

THE EFFECT OF PARENTAL INVOLVEMENT LAWS ON YOUTH SUICIDE

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Using state-level data on suicides from the period 1987 to 2003, we find that the adoption of a law requiring a parent's notification or consent before a minor can obtain an abortion is associated with an 11%–21% reduction in the number of 15- through 17-year-old females who commit suicide. In contrast, the adoption of a parental involvement law is not associated with a reduction in the number of older females who commit suicide or in the number of 15- through 17-year-old males who commit suicide. These results are consistent with the hypothesis that parental involvement laws represent an increase in the expected cost of having unprotected sex, and, as a consequence, serve to protect young females from depression and what have been termed "stressful life events" such as conflict with a parent or an abortion. (JEL I18, I10, J13)

I. INTRODUCTION

There is strong evidence that parental involvement laws, which require a parent's notification or consent before a minor can obtain an abortion, reduce pregnancies, abortions, and gonorrhea infections (Klick and Stratmann 2008; Levine 2003). This evidence is consistent with the hypothesis that parental involvement laws represent an important increase in the expected cost of having unprotected sexual intercourse, and raises the possibility that their implementation could help minors avoid the potentially acute psychological trauma associated with unprotected sex, which may lead to an unwanted pregnancy or being infected with a sexually transmitted disease.

This study explores the relationship between parental involvement laws and suicides among 15- through 17-year-old females. Despite the fact that restricting the access of minors to abortion services is often promoted on the

grounds that it will protect their emotional health (Quinn 2000), there have been no previous attempts to estimate the relationship between parental involvement laws and what has been called "the ultimate expression of despair," nor has there been an exploration of the relationship between parental involvement laws and alternative measures of psychological well-being.¹

Using state-level data for the years 1987–2003, we find that the adoption of a parental involvement law is associated with an 11%–21% reduction in the number of 15- through 17-year-old females who commit suicide. There is little evidence of a similar relationship among older females, who are not covered by parental involvement laws. Moreover, we find that the adoption of a parental involvement law is unrelated to the number of young males who commit suicide, a result that is consistent with the hypothesis that unprotected sex imposes a greater psychological burden on female adolescents than on their male counterparts.

II. BACKGROUND

As of July 2009, 34 states had instituted and were enforcing a parental involvement law. Another seven states had passed a parental

*The authors thank Andres Araoz, R. Preston Brown II, Whitney Dudley, and Amrita Sen for excellent research assistance. We also thank Marianne Bitler and Madeline Zavodny for sharing their data on abortion policies; Jonathan Klick and Thomas Stratmann for sharing their data on enjoined parental involvement laws; and Laura Langbein and Daniel Eisenberg for sharing data on alcohol policies.

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1. The phrase "the ultimate expression of despair" is from Reading (2004, 155). The full quote is: "[s]uicide, of course, represents the ultimate expression of despair, the absolute inability to foresee a tolerable future for oneself." Suicide and mental health are clearly linked. In fact, there is evidence that the majority of teens who commit suicide suffer from either manic depressive disorder or major depression (Shaffer et al. 1996).

involvement law but could not enforce it as the result of a court order. Most parental involvement laws require the notification, or consent of, one parent; three states require that both parents be notified or give their consent, and six states allow the notification or consent of other adult relatives like a grandparent.²

Parental involvement laws can be thought of as increasing the expected cost of having sex, and, in theory, their adoption should result in a reduction in the number of minors who are sexually active and an increase in contraceptive use conditional on sexual activity (Levine 2003). Evidence of the relationship between parental involvement laws and a variety of outcomes is provided by Levine (2003) and Klick and Stratmann (2008). Levine used state-level data from 1985 to 1996, a period when many parental involvement laws came into effect. He found that the adoption of a parental involvement law was associated with a 15%–20% reduction in the abortion rate of 15- through 17-year-olds, and a 4%–9% reduction in their pregnancy rate. Turning to microdata from the National Survey of Family Growth, Levine (2003) estimated the effect of parental involvement laws on sexual activity and contraceptive use. The results, although not sufficiently precise to be definitive, suggested that the reduction in the pregnancy rate of 15- through 17-year-olds could be attributed to more consistent use of contraception.

Klick and Stratmann (2008) used state-level data from 1981 to 1998 to explore the effect of parental involvement laws on teen gonorrhea rates. These authors argued that gonorrhea rates can be thought of as a proxy for risky sex (i.e., sex without a condom). They found that the adoption of a parental involvement law was associated with a 20% reduction in the gonorrhea rate among Hispanic females under the age of 20, and a 12% reduction among white females under the age of 20.³

2. This paragraph is based on information available in Dennis et al. (2009). More details on parental consent laws in the United States can be found in Dennis et al. (2009).

3. Other studies that have examined the effects of parental involvement laws include Joyce, Kaestner, and Colman (2006), Colman, Joyce, and Kaestner (2008), and New (2011). Joyce, Kaestner, and Colman (2006, 1038) focused on a Texas requirement that doctors notify the parents of minors seeking an abortion. They found evidence that the introduction of this requirement led to fewer abortions among 15- through 17-year-olds. In addition, they noted an “an increase in second-trimester terminations among teens who did not reach the age of 18 years until

Could parental involvement laws promote emotional health through their effects on contraceptive use, pregnancy, and abortion? Sabia and Rees (2008) found that female adolescents who became sexually active at an early age were more likely to suffer from the symptoms of depression than their counterparts who abstained, but that this relationship was less pronounced among users of contraception.⁴ There is also evidence of a link between abortion and depression (Coleman et al. 2009; Cogle, Reardon, and Coleman 2003; Fergusson, Horwood, and Boden 2008; Fergusson, Horwood, and Ridder 2006; Pedersen 2008; Reardon and Cogle 2002; Rees and Sabia 2007), as well as evidence, albeit weaker, that other pregnancy outcomes are related to depression (Broen et al. 2005; Fergusson, Horwood, and Boden 2008; Rees and Sabia 2007).⁵

Not surprisingly, adolescents who exhibit the symptoms of depression are at increased risk of committing and attempting suicide (Cutler, Glaeser, and Norberg 2001; Fergusson, Beautrais, and Horwood 2003; Lewinsohn et al. 1994; Moscicki 2001). In addition, there is evidence that suicide among adolescents and young adults is frequently triggered by what have

after the first trimester of pregnancy,” and a small increase in births to minors who conceived between the ages of 17.50 and 17.74. Colman, Joyce, and Kaestner (2008) showed that the estimated effects of the Texas notification requirement were biased if age at abortion or birth, as opposed to age at conception, was used to calculate pregnancy, abortion, and birth rates. Using age at conception, they found that the Texas parental notification law led to a 15% decrease in the abortion rate of 17-year-olds, and a 2% increase in their birth rate. New (2011) found that the adoption of a parental involvement law was associated with a 15% reduction in the abortion rate of minors.

4. In contrast, Sabia and Rees (2008) found that adolescent males may experience an increase in self-esteem upon losing their virginity.

5. Many researchers believe that the association between abortion and mental health is spurious. For instance, after reviewing the literature, Major et al. (2009, 863) concluded that:

within the United States, the relative risk of mental health problems among adult women who have a single, legal, first-trimester abortion of an unwanted pregnancy is no greater than the risk among women who deliver an unwanted pregnancy. Evidence did not support the claim that observed associations between abortion and mental health problems are caused by abortion per se as opposed to other pre-existing and co-occurring risk factors.

See also Coleman (2006) and Warren, Harvey, and Henderson (2010), who focused on pregnancy outcomes among adolescents and mental health.

been termed “stressful life events,” such as the breakup of a romantic relationship (Beautrais, Joyce, and Mulder 1997; Brent et al. 1993; De Wilde et al. 1992; Johnson et al. 2002), conflict with a parent or sibling (Brent et al. 1993; Johnson et al. 2002), an abortion (Gissler, Hemminki, and Lonnqvist 1996; Gissler et al. 2005), or having a baby (Gissler, Hemminki, and Lonnqvist 1996).⁶ This evidence is consistent with the economic model of suicide developed by Hamermesh and Soss (1974) in which negative shocks to happiness may reduce expected lifetime utility to the point where an individual will decide to take his or her own life. Even if a shock is perceived to be temporary, an individual who discounts the future more heavily when faced with an immediate, as opposed to a future, tradeoff may commit suicide at the prospect of having to cope with an acutely “painful state in the present” (Cutler, Glaeser, and Norberg 2001, 235).⁷ If, through discouraging teens from engaging in risky sexual behavior and encouraging communication between parents and minors, parental involvement laws protect against depression and stressful events such as experiencing an unwanted pregnancy, then it is possible that their adoption led to fewer suicides, the third-leading cause of death among American teens.⁸ The empirical analysis below explores this hypothesis.

III. EMPIRICAL ANALYSIS

We examine yearly data at the state level on suicides committed by 15- through 17-year-old females. These data come from the Center for Disease Control Mortality Reports, are available online, and cover the period 1987–2003.⁹ We

6. Other stressful or traumatic events that are associated with adolescent suicide include changes in residence (Qin, Mortensen, and Pedersen 2009) and legal problems (Beautrais, Joyce, and Mulder 1997).

7. Such an individual is said to have “time-inconsistent preferences.” There is a fair amount of evidence to support the hypothesis that preferences are time inconsistent (O’Donoghue and Rabin 2001, 41), and, in particular, it seems appropriate to ascribe time-inconsistent preferences to teens.

8. The Center for Disease Control and Prevention estimates that 11.8% of deaths to 15- through 19-year-olds are caused by suicide (Center for Disease Control and Prevention 2008).

9. See the following web address: http://webappa.cdc.gov/sasweb/ncipc/mortrate10_sy.html. Table A1 shows descriptive statistics for the outcome variables used in the analysis. Over the period 1987–2003, the typical state saw an average of 7.16 suicides per year among 15-

assume that the number of suicides committed in state s and time t (S_{st}) is related to the presence of a parental involvement law by the following equation:

(1)

$$\ln E(S_{st}) = \alpha + \delta \text{PI}_{st} + \beta_1' X_{st} + \theta_s + \tau_t + \varepsilon_{st},$$

where PI_{st} is an indicator equal to one if state s had adopted and was enforcing a parental consent or parental notification law at time t and equal to zero otherwise; X_{st} is a vector of state-specific time-varying policy variables and demographic controls; θ_s is a year-invariant state effect; and τ_t is a state-invariant year effect.¹⁰ If $\exp(\varepsilon_{st})$ follows a gamma distribution with mean of 1 and variance σ , then Equation (1) represents a negative binomial model; if σ is assumed to equal 0, then the negative binomial reduces to the Poisson regression model (Grootendorst 2002). In either case, $[\exp(\hat{\delta}) - 1] \times 100$ can be interpreted as the percent change in $E(S_{st})$ associated with a one-unit change in PI_{st} , the covariate of interest.¹¹

The first two columns of Table 1 present negative binomial and Poisson estimates of δ

through 17-year-old females. The corresponding figure for males in this age group was 25.8. The mean suicide rate among females ages 15–17 was 0.33 per 10,000 population, while the corresponding rate for males in this age group was 1.20.

Prior to 1990, a number of states did not consistently report suicide counts for 16- or 17-year-olds. In 1987 and 1988, 22 states failed to report information on suicides committed by 16- and 17-year-olds; in 1989, 29 states failed to report information on suicides committed by 16- and 17-year-olds. These observations were dropped from the primary empirical analysis, although there is reason to believe that during the period 1987–1989 some states did not provide a suicide count when no suicides occurred during the year. Below we show that treating missing suicide counts as 0s does not appreciably alter our results.

10. When a parental involvement law was in effect for less than a full year, PI_{st} is a fraction. Data on parental involvement laws were provided to us by Marianne Bitler and Madeline Zavodny. In addition, we used information from Levine (2003) and a search of state statutes and newspaper articles. Table A2 shows changes in parental involvement laws during the period 1987–2003. Twenty-five states began enforcement of a parental involvement during the period under study. There have been only a handful of changes to parental involvement laws since 2003. In July 2005, the parental consent law in Idaho was enjoined. It came back into effect in March 2007. In November 2006, Oklahoma began enforcement of a parental consent law, and in August 2009 a parental notification law came into effect in Illinois.

11. Although our tables present estimated negative binomial and Poisson coefficients, they are converted to percent changes when discussed in the text. All regressions are weighted using the square root of the population of females ages 15–17 in state s at time t , and the standard errors are corrected for clustering at the state level.

TABLE 1
 Estimated Effect of Parental Involvement Laws on Suicides Committed by 15–17-Year-Old Females, 1987–2003

	Controls for Abortion Policies		Controls for Abortion and Alcohol Policies		Controls for Abortion Policies, Alcohol Policies, and State Demographics	
	(1)	(2)	(3)	(4)	(5)	(6)
Parental involvement law	-0.142* (0.078)	-0.142* (0.078)	-0.157*** (0.059)	-0.157*** (0.059)	-0.148*** (0.053)	-0.148*** (0.053)
State effects	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y
Negative binomial or Poisson?	NB	P	NB	P	NB	P
N	794	794	794	794	794	794

Notes: Regressions are weighted using the square root of the population of females ages 15–17 in the state. Standard errors corrected for clustering at the state level are in parentheses.
 ***Significant at 1% level; **significant at 5% level; *significant at 10% level.

controlling for whether state s allowed Medicaid to fund abortions at time t and whether it imposed a mandatory waiting period before an abortion could be performed. They suggest that the adoption of a parental involvement law is associated with a 13% decrease ($e^{-0.142} - 1 = -0.132$) in suicides among 15- through 17-year-old females. Controlling for beer taxes, the minimum legal drinking age, zero tolerance laws, and whether the state required a mandatory jail sentence for a first-time driving-under-the-influence conviction has very little impact on the magnitude or precision of these estimates (columns 3 and 4).¹² Likewise, adding a set of demographic controls to X_{st} has very little impact on the estimates of δ (columns 5 and 6).¹³

12. The estimated coefficient of PI_{st} is -0.157 in columns (3) and (4) of Table 1, which suggests that the adoption of a parental involvement law is associated with a 14.5% decrease ($e^{-0.157} - 1 = -0.145$) in suicides among 15- through 17-year-old females.

13. The estimated coefficient of PI_{st} is -0.148 in columns (5) and (6) of Table 1, which suggests that the adoption of a parental involvement law is associated with a 13.8% decrease ($e^{-0.148} - 1 = -0.138$) in suicides among 15- through 17-year-old females. Information on Medicaid funding restrictions and mandatory waiting periods were updated from Bitler and Zavodny (2002). Alcohol policies were updated from Eisenberg (2003) and the Beer Institute (see www.beerinstitute.org). Demographic controls include the high school graduation rate, the poverty rate, the unemployment rate, the divorce rate, and the population of females ages 15–17 in state s at time t . These data were collected from the Bureau of Labor Statistics and the National Center for Education Statistics. Means of the control variables are shown in Table A3. When parental consent and notification laws were allowed to have different effects on suicides committed by 15- through 17-year-old females, we could not reject the hypothesis that their estimated coefficients were equal.

Next we explore the robustness of the estimated relationship between parental involvement laws and suicides committed by 15- through 17-year-old females documented in Table 1. Because Poisson and negative binomial regressions consistently produced nearly identical coefficients and standard errors, we focus on Poisson estimates of δ for the remainder of the analysis.

Column (1) of Table 2 shows what happens when PI_{st} is replaced with its lagged value, PI_{st-1} . The estimated coefficient of PI_{st-1} remains negative, but is reduced in magnitude and is no longer statistically significant at conventional levels. When both PI_{st} and PI_{st-1} are included on the right-hand side of the estimating equation simultaneously, the estimated coefficient of PI_{st} is negative, statistically significant, and quite large in absolute magnitude; the estimated coefficient of PI_{st-1} is positive, insignificant, and smaller (column 2). Summing the estimated coefficients of PI_{st} and PI_{st-1} implies a “long-run” reduction in suicides of almost 10%.¹⁴ We cannot reject the hypothesis that the long-run effect of the law is not statistically different from the short-run contemporaneous effect.

This pattern of results suggests that the adoption of a parental involvement law results in an immediate reduction in suicides, but that after the first year its impact wanes. This may be because the enactment of the laws typically

14. The sum of the estimated coefficients is -0.102 ; $e^{-0.102} - 1 = -0.097$. The estimated coefficients of PI_{st} and PI_{st-1} are jointly significant at conventional levels ($\chi^2 = 11.2$; p value = .00).

TABLE 2
Sensitivity of Poisson Estimates to Using Lagged Parental Involvement and Controlling for Parental Involvement Laws in Border States

	(1)	(2)	(3)	(4)
Parental involvement law	—	−0.304** (0.129)	−0.310** (0.129)	−0.318** (0.131)
Lag of parental involvement law	−0.051 (0.083)	0.202 (0.171)	—	—
Parental involvement law* at least one adjacent state did not enforce PI law	—	—	0.187 (0.121)	—
Parental involvement law* at least 1.5 of adjacent states did not enforce PI law	—	—	—	0.195 (0.123)
State effects?	Y	Y	Y	Y
Year effects?	Y	Y	Y	Y
<i>N</i>	794	794	794	794

Notes: Regressions are weighted using the square root of the population of females ages 15–17 in the state. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1.

***Significant at 1% level; **significant at 5% level; *significant at 10% level.

comes amidst press coverage alerting minors and their parents to the new law, but dissipates as public attention to the law diminishes. For example, when Colorado's parental notification law was enacted in 2003, the *Denver Post* published five news stories that specifically discussed the new Colorado law. One year later, there was just one news story discussing a (failed) court challenge of the law and 2 years later, no articles were published. Along the same lines, the *Arizona Republic* published multiple articles on Arizona's newly enacted parental consent law in March 2003, but published no such articles in 2004.

A number of researchers have speculated that the adoption of a parental involvement law should have a larger effect on behavior when minors do not have the option of crossing state lines to obtain an abortion without receiving the consent of their parents (Dennis et al. 2009; Haas-Wilson 1996; Levine 2003). The third column of Table 2 shows an estimate of δ controlling for the interaction of the parental involvement variable and an indicator of whether s was adjacent to a state that did not enforce a parental involvement law at time t . When this interaction is included as a control, the estimated effect of adopting a parental involvement law increases as expected, although the estimated coefficient of the interaction is not significant at conventional levels. The last column of Table 2 shows an estimate of δ controlling for the interaction of the parental involvement variable and an indicator equal to

one if at least half of the states bordering state s did not enforce a parental involvement law at time t . The results are qualitatively similar to those in column (3).

A. Falsification Tests

The estimates of δ presented thus far are suggestive, but could arguably be due to time-varying unobservables at the state level correlated with both the adoption of a parental involvement law and suicides like antiabortion sentiment. To explore this possibility, we estimate Equation (1) using the log of expected suicides in state s at time t among females ages 18–21 and among females ages 22–24 as dependent variables.¹⁵ Young adult females represent a natural comparison group because parental involvement laws apply exclusively to minors and therefore should not affect their behavior. Young adults are, however, close enough in age to minors to be influenced by the same unobservables.

These results of this exercise are presented in columns (1) and (2) of Table 3. They provide little evidence that parental involvement laws are related to suicides committed by females over the age of 17. The adoption of a parental involvement law is associated with a small (less

15. When the dependent variable is suicides among females ages 18–21, we control for the population of females ages 18–21 in state s at time t . When the dependent variable is suicides among females ages 22–24, we control for the population of females in this age group.

TABLE 3
Poisson Estimates of the Effect of Parental Involvement Laws on Suicides Committed by Older Females and Males

	Females Ages 18–21 (1)	Females Ages 22–24 (2)	Males Ages 15–17 (3)	Males Ages 18–21 (4)	Males Ages 22–24 (5)
Parental involvement law	–0.002 (0.078)	0.082 (0.072)	0.069 (0.049)	0.003 (0.033)	0.002 (0.038)
State effects	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y
N	760	775	841	843	853

Notes: Regressions are weighted using the square root of the relevant age-specific population in the state. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1.

than 1%) decrease in the number of 18- through 21-year-old females who commit suicide, and an 8% increase in the number of 22- through 24-year-old females who commit suicide. These estimates, which are statistically indistinguishable from zero, suggest that if an unobservable were driving the negative relationship between parental involvement laws and suicides among 15- through 17-year-old females documented in Tables 1 and 2, it would have to be largely unrelated to suicides committed by females just a few years older.¹⁶

There is evidence that unprotected sex imposes a greater psychological burden on female adolescents than their male counterparts (Sabia and Rees 2008), raising the possibility that 15- through 17-year-old males could serve as a second comparison group. If the adoption of a parental involvement law was associated with large changes in suicides committed by adolescent males, it would call into question a causal interpretation of the estimates presented in Tables 1 and 2.

The Poisson estimate of δ for 15- through 17-year-old males is reported in column (3) of Table 3.¹⁷ The adoption of a parental involvement law is associated with a (statistically insignificant) 7% increase in suicides among 15- through 17-year-old males, suggesting that

the negative relationship between parental involvement laws and suicides committed by young females cannot be explained by unmeasured state policies targeted at minors or unobserved state sentiment. In columns (4) and (5) of Table 3, we report the estimated relationship between parental involvement laws and the number of 18- through 21-year-old males and the number of 22- through 24-year-old males who commit suicide, respectively.¹⁸ Again, it appears that parental involvement laws are essentially unrelated to male suicides.

B. Robustness Checks

In this section, we continue to explore the robustness of the relationship between parental involvement laws and suicides committed by 15- through 17-year-old females. The top panel of Table 4 shows triple-difference estimates of this relationship. They are equal to the difference between the estimate of δ presented in column (6) of Table 1 and the estimates of δ presented in Table 3, and suggest that the adoption of a parental involvement law is associated with an 11%–21% increase in the number of 15- through 17-year-old females who commit suicide. The bottom two panels of Table 4 show what happens to these estimates when state-specific linear and quadratic time trends are introduced. The results provide little evidence that the negative relationship between parental involvement laws and suicides among

16. Although statistically indistinguishable from 0, the estimates in columns (1) and (2) of Table 3 are significantly different from the estimate of δ in column (6) of Table 1 at the .10 and .05 levels, respectively.

17. When the dependent variable is suicides among males ages 15–17, we control for the population of males ages 15–17 in state s at time t . Likewise, when the dependent variable is suicides among males ages 18–21 or ages 22–24, we control for the population of males in the corresponding age group.

18. When the dependent variable is suicides among males ages 18–21, we control for the population of males ages 18–21 in state s at time t . Likewise, when the dependent variable is suicides among males ages 22–24, we control for the population of males ages 22–24 in state s at time t .

TABLE 4
Triple-Difference Poisson Estimates of the Effect of Parental Involvement Laws on Suicides Committed by Females Ages 15–17

	Females Ages 15–17 versus Females Ages 18–21 (1)	Females Ages 15–17 versus Females Ages 22–24 (2)	Females Ages 15–17 versus Males Ages 15–17 (3)	Females Ages 15–17 versus Males Ages 18–21 (4)	Females Ages 15–17 versus Males Ages 22–24 (5)
Panel I: DDD estimates					
Parental involvement law	−0.146* (0.084)	−0.231** (0.092)	−0.217*** (0.077)	−0.152** (0.065)	−0.150** (0.062)
Panel II: DDD estimates with linear state trends					
Parental involvement law	−0.151* (0.081)	−0.235** (0.098)	−0.215*** (0.077)	−0.137** (0.063)	−0.138** (0.064)
Panel III: DDD estimates with quadratic state trends					
Parental involvement law	−0.127 (0.079)	−0.206** (0.097)	−0.209*** (0.080)	−0.121* (0.063)	−0.111* (0.059)
State effects	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y
N	1,554	1,569	1,635	1,637	1,647

Notes: Regressions are weighted using the square root of the relevant age-specific population in the state. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1.

***Significant at 1% level; **significant at 5% level; *significant at 10% level.

15- through 17-year-old females is driven by state-specific time trends.

In Table 5, we experiment with using an alternative dependent variable, the suicide rate in state s at time t . The first three columns of Table 5 show triple-difference estimates in which the gender- and age-specific suicide rate per 10,000 population is on the left-hand side of the estimating equation.¹⁹ When the control group is composed of older females, these estimates are negative and statistically significant at conventional levels; the adoption of a parental involvement enforcement law is associated with a .060–.105 decrease in the suicide rate of 15- through 17-year-old females.²⁰ When the control group is composed of 15- through 17-year-old males, they are not statistically significant. Nevertheless, they are similar in terms of magnitude to those obtained using the other control groups, bolstering the case for interpreting the relationship between parental involvement laws and suicides among females ages 15–17 as

19. These regressions are weighted by the state population and the standard errors are corrected for clustering at the state level. See Table A1 for mean suicide rates by gender and age group.

20. Or, in other words, a 16%–31% decrease in the suicide rate ($0.052/0.334 = 0.156$ and $0.105/0.334 = 0.314$).

causal.²¹ It should be noted, however, that the variable PI_{st} explains only a small portion of the within-state variation in suicide rates. In fact, its inclusion increases the r^2 by only .0004–.0022, depending on which control group is used.

In column (4) of Table 5, we present triple-difference estimates of the relationship between the suicide rate among 15- through 17-year-old females and parental involvement laws in which the state and year dummies are interacted. That is, we present estimates of δ_j from

$$(2) \text{ Suicide rate}_{stj} = \alpha_j + \delta_j PI_{st} + \beta'_j X_{sj} + \theta_{sj} + \tau_{tj} + \omega_{st} + \varepsilon_{stj},$$

where j indexes group (for instance, 15- through 17-year-old females vs. 18- through 21-year-old females), and ω_{st} represents the interaction of the state and year fixed effects.²² In this regression framework, the source of the identifying variation is differences in the suicide rate between 15- through 17-year-olds and the comparison group, controlling in the

21. The adoption of a parental involvement law is associated with a 0.097–0.099 (29%–30%) decrease in the suicide rate of 15- through 17-year-old females.

22. While we attempted to estimate this model using a Poisson, the likelihood function would not converge.

TABLE 5
Sensitivity of the DDD Estimates to the Use of Suicide Rates

	DDD Model (1)	(1) + Linear Time Trends (2)	(1) + Quadratic Time Trends (3)	(1) + State × Year Dummies (4)
Panel I: females ages 15–17 versus females ages 18–21				
Parental involvement law	−0.060* (0.032)	−0.058* (0.030)	−0.052* (0.029)	−0.032 (0.043)
<i>N</i>	1,554	1,554	1,554	1,554
Panel II: females ages 15–17 versus females ages 22–24				
Parental involvement law	−0.103** (0.042)	−0.104** (0.041)	−0.105** (0.043)	−0.081 (0.060)
	1,569	1,569	1,569	1,569
Panel III: females ages 15–17 versus males ages 15–17				
Parental involvement law	−0.099 (0.066)	−0.098 (0.067)	−0.097 (0.069)	−0.085 (0.102)
<i>N</i>	1,635	1,635	1,635	1,635
State effects	Y	Y	Y	Y
Year effects	Y	Y	Y	Y

Notes: Regressions are weighted using the relevant age-specific state population. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1 (with the exception of age-specific population).

***Significant at 1% level; **significant at 5% level; *significant at 10% level.

most flexible fashion possible for state-specific trends in suicides common to both 15- through 17-year-old females and the comparison group. Although less precise, two of the three estimates reported in column (4) of Table 5 are almost as large as those reported in columns (1) through (3); when 18- through 21-year-old females are used as the control group, the adoption of a parental involvement laws is associated with only a (statistically insignificant) .032 reduction in the suicide rate of 15- through 17-year-old females.

It is often difficult to pinpoint (and code) when a particular parental involvement law came into effect. Although Levine (2003) and Bitler and Zavodny (2002) coded parental involvement laws in 36 states and the District of Columbia identically, they disagreed with regard to the correct coding of parental involvement laws in 14 states.²³ For instance, according to Bitler and Zavodny (2002), Montana never enforced a parental involvement law passed in 1991. In contrast, Levine (2003) coded Montana as having begun to enforce this law in 1991. To take another example, Levine coded

Iowa as having enforced a parental involvement law throughout 1996, while Bitler and Zavodny coded the law as coming into effect on July 1, 1997. To ensure that our results were not sensitive to differences such as these, we compare estimates of the effect of parental involvement laws as coded by Levine (2003) to estimates of the effect of parental involvement laws as coded (and updated) by Bitler and Zavodny (2002). This comparison suggests that our basic findings are robust to minor differences in how parental involvement laws are coded.

The first three columns of Table 6 show estimates of the effect of adopting a parental involvement law using the Levine coding, which is available through 2001. The adoption of a parental involvement law is associated with a 14% decrease in suicides among 15- through 17-year-old females, and a 9% increase in suicides among 18- through 21-year-old females. The difference between these estimates is statistically significant at the .05 level, as shown in column (3).

In columns (4) through (6) of Table 6, we present the corresponding estimates using the Bitler and Zavodny coding, which is much

23. It should be noted that Klick and Stratmann (2008) used Bitler and Zavodny's (2002) coding of parental involvement laws.

TABLE 6
Sensitivity of the Poisson Estimates to the Coding of Parental Involvement Laws

	Levine PI Coding (1987–2001)			Bitler–Zavodny PI Coding (1987–2003)		
	Females Ages 15–17 DD (1)	Females Ages 18–21 DD (2)	Females Ages 15–17 versus 18–21 DDD (3)	Females Ages 15–17 DD (4)	Females Ages 18–21 DD (5)	Females Ages 15–17 versus 18–21 DDD (6)
Parental involvement law	–0.150* (0.088)	0.087 (0.071)	–0.238** (0.099)	–0.165*** (0.057)	–0.007 (0.078)	–0.158* (0.091)
State effects	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y
N	692	658	1,350	794	760	1,554

Notes: Regressions are weighted using the square root of the relevant age-specific population in the state. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1.

***Significant at 1% level; **significant at 5% level; *significant at 10% level.

TABLE 7
Sensitivity of Poisson Estimates to the Coding of Missing Suicides

	Females Ages 15–17 DD (1)	Females Ages 18–21 DD (2)	Females Ages 15–17 versus 18–21 DDD (3)	Females Ages 22–24 DD (4)	Females Ages 15–17 versus 22–24 DDD (5)	Males Ages 15–17 DD (6)	Females Ages 15–17 versus Males Ages 15–17 DDD (7)
Panel I: zero filling							
Parental involvement law	–0.166** (0.067)	0.053 (0.078)	–0.219** (0.078)	0.045 (0.085)	–0.211** (0.107)	0.054 (0.055)	–0.221*** (0.085)
Panel II: mean filling							
Parental involvement law	–0.154*** (0.054)	–0.030 (0.078)	–0.125 (0.080)	0.057 (0.069)	–0.212** (0.095)	0.063 (0.051)	–0.218** (0.077)
State effects	Y	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y	Y
N	867	867	1,734	867	1,734	867	1,734

Notes: Regressions are weighted using the square root of the relevant age-specific population in the state. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1.

***Significant at 1% level; **significant at 5% level; *significant at 10% level.

closer to our own.²⁴ The adoption of a parental involvement law is associated with a 15% decrease in the number of 15- through 17-year-old females who commit suicide, although it is also associated with a small (less than 1%) decrease in suicides among 18- through 21-year-old females. The difference between

these estimates is significant at the .10 level, as shown in column (6).

We address a second coding issue in Table 7. In 1987 and 1988, 22 states did not provide information on suicides committed by 16- and 17-year-olds; in 1989, 29 states did not provide information on suicides committed by 16- and 17-year-olds. Up until now, we have dealt with this issue by dropping these observations from the analysis. In Panel I of Table 7, we present estimates of Equation (1) coding the missing suicide counts as 0s.

24. We found that when Bitler and Zavodny (2002) and Levine (2003) disagreed, the evidence pointed toward the coding proposed by Bitler and Zavodny in 13 of the 14 cases.

There is some justification for this alternative approach to dealing with the issue of missing suicide counts. Using the available data, we calculate that there was an average of 2.3 suicides committed per year by 16-year-old females in states that provided incomplete information on suicides during the period 1987–1989.²⁵ In contrast, there was an average of 4.4 suicides committed per year by 16-year-old females in the remaining states. Similarly, there was an average of 1.7 suicides committed per year by 17-year-old females in states that provided incomplete information on suicides during the period 1987–1989, whereas there was an average of 4.8 suicides per year committed by 17-year-old females in states that provided complete data.²⁶ We view these results as evidence that some states may have failed to report information on suicides when no suicides occurred.

When the missing suicide counts are coded as 0s, the adoption of a parental involvement law is associated with a 15% decrease in the number of 15- through 17-year-old females who commit suicide (column 1, Table 7). We also find that the adoption of a parental involvement law is associated with a small increase in the number of 18- through 21-year-old females who commit suicide (column 2); we can reject the hypothesis that these estimates are equal at the .05 level (column 3). Likewise, the adoption of a parental involvement law is associated with small, but insignificant, increases in the number of 22- through 24-year-old females who commit suicide (column 4), and the number of 15- through 17-year-old males who commit suicide (column 6).

In Panel II of Table 7, we report the results of replacing missing suicide counts with the mean number of suicides in state s over the period 1987–1989.²⁷ When the missing suicide counts are mean filled, the adoption of a parental involvement law is associated with a

25. This and the other means in this paragraph are weighted by the population of the state at time t .

26. There was an average of 3.37 suicides committed by 16-year-old males in states that provided incomplete information on suicides during the period 1987–1989; there was an average of 9.58 suicides committed by 16-year-old males in the remaining states during the same period. There was an average of 2.44 suicides committed by 17-year-old males in states that provided incomplete information on suicides during the period 1987–1989; there was an average of 12.94 suicides committed by 17-year-old males in the remaining states during the same period.

27. The mean was rounded to the nearest discrete number.

14% decrease in the number of 15- through 17-year-old females who commit suicide (column 1), but there is evidence that the adoption of a parental involvement law is associated with a much smaller decrease in suicides among 18- through 21-year-old females (column 2). Although the difference between these estimates is not statistically significant (p value = .12), the triple-difference estimates using males ages 15–17 and females ages 22–24 as control groups are statistically significant at conventional levels.

In Table 8, we explore the impact of zero- and mean-filling missing suicides on estimates using the suicide rate as the dependent variable. These results are similar to those reported in Table 5, lending additional support for the argument that the negative relationship between the adoption of parental involvement laws and suicides among 15- through 17-year-old females is robust to using a variety of strategies for dealing with the missing suicide counts from the period 1987 to 1989.

As a final robustness test, we pursue an empirical strategy proposed by Klick and Stratmann (2008) by estimating the following equation:

$$(3) \quad \ln E(S_{st}) = \alpha + \delta_1 \text{PI}_{st} + \delta_2 \text{Enjoined}_{st} \\ + \beta_1' \mathbf{X}_{st} + \theta_s + \tau_t + \varepsilon_{st},$$

where Enjoined_{st} is equal to one if a parental involvement law was under injunction in state s at time t , and equal to zero otherwise.²⁸ Klick and Stratmann (2008, 14) argued that, because the decision to enjoin a parental involvement law can be considered “largely orthogonal to underlying voter sentiment,” the estimated effect of an enjoined law should approximate that of an enforced law “unless the law itself, independent of any underlying social pressures or attitudes, has an effect.” This logic can be extended to suicides: if enjoined parental involvement laws are found to have an effect on suicides similar to that of enforced laws, it could indicate that changes in social pressure or attitudes are driving the estimates reported in Tables 1–8.

The first two columns of Table 9 present Poisson estimates of δ_1 and δ_2 , dropping observations with missing suicide counts from the

28. Data on enjoined parental involvement laws were provided to us by Jonathan Klick and Thomas Stratmann and supplemented with a search of state legal statutes and newspaper articles.

TABLE 8
Sensitivity of the DDD Estimates Using Suicide Rates to the Coding of Missing Suicides

	Zero Filling				Mean Filling			
	Baseline DDD Model (1)	(1) + Linear Time Trends (2)	(1) + Quadratic Time Trends (3)	(1) + State x Year Dummies (4)	Baseline DDD Model (5)	(1) + Linear Time Trends (6)	(1) + Quadratic Time Trends (7)	(1) + State x Year Dummies (8)
Panel I: females ages 15–17 versus females ages 18–21								
Parental involvement law	-0.069* (0.038)	-0.069* (0.039)	-0.070* (0.040)	-0.069 (0.054)	-0.051* (0.029)	-0.051* (0.029)	-0.051* (0.029)	-0.051 (0.040)
Panel II: females ages 15–17 versus females ages 22–24								
Parental involvement law	-0.085* (0.048)	-0.087* (0.049)	-0.087* (0.051)	-0.087 (0.069)	-0.096** (0.043)	-0.098** (0.044)	-0.098** (0.045)	-0.099 (0.062)
Panel III: females ages 15–17 versus males ages 15–17								
Parental involvement law	-0.081 (0.074)	-0.081 (0.075)	-0.081 (0.077)	-0.081 (0.105)	-0.093 (0.068)	-0.093 (0.070)	-0.093 (0.070)	-0.093 (0.096)
State effects	Y	Y	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y	Y	Y
N	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734

Notes: Regressions are weighted using the relevant age-specific state population. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1 (with the exception of age-specific population).
***Significant at 1% level; **significant at 5% level; *significant at 10% level.

TABLE 9
Poisson Estimates of Enforced versus Enjoined Parental Involvement Laws

	Deleted Missing		Zero Filling		Mean Filling	
	Females Ages 15–17	Females Ages 18–21	Females Ages 15–17	Females Ages 18–21	Females Ages 15–17	Females Ages 18–21
	(1)	(2)	(3)	(4)	(5)	(6)
Parental involvement law	-0.213*** (0.063)	-0.037 (0.094)	-0.173** (0.081)	0.030 (0.092)	-0.185*** (0.065)	-0.040 (0.093)
Enjoined law	-0.161* (0.088)	-0.092 (0.091)	-0.016 (0.127)	-0.061 (0.118)	-0.077 (0.103)	-0.026 (0.098)
State effects	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y
N	794	794	867	867	867	867

Notes: Regressions are weighted using the square root of the relevant age-specific population in the state. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1.

***Significant at 1% level; **significant at 5% level; *significant at 10% level.

analysis. The adoption of a parental involvement law is associated with a 19% decrease in the number of 15- through 17-year-old females who commit suicide; among 18- through 21-year-old females, it is associated with a 4% decrease in suicides. In contrast, the enjoining of a law is associated with a 15% decrease in the number of 15- through 17-year-old females who commit suicide, but a 9% decrease among 18- through 21-year-olds, suggesting that δ_2 may simply be capturing the influence of an unobservable.

When missing suicide counts are coded as 0s or mean filled, the difference between δ_1 and δ_2 is much greater (columns 3 and 5). The adoption of a parental involvement law is associated with a 16%–17% decrease in the number of 15- through 17-year-old females who commit suicide, but the enjoining of a parental involvement law is associated with a 2%–7% decrease, a pattern of results that suggests a minimal role for underlying social pressures or attitudes.²⁹

IV. ABORTION AND BIRTH RATES AS MEDIATORS

Using state-level data for the period 1985–1996, Levine (2003) found that the adoption of a parental involvement law was associated with a 15%–20% decrease in abortion rate of 15- through 17-year-olds, but only a 4%–7%

decrease in the abortion rate of 18- and 19-year-olds. In the first two columns of Table 10, we report our attempt to replicate Levine's results for the period 1987–2003.³⁰ The adoption of a parental involvement law is associated with a 17% decrease in the abortion rate of 15- through 17-year-olds. In contrast, it is associated with a (statistically insignificant) 2% decrease in the abortion rate of 18- and 19-year-olds.

Levine (2003) found little evidence of a link between parental involvement laws and birth rates, a result that is again echoed in our data. The adoption of a parental involvement law is associated with a 6% increase in the birth rate of 15- through 17-year-olds (column 3), but a 5% increase in the birth rate of 18- and 19-year-olds (column 4).³¹ Joyce, Kaestner, and Colman (2006) found that a Texas parental notification law that came into effect on January 1, 2000 led to a small increase in births among minors 17.50–17.74 years of age at conception. However, because of data

29. Although different in magnitude, the estimates of δ_1 and δ_2 in Table 9 are never statistically distinguishable at conventional levels.

30. We adopt a specification similar to that used by Levine. Specifically, the dependent variable is equal to the log of the abortion rate; independent variables include state and year fixed effects and the controls used in columns (5) and (6) of Table 1. Levine also controlled for welfare benefits, the percentage of females in a particular age group who were non-white, the percentage who attended college, and the percentage who were married. Data on abortion rates were collected from the Centers for Disease Control and Prevention (http://www.cdc.gov/reproductivehealth/Data_Stats/Abortion.htm).

31. Data on birth rates were collected from the Centers for Disease Control and Prevention (http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm).

TABLE 10
Abortion and Birth Rates as Mediators

	Ln (Abortion Rate of 15-17- Year-Olds) (1)	Ln (Abortion Rate of 18-19- Year-Olds) (2)	Ln (Birth Rate of 15- 17-Year-Olds) (3)	Ln (Birth Rate of 18-19-Year- Olds) (4)	Suicide Rate of 15-17- Year-Olds (5)	Suicide Rate of 15-17- Year-Olds (6)	Suicide Rate of 15-17- Year-Olds (7)	Suicide Rate of 15-17- Year-Olds (8)
Parental involvement law	-0.190*** (0.050)	-0.019 (0.044)	0.065** (0.030)	0.047* (0.024)	-0.064** (0.029)	-0.049 (0.034)	-0.044 (0.035)	-0.028 (0.036)
Ln (abortion rate of 15-17-year-olds)	—	—	—	—	—	0.003 (0.037)	—	0.008 (0.062)
Ln (birth rate of 15-17-year-olds)	—	—	—	—	—	-0.195 (0.181)	—	-0.342 (0.181)
State effects	Y	Y	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y	Y	Y
Dummy for missing abortions	N	N	N	N	Y	Y	N	N
N	710	710	867	867	794	794	657	657

Notes: Regressions are weighted using the relevant age-specific state population. Standard errors corrected for clustering at the state level are in parentheses. All regressions include the controls used in columns (5) and (6) of Table 1 (with the exception of age-specific population).
 ***Significant at 1% level; ** significant at 5% level; * significant at 10% level.

limitations, we did not explore the relationship between parental involvement laws and births to minors who conceived between these ages.

The remaining columns of Table 10 report estimates of the relationship between PI_{st} and the suicide rate of 15- through 17-year-olds females, with and without controlling for their abortion and birth rates. When a dummy is used to account for missing abortion rates, the adoption of a parental involvement laws is associated with a .064 decrease in the suicide rate, an estimate similar in magnitude to those presented in the top panel of Table 5.³² Controlling for the abortion and birth rates of 15–17-year-olds reduces this estimate by about a quarter. Specifically, the adoption of parental involvement law is associated with a (statistically insignificant) .049 decrease in the suicide rate. When the 137 observations with missing abortion rates are simply dropped from the analysis, the estimated relationship between PI_{st} and the suicide rate of 15- through 17-year-old females shrinks by about a third and becomes less precise. Nevertheless, controlling for the abortion and birth rates of 15–17-year-olds reduces it still further, providing additional evidence that parental involvement laws impact suicides, at least in part, through these channels.

V. CONCLUSION

Both opponents and proponents of restricting the access of minors to abortion services frame the debate in terms of psychological well-being. For instance, according to the National Conference of Catholic Bishops:

The need for protecting minors is compelling. Abortion can involve life-long emotional and physical trauma for women, particularly young girls. In such situations, the love and support of families is critical and needs to be encouraged. Parents should not be kept in the dark when the welfare of their children and their unborn grandchildren is at stake. (Quinn 2000)

32. Thirty-nine states provided abortion rates for females ages 15–19 during the period 1987–2003. These states were Arizona, Arkansas, Colorado, Georgia, Hawaii, Idaho, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, and Wyoming.

In contrast, Planned Parenthood argues that:

For a variety of reasons, including fear of abuse, teenagers frequently feel they cannot tell their parents about their unintended pregnancies or desire to have an abortion . . . Teenagers who cannot tell their parents must either travel out of those states or obtain approval through a court or some other alternative process. The resulting delay increases the physical and emotional health risks to the teenager, since the earlier an abortion is, the safer it is. (Planned Parenthood 2008)

Despite these claims, we know of no previous study that has examined the relationship between parental involvement laws, which require a parent's notification or consent before a minor can obtain an abortion, and the psychological well-being of minors.³³

This study examines the effect of adopting a parental involvement law on suicides among 15- through 17-year-old females using state-level data for the period 1987–2003. Poisson estimates indicate that the adoption of a parental involvement law is associated with an 11%–21% decrease in the number of 15- through 17-year-old females who commit suicide. Because there is little evidence that the adoption of a parental involvement law is associated with suicides among older females or among 15- through 17-year-old males, we conclude that these estimates likely reflect a causal relationship, but note that its magnitude appears to be modest: for an average-sized state, an 11% decrease in the number of 15- through 17-year-old females who commit suicide translates into 0.79 fewer suicides per year, while a 21% decrease translates into 1.50 fewer suicides per year; ordinary least squares estimates confirm that only a small portion of the within-state variation in suicides among U.S. minors can be attributed to parental involvement laws.

33. Previous studies have, however, examined the effects of other government policies on suicides. For instance, Jones, Pieper, and Robertson (1992) and Birkmayer and Hemenway (1999) examined the effects of the minimum legal drinking age on suicides; Markowitz, Chatterji, and Kaestner (2003) and Carpenter (2004) examined the effects of other alcohol-related policies; Klick (2006) examined the effect of mandatory waiting periods to obtain an abortion; and Klick and Markowitz (2006) examined the effect of laws mandating that insurance companies offer some form of mental health benefits. See also Gunnell, Murray, and Hawton (2000) and Burgess et al. (2004).

APPENDIX

TABLE A1

Weighted Means and Standard Deviations of Dependent Variables (1987–2003)

Dependent Variable	Number	Rate Per 10,000
Suicides of females ages 15–17	7.16 (6.39) [794]	0.334 (0.256) [794]
Suicides of females ages 18–21	10.8 (9.39) [760]	0.344 (0.200) [760]
Suicides of females ages 22–24	9.54 (8.30) [775]	0.396 (0.233) [775]
Suicides of males ages 15–17	25.8 (18.8) [841]	1.20 (0.580) [841]
Suicides of males ages 18–21	67.5 (50.1) [843]	2.20 (0.768) [843]
Suicides of males ages 22–24	57.8 (45.4) [853]	2.42 (0.826) [853]

Notes: Standard deviations are in parentheses and sample sizes are in brackets. All figures were weighted using the state population of the relevant age/gender group.

TABLE A2

Changes in Parental Involvement Laws during the Period 1987–2003

State	Year Law First Enforced	State	Year Law First Enforced
Alabama	1987	Nebraska	1991
Arizona	2003	North Carolina	1995
Arkansas	1989	Ohio	1990
Colorado	2003	Oklahoma	2001 ^b
Delaware	1997 ^a	Pennsylvania	1994
Georgia	1991	South Carolina	1990
Idaho	1997	South Dakota	1998
Iowa	1997	Tennessee	1992, ^c 1999
Kansas	1992	Texas	2000
Kentucky	1994	Virginia	1997
Michigan	1991	Wisconsin	1992
Minnesota	1990	Wyoming	1989
Mississippi	1993		

Notes: States with parental involvement provisions that allow specified health professionals to waive parental involvement under certain circumstances not involving judicial procedures were not included.

^aApplied to individuals ages 16 and younger.

^bIn effect only during 2001.

^cIn effect from 1992 through 1996.

TABLE A3

Weighted Means and Standard Deviations of Independent Variables (1987–2003)

Independent Variable	Mean (SD)
Parental consent or parental notification law in effect and enforced	0.374 (0.478)
Enjoined parental involvement law	0.284 (0.441)
Mandatory waiting period prior to abortion	0.108 (0.310)
Restrictions on Medicaid funding for abortion	0.627 (0.484)
Natural log of unemployment rate	1.72 (0.378)
Natural log of poverty rate	2.55 (0.267)
High school graduation rate	0.728 (0.082)
Divorce rate	4.34 (1.25)
Population females ages 15–17	234,252 (188,331)
Population females ages 18–21	317,110 (249,745)
Population females ages 22–24	248,450 (201,386)
Population males ages 15–17	249,519 (201,883)
Population males ages 18–21	345,890 (286,208)
Population males ages 22–24	266,960 (229,259)
Real state beer tax (in 2000 cents)	27.5 (20.7)
Zero tolerance drinking law in effect	0.548 (0.489)
A mandatory jail sentence for first conviction of driving under the influence (can usually be replaced by community service)	0.199 (0.399)
Abortion rate 15–17-year-olds	0.014 (0.008)
Abortion rate 18–19-year-olds	0.033 (0.014)
Birth rate 15–17-year-olds	0.032 (0.010)
Birth rate 18–19-year-olds	0.083 (0.020)
Dummy variable equal to one for each state	—
Dummy variable equal to one for each year	—
Number of states ^a	51
N	867

^aIncludes the District of Columbia.

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