# Racial and ethnic disparities in assisted reproductive technology access and outcomes

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Infertility is a global problem affecting all ethnic, racial, and religious groups. Nevertheless, only a minority of the U.S. population has access to treatment. Additionally, for those who do engage in treatment, outcomes are disparate among various ethnic and racial groups. This article addresses racial and ethnic disparities regarding rates of fecundity and infertility, access to care, and assisted reproductive technology outcomes. (Fertil Steril® 2016;105: 1119–23. ©2016 by American Society for Reproductive Medicine.)

**Key Words:** Ethnic disparities, access to care, ART outcomes

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Infertility is a global problem affecting all ethnic, racial, and religious groups. The precision of assisted reproductive technology (ART) has improved dramatically over the past few decades, affording many infertile couples the opportunity to fulfill their dream of having a family. Nevertheless, evidence suggests that only a minority of the U.S. population has access to treatment (1). Furthermore, among those who are able to receive treatment, duration of infertility, underlying diagnosis, and treatment outcomes differ (2–5). As a result, infertility and treatment with ART has been identified as a field with a significant health disparity.

A health disparity exists when a treatment gap disproportionately affects a disadvantaged subgroup of the population (6). The American College of Obstetricians and Gynecologists cites the National Institutes of Health in defining health disparities more broadly as differences in "incidence, prevalence, mortality and burden of disease … among specific population groups" (7). However, it is important to acknowledge the distinction between differences observed in racially diverse populations as a result of biologic variances versus differences resulting from variation in environmental exposures, lifestyle factors, access to care, and treatment once care is accessed (8).

This article addresses racial and ethnic disparities regarding rates of fecundity and infertility, access to care, and ART outcomes in black, Asian, Hispanic, and non-Hispanic white infertile populations.

## DISPARITIES IN INFERTILITY

In contrast to popular opinion, infertility rates in the United States appear to have been declining in recent years. In the National Survey of Family Growth (NFSG), a multistage probability sample conducted by the National Center for Health Statistics of married women in the United States aged 15–44 years, the general population experienced a decline in 12-month infertility from 8.5% in 1982 to 7.4% in 2002 (n = 15,303 for pooled data across four survey years). In that study, infertility was defined as failure to achieve pregnancy after 12 months of unprotected intercourse with a husband or cohabiting partner. A multivariate analysis demonstrated that infertility was most common among older, nulliparous, non-Hispanic black or Hispanic women who did not have a college degree.

In fact, although non-Hispanic white women experienced a decrease in self-reported 12-month infertility from 11.6% to 7.1% during those years, non-Hispanic black women had an increase in infertility from 7.8% to 11.6% despite a stable ethnic cohort (9). Clearly, those data are limited because factors such as marital status, contraceptive practices, risk of sexually transmitted disease, and aggressiveness of pursuit of infertility treatment may vary by

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population subgroups and dramatically affect self-reported rates of infertility (10).

For example, during the 5 years before the NSFG survey, 35.6% of births were to unmarried women. Seventy percent of non-Hispanic black women, 44.7% of Hispanic women, and 21.4% of non-Hispanic white women who delivered were not married (10). Thus, estimates of infertility limited to self-report of married women may not reflect the population as a whole given overall prevalence of nonmarital birth (10). Given ethnic variances in prevalence of nonmarital birth, the NFSG study introduces ethnic bias, and the validity of its conclusions is called into question.

## DISPARITIES IN MISCARRIAGE

Miscarriage rates are challenging to study given the dependency of estimates of risk on gestational age. However, given the association of non-white race with adverse obstetrical outcomes, including preterm delivery and fetal growth restriction, it is reasonable to hypothesize that race may be associated with early adverse pregnancy outcomes such as miscarriage. In one analysis of spontaneous abortion risk, race was treated as a confounder in assessing miscarriage risk. Black (or other) race was associated with an increased relative risk of miscarriage of 2.57 (95% confidence interval [CI] 1.54–4.30) among 2,848 total pregnancies (including only 164 black women) in southern Connecticut during 1998–1991 (11).

In a community-based prospective pregnancy cohort of 4,070 women in whom 537 subsequently underwent miscarriage, women who self-reported black race (23%; n = 932) had increased risk of miscarriage compared with whites (hazard ratio [HR] 1.57; 95% CI 1.27–1.93). When risk of loss before 10 weeks' gestational age was dichotomized, there was no difference between the groups, but black women had a greater risk of pregnancy loss between the 10th through 20th weeks of gestation (HR 1.93, 95% CI 1.48–2.51) (12). Interval to follow-up was not reported, but loss to follow-up might introduce bias toward later diagnosis of miscarriage and needs to be explored. Biologic mechanisms behind miscarriage differ in early compared with later losses, and it is noted that later losses may derive from pathophysiology similar to that of early preterm birth or stillbirth. Further research should investigate potential shared causes of preterm birth and late miscarriage within the black population.

Studies looking specifically at miscarriage rates in Hispanic and Asian women are lacking. High-quality prospective studies are needed to analyze miscarriage risk in various racial and ethnic groups to further understand not only differences in outcomes, but also potential shared causes, as well as to provide individualized patient counseling.

## ACCESS TO CARE

The American Society for Reproductive Medicine (ASRM) has declared that creation of a family is a basic human right. As such, the ASRM has proposed that "all ART stakeholders, including physicians, policy makers, and insurance providers, should address and lessen existing barriers to infertility care (13)." Although a goal for equal access to infertility care has been proposed, that goal has yet to be realized.

In fact, data from the NSFG would suggest that access to infertility services may have actually declined in recent years. Among 22,682 women aged 25–44 surveyed by the NSFG during 2006–2010, 17% had ever used infertility services compared with 20% of 10,845 women surveyed in 1995. In nulliparous women aged 25–44 years who reported "fertility problems" during 2006–2010, only 38% had ever used infertility services. This compares unfavorably to the 56% of women who reported accessing fertility care in the setting of fertility challenges in 1982. Among all survey years, those who did report using fertility services to achieve pregnancy were disproportionally non-Hispanic white women with higher levels of education and household income. For example, during 2006–2010 ever using medical help to achieve pregnancy was significantly more common among non-Hispanic white women (15%) than among Hispanic (7.6%) or non-Hispanic black (8.0%) women. In a multivariate analysis of infertility service use including all survey years, ever using infertility services was significantly less likely among Hispanic women (adjusted odds ratio [AOR] 0.7) and non-Hispanic black women (AOR 0.77) (1). Although understanding of challenges to access to infertility care is complex, involving the consideration of many sociodemographic factors, ethnic and racial disparities are clearly implicated in differential access both independently and in the relationship of these factors with others, including education level and income.

The cost of care has been identified as the greatest barrier to access to infertility care in the U.S. and likely explains a significant amount of the shared contribution of ethnicity/race, education level, and income toward disparities in access. In the U.S., the majority of patients undergoing specialized infertility treatment, such as in vitro fertilization (IVF), pay out of pocket for their treatment owing to a lack of—or limited—insurance coverage of therapy. It has been suggested that the cost of a single IVF cycle in the U.S. may exceed 50% of the average individual's annual disposable income (14). In one study, median per-person costs for 18 months of infertility treatment ranged from $1,182 (medications alone) to $38,015 (IVF–donor eggs) (15). In 2014, the U.S. Census Bureau reported median household income to be $53,657. Mean income was $60,256 among non-Hispanic whites, $42,491 among Hispanics, and $35,3989 among blacks (16). Therefore, while non-IVF infertility treatment may be less expensive, it may also be above the reach of those in lower income categories which tend to disproportionately include ethnic and racial minorities.

Although several states (Connecticut, Illinois, Maryland, Massachusetts, New Jersey, and Rhode Island) provide coverage for infertility treatment through state law mandates, these mandates have failed to achieve equal access for all. Mandates do not apply to those who obtain health coverage through government programs (such as Medicaid), are uninsured, or obtain their insurance from self-insured employers (13). As a result, even in mandated states, infertility care has been accessed disproportionately by non-Hispanic white women with higher educational training and socioeconomic

status. For example, in Massachusetts, only 3.9% of infertility patients were Hispanic/Latino, compared with 6.8% of the state population being Hispanic/Latino. Furthermore, none of the infertility patients had less than a high school diploma, compared with 15.1% of the state population, and 49.6% of infertility patients had advanced degrees, compared with 12.4% in the state. Finally, more than 60% of infertility patients had an annual household income above $100,000, compared with only 17.7% of the state's population (17).

In the equal access to care setting of the military health care system also, ethnic and racial disparities have been identified. For example, in 2005, Hispanics composed 9% of the Department of Defense but only 4% of patients seeking infertility treatment in the military health care system during 1999–2003 (18). Of note, in another publication, the African-American infertility population at Walter Reed Army Medical Center's ART program was representative of the demographic of the Department of Defense: 17.4% of Walter Reed's assisted reproduction patients identified as African American and the Department of Defense was composed of 19.1% African Americans (19).

Nevertheless, disparities in accessing care within settings with mandates for universal care or equal access suggest that economic barriers may not be the only impediments and that additional cultural and societal factors may be at play. Some of these factors may include concern regarding the stigma of infertility delaying initiation of treatment in some ethnic or racial groups (20).

Among infertile couples who pursue assisted reproduction, a disparity in duration of infertility before presentation has been reported among minority ethnic groups. Asian women have been demonstrated to have longer duration of infertility at consultation compared with white women (2). Furthermore, in a state where assisted reproduction is covered by insurance, the duration of infertility was reported to be 6 months longer for black compared with white women on presentation for infertility treatment (3). This suggests that sociocultural barriers in access to infertility care among these communities exist and offers a potential avenue for decreasing disparity through education and policy.

Differences in access to general medical care may also have an impact on fertility rates by leading to decreased treatment of precursors of infertility, such as chlamydia. Indeed, studies have shown an increased rate of tubal-factor infertility in black and Hispanic women (4, 21, 22). Furthermore, geographic distribution of obstetrician-gynecologists and IVF centers varies, and these services may not be physically accessible to many groups. Improving fertility education in underserved communities and promoting advancements in health care infrastructure that lead to enhanced access may lead to a reduction in these disparities.

Finally, ethnic minorities have been demonstrated to have increased challenges with receiving infertility services related to communication barriers (understanding diagnoses and treatments, communicating concerns to physicians), difficulty participating in not only complex but time-consuming treatments (discomfort with or inability of requesting time away from work), and sociocultural or religious beliefs about the acceptability of treatment for infertility (20, 23, 24). Effort should be focused on improving communication regarding topics related to infertility between health care providers and the underserved.

Although equal access to infertility care is fraught with a multitude of obstacles, addressing the high price of treatment, lack of accessibility of medical care, improving health education, and focusing on infertility that can be prevented may decrease ethnic disparities in access to care.

## ASSISTED REPRODUCTION TREATMENT SUCCESS RATES

Initial studies seeking to understand differences in ART outcomes among ethnic groups were limited by small numbers of nonwhite subjects. However, recent studies using data from the Society for Assisted Reproductive Technology Clinic Outcome Reporting System online database (SART CORS) have provided evidence that within the U.S. ART population, women from the three major minority groups (black, Asian, and Hispanic) have poorer outcomes. Nevertheless, confidence in the identification of racial/ethnic disparities in IVF outcomes is tempered by limited reporting of race/ethnicity (25).

### Black ART Population

Data from an equal access to care setting have shown that black women experience a statistically significant increase in spontaneous abortions compared with white women and a trend toward a decreased live birth rate (LBR). Leiomyomas were three times more prevalent in black women and associated with reduced ART success independently from race. The authors concluded that persistence of racial differences in IVF outcomes in an equal access to care environment might be explained, in part, by the increased prevalence of leiomyomas in black women (19).

In a university-based IVF program, black women undergoing initial fresh nondonor IVF–ET were also more likely to have leiomyomas and tubal-factor infertility but also had higher body mass index (BMI) and required increased gonadotropins compared with whites. Although black women in this study generated significantly fewer embryos compared with white women, despite having similar ages, day 3 FSH levels, peak $E_2$, length of stimulation, and number of oocytes retrieved, biochemical pregnancy, clinical pregnancy, and LBRs did not significantly differ between the two groups (22).

In contrast, in an inner-city university-based IVF program where black women composed 28% of the population and underwent 28% of total cycles, implantation and clinical pregnancy rates were significantly lower in black women than in white women despite similar age, basal FSH, number of ampules, and duration of stimulation (21, 26).

Similarly, according to data from SART CORS including 38,309 IVF cycles, miscarriage was increased and LBR decreased among black compared with white women (20.4% of blacks vs. 13.2% of whites reporting miscarriage, and LBR 20.7% in blacks vs. 28.4% in whites). After controlling for increased tubal- and uterine-factor infertility, black race was an independent risk factor for not achieving live

birth. Notably, LBR was equivalent among these groups in cryopreserved embryo cycles (3), suggesting, perhaps, that there may be ethnic differences in endometrial receptivity in a hyperstimulated environment.

In a subsequent study of 139,027 ART cycles from SART CORS, including 8,903 cycles in black women, black women had clinical pregnancy rates similar to white women after adjustment for maternal age, number of embryos transferred, and infertility diagnosis. However, an increased fetal loss rate among black women was seen, with black women experiencing a 21.8% miscarriage rate, significantly higher than the rates seen in other racial or ethnic groups (27).

In summary, in the ART population, black women appear to have increased tubal-factor infertility, BMI, and leiomyomas. Although some studies have suggested increased incidence of miscarriage and decreased LBRs compared with whites undergoing IVF, others have not, suggesting a potential role for confounding socioeconomic factors.

## Asian ART Population

A study using the SART database drawing from 25,843 white and 1,429 Asian patients demonstrated decreased cumulative pregnancy rate (CPR) and LBR among Asian women undergoing IVF compared with white women (CPR 33.3% among Asians vs. 41.3% among whites, and LBR 26.8% for Asians vs. 34.9% for whites). A subsequent multivariate analysis including 370 white and 197 Asian patients from a site-specific clinic demonstrated that Asian ethnicity was an independent predictor of poor outcome after adjustment for other factors known to affect IVF outcome. Notably, Asians had increased $E_2$ per follicle during ovarian stimulation, which is hypothesized to relate to differential distribution of FSH receptor polymorphisms in Asians and whites (28).

Finally, several studies have attempted to understand the differences between Asian and white populations regarding infertility diagnosis. One study demonstrated that South Asian women with polycystic ovary syndrome have lower fertilization and clinical pregnancy rates than their white counterparts despite presenting at a younger age and requiring a lower dose of gonadotropins for stimulation. In this study, South Asian women with tubal-factor infertility had clinical pregnancy rates equivalent to whites with the same diagnosis. This suggests that ethnicity may be more of a factor in the setting of certain infertility diagnoses (29).

The Asian population undergoing assisted reproduction within the U.S. contains many heterogeneous subpopulations, which suggests that further delineation of subgroups may identify populations at risk for reduced IVF outcomes. Furthermore, in the Asian population undergoing assisted reproduction, increased duration of infertility, lower BMI, and higher $E_2$ response to gonadotropin stimulation call for further exploration of potential biologic origins for population-based differences in outcomes.

## Hispanic ART Population

Studies focused on investigating the Hispanic population are limited by small numbers of participants. In the general U.S. population, Hispanics compose 12.5% of the population but only 5.4% of the assisted reproduction population (18).

Although some papers have demonstrated increased risk of tubal factor infertility within the Hispanic population (4), others have not (18). In the military health care system, there was no significant difference in IVF cycle parameters nor outcomes between Hispanics and whites undergoing infertility treatment (18). However, in the SART Writing Group 2010 paper, which included 8,969 cycles in Hispanic women, LBRs from ART were 13% lower for Hispanic than for white women (27). Additional data are needed to confirm this disparity and elucidate potential underlying causes.

## All Minority Groups

The SART Writing Group study of 139,027 ART cycles during 2004–2006 in white, Asian, black, and Hispanic women used a logistic regression model of odds of pregnancy and live birth among these ethnic and racial groups. Compared with the white majority, a reduced odds of pregnancy was demonstrated for Asians (0.86) and reduced odds of live birth were reported for all minority groups: Asian (0.90), black (0.62), and Hispanic (0.87).

Furthermore, obstetrical outcomes from ART pregnancies were affected disparately in the minority groups compared with whites. There was increased moderate and severe growth restriction among singleton deliveries resulting from IVF for all three minority groups compared with whites and increased preterm birth among black and Hispanic women (27). Notably, it has been reported that Asian, black, and Hispanic infants have increased rates of growth restriction among the general, non–ART-specific, population (30). Furthermore, in twin gestations resulting from IVF, the odds for moderate growth restriction were increased for Asian and black women, whereas severe growth restriction was increased among black women alone. Preterm birth in twin gestations was increased for black women but decreased for Asians (27).

The etiology of lower birth weight in minority ART populations after adjustment for confounders such as maternal and gestational age is unclear. Although ART is generally associated with low birth weight, particularly among multiple gestations, and in the setting of fresh (vs. frozen) embryo transfer to a hyperstimulated uterine environment, it is difficult to attribute disparities in singleton birth weights in different racial or ethnic groups to the IVF process. The possibility exists that environmental exposures (e.g., to organic solvents) may influence birth weight of infants born to exposed women and that exposures may differ within race-based populations (31). Further research is needed to elucidate potential mechanisms behind varying risk for poor pregnancy outcomes with minority racial and ethnic groups both within and outside assisted reproduction.

## CONCLUSION

Evidence is mounting that racial and ethnic disparities in access to assisted reproduction and treatment outcomes not only exist, but may be increasing (1). Although access to care differs for infertile whites and racial minorities, it is unclear if IVF outcomes vary as a result of biologic differences

with a host of other contributing factors, or if these outcomes truly represent a disparity in medical care. Of course, any study of racial and ethnic variation is complicated by social, cultural, nutritional, environmental, physical, metabolic, and genetic confounders.

In the U.S. infertile black population, there is clear evidence of increasing incidence of myomas, higher BMI, longer duration of infertility before presentation to care, and increased tubal-factor infertility. These characteristics may serve as confounding variables when IVF outcomes are analyzed.

In the U.S. Asian IVF population, heterogeneity of subpopulations prompt further delineation of at-risk populations for reduced IVF outcomes. Similarly, duration of infertility, lower BMI, and higher $E_2$ response to gonadotropin stimulation suggest biologic origins to differences in reproductive outcomes.

In the Hispanic infertility population, recent national data have suggested that LBR is significantly reduced compared with the white infertility population. Further studies are needed to confirm this disparity and further delineate additional disparities that may exist in the U.S. Hispanic population compared with the non-Hispanic white population.

More research is needed to identify the causes and remedies for these disparate ART outcomes among different ethnic and racial groups. Consistent reporting of race and ethnicity would significantly improve our understanding of how these factors influence outcomes and afford the opportunity for more robust hypothesis generation leading to changes in outcomes. Rectifying differences in treatment success is critical to achieving reproductive health equity. However, as a first step, equal access to care is paramount, because differences in treatment outcomes are less relevant when the majority of a population can not access care.

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