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History of pregnancy termination as a risk factor for preterm birth, Virginia 2000-20007

Jennifer Macdonald
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History of pregnancy termination as a risk factor for preterm birth, Virginia 2000-2007

by

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Master of Public Health Program
MPH Research Project: EPID 691

Virginia Commonwealth University
Richmond, Virginia

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Submission Statement

Master of Public Health Research Project

This MPH Research Project report is submitted in partial fulfillment of the requirements for a Master of Public Health degree from Virginia Commonwealth University's School of Medicine. I agree that this research project report be made available for circulation in accordance with the program's policies and regulations pertaining to documents of this type. I also understand that I must receive approval from my Faculty Advisor in order to copy from or publish this document, or submit to a funding agency. I understand that any copying from or publication of this document for potential financial gain is not allowed unless permission is granted by my Faculty Advisor or (in the absence of my Faculty Advisor) the Director of the MPH Program.

_____

Student Signature

_____

Date

Master of Public Health

Research Project Agreement Form

Department of Epidemiology and Community Health

Student name: Jennifer Olsen Macdonald E-mail address: macdonaldjo@vcu.edu

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Number of semester hours (3-6): 3 Semester: Spring Year: 2009

Please complete the following outline. **Do not exceed 2 pages (A-H)**.

A. PROJECT TITLE:
History of pregnancy termination as a risk factor for preterm birth, Virginia 2000-2007.

B. PURPOSE (state hypothesis/research question):
To determine the relationship between type of pregnancy termination before a first live birth on preterm birth of first live births in Virginia during 2000-2007.

C. SPECIFIC OBJECTIVES (list major aims of the study):

1. To determine the association of prior spontaneous termination of pregnancy (PSTP) on preterm birth (PTB) of first live births occurring in Virginia during 2000-2007.
2. To determine the association of prior induced pregnancy termination (PIPT) on preterm birth (PTB) of first live births in Virginia during 2000-2007.

D. DESCRIPTION OF METHODS

D.1. Identify source(s) of data (eg, existing data set, data collection plans, etc):
Data for this project was collected as part of the Virginia Live Birth Registry and the Virginia Fetal Death Record Registry between 1990 and 2007. This data was recorded by the Virginia Department of Health's (VDH) Vital Statistic Department. These datasets were linked to create the primary dataset that will be utilized in analysis and is available through VDH, Office of Family Health Services. Live birth records recorded between 2000 and 2007 and fetal death records dating back to 1990 will be utilized to determine the number and type of pregnancy terminations occurring before the first live birth.

D.2. State the type of study design (eg, cross-sectional, cohort, case-control, intervention, etc):

The study design will be a retrospective cohort study. The dataset will include first live births that occurred during 2000-2007 and maternal history linked to those first live births, dating back to 1990. The maternal history will be analyzed to determine the association of PSPT and PIPT as a risk factor for PTB. The exposure data includes PSPT, defined as a fetal death that is not induced in order to produce a nonviable fetus, and PIPT, as a fetal death in which the pregnancy has been deliberately terminated with the purpose of producing a nonviable fetus. Data includes both types of pregnancy termination occurring at any week gestation.

D.3. Describe the study population and sample size:
All first live births occurring between 2000 and 2007 in Virginia will be used in the analysis. The dataset yielded approximately 302,688 first live births occurring during that time. Of those first births, approximately 55,931 mothers reported at least one PIPT and/or PSPT prior to that first live birth.

D.4. List variables to be included (If a qualitative study, describe types of information to be collected):
The exposure variable in this study is the type and number of terminations of pregnancy before the first live birth and will be broken down into PIPT, PSPT and no history of either termination. The outcome variable to be analyzed is PTB, defined as birth occurring less than 37 weeks gestation, of the first live birth. Other variables to be studied will include maternal age, race, education, tobacco use, alcohol and other drug use, history of chronic disease, specifically chronic and pregnancy induced hypertension, diabetes and history of incompetent cervix, number of prenatal visits, method of payment/insurance and sex of the child.

D.5. Describe methods to be used for data analysis (If a qualitative study, describe general approach to compiling the information collected):
All data will be analyzed in SAS v9.1.3. Frequency counts, prevalence, crude odds-ratios and their respective 95% confidence intervals will be determined. To determine whether or not other variables were confounders or effect modifiers, adjusted odds-ratios and 95% confidence intervals will be computed. Logistic regression will also be completed to estimate adjusted odds-ratios and 95% confidence intervals to test whether a relationship occurs between type of previous pregnancy termination on the outcome variables.

E. ANTICIPATED RESULTS:
I anticipate observing an association between all types of pregnancy terminations occurring before the first live birth on preterm birth of the first live birth.

F. SIGNIFICANCE OF PROJECT TO PUBLIC HEALTH:
The overall goal of this research is to prevent infant mortality. This study will assist in identifying women who are at risk for giving birth to infants who are born preterm and help to identify intervention strategies to decrease this risk.

G. IRB Status:

1) Do you plan to collect data through direct intervention or interaction with human subjects? ___yes _ x _no

2) Will you have access to any existing identifiable private information? ___yes __x__no

If you answered "no" to both of the questions above, IRB review is not required.
If you answered "yes" to either one of these questions, your proposed study must be reviewed by the VCU Institutional Review Board (IRB). Please contact Dr. Vance or Dr. Sridhar for assistance with this procedure.

Please indicate your IRB status:
___ to be submitted (targeted date_____)
___ submitted (date of submission _____; VCU IRB # _____)
___ IRB exempt review approved (date_____)
___ IRB expedited review approved (date_____)
___ IRB approval not required

H. PROPOSED SCHEDULE: Start Date: December 2008 Anticipated End Date: May 2009

I. INDICATE WHICH OF THE FOLLOWING AREAS OF PUBLIC HEALTH KNOWLEDGE WILL BE DEMONSTRATED:

1. Biostatistics – collection, storage, retrieval, analysis and interpretation of health data; design and analysis of health-related surveys and experiments; and concepts and practice of statistical data analysis. _x__yes ___no (if yes, briefly describe): This project analyzes and interprets health data and will utilize SAS to analyze the dataset.

2. Epidemiology – distributions and determinants of disease, disabilities and death in human populations; the characteristics and dynamics of human populations; and the natural history of disease and the biologic basis of health. _x__yes ___no (if yes, briefly describe): Results of the project's data analysis will be scrutinized for the distribution of previous pregnancy terminations and whether or not they were determinants of the outcome variables preterm delivery and low birth weight.

3. Environmental Health Sciences – environmental factors including biological, physical and chemical factors which affect the health of a community. ___yes _x_no (if yes, briefly describe):

4. Health Services Administration – planning, organization, administration, management, evaluation and policy analysis of health programs. ___yes __x_no (if yes, briefly describe):

5. Social/Behavioral Sciences – concepts and methods of social and behavioral sciences relevant to the identification and the solution of public health problems. ___yes ___no (if yes, briefly describe):

SIGNATURE PAGE
Master of Public Health Research Project

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SIGNATURES:

Student: _____ Date: _____

Preceptor: _____ Date: _____

Faculty Advisor: _____ Date: _____

MPH Program Director: _____ Date: _____

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MPH Research Project Approval Form

History of pregnancy termination as a risk factor for preterm birth, Virginia 2000-2007

Submitted to the Graduate Faculty of the
Department of Epidemiology and Community Health
Virginia Commonwealth University

In partial fulfillment of the requirements for the degree of
Master of Public Health

Jennifer Olsen Macdonald

Comments:

Approval signatures:

MPH Student	Date
MPH Research Project Faculty Advisor	Date
MPH Program Director	Date
MPH Program Coordinator	Date

This work is dedicated to my boys, Farley, Mac and Jay, who teach me all that is important in life everyday.

I would like to thank Dr. Tilahun Adera, Dr. Derek Chapman and Caroline Stampfel for their guidance, assistance and expertise on this research project. I would also like to thank my numerous family members, co-workers and professors, past and present, for their support of me in obtaining my goal.

Table of Contents

Abstract

Objectives: The objective of this study was to determine if an association exists between prior induced and prior spontaneous pregnancy termination (PIPT and PSPT) and preterm birth (PTB) of first live births in Virginia.

Methods: Data was collected by linking maternal data from Virginia's live birth and fetal death registries. All first live, singleton births occurring in Virginia from 2000-2007 were analyzed. Logistic regression models that controlled for various demographic, medical and obstetric history factors were used to determine associations among prior pregnancy termination types.

Results: Compared with women who had no history of previous pregnancy terminations, women who had 1 (OR = 1.1, 95% CI 1.31, 1.53), 2 (OR = 1.2, 95% CI 1.12, 1.24) and 3 or more (OR = 1.4, 95% CI 1.07, 1.13) total prior pregnancy terminations had an increased odds of experiencing PTB. Increased odds of PTB were found for women who had 2 (OR = 1.1, 95% CI 1.05, 1.18) and 3 or more (OR = 1.3, 95% CI 1.39, 1.61) PIPTs. Women who reported 1, 2, 3 or more PSPT had PTB odds-ratios of 1.4 (95% CI 1.37, 1.50), 1.7 (95% CI 1.48, 1.98) and 3.0 (95% CI 2.09, 4.22) times, respectively.

Conclusion: Two or more PIPT and one or more PSPT were found to be a significant risk factor for PTB of a first live birth in Virginia, and women having 3 or more PSPT had three times the odds of experiencing this outcome. Health practitioners should take this data into account to target research, education and action strategies to those high risk groups of women associated with obtaining induced terminations and to those women more susceptible to spontaneous termination of pregnancy.

I. Introduction

For many parents, the birth of a first child is a life-changing and momentous occasion. For first time parents who give birth to healthy babies, the changing lifestyle and additional responsibility may be challenging and stressful enough, but for those with babies who were born premature the challenges they face may be greater because of the additional morbidity that is associated with it. It may seem redundant to say that a healthy pregnancy is a good indicator for an infant's future, but all too often there are many maternal and/or fetal events that precede a live birth and, theoretically, may play a role in the health of future pregnancies. An event such as a prior induced termination of pregnancy (PITP) or a prior spontaneous termination of pregnancy (PSTP) may impact subsequent pregnancies and could result in ectopic pregnancy, additional PSTP, preterm birth (PTB) and low birth weight (LBW) infants.[1]

Prematurity has posed itself as a significant public health challenge by ranking as the leading cause of perinatal morbidity and mortality. PTB accounts for 12.5 percent of all births in the United States (US), an increase of 30 percent since 1980.[2-4] The percentage of infant deaths that were preterm related increased from 34.6 percent in 2000 to 36.5 percent in 2005,[5] and these rates varied considerably by race and ethnicity of the mother. Preterm-related infant mortality rates were 3.4 times higher for non-Hispanic black mothers than those for non-Hispanic white mothers.[6] There are at least 25 cited etiological reasons for why PTB occurs including but not limited to socio-economic status, age, ethnicity, previous pregnancy loss, interpregnancy intervals, working status, uterine/cervical health and various drug use.[5-21] PTB can trigger infant and childhood developmental delays and physical limitations that may have profound impact on a child and family's emotional, social and financial health. Costs associated with prematurity

related morbidity are estimated to be approximately 26 billion dollars a year and this cost does not take into account medical care beyond early childhood or caretaker costs.[6]

The rate of US legal induced termination spiked in 1981 and has remained fairly stable. In 2005, a total of 809,881 legal induced abortions were reported to Centers for Disease Control (CDC), translating to a rate of 15 per 1,000 women aged 15-44.[22] More recent data published by the Virginia Department of Health (VDH) Vital Statistics show that in 2007 the rate of legal induced termination remained stable at 16.8 per 1000 women aged 15-44, slightly lower than in 2005.[23]

Spontaneous fetal death is not very well understood and is very unpredictable. Diabetes, hypertension, fetal and uterine anomalies are a few associations that have been made to explain the etiological factors related to fetal death, but for the most part, the etiologic cause of fetal death remains unexplained.[24-26] The rate of fetal deaths in the US has slowly but steadily declined since 1990. In 2003, the US fetal mortality rate was 6.23 fetal deaths of 20 weeks gestation or more per 1,000 live births and these rates are higher in a number of groups including non-Hispanic black women, teens, women 35 years and over, and unmarried women.

Three research gaps were identified in current published research regarding previous termination on preterm birth. First, research has demonstrated little consensus regarding the relationship of previous pregnancy terminations, PITP or PSTP, on subsequent pregnancy outcomes such as PTB. Many studies showing no association with one[21] or more than one[1,12,27-29] multiple PITP on PTB have been published, whereas other published studies have shown a relationship between one or more multiple PITP and PTB.[14,21,30-33] Studies examining PSTP and PTB have also been conflicting. Investigators have shown that early PSTP may increase risk of PTB[25, 26, 34, 35] whereas others have shown no risk.[12, 36] Secondly, because there have been

limitations on data collection methodologies, only a handful of research has been published comparing type of termination on PTB[8,41-43]. Lastly, very little research has focused on the first live births, a new and potentially anxious occasion for parents. Only one study was found that addressed the issue of prior pregnancy termination in the first live births and it found risk for PTB tended to be higher, although not significant, in women whose first pregnancy ended in a PITP as compared to women their first pregnancy with no history of termination(s).[36]

The objective of this research is to address these research gaps by determining the relationship between type of pregnancy termination, PITP and PSTP, and PTB of the first live birth. A population sample containing first live births in Virginia from 2000-2007 will analyzed to demonstrate these relationships.

II. Methods

Study Sample

This retrospective cohort study utilizes the Virginia live birth and fetal death record registries, originally recorded by the VDH's Vital Statistics Department. A de-identified, maternally linked dataset was prepared by the Policy and Assessment Unit, Office of Family Health Services in the VDH. This data set contained linked birth certificates documenting first live births recorded between 2000 and 2007 and fetal death records recorded as far back as 1990 by a maternal identifier, the mother's social security number (SSN). SSN and all identifiers were removed by VDH staff after the linkage was completed. The complete data set consists of 302,688 singleton first live births occurring in Virginia between 2000 and 2007, to women of childbearing age, 11-55 years of age, and regardless of whether or not the mother was a state resident. Only those birth certificates with complete information on determinants, outcome and potential confounder variables were included in the analysis.

Data Collection

Hospitals, medical practices and facilities where a live birth, fetal death and/or induced termination occur are responsible for completing the appropriate record. Information regarding the requirements for completing the Virginia live birth certificate (Form VS 1) and fetal death (Form VS 5) forms are detailed in the Virginia State Code, Title 32.1, Chapter 7, Sections 32.1-249 through 32.1-276. Institutions designate appropriate personnel to collect the data to complete the appropriate record, to obtain signatures of official attendants and to send to the State Registrar within seven days of live births and within three days of fetal death.

Parents and/or designated informants also complete a portion of the birth certificate and fetal death record. Both records contain greater than 100 similar data fields pertaining to parent demographics, education levels, the history of pregnancy, prenatal care and labor/delivery events, and information on the newborn or fetus health.

Exposure Variables

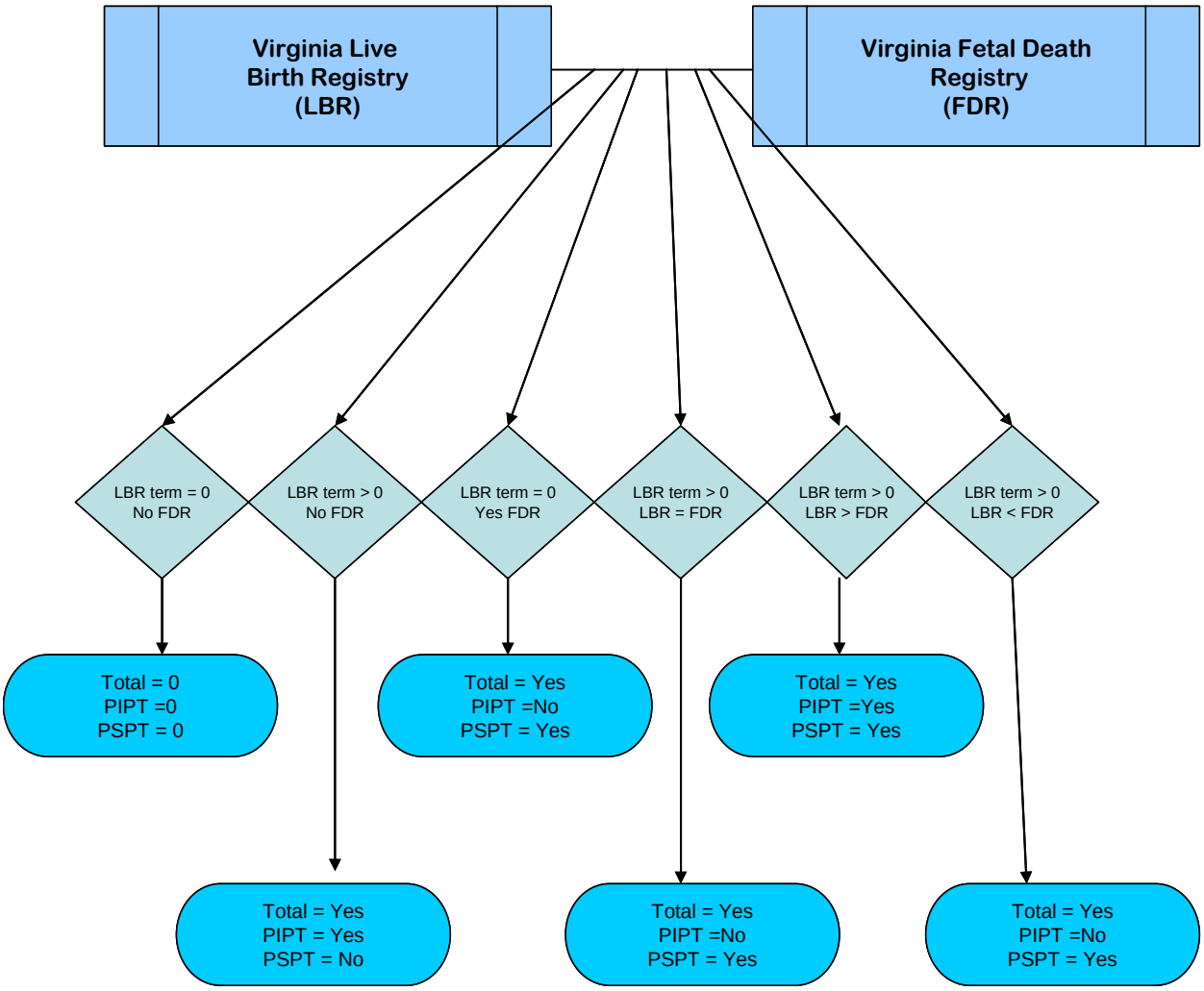
The definition of induced and spontaneous terminations are outlined in Virginia State Code, Title 32.1, Chapter 7, Sections 32.1-249 through 32.1-276 and followed by the VDH Department of Vital Statistics[23]. Induced termination of pregnancy is defined as a fetal death in which the pregnancy has been deliberately terminated with the purpose of producing a nonviable fetus. A spontaneous termination is defined as a fetal death that is not induced in order to produce a nonviable fetus. Spontaneous termination is also known as a miscarriage or natural fetal death. Termination information was obtained through the birth certificate record. Each mother completed the section entitled “other terminations (spontaneous and induced at any time after conception)” indicating a number and a check box that indicates “none”. This variable on the birth certificate does not differentiate between induced or spontaneous abortions. Virginia is

one of only 5 states that require facilities to report a fetal death regardless of duration of gestation, therefore, records from the fetal death registry assisted in indicating whether or not a PITP or PSTP occurred. The fetal death record indicates gestational week at death, therefore, a PSPT occurring at any week gestation was included in the analysis.

Prior pregnancy termination history was categorized into an overall "yes/no" category and then further categorized as "total number of previous pregnancy terminations". PITP and PSTP were categorized by the previous number of respective terminations the woman had: zero, 1, 2, 3 or more. The type of termination was calculated in the following manner (Figure 1): (1) if the "other termination" variable on the birth certificate was checked as "none" and the birth certificated was not linked to any fetal death record, prior pregnancy termination was categorized as "no"; (2) if the birth certificate was not linked to any fetal death record and "other terminations" variable on the birth certificate indicated that "yes" a prior termination existed, we categorized that termination(s) as a PITP(s); (3) if the birth certificate was linked to a fetal death record and "other termination" on the birth certificate was marked as zero, we assumed a fetal death did occur and categorized prior termination as "yes" and further categorized it as a PSTP(s); (4) if the birth certificate was linked to a fetal death record and "other termination" on the birth certificate noted an equal number, the termination(s) was categorized as a PSTP(s); (5) if the birth certificate was linked to a fetal death record and the "other termination" variable indicated a greater number of terminations than the number of linked fetal death records, we categorized prior termination as "yes" and subtracted the number of fetal death records from the number of terminations indicated on the birth certificate. The resulting number was categorized as the number of PITP(s) and the linked fetal death record(s) was categorized as PSTP(s); and (6) if the birth certificate was linked to a fetal death record and the "other termination" variable

indicated a smaller number of terminations than the number of linked fetal death records, we categorized prior termination as "yes" and assumed all the terminations were PSTP.

Figure 1



Outcome variable

The outcome variable of interest, PTB, was defined as birth occurring less than 37 weeks of gestation, a common definition found in current literature.[5,7-11] The attending physician at birth completes a section on the birth certificate called "physicians estimate of gestation (weeks)" and it is this estimate that we categorized PTB upon. Information on gestational age

was categorized as zero to 37 weeks and greater than 37 weeks. There were 51,048 first live births identified in the sample as PTB.

Confounding variables

The confounders considered were risk factors for PTB. Maternal race was based on self-report and categorized White, Black, Hispanic, Other. Women were categorized as Hispanic if they self-reported "yes" on the birth certificate variable "is mother of Hispanic origin?" Maternal age was categorized into four strata: 19 and younger, 20-34, 35-44, 45 and older. Maternal education level was defined as elementary/middle school, high school, college. Number of prenatal visits was categorized into four strata: zero, 1-10, 11-20, 21 or more. Maternal tobacco and alcohol use were each categorized as yes/no. Maternal drug use was categorized as yes/no and categorized as yes if mom checked "yes" to any of the drugs listed on the birth certificate variable "drug use during pregnancy": heroin, methadone, marijuana, cocaine or crack, amphetamine and/or other street drugs. Sex of child was categorized as male or female. Method of payment for the current pregnancy was categorized as Medicaid, private insurance, self-pay. Maternal history of diabetes, chronic hypertension, pregnancy-associated hypertension and incompetent cervix were categorized as yes/no.

Statistical Analysis

Frequency counts, prevalence, crude odds-ratios as well as their 95% confidence intervals were calculated to determine a general association between selected exposure variables, including PITP and PSTP, and PTB. To determine whether variables are confounders or effect modifiers, a logistic regression model was utilized to estimate adjusted odds-ratios and 95% confidence intervals. A separate model for each total prior pregnancy termination, PITP and PSTP was calculated to determine effect on PTB.

Statistical analysis was performed with the use of SAS 9.1.3 (v9.1, SAS Institute Inc., Cary, NC, 2002-03) to determine crude and adjusted odds-ratios and adjusted 95% confidence intervals. Microsoft Excel® was also utilized to determine 95% confidence intervals for the crude odds-ratios. The formula used to determine the crude 95% confidence intervals was $95\%CI(RR) = Exp[\ln RR \pm Z_y * s.e(\ln RR)]$.

III. Results

Table 1 describes selected maternal and infant characteristics of all first live births in Virginia between 2000 and 2007. There were a total of 302,688 first live births recorded during that time. The racial make-up of the total population was comprised of 65% white, 22% black, 6% Hispanic and 7% of other nationalities and approximately 73% were aged 20-34 years. There were 51,048 preterm births recorded during this time period. Approximately 20% of those women who delivered preterm babies had at least one prior pregnancy termination; 5.5% were noted to have at least one spontaneous termination and 16.6% had at least one induced termination. Of these women, 19.3% were 19 years of age or younger, 43.2% were educated up to high school level, 7% percent of these women stated "yes" to tobacco use during pregnancy, less than 1% stated "yes" to alcohol and drug use, 46% had 1-10 prenatal visits, 23% were on Medicaid, 4% were self-pay patients, 5.1% had a history of diabetes, 2% had a history of chronic hypertension, 12% had a history of pregnancy induced hypertension and less than 1% had a history of incompetent cervix. Of these preterm deliveries, 35.5% of babies experienced low birth weight and 52.7% were males.

Table 2 describes the prevalence and 95% confidence intervals for selected maternal and infant characteristics of preterm deliveries occurring with first live births during 2000-2007. Of all preterm deliveries occurring in first live births, prevalence rates were highest in black women,

the oldest and then youngest age groups, women with a high school education, male babies, those babies with a low birth weight, women who reported a prior termination, women who reported three or more total terminations, three or more spontaneous abortions and three or more induced terminations, those women who reported tobacco, alcohol and drug use, those women who had no prenatal visits, self-pay patients, and those women who did have a history of diabetes, chronic hypertension, pregnancy induced hypertension and incompetent cervix. Very high prevalence rates were noted in women who were black (20.27%, 95% CI 19.96, 20.58), 45 years and older (33.33%, 95% CI 27.17, 39.49), those women who experienced 3 or more total terminations (39.74%, 95% CI 22.26, 24.80), 3 or more spontaneous terminations (39.74%, 95% CI 31.93, 47.55) and 3 or more induced terminations (22.25%, 95% CI 20.85, 23.65), women who used drugs (22.92%, 95% CI 20.89, 24.95), women who had no prenatal visits (46.62%, 95% CI 44.19, 49.05), self-pay patients (20.54%, 95% CI 19.75, 21.33), history of diabetes (24.69%, 95% CI 23.87, 25.51), chronic hypertension (38.19%, 95% CI 36.35, 40.03), pregnancy induced hypertension (36.7%, 95% CI 35.97, 37.43) and incompetent cervix (55.72%, 95% CI 52.29, 59.15). In regards to the number and type of pregnancy terminations among these women, the prevalence increased within each stratum from the previous. In regards to total terminations, prevalence ranged from 16.42% (95% CI 16.27, 16.57) for zero terminations to 18.03% (95% CI 17.66, 18.40), 19.89% (95% CI 19.14, 20.64) and 23.53% (95% CI 22.26, 24.80) for 1, 2 and 3 or more terminations, respectively. In regards to spontaneous terminations, prevalence ranged from 16.63% (95% CI 16.49, 16.77) for zero terminations to 21.84% (95% CI 21.08, 22.6), 26.09% (95% CI 23.44, 28.74) and 39.74% (95% CI 31.93, 47.55) for 1, 2 and 3 or more terminations, respectively. In regards to induced terminations, prevalence ranged from 16.63% (95% CI 16.49, 16.77) for zero terminations to 17.46% (95% CI 17.06, 17.86), 19.39%

(95% CI 18.57, 20.21) and 22.25% (95% CI 20.85, 23.65) for 1, 2 and 3 or more terminations, respectively.

Tables 3, 4 and 5 describes crude and adjusted odds-ratios and their respective 95% confidence intervals by total terminations, induced terminations and spontaneous terminations, respectively. The referent values for each category are delineated in the tables as 1.00. Among the crude odds-ratios, the most significant results were found among those women 45 years and older (OR 2.6, 95% CI 1.96, 3.41), those women who had no prenatal visits (OR 6.2, 95% CI 5.57, 6.79) and 1-10 visits (OR 2.5, 95% CI 2.44, 2.54), women with a history of chronic hypertension (OR 3.1, 95% CI 2.85, 3.34), pregnancy-induced hypertension (OR 3.1, 95% CI 3.01, 3.22) and incompetent cervix (OR 6.2, 95% CI 5.43, 7.18). Those variables that demonstrated lower odds-ratios than previously mentioned, but none the less significant in association were black women, women of other nationalities, women 19 years and younger, women 35-44 years of age, women in all education strata, women who used tobacco, drugs, women who had 21+ prenatal visits, all method of payment strata and women had a history of diabetes. Having a female child was shown to be protective (OR 0.93, 95% CI 0.91, 0.95). Women who were of the Hispanic race and women who reported alcohol use were found to be statistically insignificant. Pregnancy terminations, regardless of type or number, were found to be associated with PTB and in each type of termination this association increased with the increasing number of terminations reported. In regards to total terminations, a significant association was found in women who reported 1 (OR 1.12, 95% CI 1.09, 1.15), 2 (OR 1.26, 95% CI 1.20, 1.33) and 3 (OR 1.57, 95% CI 1.46, 1.68) or more prior pregnancy terminations. Significant associations were found in women who reported 1 (OR 1.06, 95% CI 1.03, 1.09), 2 (OR 1.21, 95% CI 1.14, 1.27) and 3 or more (OR 1.44, 95% CI 1.32, 1.56) PIPT. Significant

associations were also found in women who reported to have 1 (OR 1.40, 95% CI 1.34, 1.47), 2 (OR 1.77, 95% CI 1.54, 2.03) and 3 (OR 3.31, 95% CI 2.39, 4.58) PSPT.

Adjusted odds-ratios in tables 3, 4 and 5 utilized a logistic regression analysis based on total terminations, PIPT and PSPT, respectively. Each model adjusted for maternal race, age, education, sex of child, tobacco, alcohol and drug use, number of prenatal visits, method of payment, and history of diabetes, chronic hypertension, pregnancy-induced hypertension and incompetent cervix. In regards to total terminations (Table 3), the strongest significant associations were noted in women 45 years of age and older (OR 2.2, 95% CI 1.62, 2.99), women who had zero prenatal visits (OR 6.6, 95% CI 5.88, 7.31), women who had 1 to 10 prenatal visits (OR 2.6, 95% CI 2.50, 2.61), women who had a history of chronic hypertension (OR 2.8, 95% CI 2.56, 3.05), pregnancy-induced hypertension (OR 3.2, 95% CI 3.09, 3.32) and incompetent cervix (OR 5.1, 95% CI 4.37, 5.91). Those variables that demonstrated lower odds-ratios than previously mentioned but were none the less significant in association were women of black race, women aged 35-44, women with a high school education, women who reported tobacco use, drug use, women who had 21+ prenatal visits and women with a history of diabetes. Having a female child remained protective, and variables that became protective after adjustment were women of Hispanic race, and women who were Medicaid and self-pay patients. Variables that became insignificant after adjustment were women of other races, women 19 years and younger and women with an elementary/middle school education. Women who reported alcohol use remained statistically insignificant. In regards to PIPT (Table 4), the strongest significant associations were noted in women aged 45 and over (OR 2.3, 95% CI 1.66, 3.06), women who had zero prenatal visits (OR 6.5, 95% CI 5.84, 7.27), women who had 1 to 10 prenatal visits (OR 2.6, 95% CI 2.50, 2.61), women who had a history of chronic hypertension (OR 2.8, 95% CI

2.57, 3.05), pregnancy-induced hypertension (OR 3.2, 95% CI 3.09, 3.32) and incompetent cervix (OR 5.3, 95% CI 4.52, 6.11). Those variables that demonstrated lower odds-ratios than previously mentioned but were none the less significant in association were women of black race, women aged 35-44, women with a high school education, women who reported tobacco use, drug use, women who had 21+ prenatal visits and women with a history of diabetes. Having a female child remained protective, and variables that became protective after adjustment were women of Hispanic race and women who were Medicaid and self-pay patients. Variables that became insignificant after adjustment were women of other races, women 19 years and younger, women with an elementary/middle school education. Women who reported alcohol use remained statistically insignificant. In regards PSPT (Table 5) the strongest significant associations were noted in women aged 45 years and older (OR 2.3 95% CI 1.67, 3.08), women who had zero prenatal visits (OR 6.5, 95% CI 5.86, 7.29), women who had 1 to 10 prenatal visits (OR 2.6, 95% CI 2.52, 2.63), women who had a history of chronic hypertension (OR 2.8, 95% CI 2.56, 3.04), pregnancy-induced hypertension (OR 3.2, 95% CI 3.1, 3.32) and incompetent cervix (OR 5.0, 95% CI 4.30, 5.82). Those variables that demonstrated lower odds-ratios than previously mentioned but were none the less significant in association were women of black race, women aged 35-44, women with a high school education, women who reported tobacco use, drug use, women who had 21+ prenatal visits and women with a history of diabetes. Having a female child remained protective, and variables that became protective after adjustment were women of Hispanic race and women who were Medicaid and self-pay patients. Variables that became insignificant after adjustment were women of other races, women 19 years and younger, women with an elementary/middle school education. Women who reported alcohol use remained statistically insignificant.

After adjusting for all other variables, a significant association was found in women who reported 1 (OR 1.1, 95% CI 1.31, 1.53), 2 (OR 1.2, 95% CI 1.12, 1.24) and 3 (OR 1.4, 95% CI 1.07, 1.13) or more total prior pregnancy terminations. Women who reported 1 PIPT was not found to be statistically significant (OR1.0, 95% CI 0.98, 1.05) however, significant associations were found in women who reported 2 (OR 1.1, 95% CI 1.05, 1.18) and 3 or more (OR 1.3, 95% CI 1.61, 1.39) PIPT. Significant associations were found in women who reported to have 1 (OR 1.4, 95% CI 1.37, 1.50), 2 (OR 1.7, 95% CI 1.48, 1.98) and 3 (OR 3.0, 95% CI 2.09, 4.22) PSPT. A comparison of crude and adjusted odd-ratios by termination type is detailed in Table 6.

IV. Discussion

A major strength of this study is that we were able to build upon prior research on this topic[33] by combining two birth event registries in order to differentiate the type of prior pregnancy termination a woman experienced. Since prior pregnancy termination could not be differentiated in many prior studies because of collection methodologies, it was hard to clarify the effect of PIPT or PSPT on PTB. This research geared towards the first live birth of a woman identified that one, two and three or more total prior pregnancy terminations were a significant risk factor for PTB. These findings are consistent with past research showing when type of termination was not specified it was found to be associated with preterm delivery.[42,43]

This research also demonstrated that one, two and three or more PSTP were significant risk factors for PTB and that this risk doubled in women who had three or more PSTP. These findings are consistent with other studies that studied PSPT alone[25], but did conflict with other studies[34-35]. Another finding found one PIPT was not associated with PTB but 2 and 3 or more PIPT were. These findings are consistent with Lang's[8] research, a similar study with a smaller sample size that was able to differentiate between type of prior pregnancy termination, but not

limited to first live births. One PIPT was found not to be statistically significant (OR 1.1, 95% CI 0.8, 1.5), but other stratum of PIPT and PSPT were found to have an effect. A much greater association was found in those women who reported 3 or more PIPT (OR 3.6) than that found in our study (OR 1.3). Algert[41] also found an effect of both type of terminations on PTB, but the study did not look at number of terminations. Other studies have demonstrated at least one PIPT to have an effect on PTB[14, 16, 30-33, 36], and except for one PIPT, their ORs were comparable to this research. Lao[12] found no association between PIPT and PTB. Further research is warranted to determine if the same association is seen in subsequent births and whether interpregnancy intervals contribute to the effect of prior terminations on PTB.

In comparing the two types of pregnancy terminations, induced and spontaneous, we found the associations to be similar among all stratum except 3 or more previous terminations. Women who had 3 or more PSPT had more than 3 times the odds of PTB in their first live birth, as compared with women who had 3 or more PIPT, who had only 1.3 times the odds of PTB. Past research has suggested that these two types of pregnancy termination may have different consequences on subsequent deliveries.[40] Increasing number of PSPT may be suggestive of a biological component in the causal pathway such as reproductive organ disease and/or genetics that cannot be explained by this study but may explain the increased association. Historically, it has been thought that the methods utilized in induced termination, such as vacuum aspiration, may be harmful to subsequent pregnancies by creating an insufficiency within the cervix related to the procedure and/or procedural complications.[28,33, 36-37] This research did show a large association between incompetent cervix (OR range 5.0-5.25) for all three termination variables analyzed.

A few results were noteworthy and were consistent in looking at terminations collectively, as well as in their respective analysis. First, and of particular interest, black women had increased odds of PTB, after adjustment, a finding found very consistently in literature[11]. Women of Hispanic race had decreased odds of PTB, and a limitation of this study could account for why this found. The dataset contained only women who had a valid social security number, therefore, women who may have been immigrants and/or migrant workers and who often tend to be of non-white and non-black ethnicity, may be underrepresented. Another unexpected result in this study was that PTB was not found to be significant in women 19 years and younger or in women who had an elementary/middle school education only, as had been reported in previous research[12, 38]. Thirdly, after adjustment, there was no association found between alcohol use and PTB among any of the termination categories. These findings are not consistent with multiple studies showing otherwise.[18, 20, 39] and may only be explained by the small sample sizes of this variable.

Many studies may have been subject to recall and selection bias, thus leading to this discrepancy among the research. This could be a factor in this research as well because of mother's self report on the forms Virginia used. Saying this, the data collection methods utilized in Virginia are still considered a great strength in this study. Virginia is one of only 5 states that mandate filing fetal death records and it is from these fetal death records that we were able to distinguish between induced and spontaneous terminations. We were able to link maternal records from the fetal death registry from as far back as 1990. The large and current sample size was an additional strength of this study. Further contributing to the disparity among research are the inclusion/exclusion of cofounders such as age, [12] race,[6,13] socio-economic status, education, cultural norms, interpregnancy intervals,[13-16] chronic disease,[17] smoking and drug use[18-20] and

working status[21] which have been to show an association but necessarily a definition of cause. This research was able to take most of these cofounders into consideration with the exception socio-economic status, cultural norms, interpregnancy intervals, and working status because this information couldn't be derived from the data sources utilized.

Differentiating between spontaneous and induced termination is a particular strength of this study, but the methodologies utilized in determining type may be considered a weakness. Assumptions were made when birth certificate and fetal death record data were in conflict, therefore possibly diminishing accuracy of exposure and outcome data. If anything, the problem with the data source is not how we differentiated between type of termination, but the under representation of events, therefore, underestimations of effect of PIPT or PSPT on PTB. Virginia law also mandates the reporting of an induced termination of pregnancy, but this registry asks for minimal data and is not useful for analysis. Coupled with the possibility that women are less likely to report an induced abortion due to the sensitivity of the issue may lead to an underestimation of the effect of this type of pregnancy termination. Quality assurance programs should focus on increasing reporting to both the fetal death and induced termination registries and on quality data collection.

This research demonstrates that PSPT and multiple PIPT is a risk factor for PTB. Spontaneous and induced pregnancy termination differ in etiology, so the medical community and public health practitioners need to relate these findings in a meaningful way for each. Pregnancy prevention programs in their various forms around the country should evaluate and concentrate their activities to prevent unintentional pregnancy and/or to increase support for those mothers who pregnant and considering terminating their pregnancy. This could pose a need for increased funding as well policy changes to occur at the upper levels of government to

ensure this type of health prevention funding, a historically sensitive subject. This research does not attempt to find a cause of spontaneous termination, but its findings do warrant further investigation into the epidemiology and biological etiology associated with it. If substantial association is found with a treatable risk factor, women who are more prone to this event may be able to carry babies to term and prevent further miscarriage with the distinct knowledge of their risk factors. Finally, an emphasis for the medical community to enhance already in place surveillance activities is greatly needed to further research.

V. Conclusion

Spontaneous pregnancy termination and multiple induced pregnancy terminations are risk factors for preterm birth in first live births of women. The implications for medical and public health practitioners are different for both types of pregnancy termination. A reevaluation of community-based pregnancy prevention and surveillance programs is needed to further expand knowledge in this area and to prevent preterm birth from occurring.

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VII. Tables

Table 1 Frequency of selected maternal and infant characteristics of first live births in Virginia 2000-2007 by preterm delivery

Variable	Total N	Total %	Preterm Delivery N	Preterm Delivery %
Mother's Race				
White	195,193	64.49	30,870	60.47
Black	66,320	21.91	13,442	26.33
Hispanic	18,578	6.14	2,975	5.83
Other	19,897	6.57	3,293	6.45
Missing	2,700	0.89	468	0.92
Mother's age				
19 years and younger	54,798	18.10	9,895	19.38
20-34 years	220,500	72.85	35,783	70.10
35-44 years	27,074	8.94	5,270	10.32
45 years and older	225	0.07	75	0.15
Missing	91	0.03	25	0.05
Mother's Education				
Elementary/Middle	5,088	1.68	941	1.84
High School	124,999	41.30	22,081	43.26
College	169,323	55.94	27,292	53.46
Missing	3,278	1.08	734	1.44
Sex of Child				
Male	155,128	51.25	26,923	52.74
Female	147,554	48.75	24,121	47.25
Missing	6	0.00	4	0.01
Weeks Gestation at Birth				
0 to 37 weeks	51,048	16.86		
38 weeks or more	251,578	83.11		
Missing	62	0.02		
Prior Termination				
Yes	56,438	18.65	10,612	20.79
No	246,246	81.35	40,435	79.21
Missing	4	0.00	1	0.00
Number of Prior Terminations				
0	246,246	81.35	40,435	79.21
1	41,330	13.65	7,450	14.59
2	10,789	3.56	2,146	4.20
3 or more	4,319	1.43	1,016	1.99
Missing	4	0.00	1	0.00
Induced Terminations				
0	255,884	84.54	42,544	83.34
1	34,528	11.41	6,027	11.81
2	8,868	2.93	1,719	3.37
3 or more	3,404	1.12	757	1.48
Missing	4	0.00	1	0.00

Spontaneous Terminations				
0	290,164	95.86	48,241	94.50
1	11,311	3.74	2,470	4.84
2	1,058	0.35	276	0.54
3 or more	151	0.05	60	0.12
Missing	4	0.00	1	0.00
Tobacco Use				
Yes	19,555	6.46	3,652	7.15
No	283,132	93.54	47,396	92.85
Missing	1	0.00	0	0.00
Alcohol Use				
Yes	1,121	0.37	208	0.41
No	301,566	99.63	50,840	99.59
Missing	1	0.00	0	0.00
Drug use				
Yes	1,649	0.54	378	0.74
No	296,173	97.85	49,633	97.23
MIssing	4,866	1.61	1,037	2.03
Prenatal Visits				
0	1,623	0.54	752	1.47
1 to 10	89,957	29.72	23,505	46.04
11 to 20	205,268	67.82	25,524	50.00
21 or more	3,208	1.06	702	1.38
Missing	2,632	0.87	565	1.11
Method of Payment				
Medicaid	67,243	22.22	11,826	23.17
Private Insurance	218,694	72.25	35,759	70.05
Self-Pay	10,102	3.34	2,074	4.06
Missing	6,649	2.20	1,389	2.72
History of Diabetes				
Yes	10,579	3.50	2,612	5.12
No	292,109	96.50	48,436	94.88
Missing	0	0.00	0	0.00
History of Chronic Hypertension				
Yes	2,684	0.89	1,025	2.01
No	300,004	99.11	50,023	97.99
Missing	0	0.00	0	0.00
History of Pregnancy Induced Hypertension				
Yes	16,733	5.53	6,140	12.03
No	285,955	94.47	44,908	87.97
Missing	0	0.00	0	0.00
History of Incompetent Cervix				
Yes	805	0.27	448	0.88
No	301,883	99.73	50,600	99.12
Missing	0	0.00	0	0.00

Table 2 Prevalence of preterm delivery of first live births in Virginia 2000-2007

Variable	Preterm Delivery N	%	95% CI LCL	UCL
Mother's Race				
White	30,870	15.82	15.66	15.98
Black	13,442	20.27	19.96	20.58
Hispanic	2,975	16.02	15.49	16.55
Other	3,293	16.55	16.03	17.07
Mother's age				
19 years and younger	9,895	18.06	17.74	18.38
20-34 years	35,783	16.23	16.08	16.38
35-44 years	5,270	19.47	19.00	19.94
45 years and older	75	33.33	27.17	39.49
Mother's Education				
Elementary/Middle	941	18.50	17.43	19.57
High School	22,081	17.67	17.46	17.88
College	27,292	16.12	15.94	16.30
Sex of Child				
Male	26,923	17.36	17.17	17.55
Female	24,121	16.35	16.16	16.54
Prior Termination				
Yes	10,612	18.80	18.48	19.12
No	40,435	16.42	16.27	16.57
Number of Prior Terminations				
0	40,435	16.42	16.27	16.57
1	7,450	18.03	17.66	18.40
2	2,146	19.89	19.14	20.64
3 or more	1,016	23.53	22.26	24.80
Induced Terminations				
0	42,544	16.63	16.49	16.77
1	6,027	17.46	17.06	17.86
2	1,719	19.39	18.57	20.21
3 or more	757	22.25	20.85	23.65
Spontaneous Terminations				
0	48,241	16.63	16.49	16.77
1	2,470	21.84	21.08	22.60
2	276	26.09	23.44	28.74
3 or more	60	39.74	31.93	47.55

Tobacco Use				
Yes	3,652	18.68	18.13	19.23
No	47,396	16.74	16.60	16.88
Alcohol Use				
Yes	208	18.57	16.29	20.85
No	50,840	16.86	16.73	16.99
Drug use				
Yes	378	22.92	20.89	24.95
No	49,633	16.76	16.63	16.89
Prenatal Visits				
0	752	46.62	44.19	49.05
1 to 10	23,505	26.13	25.84	26.42
11 to 20	25,524	12.44	12.30	12.58
21 or more	702	21.89	20.46	23.32
Method of Payment				
Medicaid	11,826	17.59	17.30	17.88
Private Insurance	35,759	16.35	16.19	16.51
Self-Pay	2,074	20.54	19.75	21.33
History of Diabetes				
Yes	2,612	24.69	23.87	25.51
No	48,436	16.59	16.46	16.72
History of Chronic Hypertension				
Yes	1,025	38.19	36.35	40.03
No	50,023	16.68	16.55	16.81
History of Pregnancy Induced Hypertension				
Yes	6,140	36.7	35.97	37.43
No	44,908	15.71	15.58	15.84
History of Incompetent Cervix				
Yes	448	55.72	52.29	59.15
No	50,600	16.76	16.63	16.89

Table 3 Crude and Adjusted odds-ratios of preterm delivery of first live births by total terminations in Virginia 2000-2007

	Crude			Adjusted		
		95% CI			95% CI	
Variable	POR	LCL	UCL	POR	LCL	UCL
Mother's Race						
White	1.00			1.00		
Black	1.35	1.32	1.38	1.23	1.20	1.26
Hispanic	1.02	0.97	1.06	0.91	0.87	0.95
Other	1.06	1.02	1.10	0.99	0.95	1.03
Mother's age						
19 years and younger	1.14	1.11	1.17	0.99	0.96	1.02
20-34 years	1.00			1.00		
35-44 years	1.25	1.21	1.29	1.19	1.15	1.24
45 years and older	2.58	1.96	3.41	2.20	1.62	2.99
Mother's Education						
Elementary/Middle	1.18	1.10	1.27	1.02	0.94	1.10
High School	1.12	1.10	1.14	1.07	1.04	1.09
College	1.00			1.00		
Sex of Child						
Male	1.0			1.0		
Female	0.93	0.91	0.95	0.94	0.92	0.96
Number of Prior Terminations						
0	1.00			1.00		
1	1.12	1.09	1.15	1.10	1.31	1.53
2	1.26	1.20	1.33	1.18	1.12	1.24
3 or more	1.57	1.46	1.68	1.42	1.07	1.13
Tobacco Use						
Yes	1.14	1.10	1.19	1.12	1.08	1.17
No	1.00			1.00		
Alcohol Use						
Yes	1.13	0.97	1.31	0.88	0.75	1.04
No	1.00			1.00		
Drug use						
Yes	1.48	1.32	1.66	1.16	1.02	1.31
No	1.00			1.00		
Prenatal Visits						
0	6.15	5.57	6.79	6.55	5.88	7.31
1 to 10	2.49	2.44	2.54	2.56	2.50	2.61
11 to 20	1.00			1.00		
21 or more	1.97	1.81	2.15	1.53	1.40	1.68

Method of Payment						
Medicaid	1.09	1.07	1.12	0.89	0.87	0.92
Private Insurance	1.00			1.00		
Self-Pay	1.32	1.26	1.39	0.91	0.86	0.96
History of Diabetes						
Yes	1.65	1.58	1.73	1.54	1.46	1.62
No	1.00			1.00		
History of Chronic Hypertension						
Yes	3.09	2.85	3.34	2.79	2.56	3.05
No	1.00			1.00		
History of Pregnancy Induced Hypertension						
Yes	3.11	3.01	3.22	3.20	3.09	3.32
No	1.00			1.00		
History of Incompetent Cervix						
Yes	6.24	5.43	7.18	5.08	4.37	5.91
No	1.00			1.00		

Table 4 Crude and Adjusted odds-ratios of preterm delivery of first live births by history of induced termination in Virginia 2000-2007

	Crude			Adjusted		
		95% CI			95% CI	
Variable	POR	LCL	UCL	POR	LCL	UCL
Mother's Race						
White	1.00			1.00	ref	ref
Black	1.35	1.32	1.38	1.23	1.20	1.26
Hispanic	1.02	0.97	1.06	0.91	0.87	0.95
Other	1.06	1.02	1.10	0.99	0.95	1.03
Mother's age						
19 years and younger	1.14	1.11	1.17	0.98	0.95	1.01
20-34 years	1.00			1.00		
35-44 years	1.25	1.21	1.29	1.21	1.17	1.25
45 years and older	2.58	1.96	3.41	2.25	1.66	3.06
Mother's Education						
Elementary/Middle	1.18	1.10	1.27	1.01	0.94	1.10
High School	1.12	1.10	1.14	1.07	1.04	1.09
College	1.00			1.00		
Sex of Child						
Male	1.00			1.00		
Female	0.93	0.91	0.95	0.936	0.92	0.96
Induced Terminations						
0	1.00			1.00		
1	1.06	1.03	1.09	1.02	0.98	1.05
2	1.21	1.14	1.27	1.11	1.05	1.18
3 or more	1.44	1.32	1.56	1.27	1.16	1.39
Tobacco Use						
Yes	1.14	1.10	1.19	1.13	1.09	1.18
No	1.00			1.00		
Alcohol Use						
Yes	1.13	0.97	1.31	0.89	0.75	1.05
No	1.00			1.00		
Drug use						
Yes	1.48	1.32	1.66	1.16	1.03	1.32
No	1.00			1.00		
Prenatal Visits						
0	6.15	5.57	6.79	6.52	5.84	7.27
1 to 10	2.491	2.44	2.54	2.56	2.50	2.61
11 to 20	1.00			1.00		
21 or more	1.973	1.81	2.15	1.54	1.41	1.69

Method of Payment						
Medicaid	1.09	1.07	1.12	0.89	0.87	0.92
Private Insurance	1.00			1.00		
Self-Pay	1.32	1.26	1.39	0.91	0.86	0.96
History of Diabetes						
Yes	1.65	1.58	1.73	1.54	1.47	1.62
No	1.00			1.00		
History of Chronic Hypertension						
Yes	3.09	2.85	3.34	2.80	2.57	3.05
No	1.00			1.00		
History of Pregnancy Induced Hypertension						
Yes	3.11	3.01	3.22	3.21	3.09	3.32
No	1.00			1.00		
History of Incompetent Cervix						
Yes	6.24	5.43	7.18	5.25	4.52	6.11
No	1.00			1.00		

Table 5 Crude and Adjusted odds-ratios of preterm delivery of first live births by spontaneous abortion in Virginia 2000-2007

	Crude			Adjusted		
		95% CI			95% CI	
Variable	POR	LCL	UCL	POR	LCL	UCL
Mother's Race						
White	1.00			1.00		
Black	1.35	1.32	1.38	1.23	1.20	1.27
Hispanic	1.02	0.97	1.06	0.91	0.87	0.95
Other	1.06	1.02	1.10	1.00	0.95	1.04
Mother's age						
19 years and younger	1.14	1.11	1.17	0.99	0.96	1.02
20-34 years	1.00			1.00		
35-44 years	1.25	1.21	1.29	1.19	1.15	1.24
45 years and older	2.58	1.96	3.41	2.26	1.67	3.08
Mother's Education						
Elementary/Middle	1.18	1.10	1.27	1.01	0.93	1.09
High School	1.12	1.10	1.14	1.06	1.04	1.09
College	1.00			1.00		
Sex of Child						
Male	1.00			1.00		
Female	0.93	0.91	0.95	0.94	0.92	0.96
Spontaneous Terminations						
0	1.00			1.00		
1	1.40	1.34	1.47	1.43	1.37	1.50
2	1.77	1.54	2.03	1.71	1.48	1.98
3 or more	3.31	2.39	4.58	2.97	2.09	4.22
Tobacco Use						
Yes	1.14	1.10	1.19	1.13	1.09	1.18
No	1.00			1.00		
Alcohol Use						
Yes	1.13	0.97	1.31	0.90	0.76	1.06
No	1.00			1.00		
Drug use						
Yes	1.48	1.32	1.66	1.17	1.03	1.33
No	1.00			1.00		
Prenatal Visits						
0	6.15	5.57	6.79	6.54	5.86	7.29
1 to 10	2.491	2.44	2.54	2.57	2.52	2.63
11 to 20	1.00			1.00		
21 or more	1.973	1.81	2.15	1.53	1.39	1.67

Method of Payment						
Medicaid	1.09	1.07	1.12	0.89	0.87	0.92
Private Insurance	1.00			1.00		
Self-Pay	1.32	1.26	1.39	0.91	0.86	0.97
History of Diabetes						
Yes	1.65	1.58	1.73	1.54	1.46	1.62
No	1.00			1.00		
History of Chronic Hypertension						
Yes	3.09	2.85	3.34	2.79	2.56	3.04
No	1.00			1.00		
History of Pregnancy Induced Hypertension						
Yes	3.11	3.01	3.22	3.21	3.10	3.32
No	1.00			1.00		
History of Incompetent Cervix						
Yes	6.24	5.43	7.18	5.00	4.30	5.82
No	1.00			1.00		

Table 6 Comparison of crude and adjusted odds-ratios of preterm delivery of first live births by all type of terminations, Virginia 2000-2007

	Crude			Adjusted		
		95% CI			95% CI	
Variable	POR	LCL	UCL	POR	LCL	UCL
All terminations						
0	1.00			1.00		
1	1.1	1.09	1.15	1.1	1.07	1.13
2	1.3	1.20	1.33	1.2	1.12	1.24
3 or more	1.6	1.46	1.68	1.4	1.31	1.53
Induced Terminations						
0	1.00			1.00		
1	1.1	1.03	1.09	1.0	0.98	1.05
2	1.2	1.14	1.27	1.1	1.05	1.18
3 or more	1.4	1.32	1.56	1.3	1.61	1.39
Spontaneous Terminations						
0	1.00			1.00		
1	1.4	1.34	1.47	1.4	1.37	1.50
2	1.8	1.54	2.03	1.7	1.48	1.98
3 or more	3.3	2.39	4.58	3.0	2.09	4.22