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Abstract

The issue of abortion is defined by ethical questions and, often, controversial views. This paper argues the importance of a coherent and enhanced effort to study the quantitative relationship between women's characteristics and the average number of abortions in the United States. It specifically looks at the average number of previous abortions and socioeconomic and demographic characteristics, as this relationship has not been explored before in the existing literature. We expect to establish a correlation between the average number of previous abortions and characteristics such as age, marital status, income and highest degree of education completed. An empirical model is developed, and then studied using regression analysis. Even though this study has limitations stemming from the nature of the data and the methodology employed, it illustrates that variables such as age, marital status, religion and education, employment status, income, and metropolitan status do influence the number of previous abortions a woman has had. The broader implications of this study suggest that the issue of abortion should be addressed with a clear focus on the most interested party, namely, women.

Keywords

abortion, women's rights, female demographics, socioeconomic status

A LOOK AT WOMEN AND ABORTION IN THE UNITED STATES

Denitsa Koleva, Kristina Marinova, Robyn Byrne

Abstract:

The issue of abortion is defined by ethical questions and, often, controversial views. This paper argues the importance of a coherent and enhanced effort to study the quantitative relationship between women's characteristics and the average number of abortions in the United States. It specifically looks at the average number of *previous* abortions and socioeconomic and demographic characteristics, as this relationship has not been explored before in the existing literature. We expect to establish a correlation between the average number of previous abortions and characteristics such as age, marital status, income and highest degree of education completed. An empirical model is developed, and then studied using regression analysis. Even though this study has limitations stemming from the nature of the data and the methodology employed, it illustrates that variables such as age, marital status, religion and education, employment status, income, and metropolitan status do influence the number of previous abortions a woman has had. The broader implications of this study suggest that the issue of abortion should be addressed with a clear focus on the most interested party, namely, women.

I. Introduction

This study examines the relationship between socioeconomic and demographic characteristics in women who seek an abortion and the number of legal induced abortions¹⁴ in the United States. Furthermore, it attempts to quantify and estimate this relationship with the objective of identifying which characteristics exhibit the most significant influence on the number of abortions. The moral, ethical, and political aspects of abortion have polarized American society since the landmark 1973 decision in *Roe v. Wade*, which established that most laws against abortion violate a woman's constitutional right of privacy under the Fourteenth Amendment. Advances of various magnitudes, such as The Partial Birth Abortion Ban Act signed by President George W. Bush in 2003, have been made against a woman's right to choose and to receive adequate abortion services. Thus, current public policy on abortion arguably strongly reflects partisan subjectivity on this issue.

This study reflects the authors' concern about the lack of objectivity and sufficient scientific evidence in the public discourse on abortion relating the average number of previous abortions to the profiles of women who seek one. The specific question of interest - which demographic and socioeconomic characteristics influence the average number of previous abortions in the United

14 A legal induced abortion is defined as "a procedure, performed by a licensed physician or someone acting under the supervision of a licensed physician, that was intended to terminate a suspected or known intrauterine pregnancy and to produce a nonviable fetus at any gestational age" (Strauss, 2004)

States, represents the authors' conviction that a better understanding of the women who choose to terminate a pregnancy will promote less bias in the attitudes on this issue in American society. The approach of this paper differs from the models in the existing literature because it aims at estimating the relationship between socioeconomic characteristics and the average number of *previous* abortions as opposed to the average number of total abortion for a woman in the US. Furthermore, this question is particularly interesting in the context of the recent change in the political landscape with the election of President Barack Obama who has already expressed his readiness to alter the direction of public policy on the issue by signing an executive order that allows international health organizations who promote or perform abortions to resume receiving funding from the US (Baker, 01/24/2009)¹⁵. It is important to study the relationship between the characteristics of women who seek an abortion and the average number of abortions as the results are used by policymakers to provide adequate and timely programs that best address the needs of the most affected party - women. In addition, relevant scientific evidence on this question will allow the general public to objectively assess the issue of abortion in its entirety, rather than regard it only with moral judgment.

This article provides a quantitative examination of the relationship between specific demographic and socioeconomic characteristics and the average number of previous abortions of a sample of women in the United States during the second half of 2000 and the first half of 2001. The study strives to promote a better understanding of the women who seek an abortion. It also aims at providing valuable information to policymakers and family planning agencies with the objective of improving the access to contraceptive and support services of groups where a recurrent pattern of demographic and socioeconomic characteristics is observed. The existing literature on the subject (economic, sociological, anthropological, psychological) is scant, with more in-depth research studies on the political/legal aspects of abortion, public attitudes towards it, and the effect of provider availability and legislature on demand, instead of focusing on who actually obtains an abortion.

The most contemporary and thorough analysis of the various characteristics of women who seek abortion is presented in *Patterns in the Socioeconomic Characteristics of Women Obtaining Abortions in 2000-2001* by Rachel K. Jones, Jacqueline E. Darroch and Stanley K Henshaw. However, further analysis on the topic should be made focusing on how external factors influence the average number of previous abortions in the US. Thus, this project provides a coherent and enhanced overview of the characteristics of women who seek an abortion and is justified as a response to the existing scarcity of recent and relevant scientific attention to the issue. In addition, there is an overarching bias in the contemporary discourse on abortion identified as the expression of subjective perceptions rather than the advancement of quantitative results derived

¹⁵ This effectively repeals the Global Gag Rule on abortion, which was one of the first acts of the Bush Administration in 2001.

with scientific methods. An underlying explanation for this is the nature of the questions surrounding abortion which are often distinctly ethical, moral and very personal. Nevertheless, this article expresses our determination to deepen the existing economic, sociological, and psychological understanding of the women who seek an abortion by presenting quantitative findings rather than promoting subjective and, often, extreme opinions.

Furthermore, there is a clear lack of continuous efforts on the state and national levels to compile extensive demographic and socioeconomic profiles of the women who obtain abortions. Such information is being collected on an individual basis by each state without an overarching regulatory body. In order to devise policy which is well-suited to the needs of those women, there should be extensive information on the characteristics that define them. The importance of such information can be demonstrated by establishing a relationship between the demographic and socioeconomic characteristics and the number of abortions. The clear existence of such a relationship will persuade state and national governmental organizations to gather data on the characteristics of interest and devise more efficient policy to address the needs of women who seek abortions. Furthermore, since this study examines the relationship between socioeconomic characteristics and the average number of previous abortions, we would like to establish if there are significant inconsistencies between our results and the existing literature on the subject.

In Section II, the objective and justification for research are discussed. Section III reviews the existing literature on the subject. Section IV describes and summarizes our data. Section V outlines the methodology employed. Section VI presents our results. Finally, Section VII provides some concluding remarks and suggestions for further research on the topic.

III. Literature Review

The scope of our literature review is limited. The literature on the interactions between the characteristics of women who seek a legal abortion and the actual number of abortion incidences in the United States generally studies demographic indicators such as age, race, education, income, and marital status. Other variables of interest include the number of previous births and the number of previous abortions. This is clearly observed in Strauss, 2004, Henshaw, 1983, Henshaw, 1985, Henshaw, 1991, Henshaw 2001¹⁶. Those studies provide detailed summary statistics for the variables corresponding to all of the discussed characteristics with a varying degree of accuracy. A common trait of these studies, and a possible limitation, is the methodology employed – the authors obtain their

¹⁶ The three articles published by Stanley K. Henshaw and a number of other researchers for The Alan Guttmacher Institute in 1983, 1985 and 1991, are very similar in structure, methodology and findings. However, it is important to discuss them as they represent the continuous efforts of the Guttmacher Institute to observe any general trends in the patterns of the socioeconomic and demographic characteristics of women who obtain an induced abortion. Furthermore, organizational differences exist between those articles and the most recent study produced by the AGI. In addition, Henshaw, 2001 presents a more in-depth and timely analysis of the subject. Thus, Henshaw, 2001 is studied separately, while the three previous studies of the AGI are grouped together.

findings by studying frequency distributions or by cross tabulation. Recently, those studies have confirmed that white, unmarried, young (<25yrs.) women are most likely to obtain an induced abortion, but the actual interaction between those particular characteristics and the number of average number of previous abortions is not discussed. The articles also do not identify the characteristics which are the most influential on the number of abortions obtained. The findings are descriptive in nature. No relationship between the variables and the average number of abortions is established as none of these studies employ more complex methodology such as linear or multivariate regression analyses.

A relevant response to this is found in Trent and Powel-Griner, 1991. The data employed are not released by the traditional sources – Center For Disease Control and Prevention (CDC) or The Alan Guttmacher Institute (AGI), which study only aggregate data on abortion. Thus, the Trent study can be classified as independent from the mainstream literature on the subject (AGI or CDC), because its data is obtained from the National Center for Health Statistics (NCHS). The individual-level data allowed for an increased analytical depth, as the authors were able to make detailed cross-classification, reclassify individual variables, and combine vital statistics on pregnancy outcomes. It presents a complex model that uses log-linear techniques with several interactions that focused on detailed characterization of variables and multivariate analysis. Each of the models constructed within the Trent study tested for fit-specified saturated relationship among the independent variables. The final model gives a complex seven-way or saturated relationships among the independent variables and, also, with seven three-way terms and two two-way terms.

This approach proved successful because Trent and Powel-Griner, 1991 had access to individual-level data as opposed to aggregate data¹⁷. The individual-level data obtained from the NCHS permitted for detailed reclassification and cross-classification of the variables of interest. The findings of this study are important because they establish: (1) the relationship between race and abortion varies by marital status, parity¹⁸ and state of residence; (2) the relationship between marital status and abortion varies by education, parity and state residence; (3) the relationship between education and abortion varies by marital status and parity (Trent and Powel-Griner, 1991). Thus, Trent and Powel-Griner, 1991 mathematically evaluate the net effects of selected variables on abortion. Despite the statistical significance of those findings, it is important to discuss two specific aspects of the article. First, it differs from those published by CDC and AGI as the authors assume pregnancy outcomes as the units of the study. The sample combines data on live births, fetal deaths, and induced abortions; this is a different approach within which the main goal is to facilitate the multivariate analysis. This differentiates Trent and Powel-Griner from the Strauss and Henshaw studies, as those do not provide significant manipulation of data on live births or fetal deaths.

17 Aggregate data is presented in and discussed by Strauss, 2004; Henshaw, 1983; Henshaw, 1985; Henshaw, 1991; Henshaw 2002;

18 For a woman, the number of live births over the total number of pregnancies

A significant limitation is observed in Trent and Powel-Griner, 1991 as the NCHS sample they study provides only a basic list of demographic characteristics with important variables such as income, religion, and participation in the labor force not being included. In addition, two separate samples are used for adult and teenage women in order for the selected methodology to be employed. Such limitations render the significant findings by Trent and Powel-Griner, 1991 not nationally representative. A similar problem is observed in the CDC's annual Abortion Surveillance report from 2004 (See Strauss, 2004). In addition to the lack of complex mathematical methodology employed, the conclusions advanced by this report may not be representative of the population because the data obtained by CDC is released by the individual state health departments that gather some (but usually not comprehensive) information on the demographic and socioeconomic characteristics of women who seek abortion with a varying degree of completeness. Our study offers an improvement over the discussed papers as we believe that it is nationally representative given the nature of our data.

A further distinction can be drawn between Strauss, 2004 and Henshaw, 2001. Even though both studies compare its data and findings, it can be observed that the results presented by Henshaw, 2001 are more relevant and meaningful than those of Strauss, 2004 as the sampling procedure is more accurate. The studies performed by the AGI (see Henshaw, 1983, Henshaw, 1985, Henshaw, 1991, Henshaw 2002) rely on data gathered by directly contacting the abortion provider facilities and administering surveys to women prior to their having the medical procedure. Thus, the studies produced for the AGI are better suited to select a representative and thorough sample than the sample used by CDC.

In general, the quantitative research on the issue of abortion focuses on the demand for abortion and a woman's choice to have an abortion, the impact of state/federal legislation and provider availability on the average number of abortions, or on attitudes towards abortion. The study of how demographic and socioeconomic characteristics affect the average number of previous abortions is not in the focus of the academic literature. More comprehensive research on the subject of the relationship between characteristics such as age, race, education, income, marital status, number of previous abortions and the number of abortions would pose questions as to the possibility of quantifying such a relationship. There is also a need for further and more in-depth analysis of the factors that influence this relationship.

IV. Data Description and Summary Statistics

The study uses demographic, economic, and vital data that summarize the results obtained from 10,683 usable¹⁹ questionnaires administered at participating facilities in the United States by The Alan Guttmacher Institute (AIG) with the purpose of providing an overview of the characteristics of women who seek a legal abortion. The data is cross-sectional – 71% of the women in the sample

¹⁹ A total of 13,071 abortions were performed at the participating facilities for a usable-response rate of 82%. Such a response rate indicates that results of the survey are representative of the population.

obtained abortions during the second half of 2000. The remaining 29% of the procedures were performed during the first half of 2001.

Table 1: Average Number of Previous Abortions by Age

<u>Age by Midpoints</u>	<u>Num. Obs.</u>	<u>Mean</u>	<u>Std. Dev.</u>
14	6	0.19	0.43
16	128	0.75	0.79
18.5	587	0.69	0.74
22	2531	0.94	0.99
27	1996	1.21	1.29
32	1217	1.23	1.29
37	777	1.28	1.45
40	279	1.23	1.48
Total:	10,683		

Proper sample weights used

In order to gain better understanding of the demographic and socioeconomic characteristics present in the sample, summary statistics of several variables of interest including, age, race, religion, household income, and marital status, employment and metropolitan status, are studied. It is important to discuss the limitations of the data used in this paper as the dataset does not contain any information on birth outcomes (ex. live births) except for abortion. This limits the scope of our study, as the data permits only for an analysis of the relationship between socioeconomic characteristics and the average number of previous abortions.

The dataset also has a number of limitations resulting from the sampling procedure. Cluster sampling, stratified by provider, was performed. A thorough sampling frame of all hospitals, clinics and physicians’ offices where a legal abortion can be obtained was used. However, due to a low response rate at the initial randomly chosen facilities, second- and third-choice facilities had to be designated. The low response rate can be attributed to refusal to participate, failure to properly distribute the questionnaires or not enough time for the patients to complete them. To account for this a three-stage weighting process is designed, with individual-, facility-, and stratum-level weights assigned respectively. This is represented by the weight variable in the dataset. In our analysis, proper sample weights were applied where relevant, in order to attain nationally representative results.

The average age of the women surveyed is 25.4 years; however, it is more applicable to use the median age of 22 years as the distribution has a significant positive skew. On average, a woman between the ages of 20 and 24 is expected to have had almost 1 previous abortion. Women between the ages of 20 and 24 constitute the category with the highest frequency.

Furthermore, White women constituted 40.8% of the sample, followed by women who identified themselves as Black (31.4%) and Hispanic (20.7%). Though White women represented the largest proportion of the sample studied, on average they had .94 previous abortions, which is less than the mean number of previous abortions for all other categories, though with a small deviation from the mean. On average, a Black woman has had the largest mean number of previous abortions – 1.26 with a substantial degree of variation as compared to the other ethnic groups within the sample.

A substantial proportion of the women (39%) described themselves as Protestant, while as much as 27% indicated Roman Catholicism as their religious affiliation. On average, women who identified themselves as Jewish had the largest mean number of previous abortions - 1.52, though the effect of several outliers is observed, as this group also had the highest standard deviation from the mean. This raises questions as to how the issue of abortion is viewed within the context of different religions and what their true influence over the public discourse on abortion is.

Also, women residing in what is identified as the Southern part of the United States, notably represent the largest portion of all women in the sample with a frequency of more than 38%, while women who reside in the Northeast had, on average, the highest number of previous abortions – 1.27. In addition, the number of women employed in the month when they became pregnant was significantly larger than that of the unemployed. Also, if a woman was employed she had an expected number of 1.11 previous abortions as opposed to a mean of 1 for the unemployed women.

Table 2: Average Number of Previous Abortions by Race

<u>Race</u>	<u>Num. Obs.</u>	<u>Mean</u>	<u>Std. Dev.</u>
White	2,900	0.94	1.06
Black	2,594	1.26	1.31
Asian	392	1.13	1.24
Indian	78	1.17	1.48
Hispanic	1,557	1.03	1.18
Total:	7,521		

Proper sample weights used

The women studied, on average, had a previous birth and a previous abortion. This is interesting in the context of 67.2% of the women identifying their marital status in the survey as “never have been married”. Married women had on average almost one previous abortion, however, with a high degree of variation than women who have never been married. Furthermore, 97.5% have had four previous births or less, while the proportion of women who have had four induced abortions or less is slightly larger – 98.2%. When asked if they would like to have any children in the future, 51.4% of the women gave an affirmative answer. The mean income in the sample was \$29,931; however, the median of \$22,500 represents a better measure of the central tendency because the distribution has a significant positive skew. Last, nearly 89% of the women in the sample resided in a metropolitan area.

Table 3: Average Number of Previous Abortions by Marital Status

<u>Marital Status</u>	<u>Num. Obs.</u>	<u>Mean</u>	<u>Std. Dev.</u>
Married	1,486	0.96	1.24
Separated	586	1.01	1.29
Divorced	698	0.99	1.12
Widowed	33	0.9	0.82
Never Married	4,050	1.15	1.17
Total:	6,853		

Proper sample weights used

The dependent variable in this study is the average number of previous abortions. The independent variables are age, employment status, highest degree

of completed education, income, marital status, metropolitan status, race, region and religion. This set of independent variables represents a synthesis of the socioeconomic and demographic characteristics of women who obtain abortions in the United States based on our general knowledge of the existing literature. Those were specifically chosen since age, marital status, race and religion are considered core demographic variables, while education, employment status and income reveal information regarding the human capital of the subjects. In addition, the information on region and metropolitan status provides a spatial dimension to our study. Dummy variables were generated for the original categorical variables for marital status, metropolitan status, race, region, religion in order to examine individual bivariate interactions between the dependent and independent variables. We expect to establish a relationship between each of those variables and the outcome variable, average number of previous abortions.

Our *a priori* expectations are that age, education and employment status are positively related to the number of previous abortions since a highly-educated woman in the labor force faces a higher opportunity cost to carrying a pregnancy to term. Based on the existing literature, we also expect that black women, regardless of marital status, on average have more abortions than white women. In addition, the literature indicates that religiously unaffiliated women and women who reside in a metropolitan area are expected to have the highest number of abortions. Thus, we expect to establish a positive relationship between metropolitan status, as well as between no religious affiliation indicated, and the average number of previous abortions.

V. Methodology

If the dependent variable in this study was a continuous interval variable, the appropriate methodology would be regression analysis. This assumes that the regression coefficients are constant across observations, the selected socioeconomic characteristics are truly independent, and the error terms are independent across observations, normally distributed with a mean of 0 and a constant variance.

However, a better methodology for this study is logistic regression because the dependent variable (average number of previous abortions) is categorical. The similarities between OLS regression and logistic regression are that they are both employed to determine which of the independent predictor variables are statistically significant; a test-statistic is calculated to indicate whether the overall fit of the model is good, and a coefficient and standard error for each of the independent variables are calculated. However, the results they produce are different and should be interpreted separately. The difference between the two is that logistic regression is useful for testing binary (outcomes being 0 or 1) dependent variables. Even though linear regression is not appropriate for this model, we employ it as an initial tool to examine the data while considering its limitations given that the dependent variable is not continuous.

Since the outcome variable in this model is categorical with more than 2 distinct categories, it is appropriate to use the multinomial logistic regression which is an extension of the binary logistic regression. This methodology will give an estimation of the probability of membership within specific groups over the probability of being within a designated base group (the default base group is the one with the largest frequency). In addition, our dependent categorical variable is countable and its outcomes can be ranked, thus, it is appropriate to use ordinal logistic regression. The advantage of choosing ordinal over multinomial logistic analysis is that the former recognizes the increasing nature of the dependent variable (outcomes can be ranked). It is also appropriate to run a Poisson regression. With this regression analysis we assume that the original distribution of the outcome variable is Poisson, and its mean is equal to the variance.

The dependent variable in our model is number of previous abortions and the independent variables are grouped into 3 relevant categories. The literature did not reveal the existence of a theoretical model that explores the relationship between socioeconomic characteristics and the number of previous abortions. In general, such theoretical models describe the demand for abortion given existing legislature, cost of the service or abortion availability. Thus, our empirical model is:

$$Y = \beta_0 + \beta_1 D + \beta_2 HC + \beta_3 L + E$$

Demographic Characteristics (D)=Age+Marital Status+Race+Religion

Human Capital (HC)=Highest Degree of Education+Employment Status+Income

Location (L)=Region+Metropolitan Status

This model assumes that the independent variables are not jointly correlated, though our knowledge dictates that a certain level of correlation exists. When we test for correlation, the independent variables are correlated according to our *a priori* expectations. However, the exhibited degree of correlation is not large enough to negatively impact the standard errors and the results of the study.

First, we run a linear regression with the original income variable and then with the natural logarithm of the income variable to account for the nonlinear relationship between the dependent variable and income. After testing the model, we establish that it has a problem of autocorrelation, heteroskedasticity as well as omitted variable bias. We successfully solved for all but the omitted variable bias. Then, we run a multinomial logistic regression with the dependent variable, number of previous abortions, collapsed into a new variable with three categories. The original dependent variable has 10 categories that increase in frequency from 0 to 9 (positively-skewed distribution). We recode the dependent variable, and group the original categories into three new categories by frequency. For our model, it is convenient to choose only three categories, since this results in exhaustive and non-overlapping categories. The base category includes women who have had one or less previous abortions on average. This analysis gives for each independent variable the probability of a woman being in the second or third

Number of Previous Abortions	
OLS regression	
Characteristics	Coef.
Employment Status	0.068* (0.036)
Income	-0.000* (0.000)
Age	3.983e-02*** (3.132e-03)
Race	
Black	0.248*** (0.038)
Asian	0.054 (0.078)
Indian	0.073 (0.141)
Hispanic	0.058 (0.048)
Marital Status	
Married	-0.270*** (0.042)
Separated	-0.194*** (0.061)
Divorced	-0.305*** (0.054)
Widowed	-0.456*** (0.154)
Level of Education	
Through 8th Grade	-0.120 (0.104)
Through 11th Grade	-0.072 (0.052)
Through Highschool	-0.064* (0.037)
Through College	-0.186*** (0.051)
Religion	
Roman Catholic	-0.041 (0.044)
Jewish	0.401 (0.257)
Other	0.141** (0.056)
None	0.117*** (0.041)
Region	
North-east	0.287*** (0.040)
Mod-west	-0.030 (0.047)
West	0.221*** (0.043)
Metropolitan Status	
Non-metropolitan	-0.269*** (0.041)
Other country	-0.076 (0.139)
Constant	-0.056 (0.092)
Observations	6208
R-squared	0.073
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

category as opposed to being in the base category. Next, we run an ordinal logistic regression in order to account for the increasing nature of the original dependent variable where the outcomes vary from 0 to 9. Last, we run a Poisson regression which is appropriate for nonnegative count variables.

Each model has advantages and disadvantages. The multinomial and ordinal regressions are similar, though when multinomial logistic regression is used, the significance of the ordering is lost. Thus, when comparing the results of the multinomial and ordinal regression, we expect those of the ordinal regression to give a more accurate representation of the relationship between the outcome variable and the predictors. However, we also expect the Poisson regression to give the most accurate results of the three models despite its inherent heteroskedasticity, as it is specifically designed for count outcome variables. When the results are presented, only the statistically significant variables in the model will be discussed.

VI. Results

○ *OLS Regression Analysis*

When a robust regression is run the independent variable for age and the dummy variables for black women, completing college, no religion indicated, northeast and west regions, nonmetropolitan areas and all dummy variables for marital status are statistically significant at the 10% significance level. The only variable that is statistically different from zero at the 5% significance level is the dummy variable for other religion specified.

We establish that if a woman is employed or black relative to white, and as her age increases, the average number

of previous abortions is higher. Even though, this is expected, it is also interesting because it establishes that abortion is not only a “single teenager” issue. This is also true if the woman has other or no religious beliefs relative to being Protestant, or is from the northeast or west parts of the US relative to residing in the south. The results also show that as a woman’s income increases, or she is married, divorced, widowed or separated relative to never married, the number of previous abortions decreases. In addition, there is a negative relationship between the number of previous abortions and competition of high school or college relative to having completed some years of college. The number of previous abortions also decreases if a woman identifies herself as Catholic relative to being Protestant, and if she lives in a nonmetropolitan area relative to residing in a metropolitan area. If the same robust OLS regression is run using the natural log of the income variable, there is only a small difference between the coefficients of the predictors for the two OLS regressions. However, the logged income variable and the dummy variable for completing high school are no longer statistically significant.

○ *Multinomial Logistic Regression Analysis*

Next, we study the results obtained from a multinomial logistic regression. The variables for employment and age are statistically significant at the 1% level when comparing both the second and third categories to the base category. The logged odds of having had between two and four previous abortions over having had less than

Number of Previous Abortions		
Multinomial Regression		
Characteristics	Coef. (2-4)	Coef. (5-9)
Employment Status	0.186*** (0.076)	0.060 (0.234)
Income	0.000 (1.82e-06)	-0.000** (6.60e-06)
Age	0.062*** (0.006)	0.145*** (0.017)
Race		
Black	0.500*** (0.079)	0.897*** (0.253)
Asian	0.201 (0.144)	0.166 (0.463)
Indian	0.300 (0.302)	0.171 (1.104)
Hispanic	0.225** (0.100)	-0.079 (0.346)
Marital Status		
Married	-0.308*** (0.087)	-0.237 (0.278)
Separated	-0.354*** (0.122)	0.334 (0.305)
Divorced	-0.482*** (0.119)	-0.456 (0.358)
Widowed	-0.729* (0.501)	-36.941 (1.01e+08)
Level of Education		
Through 8th Grade	-0.197 (0.206)	-0.148 (0.588)
Through 11th Grade	-0.046 (0.105)	0.009 (0.321)
Through High School	-0.133* (0.074)	-0.185 (0.237)
Through College	-0.424*** (0.105)	-0.344 (0.334)
Religion		
Roman Catholic	-0.103 (0.093)	0.320 (0.306)
Jewish	0.379 (0.377)	1.737** (0.772)
Other	0.379*** (0.106)	0.489 (0.345)
None	0.114 (0.085)	0.843*** (0.259)
Region		
North-east	0.481*** (0.080)	0.760*** (0.260)
Mid-west	-0.132 (0.112)	0.49 (0.340)
West	0.424*** (0.088)	0.626** (0.260)
Metropolitan Status		
Non-metropolitan	-0.390*** (0.122)	-1.296** (0.607)
Other Country	0.003 (0.345)	-36.638 (9.10e+07)
Constant	-3.165 (0.194)	-8.323 (0.652)
Observations	6,208	6,208
Standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

**Number of Previous Abortions
Ordered Logistic Regression**

Characteristics	Coef.
Employment Status	0.129** (0.057)
Income	-0.000 (0.000)
Age	5.671e-02*** (4.584e-03)
Race	
Black	0.364*** (0.060)
Asian	0.099 (0.113)
Indian	0.162 (0.241)
Hispanic	0.098 -0.076
Marital Status	
Married	-0.578*** (0.067)
Separated	-0.500*** (0.093)
Divorced	-0.526*** (0.088)
Widowed	-0.637* (0.337)
Level of Education	
Through 8th Grade	-0.321** (0.162)
Through 11th Grade	-0.216*** (0.082)
Through Highschool	-0.152*** (0.057)
Through College	-0.299*** (0.078)
Religion	
Roman Catholic	-0.089 (0.070)
Jewish	0.521* (0.303)
Other	0.214** (0.085)
None	0.174*** (0.065)
Region	
North-east	0.461*** (0.062)
Mid-west	-0.140* (0.079)
West	0.358*** (0.068)
Metropolitan Status	
Nonmetropolitan	-0.505*** (0.084)
Other Country	-0.014 (0.262)
Observations	6,208

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

one previous abortions increases with age. Also, the logged odds of having had between two and four previous abortions as opposed to one or less is higher for employed women than for unemployed, for black and Hispanic women relative to white women, for women who reside in the rest of the U.S. relative to the south part of the country. In addition, being married, separated or divorced decreases the logged odds of having had between two and four previous abortions over having less than one previous abortion.

Furthermore, the logged odds of having more than four previous abortions over the probability of having less or equal to one previous abortions increases by 0.14 for an increase in age and decreases for an increase in income. Also, black women have higher logged odds of having more than four previous abortions as opposed to less or equal than one relative to white women. The logged odds ratios of having more than four previous abortions increases for women of Jewish or no religious denomination relative to women who identify themselves as Protestant. In addition, the women who live in a nonmetropolitan area have smaller logged odds of having had more than four previous abortions over having had less or equal to one previous abortion relative to women who live in metropolitan areas.

Ordinal Logistic Regression Analysis

The third model presents an ordered logistic regression for the dependent variable. Age is statistically significant at the 1% confidence level, while the binary variable for employment status

is statistically different from zero at the 5% confidence level. Furthermore, the dummy variables for married, separated, and divorced are statistically significant at the 1% confidence level, while widowed is statistically significant in difference from zero at the 10% confidence level. The dummy variables for nonmetropolitan status and no religious affiliation are also statistically significant at the 1% confidence level. All of the dummy variables for education are statistically different from zero at the 1% confidence level, except the dummy for having completed 8th grade which is significant at the 5% confidence level. We establish that for an increase in age, *ceteris paribus*, the ordered log-odds of the number of previous abortion a woman has had, is expected to increase by 0.006 units. Thus, a woman is more likely to have had a higher number of previous abortions as age increases holding everything else constant. In addition, the ordered logit for employed women having had more previous abortions is 0.13 higher than for unemployed women, if the other variables in the model are held constant. The ordered log-odds for black women of having had a higher number of previous abortions are 0.36 units higher for non-blacks relative to white women. Furthermore, there is a positive relationship between a woman having had a higher number of previous abortions and being of Jewish, other or no religious denomination as opposed to being Protestant, *ceteris paribus*. Residing in the west part of the U.S. increases the ordered log-odds estimate of having had more previous abortions by 0.36 units.

Number of Previous Abortions Poisson Regression	
Characteristics	Coef.
Employment Status	0.059** (0.030)
Income	-0.000 (0.000)
Age	3.517e-02*** (2.252e-03)
Race	
Black	0.227*** (0.031)
Asian	0.060 (0.060)
Indian	0.086 (0.124)
Hispanic	0.034 (0.040)
Marital Status	
Married	-0.242*** (0.035)
Separated	-0.160*** (0.047)
Divorced	-0.262*** (0.047)
Widowed	-0.455** (0.207)
Level of Education	
Through 8th Grade	-0.117 (0.082)
Through 11th Grade	-0.071* (0.043)
Through Highschool	-0.059** (0.029)
Through College	-0.165*** (0.042)
Religion	
Roman Catholic	-0.015 (0.037)
Jewish	0.341** (0.142)
Other	0.125*** (0.043)
None	0.107*** (0.034)
Region	
North-east	0.269*** (0.032)
Mid-west	-0.036 (0.044)
West	0.205*** (0.035)
Metropolitan Status	
Non-metropolitan	-0.316*** (0.050)
Other Country	-0.063 (0.147)
Constant	-0.977*** (0.076)
Observations	6,208
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Furthermore, the ordered logistic regression model establishes a negative relationship between all of the dummy variables for marital status and the outcome variable. In other words being married, separated, divorced, or widowed decreases a woman's ordered log-odds estimate of having had more previous abortions relative to a woman who has never been married. In addition, the ordered log-odds for having had multiple abortions are negative for a woman who has completed her education through 8th grade, through 11th grade, through high school and through college relative to having completed only some years in college. The ordered logit of having had more previous abortions is also .51 units lower for women in nonmetropolitan areas relative to women in metropolitan areas.

- *Poisson Regression Analysis*

The fourth model we study is a Poisson regression. The variables for employment status and age are statistically significant at the 10% and 1% levels respectively. The dummy variable for black is also statistically significant at the 1% level. All of the dummy variables for marital status and the dummy variables for other or no declared religious affiliation are statistically significant in difference from zero at the 1% level. So is the dummy variable for metropolitan status.

The results of the Poisson regression indicate that an increase in age would lead to 0.04 units increase in the logs of expected counts, *ceteris paribus*. The difference in the logs of expected counts is 0.06 units for employed compared to unemployed women holding all other predictor variables constant. In addition, the differences in the logs of expected counts will on average be 0.23 units for black women compared to non-blacks relative to white women. Furthermore, there is a negative relationship between all of the marital status dummies relative to the dummy variable for never been married and the number of previous abortions – the difference in the logs of expected counts of the number of previous abortions will decrease. There is also a negative relationship between the dummy variables for education and the number of previous abortions – if a woman has graduated from high school or from college relative to having some years of college education, the logs of expected counts of the number of previous abortions decrease respectively by 0.06 and 0.16 units. If a woman lives in a metropolitan area, the difference in the logs of expected counts will be 0.98 units lower relative to women who live in a metropolitan area.

VII. Discussion

When comparing the results of the regressions, they confirm our *a priori* expectations based on our knowledge and the conclusions presented in the existing literature. The number of previous abortions increases with age. On average, black women are more likely to have had more previous abortions relative to whites. Also, the number of previous abortions decreases as women attain higher levels of education relative to completing some years of college. This may be caused by women who want to receive a higher return on their investment in education

(college). Furthermore, the number of previous abortions is expected to be lower for women who are or have been married, are widowed or separated relative to women who, on average, have never been married. This can be explained by the relatively higher opportunity cost of a pregnancy carried to term for a single woman. In addition, women from nonmetropolitan areas on average have a lower number of previous abortions relative to women who reside in metropolitan areas. In addition, the less strongly a woman is religiously affiliated, the more she is likely to have had a higher number of previous abortions.

None of the models in our study perfectly describes the relationship between the number of previous abortions a woman has had and the socioeconomic and demographic characteristics that define her because of various shortcomings. Nevertheless, we believe that the Poisson regression model used gives the best representation of this relationship because it is specifically designed to examine models in which the response variable is a count variable. The shortcomings of the Poisson regression in this study are the result of the over dispersion of the data due to the 25% difference between the mean and the variance of the number of previous abortions. In spite of this, the Poisson regression is superior to OLS, as the latter is not applicable for non-continuous outcome variables, which is evident in the low R-squared value (0.07). The Poisson regression is also preferred to the multinomial logistic regression because it gives a good representation of the constantly increasing nature of the dependent variable. The multinomial and ordinal regressions do represent the relationship between our dependent variable and the predictors in the model with a varying degree of success. However, the multinomial logistic regression does not account for the increasing nature of our dependent variable. The ordinal logistic regression does account for the change in the outcome variable, but it assumes that the distances between the individual levels are unknown. Since in our model the dependent variable changes at a rate of one, we believe that the Poisson regression provides the best model for our study.

The ideal data for a study on female reproductive behavior by focusing on past abortion instances is panel data that observes the behavior of a randomly selected sample of women throughout their reproductive lifespan, as opposed to cross-sectional data. This would allow for a better understanding of how women's characteristics influence the average number of previous abortions. A further expansion can be achieved if the sample has pregnancy outcomes as its units of analysis – it should include the number of live births, number of induced abortions and number of spontaneous abortions. In other words, the sample would consist of women who are not pregnant; in the case of a pregnancy there are three possible outcomes: live birth, spontaneous abortion or induced abortion. This will increase the depth of the study of women's reproductive behavior by introducing the concept of choice and provide a better understanding of why women seek an abortion and what had influenced their decision to have had a previous abortion. This would also allow us to make better predictions about future reproductive patterns in women who have had a previous abortion.

Thus, given that the dataset is expanded, further research should focus on exploring the relationship between the number of past and possible future instances of abortion. Furthermore, the response rate on what are considered “sensitive” questions, such as those regarding income, race, and even the number of previous abortions, is relatively low. So, it is important both for providers and legislators to study the factors behind these phenomena in order to ensure more accurate and comprehensive responses. This would eliminate bias in and enhance the accuracy of studies that focus on women who abort. Further research can also investigate the relationship between the choice to have an abortion and possible lack of provider availability in nonmetropolitan areas which can lead to overreporting in metropolitan areas.

The results presented in this study describe the relationship between the average number of abortions a woman has had and the socioeconomic and demographic characteristics that describe her best. In order to reduce the number of abortion, policy-makers need to be informed on what characterizes the women who have had a higher number of previous abortions. Furthermore, there needs to be a continuous and coherent effort on the state and national level to collect individual-level data on the specific characteristics of women who seek legal abortions. This study illustrates through quantitative methods the relationship between those characteristics and the number of previous abortions a woman has had in order to emphasize the importance of targeting those women specifically and providing them with adequate care and access to services.

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