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ABSTRACT

In recent years, several countries have implemented restrictive, abstinence-only policies toward reproductive health, as opposed to comprehensive, adolescent-friendly health services. Little is known, however, about the effects of these restrictive policies on adolescent birth rates at the national level or their differential effects by race and ethnicity. The extant literature is even scarcer in low- and middle-income countries. We fill this knowledge gap by exploiting an unexpected policy change in Ecuador that abruptly reversed course for reproductive health services for adolescent women in 2014. In a difference-in-differences analysis of age-specific birth rates in Ecuador's 221 cantons, we find that the abrupt policy change was associated with an increase in teen birth rates by 9 births per 1000 women. In a difference-in-difference-in-differences analysis, we find that the policy change was associated with an additional increase of 12 births per 1000 women among those cantons where at least 12 percent of the population is self-declared as indigenous. Our results are robust to changes in standard error clustering, population weighting, logarithmic model specification, adjustments for underreporting, and changes in the year when the new policy went into effect.

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1. Introduction

On February 28, 2015, Rafael Correa, then in the second full year of his final four-year term as president of Ecuador, used his weekly radio-TV broadcast to explain his new Plan Familia, which had abruptly gone into effect by presidential decree three months earlier on November 26, 2014 (Correa, 2015; Official Register, 2014). Correa attacked the now defunct Intersectoral Strategy for Family Planning and Prevention of Adolescent Pregnancy (ENIPLA for its initials in Spanish), which had formally been in effect nationwide since 2011. Acknowledging that births among adolescents aged 12–19 had dropped significantly under the ENIPLA program, Correa nonetheless claimed that the ENIPLA strategy was completely misguided in its promotion of "*hedonism*." ENIPLA talked only about "*pleasure, a terrible message*," Correa asserted, "… *and if you have problems, go to the health center.*" "*But the foundation of our society is not the health center, it's the family*." Correa continued, "*We have to enable the parents. The remedy was worse than the disease. It broke the bond with the family*." (Correa, 2015) [p.4]. In contrast to ENIPLA, which offered sexually transmitted disease testing and treatment as well as short- and long-term contraceptive services through teen-friendly clinics at local health centers, the new Plan Familia would rely on education through the family, with a focus on abstinence and delayed initiation of sexual activity (Presidencia de la República del Ecuador, 2015).

In a follow-up radio-TV message on March 28, 2015, Correa characterized the government's educational materials encouraging condom use, such as the pamphlet in Figure 1 that would now be prohibited under Plan Familia, as one of the excesses of ENIPLA (Estrella, 2015). While the ministries of public health, education, and economic and social integration jointly took charge of ENIPLA, the new Plan Familia would be under the direct control of the president.

[FIGURE 1 ABOUT HERE.]

Our goal here is to assess the impact of this abrupt change in sexual and reproductive health (SRH) policy on teen birth rates in Ecuador. To that end, we treat the unanticipated shock of the replacement of ENIPLA with Plan Familia as a natural experiment (Craig et al., 2017). To address the alternative hypothesis

that the observed patterns of birth rates were actually due to trends independent of the government's abrupt reversal in SRH policies toward adolescents, we use a difference-in-difference (DD) approach, comparing birth rates of teens aged 15-19 years with those of young adults aged 20-24 years. In contrast to adolescents, whose access to contraceptives was curtailed after 2014, young adults continued to have access to short- and long-term contraceptives, including the morning after pill, at health centers through other government programs (MSP, 2014). Even though ENIPLA was formally established as a government program in 2011, there is evidence that many non-governmental organizations had set up equivalent teen-friendly programs at health centers during the pre-ENIPLA period from 2008–2010 (Burneo Salazar et al., 2015; MSP, 2018). Accordingly, we study the interval from 2008–2017, covering the pre-ENIPLA period from 2008–2010, the ENIPLA period from 2011–2014, and the post-ENIPLA period from 2015–2017.

Here, we focus on birth rates, rather than pregnancy rates, for two reasons. First, there is no uniform record of all pregnancies as there is for live births; thus, we use the live birth rate as a proxy for the pregnancy rate. There is evidence, in particular, that the teen live birth rate is proportional to the teen pregnancy rate (Curtin et al., 2013). Second, live birth rates and pregnancy rates in Ecuador are fairly close because abortion is illegal except when the pregnancy threatens the mother's life or it arose from a rape of a mentally disabled woman. We calculate birth rates at the level of the county ("*cantón*"), which we treat as our fundamental unit of observation. We reason that the SRH services provided by ENIPLA and its predecessors were delivered in local health clinics in each canton, and that the density and intensity of services thus varied across counties.

To assess whether the abrupt switch to Plan Familia had a disproportionate effect on the most vulnerable populations, we stratify birth rates in each canton not only by age group, but also by the presence of a substantial indigenous population. We then use a difference-in-difference-differences (DDD) approach, further distinguishing between counties ("*cantones*") with high and low proportions of indigenous women. Ecuador's ministry of public health (MSP for its initials in Spanish) has emphasized that, when it comes to the indigenous population, "*adolescence does not exist as part of the cycle of life. To the contrary, childhood transitions to*

youth, and with that one acquires a social role differentiated from boys and girls. This type of 'invisibility' of adolescence is associated with marriage at very early ages…" (MSP, 2012) [p. 131]

There is a substantial literature comparing abstinence-based and comprehensive sex education interventions at the school or school district level (Bennett and Assefi, 2005; Lindberg and Maddow-Zimet, 2012). Relatively few studies, however, have assessed the effects of restrictive SRH policies at a national level, and most of these studies have analyzed data from the United States. A DD study of state-level data from the U.S. covering 2000–2011 found that state-mandated abstinence-based sexual education policies had no effect on teen birth rates or abortion rates, but may have increased the incidence of sexually transmitted infections (STIs) (Carr and Packham, 2017). Another DD study compared the changes in teen birth rates in Texas counties that lost family planning funding to changes in counties outside of Texas with publicly funded clinics. Reductions in funding for family planning services were found to have increased teen birth rates by 3.4% during 2011–2014 (Packham, 2017). Yet another DD study of the impact of the Colorado Family Planning Initiative to increase women's access to long-acting reversible contraceptives, including subdermal implants and intrauterine devices, estimated a 6.4 percent reduction in the intervention counties during 2009–2014 (Lindo and Packham, 2017).

Studies of low- and middle-income countries (LMICs) are even scarcer. One DD study based on South Africa relied upon geographic variation in the rollout of the National Adolescent Friendly Clinic Initiative (NAFCI) during 2000–2010. The investigators found that living near an NAFCI clinic delayed childbearing by 0.5–0.7 years (Branson and Byker, 2018). Another DD paper studied the impact of a major expansion of the Indonesian midwife program, which sent over 50,000 midwives to over 52,000 communities, principally during 1993–1997. The SRH services provided by the midwives included oral and injectable contraceptives and implants. Women aged 13–20 years who lived in a participating community were found to have delayed their first birth by an average of 0.96 years (Strupat, 2017).

Studies of the impact of restrictive SRH policies are particularly relevant to Latin America. The United Nations Population Fund report identified eight Latin American and Caribbean countries where least 20 percent of women ages 20–24 reported a birth before age 18: Colombia (20 percent), Bolivia (20), Ecuador (21), El Salvador (24), Guatemala (24), Dominican Republic (25), Honduras (26), and Nicaragua (28). (No data were reported for Venezuela.) (UNFPA, 2013).

In section 2, we present some theoretical considerations. Then we summarize our analytical methods in section 3. In section 4, we show our main results followed by a series of robustness tests. We present a discussion of the results in section 5, along with our study's limitations and potential paths for future research.

2. Correa's sudden reversal in light of political agency theory

Returning to Ecuador after receiving his Ph.D. in economics, Rafael Correa became minister of economy and finance under then-president Alfredo Palacio. In that capacity, he lobbied Congress for increased spending on health and education. Campaigning against what he characterized as Ecuador's neo-liberal elites, he was elected as president in 2006 and took office in January 2007. Overseeing the introduction of a new national constitution in 2008, Correa was re-elected in 2009 and again in 2013. During his tenure, Correa fashioned his own brand of socialist revolution, increasing government spending generally and in particular on health. He raised the minimum wage to combat poverty, and increased physicians' salaries. In the face of a long career of leftist policies, why did Correa perform a 180-degree turn on sexual and reproductive health policy at the start of his third and final term in office?

This question can be framed within the political agency model, pioneered by Robert Barro and John Ferejohn (Barro, 1973; Ferejohn, 1986). During his tenure in office, a politician must make a sequence of choices between an action in his private interest, which might result, for example, in increased business for his law firm or a promise of future employment, and an action in the public interest, which tends to enhance his chances for reelection. The model predicts that the politician's decisions may change abruptly during his last term in office (Rivas, 2016). It has been applied to decisions about commercial free trade agreements (Rotunno,

2016) and pension systems (Gersbach and Ponta, 2017), but not to our knowledge to sexual and reproductive health policies. The model suggests that Correa, having entered his third term and facing no further prospect of reelection, abruptly changed his posture away from the public interest and in favor of his private interests in conformance with his Catholic faith.

3. Methods

3.1. Data

Our primary data source is the detailed live birth registry records released by Ecuador's Institute of Statistics and Census (*Instituto Nacional de Estadísticas y Censos*, INEC) for the years 2008–2017, available at http://www.ecuadorencifras.gob.ec/nacimientos-bases-de-datos/. The live birth registry provides the mother's province and *cantón* of residence, as well as her age, ethnic/racial self-identification status, and education. To address delayed reporting, we followed INEC's "$t + 1$" convention of including births that reportedly occurred in a given calendar year (t), but were not registered until the following year ($t + 1$) (Carrera and Yunga, 2016). Using statistical methods to characterize the full distribution of reporting delays over several years (Harris, 1990), we estimated that during 2008–2014, INEC's $t + 1$ convention captured over 92% of all births (74.7% reported in the same year of birth, 17.7% reported in the following year). From 2015 onward, under funding from the Organization of American States (OAS/OEA, 2017). INEC was able to significantly reduce its reporting delays, so that the $t + 1$ convention captured approximately 98% of all births. We could not, however, apply the $t + 1$ convention to births occurring in 2017, as we lacked data on births occurring in 2017 that were subsequently registered in 2018. In our main results spanning the years 2008–2017, we chose not to impute the additional births occurring in 2017 but simply to use only the same-year birth registrations for that year. We estimate that this approach could have reduced the count of live births in 2017 by 2.8%. In a sensitivity analysis, we fully excluded the year 2017 and studied only data spanning 2008–2016.

The 2010 population data comes from the last Population and Housing Census (*Censo de Poblacion y Vivienda,* CPV) conducted in Ecuador, available at http://www.ecuadorencifras.gob.ec/base-de-datos-censo-de-poblacion-

y-vivienda/.The population data for before and after the census year are taken from the INEC's Official Population Projections for each province and canton (with 221 *cantones* with pre- and post-census year data), available at http://www.ecuadorencifras.gob.ec/proyecciones-poblacionales/.

3.2. Econometric analysis

Main econometric specification. We define the birth rate difference (Δ_{jt}) as the difference between the teen (15–19) and young adult (20–24) birth rates in each canton j in each year t. Thus, larger values of (Δ_{jt}) imply higher teen birth rates while lower (often negative) values imply higher young adult birth rates. We employ differences-in-differences (DD) and triple difference (DDD) approaches, estimating regressions of the form:

$$(1) \qquad \Delta_{jt} = \alpha^0 + \alpha^1 Post_t + \alpha^2 IND_j + \alpha^3 IND_j \times Post_t + \beta Z_j + \varepsilon_{jt}$$

Here, $Post_t$ is a binary indicator that the year t is after 2014, when ENIPLA was abolished by Presidential decree. Its coefficient α^1 is the DD estimator. The variable IND_j is a binary indicator that the percentage of women in canton j who self-identified as indigenous exceeded the canton average of 12%. The coefficient α^3 of the interaction term $IND_j \times Post_t$ gives the triple difference (DDD) estimator. The vector Z_j refers to canton-specific characteristics derived from the census data, including canton-level means for age, years of education, proportion indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment. We estimated equation (1) with robust errors clustered at the canton level.

3.3. Tests of Robustness

Province-Based Clustering. In our main model specification, we clustered at the level of the canton, which is the level of data aggregation and construction of the birth rates. As one test of robustness, we re-estimated our model with robust standard errors clustered at the larger *province* level. The rationale was the possibility that there may be characteristics at the province level which may affect how the national-level policies are implemented (Cameron and Miller, 2015).

Excluding Data for 2017**.** We conducted a robustness check excluding the last year (2017), for which we were unable to construct a $t + 1$ correction for reporting delays because the 2018 data was not yet available.

Log-linear Models. Our main specification tests absolute differences in rates per 1000 women. As an alternative, we ran relative risk models, where the dependent variable (Δ_{jt}) was the difference in log birth rates.

Population-Weighted Regressions. In our main specification, all cantons had equal regression weight. As another robustness test, we ran our model as a weighted regression with population weights derived from the 2010 Census data on the percentages of women (ages 15-29) at the canton level (Deb et al., 2017).

Alternative Year of Intervention. The official SRH policy changed abruptly by presidential decree in 2014 (Correa, 2015; Official Register, 2014), and thus we defined the binary variable $Post_t$ as equal to 1 if the year is greater than 2014. Since there may have been delays in the switch from ENIPLA to Plan Familia due to inertia or problems with plan implementation, we re-estimated our model with ($Post_t$) as equal to 1 if the year was greater than 2015.

Alternative Control Group. In addition to using young adults (20-24 years of age) as a control group, we re-estimated our model using adult women (25-29 years of age) as an alternative control group. That is, the dependent variable Δ_{jt} was the difference between the teen (15–19) and adult (25–29) birth rates in each canton j in each year t.

4.0 Results

4.1. Descriptive Statistics.

Table 1 presents descriptive statistics for 221 cantons in Ecuador for the 10-year span from 2008 to 2017. The average teen population at the canton level over the decade was 3,373 women aged 15 to 19 years, ranging from 86 in small rural areas to over 120,000 in large cities. The average teen birth rate was 82 per 1000 women (ranging from 6 to 195); while the average young adult birth rate was 114 per 1000 women (ranging from 15 to 301). On average at the canton level, 12 percent of women self-identified as indigenous, and 5.3% as Afro-

Ecuadorian. In terms of other measured covariates, the literacy rate was relatively high at 95%, though it ranged from 71 to 100%. Cell phone use in the previous six months was 61%, ranging from 7 to 91%. Similarly, Internet use in the previous six months was 21% on average, ranging from 4 to 56%. Computer use followed a similar pattern. Average health insurance coverage was 15%, ranging from 3 to 36%; while employment (paid work, outside of the home) was 38% on average, ranging from 15 to 61%.

[TABLE 1 ABOUT HERE.]

4.2. Analyses of Group Means.

Figure 2 shows the mean birth rates of teen mothers among 221 cantons, adjusted (black datapoints) and unadjusted (gray datapoints) for reporting delays. If one were to rely solely on counts of live births that occurred in year *t* and were also reported in the same year *t* (the gray datapoints), then one would conclude that teen birth rates increased precipitously during 2015–2017, when Plan Familia replaced ENIPLA. If one were instead to rely on counts of births that occurred in year *t* and were reported in years *t* or *t*+1 (the black datapoints), a more nuanced story emerges. The mean teen birth rate shows a pattern of decline during the ENIPLA period, especially during 2012–2013, whereas the teen birth rate after the switch to Plan Familia shows a pattern of stagnation.

[FIGURE 2 ABOUT HERE.]

Figure 3 compares the trends in mean birth rates of teen mothers (black datapoints) and young adult mothers (gray datapoints) among 221 cantons, adjusted for reporting delays. In both teens and young adults, the mean birth rate appears to be declining during the pre-ENIPLA (2008–2010) and ENIPLA (2011–2014) periods, although the rate of decline is more marked in the young adult group. In the post-ENIPLA (2015–2017) period, the rate for young adult mothers appears to continue to decline through at least 2016, while the rate for teen mothers remains stagnant.

[FIGURE 3 ABOUT HERE.]

Table 2 shows the mean live birth rates per 1000 women in each age range. Overall, teen birth rates in cantons with lower indigenous concentration were lower on average in the post period (by 10.46 per 1000 women); while young adult birth rates were lower by greater margins (by 19.24 per 1000 women). For cantons with high indigenous concentration, that difference is even more pronounced: while the teen birth rate in highly-Indigenous cantons decreased by 4.84 points, it was reduced by over 25 points among young adults. The triple differences (DDD, of teen minus young adult and indigenous minus non-indigenous) was 11.95 per 1000 women, and highly significant ($p<0.001$).

4.3. Regression Results.

Table 3 shows our main regression results based upon a random effects model clustered at the canton level, where the dependent variable is the difference between teen and young adult birth rates. In column (1), we present the main results, unadjusted for covariates, where the difference decreases among highly indigenous cantons (by 11.78 per 1000 women), it increases by 8.7 in the post period, and the interaction term of indigenous × post is 11.95 per 1000 women and highly significant ($p<0.001$). In column (2), we show the regression results for the same model specification, adjusted for covariates. The covariates do not affect the main DDD results. We can see that the difference again decreases among highly indigenous cantons (by 4.8 per 1000 women), it increases by 8.7 in the post period, and the interaction term of indigenous × post is 11.95 per 1000 women and highly significant ($p<0.001$).

[TABLE 3 ABOUT HERE.]

4.4. Robustness tests

Table 4 presents DDD regression results clustered at the province level (instead of at the canton level). As expected, the coefficients are the same as in the previous table but the standard errors are larger. Nevertheless, the DDD estimates remain highly significant ($p<0.001$).

[TABLE 4 ABOUT HERE.]

Table 5 presents results using a restricted dataset where we have excluded the year 2017 because $t + 1$ data for 2018 are not yet available. The results are qualitatively similar to the main results, though attenuated. In the unadjusted model for 2008-2016 in column (1), the interaction term of indigenous × post is 10.53 per 1000 women and highly significant ($p<0.001$). The coefficient in the adjusted model in column (2) remains virtually unchanged.

[TABLE 5 ABOUT HERE.]

Table 6 presents DDD estimates for the log difference (that is, log teen birth rate – log young adult birth rate) model, using robust standard errors in parentheses clustered at canton level. The DD term indicates that the suspension of ENIPLA increased teen births by 4.5 percent compared to young adult births. The interaction (DDD) term indicates that teen births in cantons with high indigenous concentration increased by 9.05 percent compared to young adults.

[TABLE 6 ABOUT HERE.]

Table 7 shows weighted regression results, with weights based on the 2010 Census data percentages of women (ages 15-29) at the canton level. The interaction terms are again positive and highly significant though the magnitudes are lower. In the unadjusted model in column (1), the interaction term of indigenous × post is 10.32 per 1000 women and highly significant ($p<0.001$). The coefficient in the adjusted model in column (2) remains virtually unchanged. In the log differences models (columns 3 and 4), the interaction terms indicate that teen births in cantons with high indigenous concentration increased by 7.34 percent in the comparing teens with young adults.

[TABLE 7 ABOUT HERE.]

Table 8 presents DDD regression results where we use a dummy indicator for Post such that Post=1 if the year is greater than 2015 (instead of greater than 2014). The DDD coefficients is larger than in the main results table: 14.48. The main DDD estimates, unadjusted and adjusted, remain highly significant ($p<0.001$).

[TABLE 8 ABOUT HERE.]

Appendix Table A presents the results for the alternative difference between teen (15–19) and adult (25–29) birth rates. In column (1), we present unadjusted results, where the difference decreases among highly indigenous cantons (by 3.06 per 1000 women), it decreases by 1.9 points in the post period, and the interaction term of indigenous × post is 11.04 per 1000 women and highly significant ($p<0.001$). In column (2) we show the adjusted regression results; the covariates do not qualitatively affect the DDD results: the interaction term of indigenous × post is again 11.04 per 1000 women and highly significant ($p<0.001$).

5. Discussion and Conclusion

We analyzed canton-level birth rate data for women ages 15-24 in Ecuador during 2008-2017. We took advantage of a sudden and unexpected policy change – the abrupt switch from ENIPLA to Plan Familia effective in 2015 – to identify the effect of implementing more restrictive sexual and reproductive health policies on adolescent women. Utilizing a difference-in-differences approach, we determined how the difference in the birth rates between adolescent (15–19 years) and young adult (20–24) women changed after the switch to Plan Familia. Further utilizing a triple-difference approach, we determined how this difference in birth rates varied among cantons with low and high proportions of indigenous women. Our results suggest that the dismantling of ENIPLA and the subsequent elimination of differentiated, adolescent-friendly SRH services after 2014 significantly increased teen birth rates in comparison to young adult birth rates, particularly among indigenous women. A number of robustness checks, including the comparison of teen birth rates with those of adult women 25–29 years of age, supported our primary conclusions.

Our results constitute a commentary on the chasm between the rhetoric of electoral candidates and newly-elected politicians and the policies that are actually implemented. The high cost of this divergence tends to be borne by the most vulnerable. This commentary is particularly relevant to Latin American countries, many of which have a long history of populism. Despite the socialist rhetoric of Hugo Chavez in Venezuela, his administration actually fragmented and weakened organized labor, restricted collective bargaining, and undermined vulnerable workers in cooperatives (Posner, 2016). The governments of Correa (in Ecuador) and

Chavez (in Venezuela) both engaged in strong pro-poor rhetoric (Ellner, 2012). Yet rhetoric alone does not necessarily ensure that the policies implemented are in fact pro-poor or pro-minorities.

Our research is not without limitations. First, we analyzed rates rather than individual-level data. In particular, we computed birth rates at the finest level of data aggregation, that is, the canton. We reasoned that the quantity and intensity of teen-friendly SRH services at health centers varied across cantons. Second, we analyzed birth rates rather than pregnancy rates. Although there has been progress in the timeliness and the completeness of reporting of livebirths in the last few years in Ecuador (OAS/OEA, 2017), there may be still be underreporting, particularly in rural areas. To the extent that births are underreported, however, our results are conservative and biased toward the null hypothesis of no effect. Third, we have relied on the best demographic predictions available from the official statistical agency (INEC). However, the last official Census occurred in 2010, and Ecuador does not have a mid-census counting/correction, as is available in other countries. Lastly, our identification strategy relies on the assumption that the policy change was an abrupt, unexpected shock. Although we have no reason to believe that adolescents would pre-emptively change their behaviors in anticipation of a policy change, the implementation of a national-level re-structuring of SRH policy can take time. Still, to the extent that more adolescent-friendly policies continued in some cantons after 2015, our results would be biased towards the null. In a robustness test, we found no evidence of such delays in implementation.

More research on SRH policies is needed outside of the United States. Randomized controlled trials in LMICs may have high internal validity, but they may be less generalizable, more expensive, and not always ethically acceptable. Other rigorous, non-experimental approaches can be implemented in LMICs where there are reasonably complete data sources (as we found in Ecuador) and where sudden and unexpected policy changes or other natural experiments that can be exploited for identification.

In conclusion, the main contribution of this paper is to apply econometric techniques to micro level data to assess the effects of restrictive SRH policies on adolescent women. The results provide evidence to suggest

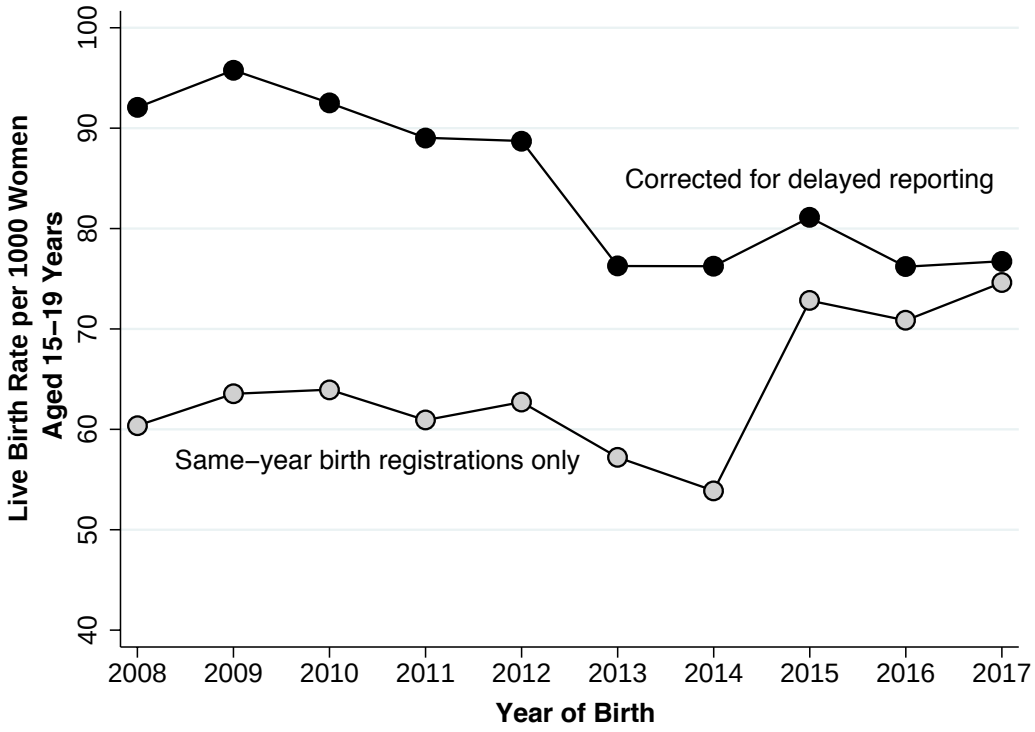
that restrictive policies, including so-called family-centered and abstinence-only policies, have increased the rates of teen pregnancy in Ecuador, particularly among indigenous women.

FIGURES

Figure 1. ENIPLA Pamphlet Encouraging Condom Use Among Adolescents

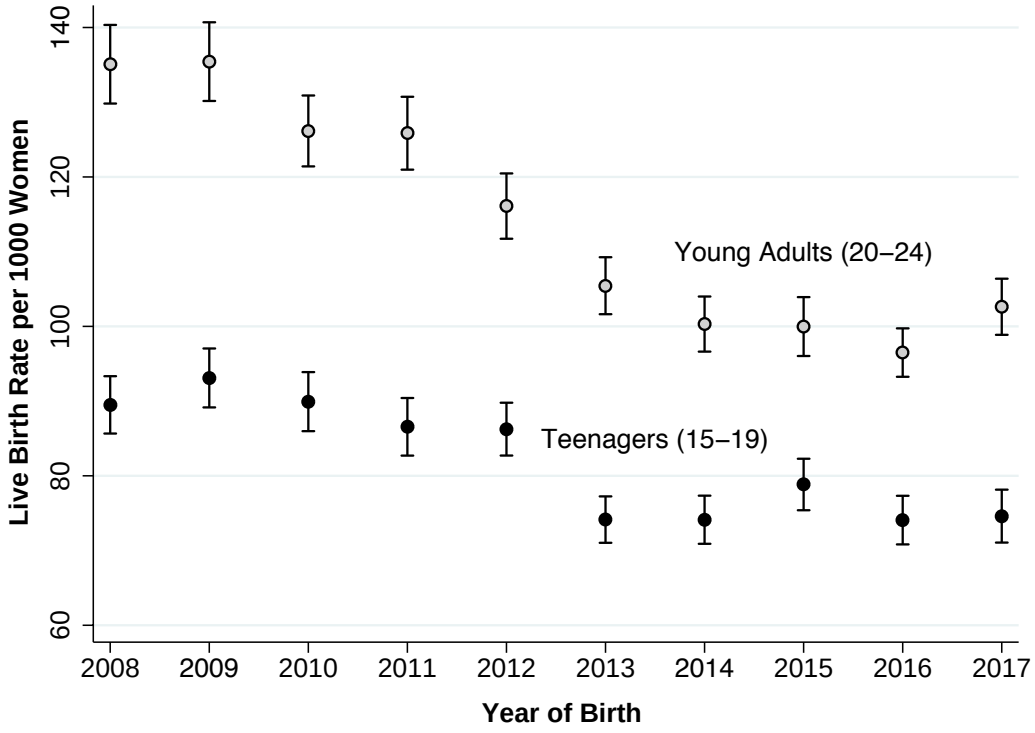
Notes: The campaign slogan "*Habla serio*," which literally means "Talk seriously," was regularly used in informal conversation as the equivalent of the English "Are you kidding? Come on, tell me seriously." The front page continues "With a condom, you enjoy a lot." The second page describes the "Correct, permanent use of the condom in all sexual relations, whether vaginal, oral or anal."

Figure 2. Teen Birth Rates at Canton Level in Ecuador: 2008-2017



Notes: Both data series represent the mean teen birth rate among 221 *cantones*. The displayed mean values have not been population-weighted. The lower series (gray data points) is calculated solely on the basis of births registered in the same year (t) that they occurred. The upper series (black data points) is calculated on the basis of birth registered in the same year of occurrence (t) or in the following year ($t + 1$). Since we had no data on births registered in 2018, we estimated the black data point for 2017 under the assumption that an additional 2.87% of births occurring in 2017 would be reported in 2018.

Figure 3. Birth Rates at the Canton level for Teens (15–19) and Young Adults (20–24)



Notes: As in Figure 1, each datapoint represents the unweighted mean birth rate among 221 *cantones*. The error bars indicate the 95% confidence interval (that is, ±1.96 standard errors) around each mean value. Birth rates are calculated on the basis of births registered in the same year of occurrence (t) or in the following year ($t + 1$).

Table 1. Summary Statistics at the Canton Level, Ecuador: Means for 2008-2017

Variable	Obs.	Mean	Std. Dev.	Min	Max
Female teen population (15-19 yrs.)	2210	3373	11043	86	120634
Female young adult population (20-24 yrs.)	2210	3098	10627	69	116203
Female adult population (25-29 yrs.)	2210	2852	10331	58	117983
Teen live births	2210	258	736	1	9227
Young adult live births	2210	362	1185	3	14148
Adult live births	2210	299	1089	3	12785
Teen birth rate*	2210	82	28	6	195
Young adult birth rate*	2210	114	36	15	301
Adult birth rate*	2210	86	25	15	206
Age	2210	29.5	0.65	27.8	31.34
Years of education	2210	9.86	1.02	7.46	12.79
Indigenous	2210	0.12	0.21	0.00	0.96
Afro-Ecuadorian	2210	0.05	0.09	0.00	0.74
Minority	2210	0.17	0.22	0.00	0.97
Literacy	2210	0.95	0.03	0.71	1.00
Cellphone use	2210	0.61	0.13	0.07	0.91
Internet use	2210	0.21	0.10	0.04	0.56
Computer use	2210	0.26	0.11	0.07	0.62
Any insurance	2210	0.15	0.06	0.03	0.36
Employed	2210	0.38	0.12	0.15	0.61
Difference 1 (teen - young adult)	2210	-32.24	23.81	-148.42	67.20
Difference 2 (teen - adult)	2210	-3.76	23.73	-86.06	96.85
Indigenous>12%	2210	0.27	0.44	0.00	1.00

Notes:
Table presents averages at the canton level for the entire decade 2008-2017.
*Birth rates are per 1000 women (in the respective age group).

Table 2. Live Birth Rates by Age Group and Indigenous Status, Ecuador: 2008-2017

Group	2008-14	2015-17	Difference
LOW INDIGENOUS			
Teen (15-19 yrs.)	81.21	70.75	-10.46
	(0.83)	(1.01)	
Young adult (20-24 yrs.)	113.90	94.66	-19.24
	(1.01)	(1.12)	
Adult (25-29 yrs.)	84.46	75.93	-8.54
	(0.71)	(0.86)	
HIGH INDIGENOUS			
Teen (15-19 yrs.)	94.64	89.80	-4.84
	(1.36)	(2.25)	
Young adult (20-24 yrs.)	139.10	113.53	-25.57
	(1.93)	(2.34)	
Adult (25-29 yrs.)	100.95	86.99	-13.97
	(1.37)	(1.87)	
DIFFERENCES			
Teens - Young adults			
Low Indigenous	-32.68	-23.90	8.78
	(0.64)	(0.82)	
High Indigenous	-44.46	-23.73	20.73
	(1.42)	(1.87)	
DDD			11.95
			(2.4)***

Notes:

Table presents canton-level live birth rates per 1000 women with standard errors in parentheses.
High indigenous concentration if more than 12% of women self-identify as indigenous.
DDD denotes triple differences.

*** significant at $p<0.001$

Table 3. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2017: Triple Difference Main Regression Results

	(1) Difference (teen - young adult)	(2) Difference (teen - young adult)
Indigenous>12%=1	-11.78***	-4.822
	(2.441)	(3.090)
Post 2014=1	8.777***	8.777***
	(0.956)	(0.959)
Indigenous>12%=1 × Post 2014=1	11.95***	11.95***
	(2.530)	(2.536)
Covariates	No	Yes
Observations	2210	2210

Notes:

Interaction term presents triple differences (DDD) in birth rates per 1000 women:
Difference 1 is for (teens – young adults).
Robust standard errors in parentheses clustered at canton level:
* p<0.05 ** p<0.01 *** p<0.001
Cantón is classified as high indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%);
low indigenous if that percentage is at or below the mean (≤12%).
Post 2014 is a dummy variable = 1 if year>2014.
Covariates include *cantón*-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.

Table 4. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2017: Triple Difference Regression Results Clustered at Province Level

	(1) Difference (teen - young adult)	(2) Difference (teen - young adult)
Indigenous>12%=1	-11.78***	-4.822
	(3.398)	(3.984)
Post 2014=1	8.777***	8.777***
	(1.870)	(1.874)
Indigenous>12%=1 × Post 2014=1	11.95***	11.95***
	(3.149)	(3.156)
Covariates	No	Yes
Observations	2210	2210

Notes:

Interaction term presents triple differences (DDD) in birth rates per 1000 women:
Difference 1 is for (teens – young adults).
Robust standard errors in parentheses clustered at province level:
* p<0.05 ** p<0.01 *** p<0.001
Canton is classified as High Indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%); low indigenous if that percentage is at or below the mean (≤12%).
Post 2014 is a dummy variable = 1 if year>2014.
Covariates include canton-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.

Table 5. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2016: Triple Difference Results Excluding Year 2017

	(1) Difference (teen - young adult)	(2) Difference (teen - young adult)
Indigenous>12%=1	-11.78***	-2.847
	(2.441)	(3.255)
Post 2014=1	11.24***	11.24***
	(0.971)	(0.974)
Indigenous>12%=1 ×Post 2014=1	10.53***	10.53***
	(2.481)	(2.487)
Covariates	No	Yes
Observations	1989	1989

Notes:

Interaction presents triple difference (DDD), excluding year 2017, for birth rates per 1000 women:
Difference 1 is for (teens – young adults).
Robust standard errors in parentheses clustered at canton level:
* p<0.05 ** p<0.01 *** p<0.001
Canton is classified as High Indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%);
low indigenous if that percentage is at or below the mean (≤12%).
Post 2014 is a dummy variable = 1 if year>2014.
Covariates include canton-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.

Table 6. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2017: Logarithmic Triple Differences

	(1) Logarithmic Difference	(2) Logarithmic Difference
Indigenous>12%=1	-0.0348	-0.0258
	(0.0233)	(0.0331)
Post 2014=1	0.0455***	0.0455***
	(0.0123)	(0.0124)
Indigenous>12%=1 ×Post 2014=1	0.0905***	0.0905***
	(0.0247)	(0.0248)
Covariates	No	Yes
Observations	2210	2210

Notes:

Interaction presents log triple differences (DDD).
Logarithmic Difference 1 is for (log teen birth rate – log young adults birth rate).
Robust standard errors in parentheses clustered at canton level:
* p<0.05 ** p<0.01 *** p<0.001
Canton is classified as High Indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%); low indigenous if that percentage is at or below the mean (≤12%).
Post 2014 is a dummy variable = 1 if year>2014.
Covariates include canton-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.

Table 7. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2017: Triple Difference Weighted Regression Results

	(1) Diff_1 (teen – young adult)	(2) Diff_1 (teen – young adult)	(3) Log Diff_1 (teen – young adult)	(4) Log Diff_1 (teen – young adult)
Post 2014=1	8.221***	8.221***	0.0274	0.0274
	(1.614)	(1.617)	(0.0147)	(0.0148)
Indigenous>12%=1	-8.901*	-4.180	-0.0421	-0.0298
	(3.485)	(3.864)	(0.0395)	(0.0467)
Post 2014=1 × Indigenous>12%=1	10.32***	10.32***	0.0734**	0.0734**
	(2.949)	(2.955)	(0.0255)	(0.0256)
Covariates	No	Yes	No	Yes
Observations	2210	2210	2210	2210

Notes:

Table presents triple differences (DDD) weighted regression estimates.
Difference 1 is for (teens' – young adults' birth rates) and
Log difference 1 is for (log teen birth rate – log young adults birth rate).
Robust standard errors in parentheses clustered at canton level:
* p<0.05 ** p<0.01 *** p<0.001
Population weights are 2010 Census percentages of women (ages 15-29) at the canton level.
Canton is classified as High Indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%);
low indigenous if that percentage is at or below the mean (≤12%).
Post 2014 is a dummy variable = 1 if year>2014.
Covariates include canton-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.

Table 8. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2017: Triple Difference Regression Results, Using Post>2015

	(1)	(2)
	Difference 1 (teen - young adult)	Difference 1 (teen - young adult)
Indigenous>12%=1	-11.09***	-4.132
	(2.341)	(3.028)
Post2015=1	4.906***	4.906***
	(1.101)	(1.104)
Indigenous>12%=1 X Post2015=1	14.48***	14.48***
	(2.829)	(2.835)
Covariates	No	Yes
Observations	2210	2210

Notes:

Interaction presents triple differences for birth rates per 1000 women:
Difference 1 (teens – young adults) and Difference 2 (teens – adults).
Robust standard errors in parentheses clustered at canton level:
* p<0.05 ** p<0.01 *** p<0.001
Canton is classified as High Indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%); low indigenous if that percentage is at or below the mean (≤12%).
Post 2015 is a dummy variable = 1 if year>2015.
Covariates include canton-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.

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APPENDIX

Table A. Effect of Abrupt Change in Sexual and Reproductive Health Policy on Adolescent Birth Rates in Ecuador 2008-2017: Triple Difference Regression Results using Adult Women (25-29 years of age) as control group

	(1) Difference 2 (teen - adult)	(2) Difference 2 (teen - adult)
Indigenous>12%=1	-3.061	-0.346
	(2.797)	(3.173)
Post 2014=1	-1.921	-1.921
	(1.058)	(1.060)
Indigenous>12%=1 × Post 2014=1	11.04***	11.04***
	(2.768)	(2.774)
Covariates	No	Yes
Observations	2210	2210

Notes:

Interaction term presents triple differences (DDD) in birth rates per 1000 women for
Difference 2 (teens – adults).
Robust standard errors in parentheses clustered at canton level:
* p<0.05 ** p<0.01 *** p<0.001
Cantón is classified as High Indigenous if percentage of women who self-identify as Indigenous is above the mean (>12%);
low indigenous if that percentage is at or below the mean (≤12%).
Post 2014 is a dummy variable = 1 if year>2014.
Covariates include *cantón*-level means for age, years of education, proportion Indigenous, proportion Afro-Ecuadorian, literacy level, percentage use for cell phone, Internet and computer, as well as dummy variables for health insurance and employment.