Racial disparities in in vitro fertilization outcomes

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Objective: To evaluate the impact of race on in vitro fertilization (IVF) outcomes.
Design: Retrospective analysis.
Setting: Private practice.
Patient(s): All women who underwent a first autologous IVF cycle at Fertility Centers of Illinois from January 2010 to December 2012.
Intervention(s): Information was collected on baseline characteristics, cycle parameters, and outcomes. Race was self-reported.
Main Outcome Measure(s): Clinical intrauterine pregnancy and live birth rates.
Result(s): A total of 4,045 women were included: 3,003 white (74.2%), 213 black (5.3%), 541 Asian (13.4%), and 288 Hispanic women (7.1%). A multivariable logistic regression was performed to control for confounders. Compared with white women, the adjusted odds ratio for clinical intrauterine pregnancy was 0.63 (95% confidence interval [CI] 0.44–0.88) in black women, 0.73 (95% CI 0.60–0.90) in Asian women, and 0.82 (95% CI 0.62–1.07) in Hispanic women. The adjusted odds ratio for live birth was 0.50 (95% CI 0.33–0.72) in black women, 0.64 (95% CI 0.51–0.80) in Asian women, and 0.80 (95% CI 0.60–1.06) in Hispanic women compared with white women. The spontaneous abortion rate was 14.6% in white women versus 28.9% in black women, 20.6% in Asian women, and 15.3% in Hispanic women.
Conclusion(s): Black and Asian women had lower odds of clinical intrauterine pregnancy and live birth and higher rates of spontaneous abortion compared with white women. Further research is needed to better characterize the mechanisms associated with this racial disparity and to improve treatment options for black and Asian women. (Fertil Steril® 2015;104:398–402. ©2015 by American Society for Reproductive Medicine.)
Key Words: Racial disparity, infertility, in vitro fertilization

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Research on predictors of in vitro fertilization (IVF) success is an area of concentrated interest. Factors known to be associated with IVF outcomes include age, ovarian reserve, oocyte quality, body mass index, endometrial receptivity, and male factors (1). In recent years, there have been several publications that suggest racial disparities in IVF outcomes. The study of racial disparity is complex and subject to a considerable number of confounders, including socioeconomic status. A large data set with a heterogeneous patient population is needed to reach meaningful conclusions, and therefore several studies on this topic have used the Society of Assisted and Reproductive Technology (SART) data set. In 2006, Purcell et al. analyzed the SART dataset and included 25,843 white and 1,429 Asian women (2). After controlling for several confounders, Asian ethnicity was found to be an independent risk factor for worse outcomes with an adjusted odds ratio (OR) for live birth of 0.76 (95% confidence interval [CI] 0.66–0.88). In 2007, Seifer et al. performed an analysis of the same SART data set, focusing on IVF outcomes in black women (3). There were 3,666 black and 68,606 white women included in the analysis. The relative risk of not achieving a live birth was found to be 1.21 in black women compared to white women. These findings were confirmed by several other studies that have also used the SART database (4, 5).

A major criticism of these SART database studies is that there are wide differences in IVF success rates among clinics. It has also been argued

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that minority access to care may be limited to clinics with worse outcomes. A study conducted in a single IVF program would therefore have the advantage of being able to better control for confounders and may eliminate some of the differences in access to care for minority patients. One such single-site study was conducted by Feinberg et al. evaluating IVF outcomes in the military setting, with service members of all ranks and races having equal access to care (6). This study revealed no statistical difference in the live birth rate between black women (29.6%) and white women (35.8%). These findings suggested that eliminating access to care issues might lessen differences in outcomes. However, because there was a trend toward worse outcomes among black women it is possible that even though the study had the highest number of minority patients in any published single-site study, it still may not have been adequately powered to detect differences. A significant challenge for single-site studies is lack of an adequate sample size, and previously published single-site studies have included only 27–197 minority women (7–11).

Fertility Centers of Illinois (FCI) is a large private practice in the Chicago area that has ten offices in diverse neighborhood settings and performs more than 3,000 IVF cycles annually. Illinois is one of 15 states with mandated insurance coverage for IVF, and Illinois law allows for four cycles of IVF to achieve a first live birth. More than 80% of all patients at FCI have at least partial insurance coverage, and access to care is increased greatly by the state mandate. Chicago is racially diverse, and therefore FCI is an excellent candidate for a single-site study. The objective of the present research was to perform a comprehensive review of IVF outcomes data in a racially diverse private practice setting. Specifically, the primary goal was to evaluate the impact of race on IVF outcomes. We hypothesized that with increased access to care and uniform treatment by a single IVF program, outcome disparities would be reduced.

MATERIALS AND METHODS

Study Design

Institutional Review Board (IRB) approval was granted by New England IRB. Women who underwent their first autologous fresh IVF cycle from January 2010 to December 2012 were included in the analysis. To limit heterogeneity among participants, donor oocyte cycles, oocyte vitrification, and embryo banking cycles were excluded. Additionally, all cycles for preimplantation genetic diagnosis were excluded. Information was collected on baseline characteristics, as well as IVF cycle parameters and outcomes. Race was self-reported and included categories developed by SART. Women who self-reported race as black, Asian, Hispanic, or white were included in the analysis, and women reporting more than one race were excluded.

A clinical pregnancy was defined as an intrauterine gestational sac visible on ultrasound after the 6th week of pregnancy. Clinical pregnancy rate was defined as the proportion of women with an intrauterine gestational sac among all women who received IVF stimulation. Live birth rate was defined as the proportion of women whose IVF treatment was followed by the birth of one or more living infants. Spontaneous abortion rate was the proportion of women with a fetal loss before 20 weeks among those women with a clinical intrauterine gestation. Multiple pregnancy rate was defined as the proportion of women with more than one live born infant among all women with a clinical intrauterine gestation. Outcomes in each racial group were compared with all other groups and with white women as a reference.

Data Analysis

Statistical analysis was performed with the use of R software version 3.0.1. To assess the contribution of race to IVF outcome, a multivariable logistic regression analysis was performed to control for age, body mass index (BMI), day 3 FSH levels, smoking status, and primary infertility diagnosis. The adjusted and unadjusted ORs are reported with 95% CIs to indicate statistical precision. To account for missing values, a multiple imputation technique was used based on an iterative regression imputation. Data on antimüllerian hormone (AMH) and number of embryos transferred were missing for a significant portion of the subjects; therefore, rather than perform imputation for those variables, we excluded them from the regression. This should not have affected our results, because there was no clinically significant difference in AMH or number of embryos transferred across the races. Continuous variables were compared with the use of Student *t* test. Categoric variables were compared with the use of chi-square test and Fischer exact test. A two-sided *P* value of $<.05$ was considered to be statistically significant.

RESULTS

Clinical information was collected on 4,155 consecutive women presenting for their first autologous IVF cycle. In this group, 110 women were excluded: 66 (1.6%) of unknown race, 12 (0.3%) American Indian or Alaskan Native, 15 (0.4%) Native Hawaiian or Pacific Islander, and 17 (0.4%) who self-reported multiple races. Information on the race of the partner was not collected. Data from the remaining 4,045 women were analyzed: 3,003 white (74.2%), 213 black (5.3%), 541 Asian (13.4%), and 288 Hispanic women (7.1%). Although mean age was similar among Hispanic, Asian, and white women, black women were slightly older than white women (36.0 vs. 35.2 years; $P=.02$; Table 1). BMI was significantly higher in black and Hispanic women (27.9 and 27.6 kg/m^2, respectively) compared with white women (25.1 kg/m^2). Asian women had a significantly lower BMI (23.3 kg/m^2). Black women were significantly more likely to have tubal factor or uterine factor as their primary infertility diagnosis compared with white women. Hispanic women were also significantly more likely to have tubal factor as their primary diagnosis (Supplemental Table 1, available online at www.fertstert.org). All other baseline characteristics were similar between groups.

There were several differences noted during IVF stimulation and embryo transfer between black and white women. Although the response to stimulation and number of oocytes retrieved were similar, black women had fewer mature oocytes, fewer fertilized oocytes, fewer day 5 transfers, fewer