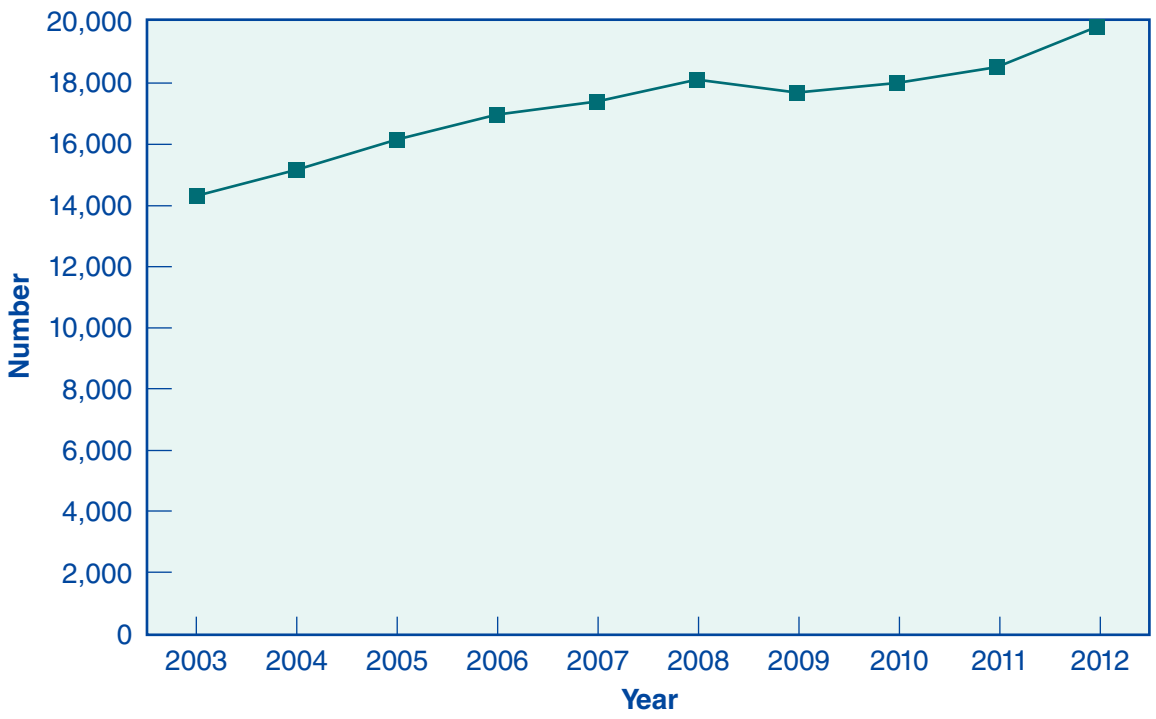


Is the number of cycles using donor eggs or embryos increasing?

A donor egg cycle is a cycle in which an embryo is formed from the egg of one woman (the donor) and the sperm from her partner or a donor and then transferred to another woman (the recipient). A donor embryo cycle is a cycle in which an embryo is donated by a patient who previously underwent ART treatment; neither the sperm nor egg is genetically related to the parent(s) who will raise the child. Donor cycles are most commonly used by women with diminished ovarian reserve, usually as a result of advanced maternal age or premature ovarian insufficiency. Donors are usually younger women, which results in higher pregnancy and lower miscarriage rates among recipients.

Figure 45 shows that the number of cycles performed using donor eggs or embryos increased almost 40%, from 14,323 in 2003 to 19,847 in 2012.

Figure 45
Numbers of ART Cycles Using Donor Eggs or Embryo, 2003–2012



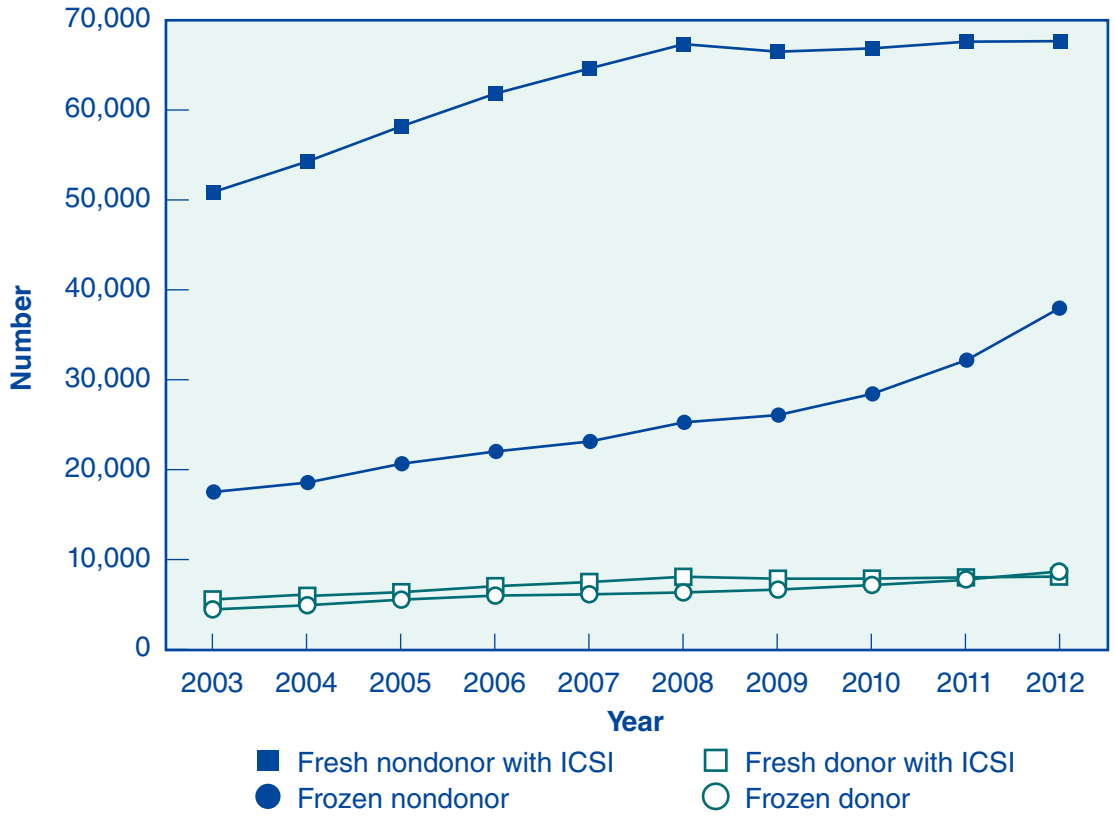
Is the use of ICSI increasing?

ICSI was originally developed for use in ART cycles to improve fertilization rates when severe male factor infertility was the indication for using ART. Today, this procedure is widely used even without a reported diagnosis of male factor infertility.

Figure 46 shows the number of ART cycles performed using ICSI from 2003 through 2012. Overall, the number of ART cycles with ICSI procedures continued to increase for all fresh cycles. During the past 10 years, the number of fresh nondonor cycles performed with ICSI increased more than 30%, from 50,872 in 2003 to 67,662 in 2012. The number of fresh donor cycles with ICSI increased almost 50%, from 5,565 to 8,245 during the same period.

Information on use of ICSI is not consistently collected across clinics for ART cycles using frozen embryos. The number of frozen cycles (with or without ICSI) more than doubled, from 17,517 in 2003 to 38,150 in 2012 for nondonor cycles, and almost doubled from 4,464 to 8,893 for donor cycles during the same period.

Figure 46
Numbers of ICSI Procedures Performed, by Type of ART Cycle, 2003–2012



Has the percentage of transfers with or without ICSI that resulted in live births changed?

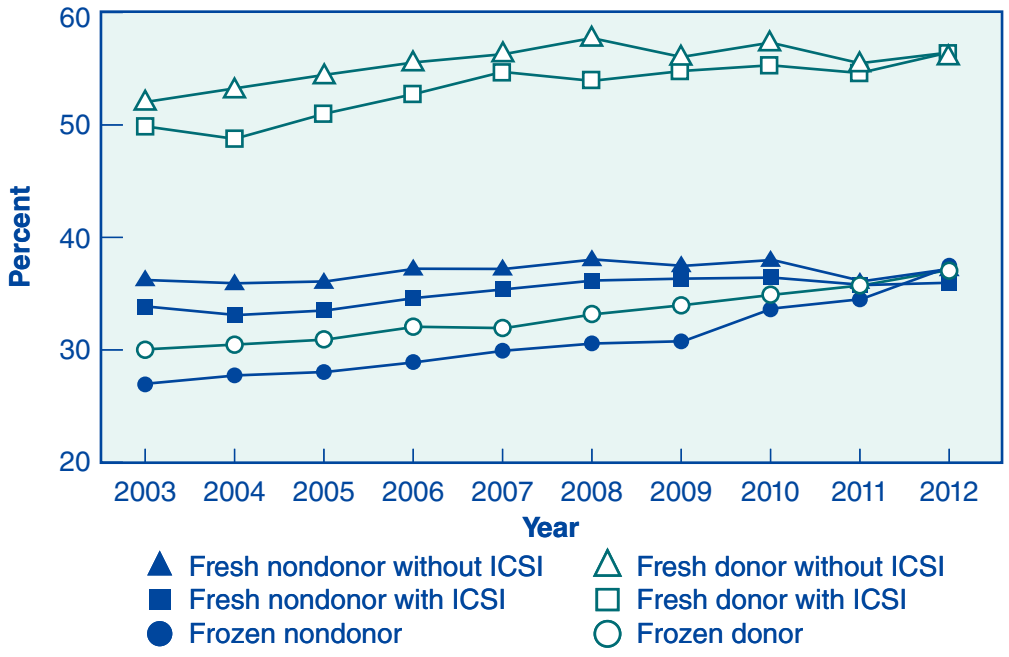
Figure 47 presents percentages of transfers with or without ICSI that resulted in live births. Percentages of transfers that resulted in live births are presented rather than percentages of cycles that resulted in live births to permit direct comparison of cycles using fresh embryos with those using frozen embryos.

In general, with or without ICSI, fresh donor transfers had the highest success rates when compared with fresh nondonor transfers or frozen transfers. However, when comparing success rates within each cycle type, the percentage of transfers without ICSI that resulted in live births remained slightly higher or equal to transfers with ICSI during 2003–2012.

The percentage of transfers using fresh donor embryos without ICSI that resulted in live births increased from 52% in 2003 to 56% in 2012, while transfers using fresh donor embryos with ICSI increased from 50% to 56% during the same period. Similar to trends with cycles using fresh donor embryos, the percentage of transfers using fresh nondonor cycles with ICSI that resulted in live births increased from 34% in 2003 to 36% in 2012.

Note that information on use of ICSI is not consistently collected across clinics for ART cycles using frozen embryos; therefore, these cycles are presented together as one group, regardless of whether ICSI is used.

Figure 47
Percentages of Transfers That Resulted in Live Births, by Type of ART Cycle and ICSI, 2003–2012

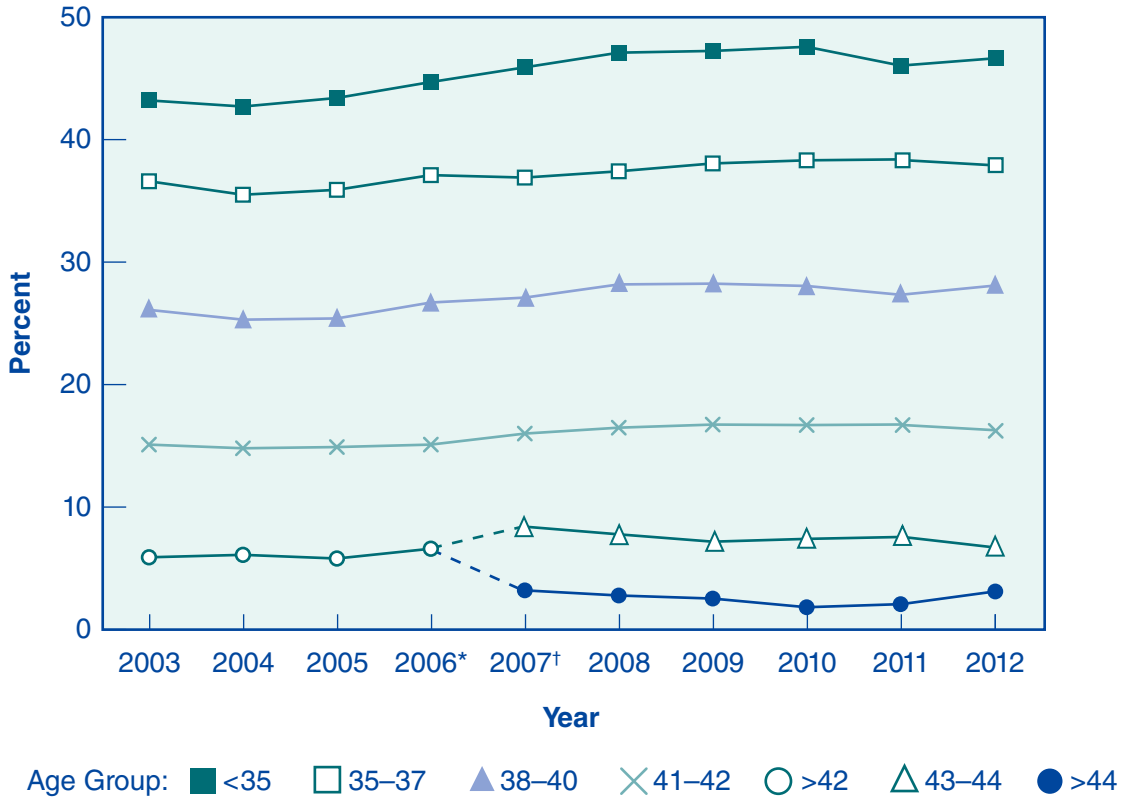


Has the percentage of transfers that resulted in live births for all ART patients changed or only for those in particular age groups?

Figure 48 presents percentages of transfers using fresh nondonor eggs or embryos that resulted in live births, by the age of the woman.

From 2003 through 2012, the percentage of transfers that resulted in live births for women younger than age 35 increased from 43% in 2003 to 47% in 2012. During the same period, the percentage of transfers that resulted in live births increased slightly from 37% to 38% for women aged 35–37 years, from 26% to 28% for women aged 38–40, and from 15% to 16% for women aged 41–42.

Figure 48
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Age Group, 2003–2012



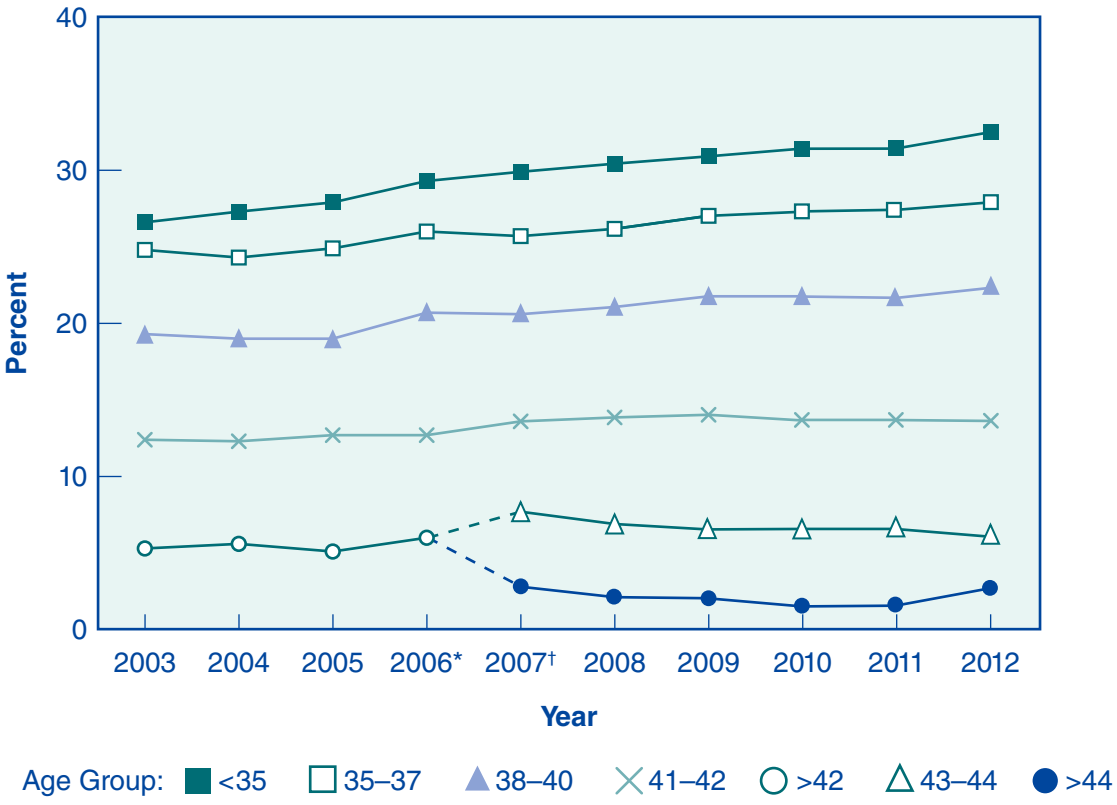
* 2006 was the last year in which data were reported together for women older than age 42.
† 2007 was the first year in which data for women older than age 42 were subdivided into ages 43–44 and >44.

Has the percentage of transfers that resulted in singleton live births for all ART patients changed or only for those in particular age groups?

Singleton live births have a much lower risk than multiple-infant births for adverse infant health outcomes, including prematurity, low birth weight, disability, and death. Figure 49 presents percentages of transfers using fresh nondonor eggs or embryos that resulted in singleton live births, by the age of the woman.

From 2003 through 2012, the percentage of transfers that resulted in singleton live births for women younger than age 35 increased from 27% in 2003 to 32% in 2012. During the same period, the percentage of transfers that resulted in singleton live births increased from 25% to 28% for women aged 35–37, from 19% to 22% for women aged 38–40, and from 12% to 14% for women aged 41–42.

Figure 49
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Singleton Live Births, by Age Group, 2003–2012

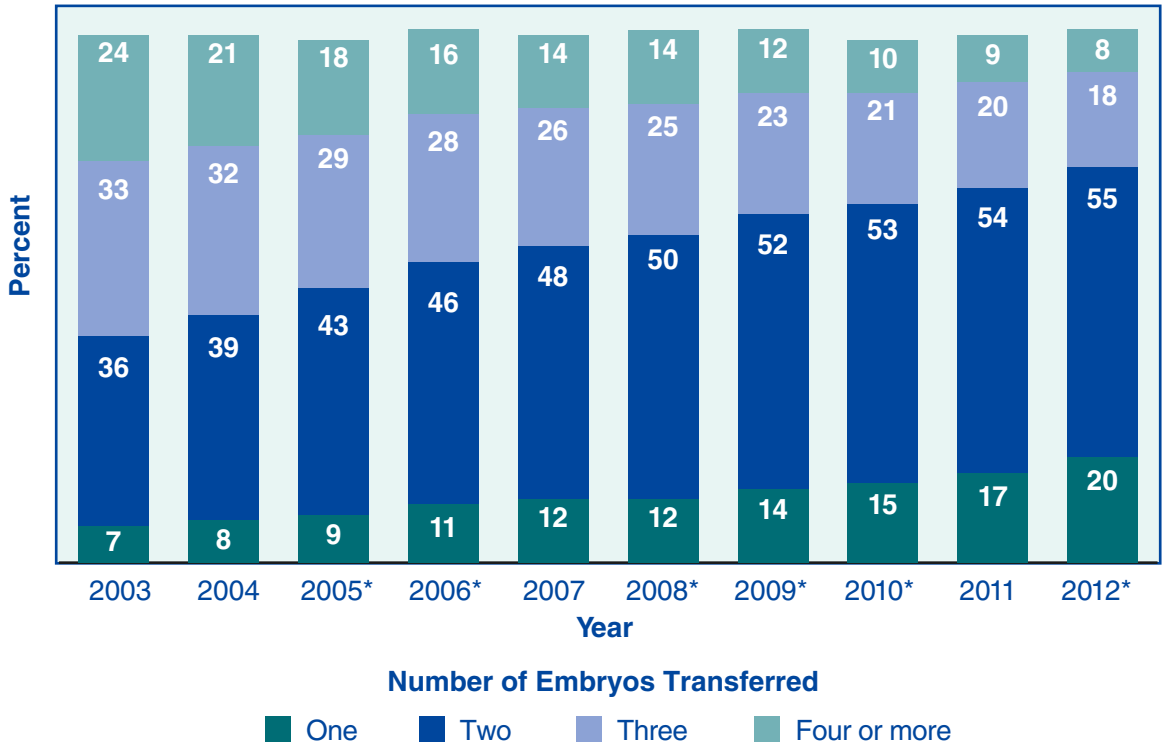


* 2006 was the last year in which data were reported together for women older than age 42.
† 2007 was the first year in which data for women older than age 42 were subdivided into ages 43–44 and >44.

Has the number of embryos transferred changed in fresh nondonor transfers?

Figure 50 presents trends in percentages for the number of embryos transferred in fresh nondonor cycles that progressed to the embryo transfer stage. From 2003 through 2012, transfers of one embryo almost tripled, from 7% to 20%; transfers of two embryos increased, from 36% in 2003 to 55% in 2012. However, transfers of three embryos decreased from 33% in 2003 to 18% in 2012, and transfers of four or more embryos decreased dramatically from 24% in 2003 to 8% in 2012.

Figure 50
Percentages of Fresh Nondonor Transfers of One, Two, Three, or Four or More Embryos, 2003–2012



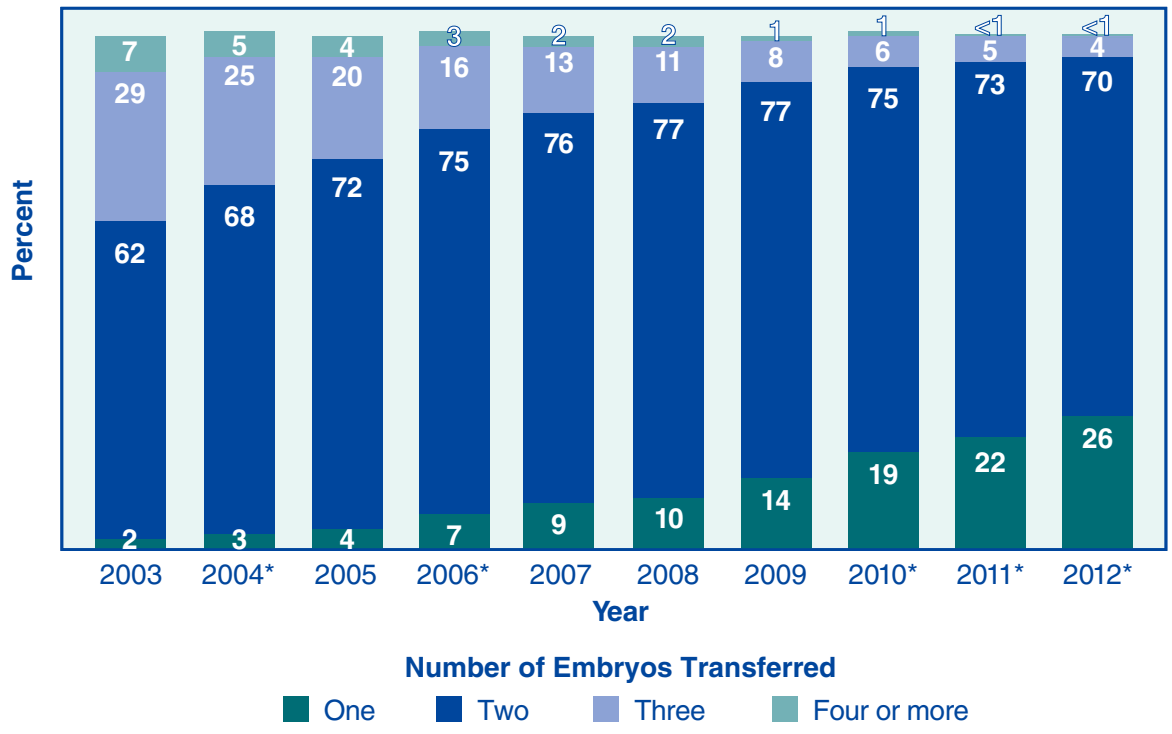
* Totals do not equal 100% due to rounding.

Has the number of embryos transferred changed in fresh nondonor transfers for women younger than age 35 who have more embryos available than they choose to transfer?

As shown in Figure 50 (page 56), the number of embryos transferred in fresh nondonor transfers has decreased during the past 10 years. Figure 51 shows the change over time in the number of embryos transferred for nondonor transfers in which the woman was younger than age 35 and chose to set aside some embryos for future cycles rather than transfer all available embryos at one time. Previous research suggests that the number of embryos available for an ART cycle is important in predicting success. Younger women also tend to have higher percentages of ART cycles that result in pregnancies and live births (see Figure 14, page 20).

Overall, the number of embryos transferred decreased among patients younger than age 35 who chose to transfer fewer embryos than were available. In 2003, approximately 7% of transfers involved the transfer of four or more embryos; 29%, three embryos; 62%, two embryos; and 2%, one embryo. By 2012, four or more embryos were transferred in less than 1% of transfers, three in 4% of transfers, two in 70% of transfers, and one in 26% of transfers.

Figure 51
Percentages of Fresh Nondonor Transfers of One, Two, Three, or Four or More Embryos Among Women Younger Than Age 35 Who Set Aside Extra Embryos for Future Use, 2003–2012



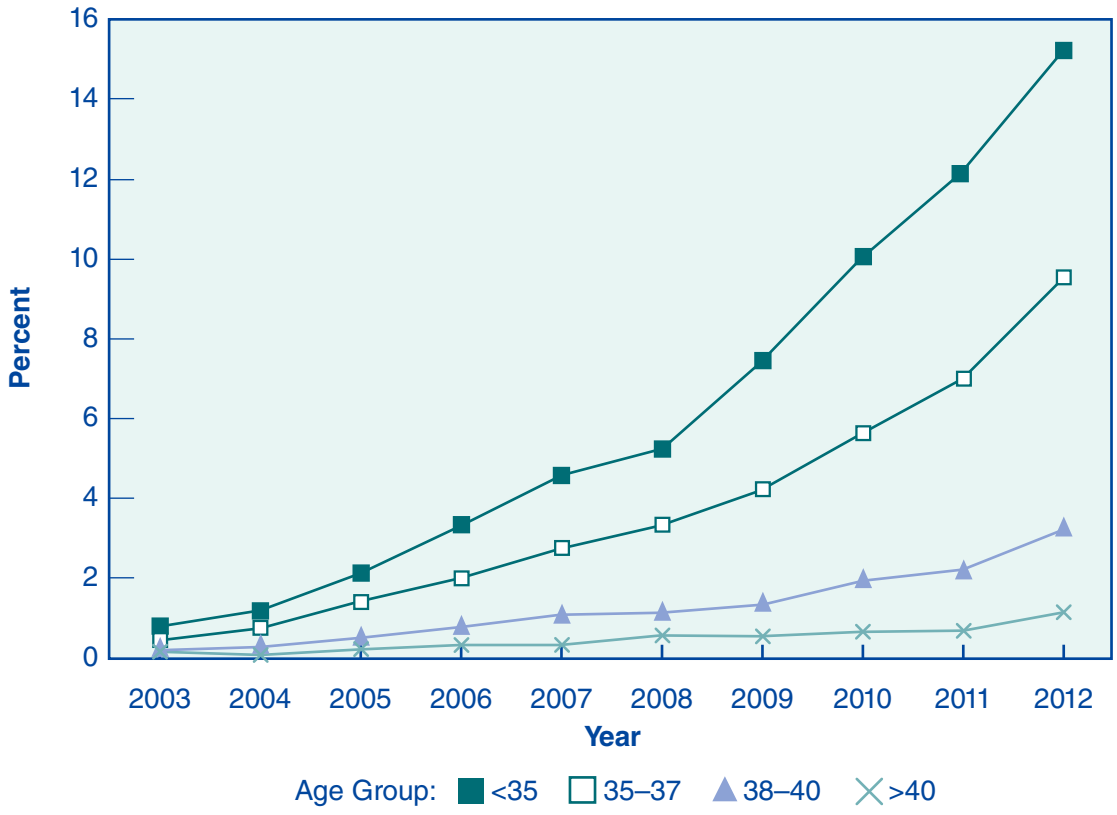
* Totals do not equal 100% due to rounding.

Has the percentage of elective single embryo transfers changed?

Elective single embryo transfer (eSET) refers to cycles in which only one embryo is transferred, even when additional, high-quality embryos are available for transfer. It does not include cycles in which only one embryo was available. When more than one embryo is available, the use of eSET is the most effective way to avoid a multiple gestation pregnancy and to reduce the risks for adverse infant health outcomes such as prematurity and low birth weight. Figure 52 presents percentages of ART transfers using fresh nondonor eggs or embryos that used eSET, by the age of the woman.

From 2003 through 2012, the percentage of transfers using eSET for women younger than age 35 increased from 1% in 2003 to 15% in 2012. During the same period, the percentage of transfers using eSET for women aged 35–37 increased from <1% in 2003 to 10% in 2012. For women aged 38–40, the percentage of transfers using eSET increased from <1% in 2003 to 3% in 2012, and, for women older than age 40, the percentage of transfers using eSET increased from <1% to 1%.

Figure 52
Percentages of Elective Single Embryo Transfer (eSET) Among All Transfers Using Fresh Nondonor Eggs or Embryos, by Age Group,* 2003–2012



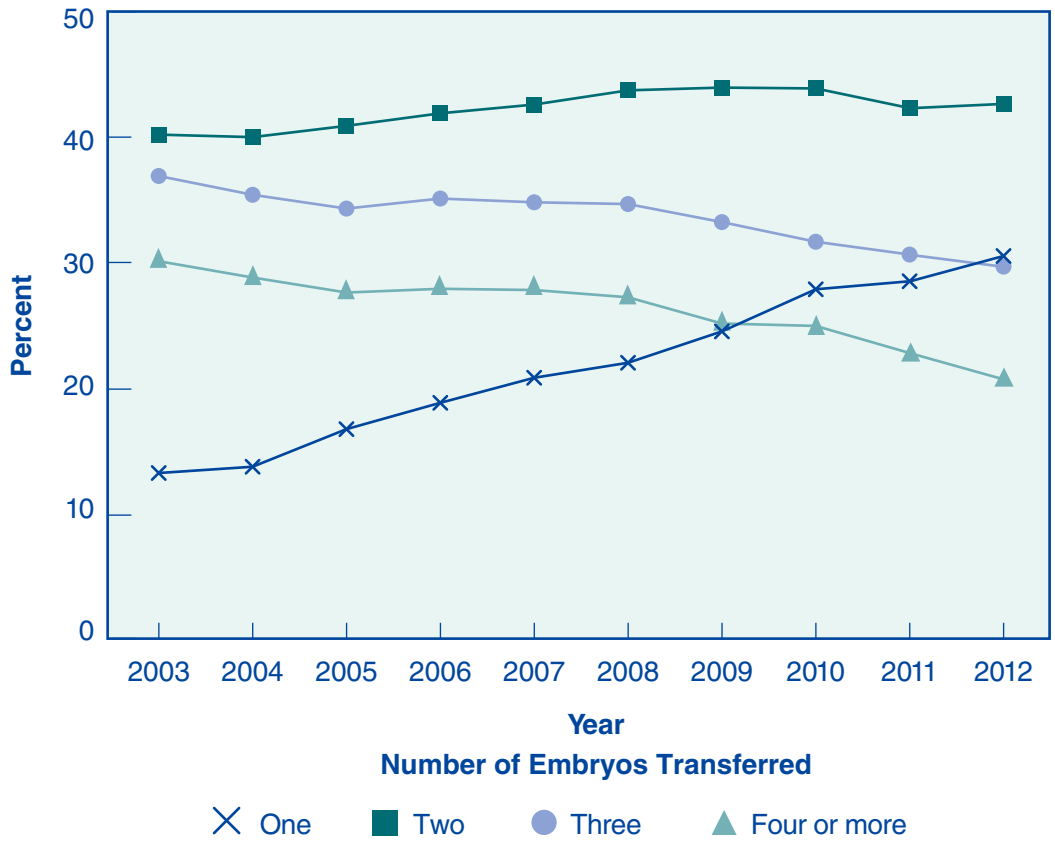
* All ages >40 years are reported together due to the small number of transfers performed with eSET.

Have there been changes in percentages of transfers that resulted in live births, by number of embryos transferred?

Figure 53 presents percentages of transfers using fresh nondonor eggs or embryos that resulted in live births, by the number of embryos transferred, from 2003 through 2012. The percentage of transfers that resulted in live births increased in the transfer of one or two embryos (13% to 31% and 40% to 43%, respectively). However, during the same period, there was a decrease in the transfer of three or four or more embryos (37% to 30% and 30% to 21%, respectively).

Interpretation of the relationship between the number of embryos transferred and success rates is complicated by several factors, such as the woman's age and embryo quality. Trends over time may reflect changes in these factors.

Figure 53
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births, by Number of Embryos Transferred, 2003–2012

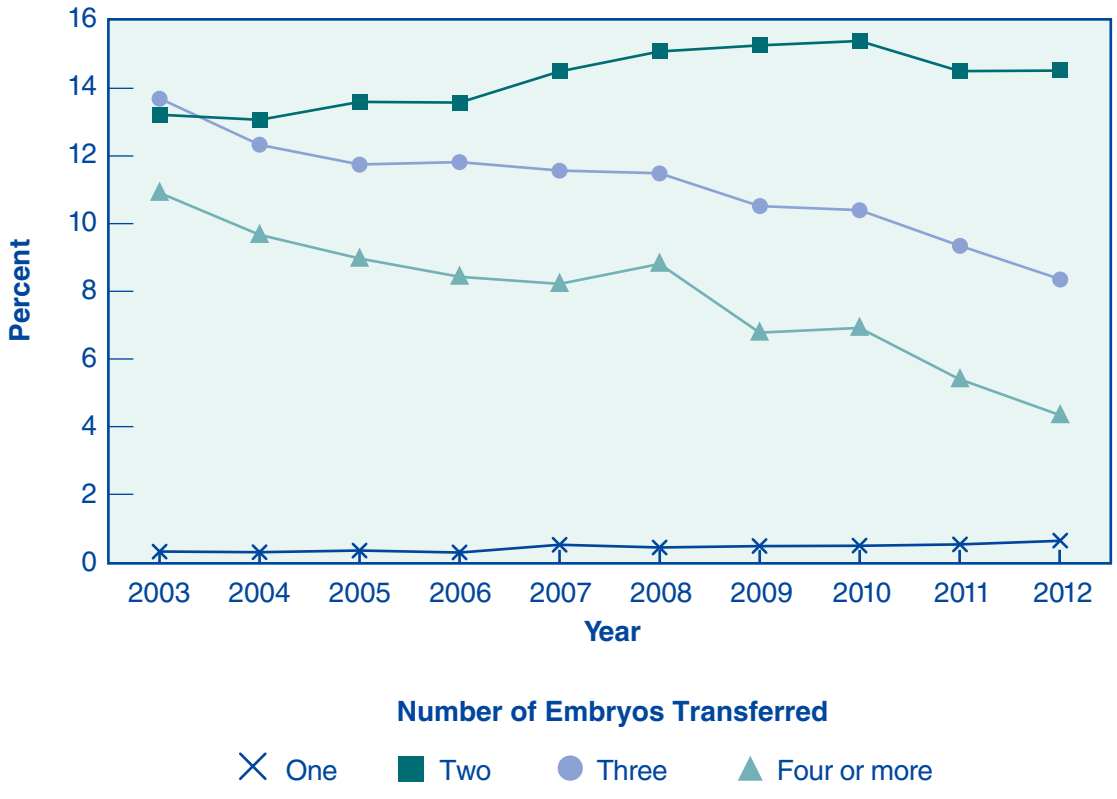


Have there been changes in percentages of transfers that resulted in multiple live births, by number of embryos transferred?

Figure 54 presents percentages of transfers using fresh nondonor eggs or embryos that resulted in multiple live births, by the number of embryos transferred, from 2003 through 2012. As shown in Figures 50 and 56 (pages 56 and 62), as the number of embryos transferred decreased from 2003 through 2012, the percentage of transfers that resulted in triplets or more also decreased.

The percentage of transfers of three or four or more embryos that resulted in multiple live births decreased from 2003 to 2012 (from 14% to 8% and from 11% to 4%, respectively). During the same period, there was a minimal increase in multiple live births for transfers of one or two embryos (the overall percentage change from 2003 to 2012 was <1% and 2%, respectively). This minimal increase may be attributable to several factors, such as the day of embryo transfer and embryo quality.

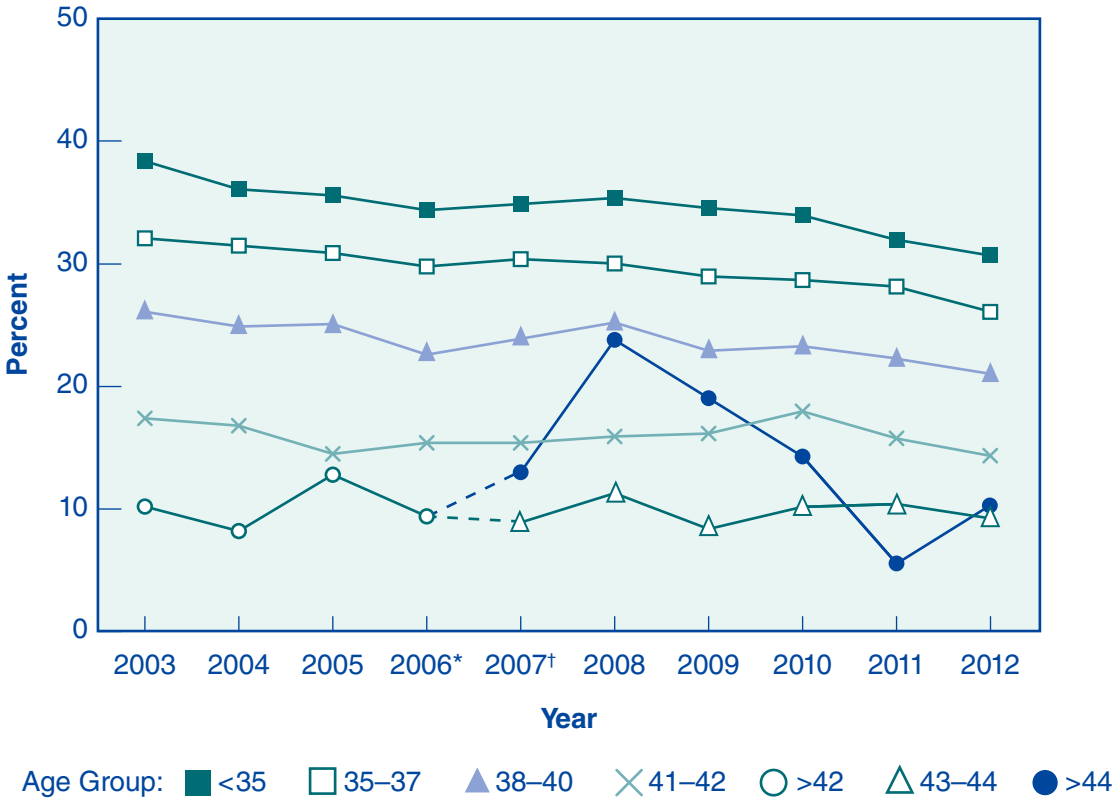
Figure 54
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Multiple-Infant Live Births, by Number of Embryos Transferred, 2003–2012



Have percentages of multiple-infant live births for ART cycles using fresh nondonor eggs or embryos that resulted in live births changed in particular age groups?

Figure 55 presents percentages of multiple-infant live births by the age of the woman, for ART cycles using fresh nondonor eggs or embryos that resulted in live births. From 2003 through 2012, the percentage of multiple-infant live births decreased 20% (from 38% to 31%) for women younger than age 35, 19% (from 32% to 26%) for women aged 35–37, 20% (from 26% to 21%) for women aged 38–40, and 18% (from 17% to 14%) for women aged 41–42. Overall, the percentage of multiple-infant live births among women older than age 44 decreased 20% (from 13% to 10%) from 2007 through 2012. Please note that percentages of multiple-infant live births were rounded to the nearest whole number, while percentage changes were calculated with raw data. Additionally, when interpreting data for women older than age 44, percentages may not be meaningful due to small numbers.

Figure 55
Percentages of Live Births Using Fresh Nondonor Eggs or Embryos That Resulted in Multiple Infants Born, by Age Group, 2003–2012



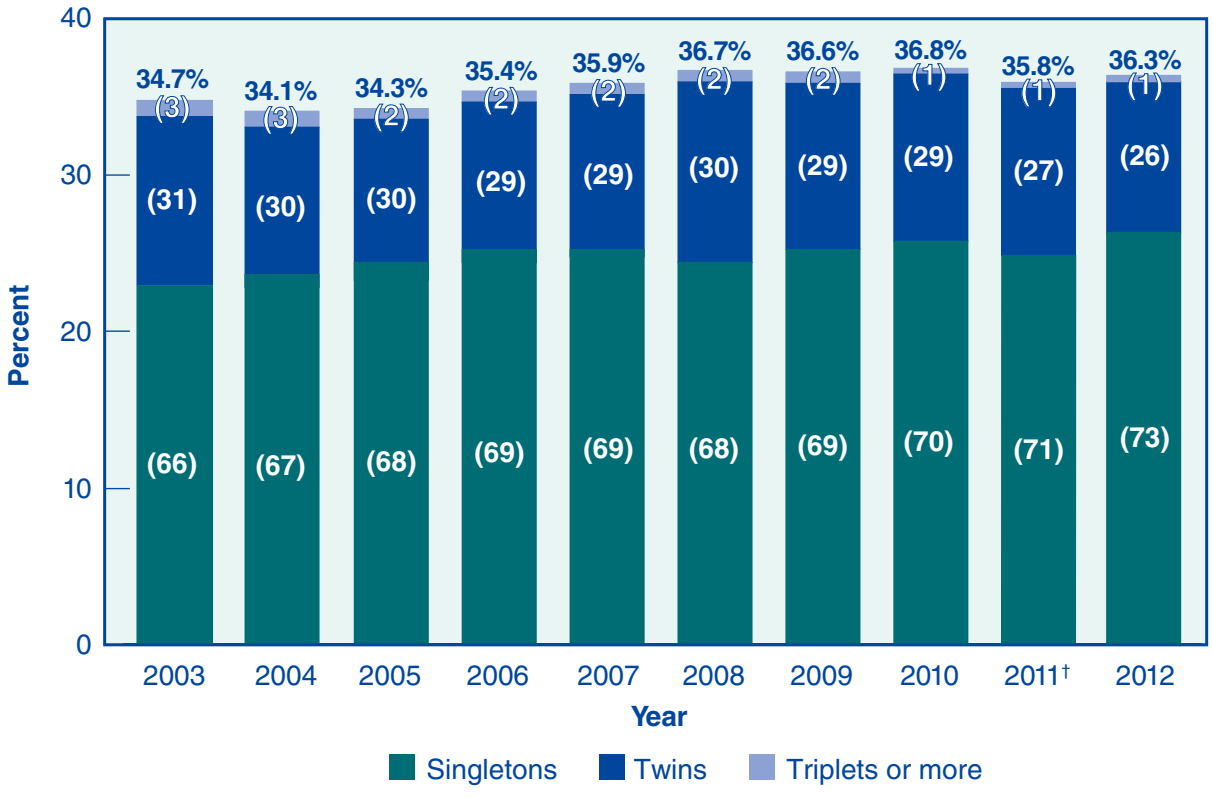
* 2006 was the last year in which data were reported together for women older than age 42.
† 2007 was the first year in which data for women older than age 42 were subdivided into ages 43–44 and >44.

Have percentages of singletons, twins, and triplets or more changed for transfers using fresh nondonor eggs or embryos?

Figure 56 presents trends in percentages of transfers using fresh nondonor eggs or embryos that resulted in live births and percentages of multiple-infant live births. Overall, the percentage of transfers that resulted in live births increased slightly during the past 10 years. From 2003 through 2012, the percentage of singleton live births increased from 66% to 73%; the percentage of twin births declined from 31% to 26%; and the percentage of triplet or higher order births decreased from 3% in 2003 to 1% in 2012.

It is important to note that twins, albeit to a lesser extent than triplets or more, are still at substantially greater risk of illness and death than singletons. These risks include low birth weight, preterm birth, and neurological impairments such as cerebral palsy.

Figure 56
Percentages of Transfers Using Fresh Nondonor Eggs or Embryos That Resulted in Live Births and Distribution of Number of Infants Born,* 2003–2012



* Percentages of live births that were singletons, twins, and triplets or more are in parentheses.
† Total does not equal 100% due to rounding.

2012

Appendix A

Validation

APPENDIX A: VALIDATION

Findings from Validation Visits for 2012 ART Data

Site visits to assisted reproductive technology (ART) clinics for validation of 2012 ART data were conducted during April through June 2014. For validation of 2012 data, 35 of the 456 reporting clinics were randomly selected after taking into consideration the number of ART procedures performed at each clinic, some cycle and clinic characteristics, and whether the clinic had been selected before. During each validation visit, ART data reported by the clinic to the Centers for Disease Control and Prevention were compared with information documented in medical records.

For each clinic, the fully validated sample included up to 40 ART cycles resulting in pregnancy and up to 20 ART cycles not resulting in pregnancy. Up to 10 cycles using donor eggs were included among the fully validated sample at each clinic. In total, 2,045 ART cycles performed in 2012 across the 35 clinics were randomly selected for full validation, along with 238 egg/embryo banking cycles. The full validation included review of 1,318 cycles for which a pregnancy was reported. Among the nondonor cycles, 331 were multiple-fetus pregnancies. In addition, among patients whose cycles were validated, we verified the number of ART cycles performed during 2012. For each of these patients, we compared the total number of ART cycles reported with the total number of ART cycles included in the medical record. If unreported cycles were identified in selected medical records, up to 10 of these cycles were also selected for partial validation.

Discrepancy rates are listed on the next pages for validated items of interest. Overall, validation of 2012 ART cycle data indicated that most discrepancy rates were low (<5%).

Discrepancy Rates by Data Fields Selected for Validation

Data Field Name	Discrepancy Rate* (Confidence Interval†)	Comments
Patient date of birth	1.7% (1.0–2.4)	For approximately two out of three discrepancies, the difference did not result in changing the age category (age of woman).
Cycle intention	4.1% (0.0–8.2)	For approximately 90% of the discrepancies, an ART procedure cycle was misreported as an egg/embryo banking cycle.
Cycle cancellation	1.4% (0.3–2.5)	For approximately half of the discrepancies, a cycle was misreported as canceled.
Number of eggs/ embryos transferred	<1%	
Outcome of ART treatment (i.e., pregnant vs. not pregnant)	1.8% (0.2–3.3)	For approximately one out of three discrepancies, the ART treatment outcome was misreported as clinical intrauterine gestation.
Number of fetal hearts on ultrasound	2.0% (1.0–3.0)	For 10% of the discrepancies, multiple-fetus pregnancies were misreported as single-fetus pregnancies, whereas for 15%, one or more fetal hearts were misreported when the medical records actually showed zero (0) fetal hearts. For approximately 50% of the discrepancies, the maximum number of fetal hearts could not be confirmed in the medical records.
Pregnancy outcome (e.g., miscarriage, live birth, and stillbirth)	2.3% (0.7–3.9)	For about 50% of the discrepancies, pregnancy outcome was misreported as a live birth when there was no information on pregnancy outcome in the medical records to confirm the birth.
Date of pregnancy outcome	4.7% (2.8–6.5)	For about 40% of the discrepancies, there was no information on pregnancy outcome date in the medical records. For another 25% of the discrepancies, the date in the medical records was within 7 days of the reported date.
Number of infants born	1.6% (0.6–2.7)	For approximately 80% of the discrepancies, there was no information on the number of infants born in the medical records.

Discrepancy Rates by Data Fields Selected for Validation (Cont'd)

Data Field Name	Discrepancy Rate* (Confidence Interval†)	Comments
Cycle count	2.3% (0.7–3.9)	For approximately 80% of the discrepancies, fewer cycles were reported by clinics than were found in the medical records. The majority of these discrepancies were due to reporting one less cycle. A further analysis of the unreported cycles revealed that approximately one in three were canceled cycles and an overwhelming majority (around 95%) did not result in a live birth (i.e. success).
Patient Diagnosis—Reason for ART		
Male factor	4.0% (1.9–6.1)	The following reasons for ART were underreported: male factor, endometriosis, tubal factor, ovulatory dysfunction, diminished ovarian reserve, and uterine factor. Other factor, as a reason for ART, was equally under- and overreported. Unknown factor, as a reason for ART, was overreported.
Endometriosis	2.2% (1.2–3.2)	
Tubal factor	2.2% (0.9–3.5)	
Ovulatory dysfunction	3.3% (1.2–5.5)	
Diminished ovarian reserve	6.5% (4.2–8.8)	
Uterine factor	1.7% (0.7–2.7)	
Other factor	5.5% (3.1–7.9)	
Unknown factor	4.0% (1.8–6.2)	

Note: ART = assisted reproductive technology.

* Discrepancy rates estimate the proportion of all ART cycles with differences for a particular data item. The discrepancy rate calculations weight the data from validated cycles to reflect the overall number of cycles performed at each clinic. Thus, findings from larger clinical practices were weighted more heavily than those from smaller practices.

† This table shows a range, called the 95% confidence interval, that conveys the reliability of the discrepancy rate. For a general explanation of confidence intervals, see page 68.

How to Interpret a Confidence Interval for Findings from Validation Visits

What is a confidence interval?

Simply speaking, confidence intervals are a useful way to consider margin of error, a statistic often used in voter polls to indicate the range within which a value is likely to be correct (e.g., 30% of the voters favor a particular candidate with a margin of error of plus or minus 3.5%). Similarly, in this report, confidence intervals are presented to provide a discrepancy rate range that we can be confident is an estimate of the proportion of all ART cycles, performed in a given reporting year, with differences for a particular data item.

Why do we need to consider confidence intervals if we already know the exact discrepancy rates for each clinic?

No discrepancy rate or statistic is absolute. Suppose that during validation, 100 cycles were reviewed, and a discrepancy rate of 15% was determined for a particular data item with a confidence interval of 10%–20%. The 15% discrepancy rate tells us that the average chance that a discrepancy occurred for the selected data field among all reported cycles was 15%. But because only a certain percentage of ART cycles were reviewed during the validation visits at a select number of clinics, how likely is it that this would be the discrepancy rate if we repeated validation? For example, if another 100 cycles were reviewed using similar validation parameters, would the discrepancy rate again be 15%? The confidence interval tells us that the discrepancy rate would likely fall between 10% and 20%.

2012

Appendix B

Glossary of Terms

APPENDIX B: GLOSSARY OF TERMS

Adverse outcome. A pregnancy that does not result in a live birth. The adverse outcomes reported for ART procedures are miscarriages, induced abortions, and stillbirths.

American Society for Reproductive Medicine (ASRM). Professional society whose affiliate organization, the Society for Assisted Reproductive Technology (SART), is composed of clinics and programs that provide ART.

ART (assisted reproductive technology). All treatments or procedures that involve surgically removing eggs from a woman's ovaries and combining the eggs with sperm to help a woman become pregnant. The types of ART are in vitro fertilization (IVF), gamete intrafallopian transfer (GIFT), and zygote intrafallopian transfer (ZIFT).

ART cycle. A process in which (1) an ART procedure is performed, (2) a woman has undergone ovarian stimulation or monitoring with the intent of having an ART procedure, or (3) frozen embryos have been thawed with the intent of transferring them to a woman. A cycle begins when a woman begins taking fertility drugs or having her ovaries monitored for follicle production.

Canceled cycle. An ART cycle in which ovarian stimulation was performed but was stopped before eggs were retrieved or, in the case of frozen embryo cycles, before embryos were transferred. Cycles are canceled for many reasons: eggs may not develop, the patient may become ill, or the patient may choose to stop treatment.

Combination cycle. A cycle that uses more than one ART procedure. Combination cycles usually involve IVF plus either GIFT or ZIFT.

Cryopreservation. The practice of freezing extra embryos from a patient's ART cycle for potential future use.

Diminished ovarian reserve. This diagnosis means that the ability of the ovary to produce eggs is reduced. Reasons include congenital, medical, or surgical causes or advanced age.

Donor egg cycle. An embryo is formed from the egg of one woman (the donor) and then transferred to another woman (the recipient). The donor relinquishes all parental rights to any resulting offspring.

Donor embryo. An embryo that is donated by a patient who previously underwent ART treatment and had extra embryos available.

Ectopic pregnancy. A pregnancy in which the fertilized egg implants in a location outside of the uterus—usually in the fallopian tube, the ovary, or the abdominal cavity. Ectopic pregnancy is a dangerous condition that must receive prompt medical treatment.

Egg. A female reproductive cell, also called an oocyte or ovum.

Egg retrieval (also called oocyte retrieval). A procedure to collect the eggs contained in the ovarian follicles.

Egg transfer (also called oocyte transfer). The transfer of retrieved eggs into a woman's fallopian tubes through laparoscopy. This procedure is used only in GIFT.

Embryo. An egg that has been fertilized by a sperm and has undergone one or more divisions.

Embryo transfer. Placement of embryos into a woman's uterus through the cervix after IVF: in ZIFT, the embryos are placed in a woman's fallopian tube.

Endometriosis. A medical condition that involves the presence of tissue similar to the uterine lining in abnormal locations. This condition can affect both fertilization of the egg and embryo implantation.

eSET (elective single-embryo transfer). Elective single-embryo transfer is a procedure in which one embryo, selected from a larger number of available embryos, is placed in the uterus or fallopian tube. The embryo selected for eSET might be from a previous IVF cycle (i.e., cryopreserved embryos [frozen]) or from the current fresh IVF cycle that yielded more than one embryo. The remaining embryos may be set aside for future use or cryopreservation.

Fertility Clinic Success Rate and Certification Act of 1992 (FCSRCA). Law passed by the United States Congress in 1992 requiring all clinics performing ART in the United States to annually report their success rate data to the Centers for Disease Control and Prevention.

Fertilization. The penetration of the egg by the sperm and the resulting combining of genetic material that develops into an embryo.

Fetus. The unborn offspring from the eighth week after conception to the moment of birth.

Follicle. A structure in the ovaries that contains a developing egg.

Fresh eggs, sperm, or embryos. Eggs, sperm, or embryos that have not been frozen. Fresh embryos, however, may have been conceived using either fresh or frozen sperm.

Frozen embryo cycle. An ART cycle in which frozen (cryopreserved) embryos are thawed and transferred to the woman.

Gamete. A reproductive cell, either a sperm or an egg.

Gestation. The period of time from conception to birth.

Gestational carrier (also called a gestational surrogate). A woman who gestates, or carries, an embryo that was formed from the egg of another woman. The gestational carrier usually has a contractual obligation to return the infant to its intended parents.

Gestational sac. A fluid-filled structure that develops within the uterus early in pregnancy. In a normal pregnancy, a gestational sac contains a developing fetus.

GIFT (gamete intrafallopian transfer). An ART procedure that involves removing eggs from the woman's ovary, combining them with sperm, and using a laparoscope to place the unfertilized eggs and sperm into the woman's fallopian tube through small incisions in her abdomen.

ICSI (intracytoplasmic sperm injection). A procedure in which a single sperm is injected directly into an egg; this procedure is commonly used to overcome male infertility problems.

Implantation rate. A measurement of ART success when the ART cycle results in an intrauterine clinical pregnancy, defined as the larger of either the number of maximum fetal hearts by ultrasound or maximum infants born, including live births and stillbirths, out of the total number of embryos transferred.

Induced or therapeutic abortion. A surgical or other medical procedure used to end a pregnancy.

IUI (intrauterine insemination). A medical procedure that involves placing sperm into a woman's uterus to facilitate fertilization. IUI is not considered an ART procedure because it does not involve the manipulation of eggs.

IVF (in vitro fertilization). An ART procedure that involves removing eggs from a woman's ovaries and fertilizing them outside her body. The resulting embryos are then transferred into a woman's uterus through the cervix.

Laparoscopy. A surgical procedure in which a fiber-optic instrument (a laparoscope) is inserted through a small incision in the abdomen to view the inside of the pelvis.

Live birth. The delivery of one or more infants with any signs of life.

Male factor. Any cause of infertility due to low sperm count or problems with sperm function that makes it difficult for a sperm to fertilize an egg under normal conditions.

Miscarriage (also called spontaneous abortion). A pregnancy ending in the spontaneous loss of the embryo or fetus before 20 weeks of gestation, or before 18 weeks from the date of transfer if the pregnancy was achieved using ART.

Multifetal pregnancy reduction. A procedure used to decrease the number of fetuses a woman carries and improve the chances that the remaining fetuses will develop into healthy infants. Multifetal reductions that occur naturally are referred to as spontaneous reductions.

Multiple factors, female and male. A diagnostic category used when one or more female cause of infertility and male factor infertility are diagnosed.

Multiple factors, female only. A diagnostic category used when more than one female cause of infertility is diagnosed.

Multiple-fetus pregnancy. A pregnancy with two or more fetuses, determined by the number of fetal hearts observed on an ultrasound performed early in pregnancy (usually in the first trimester).

Multiple-infant birth. A pregnancy that results in the birth of more than one infant.

NASS (National ART Surveillance System). Web-based data collection system used by all ART clinics to report data for each ART procedure to CDC.

Oocyte. The female reproductive cell, also called an egg.

Oocyte/Embryo banking cycle. An ART cycle started with the intention of cryopreserving (freezing) all resulting oocytes/embryos for potential future use.

Other causes of infertility. These include immunological problems, chromosomal abnormalities, cancer chemotherapy, and serious illnesses.

Ovarian monitoring. The use of ultrasound and/or blood or urine tests to monitor follicle development and hormone production.

Ovarian stimulation. The use of drugs (oral or injected) to stimulate the ovaries to develop follicles and eggs.

Ovulatory dysfunction. A diagnostic category used when a woman's ovaries are not producing eggs normally. It includes polycystic ovary syndrome and multiple ovarian cysts.

PGD (preimplantation genetic diagnosis). A technique combining advances in molecular genetics and ART. PGD allows physicians to identify various genetic diseases in the embryo (fertilized egg with several divisions) prior to implantation, that is, before the pregnancy is established. It is of special value for those who are at risk of having children with serious genetic problems.

Pregnancy (clinical). A pregnancy documented by ultrasound that shows a gestational sac in the uterus. For ART data collection purposes, pregnancy is defined as a clinical pregnancy rather than a chemical pregnancy (i.e., a positive pregnancy test).

Singleton. A single live-born infant.

Society for Assisted Reproductive Technology (SART). An affiliate of ASRM composed of clinics and programs that provide ART.

Sperm. The male reproductive cell.

Spontaneous abortion. See Miscarriage.

Stillbirth. The birth of an infant that shows no sign of life after 20 or more weeks of gestation, or 18 or more weeks from the date of transfer if the pregnancy was achieved using ART.

Stimulated cycle. An ART cycle in which a woman receives oral or injected fertility drugs to stimulate her ovaries to produce more follicles.

Thawed embryo cycle. Same as frozen embryo cycle.

Tubal factor. A diagnostic category used when the woman's fallopian tubes are blocked or damaged, making it difficult for the egg to be fertilized or for an embryo to travel to the uterus.

Ultrasound. A technique used in ART for visualizing the follicles in the ovaries, the gestational sac, or the fetus.

Unexplained cause of infertility. A diagnostic category used when no cause of infertility is found in either the woman or the man.

Unstimulated cycle. An ART cycle in which the woman does not receive drugs to stimulate her ovaries to produce more follicles. Instead, follicles develop naturally.

Uterine factor. A structural or functional disorder of the uterus that results in reduced fertility.

ZIFT (zygote intrafallopian transfer). An ART procedure in which eggs are collected from a woman's ovary and fertilized outside her body. A laparoscope is then used to place the resulting zygote (fertilized egg) into the woman's fallopian tube through a small incision in her abdomen.

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