Factors associated with disparate outcomes among Black women undergoing in vitro fertilization

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Objective: To determine if Black women have worse in vitro fertilization (IVF) outcomes than women of other races/ethnicities, and to establish which factors are associated with the IVF outcomes of Black women.
Design: Retrospective cohort study.
Setting: Not applicable.
Patient(s): All patients undergoing IVF.
Intervention(s): Not applicable.
Main Outcome Measure(s): Spontaneous abortion rate, clinical pregnancy rate, and live birth rate.
Result(s): A total of 71,389 patient cycles were analyzed. Of the 40,545 patients who were included, 6.4% of patients were Black, 62% were White, 7.3% were Hispanic/Latino, and 15% were Asian. After IVF, Black women had significantly more miscarriages than White but not Hispanic or Asian patients (8.0% Black vs. 6.9% White, 7.4% Hispanic, and 7.5% Asian). Clinical pregnancy rates were significantly lower for Black women compared with all other races (45% Black vs. 52% White, 52% Hispanic, and 53% Asian). The odds ratio (OR) of live birth from all cycles were 30% less than that for White women (OR, 1.00 Black vs. 1.43 White) and 22% less than that for Hispanic women (OR, 1.00 Black vs. 1.29 Hispanic). This statistically significant difference in the live birth rate persisted even after adjusting for patient characteristics (OR, 1.00 Black vs. 1.32 White, 1.23 Hispanic, and 1.18 Asian).
Conclusion(s): Black women have worse IVF outcomes than women of all other racial backgrounds undergoing IVF. The factors associated with the disparate outcomes of Black women undergoing IVF outcomes include older age starting IVF, higher body mass index, tubal factor infertility, and diabetes. (Fertil Steril Rep® 2022;3:14–21. ©2021 by American Society for Reproductive Medicine.)
Key Words: Assisted reproductive technology, in vitro fertilization, health care disparity, racial disparity

Infertility is a disease capable of impacting a person of any country, sex, or race/ethnicity. Deemed both a disease and a disability by the World Health Organization, infertility has been estimated to affect 10% of reproductive-age American couples (1). The development of in vitro fertilization (IVF) in the 1970s has provided the tools to overcome numerous factors directly associated with infertility. Whether it is secondary to ovarian, tubal, or male factors, having access to IVF offers significant hope for people seeking fertility.

However, data reveals disparate rates of infertility and IVF outcomes based on race and ethnicity. Race is a social construct based on White

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supremacy and is understood as a person's self-identification with one or more social groups (2). Race is socially imposed and hierarchical, whereas ethnicity refers to belonging to a social group with a common national or cultural tradition. According to the Census Bureau, racial categories are White, Black, Asian, American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, or some other race. Ethnicity determines whether a person is of Hispanic origin or not.

Racial/ethnic health disparities are prevalent in the United States, and health disparities research is evolving with disparities demonstrated in many areas such as pregnancy-related mortality, spontaneous abortion, preterm birth, to name a few. Even when confounders such as socioeconomic status, marital status, and medical risk factors of age, weight, uterine fibroids, and tubal factor are statistically adjusted for, Black women continue to experience significantly higher rates of infertility compared with White women (3). The commonality appears to be race and, logically, racism which can manifest in the practice of medicine via the incorrect belief that Black women are hyperfecund, only need contraception, and have lower infertility rates when the converse is true. This possibly limits early referral to reproductive endocrinologists and causes delays in care (4). Multiple studies have concluded that Black women have significantly lower clinical pregnancy rates (CPR), lower live birth rates (LBR), and higher spontaneous abortion rates after IVF (3, 5).

Despite the many attempts to describe the relationship between race/ethnicity and IVF outcomes, completing the task is not without limitations. A significant hindrance has been the lack of consistent and thorough documentation of race/ethnicity within IVF databases. In 1992 the "Fertility Clinic Success Rates Certification Act" was passed, mandating that all clinics performing assisted reproductive technology (ART) provide data for all patients annually to the Centers for Disease Control and Prevention via the National ART Surveillance System (6). The data collected are determined through a partnership of the Centers for Disease Control and Prevention, the American Society of Reproductive Medicine, and the Society of Assisted Reproductive Technology (SART) (7). Since the development of National ART Surveillance System, other databases have been developed to compensate for the limited pregnancy outcomes recorded and other gaps in the reported variables (6–7). Practice Hwy launched eIVF in 2002 as an electronic health record (EHR) database specifically for infertility practices. It is reported to be the only web-enabled, fully customizable software system dedicated to infertility practices. In 2020, it was used by 140 academic and private clinics throughout the United States. As an EHR, eIVF contains more patient demographics and variables than what is collected through the SART database, such as sperm parameters, characteristics and outcomes of intrauterine insemination, and results of preimplantation genetic testing. Accordingly, data on differential outcomes of IVF based on race/ethnicity may be better captured using the eIVF database. The objective of this study was to determine if Black women continue to have worse IVF outcomes than White women based on the data in the eIVF database. Additionally, we sought to determine which factors are associated with IVF outcomes of Black women.

MATERIALS AND METHODS

This retrospective cohort study uses deidentified data from the national eIVF database. This study was made possible by a grant from the New England Fertility Society and Practice Hwy eIVF. The eIVF EHR was used by over 63 IVF clinics during our inquiry in April 2018 (8). The data were received deidentified from its source on arrival. None of the investigators had access to identifiable information at any point. As such, this study was deemed exempt from institutional review board approval.

Patient charts from the database were extracted if they had at least one embryo transferred during IVF. Variables collected include race/ethnicity, body mass index (BMI) in categories, age in categories, infertility diagnosis, comorbidities, smoking status, obstetric history, IVF history, and cycle characteristics such as intracytoplasmic sperm injection (ICSI) and preimplantation genetic testing. Psychological stress was recorded as a significant complication during an IVF cycle within the eIVF database as opposed to a comorbidity before IVF. Race/ethnicity was categorized from text entries in the data set, and outcomes of Hispanic/Latino and Asian/South Asian women were included as comparison groups (Supplemental table 1, available online). Outcomes of interest were spontaneous abortion rate, CPR, and LBR. Variables were compared by race/ethnicity using the χ^2 test, analysis of variance, and the Kruskal-Wallis test. Logistic regression with generalized estimating equations was used to adjust for within-patient correlation across cycles when evaluating binary outcomes such as LBR. Other cycle-specific comparisons were performed with generalized estimating equations using an appropriate distribution: multinomial for cycle type, Poisson for the number of births or number of embryos transferred, and normal for log-transformed follicle-stimulating hormone. An independent working correlation was assumed for all models, and robust standard errors were used for statistical testing and confidence intervals. Covariate selection for multivariable logistic regression models was based on a priori knowledge of factors associated with LBR. For the model among Black or African American women only, predictors were included if associated with LBR with $P<.1$ in this subset of patients. Sensitivity analyses were performed to assess whether the outcomes of patients with missing race/ethnicity data differed from those with known race/ethnicity. All P values presented are two-tailed, with $P<.05$ considered statistically significant. No adjustments for multiple comparisons were performed. SAS version 9.4 (SAS Institute, Cary, NC) was used for analysis.

RESULTS

Out of 175,769 patient cycles available from US-based practices, 40,545 patients and 71,389 patient cycles in which race/ethnicity was reported were analyzed (Supplemental Figure 1, available online). Patients were excluded if race or ethnicity

TABLE 1

Patient characteristics by race at first recorded cycle.

Variable	Total patients	Black/African American	White/Caucasian	Hispanic/Latino	Asian/South Asian	All others
Total, n (row %)	40,545	2,615 (6.4)	25,244 (62.3)	2,975 (7.3)	6,084 (15.0)	3,627 (8.9)
Cycles per patient						
Mean (±SD)	1.8 (1.2)	1.7 (1.1)	1.8 (1.3)	1.6 (1.0)	1.7 (1.1)	1.5 (0.9)
P value		Reference	.00062	.00053	.00081	<.0001
Age (y)						
<35	19,549 (48.2)	1,015 (38.8)	12,986 (51.4)	1,289 (43.3)	2,714 (44.6)	1,545 (42.6)
≥35	20,996 (51.8)	1,600 (61.2)	12,258 (48.6)	1,686 (56.7)	3,370 (55.4)	2,082 (57.4)
P value		Reference	<.0001	.00062	<.0001	.0027
BMI (kg/m^2)	(n =39,880)	(n =2,579)	(n =24,685)	(n =2,951)	(n =6,050)	(n =3,615)
<30	31,933 (80.1)	1,646 (63.8)	19,370 (78.5)	2,166 (73.4)	5,658 (93.5)	3,093 (85.6)
≥30 (obese)	7,947 (19.9)	933 (36.2)	5,315 (21.5)	785 (26.6)	392 (6.5)	522 (14.4)
P value		Reference	<.0001	<.0001	<.0001	<.0001
Smoker (yes)	1,109 (2.7)	52 (2.0)	844 (3.3)	65 (2.2)	63 (1.0)	85 (2.3)
P value		Reference	.00019	.61	.00036	.34
Diagnosis						
Polycystic ovarian syndrome	2,841 (7.0)	120 (4.6)	1,820 (7.2)	209 (7.0)	398 (6.5)	294 (8.1)
P value		Reference	<.0001	.00011	.00042	<.0001
Tubal factor	3,772 (9.3)	518 (19.8)	2,180 (8.6)	442 (14.86)	405 (6.66)	227 (6.26)
P value		Reference	<.0001	<.0001	<.0001	<.0001
Uterine factor	1,526 (3.8)	193 (7.4)	793 (3.1)	110 (3.7)	277 (4.6)	153 (4.2)
P value		Reference	<.0001	<.0001	<.0001	<.0001
Male factor	5,703 (14.1)	299 (11.4)	3,485 (13.80)	419 (14.1)	774 (12.7)	726 (20.0)
P value		Reference	.00075	.0031	.094	<.0001
Endometriosis	1,497 (3.7)	67 (2.6)	1,046 (4.1)	106 (3.6)	179 (2.9)	99 (2.7)
P value		Reference	<.0001	.031	.33	.69
Diminished ovarian reserve	5,239 (12.9)	294 (11.2)	2,526 (10.0)	438 (14.7)	1,293 (21.3)	688 (19.0)
P value		Reference	.046	.00012	<.0001	<.0001
Other	9,769 (24.1)	499 (19.1)	6,373 (25.2)	692 (23.3)	1,471 (24.2)	734 (20.2)
P value		Reference	<.0001	.00014	<.0001	.26
Psychological stress	17 (0.0)	4 (0.2)	9 (0.0)	1 (0.0)	1 (0.0)	2 (0.1)
P value		Reference	.008	.14	.015	.22
Prior gravida						
0	23,614 (58.2)	1,320 (50.5)	14,556 (57.7)	1,666 (56.0)	3,865 (63.5)	2,207 (60.8)
1	7,899 (19.5)	505 (19.3)	5,179 (20.5)	541 (18.2)	1,071 (17.6)	603 (16.6)
≥2	9,032 (22.3)	790 (30.2)	5,509 (21.8)	768 (25.8)	1,148 (18.9)	817 (22.5)
P value			<.0001	<.0001	<.0001	<.0001
Prior parity–preterm						
0	39,146 (96.5)	2,497 (95.5)	24,366 (96.5)	2,848 (95.7)	5,941 (97.6)	3,494 (96.3)
≥1	1,399 (3.5)	118 (4.5)	878 (3.5)	127 (4.3)	143 (2.4)	133 (3.7)
P value		Reference	.0067	.66	<.0001	.093
Prior parity–term						
0	32,007 (78.9)	2,063 (78.9)	19,784 (78.4)	2,274 (76.4)	5,031 (82.7)	2,855 (78.7)
≥1	8,538 (21.1)	552 (21.1)	5,460 (21.6)	701 (23.6)	1,053 (17.3)	772 (21.3)
P value		Reference	.54	.028	<.0001	.87

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TABLE 1

Continued.

Variable	Total patients	Black/African American	White/Caucasian	Hispanic/Latino	Asian/South Asian	All others
Prior assisted reproductive technology cycles						
0	22,699 (56.0)	1,378 (52.7)	15,202 (60.2)	1,659 (55.8)	2,427 (39.9)	2,033 (56.1)
≥ 1	17,846 (44.0)	1,237 (47.3)	10,042 (39.8)	1,316 (44.2)	3,657 (60.1)	1,594 (43.9)
P value		Reference	< .0001	.022	.0001	.0086
Prior cancelled cycles						
0	35,407 (87.3)	2,087 (79.8)	22,235 (88.1)	2,570 (86.4)	5,292 (87.0)	3,223 (88.9)
≥ 1	5,138 (12.7)	528 (20.2)	3,009 (11.9)	405 (13.6)	792 (13.0)	404 (11.1)
P value		Reference	.0001	< .0001	< .0001	< .0001
Prior retrievals						
0	26,324 (64.9)	1,766 (67.5)	17,456 (69.1)	1,962 (65.9)	2,817 (46.3)	2,323 (64.0)
≥ 1	14,221 (35.1)	849 (32.5)	7,788 (30.9)	1,013 (34.1)	3,267 (53.7)	1,304 (36.0)
P value		Reference	.089	.21	< .0001	.0043
Prior no suitable embryos						
0	37,752 (93.1)	2,491 (95.3)	23,958 (94.9)	2,809 (94.4)	5,282 (86.8)	3,212 (88.6)
≥ 1 numbers	2,793 (6.9)	124 (4.7)	1,286 (5.1)	166 (5.6)	802 (13.2)	415 (11.4)
P value		Reference	.43	.16	< .0001	< .0001

Note: Denominators are patients. Data are n (column %) unless otherwise noted. *P* values are reported comparing each group vs. Black/African American (reference group). The number with available body mass index data are in parentheses. BMI = body mass index; IQR = interquartile range (25th–75th percentile); n = number.

Ghidei. Outcomes for Black women undergoing IVF. Fertil Steril Rep 2021.

was unknown (60%, 58,132). Black patients comprised 6.4% (2,615 patients) of our study population, while 62% (25,244) were White, 7% (2,975) were Hispanic/Latino, and 14.1% (10,096) were Asian/South Asian.

Black patients were significantly more likely to be >35 years old (61% Black vs. 50% White, $P<.0001$) and significantly more likely to be obese as defined as BMI ≥30 kg/m^2(36% Black vs. 22% White, $P<.0001$; Table 1). Black women were more likely to be diagnosed with tubal factor (19.8% Black vs. 8.6% White, $P<.0001$) and uterine factor (7.4% Black vs. 3.1% White, $P<.001$) infertility. Black women also were more likely to have a pregestational diagnosis of hypertension (1.8% Black vs. 0.8% White, $P<.0001$) and diabetes mellitus (3.4% Black vs. 1.3% White, $P<.0001$). Black women undergoing IVF experienced more psychological stress than all other groups, including White women (0.15% Black vs. 0.04% White, $P=.008$).

In regards to the reproductive history of our cohort, Black women were more likely to have prior terminations (16.7% Black vs. 7.5% White, $P<.0001$) and spontaneous abortions (23.1% Black vs. 21.1% White $P=.02$), although these differences may not be clinically significant. Despite having similar rates of prior retrievals to their White counterparts (32.5% Black vs. 30.9% White, $P=.089$), they were significantly less likely to undergo ICSI (3.5% Black vs. 5.8% White, $P<.0001$; Table 2).

After IVF, Black women had significantly more miscarriages than White but not Hispanic or Asian patients (8.0% Black vs. 6.9% White $P=.018$; 7.4% Hispanic $P=.32$; 7.5% Asian $P=.016$). Clinical pregnancy rates were significantly lower for Black women compared with all other races and ethnicities (45% Black vs. 52% White $P<.0001$; 52% Hispanic $P<.0001$; 53% Asian $P<.0001$). The odds ratio (OR) of a live birth from all cycles were 30% less for Black women than for White women (OR, 1.00 vs. 1.43, $P<.0001$), 24% less than for Asian women (OR, 1.00 vs. 1.31, $P<.0001$), and 22% less than for Hispanic women (OR, 1.00 vs. 1.29, $P<.0001$; Table 3). The significant differences of LBR persisted even after adjusting for patient characteristics (age, BMI, infertility diagnosis, hypertension, diabetes, cycle type, ICSI, preimplantation genetic diagnosis, transfer count) (OR, 1.00 Black vs. 1.32 White, $P<.0001$; 1.23 Hispanic, $P<.0001$; 1.18 Asian $P=.0003$). Age ≥35 years and obesity were significantly associated with lower odds of live birth among Black women, adjusting for the other factors (Table 4). The male factor was significantly associated with higher odds of live birth after adjusting for the other variables.

Patients with missing race/ethnicity status at the first recorded cycle were more likely to be older and have lower BMI (Supplemental Table 2). Patients with missing race/ethnicity tended to not have specific diagnoses or comorbidities compared with those with race/ethnicity documented. They also tended to have fewer prior pregnancies and fewer prior ART cycles, but the median number of cycles analyzed was not different between those with and without known race/ethnicity. Regarding cycle-specific data, patients with missing race/ethnicity were more likely to use fresh cycles and ICSI but were less likely to have some of the pregnancy-related outcomes. One exception was live birth

TABLE 2

Cycle-specific characteristics and outcomes by race.

Variable	Total patients	Black/African American	White/Caucasian	Hispanic/Latino	Asian/South Asian	All others
Total, n (row %)	71,389	4,490 (6.3)	46,517 (65.2)	4,803 (6.7)	10,096 (14.1)	5,483 (7.7)
Cycle type						
Fresh (any transfer)	38,940 (54.5)	2,772 (61.7)	26,402 (56.8)	2,542 (52.9)	4,215 (41.7)	3,009 (54.9)
Frozen (any transfer)	31,616 (44.3)	1,662 (37.0)	19,502 (41.9)	2,216 (46.1)	5,793 (57.4)	2,443 (44.6)
Fresh + frozen (both)	833 (1.2)	56 (1.2)	613 (1.3)	45 (0.9)	88 (0.9)	31 (0.6)
P value		Reference	< .0001	< .0001	< .0001	< .0001
Intracytoplasmic sperm injection						
Yes	3,475 (4.9)	157 (3.5)	2716 (5.8)	240 (5.0)	285 (2.8)	77 (1.4)
No	67,914 (95.1)	4,333 (96.5)	43,801 (94.2)	4,563 (95.0)	9,811 (97.2)	5,406 (98.6)
P value		Reference	< .0001	.0027	.0068	< .0001
Preimplantation genetic testing						
Yes	8,248 (11.6)	432 (9.6)	4,136 (8.9)	595 (12.4)	1,729 (17.1)	1,356 (24.7)
No	63,141 (88.4)	4,058 (90.4)	42,381 (91.1)	4,208 (87.6)	8,367 (82.9)	4,127 (75.3)
P value		Reference	.22	.0011	< .0001	< .0001
Day 3 FSH	(n = 48,185)	(n = 3,463)	(n = 32,496)	(n = 3,189)	(n = 5,712)	(n = 3,325)
Mean (SD)	8.3 (8.6)	9.3 (12.3)	8.2 (7.8)	8.5 (10.0)	8.3 (8.7)	8.1 (10.0)
Median (range)	7.0 (0.0–220.0)	6.8 (0.1–170.0)	7.1 (0.0–163.9)	6.8 (0.1–220.0)	6.9 (0.1–127.6)	6.7 (0.1–163.4)
IQR	5.4–9.0	5.1–9.1	5.5–9.1	5.4–8.8	5.5–8.8	5.2–8.5
P value (on log FSH)		Reference	.57	.47	.27	.004
Positive pregnancy test						
Yes (all transfers)	42,925 (60.1)	2,299 (51.2)	28,197 (60.6)	2,827 (58.9)	6,080 (60.2)	3,522 (64.2)
No	28,464 (39.9)	2,191 (48.8)	18,320 (39.4)	1,976 (41.1)	4,016 (39.8)	1,961 (35.8)
P value		Reference	< .0001	< .0001	< .0001	< .0001
Clinical pregnancy						
Yes	37,125 (52.0)	2,018 (44.9)	24,166 (52.0)	2,474 (51.5)	5,343 (52.9)	3,124 (57.0)
No	34,264 (48.0)	2,472 (55.1)	22,351 (48.0)	2,329 (48.5)	4,753 (47.1)	2,359 (43.0)
P value		Reference	< .0001	< .0001	< .0001	< .0001
Ongoing pregnancy						
Yes	36,463 (51.1)	1,958 (43.6)	23,688 (50.9)	2,439 (50.8)	5,287 (52.4)	3,091 (56.4)
No	34,926 (48.9)	2,532 (56.4)	22,829 (49.1)	2,364 (49.2)	4,809 (47.6)	2,392 (43.6)
P value		Reference	< .0001	< .0001	< .0001	< .0001
Live birth						
Yes	19,202 (26.9)	950 (21.2)	12,882 (27.7)	1,237 (25.8)	2,623 (26.0)	1,510 (27.5)
No	52,187 (73.1)	3,540 (78.8)	33,635 (72.3)	3,566 (74.2)	7,473 (74.0)	3,973 (72.5)
P value		Reference	< .0001	< .0001	< .0001	< .0001
Spontaneous abortion						
Yes	5,043 (7.1)	357 (8.0)	3,232 (6.9)	354 (7.4)	685 (6.8)	415 (7.6)
No	66,346 (92.9)	4,133 (92.0)	43,285 (93.1)	4,449 (92.6)	9,411 (93.2)	5,068 (92.4)
P value		Reference	.018	.32	.016	.50
Transfer count						
Mean (SD)	1.7 (0.8)	1.8 (0.8)	1.7 (0.8)	1.7 (0.7)	1.5 (0.7)	1.6 (0.7)
Median (range)	2 (1–12)	2 (1–12)	2 (1–12)	2 (1–8)	1 (1–10)	2 (1–6)
IQR	1–2	1–2	1–2	1–2	1–2	1–2
P value		Reference	< .0001	< .0001	< .0001	< .0001
Single-embryo transfer						
Yes	4,483 (6.3)	285 (6.3)	2572 (5.5)	355 (7.4)	756 (7.5)	515 (9.4)
No	66,906 (93.7)	4,205 (93.7)	43,945 (94.5)	4,448 (92.6)	9,340 (92.5)	4,968 (90.6)
P value		Reference	.078	.13	.059	< .0001

Note: Denominators are cycles. Data are n (column %) unless otherwise noted. *P* values are reported comparing each group vs. Black/African American (reference group). Within-patient clustering is accounted for by generalized estimating equations and robust standard errors. FSH = follicle-stimulating hormone; IQR = interquartile range (25th–75th percentile); n = number.

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TABLE 3

Association between race and live births by multiple logistic regression.

Variable	Black/African American	White/Caucasian	Hispanic/Latino	Asian/South Asian	All others
Total, n (row %)	4,490 (6.3)	46,517 (65.2)	4,803 (6.7)	10,096 (14.1)	5,483 (7.7)
Unadjusted					
OR	1.00	1.43	1.29	1.31	1.42
95% CI	–	(1.32–1.54)	1.17–1.43	1.20–1.43	1.29–1.56
P value	Reference	< .0001	< .0001	< .0001	< .0001
Adjusted[a]					
OR (for live birth)	1.00	1.36	1.26	1.28	1.31
95% CI	–	1.26–1.47	1.14–1.39	1.17–1.40	1.19–1.44
P value	Reference	< .0001	< .0001	< .0001	< .0001
Adjusted[b]					
OR	1.00	1.32	1.23	1.18	1.24
95% CI	–	1.22–1.43	1.11–1.36	1.08–1.29	1.13–1.37
P value	Reference	< .0001	< .0001	.0003	< .0001

Note: Denominators are cycles. *P* values are reported comparing each group vs. Black/African American (reference group). Within-patient clustering is accounted for by generalized estimating equations and robust standard errors. CI = confidence interval; OR = odds ratio for live birth.
[a] Age (≥35 vs. <35 years), female infertility (anovulation, tubal, or uterine), male factor, endometriosis, polycystic ovarian syndrome, hypertension, diabetes, cycle type (fresh, frozen, both), intracytoplasmic sperm injection, preimplantation genetic testing, and transfer count. Model included 71,389 cycles.
[b] Also adjusted for body mass index (≥30 vs. <30). The model included 70,210 cycles with available body mass index data.

Ghidei. Outcomes for Black women undergoing IVF. Fertil Steril Rep 2021.

which is nearly identical between patients with race/ethnicity missing and not missing; Supplemental Table 3). Compared with Black patients, those with unknown race or ethnicity had higher unadjusted odds of live birth (1.35; Supplemental Table 4). The OR was less than that for White or other patients, but more than that for Hispanic or Asian patients. Adjusting for other variables, unknown race/ethnicity, like all other groups, had higher odds of live birth relative to Black patients (OR, 1.00 Black vs. 1.24 Unknown race, $P<.0001$). Adding unknown race as a group in logistic regression models did not significantly change the results (Table 3).

DISCUSSION

The findings of this study using the large national eIVF database demonstrate that Black women continue to have worse outcomes after IVF than all other groups. Compared with all the other races/ethnicities examined, Black women had the lowest CPR. After adjusting for patient characteristics, Black women were still 24% less likely than White women to experience a live birth after IVF.

TABLE 4

Predictors of live birth among Black or African American women by multivariable logistic regression.

Factor	Adjusted OR (95% CI)[a]	*P* value
Age ≥35 vs. <35 y	0.71 (0.61–0.82)	< .0001
Body mass index ≥30 vs. <30 kg/m^2	0.79 (0.67–0.92)	.0035
Tubal factor infertility vs. no	0.83 (0.68–1.01)	.06
Male factor vs. no	1.28 (1.03–1.60)	.026
Diabetes vs. no	0.61 (0.37–1.00)	.05

Note: Denominators are cycles. CI = confidence interval; OR = odds ratio for live birth.
[a] Variables included were associated with live birth for Black or African American women in the univariable models with $P<.1$. The mutually adjusted model included 4,433 patient cycles with available body mass index data.

Ghidei. Outcomes for Black women undergoing IVF. Fertil Steril Rep 2021.

Sensitivity analyses were performed to assess if the outcomes of those with missing data differ from those with documented race/ethnicity. The results of this analysis perhaps suggest that patients with missing data were pursuing IVF for age-related reasons. They were more likely to undergo fresh cycles and ICSI while less likely to undergo single-embryo transfer. Although they were less likely to have clinical pregnancy or spontaneous abortion, LBR was nearly identical between missing and not missing groups. Importantly, differences seen in this analysis were statistically significant but may not be clinically significant.

Our findings are consistent with and strengthen other analyses in the literature (2, 4–5, 9–11). The United States registry-based studies demonstrate that ethnic minorities have lower CPR and/or LBR after IVF, compared with White women, although previous analyses have been limited by heterogeneity, missing data, and inadequate power. Nonetheless, countless other studies have corroborated these disparate outcomes, even when approaching the question through different lenses.

For example, Black Afro-Caribbean women were found to have a significantly lower LBR than White women, specifically after fresh embryo transfer (9). Additionally, Black recipients of donated oocytes from Black women were 78% less likely to have a clinical pregnancy compared with their White counterparts in one study (10). Another recent study found minority women >40 years of age were less likely to achieve clinical pregnancy. Once pregnant, minority women in this study were five times more likely to experience preterm birth (11).

By incorporating and analyzing data from all racial/ethnic groups, we were uniquely positioned to find that Black patients not only had worse outcomes compared with White women, but to all other groups as well. We were able to perform one of the largest studies assessing the racial differences among IVF outcomes with the use of an extensive EHR database used throughout the United States. This allowed us

to incorporate many prepregnancy comorbidities and important covariates, such as psychological stress.

The limitations of this study include the amount of excluded cycles because of unknown race/ethnicity. Racial data were missing from roughly 60% of the eIVF EHR database, which mirrors prior publications that have analyzed SART data (3). This potentially contributed to selection bias. The conundrum of better understanding racial disparities while not having access to accurate patient information on race/ethnicity must be tackled as one of the first steps in addressing disparate outcomes (12). Another limitation of this study involves the inability to account for the intersection of race and ethnicity, such as outcomes specific to Afro-Latinas because race/ethnicity data were merged within the IVF database (1). We also acknowledge that our analysis may be limited by heterogeneity and/or errors in how race/ethnicity or other variables are accounted for within individual practices using the eIVF database, as many clinics do not currently include self-reported racial data. These limitations may affect external generalizability and could be mitigated if large databases such as SART designate race and ethnicity as a required item.

What mechanisms contribute to this disparity, and can these mechanisms be mitigated, altered, or eliminated? Some scholars suggest that Black women have poorer IVF outcomes because of a higher incidence of tubal or uterine factor infertility (13–14). In our study, Black women had >50% greater chance of a tubal factor and uterine factor compared with White women. However, lower CPR and LBR for Black women in our study still existed after adjusting for the cause of infertility (among many other confounders). This has also been confirmed in several other studies (5, 15). Lebovitz et al. (16) found that Black women have worse IVF outcomes even after undergoing myomectomy, further strengthening the need to look beyond intrinsic patient factors.

Our analysis found that Black women undergoing IVF reported psychological stress 3.75 times more than White women (16). Chronic stress among racial minorities has been linked to poorer health and medical treatment outcomes through several mechanisms, such as weathering, a term describing the phenomenon in which chronic exposure to stress leads to a chronic state of inflammation (17). Weathering has recently been linked to racial disparities seen within IVF. A study using a national survey demonstrated that Black women pursuing fertility treatments had weathering scores 1.29 times as high as White women's scores, although this was not statistically significant (18). Other nonbiological causes such as unequal access to care have been evaluated as potential explanations to account for observed differences. Yet, Black women still have poorer fertility treatment outcomes even when cost and access are eliminated as barriers to care (19).

To understand how the racial disparities highlighted in this study can be mitigated, disparate IVF outcomes should be contextualized within the reproductive injustices that systematically permeate medical practices in the United States (10, 20). Racial minorities often have a higher need for fertility treatment yet are much less likely to use IVF treatment. Furthermore, Black women are three times more likely to discontinue IVF treatment than White women regardless of income or insurance coverage (21, 22), perhaps because many Black participants believe that their physician does not understand their cultural background (42.3% Black vs. 16.5% White participants, $P<.0001$) (23). Persistent disparate outcomes may also be explained by provider bias and gate-keeping experienced by racial minorities (19). Studies have shown that Black populations are more likely to receive older and more conservative treatments than White people (24–25). Further studies incorporating both patient and provider perspectives may help understand this disconnect and dilemma within the reproductive endocrinology and infertility field.

CONCLUSION

This study assessed the factors that determine the inferior IVF outcomes of Black women compared with all other racial/ethnic groups. Disparate outcomes for Black women persisted despite adjusting for known confounders. Poorer outcomes for Black women were associated with older age starting IVF, higher BMI, tubal infertility, and diabetes. We conclude that Black women can expect less chance of successful IVF treatment, likely because of the factors above, in addition to pervasive reproductive injustices in the United States. Future directions should focus on integrating comprehensive bias training into medical training, mandating the report of race/ethnicity by practices, and conducting research to further understand the barriers, bias, and racism Black patients may experience.

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