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Assessing the use of assisted reproductive technology in the United States by non–United States residents

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Abstract

Objective: To study cross-border reproductive care (CBRC) by assessing the frequency and nature of assisted reproductive technology (ART) care that non-U.S. residents receive in the United States.

Design: Retrospective study of ART cycles reported to the Centers for Disease Control and Prevention's National ART Surveillance System (NASS) from 2006 to 2013.

Setting: Private and academic ART clinics.

Patient(s): Patients who participated in ART cycles in the United States from 2006 to 2013.

Intervention(s): None.

Main Outcome Measure(s): Frequency and trend of ART use in the U.S. by non-U.S. residents, countries of residence for non-U.S. residents, differences by residence status for specific ART treatments received, and the outcomes of these ART cycles.

Result(s): A total of 1,271,775 ART cycles were reported to NASS from 2006 to 2013. The percentage of ART cycles performed for non-U.S. residents increased from 1.2% (n = 1,683) in 2006 to 2.8% (n = 5,381) in 2013 (P<.001), with treatment delivered to residents of 147 countries. Compared with resident cycles, non-U.S. resident cycles had higher use of oocyte donation (10.6% vs. 42.6%), gestational carriers (1.6% vs. 12.4%), and preimplantation genetic diagnosis or screening (5.3% vs. 19.1%). U.S. resident and non-U.S. resident cycles had similar embryo transfer and multiple birth rates.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Discuss: You can discuss this article with its authors and with other ASRM members at https://www.fertstertdialog.com/users/16110-fertility-and-sterility/posts/19017-24322

Conclusion(s): This analysis showed that non-U.S. resident cycles accounted for a growing share of all U.S. ART cycles and made higher use of specialized treatment techniques. This study provides important baseline data on CBRC in the U.S. and may also prove to be useful to organizations interested in improving access to fertility treatments. (Fertil Steril® 2017;108:815–21. ©2017 by American Society for Reproductive Medicine.)

Keywords

Assisted reproductive technology; cross-border reproductive care; oocyte donation; gestational carriers; preimplantation genetic diagnosis

Assisted reproductive technology (ART) treatments—here defined as fertility treatments in which eggs or embryos are handled in the laboratory to establish a pregnancy—account for ~ 1.6% of U.S. births (1). Some of the resulting children are born to parents who have traveled to the U.S. from other countries specifically for ART and who are engaged in cross-border reproductive care (CBRC) or, more colloquially, reproductive tourism. This practice is thought to be growing around the world (2). CBRC patients, as with patients who engage in other forms of medical tourism, may travel for a variety of reasons, including a desire to receive care that is higher in quality or lower in cost than the care available in their home countries (3, 4). In the context of ART, for which numerous countries have regulations limiting access to specific techniques, patients may also travel to obtain care that is restricted or illegal in their home countries (3–6). Although CBRC offers expanded access to family-building options, the practice also raises potential concerns: about the quality of CBRC received (7), the treatment of oocyte donors and gestational carriers participating in CBRC, including the medical risks these third parties bear (8), and the legal status of children resulting from CBRC (9).

Several organizations, including the International Committee Monitoring Assisted Reproductive Technologies (ICMART), the American Society for Reproductive Medicine (ASRM), and the European Society of Human Reproduction and Embryology (ESHRE) have highlighted the need for better data and analyses to improve our understanding of CBRC (3, 10, 11) and, in some cases, called attention to potential medical, ethical, and legal issues associated with the practice (3, 12). Other than a single summary statistic from the National ART Surveillance System (NASS) data (1), which is analyzed in more detail in the present study, most information regarding the prevalence of and reasons for CBRC come from two studies: a study of a single calendar month at a subset of fertility clinics in six European countries (11) and a survey of U.S. and Canadian fertility clinics (13). A recent pilot study that attempted to address this gap had such a low response rate that the authors concluded “clinicians are not motivated to collect even the simplest of data regarding CBRC patients” (14). The present study responds to the need for improved understanding of CBRC by providing a detailed analysis of CBRC in the U.S. from 2006 through 2013. We assessed the frequency and trend of CBRC use in the U.S., countries of residence for non-U.S. residents, differences by residence status for specific ART treatments received, and the outcomes of those ART cycles.

MATERIALS AND METHODS

Study Data

We used data from NASS, the federally mandated reporting system that collects ART procedure information under the Fertility Success Rate and Certification Act of 1992 (Public Law 102–493) (15). NASS data are ART cycle based and include patient medical and obstetrical history, infertility diagnoses, detailed parameters of each ART treatment cycle, and, if applicable, the pregnancy outcome, as well as a limited set of patient demographics, including residency status. Our analysis included all cycles in NASS from 2006 through 2013.

As of 2013, NASS was estimated to include 98% of ART cycles performed in the U.S. (16). Annually, 7% to 10% of reporting clinics undergo data validation (16). Discrepancy rates were low (<5%) for most fields included in this study, although the patient residence fields were not among those verified.

Ethical Approval

The Centers for Disease Control and Prevention (CDC) and Georgia Institute of Technology Institutional Review Boards approved this study; a waiver of informed consent was obtained.

Definitions

Residency status.—NASS contains a binary variable indicating whether the patient was a U.S. resident as well as information on the country and, for U.S. residents, the state of residence. In 40,611 cycles (3.2%) in which residency status was coded as “not specified,” we used the country and state of residence variables to classify residency status, when possible. Specifically, we classified 3,858 cycles (0.3%) with a patient’s country of residence identified as the U.S. and 30 cycles with a U.S. state of residence (but no country of residence) identified as U.S. residents. For three cycles with a specific country of residence outside of the U.S. identified, we classified the patients as non-U.S. residents. Following this process, 36,720 (2.9%) cycles were classified as “not specified.” We identified an additional 211 cycles (0.02%) for which the U.S. residency and patient country of residence variables were included in NASS but conflicted and classified these as “not specified.” This yielded a total of 36,931 cycles (2.9%) that were classified as “not specified.”

ART procedures.—NASS includes information on several specific ART procedures. These include the use of donor/third-party oocytes, use of a gestational carrier, preimplantation genetic diagnosis or screening (PGD/PGS), i.e., techniques that permit embryos to be genetically tested or screened prior to implantation (17), and intracytoplasmic sperm injection (ICSI), a technique developed to address some forms of male infertility but also used for patients with other underlying diagnoses (18).

Statistical Analyses

To evaluate whether the use of CBRC has increased over time, we compared the annual percentage of U.S. ART cycles involving non-U.S. residents from 2006 to 2013. We

assessed significance by means of the Cuzick trend test (19). To assess whether non-U.S. residents differentially used oocyte donation, gestational carriers, PGD/PGS, or ICSI, we compared the percentage of ART cycles undertaken by U.S. and non-U.S. residents over the entire 8-year period included in our analysis for each of these treatment options. To account for potential variation among the use of specific ART treatments by patient age, we repeated these comparisons stratifying by patient age into five categories (<35, 35–37, 38–40, 41–42, and >42 y). For oocyte donation and gestational carriers, we report the percentage of all ART cycles that used these techniques. For PGD/PGS and ICSI, we report the percentage of fresh noncancelled ART cycles that used these techniques. We also compared the age distribution of U.S. resident and non-U.S. resident ART patients. To assess differential use of any of the techniques by patients from specific countries, we calculated the percentage of ART cycles undertaken by non-U.S. residents using donated oocytes, gestational carriers, PGD/PGS, or ISCI for the 24 countries with the largest number of ART cycles reported in the U.S. and compared those results to the percentage of ART cycles undertaken by U.S. residents using these techniques. This subanalysis excluded 44 cycles for which the patients were classified as non-U.S. residents but the specific country of residence was missing in addition to the 36,931 (2.9%) cycles for which the residency status was “not specified.” Finally, to determine whether ART outcomes differed by residency status, we compared embryo transfer rates, live birth rates, and multiple birth rates for U.S. resident and non-U.S. resident ART cycles from 2006 through 2013. Nondonor and oocyte-donor cycles were analyzed separately. Because maternal age is a well established predictor of ART outcomes for nondonor cycles (16), we stratified this analysis by age.

RESULTS

ART Use by Non-U.S. Residents

NASS contains information on 1,271,775 ART cycles initiated in the U.S. from January 2006 through December 2013. We assessed the frequency of non-U.S. resident cycles across this period and found that ART cycles by non-U.S. residents accounted for a small but growing fraction. In 2006, 1.2% of ART cycles (n = 1,683) were reported for non-U.S. residents. By 2013, the percentage of ART cycles reported for non-U.S. residents had more than doubled to 2.8% (n = 5,381; P<.001; Table 1).

For non-U.S. residents, 43.5% (10,352/23,772) of cycles were in women older than 40 years of age, compared with 20.9% (252,966/1,211,072) of cycles for U.S. resident patients. The average patient ages for U.S. and non-U.S. resident cycles were 36.1 and 39.3 years, respectively.

We found higher use of donor oocytes, gestational carriers, and PGD/PGS in non-U.S. resident cycles compared with resident cycles (Table 2). ART cycles among non-U.S. residents were ~4.0 times more likely to use oocyte donors (42.6% vs. 10.6%), 7.8 times more likely to use gestational carriers (12.4% vs. 1.6%), and 3.6 times more likely to use PGD/PGS (19.1% vs. 5.3%). The differential use of these specialized ART treatment techniques by non-U.S residents persisted when the data were stratified by patient age: ART cycles among non-U.S. residents were more likely to use oocyte donation, gestational

carriers, PGD/PGS, and ICSI than resident cycles for patients in each of the five age categories analyzed.

Residents of 147 other countries received ART treatment in the U.S. during the 8 years studied (Table 3 [top 25 countries]). The most common source countries were Canada and Mexico, with 23.9% and 14.2% of non-U.S. resident cycles, respectively. These were followed by the United Kingdom (10.2%), Japan (9.6%), and the People's Republic of China (6.5%). We found substantial variation in the percentage of ART cycles by patients from specific countries using donated oocytes, gestational carriers, and PGD/PGS (Table 3). The use of donated oocytes was reported in more than 60% of ART cycles by patients from five countries (Japan, Australia, France, Israel, and New Zealand), compared with 42.6% of all non-U.S. resident and 10.6% of all resident cycles. Similarly, gestational carriers were used in more than 40% of cycles by patients from six countries (France, Germany, Spain, Israel, Sweden, and Norway), compared with 12.4% of all non-U.S. resident cycles and 1.6% of resident cycles. PGD/PGS was used in more than 30% of fresh noncancelled cycles by patients from two countries (China and Spain), compared with 19.1% of all non-U.S. resident cycles and 5.3% of U.S. resident cycles.

ART Outcomes for U.S. and Non-U.S. Residents

We found generally similar outcomes for U.S. and non-U.S. resident ART cycles (Table 4). Embryo transfer rates and multiple birth rates were similar for U.S. and non-U.S. resident cycles for each age group examined. The live birth rates were similar but slightly higher for non-U.S. resident ART cycles compared with U.S. resident cycles for each age group examined, with this difference being the largest for patients aged 38–40 years (30.4% vs. 27.9%) and patients aged 41–42 years (19.1% vs. 16.3%).

DISCUSSION

Although CBRC has received increased attention in recent years, much of the discussion has been anecdotal in nature. The present study provides a comprehensive analysis of the use of CBRC in the U.S. We found that non-U.S. resident cycles accounted for a small but growing share of all ART cycles in the U.S. from 2006 to 2013 and had higher use of donated oocytes, gestational carriers, and PGD/PGS. Non-U.S. resident patients were also older, on average, than U.S. residents receiving ART treatment. Residents and non-U.S. residents within the same age groups had similar numbers of embryos transferred and multiple birth rates. Live birth rates were similar but slightly higher among non-U.S. resident cycles compared with U.S. resident cycles in each age category examined.

The fact that non-U.S. residents had higher use of specific techniques, including oocyte donation, gestational carriers, and PGD/PGS, and that these patterns of use varied substantially among patients from various countries, suggests that patients may engage in CBRC in the U.S. to gain access to techniques that are difficult to access or unavailable in their home countries. This is supported by the substantial heterogeneity observed in the regulation and oversight of ART around the world (20).

Unlike many developed countries, the U.S. has a relatively open market for human oocytes, in which women typically receive $5,000–$10,000 (and sometimes as much as $50,000) for the use of their oocytes in ART procedures by others (21). Many countries impose restrictions on oocyte donation, ranging from banning the practice altogether to limiting donor anonymity or compensation (20). These restrictions may reflect a variety of factors, including ongoing debates over the ethics of third-party reproduction (e.g., the potential for harm to children following anonymous oocyte donation, and whether compensation of oocyte donors inappropriately commodifies human genetic material or unduly influences potential oocyte donors) and may motivate non-U.S. resident patients to seek CBRC in the U.S. (20, 22–26).

The situation is similar for gestational carriers. The U.S. policy environment varies from state to state, but many states permit an ART patient to enter into a legally enforceable surrogacy contract involving payment of a substantial sum to a gestational carrier in exchange for carrying a baby (27). In contrast, many developed countries place restrictions on the practice or permit only altruistic (unpaid) surrogacy (28).

Similarly, the international policy environment for various forms of PGD/PGS is heterogeneous; some countries impose restrictions, such as prohibiting the use of these techniques for nonmedical sex selection or for the selection of other specific genetic traits (20). In addition, the technical skills and facilities necessary to perform certain kinds of PGD/PGS are not evenly distributed around the world, raising the possibility that some non-U.S. resident patients may seek CBRC to gain access to procedures not available in their home countries (20).

As the ASRM Ethics Committee has written, traveling across national borders in pursuit of ART care may pose risks for CBRC patients, for children resulting from CBRC, and for third-party participants, including oocyte donors and gestational carriers (3). These risks are similar to those encountered by patients accessing ART care in their home countries but may be greater in CBRC for a variety of reasons. They may, for example, be associated with difficulty accessing information about treatment quality or options outside of a patient’s home country as well as language barriers (including concerns about providing informed consent in a nonnative language) (3). Harm to patients and children may also result from multiple embryo transfer and higher multiple birth rates in some destination countries (compared with patient home countries) and the maternal and neonatal complications associated with multiple births (3). In addition, for children born after gamete donation, limitations on access to information about their genetic origins may pose health risks (a concern that may arise when patients travel from a country that restricts anonymous gamete donation to one, such as the U.S., that permits it) (3). Finally, concerns have been expressed about the potential for physical and psychologic harm to oocyte donors and gestational carriers participating in CBRC (3, 29, 30). The differential use of oocyte donation, gestational carriers, and PGD/PGS by non-U.S. residents reported in our analysis suggests that CBRC helps to provide access to these specialized techniques. In addition, although the majority of oocyte donor and gestational carrier cycles reported in our data were for U.S. residents, our analysis suggests that CBRC contributes to the demand for these third-party participants in the U.S. and to women in the U.S.

bearing the rare but potentially serious medical risks associated with these techniques (e.g., ovarian hyperstimulation syndrome, intra-abdominal bleeding, and ovarian torsion are estimated to occur in <1% of oocyte retrievals (31), and hypertensive disorders of pregnancy and placental abruption are estimated to occur in <10% and <5%, respectively, of gestational carrier cycles (32)). Considering ongoing debates over the ethics and oversight of these techniques in both domestic and cross-border arrangements (25, 33–35), uncertainty surrounding the long-term health implications of oocyte donation (29, 36) and potential legal and economic vulnerabilities associated with serving as a gestational carrier for CBRC (37), more detailed and longerterm assessment of the outcomes of CBRC, extending beyond that possible with surveillance data and incorporating both the experiences of patients and third-party participants, is warranted. Such an effort would align with the need to evaluate the safety and efficacy of the use of donors (including both oocyte donors and gestational carriers) in the management of infertility more broadly articulated in CDC's 2014 "Public health action plan for the detection, prevention and management of infertility" (38).

Given the costs and logistics of receiving ART treatment, we examined whether CBRC patients chose to transfer higher numbers of embryos in an attempt to maximize the likelihood of having at least one live birth, even if such a choice raised the chances of multiple births, with the attendant heightened medical risks to both mothers and newborns. Our results did not identify significant differences in embryo transfer rates or multiple birth rates among non-U.S. resident cycles compared with U.S. resident cycles. This is noteworthy, given the high rate of PGD/PGS in non-U.S. resident cycles, especially among younger women, which should theoretically result in the transfer of fewer embryos if the procedure is used to detect chromosomal abnormalities. However, if PGD/PGS is being used for other reasons (e.g., sex selection), the number of embryos transferred may be similar for non-U.S. and US resident patients because both groups seek to optimize their chances for a live birth. Thus, while twins and higher-order multiples remain an important medical and public health concern associated with ART (38, 39), we did not find evidence that CBRC cycles, overall, were more likely to result in multiple births.

Our analysis is subject to several limitations. The surveillance data we analyzed do not contain information about the specific reason(s) for which individual patients participated in CBRC (as opposed to receiving ART treatment in their home countries) nor does it permit us to reliably ascertain the specific reason(s) that a patient opted to use an oocyte donor or gestational carrier or chose to use PGD/PGS or ICSI. In addition, we can not exclude the possibility that a small number of patients classified as non-U.S. residents in NASS did not travel to the U.S. specifically for ART but received care in the U.S. while they were in the country for other reasons. NASS does not include detailed demographic information on oocyte donors and gestational carriers; it is possible that some third-party participants may be non-U.S. residents who traveled to the U.S. to participate in ART treatment. Finally, patient residency may be misclassified for some cycles.

Although our analysis provides the most detailed picture of CBRC in the U.S. to date and advances our understanding of CBRC, it can not answer many important questions. These questions include the reasons why non-U.S. resident patients chose to receive ART care in the U.S., how and why they chose specific clinics and ART treatments, and whether

the benefits of CBRC outweigh its costs and potential harms. In addition, because NASS includes data only on ART cycles within the U.S., it can not provide insight into the use of CBRC by U.S. residents. Studies addressing these questions are needed. In the meantime, the present analysis provides important baseline data on CBRC in the U.S. and may also prove to be useful to ICMART, ASRM, ESHRE and others interested in using these data to improve access to fertility treatments.

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TABLE 1

Distribution of ART cycles by residency status, 2006–2013, n (%).

Residency	2006	2007	2008	2009	2010	2011	2012	2013	Total
U.S. resident cycles	136,169 (97.6)	136,967 (94.8)	140,695 (92.7)	143,498 (94.8)	146,514 (94.9)	153,886 (94.4)	169,643 (96.2)	183,700 (96.3)	1,211,072 (95.2)
Non-U.S. resident cycles	1,683 (1.2)	1,815 (1.3)	2,323 (1.5)	2,482 (1.6)	2,789 (1.8)	3,333 (2)	3,966 (2.2)	5,381 (2.8)	23,772 (1.9)
Residency not specified cycles	1,662 (1.2)	5,768 (4)	8,812 (5.8)	5,315 (3.5)	5,124 (3.3)	5,826 (3.6)	2,665 (1.5)	1,759 (0.9)	36,931 (2.9)
Total	139,514	144,550	151,830	151,295	154,427	163,045	176,274	190,840	1,271,775

Note: ART = assisted reproductive technology.

Levine. ART use in the U.S. by nonresidents. Fertil Steril 2017.

TABLE 2

Use of specific ART treatments by U.S. and non-U.S. residents, 2006–2013, n (%).

	U.S. residents						Non-U.S. residents					
ART treatment	**< 35 y (n = 469,771)**	**35–37 y (n = 251,408)**	**38–40 y (n = 236,927)**	**41–42 y (n = 123,497)**	**>42 y (n = 129,469)**	**All ages (n = 1,211,072)**	**< 35 y (n = 5,303)**	**35–37 y (n = 3,784)**	**38–40 y (n = 4,333)**	**41–42 y (n = 2,978)**	**>42 y (n = 7,374)**	**All ages (n = 23,772)**
Oocyte donor cycles	13,967 (3.0)	12,385 (4.9)	21,452 (9.1)	21,804 (17.7)	59,085 (45.6)	128,693 (10.6)	842 (15.9)	869 (23.0)	1,348 (31.1)	1,441 (48.4)	5,635 (76.4)	10,135 (42.6)
Gestational carrier cycles	5,578 (1.2)	3,634 (1.5)	3,686 (1.6)	2,076 (1.7)	4,941 (3.8)	19,915 (1.6)	511 (9.6)	447 (11.8)	522 (12.1)	416 (14.0)	1,050 (14.2)	2,946 (12.4)
PGD/PGS cycles	13,735 (4.5)	8,774 (5.6)	9,123 (6.2)	4,647 (6.1)	3,684 (5.4)	39,963 (5.3)	910 (24.9)	590 (23.9)	508 (18.4)	261 (14.8)	512 (13.2)	2,781 (19.1)
ICSI cycles	240,635 (75.5)	120,326 (74.0)	112,772 (73.7)	57,746 (73.3)	54,004 (74.8)	585,483 (74.6)	3,074 (81.7)	2,078 (80.6)	2,362 (81.3)	1,562 (83.8)	3,622 (85.5)	12,698 (82.8)

Note: The percentages of oocyte donor and gestational carrier cycles were calculated among all ART cycles (shown in column headers). The percentages of cycles using PGD/PGS and ISCI techniques were calculated among 797,211 (PGD/PGS) and 826,153 (ICSI) cycles for which these fields were reported, because PGD/PGS and ICSI status were not collected for frozen and cancelled cycles. ART = assisted reproductive technology; PGD = preimplantation genetic diagnosis; PGS = preimplantation genetic screening; ICSI = intracytoplasmic sperm injection.

Levine. ART use in the U.S. by nonresidents. Fertil Steril 2017.

TABLE 3

Use of specific ART treatments by country of residence, 2006–2013, n (%).

Rank	Country	ART cycles	Oocyte donor cycles	Gestational carrier cycles	PGD/PGS cycles	ICSI cycles
1	United States	1,211,072	128,693 (10.6)	19,915 (1.6)	39,963 (5.3)	585,483 (74.6)
2	Canada	5,669	2,655 (46.8)	244 (4.3)	845 (25.1)	3,129 (85.1)
3	Mexico	3,367	416 (12.4)	66 (2.0)	159 (6.4)	1,556 (62.7)
4	United Kingdom	2,422	1,251 (51.7)	281 (11.6)	302 (20.8)	1,291 (82.4)
5	Japan	2,268	2,059 (90.8)	114 (5.0)	105 (9.1)	1,099 (94.5)
6	People's Republic of China	1,539	380 (24.7)	341 (22.2)	348 (40.0)	890 (91.8)
7	Australia	1,040	696 (66.9)	228 (21.9)	172 (26.5)	624 (91.2)
8	France	648	401 (61.9)	313 (48.3)	61 (16.5)	319 (81.0)
9	Italy	479	192 (40.1)	116 (24.2)	29 (9.6)	253 (82.4)
10	Germany	440	199 (45.2)	188 (42.7)	50 (19.9)	247 (90.8)
11	Spain	396	210 (53.0)	195 (49.2)	81 (34.2)	229 (92.3)
12	Israel	283	201 (71.0)	147 (51.9)	22 (13.7)	122 (73.9)
13	Dominican Republic	281	44 (15.7)	(0)	11 (5.5)	183 (90.6)
14	Bahamas	277	68 (24.5)	7 (2.5)	12 (6.7)	154 (84.6)
15	Switzerland	274	111 (40.5)	53 (19.3)	23 (14.9)	124 (79.0)
16	Nigeria	268	70 (26.1)	16 (6.0)	37 (22.6)	162 (91.0)
17	New Zealand	234	193 (82.5)	19 (8.1)	31 (21.4)	127 (85.8)
18	Ireland	213	105 (49.3)	63 (29.6)	23 (17.7)	113 (78.5)
19	Sweden	208	116 (55.8)	99 (47.6)	18 (16.5)	71 (58.2)
20	United Arab Emirates	177	53 (29.9)	17 (9.6)	30 (27.0)	103 (91.2)
21	Norway	152	62 (40.8)	67 (44.1)	26 (27.1)	75 (71.4)
22	Netherlands	144	66 (45.8)	44 (30.6)	8 (9.9)	77 (87.5)
23	Argentina	142	47 (33.1)	50 (35.2)	13 (14.9)	84 (92.3)
24	India	131	7 (5.3)	_[a]	26 (27.1)	94 (94.0)
25	Qatar	125	(0)	(0)	15 (17.6)	85 (100)

Note: The percentages of oocyte donor and gestational carrier cycles were calculated among all ART cycles from the specified country (column 3). The percentages of cycles using PGD/PGS and ISCI were calculated among each country's share of the 797,211 (PGD/PGS) and 826,153 (ICSI) cycles for which these fields were reported, because PGD/PGS and ICSI status were not collected for frozen and cancelled cycles. Abbreviations as in Tables 1 and 2.

[a]To protect confidentiality, values from 1 to 4 are suppressed.

TABLE 4

Embryo transfer and birth rates by age and residency status, 2006–2013.

Cycles	Age group (y)	Outcome	U.S. residents	Non-U.S. residents
Fresh nondonor cycles	<35	No. of cycles	279,083	2,770
		Average no. of embryos transferred	2.0	2.2
		Percentage with live births	46.8	47.6
		Percentage with multiple live births	15.5	16.0
	35–37	No. of cycles	138,403	1,610
		Average no. of embryos transferred	2.3	2.3
		Percentage with live births	38.0	38.5
		Percentage with multiple live births	10.9	10.9
	38–40	No. of cycles	122,219	1,502
		Average no. of embryos transferred	2.6	2.6
		Percentage with live births	27.9	30.4
		Percentage with multiple live births	6.4	6.3
	41–42	No. of cycles	55,092	645
		Average number of embryos transferred	3.0	2.8
		Percentage with live births	16.3	19.1
		Percentage with multiple live births	2.5	2.5
	>42	No. of cycles	29,842	446
		Average no. of embryos transferred	3.1	2.8
		Percentage with live births	6.6	7.0
		Percentage with multiple live births	0.7	0.9
Fresh donor cycles	All ages	No. of cycles	70,868	5,512
		Average no. of embryos transferred	2.0	2.0
		Percentage with live births	55.2	57.1
		Percentage with multiple live births	20.8	20.8

Note: Average number of embryos transferred, percentage with live births or multiple live births were calculated among all cycles in which embryo transfer was attempted. Age group is based on patient age at cycle start.

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