The Relationship Between Offspring Sex Ratio and Vasectomy Utilization

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OBJECTIVE To determine if there was an association between vasectomy utilization and offspring sex ratio (male offspring : total offspring), as offspring sex preference may have an impact on family planning in the United States.

METHODS Using data from the National Institutes of Health-AARP Diet and Health Study, we calculated the number of sons and daughters of all men stratified by vasectomy status. We utilized a logistic regression model to determine if vasectomy utilization varies based on offspring sex ratio while accounting for known factors that impact vasectomy utilization.

RESULTS Of these men, 30,927 (30.8%) underwent vasectomy. Marital status, race, age, education level, region or state, and number of offspring were all significantly correlated with vasectomy utilization ($P < .01$). The sex ratio for vasectomized fathers (51.3%) was significantly higher than for fathers who had not undergone vasectomy (50.7%, $P < .01$). This difference remained even after we stratified by the total number of offspring: vasectomized men with 4 or more children had a sex ratio of 947 girls per 1000 boys, whereas the no vasectomy group had a sex ratio of 983 girls per 1000 boys ($P < .01$). For men with at least 2 children, each additional son increased the likelihood of vasectomy by 4% ($P < .01$), whereas each additional daughter led to a 2% decrease in vasectomy utilization ($P = .03$).

CONCLUSION Vasectomized fathers have a higher proportion of sons compared with non-vasectomized fathers, suggesting that offspring sex ratio is associated with a man's decision to undergo vasectomy. Further research is indicated to understand how offspring sex ratio impacts a man's contraceptive decisions. UROLOGY ■■: ■■–■■, 2016. © 2016 Elsevier Inc.

Surgical sterilization is a common method of primary contraception in the United States.[1] Due to its relative ease, high efficacy, and low complication rate, vasectomy is an important option for couples interested in pregnancy prevention.[2,3] Approximately 300,000-500,000 vasectomies are performed annually in the United States; however, the factors that are associated with vasectomy utilization are not completely understood.[4,5]

Although socioeconomic and demographic factors including age, number of biological children, ethnicity, education, and religion have been found to be associated with vasectomy and tubal ligation, other factors may also be important.[6] The sex of the offspring may also be important, and its role has yet to be evaluated.

Data from the general US population suggest that there is a slight preference toward sons,[7] and this trend has been observed in other Western countries as well.[7,8] Likewise, this sex preference exists in Eastern countries. For example, a recent study from India suggests that the preference for sons has led to an increase in the selective abortion of girls.[9] However, the relationship between offspring sex and contraception is unknown.

Given that vasectomy is an important contraceptive option for millions of couples in the United States, further investigation into the factors associated with its utilization is important. As offspring sex preference may influence family planning, we hypothesize that there may be a relationship between vasectomy utilization and a man's offspring sex ratio (male offspring : total offspring).

METHODS

Study Population

From 1995 to 1996, 3.5 million members of the AARP aged 50-71 and living in 1 of the 6 states (California, Florida, Louisiana, New Jersey, North Carolina, and Pennsylvania) or 2 metropolitan areas (Atlanta, Georgia, and Detroit, Michigan) were mailed a questionnaire on medical history and lifestyle characteristics to initiate the National Institutes of Health (NIH)-AARP Diet and Health Study[10] (Supplementary Fig. S1). AARP, formerly the American

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Association of Retired Persons, is a United States-based non-governmental organization and interest group composed of people age 50 and over. In late 1996, a supplementary survey was mailed to those participants who had successfully completed the baseline survey and did not have prostate, breast, or colon cancer at baseline. The additional questionnaire asked questions regarding the number of offspring. Beginning in 2004, a final questionnaire was sent to all living participants in the baseline cohort and queried men regarding their vasectomy status.

Identification of Vasectomy Status

On the final questionnaire, individuals were asked: "Have you ever had any of the following procedures performed?" This included a subsection titled "Vasectomy (MALES ONLY)" on the list of procedures. Men were dichotomized based on vasectomy status.

Assessment of Offspring Number

Information on offspring number was assessed by self-report on the follow-up questionnaire. The survey asked the following questions: "How many sons do you have, both living and deceased? Include blood relatives only." "How many daughters do you have, both living and deceased? Include blood relatives only." The total offspring number was generated by summing the results of total sons and daughters. We collapsed fathers with 4 or more offspring into 1 category because there were a low number of men with high numbers of offspring.

Statistical Analysis

After stratification based on vasectomy status, the characteristics of the subjects were compared. Chi-square tests were used to evaluate the association between categorical variables. Analysis of variance was used to compare continuous variables. The total number of male and female offspring of all the subjects was calculated and combined based on vasectomy status. Offspring sex ratios (male offspring : total offspring) were calculated. Chi-square tests were used to compare offspring sex ratios. Analyses were performed in aggregate and were stratified based on the total offspring number. Multivariable logistic regression was used to estimate the relationship between offspring sex and vasectomy utilization. Covariates that have been consistently shown in the literature to affect vasectomy utilization were selected for inclusion a priori, including birth cohort, race (categorical: white, black, Hispanic, other), education (categorical: less than high school, high school and some college, college or higher than college education), marital status (ever married vs never married), median household income for zip code of the retiree (continuous), and state of residence. Linear trend tests were based on ordered categorical variables in the model after replacing each category with the mean of the original variable. All statistical tests were two-sided and *P* values less than .05 were considered to be statistically significant. SAS (version 9.3, SAS Institute, Inc, Cary, NC) was used for all analyses.

RESULTS

Among the 100,363 men with both offspring status and vasectomy data available for analysis, a total of 30,927 (30.8%) reported having undergone vasectomy. A number of respondent characteristics were associated with vasectomy utilization, including marital status, race, age, education level, region or state, number of offspring, and median income (Table 1). Men who were married or had been married underwent vasectomy at a rate of 31.8% compared with 1.6% of men who were never married ($P < .01$). White men underwent vasectomy 31.4% compared with only 12.6% for black men and 24.6% for all other ethnic groups ($P < .01$). Birth cohort also correlated with vasectomy usage. Men born before 1935 underwent vasectomy less frequently than those born after this. Among men with at least a high school degree, 31.1% had vasectomy compared with 23.2% of men with less than 12 years of education. The more children men fathered, the more likely they were to undergo vasectomy, which plateaued around 3 children. In addition, fathers who came from larger families (>4 siblings) used vasectomy less than those who had fewer siblings ($P < .01$). There was a large variation of vasectomy usage with respect to state of residence. A vasectomy rate of 42.8% in California was seen compared with 18.2% of men in New Jersey ($P < .01$).

The ratio of sons to total offspring (sex ratio) was significantly different between men who had vasectomy and those who had not (51.3% vs 50.6%, $P < .01$; Table 2). Per 1000 sons, vasectomized men sired 974 girls, compared with 948 girls for non-vasectomized men. This difference remained statistically significant as we stratified by the total number of offspring ($P < .01$). For example, among men with at least 4 children, vasectomized men had a higher sex ratio compared with non-vasectomized men (51.4% vs 50.4%, $P < .01$).

Next we compared fathers with children of only 1 sex. All fathers with at least 1 child were less likely to have vasectomy if they either had no daughter (odds ratio [OR] = 0.88, 95% confidence interval [CI]: 0.84-0.91) or no son (OR = 0.85, 95% CI: 0.82-0.89) (Table 3), consistent with the relationship of offspring number with vasectomy utilization. However, as the number of offspring increased, the relationship differed for men without sons compared to those without daughters. For example, for men with 2 or more children, a man with only daughters (ie, no sons) had a 6% lower odds of utilizing vasectomy (OR = 0.94, 95% CI: 0.90-0.99) compared to a man with sons. In contrast, a man with only sons (ie, no daughters) had no difference in the odds of vasectomy utilization (OR = 1.00, 95% CI: 1.00-1.04) compared to a man with daughters. A similar trend was seen for higher numbers of offspring.

As many factors can impact vasectomy, we created a multivariable model to account for sociodemographic factors known to impact vasectomy utilization. Again, as the number of children increased, the odds of a vasectomy increased. Although no association between offspring sex and vasectomy utilization was found in men with few children (eg, 1), as the number of offspring increased, the like-