

The Health Effects of Cesarean Delivery for Low-Risk First Births

David Card, Alessandra Fenizia, David Silver

Online Appendix

April 2018

Appendix Table 1: Potential Outcomes of Hospital Choice and Delivery Mode

Potential Hospital Choices (H_{0i}, H_{1i})	Potential Delivery Choices (C_{0i}, C_{1i})	Description	Assumed to be Present?
(0,0)	(0,0)	H never-takers, C never-takers	yes
(0,0)	(1,1)	H never-takers, C always-takers	yes
(0,0)	(0,1)	H never-takers, C changers	no
(0,0)	(1,0)	H never-takers, C changers	no
(1,1)	(0,0)	H always-takers, C never-takers	yes
(1,1)	(1,1)	H always-takers, C always-takers	yes
(1,1)	(0,1)	H always-takers, C changers	no
(1,1)	(1,0)	H always-takers, C changers	no
(0,1)	(0,0)	H compliers, C never-takers	yes
(0,1)	(1,1)	H compliers, C always-takers	yes
(0,1)	(0,1)	H compliers, C compliers	yes
(0,1)	(1,0)	H compliers, C defiers	no
(1,0)	(0,0)	H defiers, C never-takers	no
(1,0)	(1,1)	H defiers, C always-takers	no
(1,0)	(0,1)	H defiers, C changers	no
(1,0)	(1,0)	H defiers, C changers	no

Notes: Potential hospital choices (H_{0i}, H_{1i}) are indicators for choice of high c-section hospital when indicator for being closer to high c-section hospital (z_i) is 0 or 1 respectively. Potential delivery choices (C_{0i}, C_{1i}) are indicators for c-section delivery when indicator for being closer to high c-section hospital is 0 or 1 respectively.

Appendix Table 2: Characteristics of High and Low C-section Hospitals

	Hospital Type:		Within-HSA Gap	
	High CS	Low CS	H-L Gap	std. error
<i>C-section rate (LRFB):</i>				
All	0.289	0.220	0.075	0.002
Scheduled	0.104	0.081	0.027	0.001
Unscheduled	0.186	0.139	0.048	0.002
<i>Ownership:</i>				
For profit	0.180	0.086	0.109	0.001
Private non-profit	0.746	0.723	0.033	0.015
Government	0.068	0.140	-0.083	0.013
Academic	0.006	0.051	-0.059	0.005
<i>Other Characteristics:</i>				
Has NICU	0.741	0.858	-0.144	0.013
NICU admit rate	0.027	0.042	-0.017	0.001
Volume (births/yr.)	3,695	3,635	121	74
Weekend admit rate	0.240	0.262	-0.024	0.002
# births in sample	253,318		253,318	

Notes: see text for procedure to define H and L hospitals. Characteristics are based on low risk first births (LRFB's). Standard errors in 4th column clustered by patient zip code.

Appendix Table 3: Test for Orthogonality of Extra Risk Factors with Relative Distance

Risk Factor:	Risk Variable:		Coeff. on Rel. Distance			Std err of	
	Mean	Std Dev	Coeff.	std. err.	t-stat	Effect Size	Eff. Size
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gestation (days)	279.40	9.70	0.134	0.710	0.19	0.001	0.007
# Prenatal Visits	12.20	2.99	0.257	0.563	0.46	0.009	0.019
Late Start for Prenatal Care	0.071	0.257	0.037	0.021	1.78	0.014	0.008
Month Start Prenatal Care	2.516	1.310	0.244	0.207	1.18	0.019	0.016
Diabetes	0.025	0.155	-0.005	0.010	-0.48	-0.003	0.006
Asthma	0.011	0.106	0.011	0.006	1.81	0.011	0.006
Herpes	0.007	0.083	-0.011	0.005	-2.23	-0.013	0.006
Smoked While Pregnant	0.019	0.136	0.008	0.011	0.71	0.006	0.008
Cigs/Day Pre-Preg.	0.329	2.162	0.091	0.200	0.46	0.004	0.009
Cigs/Day 1st Trimester	0.140	1.326	0.067	0.108	0.62	0.005	0.006
Cigs/Day 2nd Trimester	0.070	0.881	0.044	0.069	0.63	0.005	0.006
Cigs/Day 3rd Trimester	0.056	0.770	0.032	0.059	0.54	0.004	0.002
Birthweight (grams)	3348.0	433.0	-0.16	25.99	-0.01	0.000	0.001
Low BW	0.023	0.151	0.003	0.009	0.29	0.002	0.004
#ED Visits by Mom pre-birth	0.258	0.563	0.027	0.014	2.00	0.005	0.005
In-pat. visits by mom pre-birth	0.039	0.194	-0.017	0.010	-1.66	-0.009	0.008
Predicted Infant ED Admission	0.338	0.130	0.002	0.001	1.41	0.001	0.008
Predicted C-section delivery	0.256	0.122	-0.002	0.005	-0.38	-0.002	0.008

Notes: see text for description of extra risk factors. Columns 1 and 2 contain mean and standard deviation of risk factor. Column 3 gives the coefficient of relative distance to an H hospital (x100) in a model with the risk factor as the dependent variable and baseline controls included. Column 4 gives standard error, clustered by mother's home zip code. Column 6 gives implied effect size of a 10 mile change in relative distance = col. 3 / (10 x col. 2). Column 7 gives standard error of effect size.

Appendix Table 4: Estimated Reduced Form Effects of Relative Distance on Probability of ED Visit During Alternative Time Windows

Duration of Time Window After Birth:	Reduced Form Effect: IV= Relative Distance	Reduced Form Effect: IV= Closer to H Hospital
1 month	0.023 (0.014)	0.017 (0.011)
2 months	0.045 (0.021)	0.030 (0.016)
3 months	0.066 (0.025)	0.045 (0.019)
4 months	0.074 (0.029)	0.050 (0.021)
5 months	0.096 (0.034)	0.062 (0.024)
6 months	0.118 (0.037)	0.062 (0.027)
7 months	0.135 (0.041)	0.072 (0.030)
8 months	0.145 (0.044)	0.080 (0.031)
9 months	0.145 (0.047)	0.071 (0.034)
10 months	0.156 (0.050)	0.081 (0.036)
11 months	0.164 (0.052)	0.083 (0.038)
12 months	0.163 (0.054)	0.080 (0.040)

Notes: Entries are estimated reduced form coefficients on distance measure in column heading. Standard errors clustered by 5-digit ZIP code in parentheses. See notes to Table 5.

Appendix Table 5: First Stage and Reduced Form Models for Four Quartiles of Predicted Probability of C-Section at H Hospital

	Quartile Group:			
	1	2	3	4
<i>Characteristics of Quartile Group:</i>				
Prob. Deliver at H hospital	0.266	0.484	0.602	0.710
Prob. C-section	0.157	0.210	0.265	0.390
ED Admission Rate	0.340	0.332	0.333	0.348
<i>First Stage Coefficients (Binary Instrument):</i>				
Prob. Deliver at H hosp. (×10)	0.752	1.118	1.160	0.943
(std. error)	(0.125)	(0.141)	(0.155)	(0.150)
Prob. C-section (×10)	0.069	0.096	0.156	0.129
(std. error)	(0.029)	(0.035)	(0.038)	(0.049)
Implied Fraction of H&C Compl's Among H Compl's	0.092	0.085	0.135	0.137
<i>Reduced Form Coefficient (Binary Instrument):</i>				
ED Admission Rate	0.048	0.059	0.095	0.113
(std. error)	(0.062)	(0.055)	(0.054)	(0.049)

Notes: Columns report mean characteristics and estimated first stage and reduced form coefficients for four separate quartile groups, based on predicted probability of c-section delivery at a high c-section hospital (C×H). Prediction model includes basic controls plus 16 extra risk factors -- see text. Each quartile group has 122,901 obs.

Appendix Table 6: Bounds on Effect of Delivery at High C-section Hospital on ED Admission Rate for H-compliers Who Do Not Change Delivery Mode

	Unadjusted	Adjusted	
	IV	Lower Bound	Upper Bound
H-complier / C-always takers	0.099 (0.050)	-0.250 (0.120)	0.313 (0.079)
H-complier / C-never takers	0.072 (0.042)	0.022 (0.048)	0.186 (0.043)

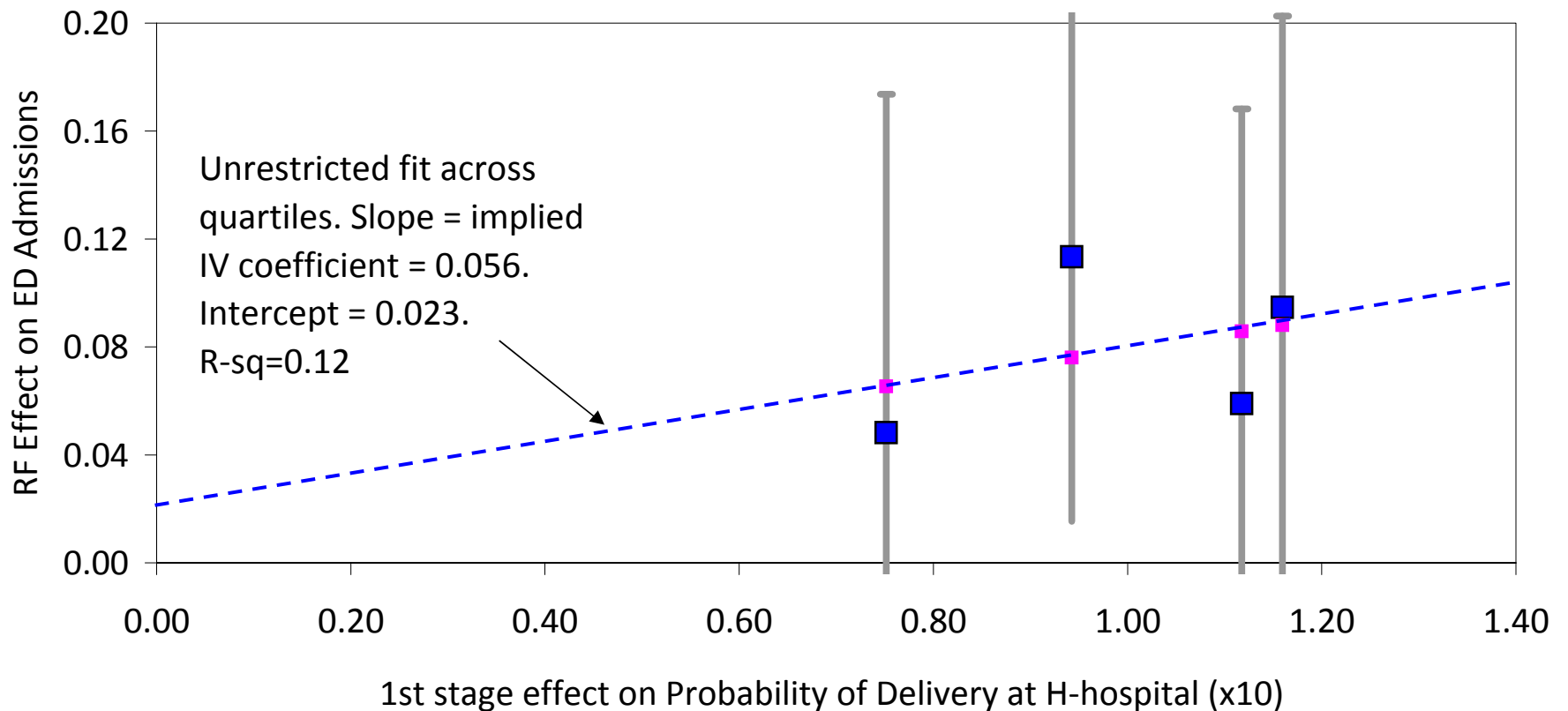
Notes: Unadjusted IV for H-complier/C-always takers is IV estimate of effect of delivery at H-hospital on ED admission rate for infants who are delivered by c-section, using indicator for closer to H-hospital as instrument. Unadjusted IV for H-complier/C-never takers is IV estimate of effect of delivery at H-hospital on ED admission rate for infants who are delivered vaginally, using indicator for closer to H-hospital as instrument. See text for description of lower and upper bounds. Standard errors for unadjusted IV's are clustered by mother's home zip code. Standard errors for lower and upper bounds are estimated by Monte Carlo with clustered design.

Appendix Table 7: Characteristics of Infants at High Risk of Death and those that Die

	Low Risk 1st Births		High Risk of Death:	
	All	Deaths	All	Deaths
<i>Mother's characteristics</i>				
Mean age	25.6	24.2	23.8	23.1
At most high school education (%)	41.2	54.4	56.8	61.5
Mean weight (pounds)	137	138	138	137
Mother obese (%)	8.1	9.6	9.4	9.5
Race/eth: Hispanic (%)	44.2	45.5	47.4	46.1
Asian (%)	17.6	16.3	15.9	16.2
Nonhispanic white (%)	31.7	30.0	28.4	29.3
Nonhispanic black (%)	5.6	7.0	7.1	7.0
<i>Birth risk factors and characteristics</i>				
Mean number prenatal care visits	12.2	11.6	11.6	11.2
18 or more prenatal visits (%)	4.3	3.9	3.2	3.9
Mother ED visit prior to birth (%)	19.5	23.7	23.6	27.4
Mean birthweight (grams)	3348	3091	3131	2901
Low birth weight (%)	2.3	14.4	6.3	23.2
Abn. fetal heart rate/rhythm (%)	20.2	33.9	33.9	41.9
<i>Delivery outcomes</i>				
C-section delivery (%)	25.6	34.6	24.9	33.0
Scheduled c-section (%)	9.2	22.5	11.1	23.7
Delivered at H hospital (%)	51.5	50.2	50.6	48.9
Apgar score <=7 (%)	1.6	30.4	1.9	32.4
Prolonged labor (%)	1.8	2.2	1.2	1.1
Vacuum/forceps induction (%)	12.0	12.2	13.2	11.2
<i>Postpartum outcomes</i>				
Infant transferred to NICU unit (%)	3.4	30.5	4.2	30.4
Infant re-admitted to ED (%)	33.8	29.0	37.7	31.6
Infant re-admitted as in-patient (%)	8.2	31.2	8.9	31.6
Mother readmitted (any type) (%)	14.9	26.8	17.5	29.1
Another birth within 4 years (%)	36.4	51.1	32.7	51.7
Sample size	491,604	596	163,868	358

Notes: See notes to Table 1. High risk sample is classified using 10-fold sample-splitting technique (see Table 9). Abnormal fetal heart rate/rhythm indicated by presence of secondary diagnosis code of 659.71.

App. Figure 1: First Stage and Reduced Form Effects of Proximity to H-Hospital on Prob. of H-Delivery and Infant ED Admission



Note: Points = fitted pairs of 1st stage and reduced form coefficients (with 95% CI for RF coefficients) by quartile of predicted probability of c-section at H-hospital.