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Minimum drinking age laws and infant health outcomes

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ABSTRACT

Alcohol policies have potentially far-reaching impacts on risky sexual behavior, prenatal health behaviors, and subsequent outcomes for infants. After finding initial evidence in the National Longitudinal Survey of Youth (NLSY) that changes in the minimum legal drinking age (MLDA) are related to prenatal drinking, we examine whether the drinking age influences birth outcomes. Using data from the National Vital Statistics (NVS) for the years 1978–1988, we find that a drinking age of 18 is associated with adverse outcomes among births to young mothers—including higher incidences of low birth weight and premature birth, but not congenital anomalies. The effects are largest among black women. We also report evidence that the MLDA laws alter the composition of births that occur. In states with lenient drinking laws, young black mothers are less likely to report paternal information on the birth certificate, particularly in states with restrictive abortion policies. The evidence suggests that lenient drinking laws generate poor birth outcomes in part because they increase the number of unplanned pregnancies.

1. Introduction

This study examines the consequences of minimum legal drinking age (MLDA) laws on birth outcomes. Despite the fact that all states have had a drinking age of 21 since the late 1980s, policy interest in the causes and consequences of youth alcohol use remains high. Furthermore, debate over the drinking age as a policy tool is re-emerging. In 2008, over 100 college presidents and chancellors from around the country, including the presidents of Duke, Dartmouth, Tufts, and Ohio State, signed a petition encouraging discussion about whether to reduce the drinking age to 18. The petition contends that the drinking age of 21 causes a culture of clandestine and dangerous binge drinking on many college campuses. At the same time, state restrictions on the consumption of alcohol by minors are widely credited with reducing teen drinking overall and alcohol-related traffic fatalities. Additional evidence on the costs and benefits of a low drinking age is needed; this paper explores the effect of the drinking age on infant health.

The potential effect of drinking policy on the probability of pregnancy, drinking while pregnant, and subsequent outcomes for infants has received little attention from the literature. The existing evidence suggests that alcohol policies affect risky sexual behavior and influence teen birth rates. However, surprisingly little is known about whether, by reducing underage drinking, alcohol regulations also improve birth outcomes. Given the high teen pregnancy rate in the United States and the high incidence of drinking among young adults (47% of 12th graders in the 2005 Monitoring the Future Survey drank in the month prior to the survey), the impact of alcohol regulation on outcomes among births to young mothers is potentially large.

There are two channels by which access to alcohol by young adults might affect the health of the next generation. First, by increasing risky sexual behavior, alcohol consumption could change the composition of births towards parents with fewer resources and births resulting from unintended pregnancies. Second, independent of the compositional effect, drinking alcohol during pregnancy may cause poor health outcomes directly.

Our analysis proceeds in three parts. First, using data from the National Longitudinal Survey of Youth (NLSY), we confirm that the drinking behavior of young women who subsequently give birth is correlated with MLDA laws. Second, we use National Vital Statistics (NVS) data to analyze increases in state minimum drinking ages over the 1980s. We find that lenient drinking laws are associated with higher rates of low birth weight and premature birth to young mothers. The results are particularly strong for black mothers. Third, we document that these adverse outcomes are due in part to changes in observable parental characteristics. In particular,

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young black mothers are less likely to report paternal information on the birth certificate in states with a drinking age of 18, especially in states with restrictive abortion policies. Part of the relationship between alcohol policy and infant health is likely due to a change in the number of unplanned pregnancies with poor birth outcomes.

2. Background and previous literature

2.1. Minimum drinking age laws

During the early 1970s, 29 states lowered their minimum legal drinking age from 21 (in most cases) to 18, 19, or 20. Because of a subsequent rise in alcohol-related traffic accidents involving young drivers, the majority of these states increased their MLDA in the late 1970s and early 1980s. In 1984, the federal Uniform Drinking Age Act stipulated that federal highway funds would be withheld from states that did not have a MLDA of 21; as a result, the MLDA in all states was 21 by 1988. Our study focuses on the years 1978–1988.[1]

The changes in the MLDA have been widely studied, and there is agreement among most researchers in the field that a higher MLDA reduces driving fatalities and alcohol consumption among young adults (Coase and Grossman, 1988; Kaestner, 2000; DiNardo and Lemieux, 2001; Wagenaar and Toomey, 2002; Carpenter and Dobkin, 2007).[2] In an overview of the alcohol policy literature, Cook and Moore (2002) conclude that there is "consensus that MPA [minimum purchase age] is effective in controlling alcohol consumption and abuse by those young enough to be affected" (p. 125). The effect size is generally below 10% for moderate drinking outcomes but higher for more frequent drinking outcomes. There is also some evidence that the effect on women's alcohol consumption is more robust than on men's drinking (Kaestner, 2000).

It is also worth noting that several of the studies referenced above document effects of drinking age policies on high school seniors or youth under 18 years of age. When the drinking age is 21, a 16-year old is less likely to have friends or siblings who are legal to purchase alcohol, and is less likely to be able to 'pass' as legal using false identification. Indeed, given the lack of drinking age enforcement on college campuses, it is possible that the effects of the minimum age laws would be concentrated among high school students.

In sum, the preponderance of evidence suggests that higher legal drinking ages reduce alcohol consumption among young adults, particularly women and including high school students under 18, to a modest degree.

2.2. Effect of alcohol policies on prenatal alcohol use

Despite a large literature on alcohol policies in general and minimum drinking age laws in particular, there is little evidence on the effect of these policies on drinking while pregnant and on infant outcomes. It is striking to contrast the sizable literature on the effect of tobacco control policies on maternal tobacco use (e.g., Evans and Ringel, 1999; Colman et al., 2003) to the absence of information on the effect of alcohol policies on maternal alcohol use.

Maternal alcohol use is of interest because the potential impact is large. Estimates of drinking alcohol among pregnant women are around 20% according to three data sources (CDC, 1995; NIDA, 1994; Serdula et al., 1991) and the rates of drinking and heavy drinking are particularly high for women who are younger, less educated, and single (Leonardson and Loudenburg, 2003). Fetal Alcohol Syndrome (FAS), which is thought to result from high prenatal alcohol exposure, involves growth retardation, characteristic facial features, and anomalies of the central nervous system (O'Leary, 2004). A conservative estimate of the prevalence of Fetal Alcohol Syndrome (FAS) in 1993 is 6.7 cases in 10,000 births, based on the Centers for Disease Control and Prevention birth defects surveillance programs (CDC, 1995). These estimates are expected to be a lower bound since FAS is a complex diagnosis and is not always recognized at birth (Stratton et al., 1996). Higher estimates of FAS and more generally of fetal alcohol effects are found by clinic-based studies—from 1.7 to 3.3 cases in 1000 births in the U.S. (Stratton et al., 1996). Given that there are 4 million births a year in the U.S., there could be as many as 13,000 babies born with birth defects associated with prenatal alcohol use. The estimated annual cost of care for individuals with FAS in the U.S. was $4 billion in 1998 (Lupton et al., 2004).

While there is substantial evidence that heavy drinking is correlated with preterm delivery (Albertsen et al., 2004) and low birth weight (Day and Richardson, 2004; Whitehead and Lipscomb, 2003), epidemiologists and other medical researchers argue that the effects of prenatal exposure to alcohol may be significant even for low and moderate drinking (see Russell, 1991, for a review). Day and Richardson (2004) argue that the effects of alcohol exposure on growth are measurable at below one drink per day. Testa et al. (2003) find that prenatal alcohol exposure at any level is associated with impaired mental development. Day et al. (1991) find that children born to mothers who drank alcohol moderately during pregnancy had significant height and weight deficits at age three. In addition, policies affecting prenatal alcohol consumption in Sweden are linked to adult labor market outcomes (Nilsson, 2008). An Institute of Medicine report on prenatal nutrition suggests that prenatal alcohol use may interfere with the absorption of some minerals, particularly zinc, calcium, and amino acids, and notes that heavy drinkers tend to have poor nutrition (Institute of and Medicine., 1985). However, the report concludes that "the evidence concerning the effects of low levels of alcohol consumption is both limited and inconsistent" (p. 395). Indeed, most of the studies in this area are associational in nature and are subject to selection concerns (Nilsson (2008), is a notable exception). Thus, neither the effect of alcohol policy on prenatal drinking nor the effect of prenatal drinking on infant health is well understood.

2.3. Effect of alcohol policies on the composition of births

Alcohol policies may also affect infant outcomes through a change in the composition of births. There is an extensive literature demonstrating the positive relationship between substance use and risky adolescent sexual behavior, including early initiation of sexual intercourse, the existence of multiple sexual partners, and engaging in intercourse without contraception (see Rashad and Kaestner (2004) for an extensive list). It is fairly well established that teens who drink are more likely to have unprotected sex and to become pregnant (Hingson et al., 1990; Kaestner and Joyce, 2000; Rees et al., 2001; Cooper, 2002; Grossman and Markowitz, 2002; Sen, 2002; Rashad and Kaestner, 2004; Markowitz et al., 2005).

Previous work has also investigated the relationship between alcohol policy and fertility. Sen (2003) finds that higher beer taxes do not have an effect on aggregate state-level birth rates, but that they reduce teen abortion rates. Using variation in MLDA laws, Dee (2001) reports that alcohol availability and use have large effects on childbearing among black teens, but does not find robust evidence that this is the case for white teens.

[1] We do not examine the effect of legal drinking age reductions in the early 1970s. Vital statistics data do not include consistent reporting for prematurity or congenital anomalies during this time period. Furthermore, it should be noted that these reductions sometimes corresponded with "mature minor" provisions that influenced access to contraception for young women, making it difficult to isolate the effect of the MLDA policy during that time period.

[2] Miron and Tetelbaum (2007), however, argue that increases in the drinking age are not responsible for declining traffic fatalities.

Birth outcomes may suffer if a greater fraction of births are to teen mothers whose pregnancies resulted from alcohol use and were unintended. Those women whose fertility responds to the policy change could be particularly advantaged or disadvantaged, thereby affecting average birth outcomes. Furthermore, unwanted pregnancy is associated with prenatal and postpartum maternal behaviors that adversely affect infant and child health (Brown and Eisenberg, 1995; Joyce et al., 2000). In sum, it is possible that alcohol control policies alter the composition of teens who give birth and that this compositional change affects infant health.

3. Data

The primary data used in this study are the National Vital Statistics Natality Detail Files (NVS). Publicly available data exist for births in 1968 and subsequent years; these data represent 50 or 100% samples of birth certificates for U.S. births, depending on the state and year. By 1979, all but nine states report information for 100% of births.

We use birth years 1978–1989 to create a sample of births conceived in the years 1978–1988 to mothers aged 14–24 at the time of conception. In 1978, 37 states and DC permitted alcohol consumption for those under the age of 21; 1988 is the first year in which no states permitted drinking under age 21. We include women under age 18 because the literature described above indicates that alcohol consumption among those under 18 is affected by state MLDA policies.

Importantly, the data contain information on mother's age, race, and state of residence. There is also information on birth weight, and, with less completeness, gestation length and congenital anomalies. Maternal and paternal characteristics are also reported. More recently, birth certificate data include questions about smoking and drinking behavior, but this information is unavailable in the years prior to 1989.[3] We therefore use the Vital Statistics data to estimate the reduced form relationship between MLDA laws and birth outcomes, and use another data source, the NLSY, to investigate prenatal drinking.

There are well known differences in infant health outcomes across race and ethnicity groups and between immigrants and non-immigrants. A limitation of the natality data in this period is that Hispanic status is inconsistently measured over time and across states, with a very large fraction of missing values. To investigate heterogeneous effects of alcohol policy, two demographic sub-samples are considered: births to native born white mothers and birth to native born black mothers. A third group, births to immigrant mothers, is included in the full sample, but because results for this group are almost always insignificant, we do not report them separately.[4] In interpreting the results, it is important to keep in mind that all groups include a combination of Hispanic and non-Hispanic mothers.

The main sample includes 16.17 million observations on births to mothers aged 14–24 at the time of conception. As shown in Table 1, about 7.4% of births recorded in Vital Statistics have low birth weight, with a higher rate of 13.0% for births to black mothers. The rates of prematurity and congenital anomalies are 10.5 and 1.3%, respectively, with rates of 18.3 and 1.4% for black mothers.

Data on MLDA laws come from the Distilled Spirits Council of the U.S. (DISCUS).[5]

As a supplement to the main analysis, we examine drinking (and smoking) behavior among young mothers using the National Longitudinal Survey of Youth 1979 (NLSY). The NLSY follows a cohort aged 14–21 in 1979 from 1979 onwards. In 1979, when all individuals in the NLSY were 21 or younger, 37 states and DC permitted alcohol consumption for those under the age of 21. By 1986, when the youngest participants in the NLSY reached age 21, only 7 states permitted drinking under age 21. The restricted version of the dataset includes state identifiers which allow us to match individuals to the relevant alcohol policy regime. The NLSY asks all mothers whether they had used alcohol or cigarettes in the 12 months prior to the birth of their child and, if so, whether they had used these products during pregnancy.[6]

Table 2 shows means of variables for the NLSY sample of births that occurred to women in the cohort aged 14–24. To be consistent with the NVS analysis, we show separate analyses for native born white mothers and native born black mothers, where native born Hispanic mothers are assumed to be white. The sample includes 4523 births to 2987 mothers aged 14–24 at the time of conception. 41% of these mothers drank during the 12 months before the birth of their child and 33% drank during pregnancy, with higher rates of drinking of 47 and 38%, respectively, among native white women. These are higher rates of prenatal alcohol use than the 20% estimated by the CDC and others (CDC, 1995; NIDA, 1994; Serdula et al., 1991) mentioned above, presumably because this is a young cohort of women. Over 80% of women who report drinking at some point in the 12 months prior to birth say they drank during pregnancy.

Several features of the NLSY are important to note. First, the data set is longitudinal, so, if a woman has had multiple children, she appears multiple times in the birth sample. We treat each birth as a separate observation. Standard errors take account of intrastate correlations across observations, so they account for repeated observations of a mother in most cases. Second, the NLSY over-samples blacks and Hispanics. We treat the un-weighted NLSY cohort as our sample, recognizing that it is not representative of the United States. Furthermore, because of the aging of the cohort, there are no births to 16-year olds after 1981 and no births to 17-year olds after 1982, and so on. These limitations lead us to view the NLSY evidence as suggestive rather than definitive, particularly for births to the youngest mothers.

4. Empirical strategy

Studying the effects of alcohol policy, rather than alcohol use *per se*, has the advantage that it is less subject to concerns about selection. Women who drink prior to pregnancy or while pregnant are likely to be different on a wide range of unobserved dimensions. Potential confounding factors which may be correlated with prenatal drinking include illicit drug use, the number of prenatal doctor visits, nutrition, and other health and life-style behaviors. Drinking frequency may be positively related to socioeconomic status.[7] Because drinking is correlated with factors that directly impact infant health, it is difficult to isolate the causal

[3] In addition, there is concern that prenatal alcohol use in particular is underreported in the Natality data (Evans and Ringel, 1999).

[4] The lack of significance may indicate that these mothers are not affected by the laws or may result from smaller sample sizes.

[5] We are grateful to Thomas Dee for sharing the data with us.

[6] The NLSY also asks questions about a woman's sexual and fertility history in 1984 and 1985 and a more limited set of questions in 1986. However, we do not report our analysis of sexual initiation and pregnancy of young women here because we found that the results were very sensitive to sample selection criteria and specification.

[7] Casswell et al. (2003) find that frequency of drinking is positively influenced by income, but less well-educated young adults drink significantly more during a given drinking occasion. Cook and Moore (2002) use the National Household Survey on Drug Abuse for 1996 and find that the self-reported prevalence of drinking increases with education and family income. However, Lowry et al. (1996) report that lower family income is associated with episodic heavy drinking among adolescents.

Table 1
Summary statistics for vital statistics data.

	All women (N = 16,165,747)	Native white (N = 11,426,203)	Native black (N = 3,032,108)
Birth outcomes			
Low birthweight	0.074	0.061	0.130
Birthweight in grams (if available)	3297.001	3356.365	3074.426
Exact birthweight missing	0.002	0.001	0.002
Preterm birth (if available)	0.105	0.084	0.183
Weeks gestation (if available)	39.391	39.628	38.539
Preterm birth/gestation length missing	0.105	0.100	0.117
Congenital anomoly (if available)	0.013	0.013	0.014
Congenital anomoly missing	0.195	0.178	0.162
Birth characteristics			
Baby male	0.512	0.514	0.508
Twin birth	0.017	0.016	0.021
Triplets or higher order birth	0.000	0.000	0.000
Maternal characteristics			
Mother native white	0.701	1.000	0.000
Mother native black	0.186	0.000	1.000
Mother foreign born	0.096	0.000	0.000
Mother Hispanic (if available)	0.174	0.126	0.007
Mother Hispanic missing	0.427	0.454	0.434
Estimated mother age at conception	20.340	20.517	19.512
Second birth	0.310	0.315	0.296
Third birth	0.131	0.124	0.158
Fourth or higher order birth	0.069	0.056	0.111
Mother education high school (if available)	0.481	0.506	0.436
Mother education some college (if available)	0.153	0.160	0.134
Mother education college grad or more (if available)	0.043	0.048	0.022
Mother education missing	0.217	0.203	0.145
Paternal characteristics			
Father race black	0.115	0.009	0.545
Father race Native American	0.007	0.004	0.000
Father race Asian	0.013	0.003	0.001
Father race other/missing	0.176	0.109	0.445
Father Hispanic	0.091	0.065	0.006
Father Hispanic missing	0.522	0.513	0.673
Estimated father age at conception (if available)	23.915	23.834	23.469
Father age missing	0.193	0.121	0.490
Father education high school (if available)	0.507	0.510	0.565
Father education some college (if available)	0.167	0.171	0.152
Father education college grad or more (if available)	0.094	0.099	0.048
Father education missing	0.385	0.304	0.599
State characteristics			
Real beer tax (if available)	0.185	0.178	0.246
Real cigarette tax (if available)	0.160	0.162	0.153
Beer/cigarette tax missing	0.005	0.002	0.001
Parental notification (or consent) law (if available)	0.417	0.433	0.422
Parental consent law (if available)	0.270	0.269	0.304
Parental notification/consent law missing	0.018	0.021	0.004
Age-group birth rate (if available)	99.305	90.336	117.268
Birth rate missing	0.017	0.000	0.000
MLDA is 18	0.279	0.272	0.343
MLDA is 21	0.480	0.480	0.422

effect of drinking on birth outcomes. For this reason, we focus on the effect of MLDA laws, which are plausibly exogenous to the personal characteristics of young women affected by them. Changes in birth outcomes associated with MLDA laws are likely due to the causal impact of the laws on substance use prior to or during pregnancy.

It is important to keep in mind that alcohol policy may affect the use of drugs other than alcohol. For example, alcohol consumption is a complement to cigarette consumption (Cameron and Williams, 2001; Decker and Schwartz, 2000; Serdula et al., 1991), and maternal smoking is known to be harmful to the fetus (Case and Paxson, 2002). Decker and Schwartz (2000) estimate that a 1% rise in the price of beer decreases smoking by about the same amount as a 1% rise in the price of cigarettes, suggesting that smoking is very responsive to changes in drinking behavior. Marijuana use may also be affected by alcohol policies, although the direction of the relationship is not clear in the literature.[8] The observed relationship between alcohol policy and infant outcomes could be mediated by substances which are complements or substitutes to alcohol. We address this concern in part by investigating whether changes in MLDA laws affect smoking behavior using the NLSY.

To estimate the effect of MLDA laws on birth outcomes, we use a linear probability model which includes year–month of conception fixed effects, state fixed effects, maternal age at conception

[8] DiNardo and Lemieux (2001) estimate that raising the minimum drinking age from 18 to 21 increases the prevalence of marijuana use among high school seniors by about 2 percentage points, implying that marijuana and alcohol are substitutes. However, Pacula (1998) finds that increases in the beer tax or the legal drinking age decrease the demand for marijuana by about the same percentage that they decrease alcohol consumption, suggesting a complementary relationship.

Table 2
Summary statistics for NLSY data.

	All births (*N* births: 4,523; *N* mothers: 2,987)	Native white (*N* births: 2,916; *N* mothers: 1,952)	Native black (*N* births: 1,355; *N* mothers: 869)
Behavioral outcomes			
Drank 12 months before birth	0.405	0.466	0.312
Drank during pregnancy	0.332	0.382	0.253
Smoked during pregnancy	0.344	0.392	0.281
Individual characteristics			
Native born white	0.646	1.000	0.000
Native born black	0.300	0.000	1.000
Immigrant	0.053	0.000	0.000
Hispanic	0.191	0.237	0.000
Race/ethnicity/nativity status missing	0.003	0.000	0.000
Maternal age at birth	21.414	21.551	21.054
Age-adjusted AFQT score	19.849	24.089	12.569
Mother's education (of respondent, if avail.)	9.951	10.101	10.292
Mother's education missing	0.070	0.062	0.080
Father's education (of respondent, if avail.)	9.716	10.064	9.569
Father's education missing	0.196	0.147	0.302
Respondent lived with both parents at 18 (if avail.)	0.478	0.502	0.411
Both parents at 18 missing	0.108	0.117	0.077
State characteristics			
MLDA is 18	0.376	0.363	0.424
MLDA is 21	0.355	0.377	0.284

fixed effects, and state-specific time trends. Women aged 21–24 at the time of conception are treated as a control group to account for unobserved time-varying state-level factors which could affect infant health. The model implicitly assumes that drinking laws have a negligible effect on the behavior of those 21 and older.[9] We view a higher drinking age as an increase in the cost of obtaining alcohol for young women.

We use the minimum drinking age in the estimated month of conception as the indicator for the relevant policy regime. The date of conception is appropriate because (1) the direct effects of prenatal alcohol use are thought to be particularly pronounced in the first trimester and (2) the policy at the date of conception captures health effects due to changes in the composition of women becoming pregnant as the result of policy-induced risky sexual behavior. We assume the month of conception is 9 months prior to the month of birth in cases where gestation length is not reported, and otherwise use the gestation length to calculate the month of conception. It is important to note that, in some cases, the drinking age was raised in the midst of a woman's pregnancy. In some states cohorts were grandfathered such that the law did not revoke the right to drink among those who were of age prior to the change, and even within non-grandfathered cohorts it is probable that a woman legal to drink at the time of conception might be more likely to drink subsequently. We test the sensitivity of our results to evaluating the policy environment at conception versus at birth.

Because the vital statistics report maternal age at birth but not exact maternal birthday, we assume age at conception is 1 year younger than age at birth if gestation length exceeds 6 months or is not reported and assume age at conception equals age at birth otherwise. Roughly 25% of our sample will be classified as younger at conception than their actual age. This could bias the estimated effect of the policy regime, most likely by attenuating the results.[10]

[9] Because 21–24-year olds in low MLDA states were themselves more likely to have been legal to drink at eighteen, they may be more likely to drink as adults. If that is the case, the effect of MLDA laws on women under 21 would be understated.

[10] Analysis by year of age shows a minimal effect of MLDA policies on birth outcomes for 20-year-old mothers. We are therefore not concerned that our results are driven by misclassification.

In an analysis of drinking habits among high school seniors, Dee (2001) finds that an indicator for an MLDA of 18 captures the relevant variation in drinking behavior. We follow this approach in our analysis. We also try alternatives, including using an indicator for an MLDA of 21, indicators for both MLDA of 18 and MLDA of 19/20, and tracking the legality of each cohort to drink. Below we discuss the results using these different approaches.

The birth outcomes we examine in the NVS analysis are low birth weight status, preterm birth status, and whether the baby has any congenital anomalies. Our preferred specification is as follows:

$$\begin{aligned} outcome_{iasm} = {} & B_1\, MLDA18_{sm} \\ & + B_2\, MLDA18_{sm}\, age14\text{–}17_{iasm} \\ & + B_3\, MLDA18_{sm}\, age18\text{–}20_{iasm} \\ & + \delta_s + \theta_m + \alpha_a + \gamma_{s*m} + \beta X_{iasm} + u_{iasm} \end{aligned} \quad (1)$$

where *MLDA18* indicates whether the drinking age in the state was 18 in the month of conception, *age* 14–17 indicates mothers who were between the ages of 14 and 17 at the time of conception, and *age* 18–20 indicates mothers who were between the ages of 18 and 20 at the time of conception. The *MLDA*18 variable controls for any unobserved state characteristics affecting birth outcomes across all ages in a given month. The subscript i indicates each individual birth, a indicates the estimated age at conception, s indicates the state of residence, and m indicates the year–month of conception. We include state fixed effects, year–month fixed effects, maternal age fixed effects, and state-specific linear time trends in the preferred specification. X_{iasm} represents controls for birth characteristics – whether the infant is male and the plurality of the birth – which are unlikely to be endogenous to the policy regime. The standard errors are clustered by state to correct for serial correlation as suggested by Bertrand et al. (2004).

To augment this baseline model, we include various sets of controls. In some specifications, we add controls for maternal characteristics including ethnicity, education, and number of children. These factors may reflect underlying state-level population changes, or may stem from compositional effects associated with the policy change. Paternal characteristics such as age,

Table 3
MLDA and maternal drinking before birth, National Longitudinal Survey of Youth sample.

Dependent variable:	Drank 12 months prior to birth			Drank during pregnancy		
	I	II	III	IV	V	VI
Sample:	All women	Native white women	Native black women	All women	Native white women	Native black women
Mean:	0.41	0.47	0.31	0.33	0.38	0.25
Births conceived 1978–1987 among women aged 14–24						
MLDA 18	−0.069+	−0.091*	−0.063	−0.080*	−0.111**	−0.051
	(0.039)	(0.044)	(0.068)	(0.031)	(0.033)	(0.047)
MLDA is 18*mother is ≤17	−0.000	0.011	0.055	−0.002	0.033	−0.014
	(0.045)	(0.064)	(0.060)	(0.042)	(0.055)	(0.067)
MLDA is 18*mother is 18–20	0.071*	0.053	0.101+	0.067+	0.072	0.063
	(0.033)	(0.045)	(0.059)	(0.034)	(0.046)	(0.059)
State of residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Maternal age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State-specific linear time trends	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	4,523	2,916	1,355	4,523	2,916	1,355
R-squared	0.13	0.14	0.11	0.11	0.13	0.11

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses.+,*,** represent statistical significance at the 10, 5, and 1% levels respectively. Each birth represents a separate observation. Samples include Hispanic and non-Hispanic women. Maternal age at conception dummies included for each year of age (age 14 omitted). Individual controls include three race/ethnicity/nativity categories (native born black, immigrant, Hispanic, with native born white omitted), age-adjusted AFQT Score, respondent's mothers' and fathers' education, respondent lived with both parents at 18, and missing indicators for all controls.

race/ethnicity, and education, are also included in some models.[11] Finally, in some specifications, we control for age-specific time trends.[12]

The NLSY analyses of drinking behavior use a similar specification to the NVS analyses described above. The outcomes of interest are whether the woman reports drinking alcohol in the 12 months prior to birth, drinking alcohol prenatally, or smoking prenatally. We control for a number of family background characteristics, including ethnicity, education of the respondent's mother and father, whether the respondent lived with both parents at age 18, and the respondent's age-adjusted Armed Forces Qualification Test (AFQT) score. The models include state fixed effects, age fixed effects, year fixed effects, and state-specific time trends.

All reported results are for linear probability models.[13] Standard errors are clustered at the state level.

5. Effect of MLDA laws on maternal drinking

The first step in the analysis is to confirm that the MLDA laws have an effect on drinking behavior within our population of interest. Though prior work has documented that MLDA laws affect drinking behavior to a modest degree, to our knowledge there is no direct evidence on whether MLDA laws affect drinking prior to or during pregnancy. The NLSY offers an opportunity to study these issues.[14] In particular, women are asked whether they drank alcohol in the 12 months prior to birth and, if so, whether they drank alcohol prenatally.[15]

In Table 3, we document the relationship between a drinking age of 18 at the time of conception and drinking behavior. Given the aging of the NLSY cohort, we focus the discussion on results for women aged 18–20. For all 18–20-year-old women, there is evidence that both drinking in the 12 months prior to birth and prenatal drinking are about 7 percentage points higher (on bases of 40 and 33% respectively) when the drinking age is 18.[16] For white women, the standard errors are larger, so we cannot reject the null hypothesis of no relationship. On the other hand, there is a marginally significant relationship between the laws and drinking among black women. After controlling for a number of factors, 18–20-year-old black women are 10 percentage points more likely to report drinking in the 12 months prior to birth if the drinking age is 18, on a base of 31%. The association is robust to the inclusion of controls for individual characteristics, including Hispanic origin, education of the mother's parents, and whether she lived with both parents until age 18. We also test models which account for age-specific time trends and find that, while the coefficients remain large in magnitude, they are not statistically significant (results not shown).

Because smoking is a complement to drinking, and the effects of prenatal smoking are believed to be quite detrimental, we also examine whether MLDA laws affect prenatal smoking. We do not show the results because, regardless of specification or demographic group, the coefficients are almost never significant and often wrong-signed.

[11] We experiment with including mother's marital status as a proxy for the father's relationship to the mother. However, states had different policies for reporting marital status on birth certificates during this time. Some states used last names to impute marital status, and others assumed the mother was married unless she specifically indicated otherwise. The results of models including the marital status variables are often counterintuitive. Because this variable appears to be unreliable, we exclude it from the specifications we present here. We view the presence or absence of paternal information on the birth certificate as a more reliable indicator of the relationship between the parents at the time of birth.

[12] We also consider the effects of other time-varying factors that could be related to birth outcomes for young mothers, such as beer and cigarette taxes, parental notification and consent abortion laws and aggregate birth rates. A detailed discussion of these analyses is provided in the appendix to our working paper, available at http://www.nber.org/w14118.

[13] As noted by Ai and Norton (2003), coefficients on interaction terms in non-linear models cannot be readily interpreted.

[14] Each birth is treated as a separate observation, but standard errors are clustered to account for within-state correlations. As noted above, we have a small sample of births to women under 18, so these results should be interpreted with caution.

[15] Only about 7% of all women and 18% of drinkers drank in the 12 months prior to birth but did not drink prenatally. Unfortunately, we cannot separately identify women who drank prenatally but did not drink prior to pregnancy.

[16] We expect an imperfect correlation between the policy regime and behavior. Drinking laws are widely evaded, grandfathering of cohorts implies that not all 18–20-year-old women are affected when the law is changed, and individuals may live near a state with a lower drinking age than their own. Coase and Grossman (1988) report small effects of the drinking age in bordering states in some models.

Table 4
MLDA and birth outcomes, National Vital Statistics sample.

Dependent variable:	Low birth weight			Preterm birth			Congenital anomalies		
	I	II	III	IV	V	VI	VII	VIII	IX
Sample:	All women	Native white women	Native black women	All women	Native white women	Native black women	All women	Native white women	Native black women
Mean:	0.074	0.061	0.130	0.105	0.084	0.183	0.013	0.013	0.014
Births conceived 1978–1988 among women aged 14–24									
MLDA is 18	−0.0017*	−0.0010*	−0.0045*	−0.0035**	−0.0018*	−0.0080**	−0.0018	−0.0008	−0.0039
	(0.0007)	(0.0004)	(0.0017)	(0.0009)	(0.0007)	(0.0021)	(0.0012)	(0.0007)	(0.0026)
MLDA is 18*mother is ≤17	0.0050**	0.0024+	0.0101**	0.0086**	0.0043**	0.0132**	−0.0004	−0.0003	−0.0002
	(0.0018)	(0.0013)	(0.0024)	(0.0028)	(0.0016)	(0.0028)	(0.0005)	(0.0004)	(0.0007)
MLDA is 18*mother is 18–20	0.0026**	0.0013+	0.0060**	0.0026*	0.0006	0.0068**	−0.0003	−0.0002	−0.0004
	(0.0010)	(0.0006)	(0.0015)	(0.0012)	(0.0008)	(0.0014)	(0.0002)	(0.0002)	(0.0003)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year–month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth characteristic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	16,165,747	11,426,203	3,032,108	14,514,530	10,312,349	2,686,093	13,589,617	9,748,369	2,617,711
R-squared	0.07	0.07	0.06	0.04	0.04	0.03	0.00	0.00	0.01

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses.+,*,** represent statistical significance at the 10, 5, and 1% levels respectively. Year–month references time of conception. Maternal age at conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted).

Given the large confidence intervals and other limitations associated with the NLSY analysis, we cannot *precisely* estimate the impact of MLDA policy on drinking among women who subsequently give birth. Nevertheless, there does appear to be a relationship between the laws and drinking behavior, particularly among black women. In the next section, we turn to our analysis of the National Vital Statistics to investigate the association between MLDA laws and birth outcomes.

6. Effect of MLDA laws on birth outcomes

6.1. Birth weight

Birth weight is a widely used and accurately measured indicator of infant health at birth, and has been linked to many health consequences in later life (IOM, 1990; Paneth, 1995; McCormick et al., 1992; and Case et al., 2005).[17] The medical literature suggests that prenatal alcohol use may stunt fetal growth, which could lead to low birth weight. In addition, if alcohol use leads to an increase in the number of unintended pregnancies, the resulting births could have an increased incidence of low birth weight because of associated prenatal behaviors or parental characteristics. Births under 2500g are considered low birth weight.

The first three columns of Table 4 show the results of the low birth weight analysis for all women, for native born white mothers, and for native born black mothers. In the first column of Table 4, there is a small but statistically significant effect of the MLDA of 18 on low birth weight for both women younger than 18 and women between the ages of 18 and 20. Women conceiving under age 21 are 0.26–0.50 percentage points more likely to conceive a low birth weight birth in months and states with a drinking age of 18 (on a base of 7.4%). The effects are larger for younger mothers. However, even among the youngest group, the estimated effect is small in magnitude; moving to an MLDA of 18 increases the probability of low birth weight by less than 10%. The results for native born white mothers are marginally significant but smaller in magnitude, ranging from 0.13 to 0.24 percentage points. The estimated effects for native born black mothers are much larger, ranging from 0.60 to 1.01 percentage points.[18]

Although not shown here, we explore the effect of controlling for preterm birth in the birth weight analysis. Controlling for preterm birth (<37 weeks gestation) and whether the gestational length information is missing reduces coefficients by about a quarter to a third for native black mothers and somewhat less for white mothers. This suggests that MLDA laws are associated with prematurity, but that prematurity cannot fully account for the relationship between MLDA laws and birth weight.[19] Below we examine the association between MLDA laws and preterm birth directly.

We also examine the effect of drinking age policy on a continuous variable, birth weight in grams. The results (not shown) suggest an MLDA of 18 is associated with a significant 17–23 g

17 Almond et al. (2002) argue that APGAR scores taken 5 min after birth represent a better measure of overall infant health than low birth weight; however, APGAR scores are not available in the Vital Statistics data during the relevant time period.

18 If we separate by metropolitan status, the results are statistically significant for rural white mothers, rural black mothers, and urban black mothers, but not urban white mothers. Also, it should be noted that the size of the coefficients for the youngest black mothers are reduced by about half (but remain statistically significant) when controls for beer taxes are included in the model. However, we suspect that the beer tax variables may not capture meaningful policy variation and we exclude them from our preferred specification. Additional discussion of this issue can be found in the appendix to our working paper, available at http://www.nber.org/w14118.

19 Of course, there could be more subtle changes in gestational age that are not fully captured by the preterm birth indicator and could affect birth weight.

decrease among black women. There is a negligible and statistically insignificant birth weight decrease among white women.

We explore the sensitivity of our main results to several alternative specifications. First we try measuring the minimum drinking age at birth rather than at conception. The results (not shown) are statistically significant for both native white and native black women, with slightly larger coefficients than the baseline for white women and slightly smaller coefficients for black women. If the policy regime at conception and the policy regime at birth are both included in the model, the significant effects operate through the policy at conception for black women and the policy at birth for white women. These results may point to an important role for compositional effects among black women; we explore this issue in more detail below.

We also replicate our models using an indicator for a drinking age of 21 and find results (not shown) for the low birth weight analysis that are similar in magnitude and significance to those presented here. In addition, we try including an additional indicator for an MLDA of 19 or 20. Moving the drinking age from 18 to 19 or 20 appears to generate about half of the effect on birth weight as moving it from 18 to 21. We also experiment with tracking the legality of each cohort to drink. This approach generates results that are not robust, perhaps because teenagers under eighteen are indirectly affected by changes to the legal drinking age.

Our results are somewhat sensitive to the inclusion of age-specific time trends (not shown). The coefficients become only marginally significant for 18–20-year-old white women and all women, and insignificant for other groups. There are two explanations for this phenomenon. First, policy or other changes over time may differentially affect the health of infants born to some age groups. The observed pattern is consistent with the secular improvement in birth outcomes for births to younger mothers relative to older mothers. We try controlling for a number of factors that might be related to birth outcomes. However, none of these factors explain the observed pattern.[20] A second possibility is that the age-specific trends absorb useful variation in MLDA laws and make identification of their effects difficult, particularly for subsets of the population. We report results for the model with state-specific time trends but not age-specific time trends here.

Finally, we also try a less restrictive triple difference specification which includes age–times–year interactions, state–times–age interactions and state–times–year interactions. We do not have the power to identify any significant effects using this less restrictive model.

6.2. *Prematurity*

Using our preferred specification, we examine the relationship between MLDA laws and premature birth, defined as gestation length under 37 weeks. Results are shown in columns IV–VI in Table 4. The results indicate that a drinking age of 18 is associated with an increased likelihood of premature birth by 0.43 percentage points for native white women (on a base of 8.4%) among mothers under age 18 at conception. There is no significant relationship for 18–20-year-old white mothers. For native black mothers, the estimated coefficients are much larger. A drinking age of 18 is associated with an increased likelihood of premature birth by 1.32 percentage points for native black mothers under age 18 and 0.68 percentage points for native black mothers between the ages of 18 and 20 (on a base of 18%). As in the case of birth weight, the estimated effects of MLDA policy are small in magnitude, representing less than a 10% change in the prematurity rate. Estimation of the model with the continuous gestation in weeks as the dependent variable indicates reductions in gestation length of 0–0.04 weeks for white women (with only the youngest group showing a significant relationship) and 0.07–0.11 weeks for black women (results not shown).

As in the birth weight analysis, when age-specific time trends are added to the pre-term birth model (not shown), the sizes of the coefficients fall. Effects for all women and the youngest black women are marginally significant, and the effects for white women are insignificant.

6.3. *Congenital anomalies*

Of the three outcome measures, congenital anomalies is the least well measured. Definitions of congenital anomalies differ across states and the variable is not reported by every state in every year. Furthermore, reported anomalies are rare (occurring in about 1% of births) and so policy impacts are likely to be difficult to detect. Nevertheless, because the medical literature suggests a relationship between heavy prenatal alcohol use and Fetal Alcohol Syndrome (FAS), it is important to consider the effect of drinking laws on anomalies evident at birth.[21]

The results in the last three columns of Table 4 are small, wrong-signed, and insignificant, suggesting no relationship between MLDA laws and congenital anomalies. That we find no significant effects on congenital anomalies is somewhat surprising, given the apparently strong link between heavy drinking during pregnancy and Fetal Alcohol Syndrome. There are at least three potential explanations. First, given the caveats described above, we cannot rule out the possibility that measurement error is driving the null result. Second, the relationship between alcohol use and congenital anomalies may be overstated. Third, it is possible that alcohol policy has little impact on the heavy prenatal drinking that is thought to cause FAS. If either of the latter two possibilities are points of fact, the observed effects of MLDA laws on birth weight and prematurity might relate to selection into birth rather than adverse impacts of prenatal drinking. In the next section, we investigate how MLDA laws are associated with the composition of births.

7. Effect of MLDA laws on the composition of births

We find significant effects of MLDA laws on birth weight and prematurity. The relationship may arise because drinking laws affect prenatal drinking, which in turn affects infant health. Or, it is possible that drinking laws affect risky sexual behavior, which in turn leads to births that would not have happened otherwise and which experience inferior health outcomes. In this section, we use the NVS to investigate changes in the composition of observable maternal and paternal characteristics.

First, in order to get a sense of whether MLDA laws could plausibly generate a substantial compositional change in birth characteristics, we estimate the log number of "extra" births associated with MLDA laws in each state-age-year cell. We control for state, age, and year fixed effects, and state-specific time trends (results not shown). For whites, a drinking age of 18 is not associated with increases in the number of births for the youngest group, but is associated with a significant 4.6% increase in the number of births for the 18–20 group. For blacks, a drinking age of 18 is associated with an insignificant 4.3% and a significant 3.9% increase in the number of births for the under 18 and 18–20 age groups, respectively.

[20] A detailed discussion of these results is provided in the appendix to our working paper, available at http://www.nber.org/w14118.

[21] The diagnosis of FAS was not developed until 1973 (Armstrong and Abel, 2000).

Table 5
Compositional effects and low birthweight, National Vital Statistics sample.

Dependent variable:	Low birth weight							
Sample:	Native white women (mean = 0.061)				Native black women (mean = 0.130)			
	I	II	III	IV	V	VI	VII	VIII
Births conceived 1978–1988 among women aged 14–24, native white and native black women								
MLDA is 18	−0.0010*	−0.0009	−0.0010*	−0.0009	−0.0045*	−0.0051*	−0.0037*	−0.0042*
	(0.0004)	(0.0006)	(0.0004)	(0.0005)	(0.0017)	(0.0021)	(0.0017)	(0.0020)
MLDA is 18*mother is ≤17	0.0024+	0.0009	0.0016*	0.0009	0.0101**	0.0091**	0.0076**	0.0071**
	(0.0013)	(0.0011)	(0.0007)	(0.0011)	(0.0024)	(0.0025)	(0.0020)	(0.0022)
MLDA is 18*mother is 18–20	0.0013+	0.0005	0.0008	0.0005	0.0060**	0.0055**	0.0047**	0.0044**
	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0015)	(0.0014)	(0.0012)	(0.0013)
Birth characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal characteristics		Yes		Yes		Yes		Yes
Paternal characteristics			Yes	Yes			Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year–month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	11,426,203	11,426,203	11,426,203	11,426,203	3,032,108	3,032,108	3,032,108	3,032,108
R-squared	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses.+,*,** represent statistical significance at the 10, 5, and 1% levels respectively. Year–month references time of conception. Maternal age at conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Maternal characteristics dummies take 60 unique values determined by ethnicity (Hispanic, non-Hispanic, or Hispanic status missing), indicators for education (less than high school graduate, high school graduate, some college, and college graduate or more, or missing), and plurality (first birth, second birth, third birth, or fourth or greater birth). Paternal characteristics dummies take 169 unique values determined by age (17 or under, 18–21, 21 or higher, or missing), race (black, white, or other/missing race), ethnicity (as above) and indicators for education (as above).

Though the results are not precisely estimated, they are broadly consistent with Dee (2001), who finds 6% reductions in childbearing among 15–19-year-old black women associated with a higher drinking age. We also find that a lower drinking age is associated with a shift in the composition of births toward native black mothers of 0.6–2.2 percentage points, but the estimates (not shown) are statistically insignificant.

For the observed increases in low birth weight rates reported in Table 4 to be solely operating through inferior health outcomes among births that would not otherwise have occurred, the “marginal” births would have implied low birth weight rates of 0.09 for 18–20 white women, 0.37 for under 18 black women, and 0.29 for 18–20 black women. These rates are 1.5–3 times the baseline rates of low birth weight in these populations. Although the implied compositional effect is large, previous work has documented that the policy environment can have substantial impacts on infant health for some groups. For example, Lien and Evans (2005) find that women induced to smoke as a result of cigarette tax changes are twice as likely to have a low birth weight birth. Gruber et al. (1999) estimate that the “marginal” child not born due to abortion is 40% more likely to die in the first year and 14% (though insignificantly) more likely to be low birth weight. It is therefore plausible that the estimated effects of MLDA laws on birth outcomes are operating partly or mainly through compositional channels.

To investigate this hypothesis, we explore whether MLDA laws are related to observable characteristics. In Table 5, we examine whether adding controls for parental characteristics changes the estimated effects of MLDA laws. In columns I and V, we present our baseline specification for native white women and native black women.[22] In the column to the right, we add dummies for the maternal characteristics. We consider 60 categories of maternal characteristics, determined by ethnicity, education, and parity. In columns III and VII, we add paternal controls. We consider 169 categories of paternal characteristics, determined by age, race, ethnicity, and education, including whether the information is missing. Missing paternal information proves to be an important predictor of poor health outcomes. Finally, we add both maternal and paternal controls in the final columns. We focus on low birth weight in this table, but the pattern is similar for prematurity (not shown).

The inclusion of maternal controls reduces the size of the estimated coefficients on MLDA laws for native white women. Further analysis (not shown) suggests that lower minimum age laws are associated with a lower education levels of women who give birth. After controlling for maternal characteristics, there is no significant relationship between MLDA laws and infant health among white mothers.

In contrast, column VI of Table 5 suggests that including maternal information does not reduce the estimated effect of MLDA very much for black mothers; observable characteristics of black mothers do not change substantially as the result of drinking age laws. Rather, it is the inclusion of paternal characteristics that affects the coefficients. About a quarter of the relationship between MLDA laws and birth weight can be explained by observable paternal characteristics. A drinking age of 18 is associated with undesirable (from an infant health perspective) paternal characteristics. Further analysis suggests that controlling for any one set of paternal controls – age, education, or race/ethnicity – weakens the relationship between the policy and infant health. This leads us to explore the role of missing paternal information.

Given the link between alcohol policy and risky sexual behavior, we are particularly interested in births that might arise as the result of unintended or unplanned pregnancies. Though the birth certificate data do little to shed light on this issue directly, one proxy for the involvement of the father is the presence of his information on the birth certificate.[23] We focus on whether or not his age is

[22] These models are the same as those presented in columns II and III of Table 4.

[23] As noted in a footnote 11, we have concerns about the marital status variables and we do not use them here.

Table 6
MLDA and missing paternal age, National Vital Statistics sample.

Dependent variable:	Missing paternal age					
	I	II	III	IV	V	VI
Sample:	Native white women (mean = 0.121)			Native black women (mean = 0.490)		
		Parental notification?			Parental notification?	
		No	Yes		No	Yes
Births conceived 1978–1988 among women aged 14–24, native white and native black women						
MLDA is 18	−0.0009	−0.0010	−0.0043	−0.0467*	−0.0307	−0.0745*
	(0.0083)	(0.0120)	(0.0099)	(0.0205)	(0.0253)	(0.0330)
MLDA is 18*mother is ≤17	−0.0011	−0.0011	0.0145	0.1229**	0.0674	0.1955**
	(0.0299)	(0.0441)	(0.0336)	(0.0414)	(0.0538)	(0.0560)
MLDA is 18*mother is 18–20	−0.0044	−0.004	−0.0006	0.0523*	0.0275	0.0877**
	(0.0098)	(0.0148)	(0.0111)	(0.0212)	(0.0291)	(0.0276)
State of residence fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year–month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Maternal age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes
Birth characteristic controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	11,426,203	6,116,456	5,050,375	3,032,108	1,678,628	1,340,828
R-squared	0.10	0.09	0.10	0.26	0.24	0.28

Note: Linear probability model. Standard errors are clustered by state of residence and reported in parentheses.+,*,** represent statistical significance at the 10, 5, and 1% levels respectively. Year–month references time of conception. Maternal age at conception dummies included for each year of age (age 14 omitted). Birth controls include male infant and four plurality categories (twins, triplets or more, and plural birth information missing, with singleton omitted). Notification refers to the requirement that young women obtain parental notification or parental consent to undergo an abortion in the state of residence and year of conception.

reported.[24] Births with missing paternal information may be more likely to be the result of unintended pregnancies or may otherwise reflect unobserved maternal or paternal characteristics associated with poor infant health outcomes.[25]

Table 6 shows that lower minimum drinking ages are significantly associated with higher rates of missing paternal age for native black women, but not for white women. A drinking age of 18 increases the probability of missing paternal information by 5–12 percentage points for black women. To investigate whether these results suggest a link between MLDA laws and unintended pregnancies, we divide the sample into states with and without parental notification (or consent) abortion laws. If abortions are harder for young women to obtain, then we expect the compositional effects of MLDA laws on births to be greater. For white women we find no relationship regardless of the presence of notification laws. For native born black women, on the other hand, the effect of MLDA laws on missing paternal information is sizable in states with restrictive abortion laws but not other states. In parental notification states, a drinking age of 18 is associated with an 8.8–19.6 percentage point increase in the probability of a birth with missing father information (on a base of 49%).[26] Though there may be other differences between notification and non-notification states, these results are consistent with the notion that missing paternal information is serving as a proxy for unintended pregnancies.[27]

In sum, the evidence reported in this section suggests that drinking laws may affect the composition of births, particularly among native black women. The inclusion of maternal and paternal controls dampens the effect of MLDA laws on the probability of low birth weight, suggesting an increase in births to parents with less healthy characteristics in states with lower drinking ages. Among white women, maternal characteristics change substantially with MLDA laws. However, other evidence does not corroborate a compositional story for whites. Among black women, a low drinking age is linked to a 25% higher fraction of births with absent fathers. The effects of MLDA policies on missing paternal information and birth weight are most pronounced in states with restrictive abortion laws. Among blacks, about a quarter of the relationship between the MLDA laws and birth weight can be explained by parental characteristics; it is likely that unobservable parental characteristics are also affected. Overall, the weight of the evidence points to an association between the drinking age and the fraction of births stemming from unintentional pregnancy.

8. Conclusions

This paper examines the effect of minimum age drinking laws on birth outcomes. A drinking age of 18 is associated with higher rates of low birth weight and premature births, particularly among black women. We find that drinking ages are associated with maternal drinking rates prior to birth, suggesting that there may be a direct impact of prenatal drinking on infant health. However, we also provide evidence that parental characteristics are related to MLDA laws. In particular, a lower drinking age is associated with lower educational levels for white women and the absence of paternal information on the birth certificate for black women. For black women, the effects of the drinking age on missing paternal information and birth weight are most pronounced in states with restrictive abortion policies. Taken together, these findings suggest that a lower drinking age raises the proportion of births resulting from unintentional teen pregnancy, thereby generating adverse health outcomes for infants. These compositional effects explain at least a quarter, and perhaps a substantially higher fraction, of the relationship between MLDA policy and birth outcomes.

The infant health effects associated with an MLDA of 18 are small, representing less than a 10% change in rates of prematurity

[24] Paternal age is almost always reported if any paternal information is reported. One exception is that paternal race is sometimes included even if other information is missing. This may due to imputation based on the mother's race.

[25] For instance, the probability of a low birth weight birth is estimated to be 0.3–1.8 percentage points lower for any reported age paternal category relative to the missing age category. The link between missing paternal age and birth weight is stronger for black women.

[26] In analyses not shown, we also find that a drinking age of 18 is associated with a higher rate of low birth weight in parental notification states compared to states where abortions are less restricted.

[27] We also use the NLSY to examine the link between MLDA policies and sexual behavior and fertility. However, the results of those analyses are not robust and we do not report them here.

or low birth weight for blacks, and smaller changes for other groups. However, the effects of minimum legal drinking ages on drinking are also modest. Alcohol policy that more effectively curtailed drinking, or the risky behaviors associated with it, might hold greater promise for infant health. Our results also suggest that stricter alcohol policies may have positive unintended consequences—benefits for the well-being of a generation beyond those directly targeted. As college presidents and others evaluate the costs and benefits of lowering the minimum drinking age, it is important that the full range of potential effects of such a policy shift are considered.

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