

Supplementary Appendix

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Supplementary Appendix to:

Changes in Abortions and Births and the Texas Parental Notification Law

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In this Appendix we describe in more detail four points made in the text. In Section 1 we explain how we obtain estimates of the standard error of the relative rate ratio. In Section 2 we show how the relative rate ratios will be unaffected by proportionately more missing cases in the pre-law period, provided that the proportion missing is the same among those exposed to the law and the comparison group, in our case minors and older teens. We then show the proportion of cases missing the exact date of birth by year of abortion and age at termination (in years), both of which are well recorded. In Section 3 we present results from a re-analysis of Table 1-3 in the text in which we limit the data to one year before and one year after the law. These are useful because the proportion of missing cases is significantly less. As we show below, the results in Appendix Tables 2-4 are similar to those reported in Tables 1-3 in the text, although the confidence intervals in the one-year comparisons are wider. Finally, in Section 4, we compare changes in abortion among Texas minors before and after the law to changes in nearby states as well as changes in the rest of the states in the U.S. that report abortions to Centers for Disease Control and Prevention (CDC). As we demonstrate, none of our inferences regarding abortion would have changed, if we had used, as the relevant counterfactual, changes in abortion to minors in states in which there were no changes in parental involvement laws.

1. Standard errors of the rate ratios and relative rate ratios.

Let a_1 be the number of abortions to 17-year olds in the pre-law period and n_1 the relevant population; thus, a_1/n_1 is the abortion rate of 17-year olds in the pre-law period ($AR_{17,pre}$) and the variance of the abortion rate is $a_1/n_1 * (1 - a_1/n_1) * 1/n_1$. Using the delta method, it is straightforward to show that the variance of the natural logarithm of pre-law abortion rate $[\ln(AR_{17,pre})]$ is equal to $(1/a_1 - 1/n_1)$ (see reference 18 in the text). Analogously, the variance of the natural logarithm of abortion rate in the post-law period ($AR_{17,post}$) is $(1/a_2 - 1/n_2)$. The variance of the logarithm of the rate ratio is thus the sum of the two variances $[(1/a_1 - 1/n_1) + (1/a_2 - 1/n_2)]$.

Now let a_3/n_3 and a_4/n_4 be the abortion rates respectively of 18 year olds before and after the law. The variance of the natural logarithm is thus, $[(1/a_3 - 1/n_3) + (1/a_4 - 1/n_4)]$. We define the relative rate ratio as $\{(a_1/n_1)/(a_2/n_2)\} / \{(a_3/n_3)/(a_4/n_4)\}$. The variance of the logarithm of the relative rate ratio is the sum of the four variances of the natural logarithm of abortion rate. With these variances we approximate the standard error of the natural logarithm of the relative rate ratio ($\ln SE_{RR}$) as $[(1/a_1 - 1/n_1) + (1/a_2 - 1/n_2) + (1/a_3 - 1/n_3) + (1/a_4 - 1/n_4)]^{1/2}$. We compute the 95 percent confidence interval of the relative ratio (RRR) as follows $\exp[\ln(RRR) + \ln SE_{RR} * 1.96]$, where “exp” is the anti-log of the natural logarithm.

2. Differences in the proportion missing the exact date of birth between 15-17 and 18-19 year olds by year, 1997-1999.

In 1997, the Texas State Department of Health Services began to collect information on the exact date of birth of all abortion patients. Exact date of birth on the birth certificates has been collected since 1989. Approximately 76 percent of abortion records contained complete information on date of birth in 1997. This figure rose to 90 percent in 1998 and 97 percent in

1999. Because of proportionately more missing cases in the pre- as compared to the post-law years, we underestimate the absolute changes in abortion from the pre-law to the post-law period. However, if the proportion of missing cases among minors is the same as among older teens, then the relative rate ratios will be unaffected. To see this, let π be the proportion of cases with exact date of birth ($0 < \pi < 1$). Using the notation from above, the relative rate ratio for 17-year olds with respect to 18-year olds is unaffected, since π drops out. The same is true in the estimation of the odds ratio of a late abortion.

$$\text{RelativeRR} = \frac{\pi AR_{17_{pre}} / AR_{17_{post}}}{\pi AR_{18_{pre}} / AR_{18_{post}}} = \frac{AR_{17_{pre}} / AR_{17_{post}}}{AR_{18_{pre}} / AR_{18_{post}}}$$

Appendix Table 1 below shows the proportion of cases with missing data on the exact date of birth for minors and older teens by year of abortion and age at termination. Age as measured in years at the time of termination is well-recorded. Less than five percent of the abortion records for all women lacked age in years at termination for the years 1997-2003. Table 1 shows the observations in which the patient's age in years at the time of the abortion is known, but the teen's exact date of birth is unknown. As is evident, the proportion missing falls each year from 1997 to 1999, but is statistically the same within each year. The last column shows the prob-value associated with the t-test of the differences between the two proportions.

Table 1. The Proportion of Cases Missing Exact Date of Birth on Abortion Certificates in Texas for Minors and Older Teens, 1997-1999

	15-17	18-19	p-value
1997	0.231	0.241	0.172
1998	0.099	0.094	0.333
1999	0.032	0.027	0.112

3. Re-analysis of Changes in Abortion Rates, Birth Rates and Odds of a Late Abortion One Year Before and After the Law.

Appendix Tables 2-4 are analogous to Tables 2-4 in the text. In Tables 2-4 of the Appendix, we limit the data to one year before (8/98-7/99) and after the law (2000).

Table 2. Teen Abortion & Birth Rates by Age at Conception and Year of Conception, Texas Residents

	1999		2000		Rate Ratio [§]	Relative Rate Ratio [¶] (95% CI)
	No.	Rate ⁺	No.	Rate ⁺		
Abortions						
<i>Age</i>						
15	1,004	6.4	883	5.6	0.86	0.91 (0.83, 1.01)
16	1,939	12.3	1,494	9.5	0.77	0.82 (0.75, 0.88)
17	2,904	18.7	2,420	15.3	0.82	0.86 (0.81, 0.92)
18	4,344	28.3	4,244	26.9	0.95	
19	4,970	32.5	4,840	30.5	0.94	0.99 (0.94, 1.05)
Births						
<i>Age</i>						
15	5,048	32.4	4,962	31.3	0.97	0.99 (0.95, 1.04)
16	9,167	58.3	8,607	54.9	0.94	0.97 (0.93, 1.00)
17	13,334	86.0	13,537	85.8	1.00	1.02 (0.99, 1.05)
18	17,899	116.8	17,986	113.9	0.98	
19	19,665	128.4	20,207	127.5	0.99	1.02 (0.99, 1.05)

⁺ Abortion rates are abortions to residents of Texas per 1000 age-specific population. Birth rates are calculated similarly. Age is measured at conception. Years refer to the year in which the teen conceived. Population estimates are from the CDC website: <http://www.cdc.gov/nchs/about/major/dvs/popbridge/datadoc.htm>. The pre-law years are measured from August 1, 1998-July 31, 1999. The post-law years are from January 1, 2000-December 31, 2000.

[§] Abortion (birth) rate ratios are the abortion (birth) rate by single year of age after the law divided by the abortion (birth) rate before the law.

[¶] We divide the rate ratio for each age group by the rate ratio of 18-year olds to obtain the relative rate ratio. The relative rate ratio for 17-year olds is 0.82/0.95 or 0.86. Relative rate ratios for births are calculated similarly.

Table 3. Abortion and Birth Rates in Texas Among Teens 17.5 -18.24 Years of Age at Conception by Year of Conception

	1999		2000		Rate Ratio ⁺	Relative Rate Ratio [§] (95% CI)
	No. *	Rate	No.	Rate		
Abortions:						
17.50-17.74	726	18.7	622	15.8	0.84	0.89 (0.78, 1.03)
17.75-17.99	852	22.0	789	20.0	0.91	0.97 (0.85, 1.10)
18.00-18.24	1,001	26.1	972	24.6	0.94	
Births:						
17.50-17.74	3,398	87.6	3,593	91.1	1.04	1.05 (0.99, 1.12)
17.75-17.99	3,624	93.4	3,780	95.9	1.03	1.04 (0.98, 1.11)
18.00-18.24	4,117	107.5	4,182	105.9	0.99	
<u>White-NH:</u>						
Abortions:						
17.50-17.74	301	16.6	270	14.8	0.89	1.05 (0.84, 1.30)
18.00-18.24	418	23.7	366	20.2	0.85	
Births:						
17.50-17.74	1,027	56.7	1,032	56.7	1.00	1.08 (0.96, 1.21)
18.00-18.24	1,284	72.7	1,220	67.3	0.93	
<u>Black-NH:</u>						
Abortions:						
17.50-17.74	130	26.0	113	22.4	0.86	0.96 (0.70, 1.34)
18.00-18.24	186	37.5	169	33.5	0.89	
Births:						
17.50-17.74	480	96.1	496	98.3	1.02	1.03 (0.88, 1.22)
18.00-18.24	608	122.7	612	121.2	0.99	
<u>Hispanics:</u>						
Abortions:						
17.50-17.74	251	17.3	213	14.2	0.82	0.75 (0.60, 0.95)
18.00-18.24	344	23.7	391	26.0	1.10	
Births:						
17.50-17.74	1,854	127.5	2,038	136.1	1.07	1.05 (0.96, 1.14)
18.00-18.24	2,175	149.9	2,300	153.1	1.02	

* Abortion and birth rates have been annualized by multiplying the numerator by four and dividing by the population of 17 or 18 years olds. This facilitates comparisons but has no effect on the relative rate ratios.

+ Abortion (birth) rate ratios are the abortion (birth) rate by single year of age after the law divided by the abortion (birth) rate before the law.

[§] We divide the rate ratio for each age group by the rate ratio of teens 18.0-18.24 years of age to obtain the relative rate ratio. Relative rate ratios for births are calculated similarly. Standard errors for the relative rate ratios are estimated based on the non-annualized rates.

Table 4. Adjusted Odds Ratios for Abortion Among Pregnant Girls Age 17 versus 18 at Conception Associated with the Texas Parental Notification Law

	Abortion if Pregnant		Second Trimester Abortion	
	Adj OR [*]	95% CI	Adj OR [*]	95% CI
<i>Age</i>				
17.0-17.24 yrs	0.80	(0.69, 0.92)	1.02	(0.73, 4.43)
17.25-17.49 yrs	0.75	(0.65, 0.86)	1.30	(0.94, 1.81)
17.5-17.74 yrs	0.81	(0.71, 0.93)	1.31	(0.96, 1.77)
17.75-17.99 yrs	0.92	(0.81, 1.05)	1.32	(1.00, 1.75)
18.0-18.99 yrs	1.00	-----	1.00	-----
N [§]		157,872		28,679

^{*} The reported odds ratios were estimated by logistic regression and were obtained from the coefficients on the interaction between the post-law indicator and age at conception. The odds ratios were adjusted for race/ethnicity, age at conception, marital status, previous induced abortions, previous live births, health service region of residence, and the post-law years. Age is measured at the time of conception. The omitted age category is teens 18.0-18.99 years of age at conception. The analysis included abortions and births to teens 15 to 19 years of age who conceived in the period August 1, 1998-July 31, 1999 and January 1, 2000-December 31, 2000.

[§] Pregnancies include all induced abortions and live births. We included dichotomous indicators for missing data on race, region, marital status, previous live births and previous induced abortions. Among pregnancies, 4894 observations (3.1%) had missing information for at least one of these characteristic. For the sample of abortions only, there were 2110 cases (7.4%) with missing information on one of these characteristics.

4. The availability of abortion data and changes in abortions among minors in Texas, as compared to changes in nearby states and the rest of US in the year before and after Texas enforced its parental notification statute.

a. The availability of abortion data

The CDC collects data on abortions from state health departments as part of its abortion surveillance system. Forty-two states and the District of Columbia reported abortions to the CDC in both 1999 and 2000 (See references 16 and 22 in the text). There are significant limitations to these data that preclude the type of analysis that we did in Texas. First, data are only available at the aggregate level and are only stratified by a single characteristic. Thus, data on abortions are available by state and age and by state and race but they are not available by state, age and race. For the same reason it is not possible to analyze changes in the proportion of late abortions by age with the CDC data. Second, age is measured at the time of the abortion and not when the women conceived. Third, abortions are recorded by state of occurrence and not by state of residence. Changes in abortion associated with a parental involvement law based on the CDC data overestimate the decline in abortion because they fail to record abortions to minors who left the state as well as the abortions to non-resident minors who stop coming into the state after the law.

To overcome these limitations researchers have used individual level data as obtained by state health departments. Unfortunately, only 31 states maintain individual induced termination records in electronic format. Nineteen states and the District of Columbia have either statutory restrictions on the release of such data or they do not store individual records after submission to the CDC. Moreover, even when abortion data are available electronically, the completeness of the data varies widely by state.¹

In 1999, there were no individual abortion records available from the state health departments in the three states that border Texas: Louisiana, Oklahoma and New Mexico. Oklahoma began collection of individual data in 2000. However, Louisiana and New Mexico did report induced termination to the CDC in 1999. We use these data below to demonstrate that the decline in abortions among minors in Texas after implementation of the state's parental involvement law greatly exceeded the declines observed in nearby states and in the rest of the states that report such data.

b. Changes in abortions to minors between 1999 and 2000 as recorded by the CDC.

Table 5 below shows the number of abortions and abortion rates among minors in 1999 and 2000 in Texas, the neighboring states of Arkansas (AR), Louisiana (LA) and New Mexico (NM), and finally in all states that report abortions by age to the CDC less those from Texas (US-TX). We excluded Tennessee from the comparison states because their parental notification law went into effect in January, 2000. In Texas the abortion rate of 17 year olds fell from 16.1 abortions per 1000 17-year olds in 1999 to 12.2 in 2000, a decline of 25 percent (rate ratio = 0.75). Abortions and abortion rates rose in the neighboring states, a change counter to the change

observed among 41 states and the District of Columbia in which the abortion rate fell 6 percent. There was no change in parental involvement laws in any of the 41 states or the District of Columbia between 1999 and 2000. If we compare the decline in the abortion rate of 17 year olds in Texas to those of the comparison states we find that the rate fell 20 percent more in Texas than in the other 41 states and the District of Columbia (95 percent confidence interval, 0.75,0.85). In the bottom panel of Table 5 we do the same analysis for minors 15-17 years of age. The conclusions are similar: the abortion rate among minors in Texas fell significantly more than the abortion rate in the comparison states.

Table 5. Abortions and Abortion Rates to Minors in Texas and other States in 1999 and 2000

	1999		2000		Rate Ratio	Relative Rate Ratio [#] (95% CI)
	No.	Rate	No.	Rate		
17 year olds						
Texas	2,532	16.1	1917	12.2	0.75	
AR, LA, NM	727	10.4	807	11.6	1.12	0.67 (0.60, 0.76)
US* less TX	20,732	16.3	19,796	15.4	0.94	0.80 (0.75, 0.85)
15-17 years old						
Texas	4,606	9.8	3,656	7.7	0.79	
AR, LA, NM	1572	7.5	1635	7.9	1.05	0.75 (0.69, 0.81)
US* less TX	42,228	11.2	40,224	10.5	0.94	0.84 (0.81, 0.88)

* Includes abortions from 41 states and the District of Columbia that reported to the CDC in both 1999 and 2000. Sources: <http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5212a1.htm>
<http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5109a1.htm>

[#] The relative rate ratio is the rate ratio for Texas divided by the rate ratio for the comparison states.

5. Potential underreporting of abortions to minors of Texas obtained in Mexico

We do not know whether minors sought abortions in Mexico after the law. Legal access to abortion in Mexico is more limited than in the US, although the extent of illegal abortions is not well-known.² As a sensitivity analysis, we dropped observations of teens who reside in the health service regions that border Mexico.³ In the regions that do not border Mexico, we found that the abortion rate fell 15 percent among minors between 17.5 and 17.74 years of age relative to teens between 18.0 and 18.24 years of age (Table 6). This result is quite close to the estimates

in Table 3 in the text, which suggests that underreporting of abortions to minors from Texas performed in Mexico was not a significant problem.

Table 6. Abortion and Birth Rates in Texas Among Teens 17.5 -18.24 Years of Age at Conception by Year of Conception^{*}, Excluding Regions that Border Mexico

	1998-1999		2000-2002		Rate Ratio ⁺	Relative Rate Ratio [§] (95% CI)
	No [*]	Rate	No.	Rate		
Abortions:						
17.50-17.74	568	20.5	411	14.2	0.69	0.85 (0.76, 0.94)
17.75-17.99	631	22.8	550	19.0	0.83	1.02 (0.92, 1.13)
18.00-18.24	746	27.2	648	22.3	0.82	
Births:						
17.50-17.74	2,375	85.7	2,398	82.9	0.97	1.06 (1.01, 1.11)
17.75-17.99	2,534	91.4	2,503	86.5	0.95	1.04 (0.99, 1.09)
18.00-18.24	2,944	107.2	2,852	97.9	0.91	

^{*} The number of abortions or births is the annual average for each age group. Abortion and birth rates have been annualized by multiplying the numerator by four and dividing by the population of 17 or 18 years olds. This facilitates comparison but has no effect on the relative rate ratios.

⁺ Abortion (birth) rate ratios are the abortion (birth) rate by single year of age after the law divided by the abortion (birth) rate before the law.

[§] We divide the rate ratio for each age group by the rate ratio of teen 18.0-18.24 years of age to obtain the relative rate ratio. Relative rate ratios for births are calculated similarly. Standard errors for the relative rate ratios are estimated based on the non-annualized rates.

References

- 1.** Joyce T, Kaestner R, Korenman S, Henshaw SK. Family cap provisions and changes in births and abortions. *Population Research and Policy Review*. 2004;23:475-511.
- 2.** Becker S, Garcia SG, Larsen U. Knowledge and opinions about abortion law among Mexican youth. *International Family Planning Perspectives*. 2002;24(4):205-213.
- 3.** Texas Department of State Health Services. Accessed May 24, 2005 at <http://www.dshs.state.tx.us/regions/state.shtm>.