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Association of Ethnicity with Involuntary Childlessness and Perceived Reasons for Infertility: Baseline Data from the Study of Women's Health Across the Nation (SWAN)

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Abstract

Objective—To evaluate whether ethnicity is associated with involuntary childlessness and perceived reasons for difficulties in becoming pregnant .

Design—Cross-sectional analysis of baseline data from a longitudinal cohort

Setting—Multiethnic, community-based observational study of US women

Patient(s)—3149 midlife women, aged 42-52

Main Outcome Measure(s)—Involuntary childlessness and perceived etiology of infertility

Result(s)—One hundred and thirty-three subjects (4.2%) were involuntarily childless, defined by a reported history of infertility and nulliparity. Ethnicity was significantly associated with self-reported involuntary childlessness. After controlling for economic and other risk factors, African-American (OR 0.30; 95% CI 0.15 – 0.59) and Chinese women (OR 0.36; 95% CI 0.14 – 0.90) were less likely to suffer from involuntary childlessness as compared to non-Hispanic Caucasian women.

Additionally, 302 subjects reported a perceived etiology of infertility. An unexpectedly large proportion of these women (24.5%, 74 out of 302) reported etiologies not known to cause infertility (i.e. tipped uterus, ligaments for tubes were stretched), with African-American women having been most likely to report these etiologies (OR 2.81; 95% CI 1.26 – 6.28) as the reason for not becoming pregnant.

Conclusion(s)—Ethnicity is significantly associated with involuntary childlessness and perceived etiology of infertility. Misattribution of causes of infertility is common and merits further consideration with respect to language or cultural barriers as well as possible physician misattribution.

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Keywords

childlessness; infertility; ethnicity

INTRODUCTION

In the United States, infertility (defined as failure to conceive after one year of regular unprotected intercourse) is estimated to affect 8-20% of couples (1, 2). Involuntary childlessness is associated not only with the traditional factors affecting fertility, such as reproductive aging and history of tubal disease, but also with sociocultural and economic characteristics, including access to health care, treatment seeking behavior, and perception of nulliparity.

Theories attempting to explain trends in childlessness have hypothesized that as countries become more developed, involuntary childlessness decreases due to a lower incidence of malnutrition and infectious diseases affecting the reproductive system. At the same time, however, rates of voluntary childlessness have been noted to escalate, likely due to increased educational and employment opportunities for women and delayed childbearing (3). The distinction between voluntary and involuntary childlessness begins to blur in some cases, as childbearing delayed beyond the mid-4th decade of life may become involuntary infertility due to diminished ovarian reserve (4).

A number of studies have investigated differences in childlessness and its involuntary component among various ethnicities. Mosher and Pratt used the data from the 1982 National Survey of Family Growth to analyze fecundity status and related factors (5). In this study, African-American women were twice as likely as Caucasians to have had pelvic inflammatory disease leading to infertility. While other studies have reported high rates of childlessness among African-Americans, this was at least partially attributed to social factors, such as less time spent in marriage (6, 7). In addition, an emerging body of literature points toward reduced access to infertility care among US ethnic minorities (8). Taken together, the data imply that ethnic minorities have greater exposure to risk factors for infertility and have reduced access to treatment.

A comprehensive understanding of involuntary childlessness and ethnicity necessitates a close look at differences in etiology of infertility. However, ethnic differences in women's self-reported perception of their own infertility, and whether they know of its etiology at all, have rarely been examined. The Study of Women's Health Across the Nation (SWAN) is an appropriate platform to elucidate the sociocultural factors and ethnic differences associated with involuntary childlessness and etiology of infertility as it represents a large, multiethnic cohort of women that collected detailed information on reproductive history.

METHODS

The Study of Women's Health Across the Nation (SWAN)

The SWAN, a multiethnic, multi-center longitudinal study of women as they progress through menopausal transition, has been previously described (9). Screening surveys were administered by telephone to women selected from a sampling frame based on random digit dialing (Los Angeles, Pittsburgh, New Jersey) or household lists (Boston, Chicago, Detroit, Oakland). Of the eligible women, 3302 were recruited (51%). At each site, approximately half of the women were of one of the four purposely-sampled ethnic backgrounds (African American, Chinese, Japanese, or Hispanic), in addition to Caucasians. Eligibility criteria included: age 42-52, at least one menstrual period and no hormonal therapy within the prior

three months, intact uterus and at least one ovary. Institutional Review Board (IRB) approval for SWAN was obtained from all appropriate institutions.

Definitions of fertility parameters

History of infertility was ascertained by the question “Have you ever had a period of 12 months when you could not get pregnant although you were attempting to get pregnant or were letting yourself get pregnant?” The respondents were further probed by the question “Did a doctor give you a reason why you were not getting pregnant?” Those who responded affirmatively were asked to fill in a reason. Abstraction of this write-in variable was done by two reviewers independently (NS, AJP). Available responses were abstracted to fit into the known causes of infertility: unexplained, tubal factor, male factor, anovulation, diminished ovarian reserve, endometriosis and uterine factor. Some answers represented attributes not medically known to cause infertility (such as ‘tipped uterus’) and were coded as a distinct category. Disagreements were adjudicated (inter-observer correlation of 94%). The following dichotomous variables were created: use of fertility medications, history of eating disorders, and history of salpingitis.

Menstrual regularity was ascertained and a oligomenorrhea variable was created (any history of amenorrhea ≥ 3 months not related to pregnancy or breast-feeding vs. none). Continuous oral contraceptive (OCP) use between the ages of 25 to 35 was also ascertained. Sexual practices were addressed by asking, ‘Who have you have generally had sex with over your adult lifetime?’ All responses stating that a participant “never had sex” or had “sex with a woman” were used to create a corresponding variable: report of sexual preference for women or not sexually active vs. else (defined as preference for men or sex with men and women). This re-coded variable is referred to as “not sexually active or predominantly homosexual sex”.

Demographic and lifestyle factors

Race/ethnicity was self-identified. Marital status was dichotomized as ever married vs. never. Smoking was dichotomized as ever vs. never. Education was dichotomized based on college attendance. Socioeconomic status was categorized into 2 levels based on ability to pay for basic needs, such as food and shelter. Income was categorized into low income ($< \$35,000$ annually), middle income ($\$35,000 - \$74,999$ annually), and high income ($\$75,000$ or higher annually).

Outcomes

Involuntary childlessness was used as a descriptor of self-reported unresolved infertility. Participants who reported a history of infertility and were nulliparous were deemed involuntarily childless. Perceived etiology of infertility was used as a descriptor of self-reported reasons for “not getting pregnant” as given to the participants by a physician.

Analytic sample

Of the total SWAN cohort of 3302 women, 153 women were excluded from this analysis because of missing pregnancy history and/or missing infertility history. Therefore, the final analytic sample included 3149 women. Data from 302 of these women (subjects who reported a history of infertility and stated a given etiology of infertility) were included in our analyses regarding self-reported etiology of infertility.

Statistical analysis

Associations between demographic and clinical characteristics of the cohort by ethnicity were assessed using the Student t-test, ANOVA or the Kruskal-Wallis test for continuous

variables and chi square or Fisher's exact tests for categorical variables. To evaluate the independent association of ethnicity on the outcomes, multivariable logistic models were specified using model-building strategies suggested by Hosmer and Lemeshow (10). Sensitivity analyses were conducted by excluding those who reported history of continuous OCP use, and those who reported a history of fertility drug use. Lastly, a combined sensitivity analysis was performed, excluding all of the above-mentioned groups. All statistical tests used a two-tailed alpha of 0.05. All analyses were performed using SPSS 17.0 (SPSS Chicago, IL).

RESULTS

Table 1 describes the demographics and fertility determinants of the cohort by ethnicity. In almost every case, significant differences in known risk factors for infertility were reported among various ethnic groups. Prevalence of self-reported history of fallopian tube infection was highest among African-American women. Considerable differences in demographic variables were also evident, with Caucasian and Japanese women having been more likely to attend college, and along with Chinese women, more likely to possess private insurance. African-American women had the youngest median age at the time of their first birth, while Chinese and Japanese subjects were the oldest.

One hundred and thirty-three subjects were involuntarily childless, defined by a reported history of infertility and nulliparity. African-Americans had the lowest prevalence of involuntary childlessness (1.8%), while Caucasian and Japanese women had the highest prevalence (5.6% and 7.7%, respectively). Results are similar when history of infertility alone is analyzed, although rates of infertility are higher than rates of involuntary childlessness. Women with involuntary childlessness were also more likely to report a higher income, attend college, hold private insurance, and report a history of fallopian tube infection (table 2a). Risk factors associated with history of infertility are demonstrated in table 3.

Multiple logistic regression demonstrated that ethnicity remained significantly associated with involuntary childlessness after adjustment for adult body mass index, measures of socio-economic status, history of fallopian tube infection, and oligomenorrhea (table 2b). Notably, African-American and Chinese women were less likely to be involuntarily childless as compared to Caucasian women ($p = < 0.001$ and 0.028 , respectively). Additionally, the adjusted odds ratios of African-American and Chinese women for the outcome of involuntary childlessness were not sensitive to the variables 'history of fertility drug use,' 'ever use of birth control pills,' or 'use of birth control pills to prevent pregnancy,' as demonstrated by sensitivity analyses excluding these populations separately and combined (data not shown).

In an attempt to clarify differences in reported infertility among various ethnic groups in the SWAN baseline cohort, further analyses were performed on a subset of data obtained only from women who described a history of infertility and who provided a reported etiology for their infertility ($n = 302$). Ethnicity was significantly associated with reported male factor infertility and reported attributes not known to cause infertility. Caucasian and Japanese subjects had the highest rates of reported male factor infertility and the lowest rates of reporting an etiology not known to cause infertility as compared to Chinese, African-American and Hispanic women (table 4). Additionally, among women with a history of infertility, no significant difference in ethnicity was found among subjects who did and did not report a known etiology for their infertility ($p = 0.069$, data not shown).

After adjustment for socio-economic status via multivariable analysis (table 4), African-American women were almost 3 times more likely to report an etiology not known to cause infertility as compared to their Caucasian counterparts, and less likely to report male factor infertility.

DISCUSSION

In concert with extant literature, involuntary childlessness and perceived etiology of infertility in the SWAN cohort were profoundly intertwined with ethnicity, as evidenced by multivariate models demonstrating these associations after controlling for economic and other known risk factors for infertility. We found that African-American and Chinese women were less likely to be involuntarily childless as compared to Caucasian subjects. These results are in contrast to other studies reporting that African-American and Asian women have higher rates of infertility than their white counterparts (1, 11-15).

One possible reason for our departure from results of previous studies may be the changing demographic of African-American women today. Seventy-five percent of African-American subjects in SWAN attended college, 78% held private insurance, and 41% earned between \$35,000 and \$74,999 annually. Many of the reports quoting high rates of childlessness and tubal infections in African-American women were published in the 1970s and 1980s, when social and demographic characteristics of the African-American population were different than they are today (5, 6).

In the setting of the National Survey of Family Growth, Stephen and Chandra observed a greater prevalence of infertility among Hispanic and non-Hispanic black women (1). Although their study is one of the largest to date, their results have been debated (2). Stephen and Chandra defined infertility as existing in married women of reproductive age who were sexually active, not using contraception, and did not conceive a child within the year prior to screening. Significantly, desire for pregnancy or history of infertility prior to the 12 months' timeline was not considered. Through construction of this infertility variable, true infertility rate may have been skewed by including unmarried women and sterilized women in the denominator but not in the numerator (2). In addition, differences in marital status and contraception use among various ethnicities would affect the reported fertility rate.

In contrast to these findings, our data suggest that African-American women are less likely to suffer from involuntary childlessness as compared to Caucasian women. This inconsistency may be due to a number of factors, including choice of dependent variable. We chose to use involuntary childlessness as our outcome of interest. Defined as reported history of a 12 month period of failure to conceive despite attempts to become pregnant PLUS lifetime nulliparity, involuntary childlessness has a strong objective component (nulliparity) while still capturing stated attempts to become pregnant. Furthermore, unresolved infertility is reported in the literature to be affected by infertility treatment and, therefore, by those factors which affect access to healthcare and ART outcomes (16, 17). Of note, our conclusions are similar even when using reported history of infertility alone as the dependent variable. Indeed, African-American women were less likely to report a history of infertility as compared to other ethnicities ($p = 0.023$, data not shown).

A potential explanation may involve a previously reported finding that African-American adolescents, on average, initiate sexual activity at an earlier age compared to Caucasian adolescents (18).) In our study, African-American subjects were younger at the age of their first birth as compared to other ethnicities and may have completed childbearing earlier, thus mitigating age-related subfertility. Indeed, aging is a well documented risk factor for

diminished ovarian reserve (19), and may be related to other etiologies of infertility such as cumulative risk for pelvic infection (20) and increasing incidence of endometriosis (21).

Our second notable finding was a high prevalence in attributes not known to cause infertility as the explanation for “not getting pregnant” among African-American women. We have included a supplementary table detailing a few examples of such attributes. In our cohort, although Caucasian ethnicity was not related to whether or not a subject reported an etiology for infertility, it was significantly associated with attributes not known to cause infertility. African-American women were significantly more likely to report an etiology not known to cause infertility, as compared with Caucasian women. This may illustrate differences in physician attitude toward infertility among various ethnic groups. Medical providers may not take infertility in African-American women as earnestly, as it is sometimes perceived by medical providers as an issue mainly affecting Caucasian women (22). As such, providers may not perform a thorough work-up, inadvertently encouraging erroneous perceptions of infertility in their African-American patients. Finally, decreased access to care among African-American women may cause them to seek treatment from physicians who lack subspecialty qualification and are therefore potentially less effective in communicating a correct diagnosis (23).

The strengths of our study lie in the large numbers and ethnic diversity of the SWAN cohort. Limitations of the study include the cross-sectional design, as in such analyses one may not ensure that a given exposure precedes the outcome. However, our primary outcome (childlessness) has been chosen to reflect an objective event (absence of children). Factors meriting further consideration include potential impact of cultural and/or language barriers on self-reported involuntary childlessness and etiology of infertility.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographics and fertility determinants of SWAN baseline cohort by ethnicity (expressed as percentage within race (n), p value results from chi-square test unless otherwise noted)

Characteristic	Caucasian (n=1508)	African- American (n=913)	Chinese (n=248)	Hispanic (n=258)	Japanese (n=222)	p-value
Demographic parameters						
Ever Married	88.1(1327)	78.5(717)	91.1(226)	94.2(242)	91.4(203)	<0.001
Age at first birth ¹ (years; median (IQR))	26(9)	20(7)	28(6)	22(7)	29(7)	<0.001
Income Level	21.0(312)	42.1(369)	21.0(51)	81.1(202)	11.7(25)	<0.001
Low						
Middle	44.5(661)	41.4(363)	43.6(106)	14.9(37)	40.4(86)	
High	34.6(514)	16.4(144)	35.4(86)	4.0(10)	47.9(102)	
College Attended	84.7(1271)	74.7(674)	71.0(176)	28.8(74)	85.6(190)	<0.001
Private Insurance	90.8(1368)	78.3(714)	99.6(247)	36.0(93)	94.6(210)	<0.001
Hard to pay for basics	32.0(481)	46.4(421)	28.2(70)	81.7(210)	29.7(66)	<0.001
Fertility parameters						
Ever Smoking	48.2(727)	46.9(428)	5.6(13)	34.1(87)	36.8(81)	<0.001
Oligomenorrhea	18.4(274)	17.3(157)	10.9(27)	5.2(13)	14.4(32)	<0.001
OCP use from ages 25 to 35	6.3(95)	9.7(89)	10.1(25)	12.4(32)	4.1(9)	<0.001
Fallopian Tube Infection	3.1(46)	9.1(80)	2.4(6)	3.5(9)	2.3(5)	<0.001
BMI at baseline ² (kg/m ² ; mean(S.D.))	27.8(6.83)	31.8(7.76)	23.3(4.00)	29.5(5.97)	23.1(3.77)	<0.001
Anorexia	1.4(21)	0.4(4)	0.4(1)	0.4(1)	0.0(0)	0.038
Bulimia	0.7(11)	0.3(3)	0.0(0)	0.4(1)	0.5(1)	0.494
Not sexually active or predominantly homosexual sex	3.5(52)	1.2(11)	5.2(12)	0.8(2)	0.9(2)	<0.001

Characteristic	Caucasian (n=1508)	African- American (n=913)	Chinese (n=248)	Hispanic (n=258)	Japanese (n=222)	p-value
Involuntary Childlessness	5.6(84)	1.8(16)	2.8(7)	3.5(9)	7.7(17)	<0.001
History of infertility	25(377)	21(192)	20.6(51)	22.5(58)	31.1(69)	0.010

¹ Results expressed in median (interquartile range), with p-value results from the Kruskal-Wallis Test

² Results expressed in mean (standard deviation), with p-value results from ANOVA.

Post hoc comparisons: Age at first birth: AA vs. Hispanic p=0.0042; Chinese vs. Japanese p= 0.8150. All other comparisons p<0.001. Using a conservative Bonferroni correction a p<0.005 is statistically significant.

BMI: Caucasian vs. Hispanic p=0.002; Chinese vs. Japanese p=0.995. All other comparisons p<0.001.

Table 2a

Characteristics and risk factors associated with involuntary childlessness, univariate analyses (Results expressed in percentage (n), p value results from chi-square test unless otherwise noted)

Variable	No Involuntary Childlessness (n=3016)	Involuntary Childlessness (n=133)	p-value
BMI ¹ (kg/m ² ; mean(S.D.))	28.4(7.24)	26.9(7.14)	0.020
History of Anorexia ²	0.9(26)	0.8(1)	1.000
History of Bulimia ²	0.5(16)	0.0(0)	1.000
Income			
Low	31.8(933)	19.8(26)	0.003
Middle	40.8(1199)	41.2(54)	
High	27.4(805)	38.9(51)	
College Attended	75.8(2273)	84.2(112)	0.027
Not sexually active or predominantly homosexual sex ²	2.7(78)	0.8(1)	0.259
Private Insurance	83.2(2509)	92.5(123)	0.005
Ever Smoking	42.7(1279)	43.2(57)	0.914
Oligomenorrhea	15.9(475)	21.5(28)	0.086
OCP use from ages 25 to 30	8.0(242)	6.0(8)	0.401
Fallopian Tube Infection	4.5(132)	10.6(14)	0.001
Difficulty paying for basics	40.6(1220)	21.2(28)	<0.001
Ever Married	86.1(2593)	91.7(122)	0.063

¹ Results expressed in mean (standard deviation), p-value results from t-test.

² p-value results from Fisher's exact test.

Table 2b

Association of Involuntary Childlessness with Fertility and Demographic Parameters, Multivariable-Adjusted Odds Ratios (95% CI). ³

Variable	Adjusted Odds Ratio	95% Confidence Interval	p-value
African-American ⁴	0.301	0.153 – 0.590	<0.001
Chinese ⁴	0.355	0.141 – 0.895	0.028
Hispanic ⁴	0.858	0.300 – 2.450	0.774
Japanese ⁴	1.684	0.738 – 3.842	0.216
BMI	0.990	0.960 – 1.020	0.502
Private Insurance	1.543	0.662 – 3.596	0.315
College Attended	1.386	0.800- 2.404	0.245
History of Fallopian Tube Infection	3.509	1.860 – 6.620	<0.001
Hard to Pay for basics	0.439	0.266- 0.722	0.001
History of oligomenorrhea	1.511	0.964 – 2.368	0.072
Ever married	1.821	0.889 – 3.729	0.101

³ Multivariable adjusted odds ratio, adjusted for study site, income, ethnicity, BMI, private insurance, college attendance, history of fallopian tube infection, hard to pay for basics

⁴ Compared to Caucasian Women

Table 3

Characteristics and risk factors associated with history of infertility (Results expressed in percentage (n), p value results from chi-square test unless otherwise noted)

Variable	No history of infertility (n=2402)	History of infertility (n=747)	p-value
BMI ¹ (kg/m ² ; mean(S.D.))	28.5(7.29)	28.1(7.09)	0.267
History of Anorexia	0.9(22)	0.7(5)	0.522
History of Bulimia ²	0.6(14)	0.3(2)	0.387
Income			0.002
Low	32.8(768)	26.3(191)	
Middle	40.5(948)	42.1(305)	
High	26.8(627)	31.6(229)	
College Attended	75(1790)	80.2(595)	0.003
Not sexually active or predominantly homosexual sex	3.2(74)	0.7(5)	<0.001
Private Insurance	82.5(1979)	87.4(653)	0.001
Ever Smoking	42.8(1019)	42.6(317)	0.941
Oligomenorrhea	14.5(344)	21.4(159)	<0.001
OCP use from ages 25 to 30	8.4(201)	6.6(49)	0.112
Fallopian Tube Infection	4.0(95)	7.0(51)	0.001
Difficulty paying for basics	40.2(963)	38.3(285)	0.341
Ever Married	84.0(2015)	93.8(700)	<0.001

¹ Results expressed in mean (standard deviation), p-value results from t-test.

² p-value results from Fisher's exact test.

Perceived Etiology for Infertility by Ethnicity (expressed in percentage within ethnicity (n), p value results from Fisher's exact unless otherwise noted)

Table 4

Characteristic	Caucasian (n=164)	African- American (n=82)	Chinese (n=15)	Hispanic (n=20)	Japanese (n=21)	p-value
Unexplained (n=11)	3.7(6)	1.2(1)	6.7(1)	5.0(1)	9.5(2)	0.197
Tubal (n=70)	20.7(34)	30.5(25)	13.3(2)	20.0(4)	23.8(5)	0.446
Male (n=54)	24.4(40)	8.5(7)	6.7(1)	5.0(1)	23.8(5)	0.006
Male adjusted Odds Ratio (95% CI) ¹	1.00 ²	0.26 ² (0.10-0.66)	0.61 ² (0.05- 7.53)	0.28 ² (0.02-3.55)	2.77 ² (0.47-16.4)	-----
Anovulation (n=43)	16.5(27)	13.4(11)	6.7(1)	15.0(3)	4.8(1)	0.667
DOR (n=21)	6.7(11)	4.9(4)	13.3(2)	5.0(1)	14.3(3)	0.356
Endometriosis (n=20)	7.9(13)	6.1(5)	6.7(1)	0	4.8(1)	0.854
Uterine (n=9)	1.8(3)	3.7(3)	6.7(1)	5.0(1)	4.8(1)	0.314
Attributes not known to cause infertility (n=74)	18.3(30)	31.7(26)	40.0(6)	45.0(9)	14.3(3)	0.009
Attributes not known to cause infertility adjusted Odds Ratio (95% CI) ¹	1.00 ²	2.81 ² (1.26-6.28)	1.53 ² (0.37- 6.30)	2.42 ² (0.40- 14.56)	0.42 ² (0.09-2.03)	-----

¹ Adjusted for study site and marital status, socio-economic status and private insurance

² Compared to Caucasian Women