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**Darwin Cortés**

**Clara Jimenez**

**Ivonne Lara**

**Paul Rodríguez**

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# When Partial Liberalization Saves Lives: The Impact of Colombia's 2006 Abortion Reform on Neonatal Health

Darwin Cortés<sup>\*</sup> Clara Jimenez<sup>†</sup> Ivonne Lara<sup>‡</sup> Paul Rodriguez<sup>§</sup>

Pilar Torres<sup>¶</sup>

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## Abstract

This paper examines the effects of abortion liberalization on newborn health outcomes in a middle-income country context. We exploit Colombia's 2006 Constitutional Court ruling (C-355), which partially decriminalized abortion in three circumstances: risk to the mother's health, fetal inviability, and pregnancies resulting from sexual violence, as a quasi-natural experiment. Using a difference-in-differences design with administrative data on all live births, we estimate the causal impact of this reform on key neonatal health indicators, including birth weight, gestational age, and APGAR scores. We find that the partial liberalization led to significant improvements in newborn health, particularly among younger and socially vulnerable mothers. The results suggest that expanded legal access to abortion reduced the incidence of high-risk pregnancies and improved the composition of births, consistent with maternal

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<sup>\*</sup>*Corresponding Author*, Universidad del Rosario. E-mail: [darwin.cortes@urosario.edu.co](mailto:darwin.cortes@urosario.edu.co).

<sup>†</sup>Universitat de València. E-mail: [clajigon@alumni.uv.es](mailto:clajigon@alumni.uv.es).

<sup>‡</sup>Universidad del Rosario. E-mail: [ivonne.lara@urosario.edu.co](mailto:ivonne.lara@urosario.edu.co).

<sup>§</sup>Universidad del Rosario. E-mail: [paul.rodriguez@urosario.edu.co](mailto:paul.rodriguez@urosario.edu.co).

<sup>¶</sup>Universidad del Rosario. E-mail: [pilar.torres@urosario.edu.co](mailto:pilar.torres@urosario.edu.co).

selection mechanisms observed in the United States and other high-income settings. These effects are robust to alternative specifications and concentrated in areas with greater hospital availability, indicating that institutional capacity mediated the reform's health benefits. Our findings contribute to the global evidence that liberalizing abortion laws can improve both maternal and neonatal health, even when reforms are partial and implemented within constrained health systems. They highlight that legal access, combined with adequate service delivery, can yield measurable population-level gains in newborn survival and equity in reproductive health.

**Keywords:** Abortion reform; Neonatal health; Maternal selection; Difference-in-differences; Colombia; Reproductive health policy.

**JEL Codes:** I14 (Health and Inequality); J13 (Fertility, Family Planning, and Children); K38 (Human Rights Law); O54 (Latin America).

## 1 Introduction

Access to safe abortion services remains one of the most debated public health and human rights issues worldwide. Restrictive abortion laws have been linked to higher rates of unsafe procedures, maternal morbidity, and preventable deaths, particularly in low- and middle-income countries (LMICs). In 2006, Colombia took a landmark step in reforming its legal framework through the Constitutional Court's ruling *C-355*, which decriminalized abortion in three specific circumstances: when the pregnancy results from rape, when the fetus has malformations incompatible with life, and when the continuation of pregnancy endangers the woman's health or life. This partial decriminalization transformed the institutional landscape of reproductive health, prompting questions about how improved access to legal abortion services may have affected the health outcomes of newborns.

A growing body of evidence shows that restrictive abortion laws are consistently associated with adverse consequences for women's and newborns' health, while liberalization improves outcomes through changes in fertility, maternal selection, and access to health

care. Early evidence from the United States shows that state-level restrictions on minors' access to abortion reduced abortion rates but led to delayed procedures and increased interstate travel for care (Haas-Wilson, 1996). Likewise, limiting public funding for abortion under Medicaid increased the number of births and lowered birth weight among affected populations (Currie et al., 1996). In contrast, the legalization of abortion was associated with better socioeconomic and child health outcomes, as demonstrated by Gruber et al. (1999) and Ananat et al. (2009), who identified long-term improvements in the circumstances of the "marginal child." Recent analyses of targeted regulation laws (TRAP) confirm that restrictive measures raise adolescent fertility and reduce educational attainment (Jones and Pineda-Torres, 2021).

More recent research links these behavioral and socioeconomic mechanisms to direct effects on neonatal and infant health. Following Texas's 2021 near-total abortion ban, infant deaths rose by 12.9% (255 additional deaths), with a notable increase in deaths due to congenital anomalies (Gemmill et al., 2024). Similar patterns have been documented elsewhere in the United States: gestational-age-limit abortion laws were associated with 0.23 excess infant deaths per 1,000 live births (Karletsos et al., 2021), and restrictive legislation has also been linked to widening health inequalities. In particular, Adkins et al. (2025) show that maternal morbidity increased by 15% among foreign-born women in states with restrictive abortion access, underscoring how abortion bans exacerbate preexisting socioeconomic and demographic disparities. Beyond the U.S., a total abortion ban in the Dominican Republic led to an additional 6.3 neonatal deaths per 1,000 live births (Ishola et al., 2025). In contrast, countries that have implemented legal abortion reforms, such as Mozambique, observed short-term challenges followed by improvements in neonatal survival once safe and accessible services became available (Ishola et al., 2024).

Evidence from LMICs further suggests that liberalizing abortion laws improves maternal and, in some cases, newborn health, while restrictive laws exacerbate risks of unsafe abortion, maternal mortality, and neonatal deaths (Ishola et al., 2021; Ngo et al., 2021; Allotey et al., 2020). Reforms in Nepal and similar contexts reduced septic abortions by 40% and serious complications by 30%, demonstrating the potential health benefits of legal access (Arroyave, 2018). However, even where abortion is legal, barriers such as

stigma, lack of provider training, cost, and limited service availability, particularly in rural areas, continue to constrain access and perpetuate inequalities (Arroyave, 2018; Allotey et al., 2020; Marthias et al., 2025). These disparities in reproductive, maternal, and newborn health coverage underscore that legal reform alone is insufficient without effective implementation and equitable health infrastructure (Ishola et al., 2024; Hall et al., 2023).

In Latin America, where most countries still maintain restrictive abortion laws, the consequences for women and newborns have been severe. The region faces some of the world's highest rates of unsafe abortion and related health inequities. A total abortion ban in the Dominican Republic increased neonatal deaths by 6.3 per 1,000 live births and reduced modern contraceptive use, with the largest effects among poorer, rural, and less-educated populations (Ishola et al., 2025). In Brazil, despite strict legal limits, approximately 500,000 illegal abortions occur annually, leading to high rates of complications and preventable maternal deaths (Malta et al., 2019; Galli, 2020). The Zika epidemic further exposed these inequities, as most countries failed to relax abortion restrictions even in the face of severe fetal anomalies (Carabali et al., 2018). Where reforms have occurred, such as in Mexico City, decriminalization of early-term abortion led to substantial declines in maternal morbidity, particularly from early pregnancy complications (Clarke and Mührlad, 2020). However, regional implementation remains limited and uneven, hindered by stigma, lack of services, and fear of prosecution (Gialdini et al., 2024; Galli, 2020). In Uruguay, where abortion was legalized in 2012, Antón et al. (2022) find a decline in births, particularly among adolescents, and modest improvements in newborn health indicators.

Beyond Latin America, studies in high-income settings demonstrate that liberalization can improve both maternal and newborn health outcomes through better maternal selection into childbirth and delayed fertility. Joyce (1987) found that induced abortion access improved birth outcomes among Black and White women in the United States, while Ananat et al. (2009) and Myers (2017) documented long-term gains in child health and socioeconomic conditions. Complementing these findings in a European context, González et al. (2025) show that access to legal abortion reduced early fertility and marriage while improving women's education and labor market outcomes. Together, this evidence under-

scores that restrictions not only heighten maternal risk but also worsen neonatal survival, while effective liberalization can generate intergenerational health benefits (Clarke and Mühlrad, 2020).

Despite this growing evidence base, the causal effects of partial abortion liberalization on newborn health in Latin America remain underexplored. Most research has focused on maternal outcomes, with little empirical evidence on how legal reforms shape neonatal health, particularly in settings with large spatial inequalities in health infrastructure. Colombia provides a valuable case study: it represents one of the earliest partial liberalizations of abortion in the region and exhibits substantial heterogeneity in hospital availability, socioeconomic conditions, and implementation capacity.

This paper examines how the partial decriminalization of abortion in 2006 affected indicators of newborn health in Colombia. We combine administrative data on live births with detailed geographic information on hospital availability to estimate a difference-in-differences model that compares municipalities with varying proximity to hospitals before and after the reform. Specifically, we classify municipalities according to whether they had at least four hospitals within a 20-kilometer radius as of 2006, and analyze outcomes such as birth rates, low birth weight, and the proportion of newborns with an APGAR score above seven. We further explore heterogeneity by maternal age (all mothers, adolescents aged 10–14 and 15–19, and adults aged 20 and older) and by municipal poverty levels.

Our findings indicate that the decriminalization was associated with a decline in birth rates and improvements in some newborn health outcomes, particularly in municipalities with better access to hospitals. The effects are stronger among teenage mothers and in poorer municipalities, suggesting that legal reforms interacted with local health capacity to shape both fertility and child health. The results contribute to the growing evidence that reproductive rights policies have far-reaching consequences beyond maternal outcomes, influencing the health and wellbeing of the next generation.

The rest of the paper is organized as follows. Section 2 describes the institutional background and data sources. Section 3 outlines the empirical strategy. Section 4 presents the results. Finally, section 5 and 6 present the discussion and conclusions.

## 2 Context: The 2006 Abortion Reform in Colombia

In 2006, Colombia's Constitutional Court issued Ruling *C-355*, which partially decriminalized abortion for the first time in the country's history. Before this decision, abortion was criminalized under all circumstances and subject to penalties of one to three years in prison for women and providers. The Court's ruling introduced three specific exceptions: (i) when pregnancy poses a risk to the life or physical or mental health of the woman; (ii) when severe fetal malformations make extrauterine life nonviable; and (iii) when the pregnancy results from rape, incest, or non-consensual insemination. In all other cases, abortion remained illegal, and the ruling did not establish abortion on request.

The decision in *C-355* followed years of legal and social mobilization by feminist and health advocacy organizations, supported by international human rights frameworks such as the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW). Importantly, the ruling did not automatically translate into widespread access to abortion services. Implementation was delegated to the Ministry of Health and the network of public and private health care providers, which were required to ensure availability of the procedure under the three legal exceptions.

Access to legal abortion remained highly heterogeneous across regions and over time. Urban areas with larger hospital networks and higher shares of public insurance affiliates were able to provide services more quickly, while rural and conservative regions experienced significant barriers, including institutional conscientious objection, limited provider training, and bureaucratic delays. Consequently, the reform's effects likely varied according to local health system capacity and the degree of effective access.

The timing of the reform and its differential implementation offer a natural setting to study the causal effects of abortion liberalization on newborn health. The ruling created a sharp policy discontinuity in 2006 but left most of the health system infrastructure, population composition, and reproductive policies unchanged. This context allows us to interpret observed improvements in neonatal outcomes as plausibly driven by the reform's selective impact on high-risk pregnancies rather than broader socioeconomic changes.

## 3 Methods

This section describes the data sources, key variables, and empirical strategy used to estimate the causal impact of the 2006 partial abortion decriminalization on newborn health in Colombia. We exploit the timing of the Constitutional Court’s ruling C-355 and the spatial heterogeneity in access to health facilities providing obstetric care to identify the effects of increased legal access to abortion on neonatal outcomes.

### 3.1 Data

We combine multiple administrative datasets at the municipal level from 2000 to 2012. The primary source is the National Vital Statistics System (*Departamento Administrativo Nacional de Estadística*, DANE), which records all registered live births and includes information on birth outcomes such as birth weight, gestational age, and APGAR scores. Demographic and socioeconomic characteristics are drawn from the 2005 Population Census and the National Planning Department’s (*Departamento Nacional de Planeación*, DNP) social indicators. Data on health infrastructure come from the Ministry of Health’s registry of hospitals and health centers.

Our key treatment variable measures whether a municipality had at least four hospitals within a 20-kilometer radius as of 2006. This variable proxies local capacity to implement the reform and provide legal abortion services under the newly defined exceptions. Municipalities with greater hospital density are expected to experience faster and more effective implementation.

Table 1 presents descriptive statistics for the main outcomes and control variables. On average, the birth rate is 13.9 per 1,000 inhabitants, 2.6% of newborns weigh less than 2.5 kilograms, and approximately 91.7% have an APGAR score of seven or higher. There is substantial heterogeneity across municipalities, reflecting differences in health infrastructure, socioeconomic conditions, and population size.

TABLE 1: Descriptive Statistics

Variable	Observations	Mean	Stan. dev.	Minimum	Maximum
	(1)	(2)	(3)	(4)	(5)
<b>Treatment</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	21,340	0.40	0.49	0.00	1.00
<b>Outcomes</b>					
Birth Rate	21,340	13.94	5.13	0.10	52.22
Birth Weight ( $\leq 2.5kg$ )	20,848	2.60	1.32	0.00	9.61
APGAR ( $\geq 7$ )	21,340	0.92	0.12	0.00	1.00

**Notes:** The following columns present the corresponding information (1) the number of observations for each variable; (2) the variable mean; (3) the variable standard deviation; (4) the variable minimum value; and (5) the variable maximum value. **Birth Rate** refers to the infant birth rate and is measured as the total number of births over the total population, multiplied by 1000. **Birth Weight** ( $\leq 2.5kg$ ) refers to the natural logarithm of the total number of newborns weighing less than or equal to the range of 2,500g - 2,999g. **APGAR** ( $\geq 7$ ) it's a proportion of the newborns with an APGAR greater than or equal to 7, it's obtained by dividing the total of newborns with the APGAR score previously mentioned over the total number of newborns. **Hosp. at 20km from 2006** ( $\geq 4$ ) is a dummy variable that takes the value of 1 if for the years 2006 and forward, there are at least four hospitals in a 20km range on the municipality.

### 3.2 Empirical strategy

We estimate a difference-in-differences (DiD) model that compares changes in newborn health outcomes before and after the 2006 reform between municipalities with high and low health service availability. The main estimating equation is as follows:

$$\begin{aligned}
 Y_{it} = & \alpha + \beta(Hosp20km_i \times Time_t) + \gamma_t + \phi_i + \theta Pob_{it} \\
 & + \sum_{d=1}^n \mu_d(IPM2005_i \times d.year_t) \\
 & + \sum_{j=1}^m \sum_{d=1}^n \lambda_d^j(X_i^j \times d.year_t) + \varepsilon_{it}
 \end{aligned} \tag{1}$$

where  $Y_{it}$  denotes the newborn health outcome (e.g., low birth weight or APGAR score) for municipality  $i$  in year  $t$ . The coefficient of interest,  $\beta$ , captures the average effect of abortion liberalization in areas with higher health system capacity ( $Hosp20km_i = 1$ ) after the reform ( $Time_t = 1$ ). The model includes municipality fixed effects ( $\phi_i$ ), year fixed effects ( $\gamma_t$ ), and interactions between pre-reform socioeconomic characteristics and time

dummies to control for differential trends. Standard errors are clustered at the municipal level.

This specification isolates the reform's differential impact across municipalities, under the assumption that in the absence of the reform, trends in neonatal outcomes would have evolved similarly across treated and control areas. In robustness checks, we include municipality-specific time trends and alternative definitions of hospital access to confirm the stability of the estimated effects.

## 4 Results

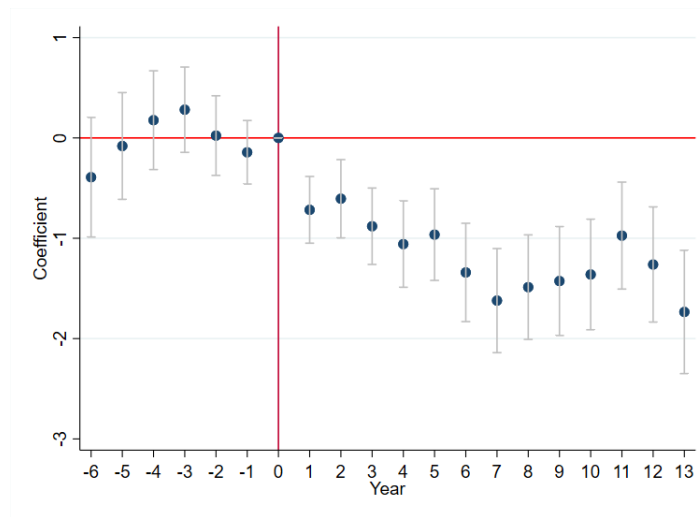
### 4.1 Event Study Analysis

We begin by examining the dynamic effects of the 2006 abortion reform through event study designs. Figures 1, 2, and 3 present the estimated coefficients from our event study specification, plotting the differential trends between municipalities with high hospital availability (at least four hospitals within 20 kilometers) and those with lower availability, relative to the year before the reform.

Figure 1 displays the effects on the overall birth rate. The pre-reform coefficients fluctuate around zero and show no systematic trend, supporting the parallel trends assumption underlying our difference-in-differences design. Following the 2006 reform, we observe a clear decline in birth rates in municipalities with greater hospital availability. The effect becomes statistically significant starting in year 2 after the reform and persists throughout the post-reform period, reaching approximately -1.5 to -2.0 births per 1,000 inhabitants by the end of the observation window. This pattern suggests that increased access to legal abortion services led to a sustained reduction in fertility, consistent with expanded reproductive choice.

Figure 2 shows the corresponding effects on the incidence of low birth weight (newborns weighing 2.5 kg or less). Again, pre-reform trends appear parallel between treatment and control municipalities, with coefficients clustering around zero. After 2006, we observe a progressive decline in low birth weight incidence in municipalities with better

FIGURE 1: Birth Rate and hospitals in 20km ( $\geq 4$ )



hospital access. The effect intensifies over time, reaching coefficients between -0.15 and -0.25 by the later years of the study period. This reduction in low birth weight suggests that the reform improved the health composition of births, likely by reducing the proportion of high-risk pregnancies carried to term.

FIGURE 2: Birth Weight of the newborn and hospitals in 20km ( $\geq 4$ )

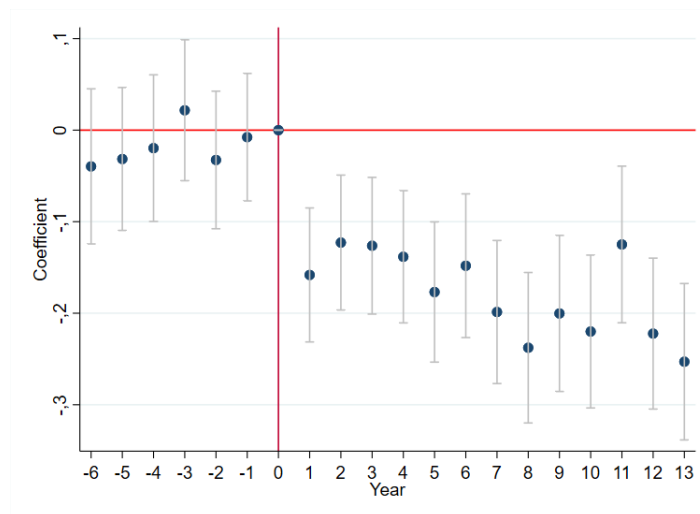
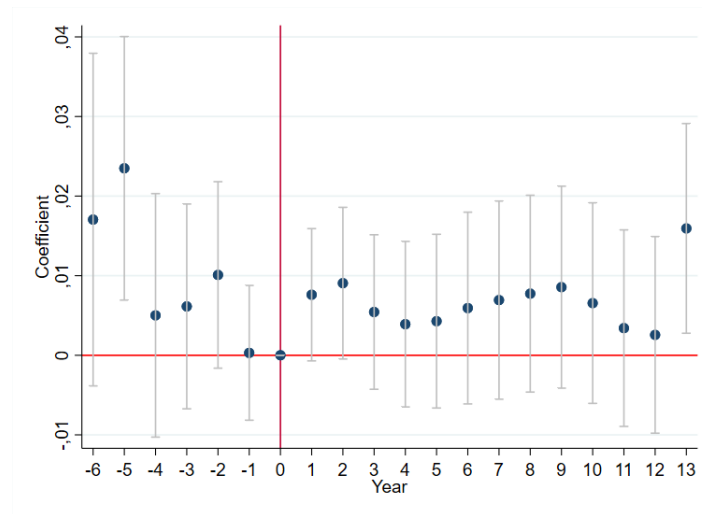


Figure 3 presents the event study results for the proportion of newborns with an APGAR score of 7 or above, a key indicator of neonatal health at birth. The pre-reform coefficients are relatively stable and statistically indistinguishable from zero, again supporting parallel trends. The post-reform pattern is more nuanced than for the previous

outcomes: coefficients remain close to zero or show small, statistically insignificant effects. This finding suggests that while the reform reduced births and improved birth weight distributions, its effects on immediate neonatal vitality as measured by APGAR scores were limited or required longer time horizons to materialize.

FIGURE 3: APGAR of the newborn and hospitals in 20km ( $\geq 4$ )



Taken together, the event study results provide strong visual evidence that the abortion reform differentially affected municipalities based on their health service capacity. The absence of pre-trends and the timing of effects coinciding with the 2006 policy change lend credibility to a causal interpretation of our findings.

## 4.2 Regression Analysis

Table 2 presents our main difference-in-differences estimates of the reform’s impact on birth rates and newborn health outcomes. We report results from three progressively saturated specifications: column (1) includes municipality and time fixed effects; column (2) adds population controls; and column (3) incorporates the multidimensional poverty index (IPM) to account for differential trends by socioeconomic status.

**Birth Rate Effects** The reform led to significant reductions in birth rates across all specifications. In our preferred specification (column 3), municipalities with at least four hospitals within 20 kilometers experienced a decline of 1.08 births per 1,000 inhabitants

relative to municipalities with fewer hospitals ( $p < 0.01$ ). This represents approximately an 8% reduction relative to the sample mean of 13.9 births per 1,000.

The effects are heterogeneous across maternal age groups. Among very young mothers (aged 10–14), the estimated effect is -0.116 but not statistically significant, likely reflecting the small number of births in this age group and limited statistical power. For adolescent mothers aged 15–19, the effect is substantial: a reduction of 3.06 births per 1,000 ( $p < 0.05$ ), representing approximately a 44% decline relative to the adolescent birth rate. Among adult mothers (aged 20 and above), the reform reduced birth rates by 3.76 per 1,000 ( $p < 0.01$ ). These patterns suggest that the reform had particularly strong effects on adolescent fertility, consistent with evidence that younger women face higher barriers to accessing reproductive healthcare and may have benefited disproportionately from expanded legal access.

**Birth Weight Effects** The reform also improved newborn health as measured by reductions in the logarithm of low birth weight cases. In column (3), municipalities with greater hospital availability experienced a 0.148 reduction in the log count of low birth weight births ( $p < 0.01$ ). This effect is driven primarily by adolescent and adult mothers. Among mothers aged 15–19, the coefficient is -0.107 ( $p < 0.01$ ), while for mothers aged 20 and older, it is -0.125 ( $p < 0.01$ ). The effect for the youngest mothers (aged 10–14) is smaller and not statistically significant (-0.038), again reflecting limited sample size in this subgroup.

These results indicate that the reform not only reduced the number of births but also improved the health composition of remaining births. This pattern is consistent with a selection mechanism whereby the availability of legal abortion allowed women facing high-risk pregnancies to avoid carrying them to term, thereby improving average neonatal health outcomes among live births.

TABLE 2: Regression Analysis

Dependent variables	(1)	(2)	(3)
<b>Birth Rate</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-1.761*** (0.242)	-1.760*** (0.243)	-1.080*** (0.242)
Observations	21,340	21,340	21,340
R-squared	0.297	0.297	0.324
<b>Birth Rate (TM10 – 14)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.407*** (0.112)	-0.404*** (0.112)	-0.116 (0.111)
Observations	15,463	15,463	15,463
R-squared	0.008	0.008	0.017
<b>Birth Rate (TM15 – 19)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-6.890*** (1.366)	-6.890*** (1.367)	-3.059** (1.389)
Observations	21,301	21,301	21,301
R-squared	0.122	0.122	0.146
<b>Birth Rate (<math>\geq 20</math>)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-5.430*** (0.869)	-5.472*** (0.869)	-3.758*** (0.895)
Observations	21,338	21,338	21,338
R-squared	0.353	0.354	0.367
<b>Birth Weight (<math>\leq 2.5kg</math>)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.200*** (0.024)	-0.202*** (0.024)	-0.148*** (0.025)
Observations	20,848	20,848	20,848
R-squared	0.023	0.024	0.036
<b>Birth Weight (<math>\leq 2.5kg</math>)(TM10 – 14)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.068** (0.032)	-0.068** (0.033)	-0.038 (0.033)
Observations	5,681	5,681	5,681
R-squared	0.016	0.016	0.025
<b>Birth Weight (<math>\leq 2.5kg</math>)(TM15 – 19)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.147*** (0.023)	-0.147*** (0.023)	-0.107*** (0.025)
Observations	18,197	18,197	18,197
R-squared	0.016	0.017	0.027
<b>Birth Weight (<math>\leq 2.5kg</math>)(<math>\geq 20</math>)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.174*** (0.024)	-0.176*** (0.024)	-0.125*** (0.025)
Observations	20,449	20,449	20,449
R-squared	0.016	0.016	0.025

Dependent variables	(1)	(2)	(3)
<b>APGAR (<math>\geq 7</math>)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.032*** ( 0.006)	-0.031*** ( 0.006)	-0.004 ( 0.006)
Observations	21,340	21,340	21,340
R-squared	0.391	0.392	0.433
<b>APGAR (<math>\geq 7</math>)(TM10 – 14)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.035*** ( 0.008)	-0.035*** ( 0.008)	-0.016* ( 0.009)
Observations	15,463	15,463	15,463
R-squared	0.081	0.081	0.087
<b>APGAR (<math>\geq 7</math>)(TM15 – 19)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.028*** ( 0.006)	-0.028*** ( 0.006)	-0.003 ( 0.006)
Observations	21,301	21,301	21,301
R-squared	0.287	0.288	0.317
<b>APGAR (<math>\geq 7</math>)(<math>\geq 20</math>)</b>			
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.031*** ( 0.006)	-0.030*** ( 0.006)	-0.004 ( 0.006)
Observations	21,338	21,338	21,338
R-squared	0.366	0.367	0.407
Municipality fixed-effects	✓	✓	✓
Time fixed-effects	✓	✓	✓
Population		✓	✓
IPM			✓

**Notes:** The following columns present the results of the regression analysis. The checks at the bottom show what components were considered in each regression, these include municipality fixed-effects, time fixed-effects in years, population and multidimensional poverty index (IPM by its acronym in Spanish) for every municipality each year. **Birth Rate** refers to the infant birth rate and is measured as the total number of births over the total population, multiplied by 1000. **Birth Weight** ( $\leq 2.5kg$ ) refers to the natural logarithm of the total number of newborns weighing less than or equal to the range of 2,500g - 2,999g. **APGAR ( $\geq 7$ )** it's a proportion of the newborns with an APGAR greater than or equal to 7, it's obtained by dividing the total of newborns with the APGAR score previously mentioned over the total number of newborns. **Hosp. at 20km from 2006 ( $\geq 4$ )** is a dummy variable that takes the value of 1 if for the years 2006 and forward, there are at least four hospitals in a 20km range on the municipality. **(TM)** stands for Teenage Mothers, the variables with this signaling were calculated for the total population of mothers between 10 and 14 years of age or between 15 and 19 years of age. Variables with the signaling ( $\geq 20$ ) were calculated for the total population of mothers over 20 years of age. Standard errors in parentheses (\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ )

**APGAR Score Effects** The effects on APGAR scores, an indicator of neonatal health immediately after birth, are mixed. In the baseline specification (column 1), municipalities with greater hospital access show a reduction in the proportion of newborns with APGAR

$\geq 7$  (-0.032,  $p < 0.01$ ). However, once we control for population and socioeconomic factors in column (3), this effect becomes small and statistically insignificant (-0.004).

When examining results by maternal age, we find that among the youngest mothers (aged 10–14), there remains a marginally significant reduction in high APGAR scores (-0.016,  $p < 0.1$ ) even in the most saturated specification. For older age groups, the effects are essentially zero and not statistically significant. The negative point estimates in the less-saturated specifications may reflect changes in the composition of births or reporting practices rather than true declines in neonatal health.

### 4.3 Robustness Analysis

Table 3 reports robustness checks that progressively add controls for mothers' social security system affiliation and parental education levels. Across all outcomes, our main findings remain qualitatively and quantitatively similar to those in Table 2.

The estimated effects on birth rates are consistently negative and statistically significant across all specifications, ranging from -1.08 to -1.12 births per 1,000 for the overall sample. The effects on adolescent birth rates (aged 15–19) remain statistically significant at the 5% level in all specifications, with coefficients between -2.80 and -3.06. Similarly, effects on adult birth rates (aged 20+) are stable across specifications, ranging from -3.48 to -3.76.

The robustness of the birth weight results is equally strong. The estimated reduction in low birth weight remains statistically significant across all specifications for the overall sample and for mothers aged 15 and older. Point estimates range from -0.123 to -0.148 for the full sample.

TABLE 3: Robustness análisis

Dependent variables	(1)	(2)	(3)	(4)	(5)
<b>Birth Rate</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-1.080*** (0.242)	-1.101*** (0.247)	-1.028*** (0.237)	-1.041*** (0.234)	-1.123*** (0.238)
Observations	21,340	21,340	21,340	21,340	21,340
R-squared	0.324	0.326	0.345	0.359	0.362
<b>Birth Rate (TM10 – 14)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.116 (0.111)	-0.127 (0.112)	-0.105 (0.110)	-0.117 (0.109)	-0.133 (0.111)
Observations	15,463	15,463	15,463	15,463	15,463
R-squared	0.017	0.019	0.021	0.021	0.026
<b>Birth Rate (TM15 – 19)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-3.059** (1.389)	-2.802** (1.422)	-2.799** (1.361)	-2.888** (1.348)	-2.876** (1.384)
Observations	21,301	21,301	21,301	21,301	21,301
R-squared	0.146	0.148	0.161	0.167	0.170
<b>Birth Rate (<math>\geq 20</math>)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-3.758*** (0.895)	-3.484*** (0.928)	-3.578*** (0.876)	-3.622*** (0.860)	-3.561*** (0.895)
Observations	21,338	21,338	21,338	21,338	21,338
R-squared	0.367	0.370	0.384	0.395	0.396
<b>Birth Weight (<math>\leq 2.5kg</math>)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.148*** (0.025)	-0.123*** (0.025)	-0.144*** (0.025)	-0.145*** (0.024)	-0.125*** (0.025)
Observations	20,848	20,848	20,848	20,848	20,848
R-squared	0.036	0.047	0.047	0.051	0.060
<b>Birth Weight (<math>\leq 2.5kg</math>)(TM10 – 14)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.038 (0.033)	-0.040 (0.034)	-0.038 (0.033)	-0.039 (0.033)	-0.041 (0.034)
Observations	5,681	5,681	5,681	5,681	5,681
R-squared	0.025	0.033	0.031	0.030	0.042
<b>Birth Weight (<math>\leq 2.5kg</math>)(TM15 – 19)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.107*** (0.025)	-0.090*** (0.025)	-0.103*** (0.024)	-0.106*** (0.024)	-0.090*** (0.025)
Observations	18,197	18,197	18,197	18,197	18,197
R-squared	0.027	0.032	0.033	0.033	0.039
<b>Birth Weight (<math>\leq 2.5kg</math>)(<math>\geq 20</math>)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.125*** (0.025)	-0.102*** (0.025)	-0.121*** (0.025)	-0.122*** (0.024)	-0.104*** (0.025)
Observations	20,449	20,449	20,449	20,449	20,449
R-squared	0.025	0.032	0.034	0.039	0.045

Dependent variables	(1)	(2)	(3)	(4)	(5)
<b>APGAR (<math>\geq 7</math>)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.004 (0.006)	-0.006 (0.006)	-0.005 (0.006)	-0.004 (0.006)	-0.005 (0.006)
Observations	21,340	21,340	21,340	21,340	21,340
R-squared	0.433	0.436	0.435	0.436	0.439
<b>APGAR (<math>\geq 7</math>)(TM10 – 14)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.016* (0.009)	-0.018* (0.009)	-0.017* (0.009)	-0.016* (0.009)	-0.018* (0.009)
Observations	15,463	15,463	15,463	15,463	15,463
R-squared	0.087	0.089	0.089	0.089	0.093
<b>APGAR (<math>\geq 7</math>)(TM15 – 19)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.003 (0.006)	-0.006 (0.006)	-0.003 (0.006)	-0.003 (0.006)	-0.006 (0.006)
Observations	21,301	21,301	21,301	21,301	21,301
R-squared	0.317	0.321	0.319	0.319	0.325
<b>APGAR (<math>\geq 7</math>)(<math>\geq 20</math>)</b>					
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.004 (0.006)	-0.006 (0.006)	-0.004 (0.006)	-0.004 (0.006)	-0.006 (0.006)
Observations	21,338	21,338	21,338	21,338	21,338
R-squared	0.407	0.410	0.409	0.409	0.413
Municipality fixed-effects	✓	✓	✓	✓	✓
Time fixed-effects	✓	✓	✓	✓	✓
Population	✓	✓	✓	✓	✓
IPM	✓	✓	✓	✓	✓
Mother's SSSH		✓			✓
Mother's education			✓		✓
Father's education				✓	✓

**Notes:** The following columns present the results of the robustness analysis. The checks at the bottom show what components were considered in each regression, these include municipality fixed-effects, time fixed-effects in years, population and multidimensional poverty index (IPM) for every municipality each year, the mother's social security system in health (SSSH), the mother's and father's education level. **Birth Rate** refers to the infant birth rate and is measured as the total number of births over the total population, multiplied by 1000. **Birth Weight** ( $\leq 2.5kg$ ) refers to the natural logarithm of the total number of newborns weighing less than or equal to the range of 2,500g - 2,999g. **APGAR ( $\geq 7$ )** it's a proportion of the newborns with an APGAR greater than or equal to 7, it's obtained by dividing the total of newborns with the APGAR score previously mentioned over the total number of newborns. **Hosp. at 20km from 2006 ( $\geq 4$ )** is a dummy variable that takes the value of 1 if for the years 2006 and forward, there are at least four hospitals in a 20km range on the municipality. **(TM)** stands for Teenage Mothers, the variables with this signaling were calculated for the total population of mothers between 10 and 14 years of age or between 15 and 19 years of age. Variables with the signaling ( $\geq 20$ ) were calculated for the total population of mothers over 20 years of age. Standard errors in parentheses (\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ )

For APGAR scores, once socioeconomic controls are included, the effects are generally small and statistically insignificant for most groups. The exception is the youngest mothers

(aged 10–14), where a small negative effect persists (around -0.016 to -0.018,  $p < 0.1$ ).

#### **4.4 Heterogeneous Effects by Municipal Poverty Level**

Table 4 explores heterogeneity in treatment effects by splitting the sample into municipalities with high versus low multidimensional poverty levels (relative to the national average). Column (1) reports results for poorer municipalities ( $IPM \geq$  national average), while column (2) reports results for wealthier municipalities ( $IPM <$  national average).

The effects of the reform are substantially larger and more precisely estimated in poorer municipalities. In high-poverty areas, the overall birth rate declined by 2.09 per 1,000 ( $p < 0.01$ ), compared to a statistically insignificant effect of -0.18 in wealthier municipalities. Similarly, the birth rate among adolescent mothers aged 15-19 fell by 5.57 per 1,000 in poorer areas ( $p < 0.01$ ) but only by 2.11 (not significant) in wealthier areas. Adult birth rates (aged 20+) declined by 6.70 per 1,000 in high-poverty municipalities ( $p < 0.01$ ) compared to an insignificant -0.66 in low-poverty areas.

The heterogeneity in birth weight effects follows a similar pattern. In poorer municipalities, low birth weight incidence declined by 0.176 ( $p < 0.01$ ), compared to 0.087 ( $p < 0.01$ ) in wealthier areas. While both estimates are statistically significant, the effect size is approximately twice as large in high-poverty municipalities. This pattern holds for both adolescent and adult mothers, suggesting that the health benefits of the reform were more pronounced among socioeconomically disadvantaged populations.

TABLE 4: Regression analysis with heterogeneous effects

Dependent variables	High IPM (1)	Low IPM (2)
<b>Birth Rate</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-2.094*** ( 0.368)	-0.184 ( 0.305)
Observations	10,680	10,660
R-squared	0.157	0.499
<b>Birth Rate (TM10 – 14)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.138 ( 0.166)	-0.288** ( 0.145)
Observations	8,079	7,384
R-squared	0.018	0.007
<b>Birth Rate (TM15 – 19)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-5.568*** ( 2.076)	-2.106 ( 1.782)
Observations	10,667	10,634
R-squared	0.062	0.228
<b>Birth Rate (<math>\geq 20</math>)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-6.695*** ( 1.368)	-0.662 ( 1.031)
Observations	10,678	10,660
R-squared	0.235	0.530
<b>Birth Weight (<math>\leq 2.5kg</math>)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.176*** ( 0.035)	-0.087*** ( 0.032)
Observations	10,452	10,396
R-squared	0.055	0.036
<b>Birth Weight (<math>\leq 2.5kg</math>)(TM10 – 14)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.050 ( 0.042)	-0.035 ( 0.052)
Observations	2,745	2,936
R-squared	0.044	0.018
<b>Birth Weight (<math>\leq 2.5kg</math>)(TM15 – 19)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.131*** ( 0.035)	-0.045 ( 0.031)
Observations	9,193	9,004
R-squared	0.037	0.026
<b>Birth Weight (<math>\leq 2.5kg</math>)(<math>\geq 20</math>)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.135*** ( 0.036)	-0.078** ( 0.032)
Observations	10,257	10,192
R-squared	0.041	0.025

<b>Dependent variables</b>	<b>(1)</b>	<b>(2)</b>
<b>APGAR (<math>\geq 7</math>)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.015 ( 0.010)	-0.013* ( 0.007)
Observations	10,680	10,660
R-squared	0.424	0.406
<b>APGAR (<math>\geq 7</math>)(TM10 – 14)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.031** ( 0.014)	-0.014 ( 0.011)
Observations	8,079	7,384
R-squared	0.097	0.066
<b>APGAR (<math>\geq 7</math>)(TM15 – 19)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.016* ( 0.009)	-0.007 ( 0.007)
Observations	10,667	10,634
R-squared	0.330	0.255
<b>APGAR (<math>\geq 7</math>)(<math>\geq 20</math>)</b>		
Hosp. at 20km from 2006 ( $\geq 4$ )	-0.015 ( 0.010)	-0.011 ( 0.007)
Observations	10,678	10,660
R-squared	0.397	0.385
Municipality fixed-effects	✓	✓
Time fixed-effects	✓	✓
Population	✓	✓
Dummy IPM	1	0

**Notes:** The following columns present the results of the heterogeneous effects analysis, (1) considers the municipalities with a multidimensional poverty index (IPM by its acronym in Spanish) over, or equal, to the national average and (2) the municipalities with a IPM below the national average. The checks at the bottom show what components were considered in each regression, these include municipality fixed-effects, time fixed-effects in years and population for every municipality each year. **Birth Rate** refers to the infant birth rate and is measured as the total number of births over the total population, multiplied by 1000. **Birth Weight** ( $\leq 2.5kg$ ) refers to the natural logarithm of the total number of newborns weighing less than or equal to the range of 2,500g - 2,999g. **APGAR ( $\geq 7$ )** it's a proportion of the newborns with an APGAR greater than or equal to 7, it's obtained by dividing the total of newborns with the APGAR score previously mentioned over the total number of newborns. **Hosp. at 20km from 2006 ( $\geq 4$ )** is a dummy variable that takes the value of 1 if for the years 2006 and forward, there are at least four hospitals in a 20km range on the municipality. **(TM)** stands for Teenage Mothers, the variables with this signaling were calculated for the total population of mothers between 10 and 14 years of age or between 15 and 19 years of age. Variables with the signaling ( $\geq 20$ ) were calculated for the total population of mothers over 20 years of age. Standard errors in parentheses (\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ )

The APGAR score results also show some heterogeneity, though effects are generally small across both groups. In poorer municipalities, the point estimate is -0.015 (not significant), while in wealthier areas it is -0.013 (marginally significant at the 10% level).

For the youngest mothers (aged 10-14), the effect in high-poverty areas is -0.031 ( $p < 0.05$ ), suggesting that the limited adverse effects on APGAR scores are concentrated among the most vulnerable subgroups.

These findings underscore that the reform's benefits were not distributed equally across socioeconomic strata. Poorer municipalities, which likely had greater unmet need for reproductive health services and faced higher barriers to safe abortion access prior to the reform, experienced larger improvements in fertility control and neonatal health outcomes. This pattern is consistent with the hypothesis that legal reforms have greater impact where baseline access constraints are most severe, and where the marginal benefit of expanded services is highest.

## 5 Discussion

Our findings contribute to a growing literature documenting the effects of abortion legislation on maternal and newborn health. In line with studies from high-income countries, we find that relaxing abortion restrictions can improve neonatal health outcomes, particularly by preventing high-risk births and modifying maternal selection. Evidence from the United States has consistently shown that legal access to abortion reduced early and unintended pregnancies, improved the timing and conditions of childbirth, and led to better socioeconomic outcomes for women and their children (Haas-Wilson, 1996; Currie et al., 1996; Gruber et al., 1999; Ananat et al., 2009). More recent work emphasizes that restrictive regulations—such as TRAP laws—raise adolescent fertility and lower educational attainment (Jones and Pineda-Torres, 2021), while gestational-age limits and near-total bans increase infant mortality and health inequities (Gemmill et al., 2024; Karletsos et al., 2021; Adkins et al., 2025). Our results are consistent with this evidence: the partial liberalization in Colombia appears to have improved neonatal outcomes, particularly among young and vulnerable mothers, by reducing the incidence of high-risk pregnancies.

The mechanisms underlying these effects resonate with evidence from low- and middle-income countries (LMICs). Ishola et al. (2024) show that Mozambique's legal reform initially led to a temporary increase in neonatal mortality among disadvantaged groups,

reflecting the challenges of scaling safe abortion services after legalization. Over time, however, neonatal survival improved as access expanded. Similarly, systematic reviews highlight that legal reforms are not sufficient on their own, effective implementation and equitable access are critical to realizing health gains (Ishola et al., 2021; Arroyave, 2018; Allotey et al., 2020; Hall et al., 2023). In this context, Colombia’s experience aligns with the broader LMIC pattern where institutional capacity and service delivery mediate the relationship between legal reform and health outcomes.

Within Latin America, restrictive abortion laws remain a major determinant of maternal and neonatal mortality, unsafe abortion, and reproductive health inequities. Studies from the Dominican Republic, Brazil, and Mexico City show stark contrasts: total bans are associated with higher neonatal deaths and reduced contraceptive use (Ishola et al., 2025; Malta et al., 2019), while legalization and safe service provision have improved maternal morbidity and access to care (Clarke and Mühlrad, 2020; Galli, 2020; Gialdini et al., 2024). Our results complement this regional evidence by offering causal estimates from a setting of partial liberalization within a restrictive legal environment. Unlike full legalization contexts such as Uruguay (Antón et al., 2022), Colombia’s reform in 2006 targeted only specific cases, yet even this limited scope was sufficient to generate measurable improvements in newborn health.

Taken together, these comparisons suggest that the health effects of abortion liberalization depend critically on both the breadth of legal reform and the strength of health system implementation. Our evidence from Colombia indicates that partial decriminalization, when coupled with existing hospital infrastructure and increasing access to maternal care, can reduce adverse neonatal outcomes. The findings reinforce the idea that abortion policy reform operates not only through fertility reduction but also through changes in the composition and health of births. This mechanism echoes the “marginal child” hypothesis (Gruber et al., 1999), now observed in a middle-income context, underscoring that improving access to safe and legal reproductive care remains a key pathway to enhancing neonatal health and reducing inequalities.

## 6 Conclusions

This paper examines the causal effects of Colombia's 2006 partial abortion decriminalization on neonatal health outcomes, exploiting spatial variation in hospital availability as a proxy for access to newly legalized services. Using administrative data on all live births from 2000 to 2012 and a difference-in-differences design, we find that the reform led to significant reductions in birth rates and improvements in birth weight, particularly among adolescent mothers and in poorer municipalities.

Our findings show that even partial abortion reforms can improve population health when combined with adequate service delivery infrastructure. The benefits were concentrated among socioeconomically disadvantaged populations, highlighting the equity-enhancing potential of reproductive rights policies. These results add to a global evidence base showing that abortion liberalization is not only a matter of reproductive autonomy but also a pragmatic public health intervention with measurable benefits for women, children, and society.

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