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The Role of Maternal Education in Child Health: Evidence from a Compulsory Schooling Law

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Keywords

Child health, Compulsory schooling, Economic development, Instrumental variables, Maternal education, Turkey

Disciplines

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JEL classification: I12, I21, J13

Keywords: Economic Development, Child Health, Maternal Education, Compulsory Schooling, Instrumental Variables, Turkey

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1 Introduction

Significant attention has been given to the relationship between parental education, especially maternal education, and child health.[1] While the problem of endogeneity has been known for several decades, only a few recent studies have investigated the causal relationship between parental education and child health. Overcoming the problem of endogeneity is crucial as unobservable confounding factors, such as ability (Griliches, 1977) and discount rates (Fuchs, 1982), could influence both education and health in the same direction, resulting in spurious relationships. This paper uses a nationwide reform of compulsory education system in Turkey as an instrument to identify the causal effect of maternal education on infant and child health. The change in the educational policy provides an ideal natural experiment since, among women for whom this policy was binding, it encouraged more education than would have otherwise been obtained. Exploiting the policy reform, this paper shows that maternal education improves infant and child health.

This paper contributes to the literature by exploring the causal relationship between maternal education and infant and child health in a developing country. In particular, this is the first paper to investigate the relationship between maternal education and child health in a developing country. This paper also adds to the literature by exploring numerous mechanisms in which education influences child health, including health care utilization, and investigating differential impacts of maternal education.

One explanation of the correlation between parental education and child health is that greater maternal education translates into greater health care utilization, including formal prenatal visits. The relationship between maternal education and health care services utilization, particularly in developing countries, holds even after controlling for factors that affect both maternal schooling and health care utilization, such as childhood place of res-

[1]For a survey of the literature, see Strauss and Thomas (1995).

idence and ethnicity, as well as socioeconomic variables, such as current residence and husband's education.[2]

Besides health care utilization, maternal education can affect child health through several other mechanisms. For example, better educated women have higher income and may "match" with better educated, and higher income, husbands (Behrman and Rosenzweig, 2002). Educated women also have greater knowledge of modern health care services and ability to communicate with health-care providers (Caldwell, 1979; Barrera, 1990). Moreover, education may affect smoking and other health behaviors during pregnancy (Currie and Moretti, 2003). Another channel is through greater female autonomy, which in turn influences health-related decisions and the allocation of resources within the household (Caldwell, 1979; Caldwell et al., 1983). Other possible explanations include greater knowledge about diseases and increased adoption of modern medical practices (Caldwell, 1979; Caldwell, 1990; Barrera, 1990).[3]

In order to identify the causal effect of maternal education, this paper employs an instrumental variables estimation (IV) using variation in the exposure to the compulsory schooling law (CSL) in Turkey in 1997, which extended compulsory schooling from five to eight years (free of charge in public schools) across cohorts as an instrument. More specifically, this paper explores the causal relationship between mother's primary school completion (8+ years) and infant health at birth, as measured by very low birth weight, child health, as measured by height-for-age and weight-for-age z-scores (HAZ and WAZ), and maternal health, as measured by the length of health facility stay after delivery (indicates delivery complications). Furthermore, I examine various channels through which maternal educa-

[2]In India Navaneetham and Dharmalingam, 2002; Sunil et al., 2006; in Bangladesh Paul and Rumsey, 2002; in Ethiopia Mekonnen and Mekonnen, 2003; in Peru Elo, 1992; in Turkey Celik and Hotchkiss, 2000; in Thailand Raghupathy, 1996; in Uganda Tann et al., 2007; in rural Guetemala Glei et al., 2003; in Indonesia Titaley et al., 2011; in South America Jewell, 2009.

[3]Barrera (1990) and Caldwell (1979) show that educated mothers benefited more from health care services, regardless of access to health services.

tion may affect child health: health care utilization, smoking behavior, type of occupation, and spouse's education and occupation. I control for many confounding factors by including individual- and community-level characteristics, and mother's province of birth fixed effects.[4]

In the context of a developed country, a few studies have investigated the causal relationship between parental education and infant and child health using various approaches and find mixed results.[5] The literature exploring the causal effect of maternal education on infant health in developing countries is limited. Breierova and Duflo (2004) investigate the impact of parental education on a measure of child mortality (the total number of child deaths before various ages of the mother) using a primary school construction program in Indonesia as exogenous variation in schooling. Chou et al. (2010) explore the impact of parental education on infant health, as measured by the probability of low-weight (less than 2,500 grams) birth, neonatal death, postneonatal death, and infant death, using a middle school expansion in Taiwan, as exogenous variation. The former paper finds that parental education reduces child mortality, whereas the latter paper finds that parental education reduces the probability of low-weight birth and infant mortality. To date, no studies have investigated the impact of maternal education on child health, which is the primary contribution of this paper. Moreover, this paper is the first to explore the channels in which

[4]For example, Behrman and Wolfe (1987) argue that the effect of female education on health outcomes may be overstated in studies that do not control for women's childhood environment during which health related skills and habits are acquired.

[5]Lindeboom et al. (2009) use a policy influencing time of school exit in the UK, and find little evidence of a causal relationship between parental education and child and infant health as well as parental health and smoking behavior. McCrary and Royer (2011) use age-at-school-entry policies in California and Texas, and find that education has small effects on infant health (as measured by birth weight, prematurity, and rate of infant mortality), and does not affect prenatal behaviors (as measured by smoking rates and prenatal care). Currie and Moretti (2003) use availability of colleges by county when the mother is aged seventeen as an instrument for education. They find that higher maternal education improves infant health, and assess the importance of various channels through which education may improve birth outcomes in the United States. The CSL provides a more ideal instrument compared to college openings as a source of identification. Currie and Moretti (2003) addressed concerns regarding the validity of their instrumental variables: (1) the location of college openings may not be random and (2) the endogenous mobility of women who move to attend college.

education operates and to explore heterogeneous effects.

Turkey provides an interesting case study because the policy intervention occurred at a time when preventive health care services were readily accessible. Rosenzweig and Schultz (1982) argue that accessible health care facilities are substitutes to knowledge of diseases and modern treatment conferred from education.[6] However, this paper provides causal evidence that educational interventions increasing maternal education can improve child health, even in a country where health care services are readily accessible. Part of the explanation for this finding is that while health care services are accessible to women, greater education promotes earlier preventive care initiation and influences other health behaviors.

This paper demonstrates that the CSL had a substantial effect on primary school completion. Using exposure to the CSL as an instrument, I find that primary school completion improves infant, child, and maternal health, even after controlling for many potential confounding factors. The results also provide evidence of the causal effect of mother's education on maternal health behaviors–primary school completion leads to earlier preventive care initiation and reduces smoking. However, maternal education does not significantly affect formal prenatal care and delivery, mother's type of occupation, and husband's education and occupation. Hence, the results suggest that maternal education affects child health in part through changing maternal health behavior. Exploring heterogeneous effects suggests that the effects of maternal education on child health depend on province characteristics and the sex of the child.

The policy implications of this paper are straightforward. The benefits of maternal primary school completion are greater than typically recognized as completion improves not only market outcomes as often emphasized but also child health, even in a country with accessible health care services. This result highlights the importance of raising educational

[6] They find support for their substitution hypothesis in urban areas in Colombia, but not in rural areas.

completion rates for both mothers and children. The results also suggest that region and urban/rural residence are important factors of infant health and health care utilization and, additionally, pregnancy experience and ethnicity are important factors of health care utilization. Therefore interventions aimed at these subpopulations are important for reducing infant health and health care utilization disparities.

The remainder of this paper is organized as follows: Section 2 provides background on child health, health care services, and the educational policy in Turkey; Section 3 describes the data; Section 4 presents the empirical strategy; Section 5 presents the results, robustness checks, and heterogeneous effects; and Section 6 concludes.

2 Background

2.1 Child Health and Maternal Health Care in Turkey Before the CSL

Women can access preventive health care in various health facilities provided by the Ministry of Health (MOH) in Turkey. Health houses and centers are the primary public maternal health care service providers in the villages, which are staffed with at least one midwife or a nurse, whereas other health care facilities such as hospitals are mostly in urban areas. Mother and Child Health and Family Planning Centers also provide health services for pregnant women throughout the country. Overall, public services are widely used sources for preventive care compared to private sector, which provides services mostly in large urban areas.[7]

According to the demographic health surveys in 1993 and 1998, 38% and 33% of births were to mothers who did not use formal prenatal care; 25% and 27% of births were not assisted by medical professionals; and about 40% and 30% of births were not delivered

[7] Turkish Demographic Health Surveys in collaboration with MOH: http://www.hips.hacettepe.edu.tr.

at a health facility, respectively.[8] In both years, assistance of traditional birth attendants and/or relatives at the delivery is higher in rural areas, compared to urban areas. Moreover, there has been a marked difference in health care utilization by educational levels within the country in both years.[9]

Infant and children under five mortality rates were extremely high in the early 1960s (over 200 per thousand live births); however, both decreased to approximately 130 in early 1980s. Despite improvements in infant and children under five mortality rates in the 1980s, both rates exceeded 55 per thousand live births during the 1990s prior to the CSL, which is very high compared to developed countries.[10] There were large regional and residential differentials in infant and children under five mortality, despite governmental efforts to provide access to preventive health care services. In addition, there were sharp differentials by mother's educational levels. In 1993 (1998), the infant and under-five mortality rates of children of mothers with fewer than five years of education were 1.6 (1.7) times higher than the rates of mothers with at least five years of education.[11] Adult literacy rates (the proportion of the adult population aged 15+ which is literate) leveled off around 70 for females and 90 for males during the 1990s prior to the CSL. Hence, the CSL took place when infant and under-five mortality rates were high, literacy rates leveled off, and the use of public preventive health care services were at suboptimal levels, even though public preventive health care services were available throughout the country.

[8]Ibid.

[9]For instance, only 40% of the mothers who did not complete 5 years of education used preventive care services, whereas almost 75% of the mothers with 5 to 8 years of education and almost 93% of the mothers with more than 8 years of schooling used prenatal care services in 1993.

[10]http://data.un.org/

[11]For rates in 1993 and 1998, see http://www.measuredhs.com/pubs/pdf/FR108/FR108.pdf.

2.2 The 1997 Educational Reform

Prior to the 1997 educational reform in Turkey, all citizens were required to receive five years of compulsory education, which is provided free of charge in public schools. In order to increase the education level to universal standards, in 1997 the Turkish government extended compulsory schooling from five to eight years as of the 1997/1998 Academic Year.[12] The government created new schools, added new classes to the existing schools, recruited new primary school teachers, provided transportation to children who live far from main primary schools, and provided free textbooks and uniforms to low-income students.

While the Program aimed to extend educational opportunities to a greater share of the population, the qualitative components of the education system in general and the design of the curriculum in particular stayed the same. In an in-depth case study prepared for the World Bank on the implementation of the 1997 Basic Education Law, Dulger (2004) attests that the Primary Education Program maintained the 1968 national curriculum with minor changes and that, due to time constraints in implementation, the Ministry of National Education (MONE) primarily focused on capacity issues to accommodate new students. Moreover, a 2007 OECD educational report emphasizes that the 1997 educational program in Turkey lacked implementation of a new curricula in order to improve the quality of the education system.[13]

The CSL led to a significant increase in the enrollment rates between the 1997/98 and the 2000/01 Academic Years, by around 15%.[14] Rural enrollment in grade six for females increased substantially between the 1997/98 and 1999/00 Academic Years, roughly 162%.[15] In the first year of the change in the law, the net primary enrollment rate and the

[12] The Basic Education Law No 4306.

[13] Reviews of National Policies for Education: Basic Education in Turkey: http://www.oecd.org.

[14] For educational statistics, see http://sgb.meb.gov.tr.

[15] http://www.unicef.org/turkey/gr/ge21ja.html.

sex ratio increased by 10.4% and 3.4%, respectively.[16] The net primary enrollment rate for boys and girls has converged over time, reaching to 98.77 for males and 98.56 for females (98.67 for both sexes) in the 2011/12 Academic Year.

3 Data and Measurement of Variables

The data used in this paper come from the most recent Turkish Demographic and Health Survey (TDHS-2008), a nationally representative household survey carried out in Turkey in 2008. The TDHS covers a representative sample of 7,405 ever-married women of reproductive ages 15-49. The survey has information on socioeconomic and demographic characteristics, fertility, and family planning, as well as maternal and child health. In addition, the survey contains information on maternal health care utilization of women who had given birth during the five years preceding the survey.

The analysis is based on the latest birth of ever-married women at the ages of 18-29 during the five years prior to the interview.[17] Restricting analysis to ever-married women is justified since childbearing out of wedlock is uncommon in Turkey.[18] Since women provide more accurate information on their most recent births, the analysis considers utilization behavior associated with only one birth (latest) per woman. Thus, the final data set is restricted to 1,677 mothers.

[16]The net primary enrollment rate is calculated by dividing the number of students of a theoretical age group enrolled in a specific level of education by the population in that age group. Sex Ratio is calculated by dividing the female gross enrollment ratio by the male gross enrollment ratio multiplied 100.

[17]The reason to restrict the sample to women at the ages of 18-29 is specified under the identification section.

[18]Hacettepe University Institute of Population Studies, TDHS-2008: http://www.hips.hacettepe.edu.tr.

Measurement of Child and Maternal Health, and Maternal Health Care Services

Child anthropometric measurements, birth weight, and delivery complications, are used as measures of child, infant, and maternal health. This paper uses height-for-age and weight-for-age z-scores as measures of child health.[19] Height-for-age, given gender, is a commonly used measure of child health and an indicator of long-term health status, whereas weight-for-age, given gender, is a measure of current child health status and provides information on the current malnutrition status (Thomas et al., 1991). This paper focuses on "very low birth weight" (VLBW) (infants weighing less than 1500 grams) as a measure of infant health at birth, which is linked to higher risk of death within the first year of life and numerous adverse adulthood outcomes.[20] In order to examine the effect of mother's education on maternal health, the length of health facility stay after delivery for the mother is used as an indicator of delivery complications (the unit is "days").[21]

Four dichotomous outcomes of use of maternal health care services are analyzed: use of prenatal services from formal sources, receipt of four or more prenatal visits, delivery in a medical institution, and delivery assistance by trained medical personnel. Following World Health Organization (WHO) definitions of appropriate maternal care, both prenatal care and assistance at delivery are coded 1 if the woman obtained services from doctors, trained nurses, or trained midwives, and 0 otherwise. I also use month of prenatal care initiation as a measure of preventive care, which takes values from 1 (preventive care is initiated in the first month of pregnancy) to 10 (mother has not initiated any prenatal care).

[19]Anthropometric z-scores are calculated using the 2006 WHO child growth standards for children 0 to 5 years of age by their sex.

[20]Definition of VLBW is listed in the International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes (World Health Organization). For adverse outcomes, see Hack et al., 1994; Hack et al., 2002; Behrman and Rosenzweig, 2004; Black et al., 2007.

[21]Although a noisy measure, the length of health facility stay after delivery is the best available proxy for maternal health in the TDHS data.

Independent Variables

The primary variable of interest–primary schooling completion (defined as "primary")–is an indicator variable equal to one if the mother has completed at least 8 years of schooling. Because women in the sample of analysis had completed their education prior to childbearing, the educational attainment observed in the sample represents final completed education.

There are several other factors that may affect child health as well as health utilization behavior. Province of birth dummies and ethnicity are included to control for childhood environment.[22] As an indicator of ethnicity, father's mother tongue categories are used: Turkish (reference category), Kurdish, and others.[23] I also control for prior pregnancy experience, which is measured as the number of previous ever-born births.[24] The number of previous births is likely to be endogenously determined by maternal education; however, excluding previous births did not substantially change the effects of maternal schooling on child health and maternal health care utilization, except for formal prenatal care (see Appendix A). I exclude father's education from all specifications since mother's and father's educations are highly correlated (Chou et al., 2010). Also, husband's education may be a channel through which mother's education affects outcomes if there is assortative mating, which in turn, may bias the relationship. I explore the possibility of assortative mating in the following sections.

I control for community-level factors, region and urban/rural residence at the time of the survey, in order to account for differential availability and quality of health care services,

[22] There are 80 provinces included in the estimations based on the 1995 boundaries of Turkey. In all the estimations throughout the study, women born in Düzce are assumed to be born in Bolu since Düzce broke off Bolu and became a province in November 1999.

[23] Specifications are robust to using mother's mother tongue categories.

[24] There are 42 mothers who experienced at least one stillbirth (5 of them were exposed to the CSL). The results are robust to excluding them.

unobservable social and cultural factors as well as geographic characteristics.[25]

All specifications control for the primary school aged population and enrollment rates in the province of mother's birth in 1995 (prior to the CSL) provided by the Turkish Statistics Institute (TurkStat), each interacted with mother's years of birth dummies, in order to control for any time-varying factors that may be correlated with schooling and the allocation of schooling inputs to each province (Breierova and Duflo, 2004; Chou et al., 2010).

Table 1 presents descriptive statistics for the dependent and selected independent variables. Around 16% of the sample used in the analysis was exposed to the CSL, and around 30% completed 8 years of schooling. 7% of the women gave VLBW births, the average length of hospital stay after delivery was around 1.7 days, and average HAZ and WAZ of the child were -0.6 and 0.1. 89% of the women used formal prenatal care, 67% received at least 4 prenatal visits, and around 90% used formal delivery assistance and gave birth in a health facility.

4 Identification Strategy

In order to account for the potential endogeneity of maternal education, this paper employs variation in the exposure to the CSL across cohorts induced by the timing of the policy as an instrumental variable. The identifying assumption is that exposure to the CSL had no direct effect on outcomes of interest other than via changing education levels. The first-stage model is:

$$S_i = \alpha_0 + \sum_{k=7}^{17}(YOB_{ik})\alpha_{1k} + \mathbf{P_i}\alpha_2 + \mathbf{K_i}\alpha_3 + \mathbf{X_i}\alpha_4 + \mathbf{C_i}\alpha_5 + u_i \tag{1}$$

[25]Geographic location at the time of the survey is most likely the place of the latest birth as well.

where S_i indicates whether a mother i completed 8 years of compulsory primary schooling; $\mathbf{P_i}$ is a vector of mother's birth-province fixed effects; $\mathbf{K_i}$ is a vector of mother's birth-province-specific variables (interactions between the number of primary school aged children in the province of mother's birth (in 1995) and mother's year of birth dummies, and interactions between the enrollment rate in the province of mother's birth (in 1995) and mother's year of birth dummies); $\mathbf{X_i}$ is a vector of mother's background characteristics; and $\mathbf{C_i}$ is a vector of community-level factors. YOB_{ik} is an indicator variable denoting whether mother i is age k in 1997 (a year-of-birth dummy). Mothers aged 18 in 1997 is the omitted control dummy.

In equation 1, the year of birth dummies are used to capture exposure to the CSL in a flexible fashion. The CSL affected children who did not complete 5 years of education in the beginning of the 1997/98 Academic Year. Children aged 7-10 in 1997 (born in or after 1987) comprise the post-reform cohort that were exposed to the CSL, while children aged 11 or older in 1997 (born before 1987) comprise the pre-reform cohort that were unlikely to have been affected by the CSL.[26] Estimates of the equation 1 with/without controls suggest that the change in compulsory schooling had a positive effect on the education of the cohorts 10 and younger, while it did not have any effect on the education of the cohorts 11 and older.[27] Hereafter, one year-of-birth dummy (k=7&8) is used for mothers aged 7 and 8 in 1997 since the effect of the CSL was almost the same for these cohorts and statistically not different from each other.

Figure 1 plots the effect of the CSL on primary school completion for each cohort from a linear probability model (LPM) of equation 1 without controls.[28] The year of birth dum-

[26]The DHS provides exact date of birth for ever-married sample, and a mother's exposure to the CSL is also defined by her year and quarter of birth. Mothers born in the last quarter of 1986 (after September) may be affected by the CSL. The results, however, did not change with the definition of exposure to the CSL by year and quarter of birth, and thus the variation in the exposure to the CSL across birth-cohorts (by age) is used.

[27]Results for this unrestricted first-stage estimation are available upon request.

[28]A probit model is also used to estimate equation 1, and the marginal effects from the probit model

mies (α_{1k} for each k) from the LPM are jointly significant for k=7 to 10 and insignificant for k=11 to 17 (p-values are 0.000 and 0.266 respectively). Imposing the restriction that mothers aged 11 to 17 in 1997 were not affected by the CSL in order to gain precision, the first-stage takes the form:

$$S_i = \alpha_0 + \sum_{k=7}^{10}(YOB_{ik})\alpha_{1k} + \mathbf{P_i}\alpha_2 + \mathbf{K_i}\alpha_3 + \mathbf{X_i}\alpha_4 + \mathbf{C_i}\alpha_5 + u_i \tag{2}$$

where the omitted control group is now mothers aged 11 to 18 in 1997. A discrete treatment dummy indicating whether mothers aged 7-10 in 1997 (post-reform cohort) is also used as an instrumental variable (in the above equation rather than year of birth dummies).

The second stage uses the predicted primary school completion from equation 2 as follows:

$$Y_i = \gamma_0 + \hat{S}_i\gamma_1 + \mathbf{P_i}\gamma_2 + \mathbf{K_i}\gamma_3 + \mathbf{X_i}\gamma_4 + \mathbf{C_i}\gamma_5 + v_i \tag{3}$$

where $\hat{S}_i$ is the predicted primary school completion.[29] In all specifications, the standard errors are adjusted for clustering on the province of mother's birth. Specifications are estimated for a sample of mothers ages 18-29, where mothers ages 22-29 are the unexposed cohorts. Furthermore, I use a tighter age window as a robustness check (mothers ages 18-25, where mothers ages 22-25 are the unexposed cohorts). It should be noted that a few husbands (1.4% of the sample of analysis; 24 observations) were exposed to the policy; however, the results are robust to excluding these observations.

To test whether the results are driven by time trends, reduced-form estimates of a mother's exposure to the CSL on outcome variables are also performed:

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suggests the same effect of the CSL for each cohort (they are also not statistically different from the LPM estimates).

[29] Angrist (1991) and Angrist (2001) discuss that conventional two-stage least squares (2SLS) models are appropriate when both the outcome and endogenous variable are discrete once valid instruments are found.

$$Y_i = \alpha_0 + \sum_{k=7}^{17} (YOB_{ik})\alpha_{1k} + \mathbf{P_i}\alpha_2 + \mathbf{K_i}\alpha_3 + \mathbf{X_i}\alpha_4 + \mathbf{C_i}\alpha_5 + u_i \quad (4)$$

The set of year of birth dummies, α_{1k}, are jointly insignificant for all unexposed cohorts ($k \geq 11$) for all outcomes at all conventional levels of significance. This suggests that the effects are not due to pre-existing time trends. (For further verification, see section below.)

Furthermore, the following equation is estimated to test whether there are pre-existing trends in maternal education:

$$S_i = \alpha_0 + T_i\alpha_1 + (UT_i \times YOB_i)\beta + \mathbf{P_i}\alpha_2 + \mathbf{K_i}\alpha_3 + \mathbf{X_i}\alpha_4 + \mathbf{C_i}\alpha_5 + u_i \quad (5)$$

where T_i is a dummy indicating whether mother i belongs to the post-reform cohort, UT_i is a dummy indicating whether mother i belongs to the pre-reform cohort, and YOB_i is the year of birth of a mother i. If there are pre-existing trends in education, β would be significantly different than zero. The regression results of equation (5) for a sample of women ages 18-29 suggest that the CSL increased education (α_1 is 0.39, and significant at the 1% level) and rejects that pre-existing trends are present (β is estimated to be very small (0.02) and statistically indistinguishable from zero).[30] Thus, the results provide further evidence that the differences in education are not driven by pre-existing time trends.

Alternative Approach: Difference-in-differences (DID)

This section replaces year of birth dummies in equation 4 with a dummy variable indicating treatment of the CSL:

$$Y_i = \alpha_0 + T_i\alpha_1 + \mathbf{P_i}\alpha_2 + \mathbf{K_i}\alpha_3 + \mathbf{X_i}\alpha_4 + \mathbf{C_i}\alpha_5 + u_i \quad (6)$$

[30] Estimation of equation (5) for a sample of women ages 18-25 also yields similar results: α_1 is 0.38 (significant at the 1% level), and β is 0.01 (statistically insignificant at any conventional levels of significance).

Equation 6 compares the outcomes of mothers aged 7-10 to 11-14 in 1997. As a control experiment, I compare the outcomes of mothers aged 11-14 to 15-18 in 1997 (both unexposed) in order to rule out pre-existing trends (the CSL should not have affected these women). The reduced-form results suggest that the health outcomes and prenatal care initiation are significantly different for exposed and unexposed mothers (Panel A of Appendix B). Moreover, the coefficients of the control experiment are small and insignificant, implying that the differences between exposed and unexposed mothers are not driven by pre-existing time trends (Panel B of Appendix B). For instance, mothers aged 7-10 in 1997 were 8 percentage points less likely to give VLBW births, compared to mothers aged 11-14 in 1997. The estimate from a comparison of the probability of giving VLBW births between mothers aged 11-14 and 15-18 in 1997 (-0.002), however, was small and statistically insignificant (the difference-in-differences (DID) estimate is -0.074).

5 Results

Primary School Completion (First-Stage Results)

The first stage results (equation 2) using a discrete treatment dummy and mother's year of birth dummies are shown in Table 2. Columns (1) and (2) do not use "previous births" as controls, while columns (3) and (4) control for the number of previous ever-born births.[31] The estimate in column (3) suggests that mothers exposed to the CSL have a substantially higher probability of completing primary school than unexposed mothers (around 32 percentage points higher). Column (4) presents the effect for each exposed cohort: mothers aged 7&8 at the time of the policy have the highest probability of completing primary school, and the effect decreases by age.

[31] The effect of the CSL on maternal schooling in column (1) is not statistically different than column (3). Likewise, the effects for each cohort in column (2) are not statistically different than those in column (4).

The first-stage results indicate that the CSL led to a substantial increase in the probability of completing primary school. F-statistic provided in column (4) of the Table 2 (11.54) demonstrates that the set of year of birth dummies are jointly significant at all conventional significance levels.[32]

Effects of Maternal Education on Infant and Child Health, and Health Care Utilization

Table 3 presents the effects of primary school completion on infant and child health, and health care utilization in Panel A and Panel B, respectively. OLS estimates for the sample of mothers ages 18-29 in column (1) suggest that mothers who completed primary school (8+ years of schooling) are around 4 percentage points less likely to give VLBW births, 3 percentage points more likely to have formal prenatal care, and 10 percentage points more likely to receive 4+ prenatal visits. Moreover, mothers who completed primary school have children with higher HAZ and WAZ (0.2 higher standard deviations), and have 0.7 months earlier prenatal care initiation. The estimated effects on length of health facility stay and delivery outcomes are not statistically significant at any conventional levels of significance.

Instrumental variables estimates, using either a discrete treatment dummy or mother's year of birth dummies as instruments, for the sample of mothers ages 18-29 are shown in columns (2) and (3) of Table 3, respectively. All IV estimates have the expected signs, and are statistically significant for health outcomes. IV estimates in Panel A suggest that completing primary school yields large infant health returns in terms of VLBW, child health returns in terms of HAZ and WAZ, and maternal health returns in terms of length of health facility stay after delivery: primary school completion decreases the likelihood of giving VLBW births by around 17 percentage points, increases HAZ and WAZ of the child by 1.1

[32] The F-statistic is greater than 10, which suggests that the instruments are not weak (Staiger and Stock, 2007).

and 0.7 standard deviations, and decreases the stay at the health facility after delivery for mothers by around 1.1 days (column 3).[33] Table 3 also suggests that the effect of maternal education on health outcomes may operate through earlier prenatal care initiation: mothers who completed primary schooling initiate preventive care around 1.6 months earlier than the ones with less than 8 years of schooling (50 percent change relative to the mean–3.2 months). Estimates on the use of formal prenatal care, receipt of 4+ visits, delivery in a health facility, and delivery by health professionals are all positive, but not statistically significant. Formal preventive care and delivery rates are high for both mothers with and without primary schooling in the sample and, therefore, it is more likely that maternal education affects infant health via other mechanisms.

The IV estimates exceed OLS estimates for all outcomes, which may be partly due to the fact that the IV estimates present the effects of maternal education for mothers whose educational attainment has been affected by the change in the compulsory schooling law (in other words, for mothers who would not have completed 8 years of schooling if there was not a change in the CSL). The effect may be much higher for those mothers than for the population, thereby, leading to larger estimates of IV than the OLS estimates.[34] The possibility of heterogeneous effects of maternal schooling on child health and health care utilization is explored in Section 5.2. Other possibilities for the downwards bias of the OLS estimates are the presence of random measurement error, and the omitted variables that positively affect the outcome variables and are negatively correlated with maternal schooling, such as family characteristics and/or peer networks.

[33] In addition to VLBW, I also explore the effect of maternal education on birth weight (in grams), log birth weight, and a discrete indicator for low birth weight (<2500 grams). The effect of maternal education on log birth weight is positive and significant, whereas the effect on birth weight is significant only for first-time mothers (Appendix C). The effect on low birth weight is statistically insignificant. These results suggest that the relationship is nonlinear and VLBW is the most relevant margin in which education impacts birth weight (note that using VLBW and log birth weight results in the highest goodness-of-fit of the OLS regression of primary school completion on various birth weight outcomes).

[34] For larger IV returns to education in terms of infant health and prenatal care, see Currie and Moretti, 2003; for a review of recent studies in terms of earnings, see Card, 2001.

Effects of Other Variables

I explore the other factors that determine child health and health care utilization behavior of mothers. Table 4 presents the effects of other determinants, using the specification in column (3) of Table 3 (mother's year of birth dummies as instrumental variables).

The effects of ethnicity, one proxy for the childhood environment, suggest that Kurdish mothers are 13 percentage points less likely to receive 4+ prenatal visits, 6 percentage points less likely to deliver at a health facility, and postpone prenatal visits by around 0.7 months, compared to Turkish mothers. Mothers with other ethnicities are 22 percentage points less likely to receive 4+ prenatal visits and postpone prenatal visits by around 1 month compared to Turkish mothers. Pregnancy experience seems to play an important role in health care utilization outcomes explored in the paper: mothers with less previous births are more likely to seek health care services. Individual-level factors, however, excluding maternal education, do not seem to explain infant health at birth.

The effect of place of residence shows that mothers in rural areas are more likely to give VLBW births (around 5 percentage points). Mothers in rural areas are also less likely to use health care services compared to mothers in urban areas. The results suggest that maternal education and place of residence have significant effects on infant health and health care utilization. There are also substantial differences in infant health and health care utilization between mothers living in Istanbul and East Anatolia, especially Southeast Anatolia in infant health and Northeast Anatolia in health care utilization. For instance, mothers living in Southeast Anatolia are 12 percentage points more likely to give VLBW births, and 15 percentage points less likely to receive 4+ visits, compared to mothers living in Istanbul. Mothers in Central Anatolia are also 11 percentage points more likely to give VLBW birth compared to mothers in Istanbul, which again highlights the importance of regional residence.

5.1 Robustness Checks

The last three columns of Table 3 present the effects of maternal education for the sample of mothers ages 18-25, where unexposed mothers are now ages 22-25. These results provide a further robustness check for ruling out that the results are driven by time-trends. The IV estimates in columns (5) and (6) are very similar to the ones in columns (2) and (3), and, additionally, the differences are not statistically significant for all outcomes, respectively. The tighter age window estimates provide further evidence that there are significant effects of maternal education of mothers who changed their educational attainment due to the change in the CSL on infant and child health, and prenatal care initiation.

Following Currie and Moretti (2003), the effect of maternal education is reestimated for a sample of first-time mothers.[35] Columns (1) and (2) of Table 5 present the results for a sample of mothers of any parity (as in Table 3, columns 1 and 2); while columns (3) and (4) present the results for a sample of first-time mothers. The significant effects of maternal education on infant and child health, length of health facility stay after delivery, and prenatal care initiation persist for the sample of first-time mothers after controlling for the endogeneity of maternal education (column 4). Thus, Table 5 presents evidence that the results are robust to the exclusion of higher parity mothers.

Sample selection is a problem if education affects the probability of being a mother.[36] I follow the two-step procedure developed by Heckman in order to account for possible sample selection bias (Heckman, 1976; Heckman, 1979). Towards this end, I estimate the probit function determining whether or not a woman becomes a mother by age 18 for the full sample using the instruments (year-of-birth dummies) as control variables, and the

[35]The treatment dummy, rather than mother's year of birth dummies, is used as the instrument for maternal education for the sample of mothers ages 18-29 due to small sample size. Of course, number of previous births is not used as a control in these specifications.

[36]Güneş (2013) shows that female education reduces teenage fertility and the probability of being a teenage mother.

propensity scores calculated from these estimates are included as controls in the estimations of health and health utilization for first-time mothers.[37] Column (5) of Table 5 presents the results after correcting for sample selection, indicating the results are robust to introducing correction for sample selection.

Additional robustness checks are provided in Table 6. Column (1) repeats the estimates in column (3) of Table 3, where mother's year of birth dummies are used as instruments. Column (2) adds a control variable indicating whether mothers exercise regularly (13% of the sample exercises regularly), which may affect both her and her infant's health.[38] The results show no significant effect of sports on any outcome, except for receipt of 4+ visits– mothers who exercise regularly are about 8 percentage more likely to receive 4+ visits. Column (3) of Table 6 accounts for the fact that exposure to internet may be associated with the outcomes; however, there was not any evidence of such associations (around 7% of the sample uses internet regularly). Column (4) controls for the type of sanitation facility of the household (30% did not have a flush toilet) as an indicator of household wealth. Type of sanitation facility is found to be correlated with the receipt of 4+ visits–mothers living in a house with a flush toilet are 18 percentage points more likely to receive 4+ visits. The effect of maternal education is robust to the inclusion of each additional variable in columns (1)-(4). Finally, column (5) includes all additional control variables, and the IV estimates of the effect of maternal education remain robust for health outcomes and preventive care initiation.

[37]The probit estimation includes other controls used in the paper.

[38]I find no evidence that educated mothers exercise more. Results of the effect of maternal education on exercise were insignificant (available upon request).

5.2 Heterogeneous Effects

In this section, I explore heterogeneous effects. First, I explore whether the effect of the CSL on maternal schooling differs by mother's parental education. Second, I explore whether the effects of maternal schooling on child and infant health, and maternal health care utilization, differ by sex of the child and characteristics of the province of mother's birth (prior to the change in the CSL), such as income and urbanization rates.

The Effect of the CSL on Maternal Education

In order to explore heterogeneous effect of the CSL on maternal education by parental education, I interact the treatment dummy with mother's parental educational attainment dummies, and use the specification in column (3) of Table 2.[39] Table 7 suggests that the CSL was more successful at increasing education of women with less than nine years of parental education, while it did not significantly affect women with parental education higher than secondary school completion (columns 2 and 3). The F-statistics (reported in the Table) show that the interaction terms and the treatment dummy are jointly significant (8.37 in column 2, and 11.08 in column 3). The results, therefore, indicate that there are heterogeneous effects by mother's parental education. The effects of maternal education on infant and child health, length of health facility stay after delivery, and prenatal care initiation are robust to using the treatment dummy interacted with parental education dummies, and the treatment dummy as instruments (Appendix D).

[39]There are 4 categories of educational attainment for both the mother and father of the mother as follows: no education, primary school completion (5 years of education in this case), secondary school completion (8 years of education), and higher than secondary school completion. In the estimations, the omitted category is mothers (fathers) with no education. Estimations include dummies for parental educational attainment categories, treatment dummy, and the treatment dummy interacted with parental educational attainment dummies as well as the other controls used in the paper.

The Effects of Maternal Education on Child Health and Health Care Utilization

To examine heterogeneity in the effect of maternal education, I split the sample into subsamples of mother's birth-province and gender of the child. I use the specification in column (2) of Table 3, which includes all controls, and use the treatment dummy as the instrument. I explore heterogeneity by income and urbanization rates by dividing the sample into provinces with average income and urbanization rates of the unexposed mothers' province of birth above (or below) the sample median.

The results are reported in Table 8. The effects of maternal education on VLBW and the length of health facility stay after delivery are greater for female children than male children (the differences are significant at the 1% and 10% levels, respectively). Specifically, for mothers of female children, primary school completion decreases the likelihood of giving VLBW births by around 35 percentage points, and decreases the stay at the health facility by around 2.2 days (columns 2-3). The effect of maternal education on HAZ is higher in provinces with income and urbanization rates below the median (columns 4-6). In provinces with income and urbanization rates below the median, primary school completion increased HAZ of the child by around 1.9 and 4.1 standard deviations, respectively (the differences between the provinces below and above the median are significant at the 10% level). These results provide evidence that there are heterogeneous effects across provinces, although standard errors are large in some cases.

5.3 Other Potential Mechanisms

In this section, other potential mechanisms through which maternal education may affect child and infant health are explored. Table 9 presents the results from instrumental variables estimation using either a discrete treatment dummy (columns 1 and 3) or mother's year of birth dummies (columns 2 and 4) as instruments for the samples of mothers ages 18-29 and ages 18-25 for various potential mechanisms.

Panel A of Table 9 explores the effect of primary school completion on husband's education and occupation. Assuming that mother's exposure to the CSL affects husband's education only through assortative mating, the first two rows of Panel A report the effect of wife's primary school completion on husband's years of education as a continuous variable and husband's primary school completion (8+ years of education).[40] The results suggest that assortative matching does not play an important role. The third row of Panel A presents the effect of maternal education on husband's occupation. Results suggest that mothers who completed primary school are more likely to marry men who work in either service or industry sectors; however, none of the results are statistically significant.

Panel B of Table 9 presents the effects of maternal education on various outcomes. One potential mechanism through which maternal education may affect child health is smoking behavior of mothers during pregnancy; however, data is available only for ever or current smoking behavior. Arguably, current smoking is a less noisy proxy for smoking during pregnancy. The results suggest that mothers with 8+ years of education are around 30 percentage points less likely to be current smokers; however, the effect on ever smoking is insignificant. The effect of maternal education on smoking behavior is consistent with the findings of Currie and Moretti (2003), which find that an additional year of schooling reduces the probability of smoking by over 30 percent in the United States. The last potential mechanism explored is mother's occupation. There is a large effect of maternal education on the probability of mother's not working or working in the agricultural sector, but the effect is only significant at the 10% significance level in columns (1) and (3).

In sum, mother's primary school completion affects infant and child health through smoking behavior and prenatal care initiation.

[40] Few husbands were exposed to the CSL as mentioned earlier; however, results are robust to excluding them.

6 Discussion and Conclusion

This paper provides evidence of the effect of maternal education on child health and explores potential mechanisms through which maternal education may affect infant and child health. I use a change in the compulsory schooling law in Turkey as a natural experiment, which extended compulsory primary schooling from five to eight years (free of charge in public schools). I find that the law increased the likelihood of mothers' completing 8+ years of schooling by around 32 percentage points on average.

Variation in the probability of completing primary school across cohorts induced by the change in the CSL is used as an instrumental variable in order to explore the causal effect of maternal education on child health and potential channels through which schooling operates. The IV estimates suggest that mother's primary school completion improves infant health, as measured by very low birth weight (reduction of approximately 17 percentage points), and child health, as measured by HAZ and WAZ (increases of 1.1 and 0.7 standard deviations, respectively), and, moreover, the results are robust to various specifications. The IV estimates also provide evidence that improvements in health outcomes are partly due to the effects of maternal education on maternal health behaviors: mother's primary school completion leads to earlier preventive care initiation and reduces smoking. Exploring other factors that are likely to influence child and infant health does not suggest significant effects of maternal education on formal prenatal care and delivery, occupation, and assortative matching. Exploring heterogeneous effects suggests that the effect of the CSL differs by mother's parental education, and the effects of maternal education on child health depend on province characteristics and the sex of the child.

The results also suggest that, even after controlling for education, region and urban/rural residence are important factors of infant health and health care utilization, and, additionally, pregnancy experience and ethnicity are important factors of health care utilization. Therefore interventions aimed at these subpopulations are important for reducing infant health and health care utilization disparities.

Future research may explore the causal effect of education along different maternal schooling margins in developing countries, which may improve child health to a greater extent. While the results are consistent with the findings of a related study for a developed country as explored by Currie and Moretti (2003), more research is needed for various settings, especially developing countries, to understand the extent that the results can be generalized.

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Figure 1: Primary School Completion of Mothers

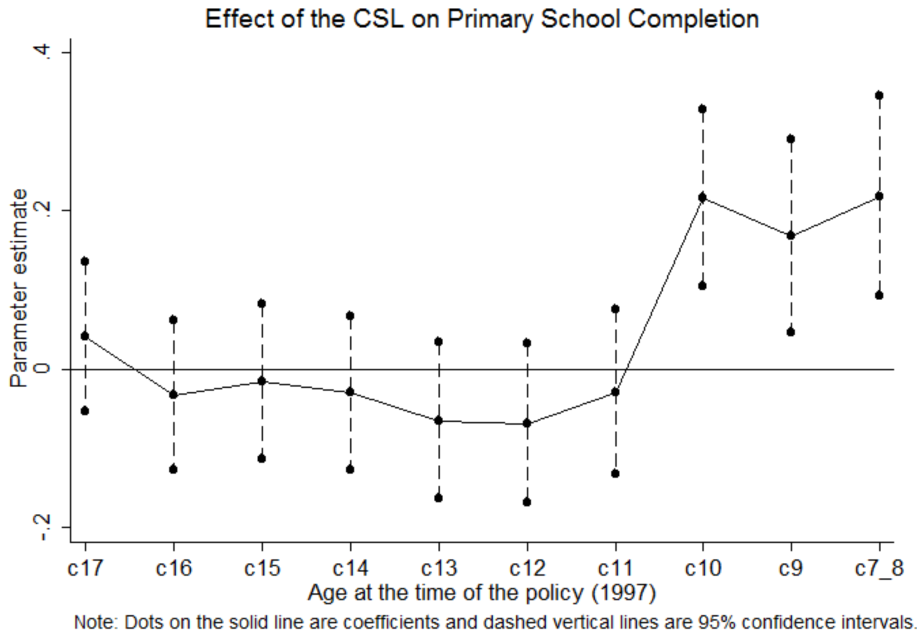

Table 1: Summary Statistics For Outcomes and Selected Explanatory Variables[a]

Variables	Mean	Std.Err.	Variables	Mean	Std.Err.
Health Outcomes			**Community-level Variables**		
VLBW (birth weight<1500 grams)	0.069	0.253	*Type of residence*		
Length of health facility stay (in days)	1.658	2.457	Rural	0.301	0.459
Height-for-age z-score (HAZ)	-0.581	1.478	Urban[b]	0.699	0.459
Weight-for-age z-score (WAZ)	0.146	1.055	*Region*		
Health Utilization Behavior of Mothers			Istanbul[b]	0.052	0.222
Prenatal care from formal sources	0.894	0.308	West Marmara	0.042	0.200
Receipt of 4+ prenatal visits	0.673	0.469	Aegean	0.061	0.239
Prenatal care initiation (in months)	3.198	2.889	East Marmara	0.064	0.246
Delivery in a health facility	0.897	0.303	West Anatolia	0.077	0.267
Delivery assistance by health professionals	0.919	0.272	Mediterranean	0.132	0.339
Individual-level Variables			Central Anatolia	0.080	0.271
Compulsory Primary School Completion (8+)	0.299	0.458	West Black Sea	0.069	0.254
Age at the time of the policy			East Black Sea	0.041	0.199
Cohort 7&8 (Age 7&8 in 1997)	0.044	0.204	Northeast Anatolia	0.095	0.294
Cohort 9 (Age 9 in 1997)	0.048	0.214	Central East Anatolia	0.114	0.319
Cohort 10 (Age 10 in 1997)	0.064	0.244	Southeast Anatolia	0.172	0.377
Pregnancy Experience					
Previous Births	0.902	1.100			
Ethnicity					
Turkish[b]	0.642	0.479			
Kurdish	0.313	0.464			
Other	0.045	0.207			

[a] N=1,677 for all; except for VLBW (N=1,616), length of health facility stay (N=1,519), HAZ (N=1,177), and WAZ (N=1,243)

[b] used as a reference category.

Table 2: Effect of the CSL on Primary School Completion (First Stage)

	(1)	(2)	(3)	(4)
Age 7-10 in 1997	0.366***		0.315***	
	(0.069)		(0.070)	
Age 7&8 in 1997		0.561***		0.520***
		(0.100)		(0.099)
Age 9 in 1997		0.294***		0.234**
		(0.096)		(0.098)
Age 10 in 1997		0.288**		0.235**
		(0.117)		(0.111)
Previous births	No	No	Yes	Yes
N	1677	1677	1677	1677
R^2	0.265	0.267	0.286	0.289
F-statistic		12.69		11.54

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The F-statistic test the hypothesis that the coefficients of the mother's year of birth dummies are jointly zero. *Notes:* Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. All models include individual- and community-level variables, and interactions between the mother's year of birth dummies and the number of primary school aged children in the province of mother's birth (in 1995) as well as interactions between the mother's year of birth dummies and enrollment rates in the province of mother's birth (in 1995). Models (1) & (3) use discrete treatment dummy, and models (2) & (4) use mother's year of birth dummies.

Table 3: Effects of Maternal Education on Infant and Child Health, and Health Care Utilization

	OLS 18-29 (1)	IV (T) 18-29 (2)	IV (YOB) 18-29 (3)	OLS 18-25 (4)	IV (T) 18-25 (5)	IV (YOB) 18-25 (6)
Panel A: Health Outcomes						
Very low birth weight	-0.039***	-0.166*	-0.167*	-0.038**	-0.174*	-0.184*
	(0.009)	(0.097)	(0.098)	(0.016)	(0.107)	(0.110)
Length of health facility stay	0.011	-1.788**	-1.114*	-0.153	-2.244**	-1.454**
	(0.155)	(0.844)	(0.617)	(0.240)	(0.919)	(0.648)
Height-for-age z-score	0.226**	1.231**	1.095*	0.371**	1.489**	1.307**
	(0.104)	(0.606)	(0.598)	(0.164)	(0.660)	(0.653)
Weight-for-age z-score	0.164*	0.902*	0.717*	0.306**	1.017*	0.999*
	(0.093)	(0.479)	(0.420)	(0.122)	(0.604)	(0.563)
Panel B: Health Utilization Outcomes						
Formal prenatal care	0.032**	0.090	0.065	0.033*	0.043	0.035
	(0.014)	(0.105)	(0.086)	(0.019)	(0.110)	(0.087)
Receipt of 4+ prenatal visits	0.096***	0.092	0.061	0.073*	0.111	0.137
	(0.023)	(0.159)	(0.141)	(0.037)	(0.179)	(0.144)
Month of first prenatal care	-0.746***	-1.603*	-1.635**	-0.787***	-1.821*	-1.495*
	(0.151)	(0.850)	(0.737)	(0.191)	(0.935)	(0.810)
Delivery in a health facility	0.002	0.015	0.079	-0.008	0.033	0.085
	(0.017)	(0.091)	(0.084)	(0.025)	(0.109)	(0.092)
Delivery by health professionals	0.002	0.030	0.075	-0.006	0.037	0.076
	(0.015)	(0.082)	(0.079)	(0.022)	(0.098)	(0.090)
Observations	1,677	1,677	1,677	927	927	927

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. All models include individual- and community-level variables, and interactions between the mother's year of birth dummies and the number of primary school aged children in the province of mother's birth (in 1995) as well as interactions between the mother's year of birth dummies and enrollment rates in the province of mother's birth (in 1995). Instrumental variables are discrete treatment dummy in models (2) and (5), and mother's year of birth dummies for those exposed to the CSL in models (3) and (6). Models (1)-(3) contain 1,616, 1,519, 1,177, and 1,243 observations, and models (4)-(6) contain 891, 836, 643, and 707 observations for VLBW, length of stay, HAZ, and WAZ outcomes, respectively. Health utilization models (1)-(3) contain 1,677, and (4)-(6) contain 927 observations.

Table 4: Effects of Other Explanatory Variables

	VLBW	Time	HAZ	WAZ	Prenatal Formal	4+ Visits	Initiation	Delivery Hospital	Delivery Formal
Individual-level variables									
Previous Births	0.018	-0.178*	-0.065	-0.056	-0.062***	-0.094***	0.505***	-0.051***	-0.044***
	(0.012)	(0.093)	(0.069)	(0.040)	(0.015)	(0.017)	(0.107)	(0.011)	(0.012)
Kurdish	0.009	-0.627***	-0.154	-0.063	-0.029	-0.130***	0.669**	-0.055*	-0.033
	(0.023)	(0.232)	(0.220)	(0.143)	(0.030)	(0.041)	(0.267)	(0.030)	(0.027)
Others	0.018	0.204	-0.312	-0.056	-0.038	-0.220***	0.994***	-0.013	-0.050
	(0.031)	(0.365)	(0.237)	(0.122)	(0.032)	(0.041)	(0.359)	(0.055)	(0.043)
Community-level variables									
Rural	0.051**	-0.339**	-0.159	-0.045	-0.054**	-0.146***	0.764***	-0.071**	-0.080**
	(0.020)	(0.154)	(0.107)	(0.096)	(0.023)	(0.030)	(0.191)	(0.033)	(0.033)
West Marmara	-0.014	1.098*	-0.090	-0.014	-0.012	-0.014	0.096	0.027	0.049
	(0.025)	(0.608)	(0.288)	(0.225)	(0.050)	(0.086)	(0.467)	(0.052)	(0.030)
Aegean	-0.028	0.390	0.009	0.017	0.072**	0.136**	-1.120***	0.039	0.068**
	(0.029)	(0.329)	(0.365)	(0.246)	(0.034)	(0.064)	(0.360)	(0.048)	(0.032)
East Marmara	0.027	-0.105	0.606**	0.084	0.023	-0.005	-0.175	0.057	0.014
	(0.029)	(0.289)	(0.300)	(0.194)	(0.043)	(0.058)	(0.323)	(0.041)	(0.032)
West Anatolia	0.050	0.283	-0.475	-0.368	-0.063	-0.094	0.992**	0.018	-0.015
	(0.031)	(0.375)	(0.358)	(0.227)	(0.054)	(0.075)	(0.456)	(0.041)	(0.033)
Mediterranean	0.077**	-0.045	-0.054	-0.259	0.054	-0.008	-0.537	-0.006	-0.019
	(0.034)	(0.370)	(0.282)	(0.167)	(0.045)	(0.061)	(0.411)	(0.068)	(0.051)
Central Anatolia	0.106*	0.206	-0.274	-0.327	0.052	-0.032	-0.588	0.034	0.011
	(0.054)	(0.423)	(0.364)	(0.249)	(0.044)	(0.073)	(0.433)	(0.037)	(0.027)
West Black Sea	0.031	1.526**	-0.163	-0.191	0.048	0.009	-0.399	0.037	0.003
	(0.028)	(0.723)	(0.387)	(0.233)	(0.049)	(0.066)	(0.429)	(0.035)	(0.029)
East Black Sea	0.025	0.742	0.336	-0.105	-0.012	0.095	-0.035	0.085*	0.058
	(0.030)	(0.543)	(0.332)	(0.219)	(0.049)	(0.086)	(0.484)	(0.044)	(0.037)
Northeast Anatolia	0.046*	0.184	-0.447	-0.401	-0.107**	-0.108*	0.977**	-0.069	-0.020
	(0.026)	(0.431)	(0.411)	(0.311)	(0.051)	(0.060)	(0.420)	(0.060)	(0.034)
Central East Anatolia	0.093*	-0.257	0.013	-0.441**	-0.048	-0.139**	0.280	-0.060	-0.105**
	(0.053)	(0.528)	(0.270)	(0.192)	(0.052)	(0.071)	(0.419)	(0.054)	(0.042)
Southeast Anatolia	0.123***	-0.041	-0.244	-0.219	-0.038	-0.149***	0.095	-0.008	-0.023
	(0.036)	(0.314)	(0.427)	(0.210)	(0.056)	(0.056)	(0.459)	(0.071)	(0.051)
N	1616	1519	1177	1243	1677	1677	1677	1677	1677

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. Specification in column (3) of Table 3 is used.

Table 5: Robustness Checks: First Births and Sample Selection Correction

	All births		First births		
	OLS	IV (T)	OLS	IV (T)	IV (YOB)
	18-29	18-29	18-29	18-29	18-29
	(1)	(2)	(3)	(4)	(5)
Panel A: Health Outcomes					
Very low birth weight	-0.039***	-0.166*	-0.017*	-0.068*	-0.095*
	(0.009)	(0.097)	(0.010)	(0.041)	(0.055)
Length of health facility stay	0.011	-1.788**	0.083	-1.505**	-1.667**
	(0.155)	(0.844)	(0.196)	(0.585)	(0.825)
Height-for-age z-score	0.226**	1.231**	0.429***	1.665*	1.745*
	(0.104)	(0.606)	(0.152)	(0.912)	(1.058)
Weight-for-age z-score	0.164*	0.902*	0.241*	1.147*	1.320*
	(0.093)	(0.479)	(0.125)	(0.660)	(0.799)
Panel B: Health Utilization Outcomes					
Formal prenatal care	0.032**	0.090	0.036***	0.035	0.019
	(0.014)	(0.105)	(0.011)	(0.054)	(0.046)
Receipt of 4+ prenatal visits	0.096***	0.092	0.089***	0.050	0.100
	(0.023)	(0.159)	(0.028)	(0.134)	(0.202)
Month of first prenatal care	-0.746***	-1.603*	-0.697***	-1.044*	-1.436*
	(0.151)	(0.850)	(0.156)	(0.608)	(0.860)
Delivery in a health facility	0.002	0.015	0.016	0.032	0.046
	(0.017)	(0.091)	(0.010)	(0.065)	(0.053)
Delivery by health professionals	0.002	0.030	0.011	0.049	0.017
	(0.015)	(0.082)	(0.009)	(0.032)	(0.051)
Sample Selection Correction	No	No	No	No	Yes
Observations	1,677	1,677	733	733	733

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. The coefficients in columns (1) and (2) are same with the ones in Table 3, and the same specifications (excluding the number of previous births as a control) are used for the sample of first-time mothers in columns (3) and (4). Model (5) accounts for sample selection. Models (1) and (2) contain 1,616, 1,519, 1,177, and 1,243 observations, and models (3), (4), and (5) contain 711, 714, 512, and 546 observations for VLBW, length of stay, HAZ, and WAZ outcomes, respectively.

Table 6: Additional Robustness Checks

	IV 18-29 (1)	IV 18-29 (2)	IV 18-29 (3)	IV 18-29 (4)	IV 18-29 (5)
Panel A: Health Outcomes					
Very low birth weight	-0.167*	-0.169*	-0.168*	-0.169*	-0.171*
	(0.098)	(0.099)	(0.098)	(0.098)	(0.098)
Length of health facility stay	-1.114*	-1.211*	-1.116*	-1.071*	-1.158*
	(0.617)	(0.638)	(0.615)	(0.611)	(0.626)
Height-for-age z-score	1.095*	1.090*	1.102*	1.108*	1.106*
	(0.598)	(0.597)	(0.605)	(0.600)	(0.605)
Weight-for-age z-score	0.717*	0.729*	0.714*	0.718*	0.726*
	(0.420)	(0.426)	(0.416)	(0.417)	(0.417)
Panel B: Health Utilization Outcomes					
Formal prenatal care	0.065	0.066	0.065	0.060	0.061
	(0.086)	(0.086)	(0.085)	(0.083)	(0.083)
Receipt of 4+ prenatal visits	0.061	0.052	0.057	0.037	0.029
	(0.141)	(0.143)	(0.142)	(0.138)	(0.139)
Month of first prenatal care	-1.635**	-1.653**	-1.633**	-1.505**	-1.529**
	(0.737)	(0.737)	(0.724)	(0.715)	(0.702)
Delivery in a health facility	0.079	0.074	0.078	0.078	0.072
	(0.084)	(0.085)	(0.082)	(0.083)	(0.083)
Delivery by health professionals	0.075	0.131	0.074	0.073	0.069
	(0.079)	(0.080)	(0.078)	(0.079)	(0.077)
Control Variables					
Sports	No	Yes	No	No	Yes
Internet	No	No	Yes	No	Yes
Flush toilet	No	No	No	Yes	Yes
Observations	1,677	1,677	1,677	1,677	1,677

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. The results of specification in column (3) of Table 3 are repeated in column (1), and the same specification is used in other columns with additional control variables. Models contain 1,616, 1,519, 1,177, and 1,243 observations for VLBW, length of stay, HAZ, and WAZ outcomes, respectively.

Table 7: Heterogeneous Effects of the CSL on Education by Mother's Parental Education

	Main Effect	Mother's Education	Father's Education
	(1)	(2)	(3)
Age 7-10 in 1997 (Treatment)	0.315***	0.196***	0.193*
	(0.070)	(0.073)	(0.100)
ME (Primary)		0.130***	
		(0.027)	
ME (Secondary)		0.298***	
		(0.111)	
ME (Higher)		0.468***	
		(0.101)	
Treatment*ME (Primary)		0.141**	
		(0.054)	
Treatment*ME (Secondary)		0.276**	
		(0.123)	
Treatment*ME (Higher)		-0.021	
		(0.122)	
FE (Primary)			0.041*
			(0.024)
FE (Secondary)			0.271***
			(0.058)
FE (Higher)			0.459***
			(0.041)
Treatment*FE (Primary)			0.173**
			(0.082)
Treatment*FE (Secondary)			0.199**
			(0.100)
Treatment*FE (Higher)			0.030
			(0.109)
N	1677	1664	1598
R2	0.286	0.318	0.361
F-statistic		8.37	11.08

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The F-statistics test the hypothesis that the coefficients of the treatment dummy and the parental education dummies interacted with the treatment dummy are jointly zero. *Notes:* Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. Model (1) repeats the coefficient in column (3) of Table (2). ME (FE) are mother's (father's) education categories, and omitted group is mothers (fathers) with no education.

Table 8: Heterogeneous Effects by Sex of the Child and Pre-change Province Characteristics

	Whole Sample	Sex of the child		Pre-Change Province of Birth Characteristics			
				GDP		Urbanization	
		Female	Male	< Median	>= Median	< Median	>= Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Health Outcomes							
Very low birth weight	-0.166*	-0.348**	0.071	-0.177	-0.185*	-0.280	-0.181
	(0.097)	(0.148)	(0.179)	(0.141)	(0.100)	(0.200)	(0.146)
Length of health facility stay	-1.788**	-2.197**	0.386	-0.211	-2.745*	-1.716	-1.791
	(0.844)	(1.029)	(1.812)	(1.186)	(1.502)	(1.598)	(1.168)
Height-for-age z-score	1.231**	0.821	0.553	1.897*	0.691	4.058*	0.590
	(0.606)	(0.828)	(0.903)	(1.030)	(0.654)	(2.258)	(0.574)
Weight-for-age z-score	0.902*	0.961	0.458	0.203	1.054	1.150*	0.473
	(0.479)	(0.714)	(0.862)	(0.450)	(0.809)	(0.667)	(0.828)
Panel B: Health Utilization Outcomes							
Formal prenatal care	0.090	0.051	0.228	0.096	0.034	-0.133	0.204*
	(0.105)	(0.121)	(0.302)	(0.180)	(0.129)	(0.224)	(0.123)
Receipt of 4+ prenatal visits	0.092	0.189	0.209	-0.145	0.155	-0.151	0.312
	(0.159)	(0.176)	(0.392)	(0.271)	(0.190)	(0.367)	(0.221)
Month of first prenatal care	-1.603*	-1.959*	-1.749	-1.070	-1.479	-0.837	-1.814
	(0.850)	(1.060)	(2.324)	(1.427)	(1.135)	(1.626)	(1.283)
Delivery in a health facility	0.015	0.076	-0.039	-0.037	0.015	0.080	-0.042
	(0.091)	(0.078)	(0.316)	(0.170)	(0.095)	(0.226)	(0.107)
Delivery by health professionals	0.030	0.087	-0.038	0.023	0.002	0.144	-0.046
	(0.082)	(0.098)	(0.335)	(0.149)	(0.099)	(0.190)	(0.110)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. All models include all control variables in Table 3 and use treatment dummy as an instrument for a sample of women ages 18-29. Column (1) repeats the estimates in column (2) of Table 3.

Table 9: IV Estimates of Other Potential Mechanisms

Potential Mechanisms	IV (T) 18-29 (1)	IV (YOB) 18-29 (2)	IV (T) 18-25 (3)	IV (YOB) 18-25 (4)
Panel A: Husband Characteristics				
Husband Education	0.320	0.279	0.373	0.124
	(1.013)	(0.932)	(1.065)	(0.940)
Husband Completed Primary School	0.057	0.055	0.051	0.027
	(0.198)	(0.181)	(0.198)	(0.182)
Husband Occupation	-0.135	-0.054	-0.122	-0.039
(Agricultural Sector and No Work)	(0.138)	(0.138)	(0.158)	(0.154)
Panel B: Mothers Characteristics				
Ever Smoke	-0.173	-0.173	-0.136	-0.112
	(0.201)	(0.204)	(0.206)	(0.192)
Current Smoke	-0.310*	-0.298*	-0.274*	-0.217*
	(0.166)	(0.171)	(0.181)	(0.166)
Occupation	-0.300*	-0.164	-0.351**	-0.187
(Agricultural Sector and No Work)	(0.162)	(0.145)	(0.175)	(0.156)
Observations	1,677	1,677	927	927

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. Instrumental variables are discrete treatment dummy in models (1) and (3), and mother's year of birth dummies for those exposed to the CSL in models (2) and (4).

Appendix A. Effects With and Without Previous Births

	OLS 18-29 (1)	IV (T) 18-29 (2)	IV (YOB) 18-29 (3)	OLS 18-25 (4)	IV (T) 18-25 (5)	IV (YOB) 18-25 (6)	OLS 18-29 (7)	IV (T) 18-29 (8)	IV (YOB) 18-29 (9)	OLS 18-25 (10)	IV (T) 18-25 (11)	IV (YOB) 18-25 (12)
Panel A: Health Outcomes												
Very low birth weight	-0.039***	-0.166*	-0.167*	-0.038**	-0.174*	-0.184*	-0.042***	-0.179*	-0.188**	-0.041***	-0.196*	-0.198**
	(0.009)	(0.097)	(0.098)	(0.016)	(0.107)	(0.110)	(0.009)	(0.096)	(0.090)	(0.016)	(0.106)	(0.098)
Length of health facility stay	0.011	-1.788**	-1.114*	-0.153	-2.244**	-1.454**	0.040	-1.377**	-1.010*	-0.113	-1.903**	-1.343**
	(0.155)	(0.844)	(0.617)	(0.240)	(0.919)	(0.648)	(0.147)	(0.686)	(0.584)	(0.233)	(0.799)	(0.598)
Height-for-age z-score	0.226**	1.231**	1.095*	0.371**	1.489**	1.307**	0.253**	1.284**	1.144**	0.389**	1.469**	1.278**
	(0.104)	(0.606)	(0.598)	(0.164)	(0.660)	(0.653)	(0.103)	(0.587)	(0.579)	(0.166)	(0.631)	(0.619)
Weight-for-age z-score	0.164*	0.902*	0.717*	0.306**	1.017*	0.999*	0.181*	0.932**	0.754*	0.347***	1.109*	1.089**
	(0.093)	(0.479)	(0.420)	(0.122)	(0.604)	(0.563)	(0.096)	(0.465)	(0.412)	(0.124)	(0.574)	(0.533)
Panel B: Health Utilization Outcomes												
Formal prenatal care	0.032**	0.090	0.065	0.033*	0.043	0.035	0.059***	0.203**	0.167**	0.061***	0.141	0.115
	(0.014)	(0.105)	(0.086)	(0.019)	(0.110)	(0.087)	(0.015)	(0.095)	(0.081)	(0.021)	(0.103)	(0.084)
Receipt of 4+ prenatal visits	0.096***	0.092	0.061	0.073*	0.111	0.137	0.135***	0.266*	0.182	0.114***	0.251	0.138
	(0.023)	(0.159)	(0.141)	(0.037)	(0.179)	(0.144)	(0.023)	(0.149)	(0.136)	(0.038)	(0.164)	(0.145)
Month of first prenatal care	-0.746***	-1.603*	-1.635**	-0.787***	-1.821*	-1.495*	-1.026***	-2.732***	-1.965***	-1.103***	-2.313**	-1.560*
	(0.151)	(0.850)	(0.737)	(0.191)	(0.935)	(0.810)	(0.154)	(0.840)	(0.739)	(0.219)	(0.903)	(0.802)
Delivery in a health facility	0.002	0.015	0.079	-0.008	0.033	0.085	0.026	0.122	0.101	0.018	0.122	0.135
	(0.017)	(0.091)	(0.084)	(0.025)	(0.109)	(0.092)	(0.016)	(0.078)	(0.078)	(0.024)	(0.097)	(0.088)
Delivery by health professionals	0.002	0.030	0.075	-0.006	0.037	0.076	0.023	0.121	0.117	0.019	0.122	0.134
	(0.015)	(0.082)	(0.079)	(0.022)	(0.098)	(0.090)	(0.015)	(0.075)	(0.072)	(0.022)	(0.086)	(0.082)
Previous Births	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Observations	1,677	1,677	1,677	927	927	927	1,677	1,677	1,677	927	927	927

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. All models include individual- and community-level variables, and interactions between the mother's year of birth dummies and the number of primary school aged children in the province of mother's birth (in 1995) as well as interactions between the mother's year of birth dummies and enrollment rates in the province of mother's birth (in 1995). Instrumental variables are discrete treatment dummy in models (2), (5), (8), and (11), and mother's year of birth dummies for those exposed to the CSL in models (3), (6), (9), and (12). Models (1)-(3) and (7)-(9) contain 1,616, 1,519, 1,177, and 1,243 observations, and models (4)-(6) and (10)-(12) contain 891, 836, 643, and 707 observations for VLBW, length of stay, HAZ, and WAZ outcomes, respectively. Health utilization models contain 1,677 for the sample of females ages 18-29 and 927 observations for the sample of females ages 18-25.

Appendix B. The Effect of the CSL on Outcome Variables

	Dependent Variable				
	VLBW	Length of facility stay	HAZ	WAZ	Month of first prenatal care
	(1)	(2)	(3)	(4)	(5)
Panel A: Women Aged 7-10 to 11-14 in 1997					
Treatment dummy for women ages 7 to 10 in 1997	-0.076**	-0.777**	0.608***	0.407*	-1.316***
	(0.037)	(0.320)	(0.203)	(0.229)	(0.481)
Observations	891	836	643	707	927
Panel B: Women Aged 11-14 to 15-18 in 1997					
Treatment dummy for women ages 11 to 14 in 1997	-0.002	-0.034	-0.017	-0.015	-0.042
	(0.022)	(0.200)	(0.142)	(0.120)	(0.309)
Observations	1363	1280	995	1063	1416

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. All models include individual- and community-level variables, and interactions between the mother's year of birth dummies and the number of primary school aged children in the province of mother's birth (in 1995) as well as interactions between the mother's year of birth dummies and enrollment rates in the province of mother's birth (in 1995). The DID estimate can be simply determined by subtracting the estimate in Panel B from the estimate in Panel A.

Appendix C. Effect of Maternal Education on Different Measures of Birth Weight

	Goodness-of-Fit of the OLS Regression (R-square Statistics)			
Dependent Variable:	VLBW	Log (Birth Weight)	Birth Weight	Low Birth Weight
Primary School Completion	0.1768	0.1612	0.1425	0.1195

	Effects of Maternal Education				
	All births		First births		
	OLS	IV	OLS	IV	IV
	18-29	18-29	18-29	18-29	18-29
	(1)	(2)	(3)	(4)	(5)
VLBW (<1500)	-0.039***	-0.167*	-0.017*	-0.068*	-0.095*
	(0.009)	(0.098)	(0.010)	(0.041)	(0.055)
Log (Birth weight)	0.072***	0.221*	0.060***	0.147*	0.193*
	(0.015)	(0.130)	(0.015)	(0.086)	(0.105)
Birth Weight	166.635***	440.948	152.988***	391.557*	559.670*
	(37.571)	(302.017)	(38.035)	(228.527)	(287.135)
Low Birth Weight (<2500)	-0.067***	-0.106	-0.091***	-0.087	-0.119
	(0.019)	(0.155)	(0.025)	(0.133)	(0.148)
Sample Selection Correction	No	No	No	No	Yes
Observations	1616	1616	711	711	711

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. All models include individual- and community-level variables, and interactions between the mother's year of birth dummies and the number of primary school aged children in the province of mother's birth (in 1995) as well as interactions between the mother's year of birth dummies and enrollment rates in the province of mother's birth (in 1995). Instrumental variables are mother's year of birth dummies for those exposed to the CSL.

Appendix D. Effect of Maternal Education with Heterogeneous Treatment Effects

	IV 18-29 (1)	IV 18-29 (2)	IV 18-29 (3)	IV 18-29 (4)	IV 18-29 (5)
	Instrument: Treatment	Instrument: Treatment	Instrument: Treatment	Instrument: Treatment*ME	Instrument: Treatment*FE
Panel A: Health Outcomes					
Very low birth weight	-0.166*	-0.171*	-0.171*	-0.150*	-0.154*
	(0.097)	(0.101)	(0.100)	(0.091)	(0.090)
Length of health facility stay	-1.788**	-1.955**	-2.069**	-1.632*	-2.145**
	(0.844)	(0.965)	(0.847)	(0.844)	(0.868)
Height-for-age z-score	1.231**	1.232*	1.412*	1.454**	1.215**
	(0.606)	(0.680)	(0.640)	(0.593)	(0.549)
Weight-for-age z-score	0.902*	0.961*	0.788*	1.240**	0.645*
	(0.479)	(0.530)	(0.475)	(0.546)	(0.391)
Panel B: Health Utilization Outcomes					
Formal prenatal care	0.090	0.077	0.097	0.101	0.092
	(0.105)	(0.118)	(0.101)	(0.094)	(0.093)
Receipt of 4+ prenatal visits	0.092	0.105	0.060	0.060	0.122
	(0.159)	(0.174)	(0.158)	(0.148)	(0.143)
Prenatal care initiation	-1.603*	-1.585*	-1.438*	-1.698**	-2.018**
	(0.850)	(0.905)	(0.849)	(0.849)	(0.870)
Delivery in a health facility	0.015	0.008	0.005	0.050	0.020
	(0.091)	(0.101)	(0.109)	(0.058)	(0.078)
Delivery by health professionals	0.030	0.034	0.000	0.092	0.058
	(0.082)	(0.090)	(0.082)	(0.061)	(0.072)
Controls:					
Mother's Education Dummies	No	Yes	No	Yes	No
Father's Education Dummies	No	No	Yes	No	Yes
Observations	1,677	1,664	1,598	1,664	1,598

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors (reported in parentheses) are adjusted for clustering on the province of mother's birth. Observation numbers change due to missing values. Instruments in column (4) are treatment dummy and the treatment dummy interacted with mother's education dummies, and instruments in column (5) are treatment dummy and the treatment dummy interacted with father's education dummies. See columns 2-3 of Table 7 for the first-stage estimations.