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Racial Differences in Self-Reported Infertility and Risk Factors for Infertility in a Cohort of Black and White Women: The CARDIA Women's Study

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Abstract

Objective—To determine racial differences in self-reported infertility and in risk factors for infertility in a cohort of black and white women.

Design—A cross-sectional analyses of data from the longitudinal Coronary Artery Risk Development in Young Adults (CARDIA) Study, a prospective, epidemiologic investigation of the determinants and evolution of cardiovascular risk factors among black and white young adults and from the ancillary CARDIA Women's Study (CWS).

Setting—Population-based sample from 4 US communities (Birmingham, AL; Chicago, IL, Minneapolis, MN; and Oakland, CA).

Participants—Women ages 33–44 who had complete data (n=764).

Interventions—none

Main Outcome Measure—Self-report of ever having unprotected sexual intercourse for at least 12 months without becoming pregnant.

Results—Among non-surgically sterile women, blacks had a two-fold increased odds (95% CI = 1.3–3.1) of infertility as compared with whites after adjustment for socioeconomic position (education and ability to pay for basics), correlates of pregnancy intent (marital status and hormonal contraceptive use), and risk factors for infertility (age, smoking, testosterone, fibroid presence, and ovarian volume). The corresponding OR among all women was 1.5 (95% CI 1.0–2.2). Difficulty paying for basics and ovarian volume were associated with infertility among black but not white women.

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Significant black/white differences in infertility were present in a population-based cohort of women even when adjusting for socioeconomic position, correlates of pregnancy intent, and infertility risk factors.

Conclusions—In this population-based sample, black women were more likely to have experienced infertility. This disparity is not explained by common risk factors for infertility such as smoking and obesity, and among non-surgically sterile women, it is not explained by gynecologic risk factors such as fibroids and ovarian volume.

Keywords

Infertility; race; ethnicity; disparity; fibroids; ovarian volume

Introduction

While infertility is a major public health problem currently affecting up to 10% of reproductive age American couples, little is known about how infertility differs between black and white women (1). The majority of studies on black/white differences in infertility have focused on women who seek infertility treatment (2–5). Among these women, black women are significantly different with regard to socioeconomic position (2,3) and marital status (3). They have a higher prevalence of some risk factors for infertility such as uterine fibroids (4) and excess weight (1,6). They also have a higher prevalence of tubal disease (2–4,6). Overall, this evidence suggests that there are major differences between black women and white women seeking care for infertility. However, whether these differences are present and contribute to increased infertility in black women in the general population is unknown.

The National Survey of Family Growth (NSFG), to our knowledge, is the only source of information on infertility in the general US population (7). The 2002 NSFG found that, with adjustment for education, income, and self-reported pelvic inflammatory disease, married black women had almost twice the odds of infertility as married white women (8). Our study is unique in that we examined black/white differences in infertility and assessed black/white differences in risk factors for infertility in a population-based cohort of both married and unmarried women from 4 US communities. We hypothesized that a higher proportion of black women would have ever experienced infertility. Further, we hypothesized that differences in proportion of women who had experienced infertility would be explained, at least in part, by differences in risk factors (markers of ovulatory dysfunction, diminished ovarian reserve, and uterine factors) for infertility.

Methods

We used data from the Coronary Artery Risk Development in Young Adults (CARDIA) Study, a prospective, epidemiologic investigation of the determinants and evolution of cardiovascular risk factors among black and white young adults (9,10) in conjunction with data from the ancillary CARDIA Women's Study (CWS). The studies were approved by the institutional review boards of all participating institutions. For CARDIA, participants 18–30 years of age were recruited from the populations of Birmingham, AL; Chicago, IL, and Minneapolis, MN, and through the membership of a large prepaid healthcare plan (Oakland, CA). Baseline examinations were performed on 5115 (51%) of the eligible persons contacted in 1985–1986 and included 2788 women. The study population was approximately balanced according to age, sex, education, and ethnicity (52% black and 48% white) at each study site. Less than 0.03% of the 5115 recruited CARDIA participants self reported Hispanic ethnicity. A description of the methodology used to recruit subjects and perform data collection is detailed elsewhere (9,10). The retention rate at the year 15 examination (2000–2001) was 74% of the surviving participants (11).

CWS was designed to examine the associations of serum androgens, polycystic ovaries, and clinical features associated with the polycystic ovary syndrome (such as infertility and

hirsutism) with the development of coronary artery calcium. Women who had had bilateral oophorectomy or who were pregnant were excluded from participation in the CWS. Approximately 86% of eligible and invited CARDIA women were successfully recruited and examined for CWS during Year 16 (n = 1163).

Data Collection Methods for CARDIA Variables (Year 15)

Sociodemographic and Lifestyle Information—Self-reported sociodemographic data (race, education, income, ability to pay for basics, insurance status, and marital status) and lifestyle data (smoking status, alcohol use, and physical activity) were collected at the year 15 examination using self and interviewer administered questionnaires. Dichotomous variables were defined as follows: race (black, white) lower education (<4 years college, ≥ 4 years college); low income (<\$35,000, ≥\$35,000); difficulty paying for basics (Very Hard/Hard/Somewhat Hard vs. Not Very Hard); health insurance (none vs. any); marital status (ever vs. never); smoking (ever vs. never); and nulliparity (0 vs. >0). Difficulty paying for basics, a measure of perceived economic deprivation, was determined with the question “How hard is it for you (and your family) to pay for the very basics like food and heating? Would you say it is: very hard/hard/somewhat hard/not very hard”. The use of < 4 years college to define lower education is similar to the NSFG’s dichotomous education variable (not college graduate vs. college graduate) (8). The cutpoint of \$35,000 to define low income was chosen based on univariate analyses of the categorical CARDIA Year 15 income variable. Nulliparity (0) was defined as having no pregnancies longer than 20 weeks gestation and no livebirths. A categorical variable included was CARDIA site (Oakland CA, Birmingham AL, Chicago IL, and Minneapolis MN). Continuous variables were alcohol consumption (mean ml of alcohol consumption per day) and physical activity (“exercise units”). Information regarding history of endometriosis, pelvic inflammatory disease, and prior abdominal surgery was not collected.

Measurements of weight and height were obtained according to a standardized protocol described previously (12). Certified technicians obtained anthropometric measurements. Body weight was measured to the nearest 0.2 kg using a calibrated balance beam scale in participants wearing light clothing. Height (without shoes) was measured to the nearest 0.5 cm using a stadiometer or vertical ruler. Body mass index (BMI) was computed as weight in kilograms divided by squared height in meters. Obesity and extreme obesity were defined as a BMI ≥ 30 and ≥ 35, respectively.

Data Collection Methods for CWS Variables (Year 16)

Self-Reported Infertility and Menstrual Cycle Characteristics—A self-administered questionnaire asked each woman about her reproductive health history. Specifically, women were asked about ever infertility with the question: “Have you and a male partner ever had unprotected sexual intercourse for at least 12 months without becoming pregnant?” In addition, women were asked about menstrual cycle characteristics: the regularity of cycles and the average length between the beginning of one cycle and the beginning of the next. Also, they were asked whether they were currently using hormonal contraception (birth control pills, implants, or injections).

Androgens—A blood draw was performed that was timed during days 2–10 of menses (and preferentially during days 2–5) for women experiencing regular menses and untimed for women on hormonal contraception or with irregular or absent menses. Androgens were assayed by the OB/GYN Research and Diagnostic Laboratory, at the University of Alabama, Birmingham (UAB). Total testosterone was measured using a competitive immunoassay (Beckman Coulter) that employed direct chemiluminescent technology on the Beckman Access Automated System. The lower limit of detection for testosterone using this system is 10 ng/dL. Values less than 10 ng/dL were coded as 5 ng/dL for analysis purposes. For this

study we used 40 ng/dl of testosterone as the cutoff to define hyperandrogenemia based on the study by Davison et al, which reported the 90th percentile as 40 ng/dl for a population-based sample of predominantly white women ages 35–44 (13). The interassay coefficient of variation (CV) for the quality control total testosterone sample (80 ng/dL) was 5.9% for the UAB laboratory. Beckman Coulter reports that the CV for this assay is <10% for total testosterone ≥ 50 ng/dL and is <20% and for total testosterone < 50 ng/dL.

Ultrasound Ovarian and Uterine Characteristics—A transvaginal ultrasound examination (TVUS) was performed on the same day as the scheduled blood draw. American Registry of Diagnostic Medical Sonographers (ARDMS) certified sonographers, who had performed at least 50 prior transvaginal ultrasound (TVUS) examinations, performed TVUS using a 5–7.5 MHz transvaginal probe. The ultrasound examiner searched no less than two minutes per ovary for each ovary. Photo documentation was performed regardless of whether or not the ovaries were visualized.

We assessed the following TVUS parameters: 1) ovarian volume calculated from three perpendicular planes; 2) uterine volume calculated from three perpendicular planes; 3) largest fibroid volume from three perpendicular planes; and 4) number of fibroids. Quality control procedures for ovarian volume included replicate TVUS at the CWS exam for 68 subjects across sites.

Christiansen et al has shown that the volume of the smaller ovary does not change over the course of a menstrual cycle (14). Since women in this study underwent TVUS at varying times during their menstrual cycle, we used the volume of the smaller of the two ovaries on TVUS in our analyses. We used 3 ml as the threshold to define a small ovary based on the systematic review of tests predicting ovarian reserve by Broekmans et al (15). We used 7ml as the threshold to define a large ovary based on Jonard et al's receiver operator characteristic analyses (ROC) of women with and without PCOS (16).

Sample Selection Method

We selected CWS participants who were ages 34–44 (n=785) for our study. Twenty-one women were excluded because of missing data for income (n=10), infertility (n=2), BMI (n=6), health insurance (n=3), ability to pay for basics (n=1), smoking (n=1), alcohol consumption (n=1), or physical activity (n=2). Thus, the overall final analytic sample included 764 women. Of the 764 women age < 44 , 240 women were surgically sterile (non-visualization of uterus on ultrasound at Year 16 or self-reported bilateral tubal ligation at Year 15). Among the non-surgically sterile women (n=524), 35 women were missing transvaginal ultrasound variables. Thus, the final analytic sample of non-surgically sterile women included 489 women.

Statistical Methods

Using SAS statistical software (version 9.1, SAS Institute Inc, Cary, NC), we compared sociodemographic and risk factors between black and white women and between self-reported ever infertile and never infertile women using Chi-square and t-tests. We used logistic regression to calculate the individual ORs for ever infertility for each risk factor in our primary sample, after adjusting for age, race, and hormonal contraception. We excluded surgically-sterile women from our primary analyses. The advantage of excluding these women was that it provided a sample with universal fibroid and ovarian measurements (because none had hysterectomy) and was similar to the strategy used in the NSFG. The disadvantage of excluding these women was that a higher proportion of black woman than white women had undergone surgical sterilization. We adjusted for current use of hormonal contraception since hormonal contraception affects many of the variables we were assessing including androgen levels, ovarian volume, and menstrual cycle characteristics. We also tested for race/risk factor

interactions after adjusting for age and hormonal contraception. Since a significant race/ability to pay for basics interaction was detected, we calculated ORs for ever infertility for each risk factor after stratifying by race and adjusting for age and hormonal contraception use.

We developed our final models by including all variables with a p-value <0.05 from analyses adjusted for age, race, and hormonal contraception use or variables with a significant interaction with race. Although not significant, we included age in our final models because of its well documented association with infertility. We also selected marital status to include as a marker of family status. Because of the high degree of collinearity, in the final models we included the only fibroid variable (presence vs. absence of fibroids) that was statistically significant in our univariate analyses of ever versus never infertility. We also performed separate regression analyses in three subgroups that, based on the literature, appear more likely to intend a pregnancy: 1) ever married women (married, divorced, separated, or widowed), 2) women currently not using hormonal contraception, and 3) ever married nulliparous women. Finally, we performed final models in all women (regardless of surgical sterility status) (n=764) but did not include fibroid or ovarian volume measurements in these analyses.

Results

Among the non-surgically sterile sample of women (n=489), more black women than white women reported infertility (48% vs. 31%; $p<0.001$). Black women were slightly younger and less often ever married and nulliparous, and more often had low income, lower education, and difficulty paying for basics (39.4 vs. 40.9, $p<0.001$; 54% vs. 72%, $p<0.001$; 34% vs. 43%, $p=0.026$; 37% vs. 12%, $p<0.001$; 67% vs. 36%, $p<0.001$, 23% vs. 15%, $p=0.016$, respectively). Regarding risk factors for infertility, fewer black women were ever smokers but more were obese (32% vs. 47%, $p=0.001$; 49% vs. 21%, $p<0.001$). Black women had lower physical activity scores and lower alcohol consumption (241 vs. 351 exercise units, $p<0.001$; 4.6 vs. 8.1 ml/day, $p=0.001$). Additionally, more black women had fibroids present on TVUS (67% vs. 35%, $p<0.001$). They also had higher numbers of fibroids and had a larger uterus (4.3 vs. 1.1, $p<0.001$; 108 ml vs. 74 ml, $p<0.001$). A similar proportion of black and white women reported current hormonal contraception use.

Among non-surgically sterile women currently not using hormonal contraception (n=183 black and n=201 white), black and white women had a similar prevalence of hyperandrogenemia and irregular or long menstrual cycles but more black women tended to have an ovary that was larger than 7 ml (27% vs. 17%, $p=0.057$). Among the overall sample (n=764), black/white differences were generally similar to black/white differences in the non-surgically sterile sample (n=489); however, in contrast, in the overall sample: 1) black women had similar alcohol consumption to white women and 2) black women had lower hormonal contraception use.

In univariate analyses of non-surgically sterile, ever infertile women versus never infertile women (n=489), more of the ever infertile women had a low income, lower education, and difficulty paying for basics (Table 1). More ever infertile women had fibroids present but they had similar numbers of fibroids, largest fibroid volume, and uterine volume to never infertile women. Ever infertile women had lower physical activity scores and also tended to be more obese. More ever infertile women had ever smoked and fewer were using hormonal contraception. Among women not taking hormonal contraception, more ever infertile women had hyperandrogenemia and more tended to have an ovary that was smaller or larger than 3ml–7ml.

After adjustment for age and hormonal contraception use, black race was significantly associated with ever infertility in the non-surgically sterile women with an OR of 2.04 (1.39–

3.01) (Table 2). After adjustment for race in addition to age and hormonal contraception use 1) lower education, 2) ever smoking, 3) the presence of fibroids, and 4) ovarian volume were significantly associated with ever infertility in the overall sample of women. After adjustment for age and hormonal contraception use, a statistically significant interaction was found for race and difficulty paying for basics ($p=0.044$) and a suggestion of an interaction was found for race and ovarian volume ($p=0.135$). All other interaction terms had associated p -values of >0.15 . In analyses that adjusted for age and use of hormonal contraception among black women only, those who reported difficulty paying for basics and low education had higher ORs of ever infertility. Black women who had ever smoked or who had an ovary that was larger or smaller than 3ml–7ml also had higher ORs of ever infertility. In comparison, in similar analyses in white women, only women who had ever smoked had higher ORs of ever infertility. Obesity ($BMI \geq 30$), extreme obesity ($BMI \geq 35$), and BMI as a continuous variable were not significantly associated with infertility in these models.

In the fully adjusted final model that included non-surgically sterile women only (Table 2), black race remained significantly associated with ever infertility (OR 1.97, 95% CI 1.25–3.12) in addition to marital status, hormonal contraception use, smoking, the presence of fibroids, and ovarian volume. Among black women, those with difficulty paying for basics, a large ovary, or who had ever been married had significantly higher odds of ever infertility. In comparison, among white women, none of these variables were statistically significantly associated with a higher odds of ever infertility.

Adjusted models limited to non-surgically sterile women currently not using hormonal contraception ($n=183$ black and $n=201$ white), ever married women ($n=124$ black and $n=188$ white), and ever married nulliparous women ($n=32$ black and $n=54$ white) (data not shown) all revealed increased ORs for ever infertility in black versus white women: ORs 2.0 (95% CI 1.3–3.1), 2.3 (95% CI 1.4–3.7), and 3.3 (95% CI 1.3–8.1), respectively. Adjusted models among surgically sterile and non-surgically sterile women ($n=419$ black and $n=345$ white), revealed a lower odds ratio for ever infertility in black versus white women; however, this odds ratio remained significant: OR 1.49 (95% CI 1.04–2.16).

Discussion

In our study, black women had a significantly higher odds of ever having experienced infertility than white women. Even after adjustment for socioeconomic position, marital status, and other risk factors for infertility, this disparity persisted. There were also significant disparities found in subgroup analyses of ever married women, ever married nulliparous women, women who were not currently using hormonal contraception; and also in analyses that included surgically sterile women. The consistent pattern of disparity in infertility that we observed suggests that infertility disproportionately burdens black women of many social groups.

We found that some of the characteristics we assessed were associated with ever infertility among black women rather than white women. A marker of socioeconomic position, difficulty paying for basics, was associated with a significantly increased OR of ever infertility in black women but not in white women. This did not appear to be related to the availability of health insurance as lack of health insurance was not associated with ever infertility in our study. However, the apparent differential association of low socioeconomic position with ever infertility among black women may reflect differences in other risk factors, such as tubal disease and endometriosis, or in gynecological health education and care that black women receive.

In our study, ovarian volume appeared to be associated with ever infertility in blacks more strongly than among whites. Small ovarian volume has been associated with diminished

ovarian reserve (DOR) which the CDC defines as the reduced ability of the ovary to produce eggs (17). Studies of IVF clinic populations have shown that a small ovarian volume is associated with a reduced chance of pregnancy with IVF (18). Our study is the first to our knowledge, to assess how ovarian volume relates to ever infertility in a population-based sample of women.

The fact that ovaries ≥ 7 ml were associated with ever infertility in black women more than white women is intriguing. Biological causes for large ovaries are typically categorized under the CDC category “ovulatory dysfunction” (17) and include increased numbers of cysts, large solitary cysts, or increased ovarian stroma. Multiple small ovarian cysts are associated with PCOS (19–21) and with Type 1 diabetes (22). Based on our finding, we believe that further study is needed to more closely assess the relationship between ovarian volume and infertility, especially in black women.

We did not find a difference in the proportion of women with hyperandrogenism or menstrual irregularities between black and white women who were not using hormonal contraception. These findings are consistent with Knochelhauer et al (23) who did not find a difference in the prevalence of PCOS as defined by the 1990 NIH panel (24) or in the prevalence of its components signs and symptoms (oligo-ovulation, clinical hyperandrogenism, and or hyperandrogenemia) in black and white southeastern women (23). In addition, we did not find that hyperandrogenemia or menstrual abnormalities were associated with infertility in late reproductive age black or white women. The lack of an association between hyperandrogenemia, menstrual irregularity, and infertility is inconsistent with the literature on PCOS (25–28). It is possible that our lack of findings regarding hyperandrogenemia may be due to low prevalence of PCOS or clinically significant hyperandrogenemia in our population, low precision of the total testosterone assay, or to the relatively older average age of our sample compared to other studies of PCOS (13).

The CDC defines “uterine factor” as a structural or functional disorder of the uterus that results in reduced fertility. Fibroids are a common structural disorder of the uterus, especially among black women (29), that may lead to infertility. Consistent with previous studies, we found that black women more commonly had fibroids and had more numerous fibroids. Nonetheless, the increased odds of ever infertility with fibroids was similar in black and white women.

Our findings regarding fibroids are consistent with those of Feinberg et al (4), who reported that black women in an equal-access-to-care (Department of Defense) setting had a significantly higher prevalence of fibroids by ultrasound. In their study, black women experienced a trend toward worse live birth rates with IVF (RR 0.83, 95% CI 0.67–1.02); however, adjustment for the presence of fibroids changed this RR only slightly (RR 0.87, 95% CI 0.68–1.12). Thus, we believe the presence of uterine fibroids explains little of the disparity in infertility between blacks and whites.

Ample evidence exists revealing an association between infertility and smoking (30). A meta-analysis of 12 population-based studies has shown an OR of 1.6 (95% CI 1.3–1.9) for infertility in smokers versus nonsmokers (31). As expected, we found a significant association between ever smoking and ever infertility in both black and white women in our study.

We did not find an association between obesity and ever infertility in adjusted analyses. This may be considered counter to the findings of Hassan et al (32) and Bolumar et al (33). They found relationships between increased BMI and increased time to pregnancy among women who achieved pregnancies. Our lack of findings regarding obesity and infertility may be related to the relatively older average age of our sample and/or because our sample included nulliparous women.

We did not find an association between self-reported physical activity and ever infertility in adjusted analyses. We also did not find an association between self-reported alcohol use and ever infertility in any analyses. Previous evidence regarding the relationship between these two variables and infertility is conflicting (34–37).

Limitations

Assessing the epidemiology of infertility is difficult. The common clinical definition of infertility in the US is the failure to conceive for 12 months (38); however, the study of infertility is complicated by the lack of a standard definition of infertility for research purposes. Marchbanks et al have shown the definition of infertility used in studies has an effect on the prevalence of infertility and the racial characteristics of the infertility population identified (39). They found that definitions that require a self-reported physician diagnosis capture a lower proportion of infertile black women while definitions that rely on a self-reported life calendar to identify 12 month time periods of unprotected intercourse without pregnancy capture a higher proportion of infertile black women. We believe that the definition used in CWS, which is based on the self-report of at least 12 months of unprotected sexual intercourse without becoming pregnant, is a reasonable research definition for ever infertility for our study.

In choosing its sample to study, the NSFG does not consider women who are unmarried, age >44, surgically sterile, or using contraception to be at risk for infertility, leading some scholars to question the validity and generalizability of infertility prevalence estimates reported from the NSFG (40–42). Since our study focuses on racial differences in ever infertility and since, at a population level, blacks and whites have differential rates of marriage and hormonal contraception use (7), we chose to include never married women and hormonal contraception users in our primary analysis and considered them as at-risk of infertility. In addition, we performed secondary analyses that included women who were surgically sterile and among subgroups of married women, married, nulliparous women, and women not currently using hormonal contraception to assess the consistency of our findings.

We found that women taking hormonal contraception had lower odds of ever infertility and that married women had a higher odds of ever infertility. However, even when looking at these subgroups of married and non-hormonal contraceptive using women, a higher proportion of black women reported ever experiencing infertility. When including both surgically sterile and non-surgically sterile women, a significantly higher proportion of black women report ever experiencing infertility. The disparity was not as pronounced as among non-surgically sterile women, although the confidence intervals overlapped significantly. The modest reduction in the OR that occurred when surgically sterile women were included in these analyses is likely due to the inclusion of black women with bilateral tubal ligation (BTL). A higher proportion of black women than white women had undergone BTL. The difference in infertility between black and white women who had undergone BTL was smaller than in any other subgroup; this difference did not reach statistical significance (data not shown).

The proportion of ever infertility in our sample (39% non-surgically sterile and 38% overall) may appear abnormally large compared to the NSFG (7%) estimates; however, NSFG reports previous 12-month infertility. Eighteen percent (87/489 non-surgically sterile and 134/764 overall) of the women in our sample reported seeing a doctor for their infertility. This is consistent with the 18% of women ages 35–44 in NSFG who reported ever using infertility services including medical advice, tests, drugs, surgery or other treatment (7).

For this study, we were able to assess objective measures regarding 3 of the 6 major clinical categories of infertility that the CDC identifies (ovulatory dysfunction, diminished ovarian reserve, and uterine factor) but were not able to assess objective measures such as hysterosalpingogram, laparoscopy, or partner's sperm counts to evaluate for tubal disease,

endometriosis, or male factor infertility, respectively (17). Chlamydial and gonococcal genital tract infections are the major causes of pelvic inflammatory disease and salpingitis (43). Black women have a higher prevalence of chlamydia and gonorrhea than white women (44) and black women seeking care for infertility have higher rates of tubal infertility than white women (2). Together, these findings suggest that there may be a difference in the prevalence of STD related tubal disease in blacks and whites which may lead to higher rates of infertility in blacks. However, lacking objective measures in all categories, we cannot assess whether differential prevalences of unmeasured clinical pathology, such as tubal disease, explain the racial disparity we observed.

Conclusion

Our study supports the small body of evidence that infertility is more common among black than white women. The strengths of our study are that we investigated a population-based sample of women and that we assessed clinical measures of several risk factors for infertility. Our study also contained a larger number of black women than previous clinic-based studies of black/white infertility disparity which included as few as 24 black women (4–6). The increased odds of ever infertility reported by black women could be due to clinical pathology we were unable to assess or because of incomplete control for confounding among those factors we could measure. Further studies are needed to address these issues.

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Table 1

Characteristics of 489 Ever Infertile and Never Infertile Women* CARDIA Women's Study (data presented as mean (SD) or n (%))

	Ever Infertile (n=190)	Never Infertile (n=299)	p-value ^a
Sociodemographics			
Black	110 (58)	118 (40)	<0.001
Age (yrs)	40.0 (2.9)	40.3 (3.0)	0.291
CARDIA site			0.538
Oakland CA	62 (35)	113 (65)	
Birmingham, AL	43 (44)	54 (56)	
Chicago, IL	46 (40)	69 (60)	
Minneapolis, MN	39 (38)	63 (62)	
Low Income (<\$5,000)	56 (29)	59 (20)	< 0.013
Lower Education (<4 Years College)	116 (61)	132 (44)	<0.001
Difficulty paying for basics:			0.022
Very Hard/Hard/Somewhat Hard Not Very Hard	45 (24)	46 (15)	
Hard	145 (76)	253 (85)	
No Health Insurance	30 (16)	38 (13)	0.337
Family Status			
Ever Married	126 (66)	186 (62)	0.357
Parity			
Nulliparous	72 (38)	118 (39)	0.556
1 Birth	54 (28)	72 (24)	
≥2 Births	64 (34)	109 (36)	
Lifestyle Risk Factors			
Ever Smoker	92 (48)	103 (34)	0.002
Obesity (BMI ≥30)	75 (39)	92 (31)	0.048
Physical Activity (exercise units)	265 (242)	322 (271)	0.019
Alcohol Consumption (ml/day)	6.7 (13.2)	6.3 (11.7)	0.687
Infertility Risk Factors			
Fibroids (present)	111 (58)	134 (45)	0.003
Fibroids (number)	3.3 (11.1)	2.2 (8.9)	0.241
Largest Fibroid (ml)	4.0 (4.9)	4.7 (6.0)	0.301
Uterine volume (L × W × H × 0.5, ml)	92 (71)	89 (78)	0.683
Current Hormonal Contraception Use	27 (14)	78 (26)	0.002
Only Women currently <i>not</i> using Hormonal Contraception	n=163	n=221	
Hyperandrogenemia (≥40 ng/dl)	39 (24)	33 (15)	0.026
Ovary volume			0.077
Small (≤3ml)	39 (24)	38 (17)	
Normal (3ml-7ml)	84 (52)	139 (63)	
Large (≥7ml)	40 (25)	44 (20)	
Irregular menses <i>or</i> cycle length >34 days	31 (19)	41 (19)	0.908

* Women had an intact uterus and non-ligated fallopian tubes.

^aT-tests were used to compare means and Chi-Square tests were used to compare proportions.

Table 2

Odds Ratios for Association between Selected Characteristics and Self-reported Ever Infertility. Includes 489 Black and White Women * CARDIA Women's Study.

	All Odds Ratios: Age, Race, and HC Adjusted ^a n=489	Black Odds Ratios: Age and HC Adjusted ^a n=228	White Odds Ratios: Age and HC Adjusted ^a n=261	All Odds Ratios: Full Model ^b n=489	Black Odds Ratios: Full Model ^b n=228	White Odds Ratios: Full Model ^b n=261
Sociodemographics						
Black	2.04 (1.39–3.01)	1.02 (0.93–1.11)	0.96 (0.87–1.06)	1.97 (1.25–3.12)	1.03 (0.93–1.14)	0.95 (0.86–1.06)
Age (yrs)	1.00 (0.94–1.08)	1.50 (0.86–2.63)	0.86 (0.37–2.00)	0.99 (0.92–1.06)		
Low Income (<\$35,000)	1.24 (0.79–1.96)	1.87 (1.06–3.31)	1.42 (0.82–2.47)	1.45 (0.96–2.21)	1.65 (0.87–3.11)	1.32 (0.74–2.35)
Lower Education (<4 Years College)	1.63 (1.10–2.42)			1.32 (0.80–2.18)	2.54 (1.25–5.16)	0.66 (0.29–1.47)
Difficulty paying for basics	1.42 (0.89–2.29) +	2.24 (1.18–4.27)	0.77 (0.36–1.67)			
No Health Insurance	1.01 (0.59–1.72)	1.06 (0.56–2.02)	0.89 (0.33–2.43)	1.80 (1.18–2.75)		
Family Status						
Ever married	1.48 (0.99–2.22)	1.53 (0.90–2.60)	1.39 (0.75–2.57)		2.14 (1.18–3.88)	1.47 (0.78–2.79)
Nulliparous	0.99 (0.67–1.45)	0.76 (0.44–1.33)	1.26 (0.73–2.15)	1.83 (1.21–2.78)		
Lifestyle Risk Factors						
Ever Smoker	1.96 (1.32–2.90)	2.12 (1.18–3.81)	1.83 (1.07–3.14)		1.84 (0.95–3.58)	1.72 (0.99–3.01)
Obesity (BMI ≥ 30)	1.13 (0.75–1.71)	1.17 (0.69–1.98)	1.07 (0.56–2.05)			
Low Physical Activity	1.16 (0.95–1.42)	1.33 (0.96–1.84)	1.06 (0.82–1.37)			
Infertility Risk Factors						
Fibroids (present)	1.50 (1.00–2.23)	1.60 (0.91–2.83)	1.43 (0.81–2.52)	1.54 (1.02–2.31)	1.69 (0.92–3.10)	1.48 (0.82–2.66)
Current Hormonal Contraception (HC)	0.47 (0.29–0.77)	0.51 (0.26–1.00)	0.42 (0.20–0.85)	0.45 (0.26–0.76)	0.59 (0.28–1.24)	0.33 (0.15–0.74)
Hyperandrogenemia (≥40 mg/dl)	1.61 (0.98–2.63)	1.67 (0.86–3.27)	1.63 (0.78–3.41)			
Ovary volume						
Small (≤3ml)	1.79 (1.12–2.85)	2.14 (1.06–4.32)	1.54 (0.82–2.88)	1.74 (1.08–2.83)	2.14 (1.01–4.53)	1.54 (0.80–2.95)
(3ml–7ml)	1.00	1.00	1.00	1.00	1.00	1.00
Large (≥7ml)	1.37 (0.84–2.25)	2.24 (1.16–4.32)	0.71 (0.31–1.59)	1.54 (1.02–2.31)	2.70 (1.33–5.50)	0.89 (0.38–2.07)

* Women had an intact uterus and non-ligated fallopian tubes.

+ Significant interaction for race and difficulty paying for basics.

^aTest via logistic regression. ORs are calculated in models including age, race, and hormonal contraception use, or age and hormonal contraception, and each of the other characteristics.

^bTest via logistic regression.