# The Effectiveness of Abstinence-Only Sex Education in Alabama

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ABSTRACT

The purpose of this paper is to assess the effectiveness and economic impact of Alabama's Title V funded abstinence-only sex education programs. The specific outcomes to be examined in this study are gonorrhea, Chlamydia, birth, and abortion rates among Alabama teens. The particular programs assessed in this study were created by Title V Section 510 of the Social Security Act and authorized under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996. The funding for Title V abstinence-only sex education programs became available from the federal government in 1998. The focus of this study is to determine the extent to which the decline in negative teen outcomes observed from 1998-2007 can be attributed to Title V funded abstinence-only sex education programs and the amount of public funds that were saved as a result of adopting these programs.

**Keywords:** sex education, abstinence-only sex education, teen health, adolescent health
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## SECTION 1: INTRODUCTION

Sexually active teens are at risk for sexually transmitted diseases (STDs) and pregnancies. These events can have serious consequences for the teens involved as well as society. Taxpayers in the United States pay billions of dollars for teen STD and pregnancy related issues. The American Social Health Association (ASHA) estimates annual direct costs of all STDs to the health care system at $8.4 billion in the United States in 1996 and $132.1 million in Alabama alone (Alexander et al., 1998). According to the Alabama Department of Public Health (ADPH), about 30 percent of those treated for STDs are under the age of nineteen (ADPH statistics), implying that a significant amount of health care costs are geared toward treating STDs in people under the age of nineteen. The ASHA estimates only include direct medical costs of illnesses and doctors' visits caused by pre-diagnosed STDs and complications from STDs. The estimates do not include the cost of STD prevention, STD screening, loss of wages and productivity due to STD-related illness, or any out-of-pocket costs. Only total cost paid via the healthcare system, by either private insurance or public assistance, is included.

The National Campaign to Prevent Teen Pregnancy estimates the net public cost of teen childbearing in a 2006 report. According to the report, the United States incurs $9.1 billion in net public costs for teen childbearing in 2004; Alabama taxpayers pay a net public cost of approximately $178 million dollars for teen childbearing. These net public cost estimates include increases in public health care costs, child welfare costs, state prison system costs, and lost tax revenue incurred by those who become parents before age twenty. These are net costs because some costs would have been incurred even if the teens had waited until age twenty to become parents (Hoffman, 2006). Unlike the STD estimates, the pregnancy estimates include

more than just costs to the health care system. These estimates include a variety of cost to the public sector.

Besides the monetary costs of teen pregnancy and STDs, there are several non-monetary costs of sexual involvement, born by all sexually active teens. Sabia (2007) finds that sexually active teens are more likely to be absent or even suspended and absences from school. He also finds that these students have a decreases affinity for school and decreases aspirations for college. Rector and Noyes (2003) find that teens that have sex are more likely to be depressed and to attempt suicide than those who abstain, regardless of whether they become teen parents or experience STDs.

There are additional non-monetary costs for those teens who acquire a STDs. Complications of bacterial STDs like Chlamydia and gonorrhea can lead to pelvic inflammatory disease (PID), chronic pain, infertility and tubal pregnancies, which can affect a woman's health and productivity throughout her lifetime (Alexander et al., 1998). Furthermore, people who have bacterial STDs are three to five times more likely to contract a viral STD like human immunodeficiency virus (HIV) and human papillomavirus (HPV). Viral STDs like HIV and HPV may require treatment over a period of years, which causes a loss in both productivity and wages. HPV infections may cause precancerous cervical lesions and possibly cervical cancer. HIV generally requires several medications with numerous adverse side effects (Kaiser, 1998). In addition, virtually every STD can be passed from a pregnant woman to her child. Because infants' immune systems are still developing, infections that are serious for an adult can be life threatening to a newborn. Common STD-related problems for infants include low birth weight, premature birth, conjunctivitis, pneumonia, neurologic problems, and congenital abnormalities

(Alexander et al., 1998). For infants who survive, these complications can have life-long effects, which can influence the level of human capital they acquire as adults.

Aside from direct expenditure by the public sector, there are additional costs of teen parenting to the teens and society. Card and Wise (1978) find that both teen mothers and teen fathers obtain less education than those who postpone parenthood until their twenties. This yields lower human capital for society and lower wages for those who become teen parents. Fletcher and Wolfe (2009) find that teen mothers have a lower probability of graduating high school and are more likely to have lower income in their twenties. Examining women at age twenty-seven, Hofferth and Moore (1979) find that the indirect effects of early parenting, such as increased family size and lower earning spouses, lead to greater incidences of poverty for women who become mothers in their teens compared to those who postpone childbearing to age twenty or older. Research by Geronimus and Korenman (1992) and Ribar (1994) concludes that teenage childbearing is not necessarily a cause of poor socioeconomic outcomes and may be just another symptom. These authors suggest that programs that help teens improve their socioeconomic status will do more to decrease teen pregnancy than programs that focus solely on sexual behaviors.

Research also suggests that teenage parenting not only has negative effects on the parents, but their children as well. Dahinten et al. (2007) find that ten to fifteen year-old children born to a young teen mother (age 13-17) had significantly lower math competency scores, even after controlling for several socioeconomic and individual factors about the mother. Haveman et al. (1997) find that if mothers who had children when they were younger than fifteen years old were to delay their childbearing until they were at least twenty years old, it would increase the probability that their children would finish high school by approximately eleven percent. They

also find that if other young mothers (age 16-19) were to delay their childbearing until they were at least twenty years old, it would increase the probability that their children would finish high school by approximately eight percent. Moore et al. (1997) find that children born to adolescent mothers aged seventeen and younger have lower scores in mathematics, reading recognition, and reading comprehension than children born to parents ages twenty or twenty-one. These lower scores increase the probability that the children of teen parents will obtain less education than their counterparts. George and Bong (1997) find that children of adolescent parents are more likely to be abused or neglected and are more likely to enter foster care than children born to parents twenty years old. Grogger (1997) finds that delaying childbearing reduces the likelihood of a young mother's son being incarcerated as an adult.

By educating teens on the dangers of risky behavior that leads to unwanted pregnancies and STDs, sex education aims to decrease the massive costs of teen childbearing and STDs. Although all sex education programs have the same basic goal, the information that they offer to adolescents varies. Sex education has been divided into two basic types: abstinence-only sex education and comprehensive sex education. Abstinence-only sex education teaches young people that the only way to be free of STDs and unplanned pregnancies is to abstain from having sex, usually until marriage. While most comprehensive sex education programs teach young people that abstaining from sex is the only absolute way to avoid STDs and unplanned pregnancies, they also discuss contraceptives and abortions (Keckner, 2008).

The federal government has been funding sex education and other types of STD and teen pregnancy prevention programs for decades. In the 1996 Title V Section 510 of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), Congress authorizes five years of funding for an abstinence-only sex education program. Each state is allocated a portion

of the total $50 million annual budget based on the proportion of low-income children in their state (NCFY Factsheet). States that accept abstinence-only sex education funds are required to provide $3 for every $4 they received in federal funds. The matching funds are allowed to come from a variety of sources including, but not limited to, private donors, community organizations, volunteer work, in-kind donations, etc. States are required to follow what is commonly referred to as the A through H (A-H) rules. The A-H rules are as follows:

A. Have as its exclusive purpose teaching the social, psychological, and health gains to be realized by abstaining from sexual activity

B. Teach abstinence from sexual activity outside marriage as the expected standard for all school-age children

C. Teach that abstinence from sexual activity is the only certain way to avoid out-of-wedlock pregnancy, sexually transmitted diseases, and other associated health problems

D. Teach that a mutually faithful, monogamous relationship in the context of marriage is the expected standard of sexual activity

E. Teach that sexual activity outside the context of marriage is likely to have harmful psychological and physical effects

F. Teach that bearing children out-of-wedlock is likely to have harmful consequences for the child, the child's parents, and society

G. Teach young people how to reject sexual advances and how alcohol and drug use increases vulnerability to sexual advances

H. Teach the importance of attaining self-sufficiency before engaging in sexual activity (SSA, 2009)

The federal government's funding of abstinence-only sex education based on government mandated guidelines has led researchers and politicians to intensify the debate on the type of sex education that is most beneficial to young people.

This study adds to the literature by assessing the effectiveness of Alabama's Title V abstinence-only sex education programs for the 1998-2007 period and the public cost impact attributed to those programs over the period. Funding for Title V abstinence-only sex education programs has been available from the federal government since 1998. Between 1998 and 2007,

the state of Alabama witnesses large decreases in birth, abortion, and gonorrhea rates and modest increases in Chlamydia rates among 10-19 year olds. The focus of this study is to determine how much of the decline in birth, abortion, Chlamydia and gonorrhea rates that occurred between 1998 and 2007can be attributed to Title V funded abstinence-only sex education programs, and estimate the public cost saving created by Title V programs for the state of Alabama.

## SECTION 2: LITERATURE REVIEW

Previous research contributes greatly to our understanding of the benefits of abstinence-only sex education. Studies like those by Sather and Zinn (2002), Borawski et al. (2005), and Denny et al. (2002) evaluate a single program by surveying students before the intervention begins and again shortly after the program ends. Sather and Zinn (2002) evaluate an abstinence-only sex education program in Nebraska. The authors find that the abstinence-only program has no impact on students' attitudes toward abstinence. Borawski et al. (2005) find results that favor abstinence-only sex education when evaluating knowledge of risk associated with sexual involvement, attitudes toward abstinence, and intentions to abstain. However, the authors are unable to find any differences between the abstinence-only group and control group, when measuring actual behavior such as having sex within the previous five months and condom use at last intercourse. The authors do find that students who report being sexually active before the program begins and then receive abstinence-only sex education report fewer recent episodes of sexual intercourse and fewer recent sexual partners than sexually active teens in the control group when surveyed at the end of the program. This offers evidence that the program curbs casual sex among young teens. Interestingly, students in this study who receive abstinence-only sex education are significantly more likely to report that they plan not to use a condom if they have sex. The authors state this result needs more research.

Denny et al. (2002) evaluate the *Sex Can Wait* program in fifteen different school districts, where participants of the program are divided into age groups and assessed before the program begins and again when it ends. In all age groups, there is a control group and a treatment group. The study finds favorable results on attitudes towards remaining abstinent and intended sexual behavior on both upper elementary students and high school students. The

attitudes toward abstinence and intentions regarding sexual behavior that students report remain unchanged for middle school students when the program ends.

Critics often point out that evaluating students at the beginning and end of a program is not enough to get a true assessment of the program's impact. Denny and Young (2006), St. Pierre et al. (1995), Trenholm et al. (2008), Doniger et al. (2001), and Jemmott et al. (2010) answer this criticism by surveying program participants long after the program ends and evaluating the long-term impacts of the programs. For Denny and Young (2006), long-term is eighteen months and, like Denny, et al. (2002), they evaluate the *Sex Can Wait* program. Denny and Young (2006) find results that favored abstinence-only sex education in all three age groups. The results from the initial middle school students are the most impressive. Middle schools students, who have unchanged attitudes immediately following the program, according to Denny, et al. (2002), are significantly less likely to have sexual intercourse than those in the control group.

For twenty-seven months after the program ends, St. Pierre et al. (1995) evaluate the impact of *Stay SMART*, an abstinence-only sex education program. They perform follow-up surveys at 3, 15, and 27 months. The *Stay SMART* program is implemented at fourteen different Boys and Girls Clubs. Five of the participating clubs adopt the *Stay SMART* program, five clubs adopt the *Stay SMART plus Booster* (this program had follow-up sessions for the entire length of the study), and the remaining four clubs serve as the control group. Neither *Stay SMART* nor *Stay SMART plus Booster* students who are virgins at pretest show significant changes in attitudes towards abstinence. However, *Stay SMART* students who are not virgins at pretest show changes in their attitudes about abstinence as well as their sexual behavior at the fifteen and twenty-seven month follow-ups. Considering the success of the *Stay SMART* program for

non-virgins, the authors are surprised that the *Stay SMART plus Booster* students who are non-virgins are not significantly different from the control group non-virgins in neither their attitudes about abstinence nor their actual sexual behaviors.

For Trenholm et al., (2008) the follow-up period is two to five years and the results are not favorable towards the abstinence-only programs. The authors evaluate four different programs and find that none of the four programs has a significant effect on whether a teen remains abstinent or on the number of sexual partners each teen has. When asked about pregnancies and STDs, the teens in the treatment groups are equally likely to report being affected as those in the control groups.

Doniger et al. (2001) evaluate a program in Monroe County, New York, for a period of five years. They find that the teen pregnancy rate in Monroe County declined at a much faster rate than teen pregnancy rates in two similar counties and New York State as a whole during the years that "Not Me, Not Now" is being implemented.

Jemmott et al. (2010) create a "theory-based" abstinence-only program. The focus of this abstinence-only sex education program is "abstaining from vaginal, anal, and oral intercourse until a time later in life when the adolescent is more prepared to handle the consequences of sex." Marriage and other moral reasons for abstaining are not mentioned. Sixth and seventh grade African American students are recruited from four public schools that serve low-income communities. Students are randomly assigned to one of four groups – abstinence-only sex education, safe-sex only sex education, comprehensive sex education, or health-promotion control group. They have follow-up sessions at 3, 6, 12, 18, and 24 months that correspond with their group assignment. The abstinence-only group is less likely to have initiated sex at the twenty-four month follow-up than the other groups. The abstinence-only

intervention group reports significantly less sexual intercourse in the last three months than other groups at the twenty-four month follow-up, but show no statistically significant difference when asked about having multiple partners and condom use.

Hernandez (2009) uses trend analysis instead of survey data to examine the outcomes of sex education policies in Florida over the previous eighteen years. The author begins by dividing the data into two periods. In the first period, 1990-1999, Florida had a comprehensive sexuality education policy while in the second period, 2000-2007, Florida has federal support for an abstinence-only sex education program. Next, the author examines the differences in the trends of teen birth rates and STD rates such as gonorrhea, Chlamydia, and syphilis for each period. The author finds that gonorrhea rates decrease more during the abstinence sex education policy – rates decreased three times faster during the abstinence period than the comprehensive period for Hispanic females, less so for other groups, but still by a statically significant amount. Syphilis rates and birth rates decrease more during the comprehensive period than during the abstinence period. Chlamydia rates increase during both periods and show no response to either policy.

Since most abstinence-only sex education programs are small and self-evaluated, researchers like Kirby (2008) and Silva (2002) bring some of those small works together and attempt to draw conclusions about the success of abstinence-only sex education programs in general. Both authors concede that the research is just too varied in methodology and types of surveys to draw accurate conclusions about abstinence-only sex education.

This study adds to the literature by examining data on Title V abstinence-only sex education program participation and outcomes at the county level over a ten year period. Because this study does not include survey data, it is easy for other researchers to replicate. Also by examining the program over a ten year period, we get a clear picture of the efficacy of Title V

funded abstinence-only sex education programs. We proceed by discussing the sources of our data, comparing the characteristics of counties that have Title V funded abstinence-only sex education programs and those who do not, presenting an empirical model for examining the effectiveness of Title V funded abstinence-only sex education programs, and finally examining the cost savings to the state for implementation of Title V funded programs.

## SECTION 3: DATA

The state of Alabama submits an annual report to the U.S. Department of Health and Human Services. The report contains information regarding all Alabama programs funded by Section 510 of Title V of the Social Security Act, which includes Title V funded abstinence-only sex education programs. Using annual reports from 1998-2007, we are able to find all Title V grantees in the state and locate the counties that those grantees serve. Some grantees serve one county, while others serve several counties. Of the sixty-seven counties in Alabama, forty-nine counties receive Title V funding for least two years, while two additional counties receive Title V funding only during the 1998 fiscal year and do not serve any students. The remaining sixteen counties never receive any Title V funding. Of the fifty-one counties that receive Title V funding, fourteen counties receive funding for the full ten years of the study. On average counties that receive funding continue to adopt the program for approximately six years.

Next, we collect information from the Annual County Health Profiles, which Alabama Department of Public Health (ADPH) provides to the public. The county health profiles provide information on birth, abortion, marriage, and divorce rates as well as the percentage of teen mothers not married, and the percentage of teen mothers who use Medicaid to pay for the birth of their child. The birth rate is defined as the number of births per 1,000 women. We collect this information for three age groups – ages 10-14, ages 15-17, and ages 18-19 for the years 1998-2007. Abortion rates are calculated in the same manner as birth rates; however there is only one age group, ages 10-19. Marriage and divorce rates are calculated per 1,000 individuals residing in a county. Data on whether the mother is unmarried or uses Medicaid is recorded at the time of the child's birth.

Next, we collect data on STD rates. The number of cases of Chlamydia and gonorrhea in each county for our age groups (ages 10-14, 15-17, and 18-19) is provided by the ADPH for each year from 1994-2007. We collect population variables from the U.S. Census Bureau, including county population by age. For the years, 1990-1999, the U.S. Census Bureau provides county populations for each age. For these years, we aggregate the data on individual ages into the three age groups. However for 2000-2007, the Census Bureau provides county populations in age groups. We collect data for two Census age groups, 10-14 year-olds and 15-19 year-olds. The 15-19 year-old age group has to be split into two smaller groups, 15-17 and 18-19. To create the two groups, we calculate the percentage of 18-19 year-olds in the larger 15-19 year-old population for each year in the 1997-1999 period. Next, we compute a three year average ratio of 18-19 year olds to the larger 15-19 year-old age group. We use the three year average and the large 15-19 year-old population data to compute the number of 18-19 year olds for the 2000-2007 period. Finally, we use the number of cases of Chlamydia and gonorrhea, along with the population in the corresponding age group, to compute Chlamydia and gonorrhea rates in the same manner that the County Health Profiles compute birth rates.

The number of students graduating from high school in each school system is provided by the Alabama Department of Education. We aggregate this data to the county level. Data on the number of students in each grade level in each school is collected from the U.S. Department of Education, which is also aggregated to the county level. We also use information from these sources to calculate graduation rates.

Graduation rates are calculated by taking the number of students who receive either a regular, advanced, or career-tech high school diploma in a given year and dividing by the number of students in the corresponding ninth grade class. The ninth grade class is calculated by

taking the ninth grade class and averaging the number of students in the ninth grade class with the number of students in the previous year's eighth grade class and the next year's tenth grade class. For example, we compute the graduation rate for the year 2000 as such: we find the average number of students in the ninth grade class of 1997, the eighth grade class of 1996, and the tenth grade class of 1998. This average is considered the 1997 ninth grade class. We divide the number of students who received a regular, advanced, or career-tech diploma in 2000 by the 1997 ninth grade class. This calculation is known as the "average freshman graduation rate" and is the standard used in accountability reports by Alabama school systems (VOICES). The 'No Child Left Behind Act' has changed those standards for reporting beginning the 2010-2011 academic year, however the data required for the new accountability standard is not available for entire period of this study.

Data on the number of students who receive free lunch, the number of full time teachers, and the total number of students in each school is collected from the U.S. Department of Education. The U.S. Department of Education calculates the number of full time teachers, by counting all full time teachers as well as the portion of part time teachers' week actually spent teaching. After aggregating all variables to the county level, we use the number of full time teachers along with the number of students in each county to calculate a county level ratio of students to teachers. We then use the number of students receiving free lunch and the total number of students to calculate the percentage of students in each county who receive free lunch during a given school year.

The financial data we collect from the U.S. Department of Education includes total expenditure, total revenue, federal revenue, state revenue, local revenue, and local property taxes each school system receives over the period. We calculate financial data on a per-student basis

by dividing those variables by the number of students in the county, after aggregating school system data to the county level.

Population variables are collected from the U.S. Census Bureau including total county population, population by race, and population by gender. We use this data to calculate the percent of the population that is female, as well as the percent of the population that is nonwhite. Also collected from the U.S. Census Bureau are median household income and percentage of population under the age of eighteen living in poverty.

Voting data is collected from the Alabama Secretary of State (Chapman). Voting data consists of the percent of voters in each county that voted Republican in the previous election of the state's U.S. Representative. These results are the same for two consecutive years because elections for U.S. Representatives are held once every two years. The percentages are calculated based on the total number of individuals who vote in a given election, not the number of individuals residing in a county.

We collect a variable indicating whether or not a county is dry, meaning no alcohol can be sold in that county, from the Alabama Alcoholic Beverage Control Board. Finally, we collect information on which counties are included in Alabama's Black Belt from the Center for Economic and Business Research at the University of Alabama (CEBR).

In the next section, we examine the differences and similarities in the characteristics of counties that adopt Title V abstinence-only sex education programs and those who do not. We also examine how this characteristics change over the period. It is especially interesting to note the change in outcome variables in the two county groups over the period.

## SECTION 4: COUNTY CHARACTERISTICS

### A: Characteristics of Title V and non-Title V counties

In this section we discuss characteristics of Title V and non-Title V counties in 1998 and 2007. We have three basic variables that tell us about the poverty level in the county – the percentage of children (under age 18) living in poverty, the percentage of teen mothers (ages 10-19) using Medicaid to pay for the birth of their child, and the percentage of students receiving free lunch. In 1998, Title V counties have a higher percentage of children living in poverty and a higher percent of students receiving free lunch than non-Title V counties, indicating a higher level of poverty for Title V counties. However, the percent of teen mothers using Medicaid to pay for the birth of their child is lower in Title V counties in the same year. By 2007, Title V counties have a lower percent of population under eighteen living in poverty, a lower percent of teen mothers using Medicaid, and a lower percent of the students receiving free lunch, indicating a lower incidence of poverty in Title V counties (Table 4.1).

Next we explore the following education variables – the percentage of students who graduate from high school in four years, the student-teacher ratio for the county, and the total expenditure per student. In 1998, Title V counties have lower graduation rates, suggesting a lower value of education. However, Title V counties also have a lower student teacher ratio, and a higher total expenditure per student than non-Title V counties, which suggests a higher value of education. In 2007, Title V counties have a higher graduation rate, a lower student teacher ratio, and a higher total expenditure per student, all of which suggest a higher community value on education (Table 4.2).

There are four basic cultural variables – the percentage of the population voting for a Republican candidate for US House of Representatives, whether the county is dry, the percentage of teen mothers not married when they give birth, and the county's divorce rate. In

| Title V and non-Title V Poverty Variables | | | |
|---|---|---|---|
| percent of population under 18 living in poverty | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 25.85 | 27.41 | 6.03 |
| Title V Counties | 27.00 | 27.01 | 0.04 |
| non Title V Counties | 24.98 | 27.91 | 11.73 |
| percent teens mothers using Medicaid | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 82.35 | 83.81 | 1.77 |
| Title V Counties | 81.61 | 82.90 | 1.58 |
| non Title V Counties | 82.92 | 84.92 | 2.41 |
| percent of students receiving free lunch | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 44.40 | 49.10 | 10.59 |
| Title V Counties | 49.45 | 47.76 | -3.42 |
| non Title V Counties | 40.47 | 50.77 | 25.45 |

**Table 4.1** Compares poverty variables in Title V and non-Title V counties for 1998 and 2007. Also shows the percentage change in those variables over the period.

1998, Title V counties have a lower divorce rate, a lower percentage of the population voting for a Republican candidate, a lower percentage of counties prohibiting the sale of alcohol, and a higher percentage of teen mothers not married. In 2007, Title V counties have a higher divorce rate, a higher percentage of the population voting for a Republican candidate, a lower percentage of unmarried teens giving birth, and a lower percentage of counties prohibiting the sale of alcohol (Table 4.3).

We explore three demographic variables – the percentage of the population that is nonwhite, the percentage of the population that is female, and the percentage of the population that is between the ages of ten and nineteen (teen population). In 1998, Title V counties have a larger nonwhite population than non-Title V counties, while the other two demographic variables are approximately the same in both the Title V and non-Title V groups. In 2007, Title V

counties have a smaller nonwhite population than non-Title V counties, while the other two demographic groups remain about the same (Table 4.4).

| Title V and non-Title V Education Variables | | | |
|---|---|---|---|
| graduation rates | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 64.36 | 64.68 | 0.50 |
| Title V Counties | 63.92 | 65.46 | 2.41 |
| non Title V Counties | 64.70 | 63.72 | -1.51 |
| student teacher ratio | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 17.23 | 15.98 | -7.25 |
| Title V Counties | 17.14 | 15.83 | -7.64 |
| non Title V Counties | 17.29 | 16.16 | -6.54 |
| total expenditure per student | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 5629.55 | 9252.84 | 64.36 |
| Title V Counties | 5657.05 | 9330.79 | 64.94 |
| non Title V Counties | 5608.56 | 9156.70 | 63.26 |

**Table 4.2** Compares education variables in Title V and non-Title V counties for 1998 and 2007. Also shows the percentage change in those variables over the period.

Along with discussing the demand for Title V abstinence-only sex education programs, we also discuss the effectiveness of the programs in Alabama. Chlamydia rates, gonorrhea rates, birth rates, and abortion rates are used in this study to access the efficacy of Title V funded abstinence-only sex education programs. In 1998, the year Title V is implemented, the gonorrhea rates for Alabama teens are 0.84, 10.07, and 17.88 per 1,000 teens in the following age groups 10-14, 15-17 and 18-19, respectively (Table 4.5). By 2007, the gonorrhea rates for Alabama teens have declined at least twenty-five percent for all age groups. Between 1998 and 2007, there is a statewide increase in Chlamydia rates for all age groups ranging from a thirty-five percent increase for 10-14 years to a 102 percent increase for 18-19 year olds. Over the same period, birth rates in Alabama decline by approximately thirty percent statewide for 10-19 year

olds. Abortion rates decline thirty-seven percent from 8.6 per 1,000 in 1998 to 5.4 per 1,000 in 2007 for 10-19 year olds (Table 4.5). This study examines how much of the decline in gonorrhea, birth, and abortion rates during this period can be attributed to Title V funded abstinence-only sex education programs and whether those programs have helped curb the increase in Chlamydia rates.

Title V and non-Title V Culture Variables

percent voting republican

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| All Counties | 51.63 | 51.96 | 0.64 |
| Title V Counties | 44.98 | 53.85 | 19.72 |
| non Title V Counties | 56.70 | 49.65 | -12.43 |

dry county

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| All Counties | 38.81 | 38.81 | 2.15 |
| Title V Counties | 24.13 | 32.43 | -20.35 |
| non Title V Counties | 50.00 | 46.67 | 30.13 |

percent teens mothers not married

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| All Counties | 67.10 | 74.34 | 10.79 |
| Title V Counties | 73.20 | 72.58 | -0.85 |
| non Title V Counties | 62.44 | 76.52 | 22.55 |

divorce rate

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| All Counties | 5.51 | 4.48 | -18.69 |
| Title V Counties | 5.32 | 4.51 | -15.23 |
| non Title V Counties | 5.66 | 4.44 | -21.55 |

**Table 4.3** Compares culture variables for Title V and non-Title V counties for 1998 and 2007. Also shows the percentage change in those variables over the period.

| Title V and non-Title V Demographic Variables | | | |
|---|---|---|---|
| percent nonwhite population | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 29.78 | 30.41 | 2.12 |
| Title V Counties | 38.69 | 23.76 | -38.59 |
| non Title V Counties | 23.76 | 31.57 | 32.87 |
| percent female population | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 51.91 | 51.47 | -0.85 |
| Title V Counties | 52.19 | 51.73 | -0.86 |
| non Title V Counties | 51.73 | 51.44 | -0.56 |
| percent teen population (ages 10-19) | | | |
| | 1998 | 2007 | Percentage Change |
| All Counties | 14.93 | 13.73 | -8.04 |
| Title V Counties | 15.38 | 14.63 | -4.88 |
| non Title V Counties | 14.63 | 13.84 | -5.40 |

**Table 4.4** Compares demographic variables in Title V and non-Title V counties for 1998 and 2007. Also shows the percentage change in those variables over the period.

Before discussing the data, we take a moment to caution the reader about one difference in the method we use to calculate the STD rates for Title V and non-Title county groups and the method we use to calculate birth and abortion rates for these two groups. The STD rates for each county are calculated so that we compute an actual STD rate for county groups in the same manner that we compute individual county rates. For example, we sum the STD cases from all Title V counties for each age group and sum the population living in those counties for the corresponding age groups and then divide the number of cases by the corresponding population and multiply by 1,000. However, birth and abortion rates are calculated by the ADPH. In this case, we do not have the actually number of cases. Instead of calculating a birth and abortion rate for Title V counties and non-Title V counties, we simply find the average birth and abortion rates for each county group.

A simple look at the data provides some clues as to the success of Title V funded abstinence-only sex education programs. Between 1998 and 2007, there is a statewide decline in gonorrhea rates. For 10-14 year olds, Title V counties have a larger decline in gonorrhea rates than non-Title V counties. Even more impressive is that 15-17 year olds and 18-19 year olds in Title V counties experience large declines in gonorrhea rates, while gonorrhea rates increase for those same age groups in the non-Title V counties. Chlamydia rates increase for teens throughout the state of Alabama; however Title V counties have a smaller increase in Chlamydia rates than non-Title V counties for all three age groups (Table 4.6). In 1998 the average birth rate for 10-14 year olds in Title V counties is 3.18 per 1,000 which then declines to 1.06 per 1,000 for 2007 Title V counties. This is a sixty-seven percent decline in Title V counties, which is much larger than the twenty-nine percent decline in non-Title V counties. Statewide abortion rates also decline over this period. For this outcome we only have one age group, ages 10-19, for which the decline in abortion rates for the Title V counties is larger than the decline for the non-Title V counties (Table 4.6). This examination of the data suggests that Title V abstinence-only sex education programs are effective at reducing teen STD, birth, and abortion rates.

Alabama Teen Outcomes

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| Gonorrhea ages 10-14 | 0.84 | 0.43 | -48.81 |
| Gonorrhea ages 15-17 | 10.07 | 6.42 | -36.25 |
| Gonorrhea ages 18-19 | 17.88 | 13.11 | -26.68 |
| Chlamydia ages 10-14 | 0.86 | 1.16 | 34.88 |
| Chlamydia ages 15-17 | 11.27 | 19.59 | 73.82 |
| Chlamydia ages 18-19 | 18.72 | 37.79 | 101.87 |
| Birth rates ages 10-14 | 1.70 | 0.90 | -51.93 |
| Birth rates ages 15-17 | 43.20 | 28.9 | -29.79 |
| Birth rates ages 18-19 | 113.40 | 91.00 | -19.75 |
| Abortion rates ages 10-19 | 8.60 | 5.40 | -37.21 |

**Table 4.5** Shows gonorrhea, Chlamydia, birth and abortion rates per 1,000 for the state of Alabama for 1998 and 2007. Also shows the percentage change in those variables over the period.

| Outcomes for Title V and non-Title V Counties | | | |
|---|---|---|---|
| Chlamydia ages 10-14 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 1.11 | 1.14 | 2.70 |
| non-Title V Counties | 0.47 | 1.20 | 155.32 |
| Chlamydia ages 15-17 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 14.08 | 19.83 | 40.84 |
| non-Title V Counties | 6.98 | 19.08 | 173.35 |
| Chlamydia ages 18-19 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 21.00 | 36.65 | 74.52 |
| non Title V Counties | 14.35 | 40.26 | 180.56 |
| gonorrhea ages 10-14 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 0.99 | 0.46 | -53.54 |
| non Title V Counties | 0.61 | 0.36 | -40.98 |
| gonorrhea ages 15-17 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 13.04 | 6.56 | -49.69 |
| non Title V Counties | 5.52 | 6.12 | 10.87 |
| gonorrhea ages 18-19 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 20.37 | 12.77 | -37.31 |
| non Title V Counties | 12.87 | 13.93 | 8.24 |
| birth rates ages 10-14 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 3.18 | 1.06 | -66.67 |
| non Title V Counties | 1.68 | 1.20 | -28.57 |
| birth rates ages 15-17 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 45.97 | 29.91 | -34.94 |
| non Title V Counties | 44.65 | 34.03 | -23.78 |
| birth rates ages 18-19 | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 113.09 | 101.39 | -10.35 |
| non Title V Counties | 111.48 | 97.84 | -12.24 |
| abortion rates | | | |
| | 1998 | 2007 | Percentage Change |
| Title V Counties | 9.20 | 4.62 | -49.78 |
| non Title V Counties | 6.11 | 3.63 | -40.59 |

**Table 4.6** Compares gonorrhea, Chlamydia, birth, and abortion rates for Title V and non-Title V counties. Also compares the percentage change in those variables over the period.

**B: Characteristics of 10-year Title V counties and 10-year non-Title V counties**

Deciding to adopt Title V funded abstinence only sex education programs is not necessarily a long term commitment. Counties are free to opt in and out of this program, which means the 1998 Title V counties and the 2007 Title V counties are not the same counties. Therefore our simple look at the characteristics of 1998 Title V counties and the characteristics of 2007 Title V counties may be misleading. To give the reader a more complete comparison, we compare characteristics of counties that remain in the program for all ten years (10-year Title V counties) and counties that do not enter the program during the entire ten years period (10-year non-Title V counties). There are fourteen 10-year Title V counties and sixteen 10-year non-Title V counties.

| 10-year Title V and 10-year non-Title V Poverty Variables | | | |
|---|---|---|---|
| percent of population under age 18 living in poverty | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 27.41 | 28.86 | 5.29 |
| 10-year non-Title V Counties | 26.12 | 27.84 | 6.58 |
| percent teens mothers using Medicaid | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 79.66 | 83.04 | 4.24 |
| 10-year non-Title V Counties | 82.43 | 85.70 | 3.97 |
| | | | |
| percent of students receiving free lunch | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 50.79 | 53.29 | 4.92 |
| 10-year non-Title V Counties | 42.00 | 48.50 | 15.48 |

**Table 4.7** Compares poverty variables of 10-year Title V and 10-year non-Title V counties in 1998 and 2007. Also compares the percentage change in those variables over the period.

We revisit our three basic poverty level variables – the percentage of population under age eighteen living in poverty, the percentage teen mothers using Medicaid to pay for the birth of their child, and the percentage of students receiving free lunches. Counties that remain an adopter of Title V programs have a higher percent of the population under age eighteen living in

poverty and a higher percent of students receiving free lunch in 1998 and 2007 than 10-year non-Title V counties. They also have a lower percent of teen mothers using Medicaid to pay for their child's birth in 1998 and 2007 (Table 4.7). Comparing the 10-year Title V counties with 10-year non-Title V counties shows much smaller differences in the percentage change in the poverty variables, especially the percentage of the population under eighteen living in poverty and the percentage of students receiving free lunch. This implies that most of the differences seen in Table 4.1 could be due to poorer counties adopting the program and/or wealthier counties opting out of the program.

10-year Title V and 10-year non-Title V Education Variables

graduation rates

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| 10-year Title V Counties | 63.94 | 64.64 | 1.09 |
| 10-year non-Title V Counties | 65.73 | 65.25 | -0.73 |

student teacher ratio

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| 10-year Title V Counties | 17.02 | 15.69 | -7.81 |
| 10-year non-Title V Counties | 17.33 | 16.20 | -6.52 |

total expenditure per student

| | 1998 | 2007 | Percentage Change |
|---|---|---|---|
| 10-year Title V Counties | 5664.97 | 9500.16 | 67.70 |
| 10-year non-Title V Counties | 5491.48 | 8798.38 | 60.22 |

**Table 4.8** Compares education variables in 10-year Title V and 10-year non-Title V counties for 1998 and 2007. Also shows the percentage change in those variables over the period.

Next, we revisit the education variables – graduation rate, student-teacher ratio, and total expenditure per student. In 1998 and 2007, 10-year Title V counties have lower student-teacher ratios (Table 4.8). This is parallel to what we see in Table 4.2. Total expenditure per student is higher in 10-year Title V counties than 10-year non-Title V counties. This is also parallel to what we see in Table 4.2, which suggests a higher value of education in those counties. In both years, 10-year Title V counties have lower graduation rates than 10-year non-Title V counties

(Table 4.8). Although having lower graduation rates suggest that the community values education less, the 10-year Title V counties do improve their graduation rates over the period, while the 10-year non-Title V counties do not.

| 10-year Title V and 10-year non-Title V Culture Variables | | | |
|---|---|---|---|
| percent voting republican | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 45.34 | 52.43 | 15.64 |
| 10-year non-Title V Counties | 55.12 | 51.69 | -6.22 |
| dry counties | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 14.29 | 14.29 | 0.00 |
| 10-year non-Title V Counties | 62.50 | 62.50 | 0.00 |
| percent teens mothers not married | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 75.60 | 76.26 | 0.87 |
| 10-year non-Title V Counties | 61.64 | 73.48 | 19.21 |
| divorce rate | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 5.02 | 3.99 | -20.52 |
| 10-year non-Title V Counties | 5.76 | 4.51 | -21.70 |

**Table 4.9** Compares culture variables in 10-year Title V and 10-year non-Title V counties in 1998 and 2007. Also shows the percentage change in those variables over the period.

Next is a brief discussion of our four basic culture variables – dry county, divorce rate, the percentage of teen mothers not married, and the percentage of population voting for a Republican candidate. Ten-year Title V counties have a lower percentage of voters choosing a Republican candidate in 1998 and a higher percentage choosing a Republican candidate in 2007 compared to 10-year non-Title V counties. For both years, 10-year Title V counties have lower divorce rates and lower percentage of dry counties (Table 4.9). Although 10-year Title V counties also have a higher percent of unmarried teen mothers in 1998 and 2007 than 10-year non-Title V counties, the increase in the percentage of unmarried teen mothers is much smaller for 10-year Title V counties.

| Title V and non-Title V Demographic Variables | | | |
|---|---|---|---|
| percent nonwhite population | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 37.70 | 38.76 | 2.81 |
| 10-year non-Title V | 25.07 | 25.23 | 0.64 |
| percent female population | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 52.09 | 51.98 | -0.21 |
| 10-year non Title V | 51.84 | 51.46 | -0.73 |
| percent teen population (ages 10-19) | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 15.29 | 14.29 | -6.54 |
| 10-year non Title V | 15.16 | 13.65 | -9.96 |

**Table 4.10** Compares demographic variables in Title V and non-Title V counties for 1998 and 2007. Also shows the percentage change in those variables over the period.

Now that we have discussed characteristics of 10-year Title V and 10-year non-Title V counties, we discuss outcome variables of those county groups. The counties that remain in the program all ten years have a much smaller increase in Chlamydia rates for all three age groups than the counties that never enter the program (Table 4.11). Gonorrhea rates for the oldest two age groups decrease more in the 10-year Title V counties than in the 10-year non-Title V counties. However, for the youngest age group, the decline was larger in the non-Title V counties. Birth rates decrease more in 10-year Title V counties for the 10-14 and 15-17 year-old age groups, but not for the 18-19 year-old age group. The decline in abortion rates for the 10-year Title V counties is larger than for the 10-year non-Title V counties. Although, the differences between the 10-year Title V counties and the 10-year non-Title V counties (Table 4.11) is not as striking as those between the Title V counties and non-Title V counties (Table 4.6), they still suggest that Title V abstinence-only sex education programs may be effective in reducing teen STD, birth, and abortion rates.

| Outcomes for 10-year Title V and 10-year non-Title V counties | | | |
|---|---|---|---|
| Chlamydia ages 10-14 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 0.95 | 1.18 | 24.21 |
| 10-year non-Title V Counties | 0.46 | 1.37 | 197.83 |
| Chlamydia ages 15-17 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 11.16 | 19.77 | 77.15 |
| 10-year non-Title V Counties | 6.80 | 14.20 | 108.82 |
| Chlamydia ages 18-19 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 16.24 | 30.27 | 86.39 |
| 10-year non-Title V Counties | 13.08 | 32.32 | 147.09 |
| gonorrhea ages 10-14 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 0.91 | 0.63 | -30.77 |
| 10-year non-Title V Counties | 0.46 | 0.25 | -45.65 |
| gonorrhea ages 15-17 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 11.89 | 6.07 | -48.95 |
| 10-year non-Title V Counties | 5.73 | 2.99 | -47.82 |
| gonorrhea ages 18-19 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 17.57 | 11.26 | -35.91 |
| 10-year non-Title V Counties | 11.99 | 8.67 | -27.69 |
| birth rates ages 10-14 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 4.91 | 1.19 | -75.76 |
| 10-year non-Title V Counties | 2.12 | 0.95 | -55.19 |
| birth rates ages 15-17 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 45.36 | 27.62 | -39.11 |
| 10-year non-Title V Counties | 45.43 | 34.25 | -24.61 |
| birth rates ages 18-19 | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 107.43 | 89.91 | -16.31 |
| 10-year non-Title V Counties | 125.80 | 103.93 | -17.38 |
| abortion rates | | | |
| | 1998 | 2007 | Percentage Change |
| 10-year Title V Counties | 9.23 | 5.09 | -44.85 |
| 10-year non-Title V Counties | 5.75 | 3.32 | -42.26 |

**Table 4.11** Compares gonorrhea, Chlamydia, birth, and abortion rates for 10-year Title V and 10-year non-Title V counties. Also compares the percentage change in those variables over the period.

## SECTION 5: MODELS

### A: Empirical study of effectiveness of abstinence-only sex education

We begin by examining how effectively Title V funded abstinence-only sex education programs decrease risky sexual behavior among teens. Our measures for the presence of risky behaviors are birth, abortion, Chlamydia, and gonorrhea rates. If having a Title V funded abstinence-only sex education program significantly lowers the rates of these outcome variables, we assume that the presence of this program decreases risky behavior. Because each of these outcome variables has unique characteristics, we create a slightly different model for each. First, we will discuss the independent variables that are included in all models. Then we will discuss how the models for abortion, birth, Chlamydia, and gonorrhea rates differ.

Our models include the poverty, culture, education, and demographic variables that we discuss in the descriptive statistics section. First, we discuss our poverty variables included in these models – the percentage of students receiving free lunch (*freelunch*), and the percentage of children living in poverty (*perun18inpov*). Living in poverty is generally a good predictor of risky teen sexual behavior (Moore et al., 1994). We expect both poverty variables to have a positive relationship to risky sexual behavior among teens and therefore have a positive relationship to teen Chlamydia, gonorrhea, and birth rates. We expect poverty variables to be negatively related to abortion rates since the cost of an abortion may make them unattainable for teens in poor families. We refrain from including both of these highly correlated variables in the model at the same time to avoid multicollinearity issues.

Next, we discuss the cultural variables – divorce rate (*divorcerate*), the percentage of teen mothers who are unmarried when they give birth (*perm10-19nmr*), and whether or not the county prohibits the sale of alcohol (*drycounty*). Research suggests that children of divorced parents are more likely to participate in risky behavior (Miller et al., 1994). We expect the divorce rate to be

positively related to Chlamydia, gonorrhea, birth, and abortion rates based on that previous research. The percent of unmarried teen mothers already residing in a county is expected to have a positive effect on risky sexual behavior. Our reasoning is that more unmarried teenage parents there are within a community, the more likely it is that this behavior will become an acceptable norm in that community. This norm can lower the perceived costs of risky sexual behavior thus causing higher occurrences of STDs and pregnancies for teens. Living in a dry county is expected to lower risky sexual behavior (or have a negative effect). Alcohol lowers inhibitions and is often associated with risky sexual behavior (Chesson et al., 2000). If a county prohibits the sale of alcohol, this presents an additional hurdle for teens who would like to purchase alcohol. If this hurdle is enough of a deterrent for teens in dry counties to decrease alcohol consumption as well as risky sexual behaviors, then we should expect to see less risky sexual behavior among teens in dry counties.

The education variables in our analysis are graduation rate (*gradrates*), student-teacher ratio (*stuteach*), and total expenditure per student (*texperh*). The graduation rate is expected to be negatively related to Chlamydia, gonorrhea, birth, and abortion rates, because students who are focused on graduating from high school are less likely to participate in risky behavior (Sabia, 2007). The student-teacher ratio is expected to be positively related to risky sexual behaviors among teens. The higher the student-teacher ratio, the less likely each student is to receive the attention that he or she needs to be successful in school and the more likely the teen is to participate in risky behavior. Total expenditure per student is used to proxy for how much a community values education and is expected to have a negative effect on risky sexual behavior. If the community values education more, those values should be adopted by teens and teens who value education are less likely to participate in risky sexual behaviors.

Finally, we have a few demographic variables - percent of nonwhites in the county population (*pernonwhpop*), percent of females in the county population (*perfemalepop*), and percent of the population between the ages of ten and nineteen (*perage10_19*). The percent of nonwhites in the population is used to control for the fact that nonwhites are more likely than whites to experience an STD and/or teen pregnancy. According to CDC Wonder, the database that houses public health data for the Center for Disease Control (CDC), gonorrhea rates are fifteen times higher for blacks in the 15-19 age groups than whites in the same age group in the state of Alabama over the 1998-2007 period. Over the same period, Alabama's Chlamydia rates for blacks age 15-19 are seven times higher than rates for whites in the same age group. According to the Alabama County Health Profiles, black teens are approximately seventy percent more likely than white teens to become parents during the 1998-2007 period. Therefore we expect the percent of the population that is nonwhite to be positively related to Chlamydia, gonorrhea, birth, and abortion rates. The percent of females in the population controls for the fact that, over the same period, females are twice as likely as males to be treated for an STD (CDC Wonder). Therefore we expect the percent of the population that is female to be positively related to Chlamydia and gonorrhea rates. We have no a priori expectations about how the female population may be related to birth and abortion rates. The population between the ages of 10 - 19 is included to make a more fair comparison among counties since the percentage of the teenage population varies among counties. We have no a priori expectations for how the percent of the teen population may affect birth, abortion, Chlamydia, or gonorrhea rates.

The first model is a treatment effect model. The purpose of the treatment model is to avoid bias that could occur due to self-selection (Wooldridge, 2002). In this study Alabama's sixty-seven counties may adopt a Title V funded abstinence-only sex education program or

construct their own sex education program. The possible selection issue is that those counties who choose to adopt a Title V funded abstinence-only sex education program and abide by the federal guidelines may be different from those counties who choose to construct their own sex education program using their own guidelines and funds. Using the treatment effects model, we can account for the fact that selection into the Title V program is not random and then determine the true effect of Title V funded abstinence-only sex education programs on Chlamydia, gonorrhea, birth, and abortion rates. A requirement of the treatment effect model is the use of instrumental variables (IVs). For this model we have two IVs. The first IV is the percentage of neighbors that have Title V funded abstinence-only sex education programs (*pernein*). Having a neighbor with a Title V funded program may encourage a county to adopt the program as well; however having a neighbor with a Title V funded program should in no way influence the outcome variables in this study – birth, Chlamydia, gonorrhea, and abortion rates. The second IV is the percentage of voters who chose a Republican candidate in the previous election for US House of Representatives (*pervoter*). Voting choices may influence whether or not a county adopts a Title V funded program, but should not influence outcomes. The following is our treatment model for abortion rates:

$$(abtrat)_i = \alpha_i + \beta_1(freelunch)_i + \beta_2(perm10\text{-}19nmr)_i + \beta_3(divorcerate)_i + \beta_4(drycounty)_i + \beta_6(stuteach)_i + \beta_6(gradrates)_i + \beta_6(texperh)_i + \beta_5(pernonwhpop)_i + \beta_6(perfemalepop)_i + \beta_6(perage10_19)_i + \varphi(titlevprog)_i + \varepsilon_i \quad (1)$$

$$(titlevprog)^*_i = \alpha i + \delta_1(penein)_i + \delta_2(pervoter)_i + \mu_i \quad (2)$$

Equation (2) includes all variables in equation (1) plus the two IVs. The reader should recall that in some specifications, *perun18inpov* is used instead of *freelunch*. Once the treatment model is estimated we use those estimates to calculate the expected value of the outcome

variable conditional on the adoption of the Title V funded abstinence-only sex education program minus the expected value of the outcome variable conditional on the absence of the program [E(outcome | titlevprog = 1) – E(outcome | titlevprog = 0)]. This estimate provides the effectiveness of Title V funded abstinence-only sex education.

The model for birth rates is very similar to that of abortion rates except the dependent variable in the birth rate model is next period's birth rate. This is because risky behaviors that transpire in one period will not appear in the birth rate data until the next period. The models for Chlamydia and gonorrhea rates are also very similar to the abortion rate model except they include a one year lagged dependent variable in addition to the variables discussed above. Since these diseases are communicable, it seems plausible that the lagged rate influences the current rate. We expect the lagged dependent variable to be positively related to the current STD rate.

One problem with using the treatment effects model is the possibility that our IVs may be weak. We perform a total of three tests to check for weak IVs (Baum et al., 2007). The first test is the Sargan-Hansen test of over-identifying restrictions. The null hypothesis of this test is that the instruments are valid instruments and are correctly excluded from the first stage equation. Failure to reject the null implies that instruments are probably valid (Green, 2003). The next test is a Lagrange multiplier (LM) version of the Anderson canonical correlations test (Anderson, 1951). The null hypothesis of this test is that the equation is under-identified or not of full rank. The purpose is to test whether the excluded instruments are correlated with the endogenous variables. A rejection of the null indicates that the matrix is full column rank and that the equation is identified, suggesting that the instruments are valid. The final test is an F version of the Cragg-Donald Wald statistic and it tests for weak identification (Cragg and Donald, 1993). The null hypothesis is that the instrumental variables are only weakly correlated with the

endogenous variable. Stock and Yogo (2005) have compiled critical values for the Cragg-Donald F statistic for several different estimators. We use those critical values to determine whether we can reject the null hypothesis. If we reject the null, the instrumental variables are not weak and are therefore valid instruments for our study.

Although our instruments do not appear to be weak, we use the propensity score matching (PSM) model as a robustness check. One advantage of this model is the fact that instrumental variables are not needed. The PSM model begins by matching observations on the probability that a particular county will participate in the program, given a set of observable county characteristics (i.e. $PS(County_i) = Prob(titlevprog_i = 1| CountyCharacteristics_i)$). By matching counties who receive Title V funding (treated) to those who do not receive funding (control) but have the same probability of program participation based on county characteristics, we are able to estimate the average treatment effect (Khandker et al., 2010). This estimate simulates a randomized experiment so we do not have to be concerned with unobserved heterogeneity among counties. Matching should ensure that there are no systematic differences between counties who adopt Title V funded programs and those that do not.

One shortfall of the PSM method is that by the nature of the matching technique no conclusions can be drawn about any variables other than program participation. Panel data methods, however allow us to control for unobserved heterogeneity as well as estimate coefficients for other independent variables of interest (Wooldridge, 2002). In order to employ the panel data method, we first test for evidence of unobserved heterogeneity using the Breusch and Pagan (1979) Lagrange multiplier test. The null hypothesis is that cross-sectional variance components are zero. Failure to reject the null implies that there is no need for a panel model. However, a rejection of the null suggests that a panel model provides a better estimation than the

pooled OLS model. Since we find evidence of unobserved heterogeneity for all ten cases (abortion rates, birth rates for all three age groups, Chlamydia rates for all three age groups, and gonorrhea rates for all three age groups), we use a panel model to find the average treatment effect that the Title V funded abstinence-only sex education programs have on outcome variables. In fixed effects panel data models, no other assumptions are needed, however in random effects panel data models, we also assume that the unobserved heterogeneity is uncorrelated with each of our independent variables. The random effects model is the more efficient estimator and we prefer to use this estimator when it is appropriate. However the additional assumption can sometimes be too strong. We use the Hausman test to decide between random effects and fixed effects models (Wooldridge, 2002). The Hausman test chooses the fixed effects model as the best model therefore we report the results of the fixed effects model in the next section.

Overall, we use three different methods to estimate the efficiency of Title V abstinence-only sex education programs in reducing birth, abortion, Chlamydia, and gonorrhea rates. Each method has a slightly different purpose and we examine the results of each method in the next section.

## B. Economic Impact Analysis

To determine the benefit of the program, we use the estimated benefit in the effectiveness section (i.e. the estimated decrease in birth, Chlamydia, and gonorrhea rates), the average benefits package paid to a single mother of one in Alabama, the cost to the state of treating STDs, and the probability that births and STDs deterred as a result of this program would have been funded with public funds had they occurred.

A new mother who meets all income restrictions could qualify for approximately $360 per month in food assistance via Supplemental Nutrition Assistance Program (SNAP). This

estimate is obtained using the SNAP Eligibility Screening Tool, by entering information for an 18 year old, new mother with no income, no rental payments (assuming teen parents live with adult), and no assets. A young mother also qualifies for $186.35 per month in Temporary Assistance to Needy Families and $249 per month for child care according to the Alabama Department of Human Resources (ADHR) 2007 Annual Report. Young mothers also qualify for approximately $169.38 per month in assistance from the Alabama Department of Public Health's Women Infant and Children (WIC) program according to the WIC annual report for fiscal year 2007. Children age 0-5 years, also use on average about $1,255 per year in Medicaid according to the Alabama Medicaid Agency (AMA) Annual Report for fiscal year 2006. This is an estimated benefit package of $10,968.26 per year to an eligible young mother. This estimate is likely to be biased since the estimates are based on information for only one fiscal year. Requests for previous annual reports remain answered by ADPH, ADHR and AMA.

Chlamydia and gonorrhea treatment costs the state approximately $242.14 per treatment for those who qualify for state assistance according to a report by the Center for Disease Control. This does not include any long term care that may result from related illnesses. We use this simple state cost to estimate the benefit of abstinence-only sex education programs as it relates to STDs.

## SECTION 6: RESULTS

### A. Effectiveness Results

We report results for three different types of models used to test the effectiveness of Title V funded abstinence-only sex education programs –the treatment effect, propensity score matching (PSM), and fixed effects models. Each model has two specifications, one that includes the percentage of children living in poverty (*perun18inpov*) as the poverty variable and one that includes the percentage students receiving free lunch (*freelunch*) as the poverty variable. In the treatment effect models, we discuss the second stage results for all dependent variables except the Title V funded abstinence-only sex education programs (*titlevprog*). For Title V programs, we discuss [E(outcome | titlevprog = 1) – E(outcome | titlevprog = 0)], where the outcomes are birth, abortion, Chlamydia, and gonorrhea rates as explained in section 5. PSM does not yield coefficients for other independent variables by nature of the matching method. Therefore when we discuss additional factors that influence outcomes, we will only discuss the treatment effect and fixed effects models.

#### 1. Birth Rate Results

For 10-14 year olds, the treatment effect and fixed effects models suggest that adopting a Title V funded abstinence-only sex education program has a negative effect on (decreases) a county's birth rates (Table 6.1 – 6.2). The PSM model suggests a significant decline in teen births in this age group when the percentage of the children living in poverty (*perun18inpov*) is the poverty variable, but the decline is not significant at traditional levels when the percentage of students receiving free lunch (*freelunch*) is the poverty variable (Table 6.2). Overall, the results for this age group suggest that counties that adopt Title V funded programs experience more of a decline in birth rates than counties that do not adopt Title V funded programs.

Table 6.1 – Birth Rates Ages 10-14 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| pernonwhpop | 0.025*** | 0.038*** | -0.005 | 0.002 |
| | (0.01) | (0.01) | (0.07) | (0.07) |
| perfemalepop | -0.193*** | -0.136* | -0.395** | -0.389** |
| | (0.07) | (0.07) | (0.18) | (0.18) |
| divorcerate | 0.096*** | 0.092*** | 0.285*** | 0.266*** |
| | (0.03) | (0.03) | (0.10) | (0.10) |
| gradrates | 0.008 | 0.006 | 0.021 | 0.025 |
| | (0.01) | (0.01) | (0.02) | (0.02) |
| texperh | -0.016** | -0.018** | -0.007 | -0.006 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| stuteach | 0.057 | 0.062 | 0.149 | 0.224** |
| | (0.06) | (0.06) | (0.10) | (0.10) |
| perm10_19nmr | 0.005 | -0.001 | 0.010 | 0.006 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| perun18inpov | 0.063*** | | 0.143*** | |
| | (0.02) | | (0.03) | |
| perage10_19 | -0.041 | -0.090 | 0.436*** | 0.372** |
| | (0.07) | (0.08) | (0.14) | (0.15) |
| drycounty | -0.141 | -0.014 | | |
| | (0.12) | (0.11) | | |
| titlevprog | -0.499 | -0.551* | -0.639*** | -0.747*** |
| | (0.33) | (0.33) | (0.20) | (0.21) |
| freelunch | | 0.009 | | 0.033 |
| | | (0.01) | | (0.02) |
| _cons | 8.789** | 7.868** | 6.918 | 8.256 |
| | (3.45) | (3.63) | (9.06) | (9.18) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.086 | 0.065 |
| adj. $R^2$ | | | -0.020 | -0.042 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.2 – Birth Rates Ages 10-14 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | -0.309*** | -0.326*** | -0.566** | -0.372 |
| | (0.04) | (0.04) | (0.26) | (0.24) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Next, we examine the results for 15-17 year olds. Using the treatment effect model, we find that the presence of Title V funded abstinence-only sex education programs decrease birth rates for this age group. The PSM model yields results similar to the treatment effects model in sign and significance (Table 6.4), but only when the percentage of children living in poverty (*perun18inpov*) is used as the poverty variable. The fixed effect model also shows a negative and significant effect on birth rates for this age group, but only when the percentage of students receiving free lunch (*freelunch*) is the poverty variable (Table 6.3). Overall, the results for this age group suggest that the decline in birth rates in Title V counties is more than the decline in other counties.

The final age group to be discussed is 18-19 year olds. The treatment effect model yields a negative coefficient for Title V programs; however this coefficient is only significant when the percentage of students receiving free lunch (*freelunch*) is the poverty variable (Table 6.6). The PSM model suggests that birth rates decline more in counties that receive Title V funding than in counties that do not receive Title V funding when the percentage of the children living in poverty (*perun18inpov*) is the poverty variable (Table 6.6). The fixed effect model suggests that the Title V funded programs has no significant effect on birth rates for this age group (Table 6.5). It is difficult to draw conclusions about the effect of Title V funded abstinence-only sex education programs on birth rates for 18-19 year olds, because not all model specifications yield a negative coefficient.

Table 6.3 – Birth Rates Ages 15-17 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| pernonwhpop | 0.079 | 0.079 | -0.678** | -0.571* |
| | (0.06) | (0.07) | (0.32) | (0.33) |
| perfemalepop | -0.969** | -0.601 | -2.628*** | -2.546*** |
| | (0.49) | (0.49) | (0.84) | (0.85) |
| divorcerate | 0.796*** | 0.825*** | 1.299*** | 1.162*** |
| | (0.25) | (0.25) | (0.44) | (0.45) |
| gradrates | -0.170** | -0.150* | -0.062 | -0.048 |
| | (0.08) | (0.08) | (0.08) | (0.08) |
| texperh | -0.167*** | -0.187*** | -0.078* | -0.070 |
| | (0.05) | (0.05) | (0.05) | (0.05) |
| stuteach | 2.037*** | 2.202*** | 2.617*** | 2.789*** |
| | (0.48) | (0.48) | (0.45) | (0.46) |
| perm10_19nmr | 0.010 | -0.025 | -0.110** | -0.120** |
| | (0.05) | (0.04) | (0.05) | (0.05) |
| perun18inpov | 0.626*** | | 0.537*** | |
| | (0.11) | | (0.16) | |
| perage10_19 | -0.661 | -0.903* | 4.407*** | 3.962*** |
| | (0.53) | (0.54) | (0.66) | (0.67) |
| drycounty | 0.426 | 1.115 | | |
| | (1.07) | (1.05) | | |
| titlevprog | -7.536*** | -7.679*** | -1.407 | -1.654* |
| | (1.71) | (1.64) | (0.93) | (0.95) |
| freelunch | | 0.255*** | | 0.007 |
| | | (0.05) | | (0.10) |
| _cons | 64.744** | 53.073** | 82.893** | 92.539** |
| | (25.93) | (26.52) | (41.92) | (42.35) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.245 | 0.232 |
| adj. $R^2$ | | | 0.158 | 0.143 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.4 – Birth Rates Ages 15-17 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | -1.376*** | -1.582*** | -3.243** | -1.513 |
| | (0.31) | (0.30) | (1.28) | (1.55) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Now, we discuss factors other than the existence of a Title V funded abstinence-only sex education program that affect county level birth rates. These results are presented in Table 6.1 for 10-14 year olds, Table 6.3 for 15-17 year olds and Table 6.5 for 18-19 year olds. We examine these additional factors by category beginning with the poverty variables. Poverty appears to have a positive and significant effect on birth rates for all age groups when the percentage of the children living in poverty (*perun18inpov*) is the poverty variable. However, when the percentage of students receiving free lunch (*freelunch*) is the poverty variable, poverty appears to have a smaller effect on birth rates and the result is not always significant.

Next, we examine the cultural variables that affect the county's birth rate. The county's divorce rate (*divorcerate*) positively and significantly influences birth rates for the all three age groups according to most models. This positive relationship provides support for the hypothesis that teens of divorced parents are more likely to participate in risky behavior, although micro-level data is needed to further test this hypothesis. Another cultural variable, the percentage of mothers not married when they give birth (*perm10_19nmr*) is negative and significant in the fixed effects models for the oldest two age groups. However, this variable is only negative and significant for 18-19 year olds in the treatment effects models.

Now, we examine the effect education variables have on birth rates. The percentage of students who finish high school in four years (*gradrate*) significantly influences birth rates for

Table 6.5 – Birth Rates Ages 18-19 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| pernonwhpop | 0.061 | -0.116 | -1.771*** | -1.701** |
| | (0.15) | (0.14) | (0.67) | (0.69) |
| perfemalepop | -2.559*** | -1.602* | -2.996* | -2.937 |
| | (0.87) | (0.85) | (1.79) | (1.80) |
| divorcerate | 3.469*** | 3.643*** | 1.438 | 1.285 |
| | (0.57) | (0.57) | (0.94) | (0.95) |
| gradrates | -0.403** | -0.294* | -0.001 | 0.034 |
| | (0.16) | (0.16) | (0.16) | (0.16) |
| texperh | -0.227* | -0.317*** | -0.063 | -0.051 |
| | (0.12) | (0.11) | (0.10) | (0.10) |
| stuteach | 2.893*** | 3.615*** | 4.150*** | 4.711*** |
| | (1.06) | (1.05) | (0.95) | (0.97) |
| perm10_19nmr | -0.228** | -0.312*** | -0.388*** | -0.422*** |
| | (0.10) | (0.09) | (0.11) | (0.11) |
| perun18inpov | 1.944*** | | 1.104*** | |
| | (0.23) | | (0.34) | |
| perage10_19 | -4.698*** | -5.045*** | 4.263*** | 3.730*** |
| | (1.19) | (1.16) | (1.40) | (1.43) |
| drycounty | 0.036 | 1.947 | | |
| | (2.52) | (2.37) | | |
| titlevprog | -19.665** | -16.794** | 1.739 | 0.931 |
| | (8.50) | (6.77) | (1.98) | (2.01) |
| freelunch | | 0.996*** | | 0.238 |
| | | (0.11) | | (0.22) |
| _cons | 253.302*** | 209.433*** | 177.895** | 189.009** |
| | (45.48) | (43.98) | (88.80) | (89.61) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.123 | 0.110 |
| adj. $R^2$ | | | 0.021 | 0.008 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.6 – Birth Rates Ages 18-19 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | -0.573 | -1.614** | -4.902* | -1.846 |
| | (.077) | (0.75) | (2.81) | (2.83) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

the two oldest age groups in the treatment effects models, but not in the fixed effects models. When significant, graduation rates are negatively related to birth rates as expected. This supports the hypothesis that the more focused teens are on education are less likely they are to participate in risky behavior. For the older two age groups, the student teacher ratio (*stuteach*) has a positive effect on birth rates as expected. Spending per student (*texperh*) appears to have a negative effect on birth rates, however this variables is not significant at traditional levels in all model specifications.

Finally, we examine the demographic variables that have an effect on birth rates. The percentage of the population that is nonwhite (*pernonwhpop*) is positively and significantly related to birth rates for 10-14 year olds in treatment effects models. In the older two age groups, the percentage of the population that is nonwhite is negatively and significantly related to birth rates in the fixed effects models and generally insignificant in the treatment effects models. A larger female population seems to have a negative effect on birth rates. This result is significant in most models for all age groups. The percentage of the population between the ages of 10 and 19 (*perage10_19*) significantly affects birth rates differently depending on the model specification age. For 10-14 year olds, *perage10_19* is positively related and only significant in the fixed effects model. For the older two age groups, *perage10_19* is positively and significantly related to teen birth rates in the fixed effects model specification, but negatively and significantly related to teen birth rates in treatment effect model specifications.

Table 6.7 – Chlamydia Rates Ages 10-14 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| lr10_14chl | 0.258*** | 0.256*** | 0.040 | 0.050 |
| | (0.07) | (0.07) | (0.05) | (0.05) |
| pernonwhpop | 0.023*** | 0.027*** | 0.018 | 0.023 |
| | (0.01) | (0.01) | (0.03) | (0.03) |
| perfemalepop | -0.040 | -0.038 | -0.004 | 0.001 |
| | (0.04) | (0.04) | (0.09) | (0.09) |
| divorcerate | 0.029 | 0.027 | -0.021 | -0.023 |
| | (0.02) | (0.02) | (0.05) | (0.05) |
| gradrates | 0.000 | -0.001 | 0.002 | 0.001 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| texperh | -0.001 | -0.000 | 0.011** | 0.011** |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| stuteach | 0.032 | 0.027 | 0.031 | 0.007 |
| | (0.04) | (0.04) | (0.05) | (0.05) |
| perm10_19nmr | 0.006 | 0.006 | 0.006 | 0.008 |
| | (0.00) | (0.00) | (0.01) | (0.01) |
| perun18inpov | -0.007 | | -0.027 | |
| | (0.01) | | (0.02) | |
| perage10_19 | -0.129*** | -0.133*** | -0.119* | -0.125* |
| | (0.05) | (0.05) | (0.07) | (0.07) |
| drycounty | 0.122 | 0.130 | | |
| | (0.08) | (0.08) | | |
| titlevprog | 0.275* | 0.265* | 0.094 | 0.129 |
| | (0.16) | (0.16) | (0.10) | (0.10) |
| freelunch | | -0.007 | | -0.017 |
| | | (0.01) | | (0.01) |
| _cons | 2.895 | 3.102 | 1.048 | 1.152 |
| | (1.93) | (1.95) | (4.36) | (4.37) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.043 | 0.043 |
| adj. $R^2$ | | | -0.069 | -0.069 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.8 – Chlamydia Rates Ages 10-14 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | 0.006 | 0.010 | 0.052 | 0.012 |
| | (0.03) | (0.03) | (0.14) | (0.15) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
*** p<.10, ** p<.05, *** p<.01**

**2. Chlamydia Rate Results**

Results from all models suggest that the presence of a Title V abstinence-only sex education program has no significant effect on Chlamydia rates for 10-14 year olds (Tables 6.7-6.8). For the older two age groups, only the fixed effects model yields significant coefficients for the Title V program (Tables 6.9 – 6.12). The positive coefficients that we observe in the fixed effects models suggest that counties that adopt a Title V program subsequently have higher Chlamydia rates than counties that do not adopt a Title V program.

Now we discuss other factors that influence Chlamydia rates. Beginning with the poverty variables, we see that neither of the poverty variables has a significant effect on Chlamydia rates for the youngest two age groups. For 18-19 year olds, the percentage of children living in poverty is positively related to Chlamydia rates and significant at the 10% level, although not at the traditional 5% level. This suggests that poverty may not be an indicator for teen Chlamydia rates.

Examining our cultural variables, we find that the county's lagged Chlamydia rate and divorce rate significantly affect the county's current Chlamydia rate. The lagged Chlamydia rate positively affects the current Chlamydia rate for all three age groups. We expect the lagged Chlamydia rate to have a positive effect on the current Chlamydia rate because Chlamydia is a communicable disease. The divorce rate does not appear to have an effect on Chlamydia rates

Table 6.9 – Chlamydia Rates Ages 15-17 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| lr15_17chl | 0.553*** | 0.551*** | 0.328*** | 0.327*** |
| | (0.05) | (0.05) | (0.04) | (0.04) |
| pernonwhpop | 0.124*** | 0.152*** | 0.531** | 0.580*** |
| | (0.04) | (0.04) | (0.21) | (0.21) |
| perfemalepop | 0.073 | 0.148 | 0.258 | 0.292 |
| | (0.22) | (0.21) | (0.55) | (0.55) |
| divorcerate | 0.241* | 0.229* | 0.223 | 0.180 |
| | (0.14) | (0.14) | (0.29) | (0.29) |
| gradrates | -0.015 | -0.023 | -0.036 | -0.038 |
| | (0.04) | (0.04) | (0.05) | (0.05) |
| texperh | -0.010 | -0.010 | 0.056* | 0.058* |
| | (0.03) | (0.03) | (0.03) | (0.03) |
| stuteach | -0.291 | -0.303 | -0.493* | -0.568* |
| | (0.28) | (0.28) | (0.29) | (0.30) |
| perm10_19nmr | 0.034 | 0.026 | 0.002 | 0.007 |
| | (0.03) | (0.03) | (0.03) | (0.03) |
| perun18inpov | 0.060 | | -0.011 | |
| | (0.07) | | (0.11) | |
| perage10_19 | -0.562* | -0.641** | -1.981*** | -2.106*** |
| | (0.33) | (0.32) | (0.44) | (0.45) |
| drycounty | 0.186 | 0.354 | | |
| | (0.60) | (0.58) | | |
| titlevprog | 4.170*** | 3.980** | 1.303** | 1.412** |
| | (1.58) | (1.59) | (0.61) | (0.61) |
| freelunch | | -0.009 | | -0.077 |
| | | (0.03) | | (0.07) |
| _cons | 6.761 | 6.374 | 12.789 | 15.736 |
| | (11.25) | (11.43) | (27.69) | (27.66) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.275 | 0.277 |
| adj. $R^2$ | | | 0.191 | 0.192 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.10 – Chlamydia Rates Ages 15-17 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | 0.210 | 0.212 | 1.455 | 0.310 |
| | (0.39) | (0.39) | (0.97) | (1.00) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

for 10-14 year olds regardless of the model specification. For 15-17 year olds, treatment models suggest that the divorce rate may have a positive effect on Chlamydia rates, although only at the 10% significance level and not the traditional 5% significance level. For 18-19 year olds, the divorce rate has a positive and significant effect on Chlamydia rates in the treatment effect models, but not the fixed effects models.

All three education variables appear insignificant in the treatment effect models. According to the FE model, expenditure per student is positively related to Chlamydia rates for all three age groups, while the student teacher ratio is negatively related to Chlamydia rates for the oldest two age groups.

Demographic variables that seem to affect the Chlamydia rates for all three age groups are the percentage of the population that is nonwhite (*pernonwhpop*), and the percentage of the population between the ages of 10 and 19 (*perage10_19*). The size of the nonwhite population is positively related to the Chlamydia rate as expected. The size of the teen population is negatively related to the Chlamydia rate as it was to the birth rate, although we have no a priori reasoning for this result.

### 3. Gonorrhea Rate Results

Results from the fixed effect and PSM models suggest that the Title V funded abstinence-only sex education programs have no significant effect on gonorrhea rates for 10-14 year olds. However, the results from the treatment effect models suggest that adopting a Title V program

Table 6.11 – Chlamydia Rates Ages 18-19 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| lr18_19chl | 0.543*** | 0.539*** | 0.304*** | 0.292*** |
| | (0.04) | (0.04) | (0.04) | (0.04) |
| pernonwhpop | 0.291*** | 0.313*** | 0.497 | 0.595* |
| | (0.07) | (0.07) | (0.35) | (0.36) |
| perfemalepop | 0.222 | 0.360 | 0.173 | 0.209 |
| | (0.41) | (0.41) | (0.93) | (0.94) |
| divorcerate | 0.567*** | 0.567*** | -0.515 | -0.635 |
| | (0.21) | (0.21) | (0.49) | (0.49) |
| gradrates | 0.050 | 0.050 | -0.045 | -0.039 |
| | (0.07) | (0.07) | (0.08) | (0.08) |
| texperh | 0.047 | 0.043 | 0.148*** | 0.156*** |
| | (0.05) | (0.05) | (0.05) | (0.05) |
| stuteach | -0.442 | -0.417 | -0.902* | -0.861* |
| | (0.43) | (0.43) | (0.50) | (0.51) |
| perm10_19nmr | 0.045 | 0.032 | -0.047 | -0.050 |
| | (0.04) | (0.04) | (0.06) | (0.06) |
| perun18inpov | 0.184* | | 0.306* | |
| | (0.10) | | (0.18) | |
| perage10_19 | -2.123*** | -2.250*** | -3.622*** | -4.018*** |
| | (0.60) | (0.59) | (0.77) | (0.77) |
| drycounty | 0.206 | 0.493 | | |
| | (0.92) | (0.90) | | |
| titlevprog | 2.875* | 2.727 | 2.699*** | 2.637** |
| | (1.69) | (1.67) | (1.03) | (1.04) |
| freelunch | | 0.051 | | -0.039 |
| | | (0.05) | | (0.11) |
| _cons | 11.010 | 8.253 | 48.327 | 58.294 |
| | (22.64) | (22.71) | (47.08) | (47.14) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.332 | 0.329 |
| adj. $R^2$ | | | 0.254 | 0.251 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.12 – Chlamydia Rates Ages 18-19 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | 0.110 | 0.060 | 0.689 | 1.728 |
| | (0.70) | (0.70) | (2.02) | (1.67) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

has a positive effect on (increase) gonorrhea rates for 10-14 year olds (Tables 6.13-6.14). According to results from all treatment effect and fixed effect models, adopting a Title V funded abstinence-only sex education program is positively related to gonorrhea rates for 15-17 year olds. These results are highly significant. The PSM model yields positive coefficients for 15-17 year olds, although they are not significant at the 5% level (Tables 6.15-6.16). Results from all model specifications suggest that the Title V funded abstinence-only sex education programs have no significant effects on gonorrhea rates for 18-19 year olds (Tables 6.17-6.18). Overall, these results suggest that counties that adopt a Title V program may subsequently have higher teen gonorrhea rates than counties that do not adopt the program.

We examine additional factors that influence gonorrhea rates by category beginning with the poverty variables. For the youngest two age groups the percentage of students participating in the federal free lunch program (*freelunch)* is negatively related to gonorrhea rates and significant in all model specifications, while the percentage of children living in poverty (*perun18inpov*) is negatively related to gonorrhea rates, but insignificant. For 18-19 year olds, the opposite is true; the percentage of children living in poverty (*perun18inpov*) is significant in all model specifications, while the percentage of students receiving free lunch (*freelunch*) is not.

Cultural factors that significantly affect the gonorrhea rate for all age groups are the lagged gonorrhea rate and divorce rate. The lagged gonorrhea rate has a positive effect on the current

Table 6.13 – Gonorrhea Rates Ages 10-14 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| lr10_14gono | 0.092* | 0.081 | -0.145*** | -0.146*** |
| | (0.05) | (0.05) | (0.04) | (0.04) |
| pernonwhpop | 0.010** | 0.015*** | -0.058*** | -0.053*** |
| | (0.00) | (0.00) | (0.02) | (0.02) |
| perfemalepop | 0.010 | 0.012 | 0.088* | 0.092* |
| | (0.03) | (0.03) | (0.05) | (0.05) |
| divorcerate | 0.014 | 0.011 | -0.013 | -0.017 |
| | (0.01) | (0.01) | (0.03) | (0.03) |
| gradrates | -0.000 | -0.002 | 0.001 | 0.000 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| texperh | -0.003 | -0.002 | 0.002 | 0.002 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| stuteach | 0.085** | 0.079** | 0.122*** | 0.111*** |
| | (0.04) | (0.04) | (0.03) | (0.03) |
| perm10_19nmr | 0.002 | 0.002 | 0.004 | 0.005 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| perun18inpov | -0.008 | | -0.006 | |
| | (0.01) | | (0.01) | |
| perage10_19 | -0.033 | -0.039 | 0.084** | 0.072* |
| | (0.03) | (0.03) | (0.04) | (0.04) |
| drycounty | -0.018 | -0.009 | | |
| | (0.05) | (0.05) | | |
| titlevprog | -0.024 | -0.039 | -0.005 | 0.011 |
| | (0.14) | (0.14) | (0.06) | (0.06) |
| freelunch | | -0.009*** | | -0.010* |
| | | (0.00) | | (0.01) |
| _cons | -1.160 | -0.923 | -5.772** | -5.492** |
| | (1.32) | (1.35) | (2.47) | (2.48) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.087 | 0.090 |
| adj. $R^2$ | | | -0.019 | -0.016 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.14 – Gonorrhea Rates Ages 10-14 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | 0.037*** | 0.042*** | 0.051 | -0.032 |
| | (0.01) | (0.01) | (0.07) | (0.07) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

gonorrhea rate as expected because gonorrhea is a communicable disease. The divorce rate is positively related to gonorrhea rates and significant for 18-19 year olds in all treatment effect model specifications. Being an unmarried teen mother has a positive and significant coefficient for 18-19 year olds in the treatment effect model, but is not significant in the fixed effects model for any age group.

Two of the education variables, student-teacher ratio and total expenditure per student have a significant effect on gonorrhea rates. The student teacher ratio has a positive and significant effect on gonorrhea rates for all age groups in all model specifications. Total expenditure per student is negative for all age groups, but generally not significant at the 5% level.

The size of the nonwhite population is positively related to gonorrhea rates in all treatment models, however in the fixed effects models, it is either negatively related or insignificant. The percentage of the population between the ages of 10 and 19 (*perage10_19*) has a negative relationship with gonorrhea rates in all treatment models, although the effect is only significant for 18-19 year olds. In the fixed effects models, the effect becomes positive for the youngest two age groups, although this positive effect is only significant for the youngest age group.

Table 6.15 – Gonorrhea Rates Ages 15-17 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| lr15_17gono | 0.412*** | 0.393*** | 0.102*** | 0.098** |
| | (0.05) | (0.05) | (0.04) | (0.04) |
| pernonwhpop | 0.068*** | 0.106*** | -0.027 | 0.021 |
| | (0.02) | (0.02) | (0.11) | (0.11) |
| perfemalepop | 0.156 | 0.195 | -0.045 | -0.010 |
| | (0.16) | (0.16) | (0.29) | (0.29) |
| divorcerate | 0.102 | 0.086 | 0.195 | 0.153 |
| | (0.07) | (0.07) | (0.15) | (0.15) |
| gradrates | -0.024 | -0.038 | -0.023 | -0.026 |
| | (0.02) | (0.03) | (0.03) | (0.03) |
| texperh | -0.030* | -0.028* | -0.015 | -0.013 |
| | (0.02) | (0.02) | (0.02) | (0.02) |
| stuteach | 0.436*** | 0.400*** | 0.712*** | 0.643*** |
| | (0.15) | (0.15) | (0.15) | (0.15) |
| perm10_19nmr | 0.018 | 0.015 | -0.002 | 0.003 |
| | (0.01) | (0.01) | (0.02) | (0.02) |
| perun18inpov | -0.030 | | -0.002 | |
| | (0.03) | | (0.05) | |
| perage10_19 | -0.137 | -0.191 | 0.167 | 0.040 |
| | (0.18) | (0.17) | (0.22) | (0.23) |
| drycounty | -0.404 | -0.311 | | |
| | (0.32) | (0.32) | | |
| titlevprog | 1.724** | 1.576* | 0.937*** | 1.042*** |
| | (0.82) | (0.81) | (0.32) | (0.32) |
| freelunch | | -0.056*** | | -0.076** |
| | | (0.02) | | (0.03) |
| _cons | -9.413 | -8.310 | -4.080 | -1.019 |
| | (8.92) | (8.76) | (14.22) | (14.20) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.088 | 0.094 |
| adj. $R^2$ | | | -0.019 | -0.012 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.16 – Gonorrhea Rates Ages 15-17 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | 0.593*** | 0.635*** | 1.030* | 0.503 |
| | (0.18) | (0.18) | (0.54) | (0.50) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

**4. Abortion Rate Results**

There is only one age group for abortion rates. Adopting a Title V funded abstinence-only sex education program is positively related to abortion rates according to treatment model specifications; however, the FE models show no significant effect (Tables 6.19 - 6.20). Although abortion rates decline statewide over the period, results suggest that counties that adopt a Title V program have higher abortion rates over the period than those that do not adopt a Title V program.

Both poverty variables, the percentage of the children living in poverty (*perun18inpov*) and the percentage of students receiving free lunch (*freelunch*) are negatively related to abortion rates and significant. The magnitudes are approximately the same regardless of which poverty variable is used in the model. This is an expected result because the cost of an abortion is prohibitive for many of those living in poverty.

Cultural variables influencing abortion rates are the percentage of teen mothers who are not married when they give birth (*perm10_19nmr*) and the divorce rate (*divorcerate*). The estimated coefficients for *perm10_19nmr* are negative and significant as expected. This provides support for the hypothesis that more unmarried teen mothers living in a community makes teen parenting more acceptable in that community. The divorce rate is positive and significant in all treatment effects and fixed effects models.

Table 6.17 – Gonorrhea Rates Ages 18-19 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| lr18_19gono | 0.484*** | 0.487*** | 0.113*** | 0.122*** |
| | (0.05) | (0.05) | (0.04) | (0.04) |
| pernonwhpop | 0.180*** | 0.176*** | -0.197 | -0.224 |
| | (0.04) | (0.04) | (0.19) | (0.19) |
| perfemalepop | 0.280 | 0.229 | 0.970* | 0.946* |
| | (0.29) | (0.29) | (0.50) | (0.50) |
| divorcerate | 0.420*** | 0.416*** | 0.339 | 0.382 |
| | (0.13) | (0.13) | (0.26) | (0.26) |
| gradrates | 0.014 | 0.012 | 0.021 | 0.015 |
| | (0.04) | (0.04) | (0.04) | (0.04) |
| texperh | -0.053* | -0.050* | -0.045* | -0.047* |
| | (0.03) | (0.03) | (0.03) | (0.03) |
| stuteach | 0.670* | 0.652* | 0.736*** | 0.661** |
| | (0.35) | (0.35) | (0.27) | (0.27) |
| perm10_19nmr | 0.041* | 0.046** | -0.004 | 0.000 |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| perun18inpov | -0.080 | | -0.202** | |
| | (0.05) | | (0.10) | |
| perage10_19 | -0.949*** | -0.906*** | -0.355 | -0.210 |
| | (0.29) | (0.30) | (0.39) | (0.40) |
| drycounty | -0.104 | -0.195 | | |
| | (0.56) | (0.56) | | |
| titlevprog | 0.498 | 0.570 | 0.457 | 0.559 |
| | (1.06) | (1.06) | (0.55) | (0.56) |
| freelunch | | -0.029 | | -0.013 |
| | | (0.03) | | (0.06) |
| _cons | -10.951 | -9.620 | -35.015 | -38.561 |
| | (16.20) | (16.16) | (24.87) | (24.99) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.080 | 0.074 |
| adj. $R^2$ | | | -0.027 | -0.034 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.18 – Gonorrhea Rates Ages 18-19 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | -0.253 | -0.233 | -0.067 | 0.028 |
| | (0.35) | (0.35) | (1.05) | (0.95) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

All three education variables significantly affect the abortion rate. Graduation rates are negatively related and significant in the treatment effects models. This result could also support our previous hypothesis that teens who focus their attention on academics are less likely to participate in risky behaviors. The total expenditure per student is negatively related to abortion rates and significant in all treatment effects and fixed effects models, while the student teacher ratio is positively related and significant in all treatment effect and fixed effects models.

The only demographic variable significantly influencing abortion rates is the percentage of the population that is nonwhite (*pernonwhpop*) and it is positively related and significant in treatment models, but insignificant in the fixed effects model.

**B. Economic Impact Results**

We use several models to examine the effectiveness of Title V funded abstinence-only sex education programs. We only use two models to estimate the economic impact – the treatment effect model and the PSM model using the percentage of children in poverty as the poverty variable. In general, we find that the Title V abstinence-only sex education programs decrease birth rates, but increase STD rates for some age groups. First, we discuss the direct economic impact of the decrease in birth rates for each age group. Then we discuss the direct economic impact of the increase in STD rates for each age group.

The decrease in birth rates for 10-14 year olds is an estimated 0.309 births per 1,000 using the treatment effects model and 0.566 per 1,000 using the PSM model. The average

Table 6.19 – Abortion Rates Ages 10-19 Results for TE and FE Models

| | TE1 | TE2 | FE1 | FE2 |
|---|---|---|---|---|
| pernonwhpop | 0.108*** | 0.163*** | -0.026 | 0.023 |
| | (0.02) | (0.02) | (0.07) | (0.08) |
| perfemalepop | 0.274** | 0.255** | -0.030 | 0.006 |
| | (0.11) | (0.10) | (0.20) | (0.20) |
| divorcerate | 0.169** | 0.131** | 0.511*** | 0.464*** |
| | (0.07) | (0.06) | (0.10) | (0.10) |
| gradrates | -0.025 | -0.050*** | -0.003 | -0.003 |
| | (0.02) | (0.02) | (0.02) | (0.02) |
| texperh | -0.050*** | -0.042*** | -0.057*** | -0.055*** |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| stuteach | 0.355*** | 0.260** | 0.341*** | 0.304*** |
| | (0.12) | (0.12) | (0.10) | (0.11) |
| perm10_19nmr | -0.040*** | -0.039*** | -0.031** | -0.028** |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| perun18inpov | -0.171*** | | 0.053 | |
| | (0.03) | | (0.04) | |
| perage10_19 | 0.152 | 0.119 | 0.327** | 0.184 |
| | (0.13) | (0.11) | (0.15) | (0.16) |
| drycounty | -0.374 | -0.334 | | |
| | (0.27) | (0.26) | | |
| titlevprog | 2.039** | 1.884** | -0.070 | -0.017 |
| | (0.88) | (0.87) | (0.22) | (0.22) |
| freelunch | | -0.137*** | | -0.057** |
| | | (0.01) | | (0.02) |
| _cons | -8.112 | -3.811 | 1.018 | 4.228 |
| | (5.55) | (5.59) | (9.75) | (9.75) |
| *N* | 737 | 737 | 737 | 737 |
| $R^2$ | | | 0.220 | 0.224 |
| adj. $R^2$ | | | 0.130 | 0.134 |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 6.20 - Abortion Rates Ages 10-19 Results for TE and PSM Models

| | TE1 | TE2 | PSM1 | PSM2 |
|---|---|---|---|---|
| titlevprog | 0.740*** | 0.820*** | 0.727* | 1.053*** |
| | (0.09) | (0.10) | (0.37) | (0.35) |
| *N* | 737 | 737 | 737 | 737 |
| poverty variable | perun18inpov | freelunch | perun18inpov | freelunch |

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

number of females age 10-14 in the state of Alabama is 152,785 for the ten year period. This implies that 47-86 teens aged 10-14 may have become mothers without the adoption of Title V funded abstinence-only sex education program. According to the County Health profiles, an average of 82.1% of all young mothers ages 10-19 use Medicaid to pay for the birth of their child during this period. We assume that all young mothers who would use Medicaid to pay for the birth of their child would qualify for other public assistance as well. The public assistance package is $10,968.26 per year as discussed in Section 5. This is a direct savings of $423,232 – $774,425 per year for the state of Alabama before adding the savings from the older age groups. Next, we consider only the 15-17 year-olds. We estimate that Title V funded abstinence-only sex education programs reduce teen births among this age group by approximately 1.376 births per 1,000 using the treatment effects model or 3.243 per 1,000 using the PSM model. The average number of females between the ages of 15-17 over the ten year period is 94,426. This yields an estimated 130-306 young women that would become teen mothers in the absence of Title V funded abstinence-only sex education programs. This is a savings of $1,170,642 - $2,755,512 for each year the child would receive public assistance. For the oldest age group, age18-19, only the PSM model suggests a significant decline in birth rates. The PSM model estimates a decline in birth rates of 4.902 girls per 1,000. Using the average number of females in that age group over the period, we estimate that approximately 309 young women would have become teen mothers in the absence of Title V funded abstinence-only sex education programs.

This is a savings of $0 - $2,782,527 for each year that the child would have received public assistance. The sum of birth rate savings for all age groups implies that the state of Alabama had a direct savings of $1,593,874 - $6,312,464 per year using Title V funded abstinence-only sex education programs.

Now that we have examined the cost savings for birth rates, we will examine the cost savings for STD rates. Using the treatment effect and PSM models, our estimates suggest that Title V abstinence-only sex education programs has no effect on Chlamydia rates for any age group although coefficients are consistently positive. Gonorrhea rates, however, are significantly increased for the youngest two age groups using those models. For 10-14 year olds, the estimated coefficient in the PSM model is insignificant, but the TE model estimates an additional 12 teens contracted gonorrhea in the presence of Title V funded abstinence-only sex education programs. Direct cost of treatment is $242.14 as discussed in Section 5. We assume 82.1% of all teens who contract gonorrhea use public assistance to pay for treatment; this is a direct additional cost to the state of $0 - $2386 for teens aged 10-14. The estimated coefficients for both the PSM and TE models are positive and significant when examining the effect of the program on gonorrhea rates for 15-17 year olds. These coefficients suggest that 114-197 additional teens contracted gonorrhea, an addition cost to the state of $22,663 - $39,163. This is a total additional cost to the state of $22,663 - $41,549 for STD treatments of teens in all age groups.

Over the period, the federal government provides approximately $7,605,425 to the state of Alabama for Title V programs. Various localities provide matching funds of approximately $5,704,100, yielding a total cost of $13,309,493. To compare the direct cost to direct benefits, we assume that teen mothers receive public assistance for five years over the ten year period.

That means the minimum costs-saving from the decline in birth rates becomes $7,969,370 and the maximum $31,652,320. The minimum additional cost from the increase in STD rates is $22,663, while the maximum additional cost is $41,549. Considering the public funds that are saved as a result of the estimated decrease in teen births and the additional public costs undertaken as a result of the estimated increase in gonorrhea rates, the adoption of Title V abstinence-only sex education programs saves the state of Alabama $7,946,707 - $31,610,771 over the period. If we compare the midpoint of our cost saving estimate, $19,778,739, to the total costs of the programs, $13,309,493, we see that it is a strong possibility that Title V programs saved the state more over the period than it cost. This is very promising for abstinence-only sex education programs. However, if the programs could be enhanced to better prevent STDs, perhaps even more state funds could be saved.

## SECTION 7: CONCLUSION

Generally, our results show that adopting a Title V funded abstinence-only sex education program leads to a decline in teen birth rates, but an increase in STD and abortion rates. The decline in birth rates is significant in most models for 10-14 year olds and 15-17 year olds, although the significance varies by model for 18-19 year olds. Overall, we estimate that the state of Alabama could have experienced 174 - 698 additional teen pregnancies if counties had not adopted the Title V funded programs. We also estimate an increase in cases of gonorrhea of 114 -208 cases over the period. Most models show no significant increase in Chlamydia rates. For abortion rates, we estimate an increase of approximately 225-230 abortions by Alabama's teens.

When estimating the cost savings (or in the case of STDs, additional costs) of the program, we find that the state saves $7,969,370 - $31,652,320 by decreasing births rates, but spent an additional $22,663 - $41,549 treating STDs as a result of the adoptions of Title V funded abstinence-only sex education programs. This is strictly an estimate of cost incurred and/or saved over the period. There are other cost associated with teen births and STDs such as the adult outcomes of the children born to teens as well as illnesses that stem for STDs later in life such as pelvic inflammatory disease and infertility. While there are several costs associated with abortions, none of these are direct costs to the state and are not measured in this study.

While measuring effectiveness, we discover some interesting facts about risky teen sexual activity. Poverty is positively related to birth rates in most model specification and for all age groups, therefore programs that improve the poverty rates, should by default decrease teen birth rates.

In addition to poverty, several cultural variables influence risky behavior among teens. Divorce rates have a positive and significant relationship with birth rates for all age groups

according to most model specifications. Divorce rates also have a positive and significant relationship with STD rates, but only for 18-19 year olds. Individual level data and more research are needed to uncover more details between divorced parents and risky behavior among teens.

Education appears to have a significant effect on birth rates, although not necessarily on STD and abortion rates. Both the student teacher ratio and the graduation rate have a significant effect on birth rates for the older two age groups. The student-teacher ratio has a positive effect which implies that a higher student teacher ratio leads to a higher birth rate. Graduation rates have a negative effect implying that a higher graduation rate – and perhaps a higher desire to succeed in school – lowers birth rates. Perhaps 10-14 is too young to detect the effect of graduation rates because most teens in this age group have not entered high school.

Moving to the final category, two of the three demographic variables had a significant effect on our outcomes. The first is the percentage of the population that is nonwhite. Having a larger nonwhite population has a positive effect on birth rates for 10-14 year olds; however for the oldest two age groups, an increase in the nonwhite population yields either a negative effect or no effect on birth rates. This may imply that other socioeconomic factors are more important in determining teen birth rates than race. For both STD rates and abortion rates, nonwhite is positive and significant for all age groups in all pooled OLS and treatment models, however in the FE model this variables appears insignificant for most age groups. The second variable yielding significant results is the teen population variable. These results vary in sign and significance and because we had no a prior expectations for this variable, further investigation is needed to determine what information the teen population variable is relaying.

Overall, we notice that although the same risky behavior leads to births, abortions and/or STDs, not all factors that affect birth and abortion rates affect STD rates. This implies that more research needs to be done on exactly what changes teens are making to reduce birth rates after participating in a sex education program – particularly abstinence-only sex education program. Once we understand how the key elements of the program are being processed by the students, we can implement changes to help curb more risky behavior.

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## APPENDIX A: VARIABLE NAMES AND MEANINGS

| | |
|---|---|
| divorcerate | Divorce rate (cases per 1000) |
| drycounty | Binary variable, 1 if county prohibits the sale of alcohol, 0 otherwise |
| freelunch | Percent of students in the county who qualify for free lunch |
| gradrates | Percent of students who graduate high school in 4 years |
| lr10_14chl | One period lagged Chlamydia rate for individuals aged 10-14 |
| lr15_17chl | One period lagged Chlamydia rate for individuals aged 15-17 |
| lr18_19chl | One period lagged Chlamydia rate for individuals aged 18-19 |
| lr10_14gono | One period lagged gonorrhea rate for individuals aged 10-14 |
| lr15_17gono | One period lagged gonorrhea rate for individuals aged 15-17 |
| lr18_19gono | One period lagged gonorrhea rate for individuals aged 18-19 |
| perage10_19 | Percentage of the population ages 10-19 |
| perfemalepop | Percentage of population that is female |
| perm10_19nmr | Percentage of those aged 10-19 who are not married when they give birth |
| pernein | Percentage of adjacent neighbors adopting a Title V funded program |
| pernonwhpop | Percentage of population that is nonwhite |
| pervoter | Percentage choosing a Republican candidate for U.S. Representative |
| perun18inpov | Percentage of population under age 18 living in poverty |
| stuteach | Student to teacher ratio |
| titlevprog | Binary variable, 1 if county participated in Title V program, 0 otherwise |
| texperh | Total expenditure by school systems per student in 2007 dollars |

## APPENDIX B: DATA SOURCES

- United States
  - Census Bureau
    - Population characteristics – total population, women, racial make-up
    - Percent of the population under age 18 living in poverty
    - Median income
- State of Alabama
  - Annual Report to Health and Human Services
    - Counties that received Title V funding each year from 1998-2007
    - Aside: annual reports contained information on how much money each grantee received and how many students each grantee served. Because some grantees who served multiple counties were unable to determine how much money was spent in each of their counties, and how many students were served in each of their counties, these data are not included in the study.
  - Department of Public Health
    - Number of STD cases by age group – 3 groups – ages 10-14, 15-17 and 18-19
    - County Health Profiles
      - Birth and abortion rates
      - Marriage and divorce rates
      - Percent of teens using Medicaid to pay for the birth of their children
      - Percent of teen mothers who are unmarried when they give birth
  - Department of Education
    - Number of students receiving advanced/college prep, regular, and career tech high school diplomas
- Alabama Secretary of State
  - Number of individuals in a county who voted for a Republican, Democrat, or third party candidate for U.S. Representative
- Alabama Alcoholic Beverage Control Board
  - Whether or not a county is considered a dry county
- Alabama Center for Economic and Business Research
  - Counties that are commonly considered to be a part of the Alabama Black Belt