

Assisted Reproductive Technology Surveillance — United States, 2009



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Front cover photo: Laboratorian performing in vitro fertilization, a procedure performed in a laboratory by which sperm is combined with an egg in a Petri dish containing a fluid medium to achieve fertilization.

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Abstract

Problem/Condition: Since the birth of the first U.S. infant conceived with Assisted Reproductive Technology (ART) in 1981, use of advanced technologies to overcome the problem of infertility has increased steadily, as has the number of fertility clinics providing ART services in the United States. ART includes fertility treatments in which both eggs and sperm are handled in the laboratory (i.e., in vitro fertilization [IVF] and related procedures). Women who undergo ART procedures are more likely to deliver multiple-birth infants than those who conceive naturally. Multiple births pose substantial risks to both mothers and infants, including pregnancy complications, preterm delivery, and low birthweight infants. This report presents the most recent data on ART use and birth outcomes for U.S. states and territories.

Reporting Period Covered: 2009.

Description of System: In 1996, CDC began collecting data on all ART procedures performed in the United States, as mandated by the Fertility Clinic Success Rate and Certification Act of 1992 (FCSRCA) (Public Law 102-493 [October 24, 1992]). ART data for 1995–2003 were obtained from the Society of Assisted Reproductive Technology (SART) through its proprietary Clinical Outcomes Reporting System data base (SART CORS). Since 2004, CDC has contracted with Westat, Inc., a statistical survey research organization, to obtain data from fertility clinics in the United States through the National ART Surveillance System (NASS), a web-based data collection system developed by CDC.

Results: In 2009, a total of 146,244 ART procedures were reported to CDC. These procedures resulted in 45,870 live-birth deliveries and 60,190 infants. The largest numbers of ART procedures were performed among residents of California (18,405), New York (14,539), Illinois (10,192), Massachusetts (9,845), New Jersey (9,146), and Texas (8,244). Together, these six states reported the highest number of live-birth deliveries as a result of ART and accounted for 48% of all ART procedures initiated, 46% of all infants born from ART, and 45% of all ART multiple-birth deliveries but only 34% of all births in the United States. Nationally, the average number of ART procedures performed per 1 million women of reproductive age (15–44 years), which is a proxy indicator of ART utilization, was 2,361. In four states (Massachusetts, New York, New Jersey, and Connecticut) and the District of Columbia, this proxy measure of ART use exceeded twice the national average. Nationally, the average number of embryos transferred was 2.1 among women aged <35 years, 2.5 among women aged 35–40 years, and 3.0 among women aged >40 years (and varied most in this age group from 1.7 in Maine to 3.5 in Missouri). Age-specific elective single-embryo transfer (eSET) rates were approximately 7% among women aged <35 years, 3% among women aged 35–40 years, and 0.5% among women aged >40 years. The highest rates of eSET were observed among women aged <35 years (41% in Delaware, 20% in Iowa, and 17% Massachusetts).

Overall, ART contributed to 1.4% of U.S. births (ranging from 0.2% in Puerto Rico to 4.3% in Massachusetts). The proportion of ART to total infants born in the state or territory, which is another measure of ART utilization, was highest in Massachusetts (>4%) with high rates also observed in New Jersey, New York, Connecticut, and the District of Columbia (>3% of all infants born). Infants conceived with ART accounted for 20% of all multiple-birth infants (ranging from 4% in Maine to 41% in New York), 19% of all twin births (ranging from 4% in Maine to 42% in New York) and 34% of triplet or higher order births (ranging from 0 in several states to 61.5% in New Jersey). Among infants conceived with ART, 47% were born as multiple-birth infants (ranging from 35% in Delaware to 60.8% in Wyoming), compared with only 3% of infants among the general birth population (ranging from 1% in New York to 5% in Connecticut).

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Nationally, infants conceived with ART contributed to approximately 6% of all low birthweight (<2,500 grams) infants, ranging from 1.3% in Mississippi to 15% in Massachusetts and to 6% of all very low birthweight (<1,500 grams) infants, ranging from 1% in Alaska to 15% in New Jersey. Overall, among ART-conceived infants, 32% were low birthweight (ranging from 20% in Alaska to 48% in Puerto Rico), compared with 8% among the general birth population (ranging from 5.8% in South Dakota to 12.2% in Mississippi), and 6% of ART infants were very low birthweight (ranging from 1.5% in Alaska to 13% in South Dakota), compared with 1% among the general birth population (ranging from 1% in Alaska to 2% in Mississippi and District of Columbia). Finally, ART-conceived infants accounted for 3.9% of all preterm (<37 weeks; range: 0.5% in Puerto Rico to 11.1% in Massachusetts) and 4.5% of all very preterm births (<32 weeks; range: 0.5% in Puerto Rico to 12% in New York). Overall, among infants conceived with ART, 33.4% were born preterm (ranging from 21.3% in Vermont to 47.1% in Wyoming), compared with 12.2% of the general birth population (ranging from 9.3% in Vermont to 18.0% in Mississippi), and 6.1% of ART infants were very preterm births (ranging from 1.5% in Alaska to 14.7% in South Dakota), compared with 2% among the general birth population (ranging from 1.4% in Alaska, Oregon, Utah, and Washington to 3% in Mississippi).

Interpretation: The proportion of births from ART varied considerably by state and territory (ranging from 0.2% to 4.3%) with substantial impact on perinatal outcomes in some states. In most states, multiple births from ART accounted for substantial proportions of twins and triplets and higher order infants, and the rates of low birthweight and preterm births were disproportionately higher among ART infants than in the general birth population. More than one embryo was transferred per procedure in most states and territories for all age groups, influencing the overall multiple birth rates in the United States. ART use was represented disproportionately in the United States, with only 13 states having above-average ART use. High rates of ART utilization were observed in Massachusetts and New Jersey, which have comprehensive statewide-mandated health insurance coverage for ART procedures. Insurance mandates might influence ART utilization and ART-related birth outcomes.

Public Health Actions: Promotion of single-embryo transfer, where feasible, is needed to reduce multiple births and related adverse consequences of ART. Nevertheless, because ART accounts for a relatively small fraction of total births in most states and territories, the overall prevalence of low birthweight and preterm births cannot be explained solely by the use of ART, and therefore non-ART causes of these adverse outcomes must be examined. Monitoring the use of non-ART infertility treatments (e.g., ovulation stimulation medications without ART) in the general population might be useful because these treatments also might be associated with high rates of multiple births and adverse outcomes such as preterm delivery and infants born with low birthweight.

Introduction

Since the birth of the first U.S. infant conceived with Assisted Reproductive Technology (ART) in 1981, use of advanced technologies to overcome the problem of infertility has increased steadily, as has the number of fertility clinics providing ART services and procedures in the United States (1).

In 1992, Congress passed the Fertility Clinic Success Rate and Certification Act (FCSRCA),* which requires that all U.S. fertility clinics performing ART procedures report data to CDC annually on every ART procedure initiated. In 1997, CDC published the first annual ART Success Rates Report under FCSRCA, which reported on ART procedures performed in 1995 (2). CDC uses the data it receives to report pregnancy success rates for all ART programs and clinics. Several measures of success for ART are presented in the annual report, including the percentage of ART cycles that result in a pregnancy, live-birth deliveries, and singleton live births. The ART Success Rates Reports contain national summaries as well as specific details for each fertility clinic.

Despite its increasing use, ART is associated with potential risks to the mother and fetus. Multiple-infant births are associated with greater health problems for mothers and infants, including higher rates of caesarean deliveries, prematurity, low birthweight, infant death, and disability (3–12). In addition, concerns exist regarding elevated risks of birth defects, genetic abnormalities, and imprinting disorders (Beckwith-Wiedemann syndrome and Angelman syndrome) associated with infertility and infertility treatments with ART (13,14). Because multiple embryos are transferred in the majority of ART procedures, ART has been associated with a substantial risk for multiple-gestation pregnancy and multiple births (3–10). Further, even singleton infants conceived with ART have a higher risk of low birthweight (15,16). CDC also performs in-depth analyses of infant health outcomes reported by U.S. fertility clinics (1).

This report is based on ART surveillance data for procedures performed in 2009 that were collected by CDC's Division of Reproductive Health. It presents data regarding the use of ART in each U.S. state and territory as well as outcomes, and examines the contribution of ART to selected adverse outcomes (e.g., multiple birth, low birthweight, and preterm delivery). A 2009 ART Success Rates Report focused on national summaries and clinic-specific data was published previously (1).

*Fertility Clinic Success Rate and Certification Act of 1992 (FCSRCA), Public Law 102-493 (October 24, 1992).

Methods

National ART Surveillance System

CDC obtained ART data for 1995–2003 from the Society of Assisted Reproductive Technology (SART) through their proprietary Clinical Outcomes Reporting System (CORS) data base, or SART CORS. Since 2004, CDC has contracted with Westat, Inc., a statistical survey research organization, to obtain data from fertility clinics in the U.S through the National ART Surveillance System (NASS), a web-based data collection system developed by CDC (<http://www.cdc.gov/art/NASS.htm>).

Data collected include patient demographics, medical history, and infertility diagnoses; clinical information pertaining to the ART procedure type; and information regarding resultant pregnancies and births. The data file is organized with one record per ART procedure performed. Multiple procedures from individual patients are not linked. A few clinics (9%) do not report their data to CDC and are listed as nonreporting programs in the ART Success Rates Report as required by FCSRCA. Since nonreporting clinics tend to be smaller, NASS is estimated to contain information on >95% of all ART cycles in the United States. Because NASS collects information on deliveries, NASS data can be used to identify deliveries in which stillborn fetuses were delivered together with live-born infants. Because ART providers typically do not provide continued prenatal care after a pregnancy is established, birthweight and date of birth data are collected via active follow-up with ART patients (85%) or from their obstetric providers (15%).

ART Procedures

ART includes fertility treatments in which both eggs and sperm are handled in the laboratory (i.e., IVF and related procedures). ART does not include treatments in which only sperm are handled (i.e., intrauterine insemination) or procedures in which a woman takes drugs only to stimulate egg production without the intention of having eggs retrieved. Because an ART procedure consists of several steps over an interval of approximately 2 weeks, a procedure often is referred to as a cycle of treatment. An ART cycle generally begins with drug-induced ovarian stimulation. If eggs are produced, the cycle progresses to the egg-retrieval stage. After the eggs are retrieved, they are combined with sperm in the laboratory through IVF. If this is successful, the most viable embryos (i.e., those most likely to implant) are selected for transfer. If an embryo implants in the uterus, a clinical pregnancy is diagnosed by the presence of a gestational sac detectable by ultrasound. Most pregnancy losses occur by the first 12 weeks, with the risk of pregnancy loss increasing with the age of the mother (17). Beyond 12 weeks of gestation, the pregnancy usually progresses to a live-birth delivery, which is defined as the delivery of one or more live-born infants.

ART procedures are classified into four types based on the source of the egg (patient or donor) and the status of the embryos (freshly fertilized or thawed): fresh embryo from the patient's eggs or fresh embryos from donor eggs (fresh embryo cycles), and thawed embryos from the patient's eggs or thawed embryos from donor eggs (thawed embryo cycles). ART procedures involving fresh embryos include an egg-retrieval stage. ART procedures that use thawed embryos do not include egg retrieval because the eggs were fertilized during a previous procedure, and the resulting embryos were frozen until the current procedure. An ART procedure can be discontinued at any step for medical reasons or by patient choice.

Variables and Definitions

ART data and outcomes from ART procedures are presented by the patient's state or territory of residence at the time of treatment. If this information was missing, the state or territory of residence was assigned as the state or territory in which the procedure was performed.

This report presents data on all cycles initiated; however, most outcomes are based on cycles in which embryos were obtained and transferred. The number of ART procedures performed per 1 million women in the reproductive age group (15–44 years) was calculated. This ratio approximates the proportion of women of reproductive age who used ART in each state or territory and is a proxy measure of ART utilization. However, this is only an approximation because some women who used ART might fall outside the age range of 15–44 years, and some women might have had more than one procedure during the reporting period. Live-birth delivery was defined as birth of one or more live-born infants, with delivery of multiple infants counted as one live-birth delivery. A multiple birth was defined as a birth of two or more infants, at least one of whom was live-born. A delivery of a live-born infant with one or more stillbirths was classified as a multiple birth. By contrast, CDC's National Center for Health Statistics (NCHS), which bases its statistics on live birth records rather than delivery records, classifies the delivery of a single live-born infant with one or more stillbirths as a singleton birth (18).

Elective single-embryo transfer (eSET) is a procedure in which one embryo, selected from a larger number of available embryos, is placed in the uterus. This procedure does not include cycles in which only one embryo is available. The embryo selected for eSET might be from a previous IVF cycle (e.g., cryopreserved [frozen] embryos) or from the current fresh IVF cycle that yielded more than one embryo. The remaining embryos might be set aside for future use through cryopreservation. In this report, eSET was calculated only for fresh, nondonor cycles in which the total number of oocytes/embryos transferred was equal to one and the number of embryos cryopreserved was one or more.

The average number of embryos transferred for three age groups (<35 years, 35–40 years, and >40 years) was calculated by dividing the total number of embryos transferred (for cycles that were not cancelled and in which a transfer was attempted) by the total number of embryo-transfer procedures initiated in that age group. The percentage of eSET was calculated by dividing the total number of transfer procedures, in which only one embryo was transferred and one or more embryos were cryopreserved, by this numerator plus the total number of transfer procedures in which more than one embryo were transferred.

Low birthweight was defined as <2,500 grams, moderate low birthweight was defined as 1,500–2,500 grams, and very low birthweight was defined as <1,500 grams. Gestational age was estimated as date of birth minus date of egg retrieval (and fertilization). For comparability with the general population, for whom gestational age is based on the date of the last menstrual period (LMP), gestational age was calculated for fresh cycles by subtracting the date of retrieval from the birth date and adding 14 days. For frozen cycles, and for fresh cycles, if the date of retrieval was not available, gestational age was calculated by subtracting the date of transfer from the birth date and adding 17 days (to account for an average of 3 days in embryo culture). Preterm delivery was defined as gestational age <37 weeks. Moderate preterm delivery was defined as gestational age 32–36 weeks and very preterm delivery as gestational age <32 weeks (19).

The contribution of ART to an outcome was calculated by dividing the total number of ART outcomes by the total number of overall outcomes. The contribution of ART to all infants born was calculated by plurality (singleton, multiples, twins, and triplets or higher order births) and by adverse perinatal outcomes (low birthweight and prematurity). The contribution of ART to total infants born in the state or territory was used as a second measure of ART utilization. The number and percentage of infants (ART and all) born in the state or territory were calculated for singletons, multiples, twins, and triplets or higher order births and for different categories of birthweight and gestational age.

Content of the Report

This report provides detailed information on rates of preterm birth and low birthweight for infants conceived with ART as well as for overall U.S. births. In addition, state-specific data on determinants of multiple gestations (e.g., the number of embryos transferred) and the prevalence of elective single-embryo transfers (eSET) are presented for women who underwent ART procedures.

This report provides data on the number and outcomes of all ART procedures initiated in the 50 states, the District of Columbia, Guam, the Federated Republic of Micronesia, the Commonwealth of Puerto Rico, and the U.S. Virgin Islands in 2009.[†] Live-birth

[†] Numbers <20 are not reported to preserve confidentiality but are included in totals.

delivery rates, the number of live-born infants, live singleton and multiple birth deliveries, and data regarding the number of ART procedures in relation to the number of women in the reproductive age group (15–44 years) are reported (20).[§] Data also are presented on the number of embryo-transfer procedures performed, the average number of embryos transferred, and the percentage of eSET procedures performed among women who used fresh embryos from their own eggs, by age group, for each state and territory.

For each state and territory, the proportion of singleton, multiple, twin, and triplet or higher order births resulting from ART are compared with their respective ratios in the overall births in that state in 2009. Overall births include all births in the state or territory during that year, both naturally conceived and resulting from ART and other infertility treatments. So that the proportion of ART births among overall U.S. births in 2009 could be assessed accurately, ART births were aggregated from 2 reporting years: 1) infants conceived from ART procedures performed in 2008 and born in 2009 (approximately 70% of the live-birth deliveries reported to the ART surveillance system for 2009) and 2) infants conceived from ART procedures performed in 2009 and born in 2009 (approximately 30% of the live-birth deliveries reported to the ART surveillance system for 2009). Data on the total number of live-births and multiple births in each state and territory in 2009 were obtained from U.S. natality files (18). Finally, the report presents number and percentage of select adverse perinatal outcomes (low birthweight, moderate low birthweight, very low birthweight, preterm delivery, moderate preterm delivery and very preterm delivery) among ART births and overall births, as well as the contribution of ART to these outcomes.

Results

Overview of Fertility Clinics

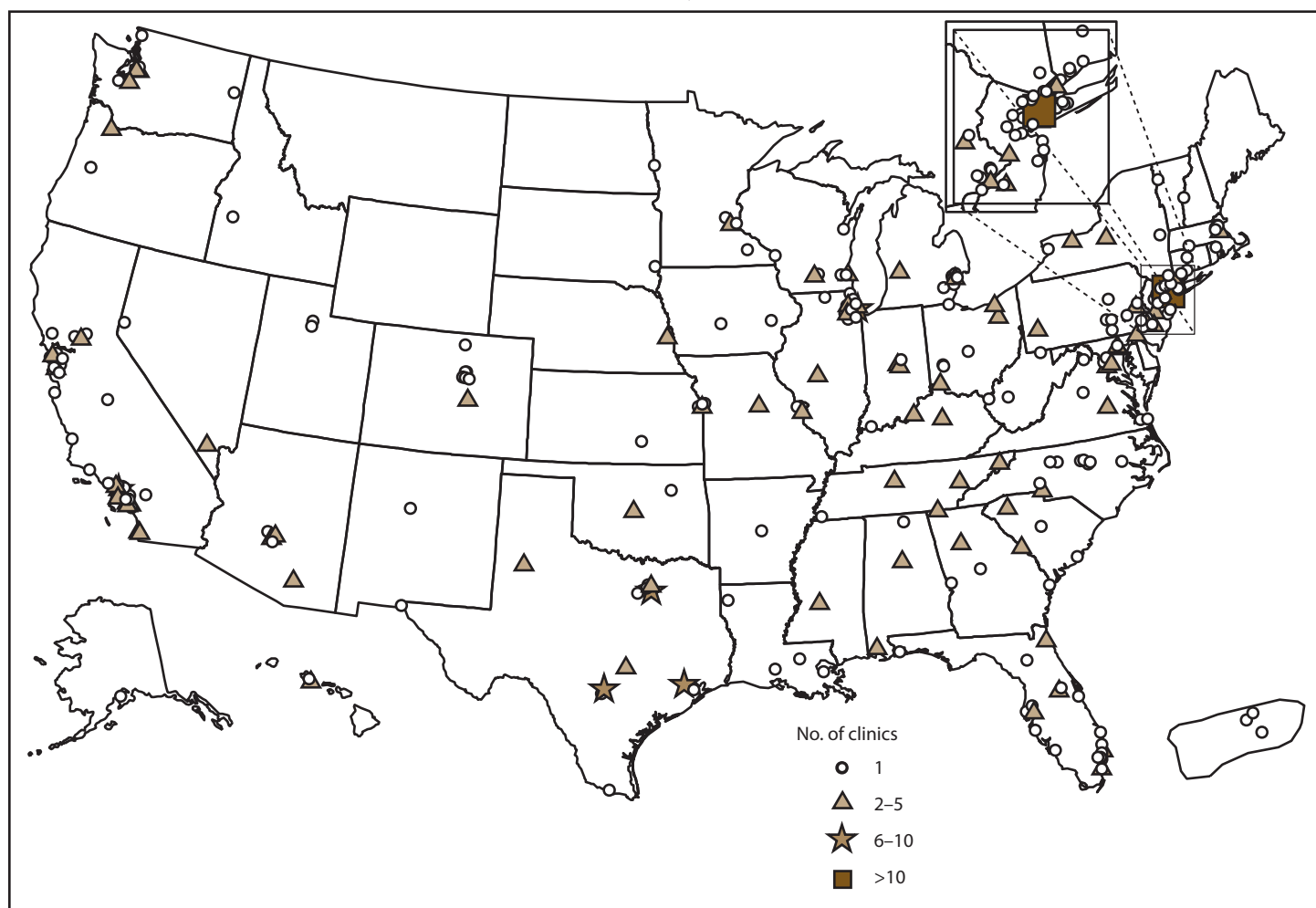
Of 484 fertility clinics in the U.S. states and territories that performed ART procedures in 2009, a total of 441 (91%) provided data to CDC (Figure 1) with the majority located in the eastern United States, in or near major cities. The number of fertility clinics performing ART procedures varied by state. States with the largest number of fertility clinics reporting data for 2009 were California (61), New York (36), Texas (35), Illinois (28), Florida (28), and New Jersey (22).

Number and Type of ART Procedures

The number, type, and outcome of ART procedures initiated for the 50 states and territories in 2009 are provided (Table 1). State residency data were missing for approximately 4% of procedures

[§] Data regarding population size are based on July 1, 2010, estimates from the U.S. Census Bureau (18).

FIGURE 1. Locations of clinics providing assisted reproductive technology (ART) — United States, 2009*



* Number of ART clinics in the United States in 2009: 484; number of ART clinics that submitted data in 2009: 441; number of ART cycles reported in 2009: 146,244 (does not include 12 cycles in which a new treatment procedure was being evaluated); number of live-birth deliveries resulting from ART cycles started in 2009: 45,870; number of infants born as a result of ART cycles performed in 2009: 60,190.

started and 3% of live-birth deliveries but are included in the total as discussed previously. Approximately, 16% of ART cycles were conducted among out of state residents. Non-U.S. residents accounted for approximately 2% of ART procedures, live-birth deliveries, and infants born.

Nationally, a total of 146,244 ART procedures were reported to CDC (Figure 1; Table 1). Of the 146,244 procedures started, 124,391 (85%) progressed to embryo transfer (Table 1). Overall, 45% (56,399/124,391) of ART procedures that progressed to the transfer stage resulted in a pregnancy, 37% (45,870/124,391) resulted in a live-birth delivery, 26% (32,205/124,391) resulted in a singleton live-birth delivery, and 11% (13,665/124,391) resulted in a multiple live-birth delivery (Figure 2). The 45,870 live-birth deliveries from ART procedures performed in 2009 resulted in 60,190 infants (32,205 singleton live-birth deliveries and 13,665 multiple live-birth deliveries) (Table 1).

California, the state with the most fertility clinics, also had the highest number of ART procedures performed among residents (18,405). The other states with the largest numbers of ART procedures performed among residents were New York (14,539), Illinois (10,192), Massachusetts (9,845), New Jersey (9,146) and Texas (8,244). Three of these states (California, Texas, and Illinois) also ranked high (first, second, and fourth) in overall births. Overall, these six states accounted for 48% of all ART procedures initiated in the United States. Correspondingly, the number of procedures that progressed to embryo transfers was the highest in these six states (California: 15,953; New York: 12,183; Illinois: 8,358; Massachusetts: 8,469; New Jersey: 7,720; and Texas: 7,267) and accounted for 48% of all embryo transfers in the United States. The number and percentages of infants born were the highest in these six states (California: 7,519 [12.5%]; New York: 4,725 [7.9%]; Texas: 4,359 [7.2%]; Illinois: 3,817 [6.3%]; New Jersey: 3,710

[6.2%]; Massachusetts: 3,401 [5.7%]) and accounted for 46% of all infants born from ART in the United States but only 34% of all births. Multiple live-birth deliveries were also highest among these states (California: 1,720 [12.6%]; Texas: 1,126 [8.2%]; New York: 967 [7.1%]; New Jersey: 861 [6.3%]; Illinois: 856 [6.3%]; Massachusetts: 650 [4.8%]) and accounted for 45% of all ART multiple live-birth deliveries (13,665).

The number of ART procedures per million women of reproductive age varied from 280 in Puerto Rico to 7,260 in Massachusetts, with an overall national average (mean) of 2,361 procedures per 1 million women of reproductive age. Thirteen states had ratios higher than the national average, of which five had ratios exceeding twice the national average (Massachusetts (7,260), New York (6,848), the District of Columbia (6,146), New Jersey (5,345), and Connecticut (4,893)), and three had ratios exceeding one and half times the national average (Maryland (4,142), Illinois (3,851), and Delaware (3,558)) (Figure 3).

Embryo Transfer and Patient's Age

The number of embryo-transfer procedures performed, the average number of embryos transferred per procedure, and the percentage of elective single-embryo transfers (eSET) performed by age group for each state and territory, among women who used fresh embryos from their own eggs are provided (Table 2). In most states and territories, the highest number of embryo-transfer procedures performed was among women aged <35 years and lowest among women aged >40 years. Only nine states (California, Connecticut, Florida, Hawaii, Vermont, Maryland, Massachusetts, New York, and Virginia), the District of Columbia, and New York City had more embryo-transfer procedures among women aged 35–40 years than among younger women. Nationally, the average number of embryos transferred varied from 2.1 among women aged <35 years (ranging from 1.8 to 2.4) to 2.5 among women aged 35–40 years (ranging from 2.0 to 3.0), and 3.0 among women aged >40 years (ranging from 1.7 to 3.5). Rates of elective single-embryo transfer (eSET) procedures varied by age group

FIGURE 2. Number of outcomes of assisted reproductive technology cycles, by stage — United States, 2009

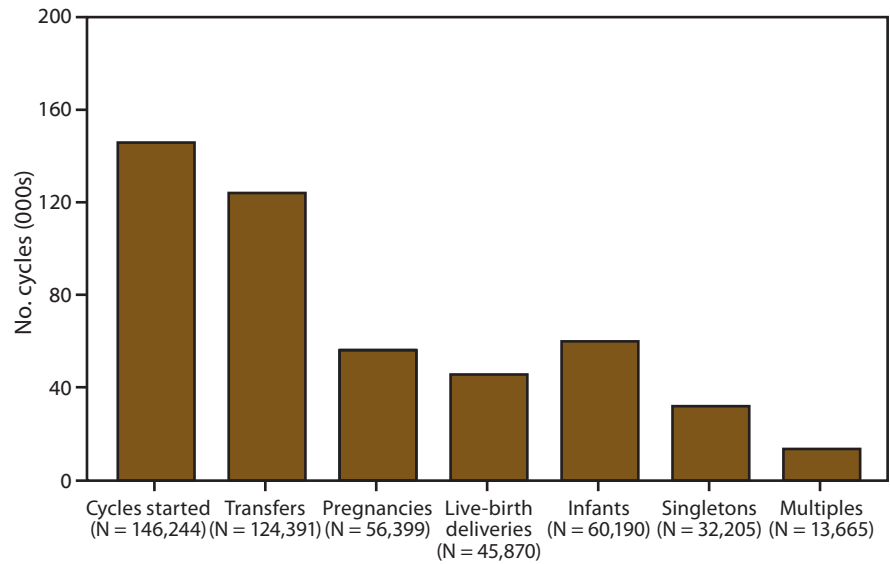
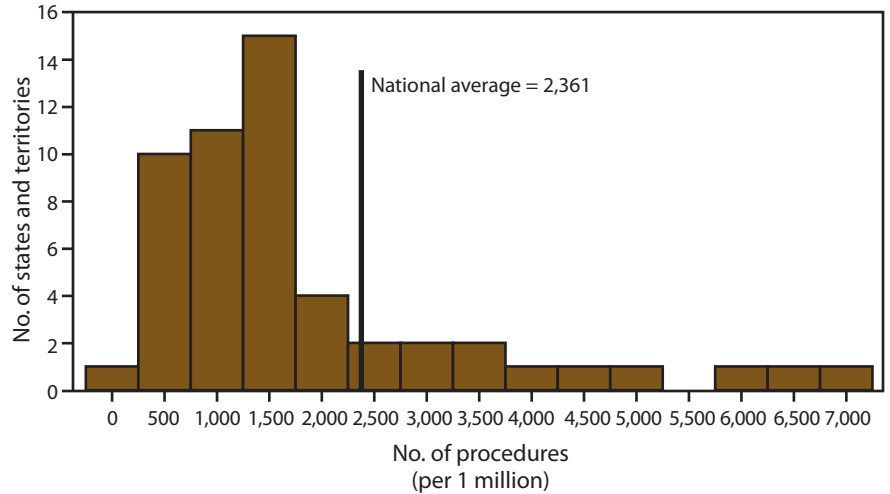


FIGURE 3. Number of procedures performed using assisted reproductive technology among women of reproductive age (15–44 years), per 1 million women — United States, 2009



and by state and territory and were highest among women <35 years and lowest among women aged >40 years. Nationally, rates of eSET ranged from 7.4% among women aged <35 years (ranging from 0 in several states to 41% in Delaware) to 2.8% among women aged 35–40 years (ranging from 0 in several states to 26% in Delaware) and 0.5% among women aged >40 years (ranging from 0 in most states to 4% in Arizona and Puerto Rico). Among women aged <35 years, the three states with the highest rates of eSET were Delaware (41%), Iowa (20%), and Massachusetts (17%). ESET rates were higher than the national average among all three age groups in Massachusetts and for both age groups for women aged <40 years in Illinois.

Singleton and Multiple Births

Among 4,180,540 infants born in the U.S in 2009, a total of 60,001 (1.4%) were conceived with ART procedures initiated in 2008 and 2009 (Tables 3 and 4). California, Texas, and Florida ranked among the three highest states in overall births. Although singletons accounted for 96.5% of total infants born in 2009, singletons accounted for only 52.6% of all ART births. Only 0.1% (in Maine and Puerto Rico) to 2.6% (in Massachusetts) of singletons were conceived with ART.

Further, 0.2% (in Puerto Rico) to 4.3% (in Massachusetts) of infants were born with ART. The contribution of ART to overall births in the state was highest in Massachusetts where ART accounted for approximately 4.3% of all births, followed by New York (3.8%), Connecticut (3.7%), New Jersey (3.5%) and the District of Columbia (3.3%) (Table 3).

The percentage of singletons among infants born from ART ranged from 39.2% in Wyoming to 65.3% in Delaware. The percentage of singletons among total births ranged from 95.2% in Connecticut to 99% in Guam (data not shown).

Nationwide, 47.3% (ranging from 34.7% in Delaware to 60.8% in Wyoming) of ART infants were multiples compared with only 3.3% (ranging from 0.7% in New York to 4.8% in Connecticut) of all births (Table 4). ART multiple births contributed to 20.3 % (ranging from 4.1% in Maine to 40.7% in New York) of total multiple-birth infants born. Approximately 43.7% (ranging from 31.6% in Delaware to 54.9% in Wyoming) of all ART infants were twins compared with only 3.3% (ranging from 1.9% in Puerto Rico to 4.6% in Connecticut) of all births. ART twin birth infants accounted for 19% (ranging from 4.2% in Maine to 41.5% in New York) of all twins born in 2009. Finally, 3.6% of ART infants were triplets or higher order multiples (ranging from 0 in several states to 13.3% in Puerto Rico) compared with only 0.2% (with very little variation) of all births. ART triplets or higher order multiples accounted for 34.4% (ranging from 0 in several states to 61.5% in New Jersey and 100% in Montana) of all triplets or higher order births in 2009.

Adverse Perinatal Outcomes

Nationally, ART infants represented approximately 6% of all low birthweight, very low birthweight, and moderate low birthweight infants. The contribution of ART to low birthweight infants ranged from 1.3% in Mississippi to 14.6% in Massachusetts. The contribution of ART to very low birthweight infants ranged from 0.9% in Alaska to 15.2% in New Jersey. The contribution of ART to moderate low birthweight infants ranged from 1.3% in Mississippi to 15% in Massachusetts. In

Connecticut, Massachusetts, and New Jersey, >10% of all low birthweight, moderate low birthweight, and very low birthweight infants born in these states were conceived with ART.

In all states and territories, rates of low birthweight, very low birthweight, and moderate low birthweight infants were higher among infants conceived with ART than in the general birth population (Table 5). Among ART infants, 32.3% were low birthweight infants (ranging from 19.7% in Alaska to 47.8% in Puerto Rico), compared with 8.1% in the general birth population (ranging from 5.8 % in South Dakota to 12.2% in Mississippi). Approximately 5.8% of ART infants were very low birthweight infants (ranging from 1.5% in Alaska to 13.3% in South Dakota), compared with 1.4% in the general birth population (ranging from 1% in Alaska, Idaho, Maine, Missouri, Oregon, Utah, Washington) to 2.1% in Mississippi and District of Columbia). Approximately, 26.6% of ART infants were moderately low birthweight infants (ranging from 14.7% in Vermont to 43.1% in Wyoming), compared with 6.6% in the general birth population (ranging from 4.8% in South Dakota to 10.1% in Mississippi).

Nationally, infants conceived with ART contributed approximately 3.9%, 4.5% and 3.8% respectively to all preterm, very preterm, and moderate preterm births. The contribution of ART to preterm births ranged from 0.5% in Puerto Rico to 11.1% in Massachusetts. The contribution of ART to very preterm infants ranged from 0.5% in Puerto Rico to 12% in New York. The contribution of ART to moderate preterm birth infants ranged from 0.5% in Puerto Rico to 11.1% in Massachusetts. In Massachusetts, New Jersey, and New York, >10% of all very preterm births in the state were conceived with ART. In addition, in Massachusetts and New York, births conceived with ART accounted for >10% of all preterm and moderate preterm births in these states.

Similar to low birthweight, rates of preterm, very preterm and moderate preterm births were higher among infants conceived with ART than in the general birth population (Table 6). Among ART infants, 33.4% were born preterm (ranging from 21.3% in Vermont to 47.1% in Wyoming), compared with 12.2% in the general birth population (ranging from 9.3% in Vermont to 18.0% in Mississippi). Approximately, 6.1% of all ART infants were very preterm (ranging from 1.5% in Alaska to 14.7% in South Dakota), compared with 2.0% in the general birth population (ranging from 1.4% in Alaska, Oregon, Utah, and Washington to 3% in Mississippi). Approximately, 27.3% of all ART infants were moderate preterm birth infants (ranging from 12.0% in Vermont to 41.7% in Mississippi), compared with 10.2% in the general birth population (ranging from 7.8% in Vermont to 15.4% in Puerto Rico).

Discussion

Overview

The use of ART has grown substantially in the United States since the beginning of ART surveillance. In 1996 (the first full year for which ART data were reported to CDC), 20,597 infants were born from 64,036 ART cycles (21). Since then, the number of cycles reported to CDC has more than doubled while the number of infants born from ART procedures has nearly tripled. In 2009, a total of 146,244 cycles resulted in 60,190 live-born infants, which is approximately 1.4% of total U.S. live-births. The impact of ART on multiple births and poor birth outcomes, however, is substantial because almost half of ART infants (47%) were born in multiple births (compared with only 3% of infants among the general birth population). On average, in all states and territories, more than one embryo was transferred among women aged <35 years, thus resulting in high rates of multiple births. National rates of elective single-embryo–transfer procedures were low, especially among women aged >35 years. As a result, the rates of low birthweight and preterm births were substantially higher among ART infants (32% and 33% respectively) than in the general population (8% and 12% respectively). Overall, 19% of all twin births and 34% of triplet or higher order birth infants were conceived with ART.

Variations by State

ART use varied widely by state, especially after controlling for the size of the population in reproductive age. Residents of California, New York, Illinois, New Jersey, Massachusetts, and Texas reported 46% of ART births but only 34% of all U.S. births. Rates of ART utilization were not correspondingly high in all six states. Only three of these six states (Massachusetts, New York, and New Jersey) were among the thirteen states with ART utilization above the national average (as measured by the number of ART procedures performed per 1 million women of reproductive age). By this measure, Massachusetts ranked first whereas California ranked twelfth nationally despite California having the highest overall number of ART procedures and the highest number of overall births. Further, the contribution of ART to total births was 4% in Massachusetts compared with 1% in California, which also suggests that ART utilization was higher in Massachusetts. Similarly, residents of the District of Columbia, New Jersey, Connecticut, Maryland, and Illinois, in addition to six other states, underwent more ART procedures relative to the national average as reflected by the high number of ART procedures performed per 1 million women of reproductive age. This divergence might be explained in part by variations in state health insurance coverage. Certain states (Massachusetts, Illinois,

and New Jersey) had mandated comprehensive insurance coverage for ART procedures that must cover at least four cycles of IVF (22). This type of mandated insurance has been associated with greater use of ART (22–24). In addition, the higher rates of ART use observed in the Northeastern states (New York, Connecticut, and Delaware) also might be associated with the availability of insurance in neighboring states (Massachusetts and New Jersey). Patients might be willing to travel to other states if better treatment options are available. Clinic registries provide corroborating data, indicating that approximately 16% of U.S. ART cycles in 2009 were performed on out-of-state residents.

State Insurance Mandates and Elective Single-Embryo Transfer Rates

Although many factors (e.g., a patient's age and diagnostic factors) influence elective single-embryo transfer rates, increasingly, research shows that broad insurance mandates for IVF result not only in large increases in access to ART services but also in substantially fewer aggressive treatments, with fewer embryos transferred within a procedure (23,25). Typically, younger women are better candidates for eSET procedures because they might have more than one embryo available for transfer and better prognosis. Data indicate that eSET rates varied by age group and also by state. ESET procedures were more prevalent among women aged <35 years. ESET rates were higher than the national average among all three age groups in Massachusetts and for women aged <40 years in Illinois but not in New Jersey or Rhode Island, all of which had mandatory insurance for ART. Currently, 15 states have passed legislation mandating insurance coverage for infertility treatments; Illinois, Massachusetts, New Jersey, and Rhode Island also have universal mandates to cover IVF.[§] Because ART procedures are expensive, attempts to reduce out-of-pocket costs might result in higher number of embryo transfers per attempt for uninsured patients. (23,25). In the United States, private insurance coverage of ART is rare. Even where mandated, coverage for infertility treatment often varies in scope, with some states requiring that all insurers cover ART whereas others require restricted coverage or merely offer plans that include ART coverage. The high use of eSET in Massachusetts and Illinois is consistent with the recommendations of the American Society for Reproductive Medicine (ASRM) on eSET (26). ESET rates also exceeded the national average in a number of states that do not have mandated insurance coverage for ART, especially among women aged <35 years, suggesting greater compliance with ASRM guidelines.

[§] States with restricted mandates are Arkansas, Hawaii, Louisiana, Maryland, Montana, Ohio, West Virginia, and New York. States with other insurance regulations on ART or other infertility treatments but not requiring coverage of ART are Connecticut, Texas, and California.

ART Multiple Births

In the United States, on average, more than one embryo was transferred in ART procedures, even among younger women. Because most states do not have mandated insurance coverage, and the majority of insurance plans do not cover IVF treatments, to control costs, patients and providers might be willing to transfer multiple embryos to maximize the chance of live-birth delivery in a single procedure. Evidence also suggests that after years of failure to conceive, infertile couples might prefer multiple births, especially twins, in their desire to achieve parenthood, and might not estimate the risks of such pregnancies accurately. Infertile women might be more receptive to the idea of a multiple birth than fertile women (27,28). Therefore, understanding the viewpoint of couples undergoing infertility treatments about multiple births is an important consideration. In 2009, almost half of all ART infants were born in multiple births. During 1980–2009, the twin birth rate in the United States, which comprises the majority of multiple births, increased by 76%, from 18.9 to 33.3 per 1,000 births (29). In 2009, one in every 30 babies born in the United States was a twin, compared with one in every 53 babies in 1980. The increased use of infertility treatments, both ART and non-ART fertility treatments (ovulation stimulation medications without ART), likely are associated with this sharp increase (30). Because of the risks associated with multiple-gestation pregnancies, the best outcomes of IVF treatment are a healthy singleton pregnancy and a singleton birth (31). Singleton live-birth deliveries have much lower risks than multiple-infant births for adverse birth outcomes such as prematurity, low birthweight, disability, and death.

The number of embryos transferred is a crucial determinant of multiple-birth deliveries. The data provided in this report indicate that a few states with universal mandated insurance coverage had lower multiple ART births (Illinois and Massachusetts), as well as lower rates of low birthweight and preterm births (Massachusetts), compared with those with more restricted coverage (e.g., California). However, Illinois, Massachusetts, and California were all among the states with the highest percentage of multiple live-birth deliveries resulting from ART. Massachusetts was among the three states in which >10% of all low, moderate, and very low birthweight, as well as preterm, very preterm, and moderate preterm infants were conceived with ART. Although more research is needed in this area, broader insurance coverage for ART procedures has been associated with lower rates of multiple births (24,25). The economic costs of multiple births are also much higher compared with singleton births. The mean medical cost of delivering a singleton baby was estimated to be \$9,329, whereas a set of twins costs \$20,318, and triplets have a delivery expense of \$153,335 (32). Transferring two embryos is associated with a more than threefold increase in the birth rate and a more than 16-fold increase in the twin birth rate (33). In 2009, the

transfer of more than two embryos was still a common practice in most states and territories, even among younger patients. As a result of these findings, clinicians and state policy makers should continue to support fewer numbers of embryos transferred and, when possible, promote the transfer of single embryos as recommended by the SART and ASRM guidelines on the number of embryos transferred based on a patient's age and prognosis (34). The guidelines on the number of embryos transferred were revised in 2004 (35), 2006 (36), 2008 (37), and 2009 (38). At the 2011 annual meeting, the ASRM Practice Committee noted that the most direct way to limit the risk of multiple gestations from ART is to transfer single embryos (31).

ART Low Birthweight Infants and Preterm Births

The rates of low birthweight and very low birthweight infants were disproportionately higher among ART infants than in the general birth population. Three states (Massachusetts, New Jersey, and New York) with high number of ART cycles and births also had high ART contributions (>10%) to very preterm births. The contribution of ART to preterm and moderate preterm births were also very high (>10%) in Massachusetts and New York. The contribution of ART to preterm births in the United States, most of which are also low birthweight, is a key concern. Since 1981, the rate of preterm births in the United States has increased >30% (39). Fertility treatments, both ART and controlled ovarian stimulations, contribute substantially to preterm births among both multiple and singleton pregnancies (39). Preterm births are a leading cause of infant mortality and morbidity, and preterm infants are at increased risk for death and have more health and developmental problems than full-term infants (39,42). The health risks associated with preterm births have contributed to increasing health-care costs. In 2005, the estimated economic burden associated with preterm births in the United States was \$26 billion (\$51,600 per infant born preterm) (39).

Limitations

The findings in this report are subject to at least seven limitations. First, ART surveillance data were reported for each ART procedure performed rather than for each patient who used ART. Linking procedures among patients who underwent more than one ART procedure in a given year is not possible with these data. Second, because patients who underwent more than one procedure in a given year were most likely to include those in which a pregnancy was not achieved during that year but were likely to do so with repeated treatments, the success rates reported might likely underestimate the actual per-patient

success rate. Third, the contribution of ART to multiples also might be slightly overestimated because stillborn infants were included in our definition of multiple births. Fourth, data are reported only for couples who sought ART services and do not represent all couples with infertility who were potential users of ART during that time. Fifth, a small percentage of fertility clinics that performed ART in 2009 did not report their data to CDC and might have had results different from clinics that reported their data. Sixth, for four states (Connecticut, Georgia, Massachusetts, and Pennsylvania) a substantial percentage (Connecticut: 5.6%, Pennsylvania: 9.8%, Georgia: 19.8%, and Massachusetts: 32.3%) of residency information was missing for procedures started in 2009. Finally, overall, residency data were missing for approximately 4% of procedures started and 3% of all live-birth deliveries resulting from ART procedures started in 2009. Despite these limitations, the findings from this report provide useful information to ART providers, state health-care policy makers, and researchers.

Conclusion

ART-conceived infants now represent a substantial proportion of infants born in the United States, ranging from 0.2% to 4% of all infants born in U.S. states and territories. The majority of these infants were born from multiple-gestation pregnancies and resulted in multiple births. This report is the first to document the contribution of ART to multiple births, low birthweight, and preterm births by each state/territory and allows State Health Departments to monitor the extent of ART-related adverse perinatal outcomes in their individual state and territories.

Comprehensive insurance coverage of ART might increase access to fertility treatments. It also might increase the use of elective single-embryo transfers, where feasible. Further research is needed to ascertain the influence of state insurance mandates on ART use and outcomes, as well as the economic costs of multiple births (22–25), including out-of-pocket costs to patients. Addressing the risk of multiple births also requires understanding the perspectives of couples undergoing infertility treatments who might not fully consider the risks of multiple births, especially twins. Clinicians and patients should continue to strengthen and support ongoing efforts to limit the number of embryos transferred and encourage wider implementation of elective single-embryo transfers, when feasible, as one mechanism of promoting singleton infant births among ART-conceived pregnancies.

CDC is working to extend the utility of NASS by linking to data collected by states (birth certificate, infant deaths, hospital discharge, birth defect registries, and cancer registries) to

conduct state-based surveillance of ART, infertility and related issues. This initiative, the States Monitoring ART (SMART) Collaborative,[¶] has been determined to be feasible and useful, especially for monitoring long-term outcomes of ART (43). To date, data from NASS have been linked with vital records files from three states (Florida, Massachusetts, and Michigan). The overarching purpose of the SMART Collaborative is to strengthen the capacity of states to evaluate maternal and perinatal outcomes and programs through state-based public health surveillance systems.

Further efforts also are needed to monitor the use of non-ART infertility treatments and their role in the rising number of multiple births (39). Despite its substantial impact on adverse birth outcomes, ART only partially explains the overall prevalence of these adverse outcomes in the United States. Preterm births resulting from controlled ovarian stimulation (superovulation-intrauterine insemination and conventional ovulation induction) might contribute as much as ART to multiple gestations (39). More research is needed to identify the causes and consequences of preterm births that occur because of infertility treatments and to institute guidelines to reduce the number of multiple gestations (39). The risk for multiple gestations associated with these treatments is less well documented, as clinics are not mandated to report data on the use of non-ART infertility treatments. Recent studies have demonstrated that singleton infants conceived with ovulation stimulation are more likely to be small for gestational age (44). CDC is monitoring the prevalence of non-ART infertility treatment use among women who had live births and their resultant outcomes in several states through the Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based surveillance system of maternal and infant health indicators funded in part by CDC and administered by state health departments (information available at <http://www.cdc.gov/PRAMS>) (45). The most recent ART Surveillance Summary was published by CDC in 2009 (46). CDC will continue to provide updates of ART use in the United States as data become available.

[¶]SMART is a collaboration between CDC and state health departments in Massachusetts, Michigan, and Florida (information available at <http://www.cdc.gov/art/smart.htm>).

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TABLE 1. Number and outcomes of assisted reproductive technology (ART) procedures, by female patient's state/territory of residence* at time of treatment — United States, 2009

Patient's state/ territory of residence	No. procedures started	No. embryo transfers	No. pregnancies	No. live-birth deliveries	No. singleton live-birth deliveries	No. multiple live-birth deliveries	No. live-born infants	Procedures started/ women aged 15–44 yrs Ratio (per million)†
Alabama	879	747	367	305	214	91	402	925
Alaska	188	163	71	56	42	§	71	1,300
Arizona	2,105	1,893	875	710	485	225	954	1,622
Arkansas	438	388	189	163	129	34	197	771
California	18,405	15,953	7,155	5,710	3,990	1,720	7,519	2,392
Colorado	1,756	1,549	869	727	476	251	994	1,709
Connecticut¶	3,368	2,832	1,319	1,057	782	275	1,341	4,893
Delaware	629	476	202	154	127	27	182	3,558
District of Columbia**	927	761	355	279	206	73	353	6,146
Federated States of Micronesia	§	§	§	§	§	§	§	§
Florida	6,097	5,113	2,288	1,894	1,309	585	2,507	1,750
Georgia¶	3,095	2,692	1,287	1,052	695	357	1,424	1,482
Guam	§	§	§	§	§	§	§	§
Hawaii	708	568	220	166	108	58	225	2,841
Idaho	470	443	190	162	102	60	224	1,534
Illinois	10,192	8,358	3,587	2,918	2,062	856	3,817	3,851
Indiana	1,666	1,356	604	513	342	171	702	1,300
Iowa	1,107	919	534	447	337	110	559	1,916
Kansas	713	600	315	263	183	80	346	1,287
Kentucky	1,026	888	381	319	216	103	431	1,188
Louisiana	872	735	363	309	211	98	418	937
Maine	128	112	45	36	23	§	49	521
Maryland	4,871	4,110	1,842	1,488	1,116	372	1,876	4,142
Massachusetts¶	9,845	8,469	3,403	2,733	2,083	650	3,401	7,260
Michigan	3,197	2,754	1,323	1,093	736	357	1,469	1,629
Minnesota	2,102	1,847	920	783	530	253	1,042	2,009
Mississippi	445	376	148	126	90	36	163	735
Missouri	1,432	1,179	564	469	328	141	615	1,202
Montana	184	164	87	76	54	22	98	1,009
Nebraska	550	410	194	161	109	52	219	1,559
Nevada	945	820	421	333	229	104	441	1,789
New Hampshire	773	655	276	223	164	59	282	3,000
New Jersey	9,146	7,720	3,593	2,814	1,953	861	3,710	5,345
New Mexico	385	340	184	152	104	48	201	974

See table footnotes on page 13.

TABLE 1. (Continued) Number and outcomes of assisted reproductive technology (ART) procedures, by female patient's state/territory of residence* at time of treatment — United States, 2009

Patient's state/ territory of residence	No. procedures started	No. embryo transfers	No. pregnancies	No. live-birth deliveries	No. singleton live-birth deliveries	No. multiple live-birth deliveries	No. live-born infants	Procedures started/women aged 15–44 yrs Ratio (per million) [†]
New York ^{††}	14,539	12,183	4,699	3,701	2,734	967	4,725	6,848
New York City	4,737	3,833	1,605	1,243	932	311	1,562	2,494
North Carolina	3,002	2,522	1,260	1,075	712	363	1,462	1,570
North Dakota	207	175	80	67	46	21	90	1,628
Ohio	3,600	3,071	1,342	1,114	790	324	1,458	1,585
Oklahoma	647	575	305	269	178	91	362	887
Oregon	1,048	945	503	440	283	157	601	1,388
Pennsylvania [¶]	5,535	4,542	1,995	1,625	1,149	476	2,131	2,271
Puerto Rico	235	210	95	65	48	§	84	280
Rhode Island	722	621	225	180	132	48	228	3,383
South Carolina	1,022	883	436	375	255	120	500	1,118
South Dakota	222	199	67	63	48	§	78	1,446
Tennessee	1,087	926	441	376	268	108	488	856
Texas	8,244	7,267	3,804	3,169	2,043	1,126	4,359	1,591
Utah	999	866	436	382	244	138	527	1,640
Vermont	224	181	83	68	45	23	91	1,864
Virgin Islands	§	§	§	§	§	§	§	§
Virginia	4,930	4,190	1,896	1,515	1,098	417	1,945	3,021
Washington	2,562	2,230	1,203	997	680	317	1,327	1,905
West Virginia	259	229	112	100	74	26	129	752
Wisconsin	1,293	1,144	491	407	280	127	539	1,163
Wyoming	80	74	37	34	22	§	46	761
Nonresident	2,374	2,110	1,095	896	593	303	1,206	§§
Total	146,244	124,391	56,399	45,870	32,205	13,665	60,190	2,361

* In cases of missing residency data, the patient's state of residence was assigned as the state in which the ART procedure was performed.

[†] Source of population size: July 1, 2010, state population estimates. Population Division, U.S. Census Bureau, NST-EST 2010-01.

[§] Data not provided to preserve confidentiality but included in totals.

[¶] A substantial percentage (6%–32%) of residency information was missing for procedures started in these four states. Overall, residency information was missing for 5,614 (4%) procedures started and 1,552 (3%) of live-birth deliveries.

** Of all ART procedures, 0.5% were reported from military medical centers located in California, the District of Columbia, Hawaii, and Texas. States and territories for which ≥1% of ART procedures among residents were performed in a military medical center were the District of Columbia, Hawaii, Maryland, Montana, New Mexico, South Dakota, Texas, Virginia, Washington, and Wyoming. In the District of Columbia, 13% of ART procedures among residents were performed in a military medical center.

^{††} Outcomes for New York do not include New York City, but denominator used to derive ratio of ART procedures started by population and women (aged 15–44 years) includes New York City.

^{§§} Non-U.S. residents excluded from ratio because the appropriate denominators were unknown.

TABLE 2. Number of embryo transfer procedures among patients who used fresh embryos from their own eggs, by female patient's age group and state/territory of residence* at time of treatment — United States, 2009

Patient's state/ territory of residence	Age group (yrs)								
	<35			35–40			>40		
	No. embryo transfer procedures	Average no. embryos transferred (mean)	eSET† (%)	No. embryo transfer procedures	Average no. embryos transferred (mean)	eSET† (%)	No. embryo transfer procedures	Average no. embryos transferred (mean)	eSET† (%)
Alabama	346	2.0	(6.4)	171	2.5	(0.6)	§	3.3	§
Alaska	49	2.2	(4.5)	41	2.5	(5.1)	22	3.3	§
Arizona	493	2.1	(5.7)	459	2.5	(2.2)	91	2.8	(3.8)
Arkansas	166	1.9	(14.9)	79	2.4	§	§	3.0	§
California	3,397	2.2	(8.0)	4,822	2.7	(2.6)	2,009	3.2	(0.5)
Colorado	394	2.1	(8.2)	391	2.5	(1.4)	85	3.0	(1.3)
Connecticut¶	814	2.0	(10.5)	965	2.4	(3.9)	317	3.1	§
Delaware	153	1.9	(40.6)	111	2.0	(25.5)	45	2.4	§
District Of Columbia	157	2.0	(9.0)	293	2.2	(6.3)	147	2.8	§
Federated States of Micronesia	§	§	§	§	§	§	§	§	§
Florida	1,584	2.1	(5.9)	1,606	2.4	(1.0)	384	2.8	§
Georgia¶	776	2.1	(7.2)	754	2.6	(2.7)	155	3.3	§
Guam	§	§	§	§	§	§	§	§	§
Hawaii	117	2.3	§	206	3.0	(1.0)	89	3.4	§
Idaho	162	2.4	§	79	2.9	(3.9)	§	3.4	§
Illinois	2,659	2.1	(8.7)	2,389	2.4	(3.7)	675	2.7	(0.2)
Indiana	542	2.2	(2.7)	309	2.4	(0.4)	44	2.8	§
Iowa	374	1.8	(20.0)	177	2.1	(11.5)	35	2.6	§
Kansas	239	2.0	(7.4)	116	2.1	(1.9)	§	2.8	§
Kentucky	369	2.2	(2.3)	199	2.8	§	31	3.0	§
Louisiana	297	2.2	(2.1)	188	2.5	(0.6)	42	2.8	(3.2)
Maine	43	1.9	(2.6)	36	2.4	§	§	1.7	§
Maryland	1,267	1.9	(13.6)	1,321	2.2	(4.5)	415	2.8	(0.6)
Massachusetts¶	2,658	1.8	(17.4)	3,053	2.3	(4.5)	912	3.3	(0.6)
Michigan	946	2.2	(5.6)	649	2.5	(2.5)	134	2.8	§
Minnesota	701	1.9	(6.3)	499	2.2	(2.5)	82	2.7	§
Mississippi	166	2.1	§	82	2.4	§	§	1.8	§
Missouri	468	2.1	(1.4)	263	2.5	(2.5)	45	3.5	§
Montana	56	2.1	(5.6)	34	2.4	(3.0)	§	2.5	§
Nebraska	159	2.1	(4.0)	97	2.6	(1.1)	§	3.1	§
Nevada	201	2.1	(8.1)	180	2.3	(3.3)	49	2.5	(2.6)
New Hampshire	243	1.8	(13.0)	216	2.2	(3.7)	55	3.1	§
New Jersey	2,336	2.1	(3.7)	2,304	2.5	(1.4)	872	2.9	(1.0)

See table footnotes on page 15.

TABLE 2. (Continued) Number of embryo transfer procedures among patients who used fresh embryos from their own eggs, by female patient's age group and state/territory of residence* at time of treatment — United States, 2009

Patient's state/ territory of residence	Age group (yrs)								
	<35			35–40			>40		
	No. embryo transfer procedures	Average no. embryos transferred (mean)	eSET† (%)	No. embryo transfer procedures	Average no. embryos transferred (mean)	eSET† (%)	No. embryo transfer procedures	Average no. embryos transferred (mean)	eSET† (%)
New Mexico	101	2.1	(4.3)	89	2.6	§	§	3.1	§
New York**	3,160	2.2	(6.5)	3,542	2.6	(2.5)	1,744	2.9	(0.6)
New York City	697	2.1	(5.5)	1,198	2.6	(3.9)	809	3.1	(1.1)
North Carolina	851	2.1	(4.0)	670	2.5	(1.7)	130	3.1	§
North Dakota	52	2.0	(2.1)	45	2.2	(4.8)	§	2.9	§
Ohio	1,152	2.2	(1.5)	777	2.5	(1.4)	143	3.2	§
Oklahoma	270	2.1	(0.8)	134	2.2	(2.5)	26	2.7	§
Oregon	244	2.2	(1.3)	221	2.4	(1.0)	66	3.1	§
Pennsylvania¶	1,486	2.1	(6.3)	1,232	2.5	(2.4)	284	2.8	(0.9)
Puerto Rico	86	2.3	§	73	2.4	(1.5)	30	2.3	(3.8)
Rhode Island	214	2.0	(5.2)	207	2.4	(0.5)	63	3.4	§
South Carolina	304	2.0	(4.9)	228	2.4	(1.0)	31	2.9	§
South Dakota	80	2.0	(13.3)	52	2.5	(2.1)	§	2.0	§
Tennessee	312	2.0	(6.8)	187	2.4	(3.4)	41	2.7	§
Texas	2,529	2.1	(4.5)	1,986	2.4	(1.9)	478	3.0	(0.7)
Utah	400	2.1	(6.7)	138	2.3	(0.8)	31	3.1	§
Vermont	58	1.9	(10.2)	61	2.3	(6.9)	§	1.9	§
Virgin Islands	§	§	§	§	§	§	§	§	§
Virginia	1,145	1.9	(9.8)	1,319	2.3	(3.5)	383	2.8	§
Washington	645	2.0	(12.8)	612	2.4	(5.0)	140	3.0	§
West Virginia	84	2.0	(11.5)	56	2.5	(4.1)	§	2.8	§
Wisconsin	408	2.1	(5.7)	270	2.3	(2.5)	47	3.0	§
Wyoming	36	2.0	§	§	2.3	§	§	2.7	§
Nonresident	315	2.2	††	††	2.6	(0.5)	††	2.9	(1.0)
Total	36,966	2.1	(7.4)§§	35,620	2.5	(2.8)§§	11,445	3.0	(0.5)§§

Abbreviation: eSET= elective Single Embryo Transfer.

* In cases of missing residency data, the patient's state of residence was assigned as the state in which the ART procedure was performed.

† Percentages for eSET include nonresidents.

§ Data not provided to preserve confidentiality but included in totals.

¶ A substantial percentage (6%–32%) of residency information was missing for procedures started in these four states.

** Outcomes for New York do not include New York City.

†† Non-U.S. residents excluded because the appropriate denominators were unknown.

§§ Excludes cancelled cycles and embryo transfers not attempted.

TABLE 3. Number, percentage, and proportion of infants born with the use of assisted reproductive technology (ART), by female patient's state/territory of residence* at time of treatment — United States, 2009

Patient's state/ territory of residence	No. infants born in the state [†]	No. ART infants born in the state [§]	% of infants born in state who are ART infants	No. and % of ART infants born in the state who are singletons [§]		Singletons among all infants born in the state [†]		% of ART singletons to all singleton infants born in the state
				No.	(%)	No.	(%)	
Alabama	62,475	403	0.6	225	(55.8)	60,315	(96.5)	0.4
Alaska	11,324	66	0.6	32	(48.5)	10,965	(96.8)	0.3
Arizona	92,798	970	1.0	487	(50.2)	90,205	(97.2)	0.5
Arkansas	39,808	181	0.5	113	(62.4)	38,592	(96.9)	0.3
California	527,020	7,546	1.4	3,973	(52.7)	510,219	(96.8)	0.8
Colorado	68,628	986	1.4	467	(47.4)	66,284	(96.6)	0.7
Connecticut [¶]	38,896	1,421	3.7	830	(58.4)	37,043	(95.2)	2.1
Delaware	11,559	190	1.6	124	(65.3)	11,165	(96.6)	1.1
District of Columbia	9,040	297	3.3	191	(64.3)	8,696	(96.2)	2.1
Federated States of Micronesia	**	**	**	**	**	**	**	**
Florida	221,394	2,692	1.2	1,381	(51.3)	214,213	(96.8)	0.6
Georgia [¶]	141,377	1,483	1.0	752	(50.7)	136,409	(96.5)	0.5
Guam	3,415	**	**	**	**	3,366	(98.6)	**
Hawaii	18,887	292	1.5	146	(50.0)	18,271	(96.7)	0.8
Idaho	23,737	217	0.9	95	(43.8)	23,041	(97.1)	0.4
Illinois	171,163	3,728	2.2	2,029	(54.4)	164,595	(96.2)	1.2
Indiana	86,673	680	0.8	341	(50.1)	83,774	(96.7)	0.4
Iowa	39,701	506	1.3	289	(57.1)	38,279	(96.4)	0.7
Kansas	41,396	383	0.9	185	(48.3)	40,072	(96.8)	0.4
Kentucky	57,551	473	0.8	257	(54.3)	55,664	(96.7)	0.4
Louisiana	64,973	396	0.6	183	(46.2)	62,869	(96.8)	0.3
Maine	13,470	36	0.3	**	(50.0)	13,032	(96.7)	0.1
Maryland	75,059	1,855	2.5	1,090	(58.8)	72,136	(96.1)	1.5
Massachusetts [¶]	75,016	3,255	4.3	1,915	(58.8)	71,467	(95.3)	2.6
Michigan	117,294	1,574	1.3	786	(49.9)	112,965	(96.3)	0.7
Minnesota	70,646	1,039	1.5	531	(51.1)	68,036	(96.3)	0.8
Mississippi	42,901	175	0.4	84	(48.0)	41,331	(96.3)	0.2
Missouri	78,905	698	0.9	341	(48.9)	76,200	(96.6)	0.4
Montana	12,257	92	0.8	49	(53.3)	11,888	(97.0)	0.4
Nebraska	26,936	257	1.0	142	(55.3)	25,932	(96.3)	0.5
Nevada	37,612	519	1.4	248	(47.8)	36,536	(97.1)	0.7

See table footnotes on page 17.

TABLE 3. (Continued) Number, percentage, and proportion of infants born with the use of assisted reproductive technology (ART),* by female patient's state/territory of residence* at time of treatment — United States, 2009

Patient's state/ territory of residence	No. infants born in the state [†]	No. ART infants born in the state [§]	% of infants born in state who are ART infants	No. and % of ART infants born in the state who are singletons [§]		Singletons among all infants born in the state [†]		% of ART singletons to all singleton infants born in the state
				No.	(%)	No.	(%)	
New Hampshire	13,377	280	2.1	144	(51.4)	12,807	(95.7)	1.1
New Jersey	110,331	3,821	3.5	1,970	(51.6)	105,215	(95.4)	1.8
New Mexico	29,000	208	0.7	107	(51.4)	28,328	(97.7)	0.4
New York	125,784	4,837	3.8	2,611	(54.0)	120,309	(95.6)	2.1
New York City	122,326	1,603	1.3	920	(57.4)	117,754	(96.3)	0.8
North Carolina	126,845	1,436	1.1	686	(47.8)	122,360	(96.5)	0.5
North Dakota	9,001	101	1.1	47	(46.5)	8,709	(96.8)	0.5
Ohio	144,841	1,503	1.0	777	(51.7)	139,734	(96.5)	0.5
Oklahoma	54,553	323	0.6	149	(46.1)	52,931	(97.0)	0.3
Oregon	47,132	644	1.4	311	(48.3)	45,613	(96.8)	0.7
Pennsylvania [¶]	146,434	2,164	1.5	1,170	(54.1)	140,973	(96.3)	0.8
Puerto Rico	44,773	90	0.2	38	(42.2)	43,902	(98.1)	0.1
Rhode Island	11,442	272	2.4	155	(57.0)	10,977	(95.9)	1.4
South Carolina	60,620	580	1.0	300	(51.7)	58,458	(96.4)	0.5
South Dakota	11,934	75	0.6	41	(54.7)	11,627	(97.4)	0.3
Tennessee	82,211	490	0.6	235	(48.0)	79,616	(96.8)	0.3
Texas	401,977	4,367	1.1	2,054	(47.0)	389,116	(96.8)	0.5
Utah	53,887	533	1.0	272	(51.0)	52,161	(96.8)	0.5
Vermont	6,110	75	1.2	41	(54.7)	5,939	(97.2)	0.7
Virgin Islands	1,687	**	**	**	**	1,653	(98.0)	**
Virginia	105,059	2,014	1.9	1,124	(55.8)	101,140	(96.3)	1.1
Washington	89,313	1,345	1.5	691	(51.4)	86,432	(96.8)	0.8
West Virginia	21,268	124	0.6	61	(49.2)	20,616	(96.9)	0.3
Wisconsin	70,843	642	0.9	339	(52.8)	68,459	(96.6)	0.5
Wyoming	7,881	51	0.6	20	(39.2)	7,640	(96.9)	0.3
Total	4,180,540^{††}	60,001	1.4	31,575	(52.6)	4,036,029^{††}	(96.5)	0.8

* In cases of missing residency data, the patient's state of residency was assigned as the state in which the ART procedure was performed.

[†] Source: U.S. natality file, CDC, National Center for Health Statistics. Singleton deliveries reported include infants from both singleton and multiple gestations.

[§] Includes infants conceived from ART procedures performed in 2008 and born in 2009, and infants conceived from ART procedures performed in 2009 and born in 2009. Total ART births exclude nonresidents.

[¶] A substantial percentage (6%–32%) of residency information was missing for procedures started in these four states.

** Data not provided to preserve confidentiality but included in totals.

^{††} U.S. births includes nonresidents.

TABLE 4. Number, percentage, and proportion of multiple-birth, twins, and triplets (plus) infants born with use of assisted reproductive technology (ART) procedure, by female patient's place of residence* — United States, 2009

Patient's state/ territory of residence	ART multiple- birth infants born [†]		Total infants born who are multiple-birth [§]		% of ART multiples to all multiple infants born	ART twins [†]		Total twins [§]		% of ART twins to all twin infants born	ART triplets (plus) [†]		Total triplets (plus) (all) [§]		% of ART triplets (plus) to all triplets (plus) born
	No.	(%)	No.	(%)		No.	(%)	No.	(%)		No.	(%)	No.	(%)	
Alabama	178	(44.2)	2,160	(3.5)	8.2	160	(39.7)	2,074	(3.3)	7.7	¶	(4.5)	86	(0.1)	20.9
Alaska	34	(51.5)	359	(3.2)	9.5	34	(51.5)	348	(3.1)	9.8	¶	(0)	¶	(0.1)	0
Arizona	483	(49.8)	2,593	(2.8)	18.6	426	(43.9)	2,471	(2.7)	17.2	57	(5.9)	122	(0.1)	46.7
Arkansas	68	(37.6)	1,216	(3.1)	5.6	68	(37.6)	1,186	(3.0)	5.7	¶	(0)	30	(0.1)	0
California	3,566	(47.3)	16,801	(3.2)	21.2	3290	(43.6)	16,126	(3.1)	20.4	276	(3.7)	675	(0.1)	40.9
Colorado	519	(52.6)	2,344	(3.4)	22.1	480	(48.7)	2,215	(3.2)	21.7	39	(4.0)	129	(0.2)	30.2
Connecticut**	591	(41.6)	1,853	(4.8)	31.9	558	(39.3)	1,786	(4.6)	31.2	33	(2.3)	67	(0.2)	49.3
Delaware	66	(34.7)	394	(3.4)	16.8	60	(31.6)	382	(3.3)	15.7	¶	(3.2)	¶	(0.1)	50.0
District of Columbia	106	(35.7)	344	(3.8)	30.8	106	(35.7)	331	(3.7)	32.0	¶	(0)	¶	(0.1)	0
Federated States of Micronesia	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶
Florida	1,311	(48.7)	7,181	(3.2)	18.3	1,188	(44.1)	6,881	(3.1)	17.3	123	(4.6)	300	(0.1)	41.0
Georgia**	730	(49.2)	4,968	(3.5)	14.7	676	(45.6)	4,798	(3.4)	14.1	54	(3.6)	170	(0.1)	31.8
Guam	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶
Hawaii	146	(50.0)	616	(3.3)	23.7	134	(45.9)	586	(3.1)	22.9	¶	(4.1)	30	(0.2)	40.0
Idaho	122	(56.2)	696	(2.9)	17.5	116	(53.5)	671	(2.8)	17.3	¶	(2.8)	25	(0.1)	24.0
Illinois	1,698	(45.5)	6,568	(3.8)	25.9	1,578	(42.3)	6,261	(3.7)	25.2	120	(3.2)	307	(0.2)	39.1
Indiana	338	(49.7)	2,899	(3.3)	11.7	284	(41.8)	2,725	(3.1)	10.4	54	(7.9)	174	(0.2)	31.0
Iowa	217	(42.9)	1,422	(3.6)	15.3	208	(41.1)	1,352	(3.4)	15.4	¶	(1.8)	70	(0.2)	12.9
Kansas	198	(51.7)	1,324	(3.2)	15.0	186	(48.6)	1,273	(3.1)	14.6	¶	(3.1)	51	(0.1)	23.5
Kentucky	216	(45.7)	1,887	(3.3)	11.4	204	(43.1)	1,833	(3.2)	11.1	¶	(2.5)	54	(0.1)	22.2
Louisiana	212	(53.5)	2,104	(3.2)	10.1	182	(46.0)	2,013	(3.1)	9.0	30	(7.6)	91	(0.1)	33.0
Maine	¶	(50.0)	438	(3.3)	4.1	¶	(50.0)	429	(3.2)	4.2	¶	(0)	¶	(0.1)	0
Maryland	765	(41.2)	2,923	(3.9)	26.2	714	(38.5)	2,824	(3.8)	25.3	51	(2.7)	99	(0.1)	51.5
Massachusetts**	1,339	(41.1)	3,549	(4.7)	37.7	1,258	(38.6)	3,392	(4.5)	37.1	81	(2.5)	157	(0.2)	51.6
Michigan	787	(50.0)	4,329	(3.7)	18.2	718	(45.6)	4,098	(3.5)	17.5	69	(4.4)	231	(0.2)	29.9
Minnesota	508	(48.9)	2,610	(3.7)	19.5	484	(46.6)	2,505	(3.5)	19.3	24	(2.3)	105	(0.1)	22.9
Mississippi	91	(52.0)	1,570	(3.7)	5.8	76	(43.4)	1,498	(3.5)	5.1	¶	(8.6)	72	(0.2)	20.8
Missouri	357	(51.1)	2,705	(3.4)	13.2	324	(46.4)	2,532	(3.2)	12.8	33	(4.7)	173	(0.2)	19.1
Montana	43	(46.7)	369	(3.0)	11.7	40	(43.5)	366	(3.0)	10.9	¶	(3.3)	¶	(0.0)	100.0
Nebraska	115	(44.7)	1,004	(3.7)	11.5	112	(43.6)	948	(3.5)	11.8	¶	(1.2)	56	(0.2)	5.4
Nevada	270	(52.0)	1,076	(2.9)	25.1	246	(47.4)	1,032	(2.7)	23.8	24	(4.6)	44	(0.1)	54.5
New Hampshire	136	(48.6)	570	(4.3)	23.9	136	(48.6)	539	(4.0)	25.2	¶	(0)	31	(0.2)	0

See table footnotes on page 19.

TABLE 4. (Continued) Number, percentage, and proportion of multiple-birth, twins, and triplets (plus) infants born with use of assisted reproductive technology (ART) procedure,* by female patient's place of residence† — United States, 2009

Patient's state/ territory of residence	ART multiple- birth infants born†		Total infants born who are multiple-birth§		% of ART multiples to all multiple infants born	ART twins†		Total twins§		% of ART twins to all twin infants born	ART triplets (plus)†		Total triplets (plus) (all)§		% of ART triplets (plus) to all triplets (plus) born
	No.	(%)	No.	(%)		No.	(%)	No.	(%)		No.	(%)	No.	(%)	
New Jersey	1,851	(48.4)	5,116	(4.6)	36.2	1,704	(44.6)	4,877	(4.4)	34.9	147	(3.8)	239	(0.2)	61.5
New Mexico	101	(48.6)	672	(2.3)	15.0	92	(44.2)	646	(2.2)	14.2	¶	(4.3)	26	(0.1)	34.6
New York	2,226	(46.0)	5,475	(0.7)	40.7	2,052	(42.4)	4,942	(3.9)	41.5	174	(3.6)	533	(0.4)	32.6
New York City††	683	(42.6)		(3.7)		644	(40.2)	4,572	(3.7)	14.1	39	(2.4)			
North Carolina	748	(52.1)	4,485	(3.5)	16.7	664	(46.2)	4,251	(3.4)	15.6	84	(5.8)	234	(0.2)	35.9
North Dakota	53	(52.5)	292	(3.2)	18.2	50	(49.5)	274	(3.0)	18.2	¶	(3.0)	¶	(0.2)	16.7
Ohio	726	(48.3)	5,107	(3.5)	14.2	660	(43.9)	4,850	(3.3)	13.6	66	(4.4)	257	(0.2)	25.7
Oklahoma	173	(53.6)	1,622	(3.0)	10.7	152	(47.1)	1,536	(2.8)	9.9	21	(6.5)	86	(0.2)	24.4
Oregon	333	(51.7)	1,519	(3.2)	21.9	324	(50.3)	1,471	(3.1)	22.0	¶	(1.4)	48	(0.1)	18.8
Pennsylvania**	993	(45.9)	5,461	(3.7)	18.2	906	(41.9)	5,216	(3.6)	17.4	87	(4.0)	245	(0.2)	35.5
Puerto Rico	52	(57.8)	871	(1.9)	6.0	40	(44.4)	846	(1.9)	4.7	¶	(13.3)	25	(0.1)	48.0
Rhode Island	117	(43.0)	465	(4.1)	25.2	114	(41.9)	453	(4.0)	25.2	¶	(1.1)	¶	(0.1)	25.0
South Carolina	280	(48.3)	2,162	(3.6)	13.0	256	(44.1)	2,072	(3.4)	12.4	24	(4.1)	90	(0.1)	26.7
South Dakota	34	(45.3)	307	(2.6)	11.1	28	(37.3)	293	(2.5)	9.6	¶	(8.0)	¶	(0.1)	42.9
Tennessee	255	(52.0)	2,595	(3.2)	9.8	234	(47.8)	2,490	(3.0)	9.4	21	(4.3)	105	(0.1)	20.0
Texas	2,310	(52.9)	12,861	(3.2)	18.0	2,130	(48.8)	12,248	(3.0)	17.4	180	(4.1)	613	(0.2)	29.4
Utah	260	(48.8)	1,726	(3.2)	15.1	236	(44.3)	1,659	(3.1)	14.2	24	(4.5)	67	(0.1)	35.8
Vermont	34	(45.3)	171	(2.8)	19.9	34	(45.3)	168	(2.7)	20.2	¶	(0)	¶	(0)	0
Virgin Islands	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶	¶
Virginia	890	(44.2)	3,919	(3.7)	22.7	836	(41.5)	3,780	(3.6)	22.1	54	(2.7)	139	(0.1)	38.8
Washington	654	(48.6)	2,881	(3.2)	22.7	618	(45.9)	2,788	(3.1)	22.2	36	(2.7)	93	(0.1)	38.7
West Virginia	62	(50.0)	652	(3.1)	9.5	56	(45.2)	636	(3.0)	8.8	¶	(4.8)	¶	(0.1)	37.5
Wisconsin	302	(47.0)	2,384	(3.4)	12.7	284	(44.2)	2,288	(3.2)	12.4	18	(2.8)	96	(0.1)	18.8
Wyoming	31	(60.8)	241	(3.1)	12.9	28	(54.9)	232	(2.9)	12.1	¶	(5.9)	¶	(0.1)	33.3
Total	28,398	(47.3)	139,856 ^{§§}	(3.3)	20.3	26,208	(43.7)	137,914 ^{§§}	(3.3)	19.0	2,190	(3.6)	6,365 ^{§§}	(0.2)	34.4

Abbreviation: Triplets (plus) = triplets and higher order multiple births.

* In cases of missing residency data, the female patient's state of residency was assigned as the state in which the ART procedure was performed.

† ART totals include infants conceived from ART procedures performed in 2008 and born in 2009 and infants conceived from ART procedures performed in 2009 and born in 2009. Totals exclude nonresidents.

§ Source: U.S. natality file, CDC, National Center for Health Statistics.

¶ Data are not provided to preserve confidentiality but are included in totals.

** A substantial percentage (6%–32%) of residency information was missing for procedures started in these four states.

†† New York City total number of multiple birth infants cannot be separated into twins and triplets (plus) and is reported as an aggregate that includes twins and higher order multiple births.

§§ U.S. totals include nonresidents.

TABLE 5. Number, percentage, and proportion of infants born with use of assisted reproductive technology (ART), by low birthweight category and female patient's place of residence* — United States, 2009

Patient's state/ territory of residence	<2,500 g (LBW)					<1,500 g (VLBW)					1,500–2,499 g (MLBW)				
	ART†		Total births (all)		LBW contribution by ART %	ART†		Total births (all)		VLBW contribution by ART %	ART†		Total births (all)		MLBW contribution by ART %
	No.	(%)	No.	(%)		No.	(%)	No.	(%)		No.	(%)	No.	(%)	
Alabama	130	(32.3)	6,454	(10.3)	2.0	25	(6.2)	1,195	(1.9)	2.1	105	(26.1)	5,259	(8.4)	2.0
Alaska	§	(19.7)	666	(5.9)	2.0	§	(1.5)	113	(1.0)	0.9	§	(18.2)	553	(4.9)	2.2
Arizona	327	(33.7)	6,575	(7.1)	5.0	52	(5.4)	1,084	(1.2)	4.8	275	(28.4)	5,491	(5.9)	5.0
Arkansas	50	(27.6)	3,546	(8.9)	1.4	§	(4.4)	642	(1.6)	1.2	42	(23.2)	2,904	(7.3)	1.4
California	2,373	(31.4)	35,802	(6.8)	6.6	384	(5.1)	6,064	(1.2)	6.3	1,989	(26.4)	29,738	(5.6)	6.7
Colorado	399	(40.5)	6,007	(8.8)	6.6	47	(4.8)	829	(1.2)	5.7	352	(35.7)	5,178	(7.5)	6.8
Connecticut¶	391	(27.5)	3,127	(8.0)	12.5	59	(4.2)	555	(1.4)	10.6	332	(23.4)	2,572	(6.6)	13.0
Delaware	50	(26.3)	994	(8.6)	5.0	§	(3.7)	214	(1.9)	3.3	43	(22.6)	780	(6.7)	5.5
District of Columbia	78	(26.3)	929	(10.3)	8.4	§	(2.0)	187	(2.1)	3.2	72	(24.2)	742	(8.2)	9.7
Federated States of Micronesia	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Florida	918	(34.1)	19,247	(8.7)	4.8	165	(6.1)	3,498	(1.6)	4.7	753	(28.0)	15,749	(7.1)	4.8
Georgia¶	524	(35.3)	13,190	(9.3)	4.0	110	(7.4)	2,414	(1.7)	4.6	414	(27.9)	10,776	(7.6)	3.8
Guam	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Hawaii	111	(38.0)	1,592	(8.4)	7.0	§	(6.5)	264	(1.4)	7.2	92	(31.5)	1,328	(7.0)	6.9
Idaho	74	(34.1)	1,541	(6.5)	4.8	§	(3.2)	248	(1.0)	2.8	67	(30.9)	1,293	(5.4)	5.2
Illinois	1,147	(30.8)	14,316	(8.4)	8.0	201	(5.4)	2,588	(1.5)	7.8	946	(25.4)	11,728	(6.9)	8.1
Indiana	250	(36.8)	7,225	(8.3)	3.5	49	(7.2)	1,263	(1.5)	3.9	201	(29.6)	5,962	(6.9)	3.4
Iowa	153	(30.2)	2,671	(6.7)	5.7	20	(4.0)	435	(1.1)	4.6	133	(26.3)	2,236	(5.6)	5.9
Kansas	134	(35.0)	3,011	(7.3)	4.5	27	(7.0)	567	(1.4)	4.8	107	(27.9)	2,444	(5.9)	4.4
Kentucky	130	(27.5)	5,141	(8.9)	2.5	22	(4.7)	858	(1.5)	2.6	108	(22.8)	4,283	(7.4)	2.5
Louisiana	163	(41.2)	6,915	(10.6)	2.4	32	(8.1)	1,308	(2.0)	2.4	131	(33.1)	5,607	(8.6)	2.3
Maine	§	(41.7)	851	(6.3)	1.8	§	(8.3)	129	(1.0)	2.3	§	(33.3)	722	(5.4)	1.7
Maryland	580	(31.3)	6,836	(9.1)	8.5	108	(5.8)	1,339	(1.8)	8.1	472	(25.4)	5,497	(7.3)	8.6
Massachusetts¶	847	(26.0)	5,802	(7.7)	14.6	127	(3.9)	1,006	(1.3)	12.6	720	(22.1)	4,796	(6.4)	15.0
Michigan	531	(33.7)	9,799	(8.4)	5.4	121	(7.7)	1,890	(1.6)	6.4	410	(26.0)	7,909	(6.7)	5.2
Minnesota	314	(30.2)	4,604	(6.5)	6.8	60	(5.8)	792	(1.1)	7.6	254	(24.4)	3,812	(5.4)	6.7
Mississippi	70	(40.0)	5,249	(12.2)	1.3	§	(6.9)	898	(2.1)	1.3	58	(33.1)	4,351	(10.1)	1.3
Missouri	211	(30.2)	6,393	(8.1)	3.3	33	(4.7)	1,222	(1.5)	2.7	178	(25.5)	5,171	(6.6)	3.4
Montana	27	(29.3)	865	(7.1)	3.1	§	(5.4)	125	(1.0)	4.0	22	(23.9)	740	(6.0)	3.0
Nebraska	69	(26.8)	1,922	(7.1)	3.6	§	(2.7)	315	(1.2)	2.2	62	(24.1)	1,607	(6.0)	3.9

See table footnotes on page 21.

TABLE 5. (Continued) Number, percentage, and proportion of infants born with use of assisted reproductive technology (ART), by low birthweight category and female patient's place of residence* — United States, 2009

Patient's state/ territory of residence	<2,500 g (LBW)					<1,500 g (VLBW)					1,500–2,499 g (MLBW)				
	ART†		Total births (all)		LBW contribution by ART %	ART†		Total births (all)		VLBW contribution by ART %	ART†		Total births (all)		MLBW contribution by ART %
	No.	(%)	No.	(%)		No.	(%)	No.	(%)		No.	(%)	No.	(%)	
New Hampshire	87	(31.1)	925	(6.9)	9.4	§	(6.1)	147	(1.1)	11.6	70	(25.0)	778	(5.8)	9.0
New Jersey	1,255	(32.8)	9,137	(8.3)	13.7	254	(6.6)	1,667	(1.5)	15.2	1,001	(26.2)	7,470	(6.8)	13.4
New Mexico	81	(38.9)	2,416	(8.3)	3.4	§	(6.7)	355	(1.2)	3.9	67	(32.2)	2,061	(7.1)	3.3
New York	1,457	(30.1)	20,341	(8.2)	7.2	260	(5.4)	3,767	(1.5)	6.9	1,197	(24.7)	16,574	(6.7)	7.2
New York City**	458	(28.6)				69	(4.3)				389	(24.3)			
North Carolina	559	(38.9)	11,454	(9.0)	4.9	112	(7.8)	2,263	(1.8)	4.9	447	(31.1)	9,191	(7.2)	4.9
North Dakota	30	(29.7)	572	(6.4)	5.2	§	(7.9)	112	(1.2)	7.1	22	(21.8)	460	(5.1)	4.8
Ohio	459	(30.5)	12,378	(8.5)	3.7	92	(6.1)	2,331	(1.6)	3.9	367	(24.4)	10,047	(6.9)	3.7
Oklahoma	125	(38.7)	4,558	(8.4)	2.7	30	(9.3)	799	(1.5)	3.8	95	(29.4)	3,759	(6.9)	2.5
Oregon	207	(32.1)	2,955	(6.3)	7.0	24	(3.7)	479	(1.0)	5.0	183	(28.4)	2,476	(5.3)	7.4
Pennsylvania¶	636	(29.4)	12,187	(8.3)	5.2	121	(5.6)	2,347	(1.6)	5.2	515	(23.8)	9,840	(6.7)	5.2
Puerto Rico	43	(47.8)	§	§	§	§	(7.8)	§	§	§	36	(40.0)	§	§	§
Rhode Island	76	(27.9)	913	(8.0)	8.3	20	(7.4)	193	(1.7)	10.4	56	(20.6)	720	(6.3)	7.8
South Carolina	189	(32.6)	6,047	(10.0)	3.1	36	(6.2)	1,104	(1.8)	3.3	153	(26.4)	4,943	(8.2)	3.1
South Dakota	24	(32.0)	696	(5.8)	3.4	§	(13.3)	129	(1.1)	7.8	§	(18.7)	567	(4.8)	2.5
Tennessee	181	(36.9)	7,539	(9.2)	2.4	39	(8.0)	1,364	(1.7)	2.9	142	(29.0)	6,175	(7.5)	2.3
Texas	1,712	(39.2)	34,137	(8.5)	5.0	314	(7.2)	5,906	(1.5)	5.3	1,398	(32.0)	28,231	(7.0)	5.0
Utah	195	(36.6)	3,766	(7.0)	5.2	28	(5.3)	550	(1.0)	5.1	167	(31.3)	3,216	(6.0)	5.2
Vermont	19	(25.3)	411	(6.7)	4.6	§	(10.7)	67	(1.1)	11.9	§	(14.7)	344	(5.6)	3.2
Virgin Islands	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Virginia	615	(30.5)	8,779	(8.4)	7.0	119	(5.9)	1,703	(1.6)	7.0	496	(24.6)	7,076	(6.7)	7.0
Washington	428	(31.8)	5,580	(6.2)	7.7	66	(4.9)	862	(1.0)	7.7	362	(26.9)	4,718	(5.3)	7.8
West Virginia	44	(35.5)	1,952	(9.2)	2.3	§	(5.6)	313	(1.5)	2.2	37	(29.8)	1,639	(7.7)	2.3
Wisconsin	197	(30.7)	5,027	(7.1)	3.9	42	(6.5)	850	(1.2)	4.9	155	(24.1)	4,177	(5.9)	3.7
Wyoming	24	(47.1)	661	(8.4)	3.6	§	(3.9)	90	(1.1)	2.2	22	(43.1)	571	(7.2)	3.9
Total	19,408	(32.3)	336,747††	(8.1)	5.8	3,452	(5.8)	59,917††	(1.4)	5.8	15,953	(26.6)	276,830††	(6.6)	5.8

Abbreviations: LBW = low birthweight, VLBW = very low birthweight, MLBW = moderate low birthweight.

* In cases of missing residency data, the patient's state of residency was assigned as the state in which the ART procedure was performed.

† ART totals include infants conceived from ART procedures performed in 2008 and born in 2009 and infants conceived from ART procedures performed in 2009 and born in 2009. Totals exclude nonresidents.

§ Data not provided to preserve confidentiality but included in totals, except for the U.S. Virgin Islands, Puerto Rico, and Guam.

¶ A substantial percentage (6%–32%) of residency information was missing for procedures started in these four states.

** Data included in totals for New York.

†† U.S. totals include nonresidents.

TABLE 6. Number, percentage, and proportion of infants born with use of assisted reproductive technology (ART), by low gestational age category and female patient's place of residence* — United States, 2009

Patient's state/ territory of residence	<37 weeks (PTB)					<32 weeks (VPTB)				32–36 weeks (MPTB)					
	ART†		Total births (all)		PTB contribution by ART %	ART†		Total births (all)		VPTB contribution by ART %	ART†		Total births (all)		MPTB contribution by ART %
	No.	(%)	No.	(%)		No.	(%)	No.	(%)		No.	(%)	No.	(%)	
Alabama	145	(36.0)	9,712	(15.5)	1.5	25	(6.2)	1,727	(2.8)	1.4	120	(29.8)	7,985	(12.8)	1.5
Alaska	25	(37.9)	1,240	(11.0)	2.0	§	(1.5)	159	(1.4)	0.6	24	(36.4)	1,081	(9.5)	2.2
Arizona	368	(37.9)	11,821	(12.7)	3.1	52	(5.4)	1,602	(1.7)	3.2	316	(32.6)	10,219	(11.0)	3.1
Arkansas	54	(29.8)	5,189	(13.0)	1.0	§	(6.1)	805	(2.0)	1.4	43	(23.8)	4,384	(11.0)	1.0
California	2,405	(31.9)	53,956	(10.2)	4.5	413	(5.5)	7,948	(1.5)	5.2	1,992	(26.4)	46,008	(8.7)	4.3
Colorado	361	(36.6)	7,730	(11.3)	4.7	54	(5.5)	1,154	(1.7)	4.7	307	(31.1)	6,576	(9.6)	4.7
Connecticut¶	378	(26.6)	3,973	(10.2)	9.5	69	(4.9)	695	(1.8)	9.9	309	(21.7)	3,278	(8.4)	9.4
Delaware	45	(23.7)	1,445	(12.5)	3.1	§	(4.2)	267	(2.3)	3.0	37	(19.5)	1,178	(10.2)	3.1
District of Columbia	73	(24.6)	1,280	(14.2)	5.7	§	(2.7)	265	(2.9)	3.0	65	(21.9)	1,015	(11.2)	6.4
Federated States of Micronesia	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Florida	941	(35.0)	29,975	(13.5)	3.1	184	(6.8)	4,953	(2.2)	3.7	757	(28.1)	25,022	(11.3)	3.0
Georgia¶	542	(36.5)	19,407	(13.7)	2.8	105	(7.1)	3,159	(2.2)	3.3	437	(29.5)	16,248	(11.5)	2.7
Guam	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Hawaii	113	(38.7)	2,367	(12.5)	4.8	22	(7.5)	383	(2.0)	5.7	91	(31.2)	1,984	(10.5)	4.6
Idaho	83	(38.2)	2,394	(10.1)	3.5	§	(5.5)	360	(1.5)	3.3	71	(32.7)	2,034	(8.6)	3.5
Illinois	1,157	(31.0)	21,168	(12.4)	5.5	204	(5.5)	3,570	(2.1)	5.7	953	(25.6)	17,598	(10.3)	5.4
Indiana	272	40	1,0316	(11.9)	2.6	50	(7.4)	1,694	(2.0)	3.0	222	(32.6)	8,622	(9.9)	2.6
Iowa	181	(35.8)	4,467	(11.3)	4.1	20	(4.0)	637	(1.6)	3.1	161	(31.8)	3,830	(9.6)	4.2
Kansas	151	(39.4)	4,609	(11.1)	3.3	32	(8.4)	718	(1.7)	4.5	119	(31.1)	3,891	(9.4)	3.1
Kentucky	157	(33.2)	7,849	(13.6)	2.0	25	(5.3)	1,252	(2.2)	2.0	132	(27.9)	6,597	(11.5)	2.0
Louisiana	180	(45.5)	9,572	(14.7)	1.9	33	(8.3)	1,711	(2.6)	1.9	147	(37.1)	7,861	(12.1)	1.9
Maine	§	(38.9)	1,334	(9.9)	1.0	§	(8.3)	203	(1.5)	1.5	§	(30.6)	1,131	(8.4)	1.0
Maryland	553	(29.8)	9,550	(12.7)	5.8	110	(5.9)	1,694	(2.3)	6.5	443	(23.9)	7,856	(10.5)	5.6
Massachusetts¶	899	(27.6)	8,099	(10.8)	11.1	141	(4.3)	1,276	(1.7)	11.1	758	(23.3)	6,823	(9.1)	11.1
Michigan	546	(34.7)	14,564	(12.4)	3.7	125	(7.9)	2,606	(2.2)	4.8	421	(26.7)	11,958	(10.2)	3.5
Minnesota	350	(33.7)	7,084	(10.0)	4.9	65	(6.3)	1,073	(1.5)	6.1	285	(27.4)	6,011	(8.5)	4.7
Mississippi	81	(46.3)	7,712	(18.0)	1.1	§	(4.6)	1,308	(3.0)	0.6	73	(41.7)	6,404	(14.9)	1.1
Missouri	255	(36.5)	9,578	(12.1)	2.7	44	(6.3)	1,552	(2.0)	2.8	211	(30.2)	8,026	(10.2)	2.6
Montana	32	(34.8)	1,331	(10.9)	2.4	§	(4.3)	199	(1.6)	2.0	28	(30.4)	1,132	(9.2)	2.5
Nebraska	83	(32.3)	3,096	(11.5)	2.7	§	(5.1)	463	(1.7)	2.8	70	(27.2)	2,633	(9.8)	2.7
Nevada	229	(44.1)	5,133	(13.6)	4.5	38	(7.3)	719	(1.9)	5.3	191	(36.8)	4,414	(11.7)	4.3

See table footnotes on page 23.

TABLE 6. (Continued) Number, percentage, and proportion of infants born with use of assisted reproductive technology (ART), by low gestational age category and female patient's place of residence* — United States, 2009

Patient's state/ territory of residence	<37 weeks (PTB)					<32 weeks (VPTB)					32–36 weeks (MPTB)				
	ART†		Total births (all)		PTB contribution by ART %	ART†		Total births (all)		VPTB contribution by ART %	ART†		Total births (all)		MPTB contribution by ART %
	No.	(%)	No.	(%)		No.	(%)	No.	(%)		No.	(%)	No.	(%)	
New Jersey	1,251	(32.7)	13,188	(12.0)	9.5	275	(7.2)	2,313	(2.1)	11.9	976	(25.5)	10,875	(9.9)	9.0
New Mexico	87	(41.8)	3,572	(12.3)	2.4	§	(7.2)	518	(1.8)	2.9	72	(34.6)	3,054	(10.5)	2.4
New York	1,494	(30.9)	14,167	(11.3)	10.5	297	(6.1)	2,467	(2.0)	12.0	1,197	(24.7)	11,700	(9.3)	10.2
New York City**	449	(28.0)	16,062	(13.1)	2.8	75	(4.7)	2,507	(2.0)	3.0	374	(23.3)	13,555	(11.1)	2.8
North Carolina	560	(39.0)	16,494	(13.0)	3.4	122	(8.5)	3,048	(2.4)	4.0	438	(30.5)	13,446	(10.6)	3.3
North Dakota	31	(30.7)	952	(10.6)	3.3	§	(5.9)	144	(1.6)	4.2	25	(24.8)	808	(9.0)	3.1
Ohio	485	(32.3)	17,824	(12.3)	2.7	87	(5.8)	3,253	(2.2)	2.7	398	(26.5)	14,571	(10.1)	2.7
Oklahoma	133	(41.2)	7,512	(13.8)	1.8	34	(10.5)	1,159	(2.1)	2.9	99	(30.7)	6,353	(11.6)	1.6
Oregon	199	(30.9)	4,624	(9.8)	4.3	29	(4.5)	643	(1.4)	4.5	170	(26.4)	3,981	(8.4)	4.3
Pennsylvania¶	668	(30.9)	16,754	(11.4)	4.0	112	(5.2)	3,048	(2.1)	3.7	556	(25.7)	13,706	(9.4)	4.1
Puerto Rico	40	(44.4)	7,895	(17.6)	0.5	§	(5.6)	995	(2.2)	0.5	35	(38.9)	6,900	(15.4)	0.5
Rhode Island	79	(29.0)	1,305	(11.4)	6.1	§	(5.9)	264	(2.3)	6.1	63	(23.2)	1,041	(9.1)	6.1
South Carolina	200	(34.5)	8,806	(14.5)	2.3	37	(6.4)	1,553	(2.6)	2.4	163	(28.1)	7,253	(12.0)	2.2
South Dakota	23	(30.7)	1,302	(10.9)	1.8	§	(14.7)	189	(1.6)	5.8	§	(16.0)	1,113	(9.3)	1.1
Tennessee	210	(42.9)	10,630	(12.9)	2.0	41	(8.4)	1,739	(2.1)	2.4	169	(34.5)	8,891	(10.8)	1.9
Texas	1,778	(40.7)	52,650	(13.1)	3.4	333	(7.6)	7,980	(2.0)	4.2	1,445	(33.1)	44,670	(11.1)	3.2
Utah	201	(37.7)	6,092	(11.3)	3.3	31	(5.8)	746	(1.4)	4.2	170	(31.9)	5,346	(9.9)	3.2
Vermont	§	(21.3)	570	(9.3)	2.8	§	(9.3)	93	(1.5)	7.5	§	(12.0)	477	(7.8)	1.9
Virgin Islands	§	§	§	§	§	§	§	§	§	§	§	§	§	§	§
Virginia	631	(31.3)	12,002	(11.4)	5.3	141	(7.0)	2,079	(2.0)	6.8	490	(24.3)	9,923	(9.4)	4.9
Washington	457	(34.0)	9,180	(10.3)	5.0	65	(4.8)	1,288	(1.4)	5.0	392	(29.1)	7,892	(8.8)	5.0
West Virginia	44	(35.5)	2,739	(12.9)	1.6	§	(3.2)	433	(2.0)	0.9	40	(32.3)	2,306	(10.8)	1.7
Wisconsin	211	(32.9)	7,724	(10.9)	2.7	38	(5.9)	1,225	(1.7)	3.1	173	(26.9)	6,499	(9.2)	2.7
Wyoming	24	(47.1)	883	(11.2)	2.7	§	(7.8)	135	(1.7)	3.0	20	(39.2)	748	(9.5)	2.7
Total	20,039††	(33.4)§§	510,201¶¶	(12.2)	3.9	3,680	(6.1)	82,180¶¶	(2.0)	4.5	16,356	(27.3)§§	428,021¶¶	(10.2)	3.8

Abbreviations: PTB = preterm birth, VPTB = very preterm birth, MPTB = moderate preterm birth.

* In cases of missing residency data, the patient's state of residency was assigned as the state in which the ART procedure was performed.

† ART totals include infants conceived from ART procedures performed in 2008 and born in 2009, and infants conceived from ART procedures performed in 2009 and born in 2009. Totals exclude non-residents.

§ Data not provided to preserve confidentiality but included in totals.

¶ A substantial percentage (6%–32%) of residency information was missing for procedures started in these four states.

** Data included in totals for New York.

†† This number excludes nonresidents and missing gestational age.

§§ Percentage based on totals excluding nonresidents and missing gestational age.

¶¶ U.S. totals include nonresidents.

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