ARTICLES

The Impact of Mississippi's Mandatory Delay Law on the Timing of Abortion

By Ted Joyce and Robert Kaestner

Context: *Mississippi mandates that a woman seeking an abortion must first receive, in person, information about the fetus and alternatives to abortion. She must then wait at least 24 hours before having an abortion. It is not clear how such mandatory delay requirements affect the timing during pregnancy at which abortion occurs.*

Methods: *The data for analysis, from the Mississippi Department of Health, are 34,748 abortions obtained by residents in the six-year period surrounding the law's enactment in August 1992 (i.e., from August 1989 through July 1995). The records were stratified by location of the nearest provider, so abortions to women whose nearest provider is in-state comprised the "treatment group" (N=28,975), while abortions to women whose nearest provider is in a neighboring state with no such law comprised the "control group" (N=5,773). Probit regressions were used to assess effects on the likelihood of a second-trimester abortion, and ordinary least-squares regressions were used to determine effects on gestational age at the time of the abortion.*

Results: *After enactment of the law, the proportion of second-trimester procedures increased by 53% (from 7.5% of abortions to 11.5%) among women whose closest provider is in-state, but it increased by only 8% (from 10.5% to 11.3%) among women whose closest provider is out-of-state. And although the overall abortion rate declined among women in the treatment group over the period (from 11.3 procedures per 1,000 women aged 15–44 to 9.9), the rate of second-trimester procedures increased among these women (from 0.8 per 1,000 women aged 15–44 to 1.1). The law was independently associated with delays in obtaining an abortion: Once the law went into effect and net of all covariates, the proportion of second-trimester abortions increased by nearly three percentage points more among women living closest to an in-state provider than among those living closest to an out-of-state provider. The law increased the mean gestational age of the fetus at the time of the procedure by approximately four days. Women who live closest to abortion providers in other states were relatively unaffected by the law.*

Conclusions: *The proportion of abortions performed later in pregnancy will probably increase if more states impose mandatory delay laws with in-person counseling requirements.*

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The 1992 Supreme Court decision in *Planned Parenthood of Southeastern Pennsylvania v. Casey* let stand a Pennsylvania statute mandating that women wait at least 24 hours after they receive state-provided information on abortion before they can terminate their pregnancy.[1] The mandatory waiting period, the Court ruled, did not impose an "undue burden" on a woman's right to an abortion. Since the *Casey* decision, 19 states have passed waiting-period legislation; in 14 of these states the laws are currently enforced, while in five they have been enjoined.[2]

In legal challenges to mandatory delay laws, plaintiffs assert that such waiting periods cause women to abort later in pregnancy, unnecessarily increasing the medical risks associated with induced abortion. Moreover, critics of the legislation claim that the burden imposed by these laws is greater among younger and poorer women and among those who live farther away from a provider.[3] Whether these potential consequences constitute an "undue burden" is a decision for the courts; nevertheless, empirical evidence on whether such laws affect the timing of abortion is needed to determine if the plaintiffs' claims have a basis in fact.

The point during pregnancy at which an abortion occurs should be studied for two other reasons. First, although 61% of Americans polled agree that first-trimester abortions should be legal, only 15% feel the same way about second-trimester abortions.[4] Similarly, the controversy associated with "partial birth" abortions reflects, in part, the public's difficulty with later terminations. Thus, policies that potentially increase the number of second-trimester abortions may weaken public support for the legality of abortion and exacerbate the controversy over late-term procedures.

Second, the timing of an abortion during pregnancy also determines whether a women is eligible for specific types of procedures. Medical abortion with agents such as mifepristone, for example, is most effective within the first nine weeks of pregnancy.[5] Although some analysts have argued that medical abortion will increase the overall availability of abortion services,[6] mandatory delay laws might decrease the use of medical abortion and reduce access if pregnancies lengthen as a result of the law.

In this article, we use Mississippi abortion data to examine the effect of the state's mandatory delay law on the timing of abortion. We compare the timing of abortions before and after the law among two groups of Mississippi residents: women whose closest abortion provider is in-state and those whose closest provider is in an-

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other state that did not have a mandatory delay law (i.e., in one of the four border states of Alabama, Arkansas, Louisiana and Tennessee). We hypothesized that the mandatory delay law would have a greater effect on women whose closest provider is in Mississippi than on women whose closest provider is in another state.

Background

Mississippi's mandatory delay law was enacted in March 1991 and was quickly challenged. A temporary injunction was issued in August of that year, before the law was to go into effect.[7] Following the Supreme Court decision in *Casey*, the injunction was lifted and the law became effective in August 1992.

The law requires that 24 hours pass between the time of receipt of information and the actual procedure. Because the law has been interpreted to mean that the information must be related in person, two separate visits to the provider are required. (Until recently, most other states with delay requirements allowed the information to be related over the phone or through the mail, so women would not have to make two separate visits.)

The informed consent component of the Mississippi delay law is delivered in two parts. First, the referring or attending physician must inform the patient orally and in person of the probable gestational age of the fetus, the risk associated with induced abortion and the name of the doctor who will be performing the procedure. Second, the physician (or physician's agent) must inform the patient—again, in person—that she may be eligible for medical assistance to pay for prenatal, delivery and postpartum care and that the man who impregnated her is liable for child support. The woman must also be told that she has the right to review state-prepared material that describes the "unborn child" and a list of agencies that provide alternatives to abortion.[8]

The additional required informational visit increases the cost of an abortion in travel time, lost work time and possible overnight stays. For women with children, there may be additional child-care expenses. Surveys of women who obtain abortions reveal that financial and logistical considerations are important determinants of delay.[9] Thus, we hypothesize that the law would be associated with an increase in the mean gestational age of the fetus and in the proportion of abortions performed in the second trimester (more than 12 weeks of gestation).

An increase in the cost of abortion that might result from the law, however, should lower the abortion rate. If a decline in abortions that is associated with the Mississippi law occurs nonrandomly, and particularly among women who in the absence of the law would have terminated the pregnancy in the first trimester, then we may observe an increase in the *proportion* of second-trimester abortions, but no change in the number of second-trimester abortions.[10] Thus, to determine whether any changes occurred, we present overall abortion rates and rates of second-trimester abortions both before and after the law.

Further, we expect the effects of Mississippi's mandatory delay law to vary by the degree to which women are likely to access abortion providers in states with no mandatory waiting periods. For instance, among Mississippi women living close to another state that has no delay requirement (which we designate as the control group), we would anticipate little change in the timing of abortion before or after the law. Conversely, we expect the law to have a significant effect on the timing of abortion among Mississippi women who live relatively far from an out-of-state provider (the treatment group). The costs to women in this latter group—i.e., costs associated with complying with the law or with travelling outside of Mississippi to avoid compliance—should prove to be higher. We incorporated the preceding considerations into a regression model that is detailed further in the Appendix (page 12).

Cross-sectional analyses of abortion and abortion availability are potentially biased because of unobserved heterogeneity between counties or states.[11] Even estimates from studies that use panel data with county or state fixed-effects are potentially biased, given that the supply and demand of abortion services may be determined simultaneously.[12] The most effective research designs examine the effects of exogenous shocks (sudden changes imposed from without) to identify effects of abortion financing and availability on abortion utilization.[13] Our analysis follows the latter approach.

Our study design encompasses several innovations and advantages over previous research. First, the treatment-control research design can more effectively adjust for trends in the timing of abortion that might confound estimates of the effect of the law. Previous studies either lacked a comparison group or relied on changes in abortion rates in other states without delay laws to adjust for trends in abortion in Mississippi.[14] In one such study, the proportion of abortions that were second-trimester procedures rose in Mississippi between 1989 and 1992, but fell in South Carolina and Georgia, the two control states.[15]

Results from our study are more likely to be generalizable to other states; for example, the experience of Mississippi women who live nearer to out-of-state providers will be relevant for women who live in other states with a delay law who have easy access to out-of-state providers with no delay law. Correspondingly, changes in abortion timing among Mississippi residents who have limited access to out-of-state providers will be useful for states that have a delay law and are surrounded by states with similar requirements.

Another innovation is our use of travel distance to the nearest provider to test whether the availability of services is correlated with delays in getting an abortion. Previous work on the relationship between abortion and the availability of providers has focused on rates of births and abortions, and has neglected the relationship between provider availability and the timing of abortion.

However, the distance to an abortion provider may be correlated with unmeasured factors that determine the timing of abortion. For example, women who live in the suburbs of major urban areas, most of which have an abortion provider, may share propensities to abort an unintended pregnancy that other measured variables do not account for. Alternatively, abortion providers may choose to locate close to areas where women with a high propensity to abort reside. We address this potential problem (i.e., the endogeneity of distance) by using the exogenous shock of the mandatory delay law to identify the effects of travel distance on the timing of abortion.

Finally, our study expands on previous research on the determinants of the timing of abortion[16] by using individual-level data that have been adjusted for demographic and obstetric characteristics. We also include fixed effects for county and year.

Data and Methods

Our primary source of data is records supplied by the Mississippi Department of Health of all induced abortions obtained by residents from August 1989 through July 1995 (the 36-month intervals, rather than the calendar years, immediately preceding and following the August 1992 enactment of the mandatory delay law). We chose to study abortions in Mississippi for several reasons. First, Mississippi's record-keeping on abortion is especially com-

plete; its aggregate data nearly match those collected by The Alan Guttmacher Institute (AGI), which are generally believed to be the most complete abortion data available.

More important is that the Mississippi Department of Health has reciprocal abortion-reporting agreements with neighboring states, which enable us to follow many Mississippi residents who travel outside the state for an abortion. None of these neighboring states enforced a mandatory delay law during the study period. Thus, they provide an unrestricted alternative for women who wanted to circumvent Mississippi's delay requirements.

The records also indicate the county of residence for Mississippi residents who obtain their abortion in another state. Finally, the department provided us with individual-level data, which allowed us to conduct multivariate analyses of the determinants of delay, and also enabled us to determine when the abortion took place (either before or after the law's enactment) with more precision than would have been possible if we had used state-aggregate data from either AGI, other states' health departments or the U.S. Centers for Disease Control and Prevention.

The induced abortion files from Mississippi contain information on the woman's age, race, marital status, completed schooling, month of termination and previous pregnancies (i.e., live births, previous induced abortions and spontaneous abortions). Information on the woman's county of residence was available for women living in 74 of the state's 82 counties; the Mississippi Department of Health did not provide county-of-residence data for women residing in the remaining eight counties because of concerns that we would be able to identify women living in these very small counties, which had so few abortion clients. However, fewer than 1.5% (n=591) of all records were unusable because the county was not identified. (It should be noted that in 1992, 78 of Mississippi's 82 counties lacked a nonhospital abortion provider.*)

Mississippi imposed a parental consent statute in June 1993, only 10 months after the state's mandatory delay law went into effect. Therefore, to isolate the effects of the delay law, we excluded 4,792 records that corresponded to abortions obtained by minors. The final number of induced abortions, then, for analysis of the effects of the law was 34,748 abortions obtained by Mississippi adult residents from August 1989 through July 1995. To designate treatment and control groups, we stratified the sample by whether a Mississippi resident's nearest abortion provider was in-state or out-of-state, as measured by travel distance; thus, we analyzed 28,975 records for women whose nearest provider was in-state (treatment group) and 5,773 records for women whose nearest provider was out-of-state (control group).

We computed travel distance using the woman's county of residence from the abortion files, by measuring the distance a woman would have to travel from her county seat to that of the nearest county with a provider. Software from the American Automobile Association was used to compute the minimum travel distance in miles between the two points. We assigned a distance of zero miles to women living in a county that had an abortion provider.†

We obtained county-level data on the availability of nonhospital‡ abortion providers from the AGI survey of providers for the years 1988, 1991, 1992, 1995 and 1996. We used telephone directories and court documents to confirm the availability of abortion services within the state for those years for which no AGI data were available. We also considered in the analysis annual unemployment rates and per capita income, by county, from the state's Area Resource File. Overall population data by age, race, sex and county were obtained from the U.S. Bureau of the Census.

Methodological Considerations

As noted earlier, the total number of abortions reported by the Mississippi Department of Health is remarkably close to the number reported by AGI. According to the state, 8,184 abortions were performed in Mississippi in 1991, compared with 8,160 abortions in that year according to AGI. In 1992, the state's department of health and AGI reported 7,555 and 7,550 abortions, respectively.§

The two sources agree less, however, when the data are presented by the woman's state of residence. In 1988 (the most recent year for which AGI data on abortions by state of residence are available), AGI estimated that 6,480 Mississippi residents obtained an abortion, while the corresponding number reported by the Mississippi Department of Health was 6,094. Much of this discrepancy most likely stems from unreported abortions among Mississippi residents who terminated their pregnancies in Louisiana, since Mississippi has no reciprocal reporting agreement with that state. Moreover, in 1988, AGI estimated that 2,140 Mississippi residents obtained an abortion in another state, whereas the state's Department of Health reported only 1,679 residents going out-of-state for an abortion in that year.[17]

This lack of data on Mississippi residents who obtain an abortion in Louisiana is likely to bias our estimates of differential effects of the delay law on the timing of abortions by whether a woman's nearest provider is in-state or out-of-state. Consider, for instance, women who live along the border whose nearest provider is in the Louisiana cities of Baton Rouge or New Orleans. If women who leave the state to terminate their pregnancy do so at different points during pregnancy, on average, than women from the same counties who obtain their abortions in Mississippi, then our estimate of the differential effect of the law on abortion delay by location of the nearest provider will be biased (see Appendix).

We believe, however, that this bias is likely to be small. A comparison of the proportion of abortions obtained in-state and out-of-state, by whether a woman's nearest provider is in-state or out-of-state (Table 1) shows that in the three-year-period before the mandatory delay law was enacted (August 1989–July 1991), Mississippi residents having an abortion who lived closest to an out-of-state provider were, on average, nearly 2.5 times as likely as those whose closest provider was in-state to leave

*Estimate based on the authors' tabulations of data from AGI's 1991–1992 survey of abortion providers.

†We also computed travel time in minutes. However, the first-order correlation between distance and time in minutes is 0.99 for our sample; thus, to facilitate comparison with previous work, we report only travel distance data.

‡We left out hospital providers entirely because just one hospital in Mississippi (in Jackson, the capital) provides abortions. Since several major clinics in Jackson also offered the procedure during our study period, the inclusion of an additional hospital provider would not have altered our measure of travel distance.

§The number of abortions performed in Mississippi increased from 1989 to 1991, however. Part of this rise was caused by an increase in abortions to Tennessee residents, from 590 in 1989 to 1,133 in 1990, and to 1,453 by 1991. This increase likely resulted from an aggressive expansion by the sole provider in De Soto County, Mississippi, which is part of the Memphis, Tennessee, metropolitan statistical area. According to AGI, this clinic performed fewer than 400 abortions in 1988, but more than 1,000 abortions in 1991. When the clinic closed (in April 1994), the number of abortions that Tennessee residents obtained in Mississippi fell from 885 in 1993 to two in 1994. Another possible explanation for the 1990–1991 increase is a July 1991 requirement mandating that abortion clinics be licensed. The licensing regulation, which included standards for recordkeeping and reporting and was developed in cooperation with the directors of the five major abortion clinics in the state, may have improved reporting.

Mississippi for the abortion (44% vs. 18%). This differential rose sharply in the three-year period following the law's enactment: In August 1992–July 1995 (years 1992–1994 in table), abortion clients whose closest provider was out-of-state were 3.4 times as likely to cross state lines to terminate a pregancy as were those whose closest provider was in Mississippi (75% vs. 22%).*

In this article, we use the dichotomous indicator of whether the nearest provider is located in Mississippi or in another state—our proxy for "exposure" to the mandatory delay law. Clearly, this design is contaminated, in that some women in our treatment group (who live relatively far from providers in a state with no delay requirement) still obtain abortions out-of-state, while some women in our control group (who live relatively close to a state without a requirement) use in-state providers. As a result, estimates of α_5 (in the equation presented in the Appendix) will be biased downwards, although the sign should still be positive.

A positive and statistically significant difference between the two groups would demonstrate that effects of mandatory delay laws on abortion timing vary with access to out-of-state abortion providers who have no such delay requirements. Moreover, any effects of the law on our treatment group would suggest what might occur if Mississippi's neighboring states—or even if all states—were to adopt such laws.

Results

Women's Characteristics

Abortion clients' demographic and socioeconomic profiles are basically similar according to whether their nearest provider is in-state or out-of-state, both before and after the law was enacted (Table 2, page 8). The one exception is race, since the proportion of procedures to white women declined by 10 percentage points among those who lived closest to an in-state provider after enactment of the law (from 52% to 42%), while it fell by only three percentage points among those whose nearest provider was out-of-state (from 52% to 49%).†

There are important differences by travel distance, however. As would be expected, regardless of the time period, women who live nearest to an in-state provider have to travel much farther to reach an out-of-state provider (an average of 131 miles in the earlier period, for example) than to reach an in-state provider (an average of only 42 miles). Women whose nearest provider is out-of-state, however, have to travel fairly large distances, no matter whether they are travelling to the nearest out-of-state provider (an average of 101 miles) or to the nearest in-state provider (an average of 121 miles).

Researchers often view the distance women need to travel to an abortion provider as a proxy for the time costs associated with obtaining an abortion. As such, the distances in Table 2 are roughly consistent with the proportions of Mississippi women obtaining an abortion in another state (Table 1).

For example, the narrower difference in the "relative price" of an abortion in terms of only a 20-mile difference in distance between what women living closest to an out-of-state provider would have to travel to reach an in-state as opposed to out-of-state provider (121 versus 101 miles) is consistent with the finding that nearly one-half (44%) of these women obtained an abortion out-of-state in the three-year period before the law (and 75% did so after the law, Table 1). By contrast, the far larger difference in "relative price" in terms of the 89-mile difference in the distance between what women whose closest provider is in-state would have to travel to reach the nearest out-of-state as opposed to in-state provider (131 versus only 42 miles) also accords with the finding that only about 20% of these women traveled out-of-state for an abortion in either time period.

Difference-in-Differences Estimates

The upper panel of Figure 1 (page 9) presents the percentage distribution of abortions obtained by Mississippi women in the treatment group (those whose closest provider is in-state), by week of gestation, in the 12-month periods before and after the law went into effect. The lower panel of Figure 1 shows the same data for women in the control group (those whose closest provider is out-of-state). Among women in the treatment group, there was a marked shift after the law from early procedures (those at fewer than nine weeks' gestation) toward abortions somewhat later in the first trimester (at 9–12 weeks) and toward second-trimester abortions (at more than 12 weeks). The data for women in the control group indicate no distinguishable increase in second-trimester abortions, but also show a shift from early to late first-trimester abortions.

Table 3 (page 10) presents these data in another way. For example, 7.5% of abortions to women in the treatment group were second-trimester procedures in the three-year period preceding the law; this proportion rises to 11.5% in the three years following the law, a four-point change and an increase of 53%. Changes in the proportion of second-trimester abortions to women in the control group were more modest—an increase of only 8% (from 10.5% to 11.3%).

We also used difference-in-differences estimates[18] to relate the percentage-point changes over time in the proportion of second-trimester abortions among both groups of women. When the 0.8 percentage-point change among women in the control group is subtracted from the 4.0 percentage-point change among women in the treatment group, we find that the proportion of second-trimester abortions once the law was

Table 1. Percentage distribution of Mississippi abortion clients whose nearest provider is in-state and whose nearest provider is out-of-state, by whether they obtained their abortion in Mississippi or in another state, according to year

Year	Nearest provider in-state (N=28,975)			Nearest provider out-of-state (N=5,773)		
	Abortion obtained in-state	Abortion obtained out-of-state	Total	Abortion obtained in-state	Abortion obtained out-of-state	Total
1989–1991	**81.6**	**18.4**	**100.0**	**56.1**	**43.9**	**100.0**
1989	77.7	22.3	100.0	50.1	49.9	100.0
1990	83.1	16.9	100.0	53.9	46.1	100.0
1991	83.3	16.7	100.0	63.6	36.4	100.0
1992–1994	**77.8**	**22.2**	**100.0**	**25.4**	**74.6**	**100.0**
1992	77.9	22.1	100.0	49.2	50.8	100.0
1993	80.7	19.3	100.0	27.5	72.5	100.0
1994	74.0	26.0	100.0	11.2	88.8	100.0

Note: Because Mississippi's mandatory delay law became effective in the month of August, in this and the following tables, years do not represent calendar years, but refer to 12-month periods beginning in August; thus, "1989" corresponds to August 1989 through July 1990, "1990" covers August 1990 through July 1991, and so on.

*These differences are likely to be underestimates, because we lack data on Mississippi residents who obtained an abortion in Louisiana.

†This racial difference in provider location proximity over time was probably caused by the closing of a major abortion clinic in the northern part of the state in April 1994, which altered the composition of counties in the two categories of abortion provider proximity. Between 1991 and 1992, when no changes occurred in the county composition, the proportion of abortions that were obtained by white women remained the same in both categories of provider proximity.

enacted increased 3.2 percentage points more (p<.01) among women whose closest provider is in-state than among those whose closest provider is out-of-state.

The results with respect to mean gestational age at the time of the procedure are similar. Gestational age rises 0.7 weeks among women in the treatment group over the period (from a mean of 8.6 weeks to a mean of 9.3 weeks), but only by 0.2 weeks among women in the control group (from 9.2 weeks to 9.4 weeks). These changes yield a significant (p<.01) difference-in-differences estimate of 0.5 weeks, or three and one-half days. In other words, the increase in gestational age was nearly four days greater among women in the treatment group than among women in the control group.

The three-year averages for the periods before and after enforcement of the law mask an overall upward trend in the proportion of second-trimester procedures among all Mississippi women, regardless of where they live.*[19] The difference-in-differences estimates, however, should eliminate this trend, provided it is similar for the two groups of women.

If a change in abortion timing among women whose nearest provider is out-of-state (the control group) effectively captures trends common to all Mississippi residents, then the difference-in-differences estimates should be similar regardless of the time period used (i.e., 36-month periods or 12-month periods). In fact, our control group appears to effectively capture the trend. The differential effect of the law on women whose nearest provider is in-state rather than out-of-state is essentially the same, regardless of the time period used. The difference between the treatment and control groups in the proportion of second-trimester procedures was estimated to be 3.2 percentage points for the three-year periods surrounding the law, while the corresponding difference for the single year immediately preceding and following the law was 3.1 percentage points.

The mandatory delay law was associated with a decline in the overall abortion rate, but with a rise in the second-trimester abortion rate (Table 4, page 10). Among women whose nearest provider is in-state, the rate fell from 11.3 abortions per 1,000 women aged 15–44† in the three-year period preceding enactment of the law to 9.9 per 1,000 in the three years following it. The rate of second-trimester abortions, however, rose over the same period, from 0.8 second-trimester procedures per 1,000 women aged 15–44 to 1.1 per 1,000. Changes in these measures were much smaller among women in the control group (see Table 4).

We used differences in the natural logarithm of rates to measure associations; the data should be interpreted as showing relative changes. Subtracting the natural logarithm of the ratio between the 1989–1991 and 1992–1994 abortion rates for the control group from the comparable logarithm for the treatment group yields a value of –0.19. A similar procedure for the single year immediately preceding and following the law's enactment produces a value of –0.13. Thus, after the law, abortion rates fell 13–19% more among women whose nearest provider is in-state than among women whose nearest provider is out-of-state, depending on whether 12-month or 36-month periods are used. The same comparison for rates of second-trimester abortion indicates a differential rise of 17–26% associated with the law.

Table 2. Percentage distribution of Mississippi abortion clients, by characteristic, and selected county-level measures, all according to location of nearest abortion provider (in-state or out-of-state) and whether the abortion occurred before or after enactment of mandatory delay statute

Characteristic or measure	Before law (1989–1991)		After law (1992–1994)	
	In-state	Out-of-state	In-state	Out-of-state
Age				
18–19	16.9	18.4	15.1	16.0
20–24	37.8	36.8	40.8	41.6
25–29	21.8	22.3	21.3	21.1
≥30	23.4	22.5	22.9	21.4
Marital status				
Married	19.6	20.8	17.1	19.0
Single	80.4	79.2	82.9	81.0
Race				
White	51.8	52.0	42.2	49.0
Nonwhite	48.2	48.0	57.8	51.0
No. of prior induced abortions				
0	69.3	69.9	68.1	71.8
1	22.5	21.9	24.3	21.4
>1	8.3	8.1	7.6	6.9
No. of live births				
0	40.9	36.1	40.2	38.9
1	29.2	30.0	31.5	32.8
>1	29.8	33.8	28.3	28.4
Ever had miscarriage				
Yes	9.5	9.0	12.1	10.7
No	90.5	91.0	87.9	89.3
Education				
<high school	5.1	8.9	4.2	6.9
Completed high school only	25.4	30.6	25.4	32.3
>high school	41.4	33.3	42.1	41.3
Unknown	28.1	27.2	28.4	19.6
Total	100.0	100.0	100.0	100.0
County-level measures (average or median)				
Distance to nearest in-state provider (in miles)				
Average	41.7	120.8	41.6	150.3
Median	29.2	132.1	30.0	158.8
Distance to nearest out-of-state provider (in miles)				
Average	131.3	101.0	139.5	93.7
Median	146.8	112.0	155.5	96.3
Annual per capita income ($)	14,277	12,165	15,957	14,032
% unemployed	7.2	9.6	7.4	8.8
N	15,923	2,413	13,052	3,360

Note: The Ns were reduced by 114 missing observations for the variable race, and by 96 missing observations for the variable prior abortions.

Multivariate Analyses

If our experiment is valid, then results from the multivariate analysis should be similar to those from the simple difference-in-differences estimates, but more precise. Moreover, the multivariate analysis provides information on the other determinants of abortion delay, such as economic and demographic characteristics (i.e., age, marital status, race and obstetric history‡). Such data provide a point of

*This uniformity across the state is important for several reasons. First, if there had been an early "announcement" effect of the law's passage in the beginning of 1991, we should have observed a greater rise in second-trimester procedures among women whose nearest provider is in-state. Second, as noted previously, the proportion of second-trimester abortions fell in South Carolina and Georgia between 1989 and 1992, the two control states used in a previous analysis (see Joyce T, Henshaw SK and Skatrud JD, reference 14). An opposite trend in late abortions in Mississippi underscores the potential value of a control group of Mississippi residents.

†The numerator includes women aged 18 and older, whereas the denominator is women aged 15–44. This will have little effect on our analysis, however, since changes in the numerator rather than in the denominator drive the results.

‡We were unable to examine the impact of women's schooling because a large number of the abortion records were missing data on this variable, and because the extent of missing data was greater in some groups than in others (Table 2).

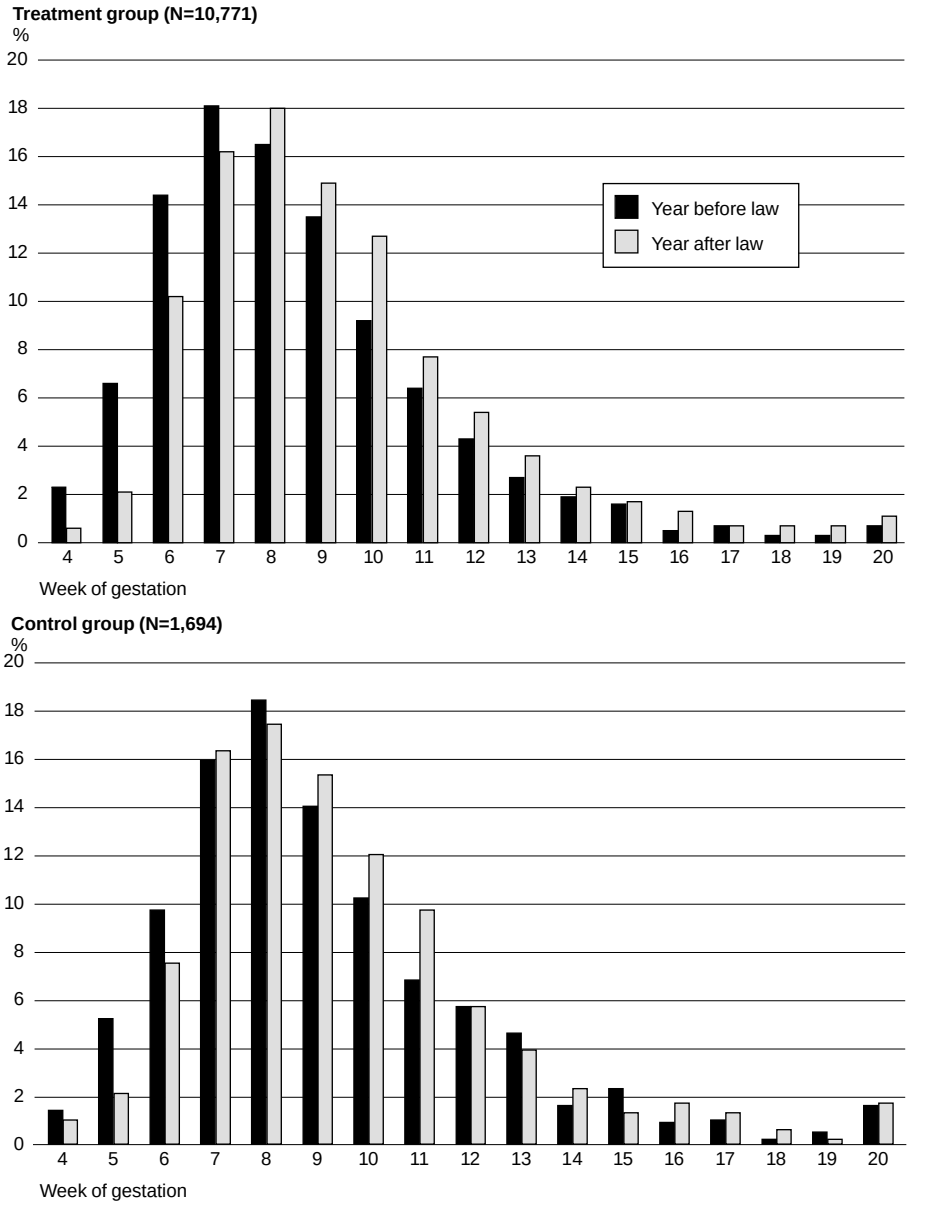
comparison with which to gauge the relative importance of Mississippi's delay law in influencing the timing of abortions.

•*Regression estimates*. Table 5 (page 11) presents the results of the multivariate analyses predicting the likelihood of delay—as measured by whether the abortion occurs in the second trimester (results of probit logression analyses) and whether the gestational age of the fetus (in weeks) at the time of the abortion is affected (results of ordinary least-squares regression analyses).

The results of the interaction between the law and the location of the nearest provider indicate that the mandatory waiting period had independent ($p<.01$) differential effects on the timing of abortions in Mississippi for women who live nearer to an in-state than to an out-of-state provider (α_5 in the Appendix equation): Once the law went into effect and net of all other variables, women who live closest to an in-state provider obtained their abortion later in pregnancy than did those who live closest to an out-of-state provider. For example, after the law's enactment, the proportion of second-trimester abortions increased 4.3 percentage points more, and mean gestation rose nearly 0.7 weeks more, among women whose nearest provider is in-state than among those whose nearest provider is out-of-state. While these adjusted results are similar to the difference-in-differences estimates based on the data in Table 3, the differential change in second-trimester abortions is larger in the multivariate analysis.

With respect to other determinants of abortion delay, the distance a woman has to travel is negatively (but not significantly) related to the likelihood of a second-trimester abortion prior to the law, but is positively related to delay after the law (see Appendix). This finding is consistent with the interpretation that the two-visit requirement imposes a differential cost on women who have to travel further to reach an abortion provider. It should be interpreted with caution, however. The relatively large negative effects of travel distance prior to the law, although nonsignificant, are not evident in the unadjusted data (results not shown). Moreover, the results are somewhat sensitive to the inclusion of county fixed-effects; this is not unexpected, since there is limited within-county variation in travel distance over time. When we estimate the model without fixed effects, the coefficients for travel distance fall in magnitude, especially in the period before the law went into effect (not shown).

Figure 1. Percentage distribution of abortions among women in the treatment or the control group, by week of gestation at the time of the procedure, according to 12-month period before and after enactment of mandatory delay law



Notes: Treatment group consists of women whose nearest provider is in-state; control group consists of women whose nearest provider is out-of-state. The year before the law is the period August 1991–July 1992; the year after the law is the period August 1992–July 1993.

There is a strong association between age and both outcomes. The proportion of second-trimester abortions is 7.4 percentage points higher among 18–19-year-olds than among women aged 30 and older; moreover, these youngest women obtained their abortion further along in pregnancy (by nearly one week's gestation) than did women in the oldest age-group. Likewise, the proportion of second-trimester procedures is 3.9 percentage points higher among 20–24-year-olds than among women aged 30 and older, and 20–24-year-olds obtained their abortion more than one-half a week later in pregnancy than did women aged 30 and older. Women aged 25–29 were also significantly more likely than those aged 30 and older to have a second-trimester abortion (a proportion 1.4 percentage points higher) and had their abortion 1.4 days later. These significant differences in timing by age were completely insensitive to the inclusion of county fixed-effects.

The outcome of previous pregnancies also independently predicted the timing of abortion. Compared with women who were having their first abortion, those who

Table 3. Among abortions obtained by Mississippi residents, percentage that are performed in the second trimester and mean gestation (in weeks) at which all abortions are obtained, by year, according to location of closest provider

Year	Nearest provider in-state (N=28,975)			Nearest provider out-of-state (N=5,773)		
	% in 2nd trimester	Mean gestation (in wks)	N	% in 2nd trimester	Mean gestation (in wks)	N
1989–1991	**7.5**	**8.6**	**15,923**	**10.5**	**9.2**	**2,413**
1989	6.5	8.6	4,874	8.7	9.2	814
1990	7.0	8.5	5,172	9.9	9.3	729
1991	8.7	8.5	5,877	12.8	9.2	870
1992–1994	**11.5**	**9.3**	**13,052**	**11.3**	**9.4**	**3,360**
1992	12.1	9.3	4,894	13.1	9.5	824
1993	12.2	9.3	4,536	10.8	9.4	999
1994	9.7	9.3	3,622	10.6	9.3	1,537

Note: See note to Table 1.

already had had one were significantly less likely to terminate their pregnancy in the second trimester (a proportion 1.7 percentage points lower), and they obtained their abortion 1.4 days sooner. Moreover, having had at least two previous abortions relative to never having had one lowered the proportion of second-trimester procedures by 2.5 percentage points, and also lowered gestational age by more than one-fifth of a week.

The association is just the opposite when we examine the effect of parity on the likelihood of delay: The level of second-trimester abortions is 1.5 percentage points greater among women who had had one previous live birth and it is 2.5 percentage points greater among those who had had two or more, relative to women who had never given birth. Parity has similar effects in increasing the mean gestational age at the time of the abortion.

There were also significant differences in abortion timing by race, as white women were less likely to delay than nonwhite women. For example, the proportion of second-trimester procedures was 1.8 percentage points lower, and the mean gestation of the fetus nearly 2.3 days shorter, among white abortion clients than among nonwhites. There were relatively small differences in timing by marital status, and neither of the county-level measures had a consistent independent impact on when in pregnancy an abortion would occur.

•*Alternative specifications.* We have several concerns about the analyses presented above: about the sensitivity of the data to the inclusion of travel distance; about whether we chose the correct time period for the analysis; and about the variability in absolute distance from a provider, regardless of whether it is in-state or out-of-state. To address the first of these concerns, we reran the models in Table 5 with and without adjustments for county fixed-effects and for travel distance. The resulting coefficients, displayed in Table 6 (page 12), show the interaction between the law and proximity to an abortion provider for the variously adjusted specifications. (Estimates from Table 5, which are adjusted for both county fixed-effects and travel distance, are shown in the first column of Table 6, for comparison purposes.) Standard errors are corrected for within-county clustering in all regressions.

A consistent finding in Table 6 is the sensitivity of the estimates to the inclusion of travel distance. For example, removing travel distance from the fully adjusted model so that the data are adjusted for fixed effects only reduces the differential effect on the proportion of second-trimester procedures from 4.3 percentage points to 2.6. Moreover, comparing the results from the model that controls for distance only with the completely unadjusted model further shows that removing travel distance lowers the differential effect on the proportion of late abortions (from 4.4 percentage points to 3.0).

When changes in mean gestation are similarly adjusted—or not—for the county fixed-effects and travel distance, they follow almost the same pattern, although the sensitivity to the inclusion of travel distance is not as great. These data are sensitive to travel distance because our indicator of the nearest provider (in-state or out-of-state) is strongly correlated with the measure of distance;* moreover, the problem persists even when we use a continuous measure of travel distance.

Therefore, our preferred specifications exclude travel distance. The results from such models are very close to the difference-in-differences estimates based on the data in Table 3, and they are insensitive to the inclusion of county fixed-effects. They provide a conservative, but substantial and statistically significant, estimate of the effect of the law on the timing of abortions for women who live relatively far from an out-of-state provider. Because our measure of relative access to in-state or to out-of-state abortion providers is strongly correlated with travel distance, we apparently do not have sufficient variation in our county-level measure of travel distance within a single state to obtain reliable estimates.

The data in Table 6 also assess the sensitivity of our findings to the choice of time period used for analysis. Specifically, we included dummy variables for each 12-month period, with 1991 (i.e., August 1991–July 1992) serving as the reference category. We then interacted each year with whether the woman's nearest abortion provider is in-state. Once we removed travel distance so the analyses of timing of abortion and

Table 4. Number of abortions and number of second-trimester abortions per 1,000 Mississippi women aged 15–44, and number of Mississippi women aged 15–44, by year, according to whether nearest abortion provider is in-state or out-of-state

Year	Nearest provider in-state			Nearest provider out-of-state		
	Abortion rate		No. of women 15–44	Abortion rate		No. of women 15–44
	Overall	2nd trimester		Overall	2nd trimester	
1989–1991	**11.3**	**0.8**	**1,405,457**	**7.2**	**0.8**	**336,169**
1989	10.5	0.7	465,135	7.0	0.6	116,583
1990	11.0	0.8	468,888	6.7	0.7	109,512
1991	12.5	1.1	471,434	7.9	1.0	110,074
1992–1994	**9.9**	**1.1**	**1,312,189**	**7.6**	**0.9**	**441,989**
1992	10.4	1.3	471,278	7.5	1.0	109,593
1993	10.2	1.2	445,249	7.3	0.8	137,680
1994	9.2	0.9	395,662	7.9	0.8	194,716

Notes: The data refer to the number of abortions (or of second-trimester abortions) obtained by women 18 and older per 1,000 women aged 15–44. Note that the population of women living in counties closest to an in-state provider declined substantially in 1993, and even more so in 1994, while the population living in counties closest to an out-of-state provider increased concomitantly. The closing of a major Mississippi abortion provider near the Tennessee border in April 1994 shifted women from one category to the other. Since we measure years from August through July, the closing of this provider affects only data for our years 1993 and 1994, so comparisons for the single year immediately preceding and following enactment of the law (i.e., August 1991–July 1992 versus August 1992–July 1993) are unaffected by this closing.

*The simple correlation between the indicator of whether the woman's nearest abortion provider is in-state and a distance of 1–50 miles to that provider is –0.41, and the correlation between in-state provider location and distance of more than 50 miles is –0.32.

Table 5. Coefficients (and standard errors) from probit regression analyses predicting the likelihood of a second-trimester abortion, percentage-point changes in the proportion of second-trimester procedures, and coefficients (standard errors) from ordinary least-squares regression analyses predicting effects on gestational age at the time of the procedure

Variable	Second-trimester abortion (N=34,576)		Gestation (N=34,576)
	Coefficient	Percentage-point change	Coefficient
Law			
Before (ref)	na	na	na
After	–0.205* (0.082)	–3.3	–0.020 (0.168)
Nearest provider			
Out-of-state (ref)	na	na	na
In-state	–0.126* (0.064)	–2.1	–0.395* (0.157)
Interaction of law and provider			
Law X in-state provider	0.257** (0.056)	4.3	0.674** (0.143)
Travel distance (in miles)			
0 (ref)	na	na	na
1–50	–0.107 (0.083)	–1.7	–0.256 (0.152)
>50	–0.276 (0.209)	–4.4	–0.150 (0.397)
Interaction of distance and law			
1–50 miles X law	0.106 (0.070)	1.8	0.182 (0.112)
>50 miles X law	0.214** (0.053)	3.7	0.169 (0.106)
Woman's age			
18–19	0.385** (0.033)	7.4	0.950** (0.059)
20–24	0.233** (0.029)	3.9	0.583** (0.052)
25–29	0.086** (0.029)	1.4	0.210** (0.052)
≥30 (ref)	na	na	na
No. of prior induced abortions			
0 (ref)	na	na	
1	–0.112** (0.026)	–1.7	–0.197** (0.034)
>2	–0.169** (0.037)	–2.5	–0.219** (0.045)
No. of live births			
0 (ref)	na	na	na
1	0.093** (0.024)	1.5	0.204** (.037)
≥2	0.147** (0.031)	2.5	0.339** (.043)
Ever had miscarriage			
Yes	0.037 (0.027)	0.6	0.177** (0.056)
No (ref)	na	na	na
Married			
Yes	0.084** (0.027)	1.4	0.086 (0.046)
No (ref)	na	na	na
Race			
White	–0.114** (0.021)	–1.8	–0.368** (0.037)
Nonwhite (ref)	na	na	na
Unemployment rate			
County % employed	0.012 (0.013)	0.2	–0.031 (.023)
Income			
County per capita income	0.054** (0.019)	0.9	–0.009 (0.028)
Adjusted R^2	*na*		*.045*
Ln likelihood	*–10,566*		*na*

*p<.05. **p<.01. *Notes:* All regressions include a set dummy variables for each month and a set for each county. A total of 172 observations were dropped from the multivariate analyses because they were missing data on either race or previous induced abortions, or both.

mean gestation are adjusted for county fixed-effects only, these results are very close to the difference-in-differences estimates generated from the Table 3 data.

For example, when women who obtained an abortion in the year after the law went into effect are compared with those who did so in the year before, the proportion of second-trimester abortions is 2.8 percentage points greater, and the mean gestational age is 0.36 weeks later, among women whose nearest provider is in-state relative to out-of-state. (The difference-in-differences estimates computed from the data in Table 3 are 3.1 percentage points and 0.50 weeks, respectively.) In sum, the effects of the law on the timing of abortion appear robust. With the exception of travel distance, they are insensitive to inclusion of other covariates and whether we examine abortion timing trends in either 12-month or 36-month periods before and after the law.

In Table 6, we also test whether the effect of the law is greater for those who live further away from an out-of-state provider (relative to an in-state provider). We raise this possibility because for some women, the difference between the nearest in-state and out-of-state abortion provider is as small as five miles. Many of these women would be unaffected by the law, even though their nearest provider may be in-state. This would tend to bias our estimates of the differential effect of the law toward zero.

As an alternative approach, we divide women whose nearest provider is in-state into two categories—those for whom the difference in the distance between the nearest in-state and out-of-state provider is 1–50 miles and those for whom the difference is more than 50 miles. The reference category for each includes women whose nearest provider is out-of-state.

In all but one case, the greater the difference (in miles) separating the nearest in-state and out-of-state provider, the greater the delay in obtaining an abortion. However, in our preferred specifications (which exclude travel distances), we cannot reject the null hypothesis that the coefficients are the same (at p<.05). This evidence that the further a woman lives from an out-of-state provider, the longer she delays her termination, suggests that a dichotomous indicator of the nearest provider as either in-state or out-of-state may underestimate the impact of delay laws on the timing of abortion among women for whom the difference between the nearest in-state and out-of-state provider exceeds 50 miles.

Our final concern is the lack of data on abortion timing for Mississippi residents who travel to Louisiana for their abortion. The direction of the bias is unclear, since it depends on whether women who leave the state delay more or less than women who obtain an abortion in-state. As a check on the sensitivity of our estimates to these missing data, we reran our regressions once more on a reduced sample of women, dropping from the analysis all abortions to women in counties where the likelihood of obtaining a procedure in Louisiana was highest.*

According to the regression results (unadjusted for distance) based on the reduced sample (not shown), the marginal effect of the interaction between the law and the proximity of a provider is modestly larger than the estimates based on the full sample of abortions to Mississippi residents: a 3.3 percentage-point change in the proportion of second-trimester procedures, and an increase in mean gestational age of 0.73 weeks, compared with increases of 2.6 percentage points and 0.61 weeks in the main regression analysis.† These slightly

*We dropped all abortions obtained by women living in counties south of Jackson. (Women living in southern Mississippi counties that are contiguous to Alabama were included, however.) Jackson was chosen because it is approximately in the center of the state, and is 180 miles from New Orleans.

†This modest rise indicates that Mississippi residents who obtain an abortion in Louisiana delay less than women from these same counties who obtain abortions in Mississippi. To further understand differences between those who travel and those who do not, we again eliminate women in counties south of Jackson and consider the proportion of second-trimester procedures among women who live nearest to an out-of-state provider. Women who have their abortion in Mississippi are much more likely to have a second-trimester abortion (19%) than are women who travel outside the state (9%). Thus, our results likely underestimate the differential impact of the law on abortion timing among women who live nearer to an in-state than to an out-of-state provider.

Table 6. Alternative specifications of probit regression results and of ordinary least-squares regression results indicating effect of the interaction between the law and proximity of the nearest provider on the timing of abortion, by adjustment for county fixed-effects and for travel distance

Interaction	% of second-trimester abortions				Mean gestation (in weeks)			
	Adjusted for fixed effects and distance	Adjusted for fixed effects only	Adjusted for distance only	Unadjusted	Adjusted for fixed effects and distance	Adjusted for fixed effects only	Adjusted for distance only	Unadjusted
Law X nearest provider								
Coefficient	0.257**	0.156*	0.260**	0.179**	0.674**	0.613**	0.565**	0.525**
Standard error	0.056	0.062	0.054	0.055	0.143	0.135	0.140	0.139
Percentage-point change	4.3	2.6	4.4	3.0	na	na	na	na
1992 X nearest provider								
Coefficient	0.239**	0.159	0.231**	0.154**	0.421**	0.361**	0.399**	0.359**
Standard error	0.054	0.056	0.053	0.057	0.117	0.117	0.119	0.110
Percentage-point change	4.3	2.8	4.2	2.7	na	na	na	na
Law X difference in distance is 1–50 miles†								
Coefficient	0.220**	0.168*	0.201**	0.165*	0.592**	0.518**	0.438**	0.373*
Standard error	0.059	0.072	0.061	0.069	0.150	0.159	0.155	0.172
Percentage-point change	3.9	2.9	3.6	2.9	na	na	na	na
Law X difference in distance is >50 miles†								
Coefficient	0.429**	0.163*	0.436**	0.191	1.061**	0.702**	1.014**	0.640**
Standard error	0.075	0.076	0.068	0.068	0.169	0.150	0.146	0.142
Percentage-point change	8.0	2.8	8.3	3.3	na	na	na	na

*p<.05. **p<.01. †Distances between nearest in-state provider and nearest out-of-state provider. Reference category is women whose nearest provider is out-of-state. *Note:* All regressions include measures of age, race, marital status, previous spontaneous and induced abortions, previous live births, county measures of unemployment and per capita income, and a set of dummy variables for each month (see Table 5).

longer delays among the reduced sample suggest that we probably underestimated the full effects of the law, because we lacked data on abortions obtained by Mississippi residents in Louisiana.

Conclusions

Our results provide convincing evidence that Mississippi's mandatory delay law has had a substantial and statistically significant effect on the timing of abortion among residents who seek abortion. We estimate that effects of the law in delaying abortion were greatest among women who had the least access to providers in states with no such law—that is, the proportion of second-trimester abortions was at least 2.6 percentage points greater among women whose nearest abortion provider is in-state than among those whose nearest provider is out-of-state. The overall effect of the law on mean gestation is to delay an abortion about four days (0.61 weeks).

Moreover, these increases in delays are likely underestimates of what would have been observed if none of the women living nearest to an out-of-state provider used an in-state provider, and none of the women living closest to an in-state provider went outside the state for an abortion. Despite the potential contamination in our treatment and control groups, the magnitude of the effect of the law is substantial. Except for young age (i.e., being 18 or 19), no other risk factor, including race, has a larger impact on the timing of abortion than does enactment of the law.

Our findings offer several insights into what might be expected if other states enforce statutes similar to Mississippi's. (Currently, four states with mandatory delay laws enforce two-visit requirements, and three additional states are contesting the two-visit interpretation in court.[20]) First, a mandatory delay law probably would have relatively little effect on the timing of abortion in small eastern states (such as Massachusetts, Rhode Island and Connecticut) where women can easily cross state lines for an abortion. The same would be true for women in much of New Jersey, Maryland and northern Virginia, as long as providers in the major cities of Washington, DC, and New York City do not require two visits. Two-visit requirements in larger western states, where relatively few women can easily travel out-of-state for an abortion, would have a greater impact on the timing of abortion, and that effect might even exceed the changes we observed in Mississippi.

Although the medical risks associated with induced abortion are very small, they rise geometrically from the first trimester to the second.[21] In the three-year period before enactment of the mandatory law, 7.5% of abortions to women whose nearest abortion provider is in-state were in the second trimester. Our conservative estimate of a differential increase in the proportion of second-trimester abortions of 2.6 percentage points among such women represents a relative increase in such second-trimester procedures of 35%.

Should medical abortion become available in Mississippi, that option would be less likely for many women, since the state's two-visit requirement seems to have increased the proportion of abortions performed after nine weeks' gestation (Figure 1). Thus, the anticipated gains in accessibility of services associated with medical abortion might not materialize in states with mandatory delay laws, especially among young women.

Finally, our findings support claims by plaintiffs in legal challenges asserting that women terminate their pregnancy later when statutes are interpreted to require two separate visits to a provider. While some of the increased delay observed in Mississippi may represent greater deliberation over the decision to terminate a pregnancy, the fact that so many women left the state for their abortion once the law took effect suggests that many found the two-visit requirement to be too costly or perhaps considered the information provided to be unnecessary.

Appendix

The regression model can be expressed as follows: $Gest_{itk} = \mathbf{X}_{itk}\beta + \alpha_1 Law_1 + \alpha_2 Dis_{tk} + \alpha_4 (Law_t * In_{tk}) + \alpha_5 (Law_t * In_{tk}) + \gamma_k + \varepsilon_{tk}$. In this equation, $Gest_{itk}$ is the gestational age of woman i's fetus, in year t and county k; *Law* is a dichotomous variable set at zero prior to August 1992 and at one thereafter; Dis_{tk} is the distance in miles to the nearest abortion provider, regardless of which state the provider is located in; In_{tk} is a dichotomous variable that equals one if the woman's nearest abortion provider is in-state (our "treatment" group) and zero if that closest provider is located out-of-state (our "control" group). Moreover, the terms $Dis_{tk} * Law_t$ and $In_{tk} * Law_t$ indicate interactions between the law and distance and between the law and proximity to an in-state provider, respectively. Finally, $\mathbf{X}_{itk}$ is a vector of maternal characteristics such as age, race, marital status and obstetric history, with γ_k capturing the county fixed-effects and ε_{itk} the residual effects.

The first coefficient in the equation, α_1, measures the effect of the mandatory delay law on the mean gestational age at which women whose nearest provider is outside Mississippi obtained their abortion; since these women should be unaffected by the law, α_1 measures trends in abortion timing that are unrelated to the law. In contrast, we expect the last coefficient in the equation,

α_5, to be positive, since it measures the differential effect of the law on women who would be expected to go to an in-state abortion provider in the absence of such a law. The implicit assumption in this design is that trends in abortion delay are similar between the two groups of women.

The effect of travel distance to the nearest provider before and after the law is captured by α_2 and α_4, respectively; if women who reside further from a provider obtain their abortion later in pregnancy after enactment of the law, then α_2 should be positive. If the additional costs associated with the law's "two-visit" requirement are greater for women who live further from a provider, then α_4 should also be positive. The interaction term exploits Mississippi's mandatory delay law as an exogenous source of variation with which to identify the relationship between the availability and use of abortion services.

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