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Family Planning and Child Health Care: Evidence from a Permanent Aggressive Intervention*

Marianna Battaglia and Nina Pallarés**

Abstract

Our study aims at estimating the effects of the exposure to an unusual family planning program on child mortality and child health. The PNSRPF, carried out in Peru during the period 1996-2000, promoted for the first time in the country voluntary surgical contraception. Yet, many indigenous women from rural areas were sterilized using coercion. We use DHS self-reported information on sterilization among indigenous women, if and when it took place —corroborated by other official data at the aggregate level— to identify which provinces were exposed to the program and at which point in time. By exploiting the geographical and time variation in its implementation, we can compare provinces affected by the program before (treated) with provinces affected later (control), before and after the policy. Results suggest that children in treated provinces are less likely to die within their first year of life and are breast-fed for longer compared to children in control provinces. Women in treated areas are also more likely to use temporary contraceptive methods. Nonetheless, we observe differential impacts by ethnic groups in treated provinces: while non-indigenous children benefit from the policy regardless of the contraceptive method adopted by their mothers, almost all its positive impacts are washed away for indigenous children whose mothers got sterilized.

Keywords: family planning, child health, ethnic minority.

JEL classification numbers: J13, J15.

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1 Introduction

Family planning plays a relevant role in every country's social policy. Couples and individuals are enabled to freely and responsibly decide about their sexual and reproductive life also thanks to the provision of information and means by governments. Prior to the late 90's, most governments had given family planning a demographic perspective: it was intended to reduce the high fertility rates and to slow the population growth in the country. After the International Conference of Population and Development (ICPD) held in Cairo in 1994, family planning gave more emphasis to human rights since reactions emerged against the demographic approach (Seltzer, 2002). Nowadays, many family planning programs are still implemented, especially in developing countries, where there is an unmet need for women that would like to delay, space, or limit their fertility but are not using any method of contraception. Distance to health centers, difficulty in reaching them and lack of intra-household bargaining power are factors which prevent women from getting access to family planning services (USAID, 2005). This paper aims at studying the effects of being exposed to an unusual family planning program promoting voluntary surgical contraception (VSC) on child mortality and child health. We contribute to the existing literature by providing new evidence on the heterogeneous effects of family planning programs on child survival and child health. To our knowledge, we are also the first to investigate the differential impacts on child health outcomes of permanent or temporary interventions reducing fertility. Births that occur at the extremes of maternal age and parity, and those following birth intervals shorter than two years, experience higher than average mortality risks. Using contraceptive methods can reduce the proportion of births in these high-risk categories and therefore enhance a population's chance of survival. Surgical permanent and temporary contraception may however have differential impacts on neonatal and infant mortality as well as on child health. We expect that the impossibility to increase family size - no more children can be born after permanent interventions - allows for a reallocation of resources in the household beneficial for child health, in line with Becker's Quality-Quantity model (Becker and Lewis, 1973; Becker and Tomes, 1976). When changes in family size occur, parents rearrange children investment

(quality): the trade-off between child investment and the number of children is advantageous for the children when their number reduces. When only temporary contraception is used, the same mechanism can occur but we expect it to be less relevant since women can resume childbearing if they desire.

The program, called *Programa de Salud Reproductiva y Planificación Familiar* (PNSRPF), was carried out in Peru during the period 1996-2000. At the time, infant and child mortality rates were exceptionally high in the country: in 1994 infant mortality rate was 50.99 per thousand live births and neonatal mortality was 23.5 per thousand live births, slightly more than the South American average (The World Bank, 2018). Child mortality, together with the high prevalence of chronic malnutrition among children under five years (25.8% in 1996), were challenges to face (UNICEF, 2008). The PNSRPF was promoted by the Peruvian Ministry of Health (MINSA) with the stated purpose of addressing widespread poverty in the country through the reduction of fertility rates.[1] For the first time voluntary surgical contraception was legal and freely provided by the public health services. The permanent intervention was largely promoted through information campaigns and family planning services.[2] Nonetheless, several sources reported irregularities during the implementation of the program: poor, indigenous women from rural areas, were often sterilized without giving consent (Boesten, 2007; Ballón, 2014; Byker and Gutierrez, 2012; Tamayo, 1999) and surgeries were mainly performed during health festivals by mobile sterilization teams (Ballón, 2014; Tamayo, 1999; Morrison, 1998). The government administration refused to recognize such irregularities and did not officially report sterilization quotas. Despite the documented episodes of forced sterilization among indigenous women, it did not publicly state guidelines about which

[1] According to Velikoff (2011), the Program manager at the Ministry of Health in 1998 declared: "The fertility rate among poor women is 6.9 children - they are poor and are producing more poor people. The president is aware that the government cannot fight poverty without reducing poor people's fertility. Thus, demographic goals are a combination of the populations right to access family planning and the governments anti-poverty strategy."

[2] The number of health posts, health clinics and health centers run by the Ministry increased by over 50% between 1995 and 2000, and over 10,000 medical and paramedical staff were added across the country. Annual government spending on health increased by 40% during the 1996-2000 period (Gribble et al., 2007). However, according to Boesten (2007) no improvements in the quality of rural healthcare services, such as the provision of a hygienic working environment, medical supplies or even beds, were provided. Instead, the government improvised mobile medical services for rural areas.

populations were targeted: there are not official data on who was actually exposed to the policy nor at which point in time. We can only rely on aggregate official data on the number of sterilizations per province recorded by the Ministry of Health (Ministerio de Salud, 2002).

To identify who was affected by the policy, we combine this information and other available official data collected by the Committee of Latin America and the Caribbean for the Defense of Women's Rights - CLADEM (Tamayo, 1999) with data provided by the Demographic and Health Surveys (DHS). The exposure to the program is not random. Nonetheless, we can exploit the key feature of the PNSRPF, that is the provision for the first time in the country of surgical contraception, and the widespread evidence it was targeting a specific population. To identify which provinces were exposed to the program and at which point in time, we use the incidence and timing of surgical contraception among indigenous women.[3] DHS data provide self-reported information on the year and month a woman got sterilized. We observe that indigenous surgical contraceptions mainly took place in a month per year per province, suggesting that mobile medical units could have reached those areas in that specific month, especially during health festivals. This information, corroborated by official data at the aggregate level (Ministerio de Salud, 2002; Tamayo, 1999), allows us to distinguish provinces affected by the program in its first year versus provinces not affected yet. We can thus compare provinces where mobile health units arrive before (treated) with provinces in which they arrive later (control). Such identification forces us to look at the impact of the PNSRPF in the short-term: the year when treated provinces were reached by the program. For robustness checks, we also look at whether the intensity of the program, measured by the percent of sterilizations among indigenous women aged 15 to 49 in the province, affects differently our outcomes of interest. We look at the impact of the program on child mortality, child health and on the use of contraceptive methods.

First, we use a difference-in-difference analysis comparing treated and control provinces before and after the policy. The treated and control samples are well balanced on covari-

[3]In our analysis, provinces are preferred to districts due to their higher population representativeness.

ates and the parallel trend assumption for outcomes holds. We confirm the validity of our identification also by performing placebo tests for pre-policy years. For robustness checks, in another specification we also include the provinces not treated by the policy or treated after the slowdown in the sterilization campaign. These provinces consistently differ in terms of observable characteristics from the provinces include in our sample and do not make up a comparable control group. Nonetheless, our results are not sensitive to their inclusion, suggesting that focusing on a sub-sample do not bias our estimates. We use all Demographic and Health Surveys (DHS) from 1996 to 2012 that contain information on women's entire fertility histories, their contraceptive methods' use and children's individual outcomes. We also use available data of the Ministry of Health on the number of sterilizations per region registered between 1990 and 1999 (Ministerio de Salud, 2002) and information collected by CLADEM (Tamayo, 1999). Second, we select only the provinces where the policy arrived and investigate the differential impacts of using one contraceptive method or another on the same main outcomes of interest. We cannot compare anymore treated and control provinces since the choice of using or not a contraceptive method and which method to employ are affected by the policy itself. If we restrict the analysis to treated areas, we can get rid of the differences in the use of contraceptive methods by provinces and focus on the effects of one contraceptive method or another on child mortality and child health.

The results suggest that children in treated provinces are less likely to die within their first year of life compared to children in control provinces. Neonatal mortality and infant mortality reduce by 5.2 percentage points and by 6.2 percentage points, respectively. These results can be partially explained by an increase in the time mothers breastfeed their children. They are 17.3 percentage points more likely to breastfeed their children more than the average length corresponding to their months of age. The likelihood they receive the appropriate vaccination within their first year of life is instead not statistically significantly different due to the policy. Results are also robust to including provinces not affected by the program. The gender of the child is not relevant for any of the outcomes of interest, nor it is the intensity of the program (percent of sterilizations in the province).

There is no heterogeneity in the results due to its higher intensity. Furthermore, the policy has an overall positive impact on the use of contraceptive methods: women in treated areas are 5.6 percentage points less likely to use no method of contraception and 9.6 percentage points more likely to use temporary modern methods, compared to women in control areas. Sterilization, widely promoted by the PNSRPF, decreased by 4.1 percentage points in treated areas compared to control areas, although it increases significantly for indigenous women compared to non-indigenous women. By comparing women in treated provinces who use a temporary contraceptive method to women who got sterilized, we observe that non-indigenous children benefit from the policy regardless of the contraceptive method their mothers use. Conversely, almost all the positive impacts of the PNSRPF are washed away for indigenous children whose mothers got sterilized.

Our paper is primarily related to the literature on the effects of family planning programs on a range of health and fertility outcomes. Family planning has the potential to improve child health and survival rates by reducing the number of births associated with higher risks (Seltzer, 2002). It promotes the reduction in the number of births that occur approximately within two years of a previous birth, in the number of high-order births (fifth of higher), and also in the number of children born to very young mothers and to women in poor health. The effects of family planning programs on child mortality have been studied, among others, by Joshi and Schultz (2013) in Bangladesh, Beegle et al. (2011) in Ethiopia and Miller (2010) in Colombia. While the first two studies find that in villages where a family planning program was introduced child mortality reduced compared to control areas, Miller (2010) does not find clear evidence that the Colombian "Profamilia" program influenced infant and child mortality, although it improved women's socio-economic status. Byker and Gutierrez (2012) are the first in investigating the PNSRPF. They use propensity score with re-weighting techniques to infer who was sterilized by the program and then look at the impact of being sterilized on household well-being outcomes. Their results show that when birth control is imposed, benefits from making choices about fertility may not accrue and that, in general, the substantial decline in fertility does not involve substantial improvements in family well-being. They

do however find a positive impact of mothers' sterilization on their children's height and female school enrolment. Conversely to Byker and Gutierrez (2012), we look at the general impact of the policy, on both sterilized and not sterilized women. Moreover, by using a difference-in-difference estimation strategy, we investigate the impact of the PNSRPF on child mortality, place of delivery, length of breastfeeding and vaccinations that are the first outcomes affected by such an aggressive family planning program. The expected changes, especially in terms of lower fertility, should quickly materialize in a reallocation of resources in the household affecting children's nutrition and chances of survival. We therefore contribute to the existing literature by providing a broader analysis of the impacts of the PNSRPF program and new evidence on the heterogeneous effects of family planning programs on child survival and on child health. As mentioned before, to our knowledge, we are also the first to investigate the differential impacts on child health outcomes of permanent or temporary interventions reducing fertility. Sterilization is the most permanent form of contraception and the most widely used a modern method. Over 220 million women worldwide rely on it, representing one out of every five women aged 15-49 years who are married or in union (UNDESA, 2013). Typically, women are sterilized once they have achieved their desired family size. However, there are few known cases when sterilization has been aggressively promoted.[4] We provide here evidence of the effects on child health care of one of these programs.

Our paper is also related to another strand of the literature focusing on Becker's Quantity-Quality Model (Becker and Lewis, 1973; Becker and Tomes, 1976). In line with the theoretical predictions, child well-being is expected to improve when family size decreases. The empirical literature has largely estimated a child *quantity-quality* trade-off, where quality is usually measured in terms of investment in education, by using multiple births. It has overall been observed that children from larger families have lower academic performance than children from smaller families (among others, Hanushek

[4]During the Indian Emergency (1975-1977), in response to the unprecedented population growth of the 1960s, aggressive sterilization camps were held all over the country and about 8.3 million sterilizations, mainly vasectomies, were carried out. In China, to achieve fertility-related targets, starting from 1982, policy advocated sterilization is strongly promoted by the government. Several researchers have suggested that, at times, birth planning officials under pressure to meet quotas have coerced women into accepting sterilization (UNDESA, 2013).

(1992); Hill and O'Neill (1997); Conley and Glauber (2006)). In a way consistent with Becker's Quantity-Quality Model, Cáceres-Delpiano (2006) also shows that the increase in household members reduces the mother's labor force participation and increases the likelihood that parents divorce. However, recent studies show that multiple births may have no impact on education. Black et al. (2005) use data from Norway and find no effects, possibly because, as suggested by Cáceres-Delpiano (2006), in a developed country families have more ways to reallocate resources to protect child quality. Little effects have also been found by Angrist et al. (2010) who look, however, at a broader range of outcomes than education. They exploit multiple third births and the effects of sibling-sex composition in families with three or more children and find that an exogenous increase in family size at second and higher births has little effect on first and second born children, though some estimates suggest that first-born girls from large families marry sooner. Our results are in line with these most recent predictions, suggesting not strong evidence to support Becker's Quantity-Quality Model.

In the next section (Section 2) we provide more details about the program. In Section 3 we describe the data and our sample. Section 4 presents the empirical strategy and the main results. Finally, Section 5 concludes.

2 The PNSRPF (1996-2000)

After the agreements reached at the International Conference of Population and Development (ICPD, Cairo 1994) and the IV Conference on Women (Beijing, 1995), in 1995 voluntary surgical contraception was introduced into the Peruvian Public Health Sector.[5] The Congress modified the National Law of Population to include VSC as a contraceptive method and especially mentioned that its adoption was based on the free exercise of personal will. The 1996-2000 PNSRPF was presented as part of the government's social

[5]In Peru, the first National Population Policy was established in 1985. It contributed to a substantial reduction in the country's total fertility rate -from 4.1 in 1986 to 3.5 in 1991- mainly due to the increased availability of contraceptives, especially in rural areas. Peru's second National Family Planning Program lasted from 1991 to 1995. The goals of the program were to reduce population growth to a maximum of an annual 2% growth by 1995 and to promote a decrease in fertility from 3.5 to 3 children per woman in 1995 (Boesten, 2007).

development policy to fight against poverty and gained the support from the United Nations (UNFPA), USAID and several NGOs. The general goals of the policy were to reduce the Total Fertility Rate from 3.5 in 1995 to 2.5 by 2000[6], and to reduce maternal and perinatal mortality. A 100% usage of contraceptive methods among women with institutional help during delivery were expected. Both information on the use of birth control methods and the provision of family planning services without a fee were planned.[7]

The PNSRPF was introduced gradually, mainly through the celebration of health festivals (Aramburú, 2002).[8] During these few days, mobile medical teams arrived to the villages, information was provided and surgeries were performed.[9] Nonetheless, statements of the doctors themselves admit irregularities in implementing the PNSRPF (Ballón, 2014). Using VSC has been reported by several non-governmental sources (i.e. the Ombudsman, NGO Flora Tristán and CLADEM) to be rather forced. According to human rights agencies and international investigations, the government established a quota system through which poor, indigenous women (especially Quechua speakers), mainly from rural areas were sterilized under coercion (Tamayo, 1999). These women were often pressured to have surgery by suffering household harassment and/or were offered money or food in exchange. Also, many of these surgeries were done without women giving an explicit consent and without doctors giving medical information about the results of the surgery or post-surgery monitoring. None of the irregularities nor the existence of sterilization quotas during the campaigns have been recognized by the government or the Ministry of Health. Nonetheless, among the 277,793 women who were sterilized during 1996-2000 by the Ministry of Health (Velikoff, 2011), it is estimated that only 10% gave explicit consent (Tamayo, 1999).[10] The peak years of the campaign were 1996 and 1997.

[6]Total Fertility Rate decreased almost as expected, as reported in Table A in the Appendix.

[7]The PNSRPF initially had the support from the United Nations (UNFPA), USAID and NGOs. Part of the funds went to Movimiento Manuela Ramos, a Lima-based NGO, to implement a participatory program to inform women on the use of birth control methods and empower them to become actively involved in the improvement of their reproductive health. The rest of funds were used by the government to provide information campaigns and family planning services, including sterilization, without a fee (Boesten, 2007).

[8]The so called *"Festivales de Ligaduras de Trompas"*

[9]Teams of doctors and nurses assembled elsewhere in the country, usually in Lima. Doctors from Colombia and India are reported to have been brought in to train Peruvian doctors and officials in how to run campaigns (Morrison, 1998).

[10]Based on the United Nations age and gender specific population tables, Byker and Gutierrez (2012)

At the end of 1997 the first complaints to the Ombudsman appeared and in 1998 the first international investigation started.[11]

3 Data and Descriptive Statistics

We use the Peruvian Demographic and Health Surveys (DHS) data for the years 1996 to 2012. There is also information available for the years 1986 and 1992 but unfortunately we cannot use these waves. In 1986 there is no direct information on ethnicity[12], and in 1992, according to DHS Data Specialists, "the survey was done at the height of *Sendero Luminoso* (Shining Path) activity so the real IDs were left off to protect the respondents"[13], so we do not know the provinces where women were living. Each of the eight waves of the survey is a cross-section with detailed information about women in their reproductive age (15-49 years). There are available data on women's characteristics, their complete reproductive history and fertility preferences, and their children's health. We also have information on gender and age for children who died. The survey asks questions about women's use and knowledge of contraceptive methods. Thus, we know who got sterilized and when it happened. We use this information to identify the areas which were reached by the program and its timing. However, we cannot determine any level of coercion or force during the PNSRPF. What we observe is that the percent of sterilizations by year among women aged 15-49 strongly increased during 1996-1997, the peak years of the family planning program (Figure 1). Additionally, if we look at the

estimate that the DHS reports of sterilizations from 1996 to 1997 imply that nearly 172,000 women were sterilized in those two years -close to 5 percent of Peruvian women aged 25-49. According to CLADEM, the government forced to sterilization almost 1.5 million of women.

[11] In January 1998 the Subcommittee on international operations and human rights of the American Congress started to investigate possible violations of human rights in the framework of the PNSRPF and USAID's participation in the planned program, considering among other points of inquiry the possible use of food - financed with funds from that country - in the catchment of users of surgical contraception (Tamayo, 1999).

[12] 1986 Peruvian DHS only provides information on the language in which the interview is conducted and not on the mother tongue. The language of the survey is hardly a good proxy for being indigenous since interviews can be performed in Spanish even by indigenous people. Moreover, there is not enough variation for this outcome: only 1% of women responds to the survey in an indigenous language.

[13] Between 1980 and 1993, the rebel group Partido Comunista del Perú - Sendero Luminoso (PCP - SL), a communist militant group, and the national army have been involved in a dramatic internal conflict that caused an intense period of violence for Peru. Since the capture of its leader Abimael Guzmán in 1992, the Shining Path diminished sharply its activity and in the period we are considering its power within the country was limited.

percent of sterilizations among non-indigenous and indigenous women separately, we find that indigenous women are less prone to choose to get sterilized both before and after the family planning program (Figure 2). While non-indigenous women were getting sterilized even before the PNSRPF (left panel of Figure 2), indigenous women mainly started with the program and stopped thereafter (right panel of Figure 2). This exploratory analysis provides support to the documented information that indigenous women were plausibly targeted by the program.

In our data we also observe that indigenous sterilizations mainly took place in a month per year per province, supporting the idea that, through the celebration of health festivals promoting VSC use, mobile health units actually reached those areas in that specific month[14]. Data from other sources - official data from the Ministry of Health (Ministerio de Salud, 2002) and CLADEM (Tamayo, 1999) - corroborate this hypothesis. We use information on when and where indigenous women got sterilized in order to define the provinces affected by the family planning policy. The provinces in which we do not observe indigenous sterilizations previous to the implementation of the program constitute our sample. We are interested in the effect of the PNSRPF and we want to be sure that the sterilizations we observe occur for the first time due to the program. Among these provinces we define as treated the provinces in which we observe indigenous sterilizations starting from 1996 and as control the provinces in which we observe indigenous sterilizations starting from 1997, exploiting thus the gradual implementation of the program. There are 46 treated provinces and 17 control provinces. The provinces not included in the sample are provinces with no indigenous sterilizations at all or provinces in which we observe indigenous sterilizations before 1996.[15] Figure 3 reports where treated and

[14]We define the month when the first indigenous sterilizations occur in the province as the date of arrival of the policy to that province. Then, using the information we have on the woman's date of interview (DHS) we identify whether she was exposed or not to the policy based on whether she was interviewed before or after the policy arrived.

[15]For robustness checks we also include in the analysis provinces not affected by the program in the time span we are considering. Nonetheless, the provinces not included consistently differ in terms of observable characteristics from those in our main sample (Table B in the Appendix), suggesting that it would be preferable not to include them in the study as we do in our main analysis.

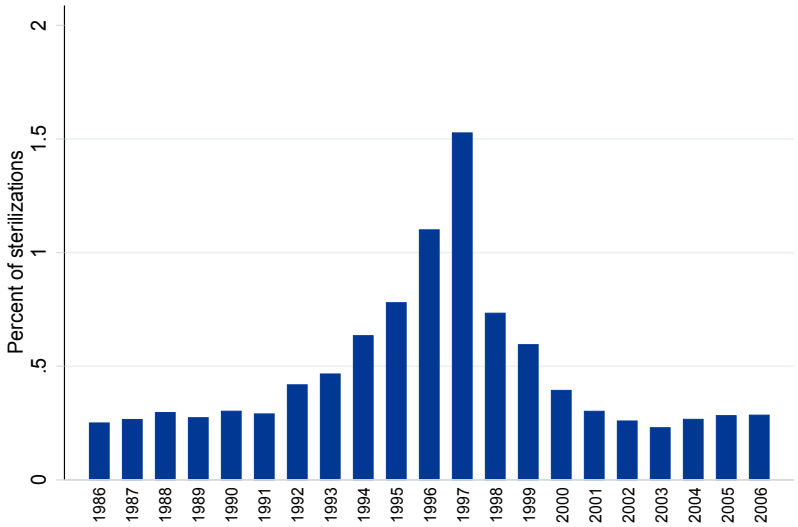


Figure 1: Percent of sterilizations by year (women aged 15-49)

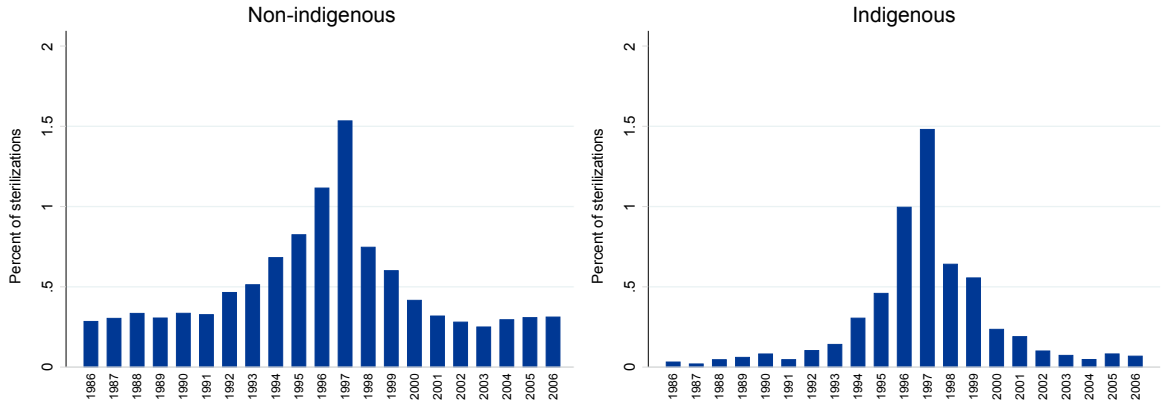


Figure 2: Percent of sterilizations by indigenous and non-indigenous by year (women aged 15-49)

control provinces are located.

3.1 Children's and Mothers' Pre-Determined Characteristics

Table 1 reports the observable pre-determined characteristics of the selected sample (column (1)), of the treated and control groups (columns (2) and (3)), the p-value of their differences (column (4)) and the normalized differences (column (5)).

In the analysis we control for children's characteristics, such as their ranking among siblings, their gender and the quarter and year of birth. We also control for women's characteristics such as age, education, marital and labor status, ethnicity, household wealth and for differences in the place and in the geographical region of residence.[16] The treated and control samples are well balanced on covariates: only few tests yield a p-value below .05, and all but one of the normalized differences are smaller than 1/4th of the combined sample variation, suggesting that linear regression methods are unlikely to be sensitive to specification changes (Imbens and Wooldridge, 2009). The only individual characteristic that differs between treated and control provinces is the proportion of indigenous women which is significantly higher in treated areas. We know that the PNSRPF was plausibly targeting indigenous women so we could expect provinces with a higher proportion of indigenous women to be reached before others. Moreover, as reported in Table C in the Appendix, these women are significantly poorer, less educated than non-indigenous women and live in rural areas. Therefore, once we control for being indigenous, we take into account observable differences between the two groups which can potentially bias the results.

[16] As reported in Figure A in the Appendix, there are three geographical regions in Peru: Jungle (*Selva*), Highlands (*Sierra*) and Coast (*Costa*).

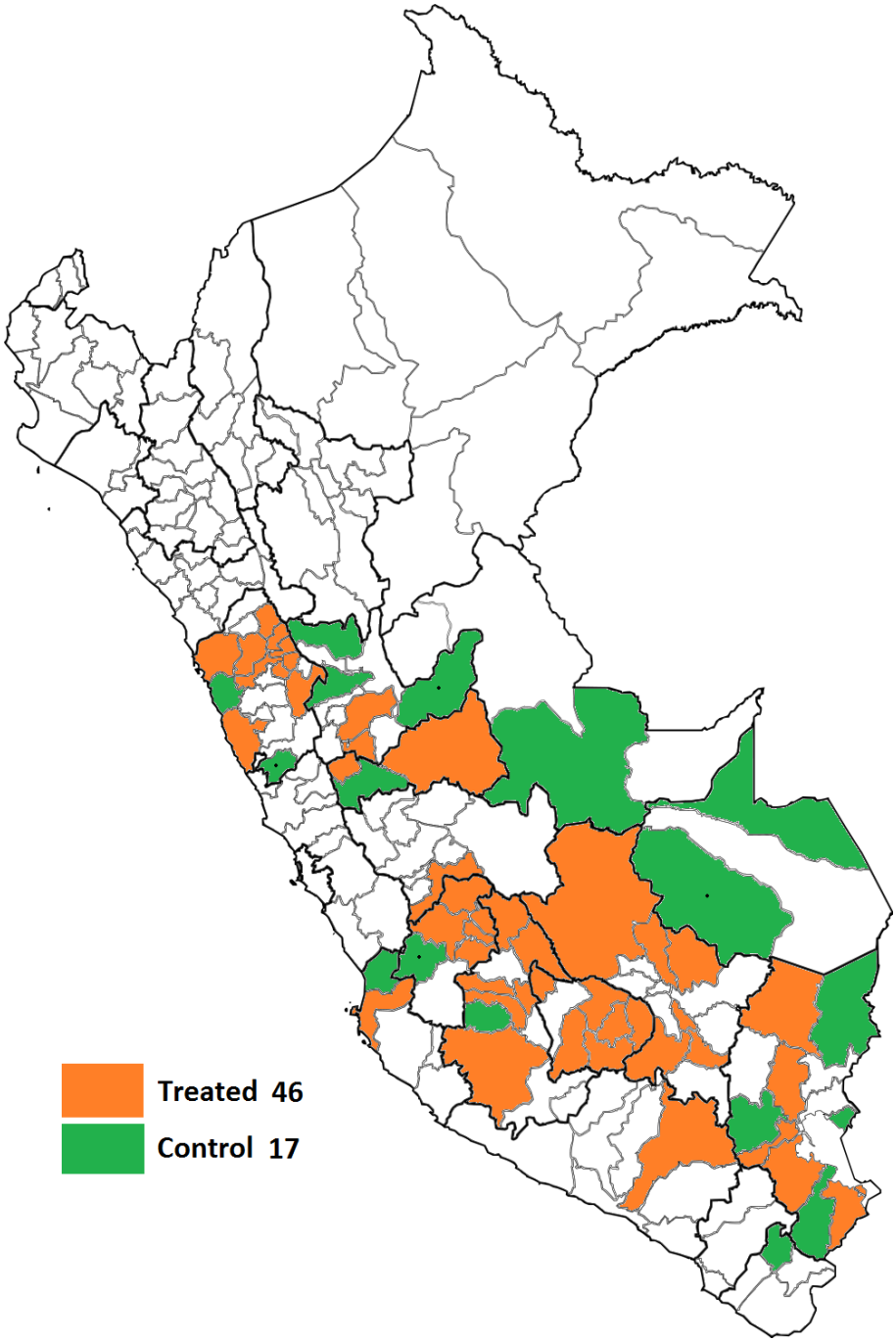


Figure 3: Treated and control provinces

Table 1: Pre-determined Characteristics

Variable	(1) All	(2) Treatment	(3) Control	(4) P-value (2)-(3)	(5) Normalized Differences
A. Child's characteristics					
Ranking among siblings	3.553	3.624	3.312	.262	.095
	(2.356)	(2.386)	(2.236)		
Female (=1)	.487	.495	.464	.308	.044
	(.5)	(.5)	(.499)		
Quarter of birth 1st	.28	.29	.248	.014	.068
	(.449)	(.454)	(.432)		
Quarter of birth 2nd	.285	.29	.27	.266	.031
	(.452)	(.434)	(.444)		
Quarter of birth 3rd	.231	.231	.23	.963	.001
	(.421)	(.422)	(.421)		
Quarter of birth 4th	.203	.189	.252	.006	-.107
	(.402)	(.392)	(.434)		
Observations	4275	3302	973		
B. Mother's characteristics					
Age mother	27.639	27.755	27.245	.288	.059
	(6.132)	(6.176)	(5.967)		
Age mother sq	1337.35	1338.425	1333.711	.996	.006
	(535.619)	(537.136)	(530.708)		
Years of education	5.321	4.991	6.443	.018	-.238
	(4.344)	(4.289)	(4.345)		
Indigenous (=1)	.449	.512	.237	.013	.419
	(.497)	(.5)	(.425)		
Married (=1)	.554	.587	.442	.010	.208
	(.497)	(.492)	(.497)		
Working (=1)	.382	.366	.436	.705	-.102
	(.486)	(.482)	(.496)		
C. Household's characteristics					
Household wealth[a]	-.514	-.609	-.192	.198	-.203
	(1.434)	(1.392)	(1.151)		
City (=1)	.196	.181	.246	.402	-.112
	(.397)	(.385)	(.431)		
Town (=1)	.115	.092	.192	.011	-.205
	(.319)	(.289)	(.394)		
Rural (=1)	.689	.726	.562	.150	.247
	(.423)	(.446)	(.496)		
Jungle (=1)	.104	.077	.195	.336	-.247
	(.306)	(.267)	(.397)		
Observations	4243	3276	967		

[a] The wealth index ranges between -2.814 and 3.463.
Columns 1 to 3 report means with standard deviation in parentheses, based on children and women in all, treatment and control provinces respectively. Column 4 reports the p-value of the test of equal means, allowing for standard errors to be clustered by province. Column 5 reports normalized differences computed as the difference in means in treatment and control villages divided by the square root of the sum of the variances.

3.2 Child Health Care and Mothers' Contraception

Our main outcomes of interest are neonatal and infant mortality, the probability of being delivered at home, the length of breastfeeding and the probability of being fully immunized for children born up to 1 year before the policy. Neonatal and infant mortality refer to the probability of dying before 1 month of age and before 1 year of age, respectively. For these outcomes, children in our sample were born either in 1995 or in 1996, before and after the policy was introduced in treated provinces and before it reached control provinces. The probability of being delivered at home is a dummy equal to 1 if the child was delivered at home and 0 if she was delivered at the hospital or health centers. The length of breastfeeding refers to the number of months a woman has breast-fed her child. We create a dummy variable equal to 1 if the mother has breast-fed her child for a number of months higher than the pre-policy average months and 0 otherwise. We control for the months of age of the child. The probability of a child to be fully immunized is measured by the probability of receiving the required vaccinations at birth and by the first year of life. They are dummies taking value 1 if the child receives all relevant vaccinations for her age.[17] All the mentioned measures can be constructed from our DHS data since we have information on every birth by women. The records include the months of pregnancy if the woman is currently pregnant, the child's date of birth if already born and, in case the child died, the date of death. Both information on vaccinations and breastfeeding are only collected for children under 5 years old at the time of the survey. Since we look at children either born in 1995 or in 1996 their information on breastfeeding and vaccination is only provided in DHS 1996 and 2000 and not in the following waves. This explains why we have fewer observations than for mortality outcomes and place of delivery.

We also study the effect of the PNSRPF on the contraceptive methods currently adopted by the mothers in our sample, controlling for the previous contraceptive method used. Women can use either traditional or modern temporary methods, get sterilized or not use any contraceptive method. Traditional contraceptive methods are defined as pe-

[17]For Peru, the general immunization schedule includes: at birth BCG (Bacille Calmette-Gurin) and OPV-0 (Oral Polio Vaccine, neonatal dose), at month two of age OPV-1 (dose 1) and DPT-1 (Diphtheria-Pertussis-Tetanus, dose 1), at month three OPV-2 (dose 2) and DPT-2 (dose 2), at month four OPV-3 (dose 3) and DPT-3 (dose 3) and at month twelve Measles vaccine (WHO, 2004).

riodic abstinence and withdrawal and they also include folkloric methods based mostly on herbal beliefs. Modern methods include the pill, IUD, injections, diaphragm/foam/jelly, condom and Norplant. In order to control for the pre-policy contraceptive use, we can only avail ourselves of information provided by DHS 1996.

4 Empirical Strategy and Results

To identify the effects of the PNSRPF on the outcomes of interest, we implement a difference-in-difference analysis. First, we compare the outcomes before and after the policy was introduced in both treated and control provinces for all children born from January 1995 to December 1996. The specification is defined as follows:

$$\begin{aligned} y_{ipt} &= \alpha + \beta_1 Treat_{ipt} + \beta_2 Post_{ipt} + \beta_3 Treat_{ipt} * Post_{ipt} + \\ &\quad + x'_{ipt}\gamma + u_{ipt} \end{aligned} \tag{1}$$

where y_{ipt} is equal to our outcomes of interest for child i, in province p, at time t. $Treat_{ipt}$ is a dummy equal to 1 if the child's mother has been exposed to the policy (treated province) and 0 if she has not (control province); $Post_{ipt}$ is equal to 1 if the child was born in 1996 and 0 if she was born in 1995; β_3 is our coefficient of interest. The vector of control variables (x'_{ipt}) includes individual and household characteristics, birth history and community characteristics, namely child's ranking among siblings, gender, year and the quarter of birth, mother's age and age squared, her years of education, whether she is married and is working, whether she is indigenous, household wealth and household's location - urban (city or town) or rural area - and geographical region.[18] Robust standard errors are clustered at the province level.

For the use of contraceptive methods by mother j, in province p, at time t, the

[18]The dummy Jungle is equal to 1 if the household lives in the Jungle (*Selva*) and 0 otherwise.

specification is defined as follows:

$$\begin{aligned} y_{jpt} &= \alpha + \beta_1 Treat_{jpt} + \beta_2 Post_{jpt} + \beta_3 Treat_{jpt} * Post_{jpt} + \\ &+ x'_{jpt}\gamma + u_{jpt} \end{aligned} \tag{2}$$

where $Treat_{jpt}$ is again a dummy equal to 1 if the child's mother lives in a treated province and 0 if she lives in a control province; $Post_{jpt}$ is equal to 1 if the contraceptive method is currently used by the mother and 0 if it was previously used and β_3 is our coefficient of interest. The vector of control variables (x'_{jpt}) includes maternal and household characteristics and robust standard errors are clustered at the province level.

To investigate if there are differential impacts for indigenous and non-indigenous women, we modify the previous specifications as follows:

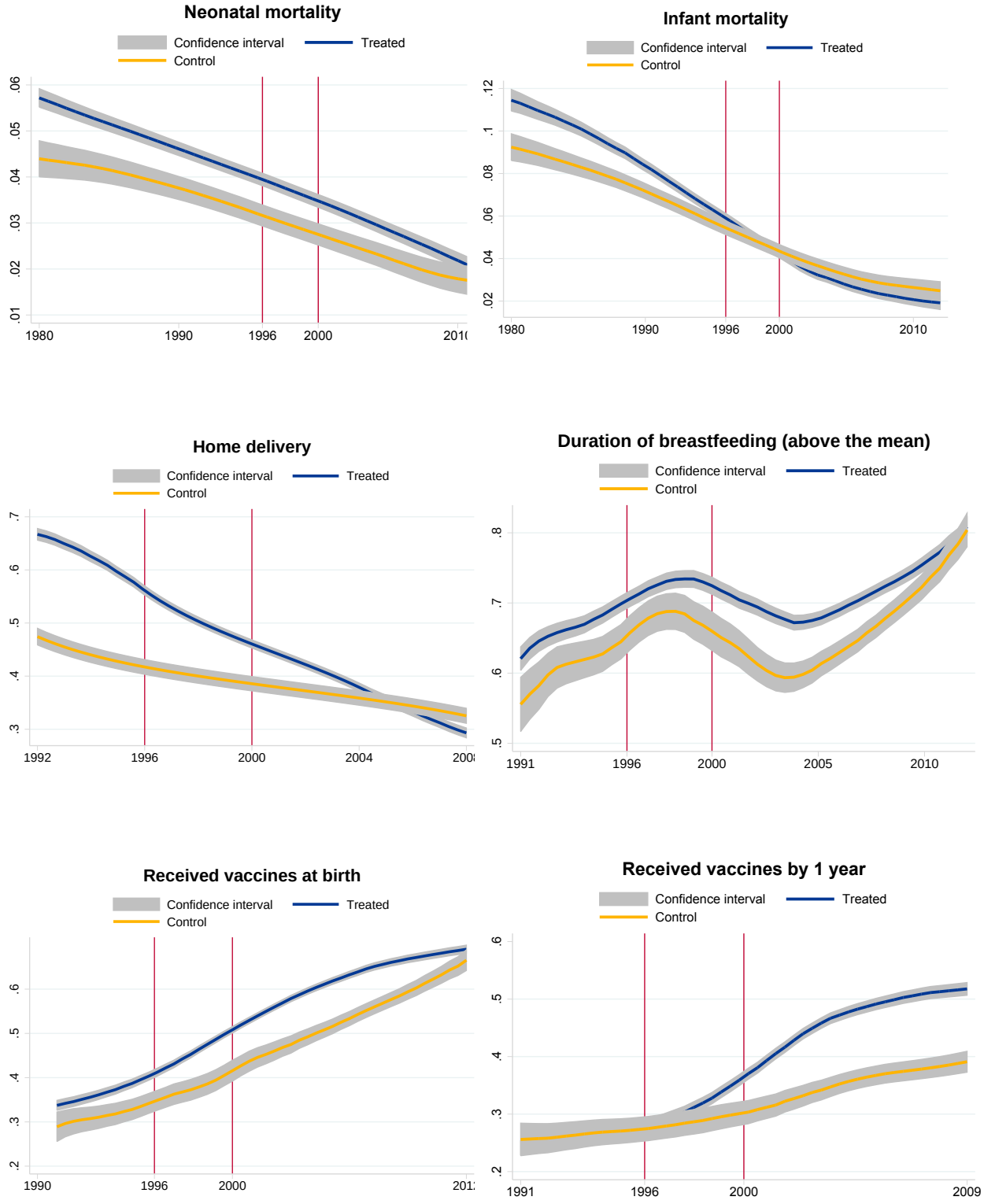
$$\begin{aligned} y_{i(j)pt} &= \alpha + \beta_1 Treat_{i(j)pt} + \beta_2 Post_{i(j)pt} + \beta_3 Treat_{i(j)pt} * Post_{i(j)pt} + \beta_4 Indigenous_{i(j)pt} + \\ &+ \beta_5 Treat_{i(j)pt} * Indigenous_{i(j)pt} + \beta_6 Post_{i(j)pt} * Indigenous_{i(j)pt} + \\ &+ \beta_7 Treat_{i(j)pt} * Post_{i(j)pt} * Indigenous_{i(j)pt} + x'_{i(j)pt}\gamma + v_{i(j)pt} \end{aligned} \tag{3}$$

where β_7 is now our coefficient of interest. The vector of control variables ($x'_{i(j)pt}$) is the same as before, excluding whether the mother is indigenous.

For our analysis to be valid we need our outcomes of interest to follow parallel trends in treated and control provinces before the arrival of the policy. The vertical lines in Figure 4 show the years when the policy started - 1996 - and ended - 2000.

While for neonatal mortality, the gap between treated and control provinces started slowly reducing after the policy, for infant mortality the picture is less clear. For infant mortality, the gap reduced before the policy, but it is after the PNSRPF that the gap reversed: infant mortality is now lower in treated than in control provinces. The figures for vaccinations (at birth and by the 1st year), home delivery and average length of breastfeeding undoubtedly show a change in the trends occurring only in treated areas

Figure 4: Parallel trend assumption



when the policy was introduced. We also perform placebo tests for pre-policy years for all the outcomes of interest (Tables D and E in the Appendix). They confirm the validity of our identification.

Since we are also interested in understanding the possible differential impacts of permanent (sterilization) versus temporary interventions (modern or traditional methods), we perform a second analysis where we focus on the effects that each type of intervention might have on the primary outcomes of interest: children's mortality, place of delivery, breastfeeding and vaccination. Since the policy affects the use of these methods only in treated provinces, we restrict the sample to those provinces and employ the following specification:

$$y_{ip} = \lambda + \delta_1 Temporary_{ip} + \delta_2 Permanent_{ip} + x'_{ip}\eta + v_{ip} \quad (4)$$

where y_{ip} is equal to our outcomes of interest for children i born up to 1 year before the policy, in province p. $Temporary_{ip}$ is a dummy equal to 1 if the mother uses a traditional or a modern temporary contraceptive method and $Permanent_{ip}$ shows if she got sterilized. The reference category is $None_{ip}$ which is a dummy equal to 1 if the mother uses none contraceptive method. The vector of control variables (x'_{ip}) is the same as in specification (2). Robust standard errors are clustered at the province level. As before, we also look at possible differential impacts for indigenous and non-indigenous women.

The δ coefficients for the method used may capture simple correlations. The policy promotes for the first time in the country voluntary surgical contraception, but it also wants to achieve a higher prevalence in the use of other modern contraceptive methods. The reason to use one contraceptive method or another can be an individual choice correlated with unobservables that also affect the outcomes of interest and thus may not be exogenously due to the policy. The PNSRPF impacts on the use of contraceptive methods all together with respect to not use any, but still women can decide which method to use. To be able to consider as exogenous the type of contraceptive method adopted, we therefore restrict the sample to women aged less than 30. We do so since these women have rarely reached their desired number of children and thus are less likely

to choose to get sterilized. For these women, the contraceptive method chosen in treated provinces reflects more convincingly the treatment they have been exposed to so that being sterilized or using another modern contraceptive method is less likely the result of their individual choice and can be considered as exogenous. The choice to restrict to women aged less that 30 is also supported by the findings of Byker and Gutierrez (2012). They estimate that women targeted by the policy were indigenous women of on average 31 years old, had 4 children and 5.6 years of education.

4.1 Results

4.1.1 PNSRPF and Child Health

By exploiting that the PNSRPF program was plausibly targeting a subgroup of the population and the provincial and time variation in its implementation, we can compare provinces affected by the program before (treated) with provinces affected later (control). We look at the short-run impacts of the program: in the year when the treated provinces were reached by it. All estimates are based on OLS.[19]

First, we look at the probability of the most recently born children to die before one month of age (neonatal mortality) and before one year of age (infant mortality) and on the probability she is delivered at home. Children are born either in 1995 or 1996. Results are presented in columns (1) to (6) of Table 2.

We find statistically significant effects of the program on both neonatal and infant mortality. Child mortality reduces for all children whose mothers are affected by the policy by 5 to 6 percentage points. Such reduction corresponds to an average decrease in neonatal mortality from 35 to 21 deaths for 1,000 live births and in infant mortality from 51 to 37 deaths for 1,000 live births, in line with official data (The World Bank, 2018).[20] This

[19]The results using probit estimates for dummy variables are comparable and available upon request.

[20]The World Bank data are reported for the entire country and are slightly lower than our estimates for the initial period. This is not surprising since we are focusing on regions where, at the beginning of the policy, mortality rates are higher than the country average. At the end of 1996, both neonatal and infant mortality show to be in line with the country average, confirming the successful impact of the policy in reducing child mortality.

Table 2: Infant and neonatal mortality and place of delivery

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality					
	neonatal		infant		home delivery	
treat	0.028***	0.023**	0.032**	0.031**	-0.021	-0.022
	(0.009)	(0.010)	(0.013)	(0.014)	(0.059)	(0.080)
post	-0.005	-0.006	-0.007	-0.005	-0.016	-0.015
	(0.008)	(0.009)	(0.012)	(0.013)	(0.033)	(0.040)
treat*post	-0.052***	-0.046***	-0.062***	-0.059***	0.021	0.061
	(0.010)	(0.011)	(0.014)	(0.017)	(0.039)	(0.050)
indigenous	0.014**	0.007	0.022***	0.031	0.140***	0.197**
	(0.006)	(0.013)	(0.007)	(0.022)	(0.027)	(0.078)
treat*indigenous		0.002		-0.002		-0.032
		(0.016)		(0.026)		(0.084)
post*indigenous		0.005		-0.008		-0.008
		(0.013)		(0.020)		(0.041)
treat*post*indigenous		-0.014		-0.003		-0.067
		(0.017)		(0.025)		(0.051)
Observations	8718	8718	7586	7586	2081	2081
Mean control	0.033	0.033	0.058	0.058	0.588	0.588

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

impact is not statistically significantly different between indigenous and non-indigenous women, as reported in columns (2) and (4). Conversely, although the coefficients in column (5) suggest a positive impact of the policy, there are not statistically significant differences in the probability of home delivery between treated and control provinces, nor between indigenous and non-indigenous women (column (6)). Table D in the Appendix reports the placebo coefficients for the year 1994, before the PNSRPF was introduced. In the years previous to the program no statistically significant differences can be observed between treated and control provinces, while indigenous women always show higher levels of child mortality and home delivery than non-indigenous women.

Second, we focus on the probability of being breast-fed longer than the average and on the probability of being fully immunized (at birth and by the first year). We expect breastfeeding and children's vaccination to explain part of the effects we observe on child mortality.

As reported in Table 3, women affected by the policy breastfeed their children longer than women in control areas. They are 17.3 percentage points more likely to breastfeed their children more than the average length for their months of age. This increase corresponds to roughly 2 weeks: the average length of breastfeeding goes from 10.2 to almost 11 months. Conversely, there are not statistical significant impacts of the PNSRPF on vaccines received by children within their first year of life. Table E in the Appendix reports the placebo coefficients for the year 1994.

Consistent results are found when we include provinces not affected by the policy, as reported in Table F in the Appendix. In Panel A, we compare treated provinces, control provinces - which were thus treated one year later - and provinces either never treated or treated after the slowdown in the sterilization campaign. The latter category comprises all remaining Peruvian provinces and therefore it includes provinces which never show indigenous sterilizations, provinces which show indigenous sterilizations before 1995 but were not treated and the few provinces which show indigenous sterilizations only starting from the end of the policy. The category omitted is control provinces treated later. In

Table 3: Children's breastfeeding and vaccination

	(1)	(2)	(3)	(4)	(5)	(6)
				vaccines		
	breastfeeding		at birth		by 1^{st} year	
treat	-0.114***	-0.139***	0.073	0.060	0.041	0.059
	(0.035)	(0.050)	(0.059)	(0.081)	(0.079)	(0.104)
post	-0.082	-0.086	0.035	0.071	0.026	0.025
	(0.050)	(0.055)	(0.066)	(0.081)	(0.077)	(0.084)
treat*post	0.173***	0.226***	-0.046	-0.085	0.032	0.000
	(0.061)	(0.081)	(0.064)	(0.080)	(0.068)	(0.081)
indigenous	-0.032	-0.045	-0.016	-0.033	0.004	-0.004
	(0.031)	(0.072)	(0.037)	(0.100)	(0.045)	(0.092)
treat*indigenous		0.060		0.037		-0.030
		(0.087)		(0.115)		(0.115)
post*indigenous		0.018		-0.130		0.001
		(0.097)		(0.119)		(0.104)
treat*post*indigenous		-0.107		0.131		0.059
		(0.118)		(0.127)		(0.123)
Observations	1567	1567	2483	2483	1517	1517
Mean control	0.790	0.790	0.342	0.342	0.246	0.246

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, year and quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Panel B, control provinces treated later and control provinces not included are collapsed in a single category. Treat is a dummy equal to 1 if the woman lives in a treated province and 0 otherwise. The results in both panels are consistent with the findings of the main analysis.[21] To further study the impacts of the PNSRPF on child mortality, place of delivery, breastfeeding and children's vaccination, we also analyze whether there are heterogeneous effects based on children's gender and the intensity of the program.[22] As reported in Tables G and H in the Appendix, neither gender nor the intensity are relevant when looking for differential impacts of the policy on our outcomes of interest.

4.1.2 Permanent versus Temporary Contraceptive Methods

To study the differential effects of permanent versus temporary interventions on our main outcomes of interest, we first look at the impact of the PNSRPF on the use of contraceptive methods. The choice of using or not a contraceptive method and which method to employ are affected by the policy itself. The results are reported in Table 4. The outcomes are mutually excludable: a woman uses none contraceptive method (columns (1) and (2)) or she uses temporary methods (columns (3) and (4)) or got sterilized (columns (5) and (6)).

Overall, women in treated provinces are 5.6 percentage points less likely to use no method of contraception and 9.6 percentage points more likely to use modern temporary methods, compared to women in control areas. They are also 4.1 percentage points less likely to get surgical contraceptions, compared to women in control areas. However, in treated provinces indigenous women are 9.6 percentage points more likely to get sterilized than non-indigenous women, confirming the target of the policy (column 6).[23]

[21] In Panel B of Table F in the Appendix the coefficient of interest for breastfeeding suggests a positive impact of the policy, although the effect is here only close to be statistically significant.

[22] We also control for children's ranking among siblings. The results are not particularly informative: there is not a clear pattern suggesting that birth order matters differently for our outcomes of interest. The results are not reported but they are available upon request.

[23] We cannot provide placebo tests for contraceptive methods since we do not have chronological information on the use of contraceptives prior to the last and current method used and we have survey data starting only from 1996.

Table 4: Contraceptive methods

	(1)	(2)	(3)	(4)	(5)	(6)
	none		temporary		permanent	
treat	0.063***	0.056***	-0.074***	-0.066***	0.011*	0.011*
	(0.021)	(0.028)	(0.021)	(0.028)	(0.005)	(0.005)
post	0.176***	0.203***	-0.296***	-0.345***	0.121***	0.142***
	(0.021)	(0.026)	(0.015)	(0.018)	(0.011)	(0.013)
treat*post	-0.056**	0.014	0.096***	0.052**	-0.041***	-0.065***
	(0.025)	(0.034)	(0.018)	(0.026)	(0.013)	(0.017)
indigenous	0.078***	0.188***	-0.086***	-0.217***	0.008	0.028***
	(0.020)	(0.036)	(0.020)	(0.036)	(0.008)	(0.009)
treat*indig		-0.051		0.062		-0.012
		(0.041)		(0.042)		(0.008)
post*indigenous		-0.115***		0.206***		-0.091***
		(0.039)		(0.030)		(0.020)
treat*indigenous*post		-0.053		-0.043		0.096***
		(0.048)		(0.037)		(0.025)
Observations	4736	4736	4736	4736	4736	4736
Mean control	0.642	0.642	0.292	0.292	0.066	0.066

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, year and quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Had the policy affected the use of these methods, we can focus on their differential effects only in treated provinces. The primary outcomes of interest are children's mortality, place of delivery, length of breastfeeding and the probability of receiving complete vaccination. Table I in the Appendix report the results for the whole sample. For indigenous children there are few statistically significant differences between temporary and permanent interventions. Children of mothers who got sterilized are barely affected by the policy compared to children whose mothers used none contraceptive method. Non-indigenous children are instead positively affected by the policy regardless of the method used. Nonetheless, the comparison of the type of method used - temporary versus permanent interventions - may capture simple correlations: the choice to use one method or another can be an individual choice correlated with unobservables which also affect the outcomes of interest. To isolate the impacts of the policy, we restrict the sample to women aged less than 30. They less likely choose to get sterilized and the method adopted can be more convincingly considered as exogenous.

As reported in Table 5, there are differences between indigenous and non-indigenous children. As for the full sample, non-indigenous children are positively affected by the policy, regardless of the contraception their mothers use. If women adopt temporary contraceptive methods, their children are 15.6 percentage points less likely to be delivered at home, compared to children whose mothers used none contraceptive method. If women got sterilized, their children are 4.1 percentage points less likely to die and 22.6 percentage points more likely to receive complete vaccination by the first year of life, compared to children whose mothers used none contraceptive method. Conversely, for indigenous children, there are positive effects on child health care only if their mothers use temporary contraceptive methods. They are 16.4 percentage points more likely to be breast-fed longer than the average (roughly 1 month more), 23.8 percentage points more likely to receive the required vaccinations at birth, compared to children whose mothers used none contraceptive method. Permanent interventions result instead less beneficial. Although children of women who got sterilized are less likely to die, this seems to be

Table 5: Treated provinces: contraceptive methods on mortality, breastfeeding and vaccination (women aged less than 30)

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality				vaccines	
	neonatal	infant	home delivery	breastfeeding	at birth	by 1^{st} year
Indigenous						
temporary	0.039	-0.025	-0.044	0.164***	0.238**	0.130
	(0.052)	(0.041)	(0.072)	(0.043)	(0.101)	(0.090)
permanent	-0.015*	-0.067***	-0.292**	-0.053	0.037	-0.026
	(0.008)	(0.024)	(0.126)	(0.166)	(0.168)	(0.110)
Observations	735	1069	260	446	350	322
Mean control	0.016	0.075	0.885	0.767	0.331	0.264
Non-indigenous						
temporary	0.003	-0.037	-0.156**	0.055	0.176	0.142
	(0.003)	(0.031)	(0.064)	(0.044)	(0.124)	(0.103)
permanent	0.003	-0.041*	-0.177	0.083	0.165	0.226*
	(0.005)	(0.021)	(0.130)	(0.241)	(0.167)	(0.124)
Observations	505	815	185	342	218	206
Mean control	0.006	0.049	0.481	0.713	0.376	0.316

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

mainly related to the fact that they were delivered in safer conditions and not because they received better child care after delivery. The anecdotal evidence can help us interpret the results: indigenous mothers may face surgical interventions after giving birth during health festivals. Their children are born in a safer environment since they are attended by doctors. They might have fewer complications during the delivery and thus be less likely to die by their first year of life, compared to women delivering at home. Nonetheless, columns (4) to (6) of Table 5 suggest that they are not breast-fed for longer nor they are more likely to receive the appropriate vaccinations by their age. The positive effects one would expect when more resources are available for each child go away. Overall, we do not observe a behavior in line with Becker's Quality-Quantity mechanism: exogenous permanent changes in family size does not make parents to rearrange child investment in the household.

We are aware that the sample reduces consistently when we look at the differential impacts of contraceptive methods used. Also, we do not know from the survey who freely decided to get sterilized and who has been forced to do it. We acknowledge that we cannot drive strong conclusions on the impacts of contraception on child health. Nevertheless, we believe these results are informative of different reactions to the policy by ethnicity and that such effects comply with the anecdotal evidence suggesting that the PNSRPF was aggressively targeting indigenous women.

5 Conclusions

The PNSRPF was carried out in Peru during the period 1996-2000. At the time, infant and child mortality rates were exceptionally high in the country and, together with the high prevalence of chronic malnutrition among children under five years, they were challenges to face. We identify which provinces were exposed to the PNSRPF by exploiting that the program was plausibly targeting a subgroup of the population, mostly indigenous women. We select as treated provinces those in which we start to observe indigenous sterilizations from 1996, suggesting that those sterilizations occur for the first

time due to the PNSRPF. Control provinces are selected to be provinces in which the program arrives later, concretely in 1997. We look at the program's short-run impacts by comparing the two types of provinces (treated vs control) in the year when the treated provinces were reached by the program (1996) compared to before. First, we observe that children in provinces affected by the policy are less likely to die within their first year of life compared to children in control provinces. These results can be partially explained by an increase in the time mothers breastfeed their children in treated provinces, compared to children in control provinces. The likelihood they receive the appropriate vaccination within their first year of life is instead no statistically significantly different due to the policy. Results are also robust to including provinces not affected by the program. Also, the gender of the child is not relevant for any of the outcomes of interest, nor it is the intensity of the program (percent of sterilizations in the province). Furthermore, the policy has an overall positive impact on the use of temporary contraceptive methods: women in treated areas are more likely to use them, compared to women in control areas. Nonetheless, in treated provinces we observe differential impacts by ethnic groups. While non-indigenous children mostly benefit from the policy regardless of the contraceptive method their mothers use, almost all the positive impacts of the PNSRPF are washed away for indigenous children whose mothers got sterilized. Especially for the last group which anecdotal evidence suggests being most likely exogenously affected by permanent interventions, these results do not support Becker's quality-quantity mechanism. The permanent change in the household size - no more children can be born after permanent interventions - does not make parents to reallocate children investment. Their last born children do not receive more accurate vaccinations nor are breast-fed longer. In line with Byker and Gutierrez (2012), we show that when birth control is imposed, benefits from making choices about fertility may not accrue and that the reduction in the number of children does not involve substantial improvements in their health care.

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A Appendix

Table A: Fertility rates by year

	1986	1991-92	1996	2000	2004-05
TFR	4.116	3.543	3.536	2.847	2.470
	(0.100)	(0.052)	(0.038)	(0.034)	(0.042)

Standard errors in parentheses

Table B: Pre-determined Characteristics

Variable	(1) All	(2) Treatment	(3) Control	(4) Control Excluded	(5) P-value (3)-(4)	(6) P-value (2)-(4)	(7) Normalized Diff (3)-(4)	(8) Normalized Diff (2)-(4)
A. Child's characteristics								
Ranking among siblings	3.207	3.624	3.312	3.059	.527	.000	.081	.175
	(2.249)	(2.386)	(2.236)	(2.185)				
Female (=1)	.484	.495	.464	.483	.388	.461	-.027	.017
	(.5)	(.5)	(.499)	(.5)				
Quarter of birth 1st	.255	.29	.248	.244	.883	.006	.006	.073
	(.436)	(.454)	(.432)	(.43)				
Quarter of birth 2nd	.256	.29	.27	.244	.018	.002	.043	.074
	(.437)	(.434)	(.444)	(.429)				
Quarter of birth 3rd	.25	.231	.23	.259	.069	.056	-.047	-.046
	(.433)	(.422)	(.421)	(.438)				
Quarter of birth 4th	.238	.189	.252	.253	.993	.001	-.002	-.110
	(.426)	(.392)	(.434)	(.435)				
Observations	14235	3302	973	9960				
B. Mother's characteristics								
Age mother	27.418	27.755	27.245	27.324	.656	.224	-.009	.050
	(6.071)	(6.176)	(5.967)	(6.043)				
Age mother sq	1313.601	1338.425	1333.711	1303.4	.764	.663	.040	.046
	(539.7)	(537.136)	(530.708)	(541.15)				
Years of education	6.528	4.991	6.443	7.047	.522	.008	-.098	-.334
	(4.46)	(4.289)	(4.345)	(4.408)				
Indigenous (=1)	.208	.512	.237	.104	.232	.000	.253	.695
	(.406)	(.5)	(.425)	(.306)				
Married (=1)	.465	.587	.442	.427	.734	.001	.021	.230
	(.499)	(.492)	(.497)	(.495)				
Working (=1)	.435	.366	.436	.458	.722	.490	-.030	-.132
	(.496)	(.482)	(.496)	(.498)				
C. Household's characteristics								
Household wealth[a]	-.193	-.609	-.192	-.055	.471	.224	-.063	-.264
	(1.545)	(1.392)	(1.151)	(1.57)				
City (=1)	.382	.181	.246	.462	.038	.001	-.327	-.445
	(.486)	(.385)	(.431)	(.499)				
Town (=1)	.112	.092	.192	.11	.015	.491	.163	-.043
	(.315)	(.289)	(.394)	(.313)				
Rural (=1)	.506	.726	.562	.428	.228	.000	.191	.449
	(.5)	(.446)	(.496)	(.495)				
Jungle (=1)	.227	.077	.195	.928	.433	.004	-.140	-.387
	(.419)	(.267)	(.397)	(.449)				
Observations	14121	3276	967	9878				

[a] The wealth index ranges between -2.814 and 3.463.
Columns 1 to 4 report means with standard deviation in parentheses, based on children and women in all, treatment and control provinces respectively. Columns 5 and 6 report the p-value of the test of equal means, allowing for standard errors to be clustered by province. Column 7 reports normalized differences computed as the difference in means in control and control excluded villages divided by the square root of the sum of the variances. Column 8 reports normalized differences computed as the difference in means in treatment and control excluded villages divided by the square root of the sum of the variances.

Table C: Pre-determined Characteristics

Variable	(1) All	(2) Indigenous	(3) Non Indigenous	(4) P-value (2)-(3)	(5) Normalized Differences
A. Child's characteristics					
Ranking among siblings	3.553	4.023	3.171	.000	.258
	(2.356)	(2.498)	(2.160)		
Female (=1)	.487	.493	.482	.627	.015
	(.5)	(.5)	(.499)		
Quarter of birth 1st	.28	.289	.169	.485	.025
	(.449)	(.453)	(.446)		
Quarter of birth 2nd	.285	.293	.279	.408	.023
	(.452)	(.455)	(.448)		
Quarter of birth 3rd	.231	.236	.226	.641	.017
	(.421)	(.425)	(.418)		
Quarter of birth 4th	.203	.181	.221	.022	.-072
	(.402)	(.384)	(.415)		
Observations	4275	1915	2360		
B. Mother's characteristics					
Age mother	27.639	28.084	27.276	.006	.093
	(6.132)	(6.429)	(5.855)		
Age mother sq	1337.619	1360.422	1318.534	.334	.055
	(535.619)	(549.897)	(523.897)		
Years of education	5.321	2.946	7.259	.000	-.824
	(4.344)	(2.844)	(4.395)		
Married (=1)	.554	.655	.471	.000	.266
	(.497)	(.475)	(.499)		
Working (=1)	.382	.244	.494	.000	.-379
	(.486)	(.429)	(.500)		
C. Household's characteristics					
Household wealth[a]	-.514	-1.213	.057	.000	-.701
	(1.434)	(1.208)	(1.349)		
City (=1)	.196	.018	.341	.000	-.655
	(.397)	(.134)	(.474)		
Town (=1)	.115	.034	.181	.000	-.345
	(.319)	(.004)	(.008)		
Rural (=1)	.689	.947	.477	.000	.858
	(.463)	(.223)	(.499)		
Jungle (=1)	.104	.054	.150	.064	-.220
	(.306)	(.225)	(.352)		
Observations	4243	1906	2337		

[a] The wealth index ranges between -2.814 and 3.463.
Columns 1 to 3 report means with standard deviation in parentheses, based on children and women in all, treatment and control provinces respectively. Column 4 reports the p-value of the test of equal means, allowing for standard errors to be clustered by province. Column 5 reports normalized differences computed as the difference in means in treatment and control villages divided by the square root of the sum of the variances.

Table D: Infant and neonatal mortality - Placebo 1994

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality					
	neonatal		infant		home delivery	
treat	-0.005	-0.011	-0.009	-0.011	-0.012	-0.009
	(0.006)	(0.008)	(0.008)	(0.010)	(0.059)	(0.077)
post	-0.003	-0.003	-0.008	-0.004	0.037	0.059**
	(0.008)	(0.008)	(0.008)	(0.009)	(0.025)	(0.029)
treat*post	0.004	0.004	0.013	0.012	-0.029	-0.012
	(0.010)	(0.009)	(0.010)	(0.011)	(0.029)	(0.043)
indigenous	0.019***	0.003	0.026***	0.027	0.083**	0.171**
	(0.005)	(0.014)	(0.006)	(0.019)	(0.035)	(0.072)
treat*indigenous		0.020		0.003		-0.055
		(0.016)		(0.021)		(0.081)
post*indigenous		-0.000		-0.015		-0.104*
		(0.017)		(0.025)		(0.058)
treat*post*indigenous		-0.002		0.009		0.027
		(0.021)		(0.028)		(0.066)
Observations	9031	9031	9031	9031	1806	1806
Mean control	0.040	0.040	0.061	0.061	0.652	0.652

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Table E: Children's breastfeeding and vaccination - Placebo 1994

	(1)	(2)	(3)	(4)	(5)	(6)
			Vaccines			
	breastfeeding		at birth		by 1^{st} year	
treat	0.060	0.030	-0.027	-0.035	-0.022	-0.017
	(0.048)	(0.056)	(0.053)	(0.055)	(0.051)	(0.053)
post	0.066	0.165	0.045	0.080	0.031	0.060
	(0.130)	(0.099)	(0.069)	(0.062)	(0.062)	(0.054)
treat*post	0.037	-0.038	0.019	-0.007	0.020	-0.014
	(0.148)	(0.125)	(0.073)	(0.071)	(0.065)	(0.060)
indigenous	0.046	-0.028	-0.014	-0.000	-0.018	0.013
	(0.042)	(0.075)	(0.041)	(0.076)	(0.038)	(0.075)
treat*indigenous		0.104		0.009		-0.028
		(0.082)		(0.085)		(0.086)
post*indigenous		-0.218		-0.153*		-0.128
		(0.301)		(0.083)		(0.082)
treat*post*indigenous		0.176		0.132		0.136
		(0.316)		(0.097)		(0.095)
Observations	901	901	1671	1671	1662	1662
Mean control	0.536	0.536	0.330	0.330	0.287	0.287

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, year and quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Table F: Children's mortality, place of delivery, breastfeeding and vaccination

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality				vaccination	
	infant	neonatal	home delivery	breastfeeding	at birth	by 1^{st} year
Categorical (the category omitted corresponds to provinces treated later - control group in the main analysis)						
treat	0.029**	0.028***	-0.006	-0.070**	0.087	0.048
	(0.012)	(0.009)	(0.063)	(0.028)	(0.059)	(0.075)
never treated	-0.013	-0.004	-0.033	-0.088***	0.136**	0.132*
	(0.010)	(0.007)	(0.063)	(0.023)	(0.055)	(0.070)
treat*post	-0.056***	-0.051***	0.025	0.094*	-0.042	0.027
	(0.013)	(0.010)	(0.039)	(0.053)	(0.064)	(0.068)
not included*post	-0.000	0.000	0.005	0.047	-0.042	-0.025
	(0.011)	(0.009)	(0.033)	(0.047)	(0.060)	(0.059)
indigenous	0.019***	0.012***	0.065***	0.002	-0.069**	-0.057*
	(0.005)	(0.004)	(0.024)	(0.019)	(0.026)	(0.029)
Observations	23124	27682	7587	5694	8602	4957
Mean control	0.040	0.024	0.472	0.710	0.486	0.385
Provinces treated later or not included						
treat	0.040***	0.032***	0.023	0.008	-0.035	-0.071*
	(0.007)	(0.006)	(0.033)	(0.024)	(0.031)	(0.037)
post	-0.005	-0.003*	-0.016	-0.017	0.033*	0.055*
	(0.003)	(0.002)	(0.010)	(0.020)	(0.019)	(0.033)
treat*post	-0.056***	-0.051***	0.020	0.050	-0.000	0.052
	(0.008)	(0.006)	(0.026)	(0.035)	(0.029)	(0.040)
indigenous	0.019***	0.012***	0.066***	0.008	-0.074***	-0.064**
	(0.006)	(0.004)	(0.023)	(0.019)	(0.026)	(0.029)
Observations	23124	27682	7587	5694	8602	4957
Mean control	0.040	0.024	0.472	0.710	0.486	0.385

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, year and quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Table G: Children's mortality, place of delivery, breastfeeding and vaccination (by gender)

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality				vaccines	
	infant	neonatal	home delivery	breastfeeding	at birth	by 1^{st} year
treat	0.043***	0.031***	-0.038	-0.104**	0.039	0.123**
	(0.016)	(0.010)	(0.075)	(0.039)	(0.047)	(0.061)
female	0.019	0.003	-0.004	-0.001	-0.067	0.096
	(0.016)	(0.009)	(0.056)	(0.044)	(0.064)	(0.096)
post	0.009	-0.005	0.018	-0.091*	0.009	0.068
	(0.014)	(0.009)	(0.046)	(0.047)	(0.048)	(0.079)
treat*post	-0.078***	-0.051***	-0.010	0.180***	-0.009	-0.036
	(0.018)	(0.013)	(0.051)	(0.063)	(0.057)	(0.077)
treat*post*female	0.033	-0.001	0.058	-0.011	-0.079	0.140
	(0.025)	(0.020)	(0.069)	(0.097)	(0.092)	(0.128)
treat*female	-0.026	-0.007	0.035	-0.022	0.073	-0.173
	(0.021)	(0.013)	(0.060)	(0.065)	(0.073)	(0.106)
post*female	-0.034*	-0.000	-0.064	0.017	0.055	-0.086
	(0.018)	(0.016)	(0.066)	(0.078)	(0.082)	(0.119)
Observations	7586	8718	2081	1567	2483	1517
Mean control	0.058	0.033	0.588	0.790	0.342	0.246

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, year and quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Table H: Children's mortality, place of delivery, breastfeeding and vaccination (Intensity)

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality				vaccines	
	infant	neonatal	home delivery	breastfeeding	at birth	by 1^{st} year
treat	0.025*	0.027**	0.001	-0.129***	0.119**	0.091
	(0.013)	(0.010)	(0.071)	(0.042)	(0.055)	(0.080)
intensity	-0.034*	-0.008	0.104	-0.013	0.170***	0.148**
	(0.018)	(0.017)	(0.064)	(0.082)	(0.056)	(0.063)
post	-0.010	-0.006	0.037	-0.078*	0.070	0.047
	(0.014)	(0.012)	(0.036)	(0.042)	(0.055)	(0.074)
treat*post	-0.061***	-0.052***	-0.012	0.177***	-0.088	-0.006
	(0.017)	(0.014)	(0.043)	(0.059)	(0.053)	(0.065)
treat*post*intensity	-0.000	0.003	0.089	-0.062	0.110	0.128
	(0.033)	(0.024)	(0.070)	(0.125)	(0.114)	(0.130)
treat*intensity	0.025	0.003	-0.051	0.097	-0.136	-0.191**
	(0.022)	(0.020)	(0.075)	(0.087)	(0.099)	(0.093)
post*intensity	0.007	0.003	-0.172***	-0.005	-0.101	-0.060
	(0.029)	(0.021)	(0.060)	(0.115)	(0.097)	(0.119)
Observations	7586	8718	2081	1567	2483	1517
Mean control	0.058	0.033	0.588	0.791	0.342	0.246

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, year and quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

Table I: Treated provinces: contraceptive methods on mortality, breastfeeding and vaccination

	(1)	(2)	(3)	(4)	(5)	(6)
	mortality				vaccines	
	neonatal	infant	home delivery	breastfeeding	at birth	by 1^{st} year
Indigenous						
temporary	0.033	-0.007	-0.048	0.141***	0.209**	0.098
	(0.046)	(0.057)	(0.064)	(0.044)	(0.103)	(0.075)
permanent	0.004	-0.034	-0.206**	0.048	0.004	-0.035
	(0.021)	(0.024)	(0.090)	(0.100)	(0.123)	(0.090)
Observations	971	1455	362	621	480	458
Mean control	0.018	0.071	0.895	0.776	0.310	0.240
Non-indigenous						
temporary	-0.001	-0.011	-0.193***	0.066	0.172*	0.113
	(0.006)	(0.037)	(0.058)	(0.044)	(0.101)	(0.087)
permanent	-0.011	-0.020	-0.219*	0.199	0.183*	0.149
	(0.008)	(0.017)	(0.123)	(0.167)	(0.094)	(0.125)
Observations	645	1032	248	435	284	268
Mean control	0.008	0.049	0.480	0.720	0.380	0.310

Robust standard errors clustered at the province level in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. In all the columns, we control for child's characteristics (ranking among siblings, gender, quarter of birth), mother's characteristics (age, age squared, years of education, whether she is indigenous, whether she is married and whether she is currently working) and household's characteristics (wealth and location).

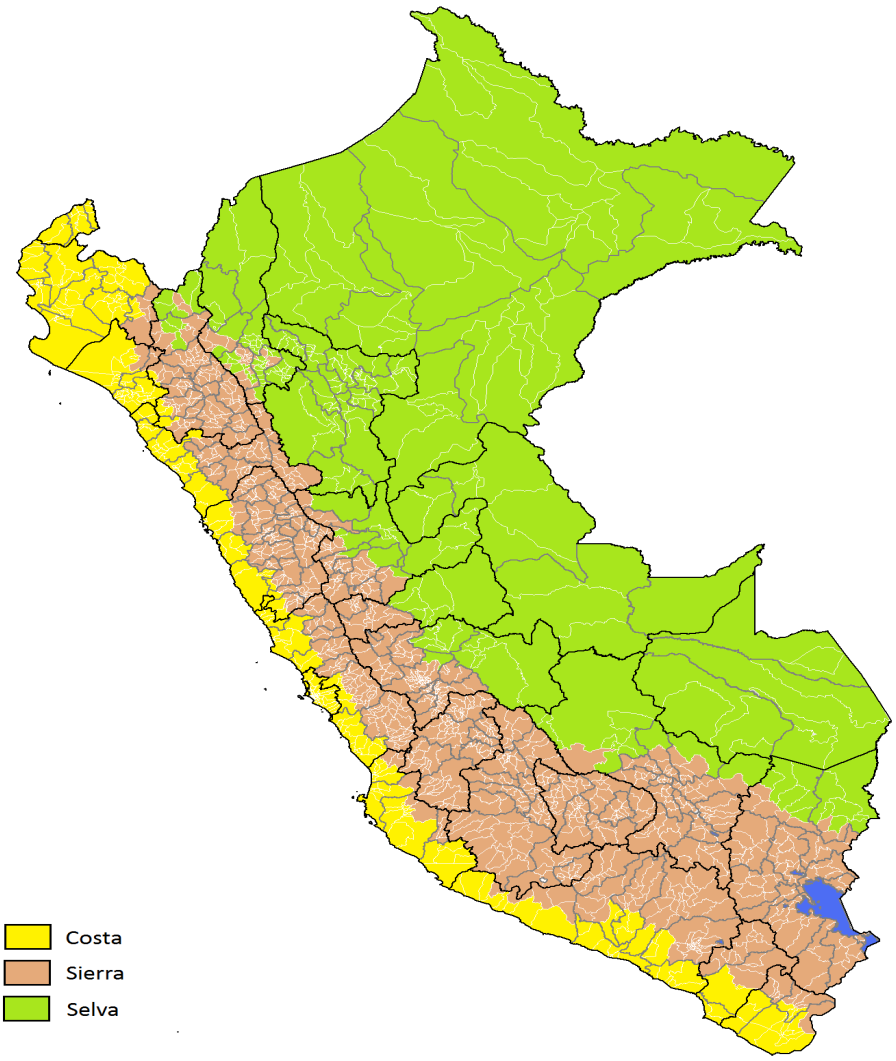

Figure A: Geographical regions of Peru

Source: Wikimedia

Ivie

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