gLOCAL EVALUATION WEEK
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The Impact of the Normal Birth Centers on the Epidemic Cesareans in Ceará

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The Epidemic of C-section in Brazil

- Despite the cesarean section (CS) being able to save lives, its indiscriminate use can pose high risks to the health of women and children (Fahmy et al., 2018; Sandall et al., 2018; Mascarello et al., 2018);
- In 1982, C-sections (28%) were already an epidemic in Brazil (Barros et al., 1991);
- The ideal rate of CS is between **10-15%** according to the international health care community (the 1985 WHO Meeting at Fortaleza, Brazil);
- In2015, Brazil holds the 2º largest rate of C-section (**56%**) among 85 countries with more than 95% of births occurring in health facilities (Boerma et al., 2018);
- **80–90%** of all babies in the private sector are born by CS, compared with **30–40%** in the public sector in the country (Betrán et al., 2018);
- An increasing of 1 pp in CS rate would generate an additional cost of US$ 3 million a year in the public health system of Brazil (Entringer et al., 2018);
- This is particularly worrying since less than 35 % of the maternity wards across the country have adequate human resources, medications, and emergency care equipment to ensure survival and adult intensive care beds (Bittencourt et al., 2016);

Potential Causes and Solution

- There are a variety of factors associated with C-sections in Brazil:
  - Women's socioeconomic status (Barros et al., 2011; Barros et al., 2015);
  - Women's fear of pain and misperception (Hopkins, 2000; Domingues et al., 2014);
  - Induction / persuasion by doctors (Hopkins, 2000; Potter et al., 2008; Barros et al., 2011);
  - Differences in clinical/obstetric practice between the public and private sectors (Torloni et al., 2016);
- In 2011, the Ministry of Health created the **Centros de Parto Normal - CPN** (*Normal Birth Centers*) under the Sistema Único de Saúde with the objective of reduce C-sections by offering humanized childbirth care (Teixeira et al., 2018).

Why study the case of Ceará?

1. Between 2007 and 2012, the C-section rate increased from 39.9% to 55,6% in Ceará (DATASUS);

2. The only state with full adherence of their municipalities to the Rede Cegonha (Santos, 2013);

3. It is the state with the largest production in CPNs with 43% of all births in the period 2013-2019 (DATASUS);

Centro de Parto Normal (Normal Birth Center)

- The characteristics of a CPN are:
  i. It integrates the Rede Cegonha (Cegonha Network);
  ii. It is a health unit for low-risk childbirth assistance that is located within or surrounding of hospital facility;
  iii. There are two types:
    - I – 3 rooms with minimum production of 480 births a year (or 40 births a month);
    - II – 5 rooms with minimum production of 840 births a year (or 70 births a month);
  iv. Minimum staff: 1 obstetrician, 1 to 2 obstetric nurse, 1 to 2 nursing technician, 1 general services assistance;
  v. It stays open 24 hours a day, 7 days a week;
  vi. It has a hospital back-up team (an obstetrician, anesthetist and pediatrician or neonatologist)

The Implementation of CPNs in Ceará

Between 2013 and 2019, 9 out of 33 planned CPNs were authorized to work.

Figure 1: Health Regions with CPN in Ceará

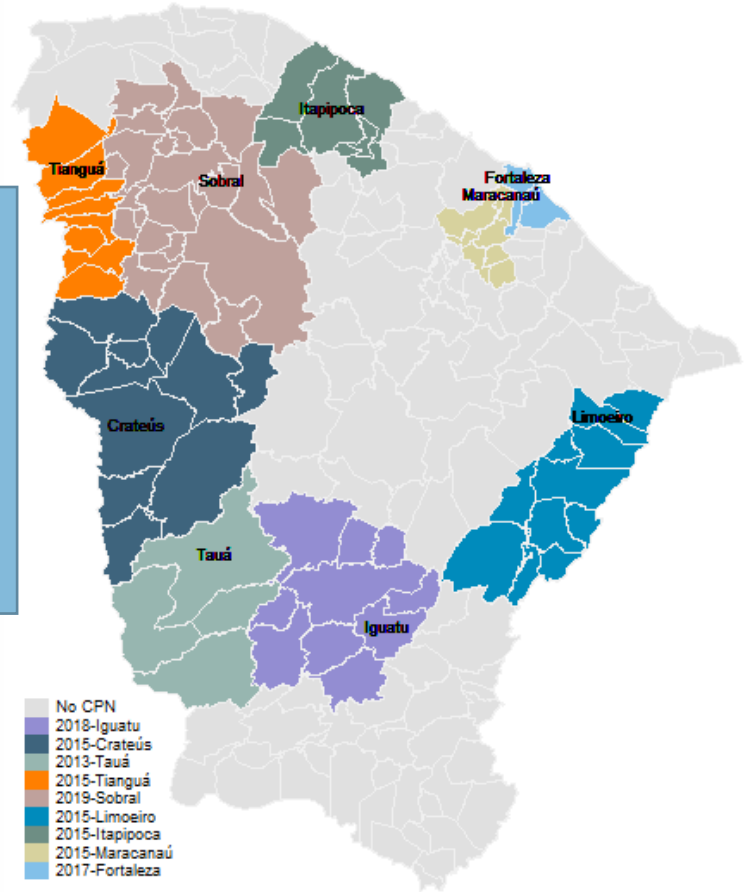
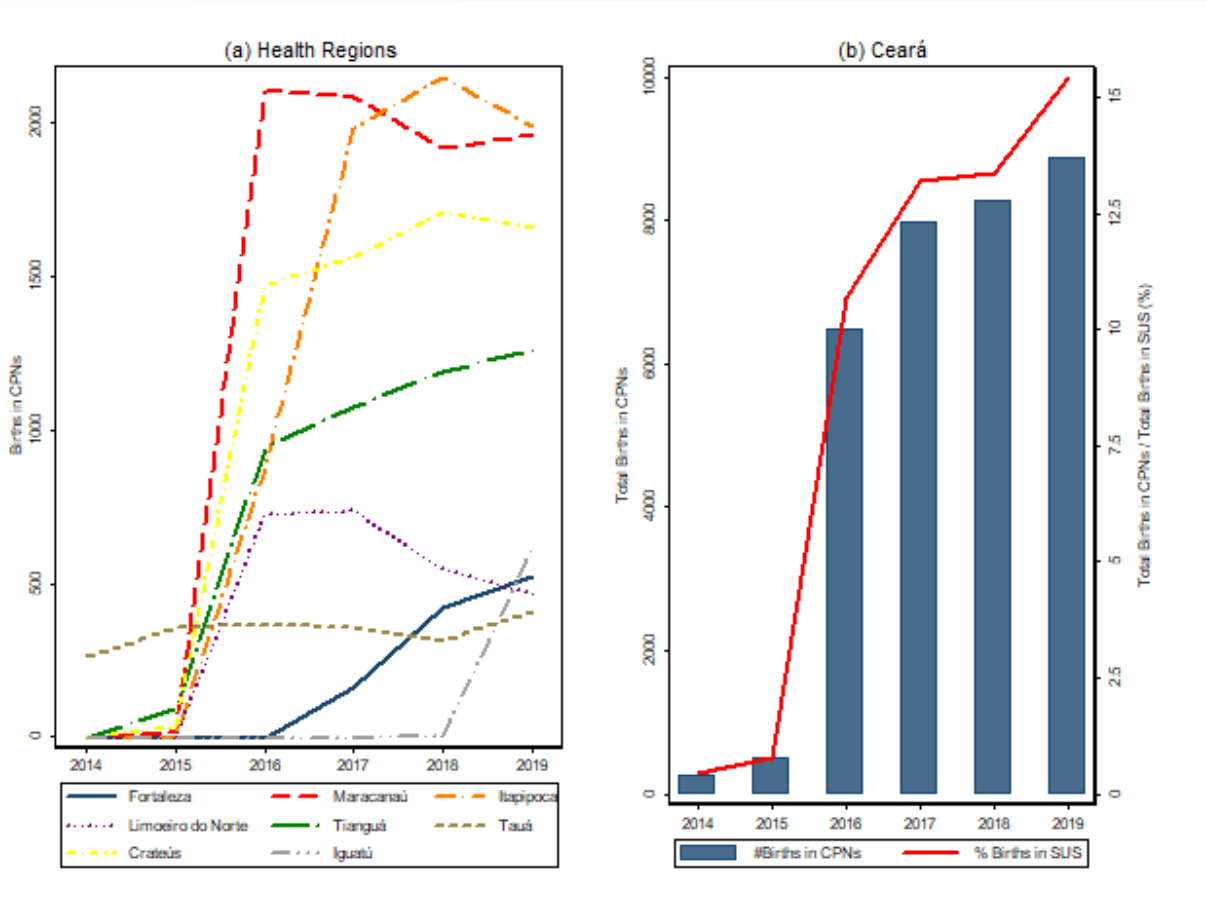


Figure 2: Births in CPNs in Ceará, 2014-2018



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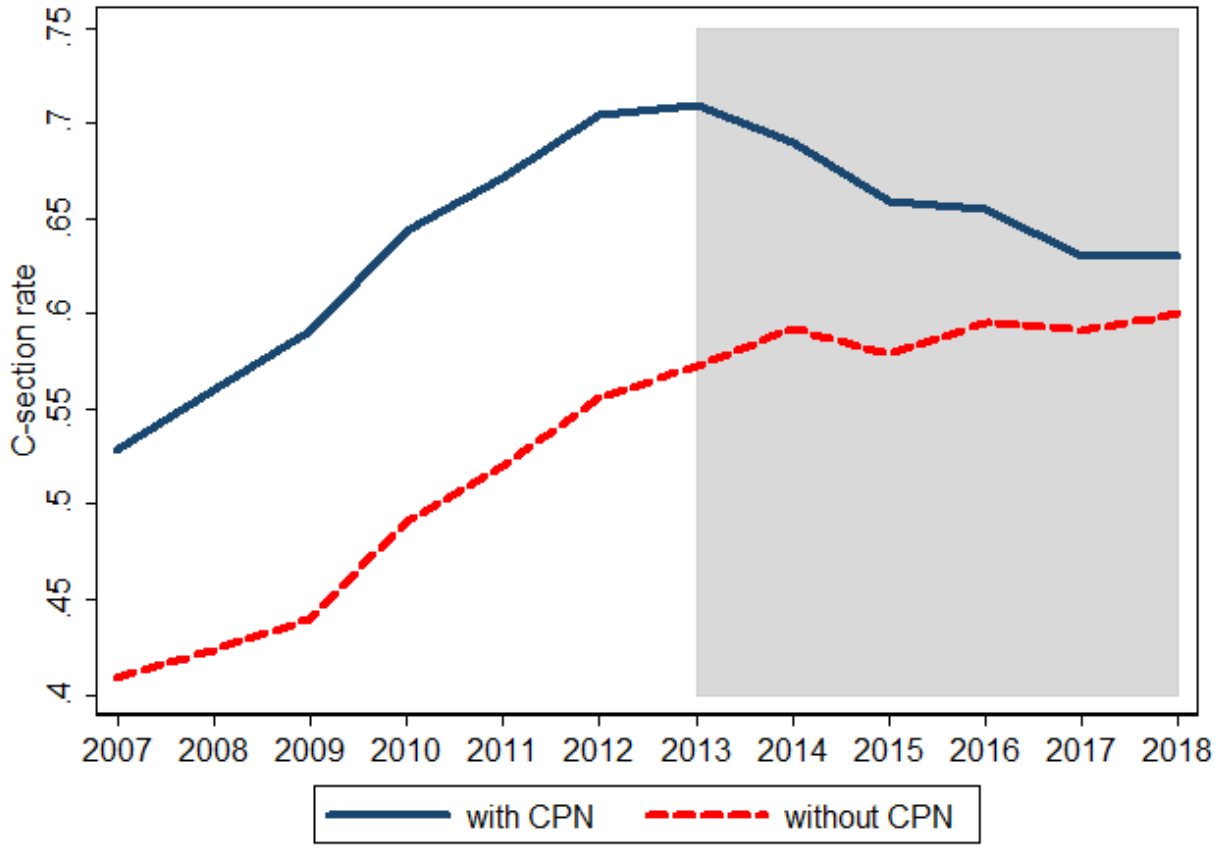
Differences in C-section rates

Figure 3: C-section rate for municipalities with and without access to CPNs in Ceará



Evidence:

i. From 2007 to 2013, the difference between municipalities with and without access to CPNs was about 14%;

ii. The difference was drastically reduced to 6% between 2014 and 2018.

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Data

Table 1: Descriptive statistics using birth cohorts from 2007 to 2013

	All (N = 1,288)		with CPN (N = 371)		without CPN (N = 917)				
	mean	s.d.	mean	s.d.	mean	s.d.	Diff.	s.d.	t-stat.
Child's characteristics									
Girls	0.487	0.019	0.487	0.015	0.487	0.023	0.000	0.001	0.09
White	0.141	0.123	0.132	0.122	0.150	0.123	-0.018	0.008	-2.40
Mother's characteristics									
Young	0.542	0.044	0.524	0.045	0.561	0.034	-0.038	0.002	-16.25
Low-educated	0.399	0.131	0.353	0.123	0.446	0.123	-0.093	0.008	-12.33
Married	0.437	0.163	0.430	0.148	0.444	0.177	-0.014	0.010	-1.37
Birth outcomes									
Birthweight	3248	50.66	3243	35.47	3253	62.24	-10.09	3.438	-2.94
Low birthweight (LBW)	0.065	0.013	0.066	0.010	0.063	0.015	0.003	0.001	3.77
Preterm	0.071	0.033	0.072	0.031	0.071	0.035	0.001	0.002	0.65
Early preterm	0.007	0.004	0.007	0.003	0.007	0.005	0.000	0.000	0.31
Late preterm	0.064	0.030	0.065	0.029	0.063	0.032	0.001	0.002	0.66
Apgar score at 1st min	8.093	0.251	8.107	0.211	8.078	0.285	0.030	0.016	1.80
Apgar score at 5th min	9.075	0.224	9.025	0.125	9.127	0.283	-0.102	0.015	-6.65
Pregnancy information									
Prenatal visits ≥ 7	0.550	0.151	0.496	0.121	0.606	0.159	-0.110	0.009	-12.02
Nullipara	0.433	0.046	0.447	0.045	0.420	0.043	0.027	0.003	10.15
Delivery information									
C-section	0.484	0.146	0.539	0.147	0.427	0.122	0.112	0.008	14.04
Weekend	0.237	0.029	0.232	0.026	0.243	0.031	-0.010	0.002	-5.77
[0h,6h)	0.156	0.036	0.145	0.034	0.168	0.035	-0.023	0.002	-10.87
[6h,12h)	0.305	0.044	0.308	0.032	0.302	0.053	0.006	0.003	2.05
[12h,18h)	0.311	0.042	0.315	0.032	0.307	0.049	0.008	0.003	2.86
[18h,24h)	0.227	0.029	0.232	0.023	0.223	0.034	0.009	0.002	4.69
Municipality of birth	0.255	0.295	0.161	0.257	0.354	0.301	-0.193	0.018	-10.87

- **Data sources:**
  - i. SINASC (2007-2018);
  - ii. SIH (2008-2018);
  - iii. CNES (2008-2018).
- **All variables are averages at municipality level;**

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Model

Difference-in-Difference

$$y_{mt} = \alpha + \delta(CPN_m \times P_t) + \beta CPN_m + \theta P_t + X_{mt}\Gamma + \epsilon_{mt}$$

- The underlying hypothesis is that treated and control municipalities share similar pre-intervention trends;

$$\begin{aligned}&\delta \\ &= \{E[y_{mt}|CPN = 1\,, P = 1] - E[y_{mt}|CPN = 1\,, P = 0]\} \\ &- \{E[y_{mt}|CPN = 0\,, P = 1] - E[y_{mt}|CPN = 0\,, P = 0]\}\end{aligned}$$

- δ measures the *Intention to Treat* (ITT), once the CPNs serve any pregnant women who seek for humanized childbirth care.

Pre-determined Characteristics of Municipalities

Table 2: Regression of municipalities of health regions benefited with CPNs on municipalities' pre-treatment characteristics

	2000	2010	Differences (2000-2010)
C-section rate	-0.008	-0.006	0.002
	(0.007)	(0.006)	(0.006)
Fertility rate	-0.062	0.340	0.107
	(0.113)	(0.259)	(0.131)
Life expectancy	0.036	-0.052	-0.040
	(0.024)	(0.043)	(0.030)
ln(Household Income per capita)	0.195	0.408	-0.075
	(0.406)	(0.476)	(0.347)
Young Population	3.407	-4.992	-2.558
	(3.982)	(3.563)	(4.916)
Fertile women	0.649	2.723	-8.767
	(4.272)	(2.861)	(4.927)
Urbanization rate	-0.004	-0.002	-0.016
	(0.005)	(0.005)	(0.011)
ln(Population size)	0.119	0.122	0.818
	(0.069)	(0.074)	(0.591)
Outcome mean	0.288	0.288	0.288
Outocme s.d.	0.454	0.454	0.454
Adj. R^2	0.334	0.349	0.258
Observations	184	184	184

Evidence:
The chance of a municipality have access to a CPN is not correlated with their pre-determined characteristics, including to previous shock in C-section rate and fertility.

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Selection on Observables

Table 3: Effect of CPNs on observable characteristics

	Girls	White	Young mother	Low-educated mother	Married mother	Nullipara
	(1)	(2)	(3)	(4)	(5)	(6)
CPN x (Year ≥ 2014)	-0.000	0.003	-0.002	0.047	0.019	-0.010
	(0.001)	(0.020)	(0.004)	(0.027)	(0.027)	(0.008)
Outcome mean	0.487	0.147	0.522	0.335	0.502	0.429
Outcome s.d.	0.019	0.13	0.051	0.136	0.179	0.044
#Clusters	184	184	184	184	184	184
Observations	2,208	2,208	2,208	2,208	2,208	2,208

Note. Standard errors are clustered at municipality level. The dependent variables are: **Girls** = proportion of girls in the sample; **White** = proportion of white babies in the sample; **Young mother** = proportion of mothers who are 25 years old or younger; **Low-educated mother** = proportion of mothers who reported less than 8 years of schooling; **Married mother** = proportion of mothers who are formally married or living in cohabitation; **Nullipara** = proportion of mothers who is experiencing the firs pregnancy. All estimations include year and municipality fixed effects. Source of information: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:
We found no change in the composition of child's and mother's characteristics due to the implementation of CPNs.

Results: Baseline Estimates

Table 4: Effect of CPNs on C-section rate

	(1)	(2)	(3)	(4)	(5)	(6)
CPN x (Year ≥ 2014)	-0.064**	-0.069***	-0.047***	-0.053***	-0.043***	-0.047***
	(0.022)	(0.019)	(0.011)	(0.013)	(0.012)	(0.013)
Outcome mean	0.521	0.521	0.521	0.521	0.521	0.521
Outcome s.d.	0.140	0.140	0.140	0.140	0.140	0.140
Year FE		X	X	X	X	X
Health region FE		X	X		X	
Municipality FE				X		X
Health region FE x Time-trend					X	
Municipality FE x Time-trend						X
Controls			X	X	X	X
F-test (H_0: X = 0)			19.443***	4.359***	18.104***	3.841***
Adj. R^2	0.208	0.777	0.836	0.915	0.846	0.939
#Clusters	184	184	184	184	184	184
Observations	2,208	2,208	2,208	2,208	2,208	2,208

Note. Standard errors are clustered at municipality level. The vector o controls include: **Girls** = proportion of girls in the sample; **White** = proportion of white babies in the sample; **Young mother** = proportion of mothers who are 25 years old or younger; **Low-educated mother** = proportion of mothers who reported less than 8 years of schooling; **Married mother** = proportion of mothers who are formally married or living in cohabitation; **Nullipara** = proportion of mothers who is experiencing the firs pregnancy. All estimates include a binary variable for municipalities with assess to CPNs, and a binary variable for the period 2014-2018. Source of information: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:
The implementation of CPNs reduced the C-section rate of municipalities in 5.3 pp, which corresponds to a drop of 10.2% relative to the baseline mean.

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Results: Baseline Estimates

Table 5: Robustness analyses

	Clustered errors		Mothers' mobility		Placebo test	
	(1)	(2)	(3)	(4)	(5)	(6)
CPN x (Year ≥ 2014)	-0.047***	-0.053***	-0.044***	-0.052***		
	(0.008)	(0.007)	(0.011)	(0.013)		
CPN x (Year ≥ 2011) - placebo					0.010	0.009
					(0.008)	(0.008)
Inter-regional displacement			0.110***			
			(0.029)			
Inter-municipal displacement				0.037		
				(0.027)		
Outcome mean	0.521	0.521	0.521	0.521	0.483	0.483
Outcome s.d.	0.140	0.140	0.140	0.140	0.147	0.147
Year FE	X	X	X	X	X	X
Health region FE	X		X		X	
Municipality FE		X		X		X
Controls	X	X	X	X	X	X
F-test (H_0: X = 0)	78.576***	12.130***	19.914***	3.868***	18.645***	4.078***
Adj. R^2	0.836	0.915	0.840	0.915	0.856	0.943
#Clusters	2,204	2,208	184	184	184	184
Observations	2,208	2,208	2,208	2,208	1,288	1,288

Evidence:

i. Standard errors are even smaller when they are clustered at municipality-year level;

ii. Mothers' mobility do not affect the baseline estimates;

iii. Placebo estimate suggests that our baseline model is appropriately capturing the effects of the CPNs.

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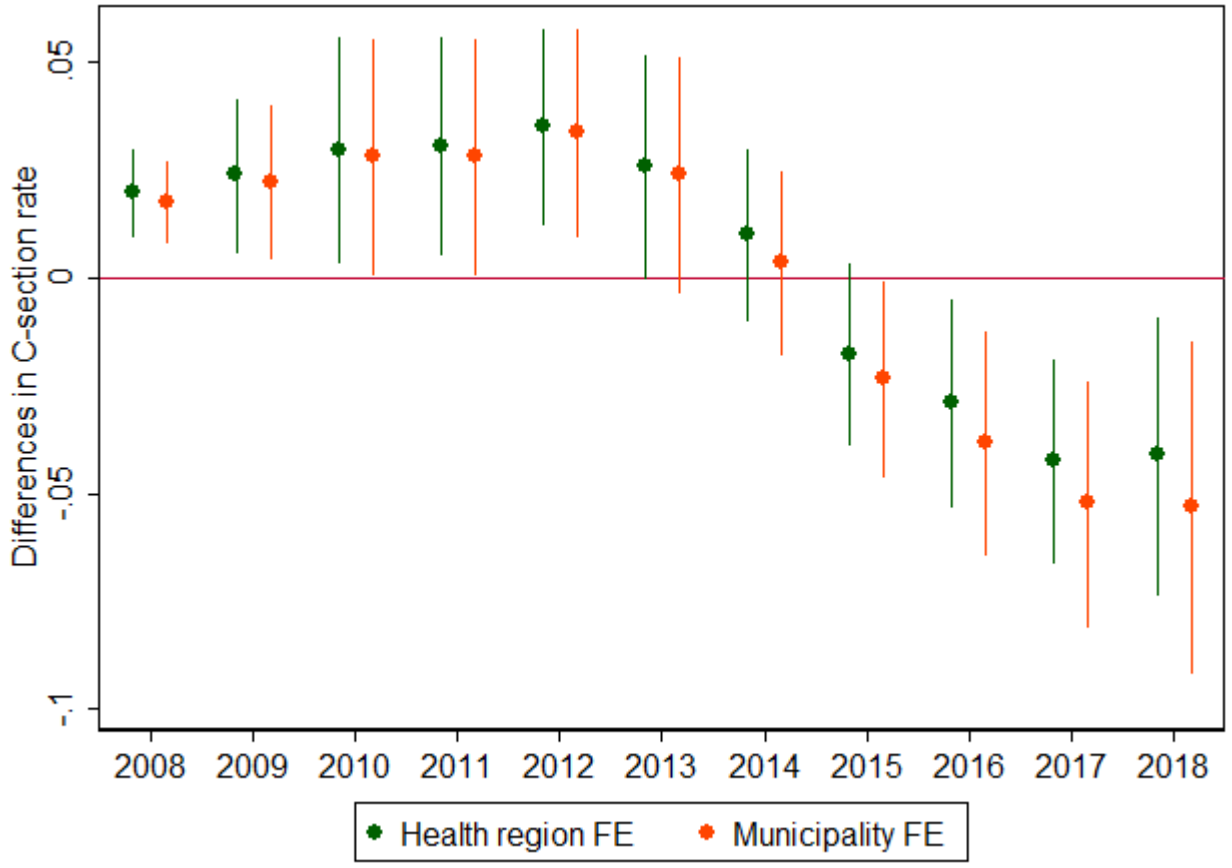
Results: Do the effects increase over the years?

Figure 4: Estimated Difference in C-section rate due to CPNs by Year in Ceará



Evidence:
The differences in the C-section rates sharply decrease after 2013, when CPNs start offering humanized childbirth care services.

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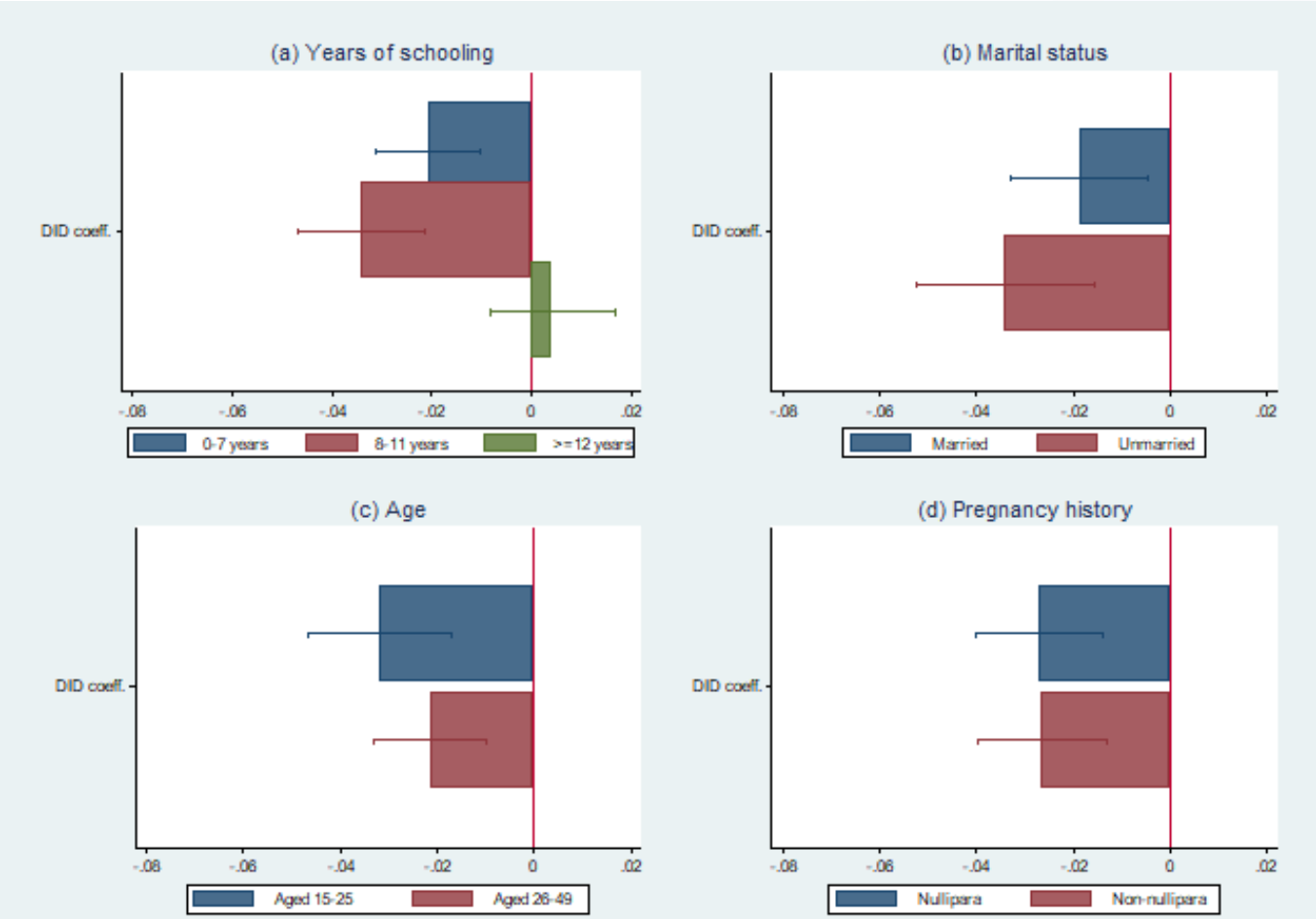
Results: Heterogeneous effects

Figure 5: Heterogeneous effects of CPNs on C-section rate based on mothers' characteristics



Evidence:
The baseline estimates seems to be driven the effects of CPNs on C-section rate of low-educated mothers and mothers with fundamental education.

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Results: Scheduled childbirth

Table 6: Effect of CPNs on Scheduled Births

	Born on Weekends	Born at [0h,6h)	Born at [6h,12h)	Born at [12h, 18h)	Born at [18h, 24h)
	(1)	(2)	(3)	(4)	(5)
CPN x (Year ≥ 2014)	0.012***	0.019***	-0.004	-0.018***	0.003
	(0.003)	(0.005)	(0.006)	(0.004)	(0.004)
Outcome mean	0.234	0.150	0.307	0.316	0.226
Outcome s.d.	0.028	0.034	0.046	0.043	0.031
F-test (H_0: X = 0)	5.064***	6.312***	2.788**	0.777	1.448
Adj. R^2	0.414	0.721	0.606	0.592	0.400
#Clusters	184	184	184	184	184
Observations	2,208	2,208	2,208	2,208	2,208

Note. Standard errors are clustered at municipality level. See footnote of Table 3 for the description of control variables. All estimates include a binary variable for municipalities with assess to CPNs and a binary variable for the period 2014-2018, as well as year and municipality fixed effects. Source of information: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:

i. The prevalence of babies born during weekends increased 1.2 pp with CPNs, or 5.1% relative to baseline mean;

ii. The prevalence babies born between 0h and 6h increased 1.9 pp, or 12.7% relative to baseline mean;

iii. The prevalence babies born between 12h and 18h decreased 1.8 pp, or -5.7% relative to baseline mean;

Results: Scheduled childbirth

Figure 6: Effect of CPNs on the prevalence of births on weekends, conditioned to the type of delivery

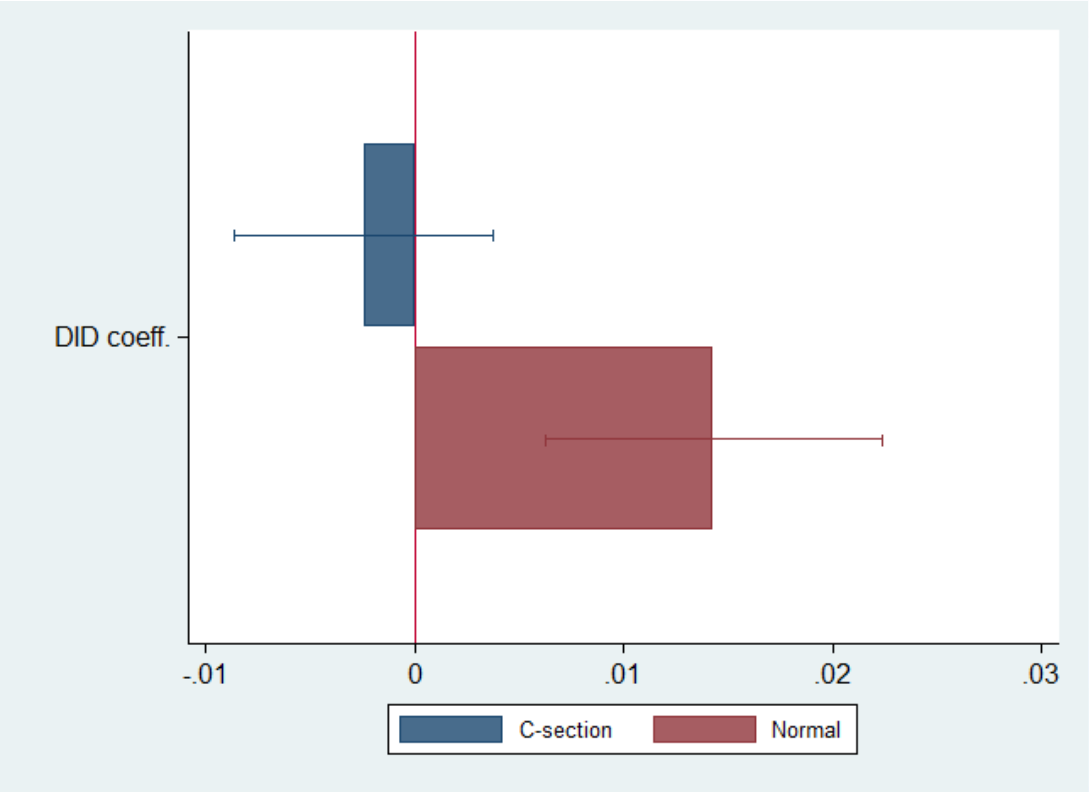
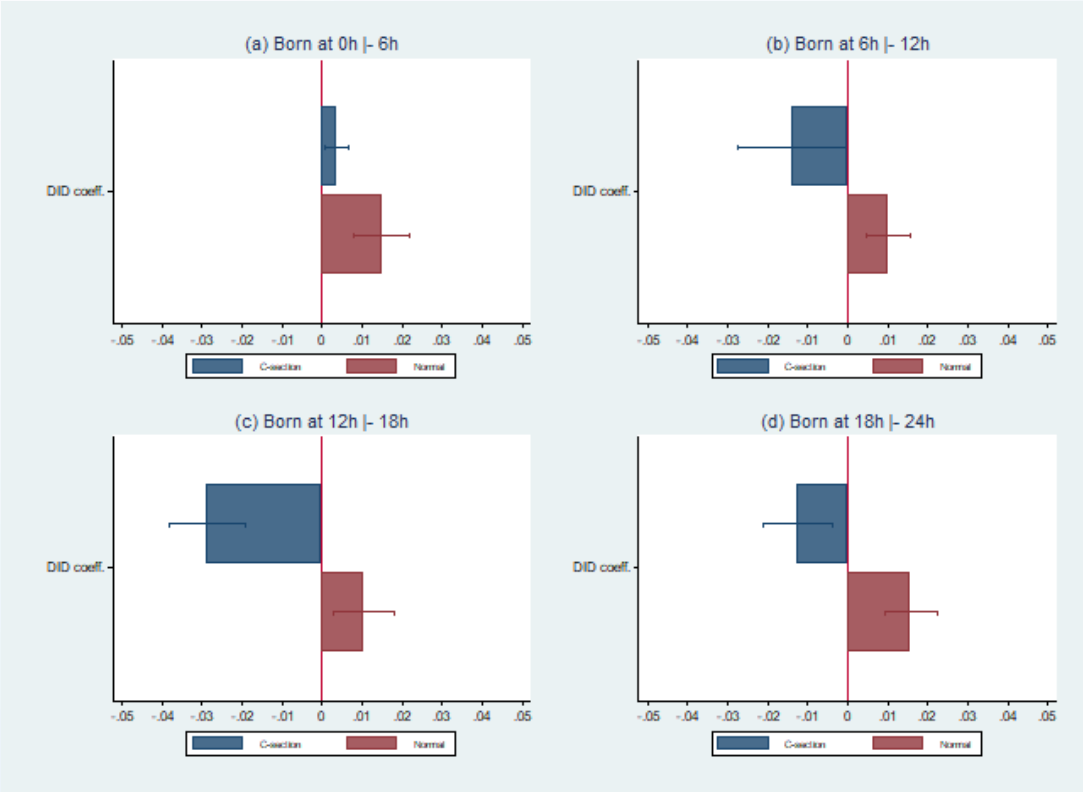


Figure 7: Effect of CPNs on the time of birth, and conditioned to the type of delivery



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Results: Mothers' behavior

Table 7: Effect of CPNs on Prenatal Care and Mobility

	Seven or more Prenatal visits	Inter-municipal displacement	Inter-regional displacement
	(1)	(2)	(3)
CPN x (Year ≥ 2014)	0.038*	-0.032	-0.024
	(0.018)	(0.018)	(0.015)
Outcome mean	0.609	0.285	0.099
Outcome s.d.	0.152	0.315	0.150
F-test (H_0: X = 0)	1.196	4.321***	2.343**
Adj. R^2	0.804	0.946	0.883
#Clusters	184	184	184
Observations	2,208	2,208	2,208

Note. Standard errors are clustered at municipality level. See footnote of Table 3 for the description of control variables. All estimates include a binary variable for municipalities with assess to CPNs and a binary variable for the period 2014-2018, as well as year and municipality fixed effects. Source of information: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:

i. The prevalence of mothers with 7 or more prenatal visits increased 3.8 pp, or 6.2% relative to the baseline mean with the implementation of the CPNs;

ii. Mothers' mobility where not affected by the implementation of the CPNs;

Results: Birth outcomes

Table 8: Effect of CPNs on Birth Outcomes

	Birth Weight	Low Birth Weight	Preterm babies	Early Preterm	Late Preterm	Apgar 1st min	Apgar 5th min
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CPN x (Year ≥ 2014)	18.913***	-0.003*	-0.010***	-0.001	-0.009***	0.036	0.016
	(4.728)	(0.001)	(0.003)	(0.000)	(0.002)	(0.026)	(0.021)
Outcome mean	3255.543	0.063	0.088	0.009	0.079	8.021	9.099
Outcome s.d.	67.419	0.021	0.042	0.008	0.039	0.260	0.253
F-test (H_0: X = 0)	7.840***	3.105**	1.257	0.423	1.475	1.295	1.965
Adj. R^2	0.736	0.430	0.837	0.334	0.829	0.852	0.816
#Clusters	184	184	184	184	184	184	184
Observations	2,208	2,208	2,208	2,208	2,208	2,208	2,208

Note. Standard errors are clustered at municipality level. The dependent variables are: average birth weight (grams); prevalence of low birth weight (<2,500); prevalence of preterm babies (< 37 weeks of gestations); prevalence of early preterm babies (< 32 weeks of gestation); prevalence of late preterm babies (32 to 36 weeks of gestation); Apgar score at the 1st minute after birth; Apgar score at the 5th minute after birth. See footnote of Table 3 for the description of control variables. All estimates include a binary variable for municipalities with assess to CPNs and a binary variable for the period 2014-2018, as well as year and municipality fixed effects and municipality-specific time-trend. Source of information: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:

i. The average birth weight increased by 0.6% relative to the baseline mean;

ii. The prevalence of LBW decreased 4.8% regarding baseline mean due to the implementation of the CPNs;

iii. The prevalence of LBW decreased 11.4% regarding baseline mean due to the implementation of the CPNs;

iv. The effect of the CPNs on preterm babies seem to be driven by the reduction in the prevalence of late preterm babies;

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Results: Childbirth in public health service

Table 9: Effect of CPNs on C-sections in the Public Health System

	Normal Delivery	C-sections	Elective C-section	Urgent C-section
	(1)	(2)	(3)	(4)
CPN x (Year ≥ 2014)	0.049**	-0.058*	-0.050**	-0.008
	(0.016)	(0.027)	(0.016)	(0.017)
Outcome mean	0.434	0.463	0.056	0.407
Outcome s.d.	0.134	0.123	0.075	0.125
Adj. R^2	0.809	0.787	0.689	0.761
#Clusters	184	184	184	184
Observations	2,024	2,024	2,024	2,024

Note. The dependent variables are: (1) Hospital admission for normal delivery relative to total live births; (2) Hospital admissions due to C-sections relative to hospital admissions due to childbirth in the public health system; (3) Hospital admissions due to the elective C-sections relative to hospital admissions due to childbirth in the public health system; and (4) Hospital admissions due to urgent C-sections relative to hospital admissions due to childbirth in the public health system. All estimates include a binary variable for municipalities with assess to CPNs and a binary variable for the period 2014-2018, as well as year and municipality fixed effects. Standard errors are clustered at municipality level. All estimates include a binary variable for municipalities with assess to CPNs and a binary variable for the period 2014-2018, as well as year and municipality fixed. Standard errors are clustered at municipality level, and regressions are weighted by the number of live births. Source of information: Hospital Information System (Sistema de Informações Hospitalares - SIH). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:

i. Hospital admission for normal childbirth in public health service relative to total live births increased 4.9 pp due to the implementation of CPNs;

ii. The fraction of hospital admissions for C-sections relative to childbirth in public health service decreased 12.5% due to the implementation of the CPNs;

iii. The fraction of hospital admissions for Elective C-sections relative to childbirth in public health service decreased 89.2% due to the implementation of the CPNs;

iv. We do not find effect on Urgent C-sections;

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Results: Delivery and postpartum complications

Table 10: Effect of CPNs on hospital admissions due to complications during and after birth

	Obstructed labor	Postpartum hemorrhage	Perinatal infections	Birth trauma	Hypoxia	Other respiratory disorders
	(1)	(2)	(3)	(4)	(5)	(6)
CPN x (Year ≥ 2014)	-0.0138	-0.0001	0.0041*	0.0000	0.0011	0.0078
	(0.0093)	(0.0001)	(0.0017)	(0.0001)	(0.0008)	(0.0043)
Outcomen mean	0.0326	0.0003	0.0115	0.0002	0.0030	0.0288
Outcome s.d.	0.0456	0.0008	0.0120	0.0007	0.0047	0.0273
Adj. R^2	0.6127	0.0700	0.5401	0.1823	0.3994	0.6071
#Clusters	184	184	184	184	184	184
Observations	2,208	2,208	2,208	2,208	2,208	2,208

Note. All variables are proportions relative to the number of live births. The dependent variables are: a) Obstructed labor = proportion of hospital admission by obstructed labor relative to live births; b) Postpartum hemorrhage = proportion of hospital admission by postpartum hemorrhage relative to live births; c) Perinatal infection = proportion of hospital admission by perinatal infection relative to live births; d) Birth trauma = proportion of hospital admission by birth trauma relative to live births; e) Hypoxia = proportion of hospital admission by other respiratory disorders relative to live births; and f) Other respiratory disorders = proportion of hospital admission by perinatal infection relative to live births. All regressions include municipality and year fixed effect, and municipality-specific time trend. Standard errors are clustered at municipality level, and regressions are weighted by the number of live births. Source of information: Hospital Information System. *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:
The number of hospital admissions due to perinatal infections relative to total live births increased 35.6% regarding the baseline mean with the implementation of the CPNs;

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Results: Infrastructure for childbirth

Table 11: Effects of the CPNs on the provision of resources (physical and human) to support childbirth

	Obstetrician	Obstetric nurse	Neonatal beds	Surgical obstetric beds	Ultrasound equipment	Infant incubator
	(1)	(2)	(3)	(4)	(5)	(6)
CPN x (Year ≥ 2014)	0.0010*	0.0002	-0.0004	-0.0026**	0.0010	-0.0013*
	(0.0005)	(0.0001)	(0.0006)	(0.0010)	(0.0013)	(0.0006)
Outcome mean	0.0006	0.0006	0.0008	0.0054	0.0055	0.0024
Outcome s.d.	0.0016	0.0019	0.0029	0.0078	0.0042	0.0039
Adj. R^2	0.9253	0.4274	0.8978	0.8214	0.8938	0.7698
#Clusters	184	184	184	184	184	184
Observations	2,208	2,208	2,208	2,208	2,208	2,208

Note. All variables are relative to the number of live births. The dependent variables are: (1) Obstetricians = number of obstetricians by live births; (2) Obstetric nurse = number of obstetric nurses by live births; (3) Neonatal beds = number of neonatal beds by live births; (4) Surgical obstetric beds = number of surgical obstetric beds by live births; (5) Ultrasound equipment = number of ultrasound equipment by live births; and (6) Infant incubator = number of infant incubator by live births. All estimates include a binary variable for municipalities with assess to CPNs and a binary variable for the period 2014-2018, as well as year and municipality fixed effects. Standard errors are clustered at municipality level, and regressions are weighted by the number of live births. Source of information: National Registry of Health Establishments (Cadastro Nacional de Estabelecimentos de Saúde). *p-value<0.05; **p-value<0.01; ***p-value<0.001.

Evidence:

i. The number of obstetricians per live births increased 167% regarding the baseline mean due to the implementation of the CPNs;

ii. The number of hospital beds for obstetric surgery per live births decreased 33.3% regarding the baseline mean with the implementation of CPNs;

iii. The number of infant incubator per live births decreased 44.7% regarding the baseline mean with the implementation of CPNs.

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Cost-benefit Analysis in Public Health System

- **C-section – Vaginal delivery** = R$ 305,54 (Entringer et al., 2018).
- **C-sections in 2019** = 51.100 (hospital admissions in public health system).
- **Impact** on C-sections in the public health system = - 5.8 pp (Column 2, Table 9).
- **Annual economy** = R$ 905,559.45.

- **Investment** = R$ 3,656,821.38 (7 CPNs).
- **Net presente value** (20 years):
  a. i = 2% ⇒ NPV = R$4,477,443.38
  b. i = 3% ⇒ NPV = R$4,067,784.43
  c. i = 4% ⇒ NPV = R$3,688,076.96
  d. i = 5% ⇒ NPV = R$3,335,668.67
- **Internal Return Rate = 24.5%.**

Evidence:
The implementation of Birth Centers for Normal Childbirth is cost-benefit for public health service with a IRR = 24.5%.

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Conclusions

- The implementation of CPNs can effectively change the epidemic scenario of Cesareans in Ceará;
- The cost-benefit analysis suggests that such health policy saves public money;
- The study shows that the CPNs reduced the scheduled childbirth, and improved birth outcomes;
- The CPNs increased the demand for normal delivery in the public health system, and reduced C-sections;
- Despite improvements in the human and physical resources focused on normal childbirth, the increased in perinatal infections per live birth is an indication of the necessity of improvements in the quality of childbirth care;

Thank you !!!

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