ORIGINAL ARTICLE: ENVIRONMENT AND EPIDEMIOLOGY

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

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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.
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;■:■–■. ©2017 by American Society for Reproductive Medicine.)
Key Words: Assisted reproductive technology, cross-border reproductive care, oocyte donation, gestational carriers, preimplantation genetic diagnosis

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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

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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