

# The Luck of the Draw: The Impact of Physicians on Health at Birth

**Arlen Guarin**  
UC Berkeley

Christian Posso  
Banco de la República

Estefanía Saravia  
Harvard BS

Jorge Tamayo  
Harvard BS

NBER SI 2021 Children  
July 27th, 2021

## Motivation

- ▶ Origins of inequality between individuals can be found as early as the nine months that they spend in utero (Almond and Currie, 2011; Almond, Chay and Lee, 2015; Hoynes, Schanzenbach and Almond, 2016)

# Motivation

- ▶ Origins of inequality between individuals can be found as early as the nine months that they spend in utero (Almond and Currie, 2011; Almond, Chay and Lee, 2015; Hoynes, Schanzenbach and Almond, 2016)
- ▶ Causes of such differences in birth outcomes?
  - ▶ Parents' decisions during pregnancy
  - ▶ Families' socioeconomic conditions (Currie and Moretti, 2003; Currie, 2011)
  - ▶ Environmental factors (Currie and Schwandt, 2016)
  - ▶ Access to the health system (Currie and Gruber, 1996; Atkin, 2009; Almond, Doyle, Kowalski and William, 2010)
  - ▶ Others (Camacho, 2008; Ananat and Hungerman, 2013; Bharadwaj, Løken and Neilson, 2013; Card, Fenizia and Silver, 2018)

# Motivation

- ▶ Origins of inequality between individuals can be found as early as the nine months that they spend in utero (Almond and Currie, 2011; Almond, Chay and Lee, 2015; Hoynes, Schanzenbach and Almond, 2016)
- ▶ Causes of such differences in birth outcomes?
  - ▶ Parents' decisions during pregnancy
  - ▶ Families' socioeconomic conditions (Currie and Moretti, 2003; Currie, 2011)
  - ▶ Environmental factors (Currie and Schwandt, 2016)
  - ▶ Access to the health system (Currie and Gruber, 1996; Atkin, 2009; Almond, Doyle, Kowalski and William, 2010)
  - ▶ Others (Camacho, 2008; Ananat and Hungerman, 2013; Bharadwaj, Løken and Neilson, 2013; Card, Fenizia and Silver, 2018)
- ▶ We explore an under investigated channel: What role can skilled physicians play in patients' health conditions at birth?
  - ▶ Settings suffer from selection bias (i.e., match between physicians and hospitals or physicians and patients)

# Motivation

- ▶ Origins of inequality between individuals can be found as early as the nine months that they spend in utero (Almond and Currie, 2011; Almond, Chay and Lee, 2015; Hoynes, Schanzenbach and Almond, 2016)
- ▶ Causes of such differences in birth outcomes?
  - ▶ Parents' decisions during pregnancy
  - ▶ Families' socioeconomic conditions (Currie and Moretti, 2003; Currie, 2011)
  - ▶ Environmental factors (Currie and Schwandt, 2016)
  - ▶ Access to the health system (Currie and Gruber, 1996; Atkin, 2009; Almond, Doyle, Kowalski and William, 2010)
  - ▶ Others (Camacho, 2008; Ananat and Hungerman, 2013; Bharadwaj, Løken and Neilson, 2013; Card, Fenizia and Silver, 2018)
- ▶ We explore an under investigated channel: What role can skilled physicians play in patients' health conditions at birth?
  - ▶ Settings suffer from selection bias (i.e., match between physicians and hospitals or physicians and patients)
- ▶ We provide experimental evidence using physicians' random assignment to hospitals

## SSO Program in Colombia

- ▶ Medical school graduates are **required** to work for the first year of their career in the national **Mandatory Social Service (SSO)**
  - ▶ Physicians provide professional services in areas with **difficult access to health services**
  - ▶ The SSO randomly assigns physicians to hospitals across the country
- ▶ We leverage this random assignment to provide causal evidence on the impact of more skilled physicians on newborns' health outcomes

# Outline

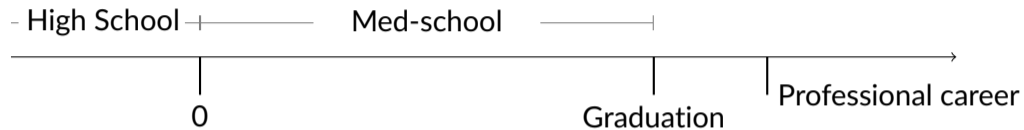
**Institutional Background**

Data and Methodology

Results

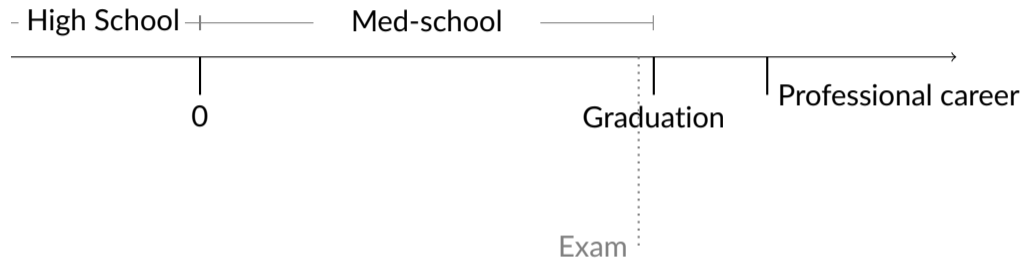
Conclusion

## Example: Physicians Timeline

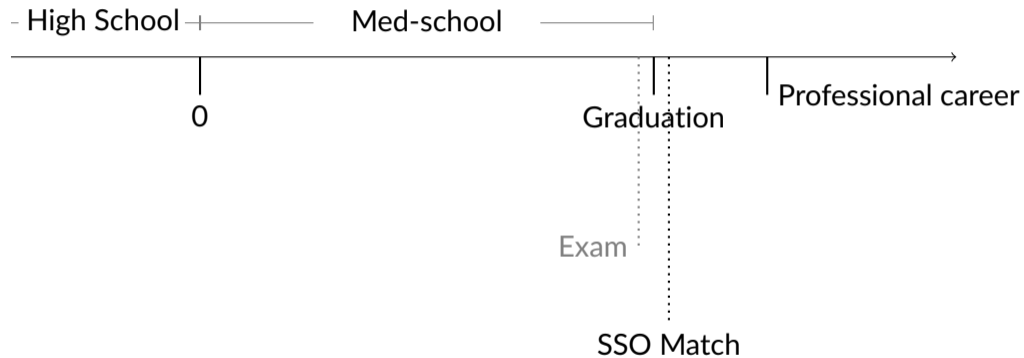




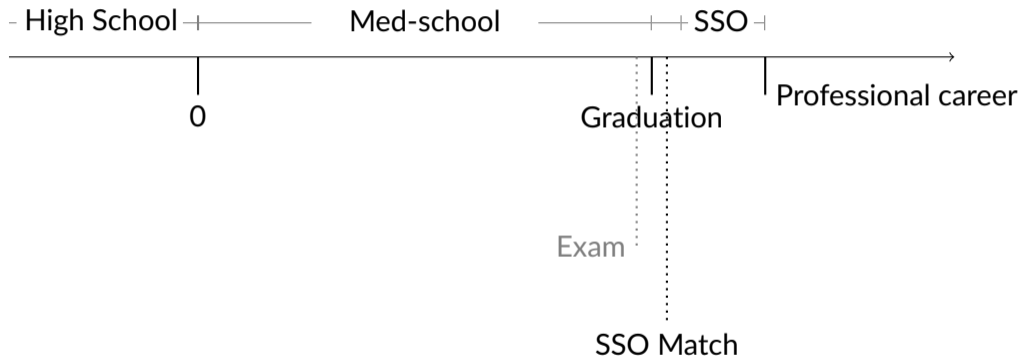
## Example: Physicians Timeline



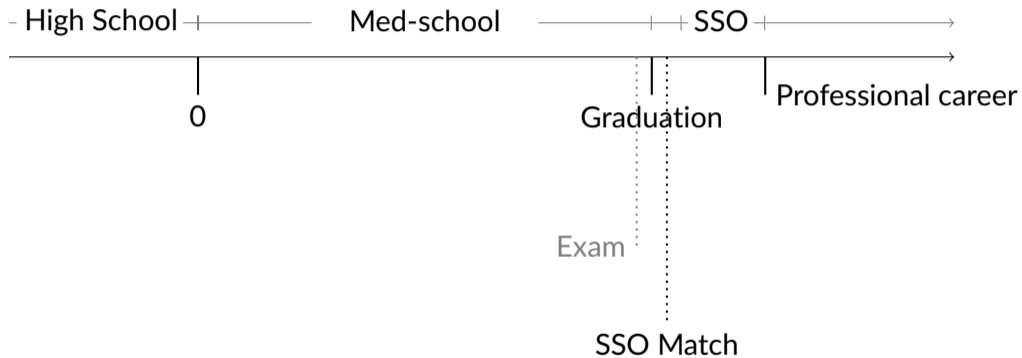
## Example: Physicians Timeline



## Example: Physicians Timeline



## Example: Physicians Timeline



# The SSO Program History

- ▶ 2007 (Law **1164**): selection had to be made through state-level random draws

# The SSO Program History

- ▶ 2007 (Law **1164**): selection had to be made through state-level random draws
- ▶ 2012 (Resolutions **4503** y **566**):
  - ▶ 4 yearly **state level** random draws (Jan, Apr, Jul, Oct)
  - ▶ Physicians could apply one time and only to one state and only when  
# of applicants  $< 2 \times$  # of available places

# The SSO Program History

- ▶ 2007 (Law **1164**): selection had to be made through state-level random draws
- ▶ 2012 (Resolutions **4503** y **566**):
  - ▶ 4 yearly **state level** random draws (Jan, Apr, Jul, Oct)
  - ▶ Physicians could apply one time and only to one state and only when  
# of applicants  $< 2 \times$  # of available places
- ▶ 2013-2014 Random assignment (due to oversubscription):
  - ▶ White ballot → “Not Selected” = exonerated

# The SSO Program History

- ▶ 2007 (Law **1164**): selection had to be made through state-level random draws
- ▶ 2012 (Resolutions **4503** y **566**):
  - ▶ 4 yearly **state level** random draws (Jan, Apr, Jul, Oct)
  - ▶ Physicians could apply one time and only to one state and only when  
# of applicants  $< 2 \times$  # of available places
- ▶ 2013-2014 Random assignment (due to oversubscription):
  - ▶ White ballot → “Not Selected” = exonerated
  - ▶ Red ballot → “Selected” = must work for SSO
    - ▶ **Randomly assigned** hospital (in the state they applied to) where they will provide their services for **one year**



# The SSO Program History

- ▶ 2007 (Law **1164**): selection had to be made through state-level random draws
- ▶ 2012 (Resolutions **4503** y **566**):
  - ▶ 4 yearly **state level** random draws (Jan, Apr, Jul, Oct)
  - ▶ Physicians could apply one time and only to one state and only when  
# of applicants  $< 2 \times$  # of available places
- ▶ 2013-2014 Random assignment (due to oversubscription):
  - ▶ White ballot → “Not Selected” = exonerated
  - ▶ Red ballot → “Selected” = must work for SSO
    - ▶ **Randomly assigned** hospital (in the state they applied to) where they will provide their services for **one year**
- ▶ After 2014: Random assignment was replaced by a centralized system (professionals stated their preferences)

# Outline

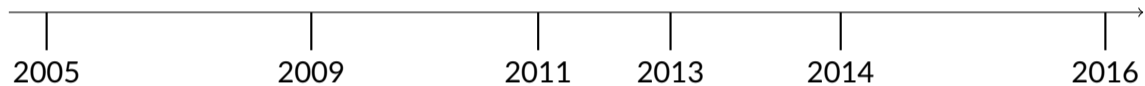
Institutional Background

**Data and Methodology**

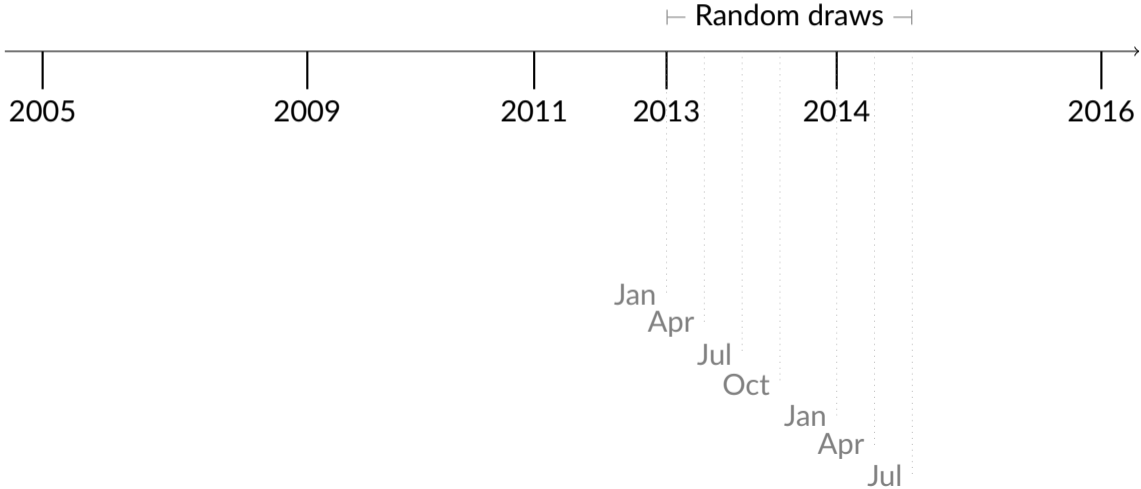
Results

Conclusion

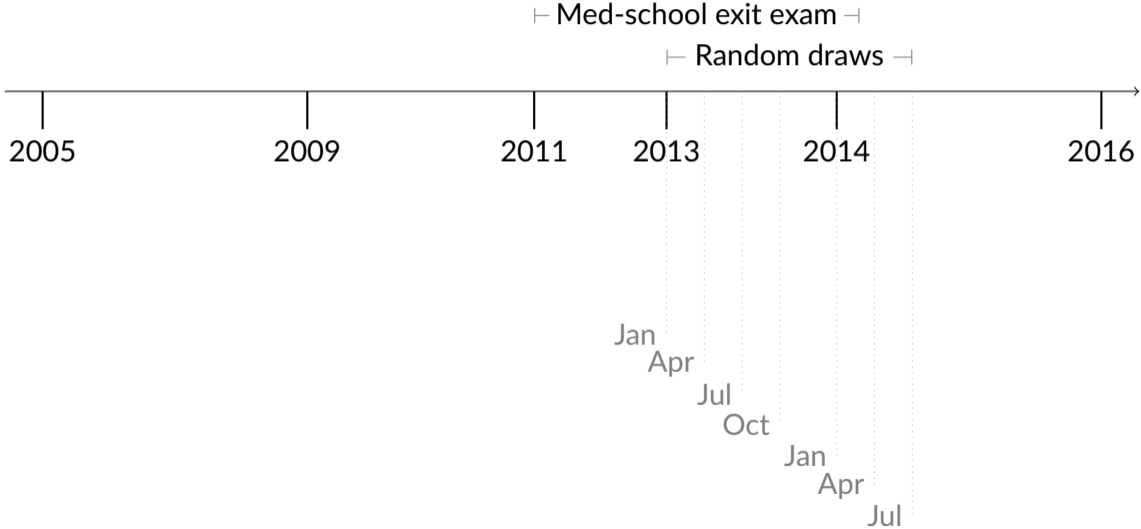
## Graph of the data sources and timeline



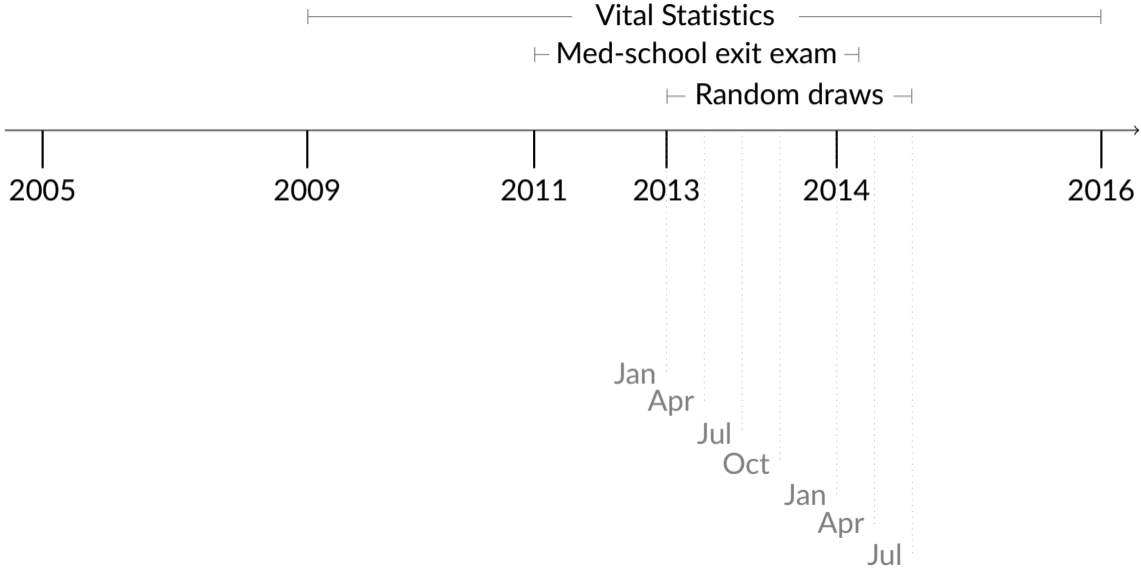
# Graph of the data sources and timeline



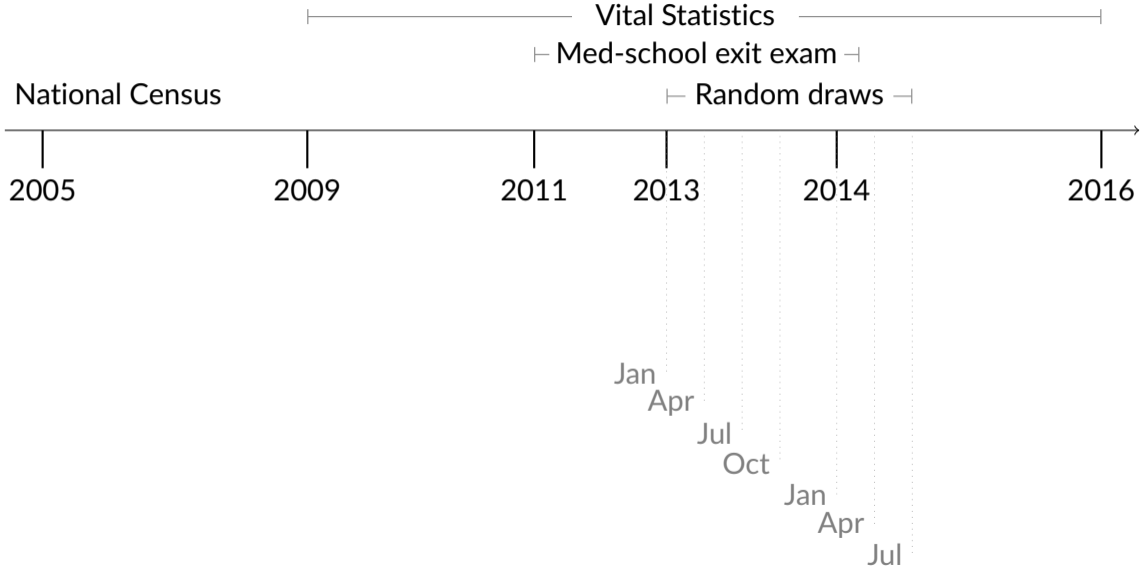
# Graph of the data sources and timeline



# Graph of the data sources and timeline



# Graph of the data sources and timeline



## Empirical Strategy - ITT

$$Y_{hij} = \alpha + \gamma_d + \beta Z_{hj} + \epsilon_{hij} \quad (1)$$

↓  
Causal effect of interest

where

- ▶  $Y_{hij}$  is the outcome of child  $i$  that was born at the hospital  $h$  and is exposed to a physician from the cohort  $j$
- ▶  $Z_{hj}$  is a score that measures the “skill” of the physicians in a cohort  $j$  assigned to hospital  $h$
- ▶  $\gamma_d$  is a draw-by-state fixed effect

**Identification assumption:** Conditional on  $\gamma_d$ , the allocation of physicians is independent of potential outcomes

SEs are clustered at the hospital level



## Main outcomes

**Table:** Descriptive Vital statistics registers main sample 2013-2016

Outcome	Description	SSO sample	SSO Rural
		Mean	Mean
Low Birth Weight (LBW)	$\mathbb{1}(\text{Weight} < 2500\text{grams})$	0.0601	0.0426
Prematurity	$\mathbb{1}(\text{Gestational weeks} < 37)$	0.0623	0.0409
Low APGAR	$\mathbb{1}(\text{APGAR Score} < 7)$	0.0378	0.0374
<b>Unhealthy</b>	$\max(\text{LBW}, \text{Premature}, \text{APGAR})$	0.1183	0.0950
	Number of observations	372,609	256,806

## Balance Test: No correlation between hospital *ex-ante* chars. and skill measure

$$X_{hj,(t-1)} = \alpha + \gamma_d + \beta Z_{hj} + \epsilon_{hj}$$

Covariate	Coefficient	Standar Error	p-value (single hypothesis)	p-value (RW)
Unhealthy (Prop.)	0.001	0.001	0.648	0.994
Low birth weight (Prop.)	0.000	0.001	0.328	0.875
Prematurity (Prop.)	0.000	0.007	0.361	0.893
Apgar < 7 (Prop.)	0.003	0.009	0.860	0.997
Antenatal consultations > 4 (Prop.)	0.000	0.003	0.465	0.918
Proportion of female newborns	0.000	0.001	0.356	0.893
Proportion of mothers with basic education	-0.002	0.003	0.403	0.893
Proportion of married mothers	0.001	0.002	0.237	0.688
Proportion of teenage mothers	0.000	0.002	0.783	0.997
LBW > p(75)	0.003	0.013	0.800	0.997
Prematurity > p(75)	-0.004	0.011	0.830	0.997
Mean number of antenatal consultations	-0.005	0.022	0.401	0.893
Hospitals by municipalities	0.000	0.010	0.734	0.996
Municipality population	325.7	1,032.3	0.829	0.997

1,696 Observations

# Outline

Institutional Background

Data and Methodology

**Results**

Conclusion

# Physicians improve health outcomes at birth

$$Y_{hij} = \alpha + \gamma_d + \beta Z_{hij} + \epsilon_{hij}$$

	Unhealthy	LBW	Prematurity	APGAR < 7
	(1)	(2)	(3)	(4)
Average Health Scores				
<b>Without controls</b>				
Coefficient	-0.0060***	-0.0033**	-0.0033**	-0.0027**
Stand. Err.	(0.0020)	(0.0016)	(0.0015)	(0.0013)
Adjusted Coeff.	-6.31%	-7.71%	-7.97%	-7.16%
Average Dependent Variable	0.095	0.043	0.041	0.037
Number of Observations	256,805			

▸ Rob. Checks

▸ AME logit

▸ Hospital FE

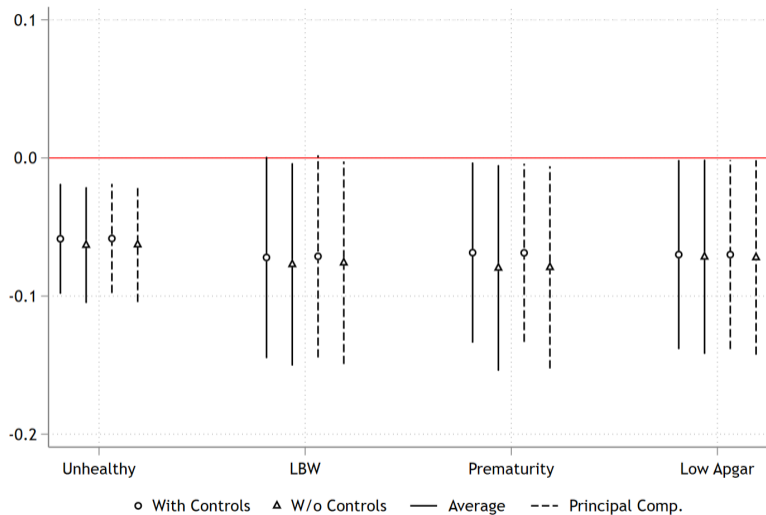
▸ Linearity

▸ LBW - GW

▸ Programs

▸ Other scores

# The results are robust to using alternative specifications



95% confidence intervals.

## Precisely estimated zeros for the placebo (leads) tests

	<b>Unhealthy</b>	<b>LBW</b>	<b>Prematurity</b>	<b>APGAR &lt; 7</b>
	(1)	(2)	(3)	(4)
<b>Average Health Scores</b>				
<b>Without controls</b>				
Coefficient	-0.0018	-0.0009	-0.0009	-0.0010
Stand. Err.	(0.0017)	(0.0010)	(0.0011)	(0.0013)
Adjusted Coeff.	-1.73%	-1.81%	-2.07%	-2.43%
Average Dependent Variable	0.105	0.047	0.042	0.042
Number of Observations		259,396		

▶ Rob. Checks

▶ AME logit

▶ Other leads

# Outline

Institutional Background

Data and Methodology

Results

Conclusion

## In summary...

We provide causal evidence on the effect of physicians on birth outcomes:

- ▶ We find that more skilled physicians have a negative and significant effect on the probability of poor health at birth

### Further results:

- ▶ We document that these effects are stronger in hospitals with high incidence of poor health of newborn the years before the program (optimal assignment policy implications) [▶ Results](#)
- ▶ More skilled doctors target prenatal checkups towards mothers with a higher predicted probability of giving birth to a baby with poor health at birth [▶ Results](#)



Thank you!

# Outline

Institutional Background

Data and Methodology

Results

Conclusion

# Results are robust to different specifications

	Unhealthy		LBW		Prematurity		APGAR < 7	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)	Score average (5)	PCA score (6)	Score average (7)	PCA score (8)
<b>Panel A. Without controls</b>								
Coefficient	-0.0060***	-0.0060***	-0.0033**	-0.0032**	-0.0033**	-0.0032**	-0.0027**	-0.0027**
Stand. Err.	(0.0020)	(0.0020)	(0.0016)	(0.0016)	(0.0015)	(0.0015)	(0.0013)	(0.0013)
Adjusted Coeff.	-6.31%	-6.28%	-7.71%	-7.59%	-7.97%	-7.92%	-7.16%	-7.21%
<b>Panel B. With controls</b>								
Coefficient	-0.0056***	-0.0055***	-0.0031*	-0.0030*	-0.0028**	-0.0028**	-0.0026**	-0.0026**
Stand. Err.	(0.0019)	(0.0019)	(0.0016)	(0.0016)	(0.0014)	(0.0013)	(0.0013)	(0.0013)
Adjusted Coeff.	-5.85%	-5.83%	-7.21%	-7.12%	-6.86%	-6.87%	-7.00%	-7.00%
Average Dependent Variable	0.095	0.095	0.043	0.043	0.041	0.041	0.037	0.037
S.D. Dependent Variable	0.293	0.293	0.202	0.202	0.198	0.198	0.190	0.190
Number of Observations	256,805							

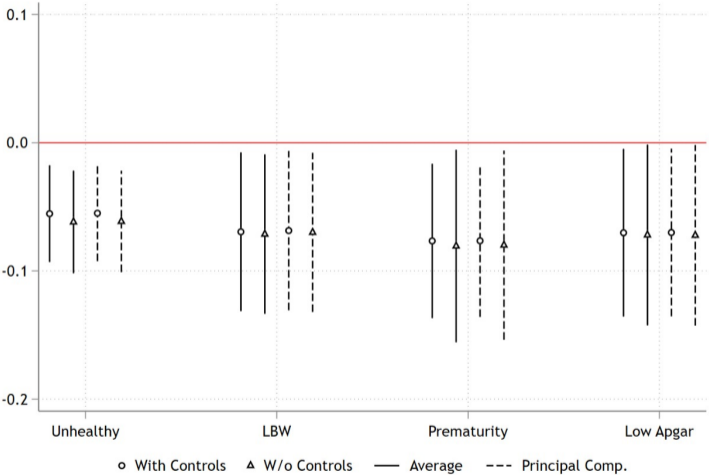
[← Return](#)

# Average marginal effects from logit model

	Unhealthy		LBW		Prematurity		APGAR < 7	
	Health Average Score	Health PCA score	Health Average Score	Health PCA score	Health Average Score	Health PCA score	Health Average Score	Health PCA score
<b>Panel A. Without controls</b>								
Coefficient	-0.0059***	-0.0058***	-0.0030**	-0.0030**	-0.0033**	-0.0033***	-0.0027**	-0.0027**
Stand. Err.	(0.0019)	(0.0019)	(0.0013)	(0.0014)	(0.0016)	(0.0015)	(0.0013)	(0.0013)
Adjusted Coeff.	-6.18%	-6.14%	-7.13%	-7.00%	-8.06%	-7.99%	-7.20%	-7.23%
<b>Panel B. With controls</b>								
Coefficient	-0.0053***	-0.0052***	-0.0030**	-0.0029**	-0.0031**	-0.0031**	-0.0026**	-0.0026**
Standard Error	(0.0018)	(0.0018)	(0.0013)	(0.0014)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Adjusted Coeff.	-5.54%	-5.50%	-6.95%	-6.86%	-7.66%	-7.65%	-7.02%	-7.01%
Average Dependent Variable	0.095	0.095	0.043	0.043	0.041	0.041	0.037	0.037
Number of Observations	256,602							

[← Return](#)

# Average marginal effects from logit model



95% confidence intervals.

[Return](#)

# Results are robust to the inclusion of hospital fixed effects

	LBW		Prematurity		APGAR < 7	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)	Score average (5)	PCA score (6)
<b>Panel A. Without controls</b>						
Coefficient	-0.0039	-0.0041	-0.0030	-0.0029	-0.0113*	-0.0115*
Stand. Err.	(0.0052)	(0.0053)	(0.0047)	(0.0047)	(0.0065)	(0.0066)
Adjusted Coeff.	-8.18%	-8.46%	-7.77%	-7.34%	-27.52%	-27.99%
<b>Panel B. With controls</b>						
Coefficient	-0.0052	-0.0053	-0.0041	-0.0039	-0.0130**	-0.0132**
Stand. Err.	(0.0052)	(0.0052)	(0.0049)	(0.0049)	(0.0066)	(0.0067)
Adjusted Coeff.	-10.80%	-11.03%	-10.58%	-9.97%	-31.76%	-32.13%
Average Dependent Variable	0.048	0.048	0.039	0.039	0.041	0.041
S.D. Dependent Variable	0.214	0.214	0.194	0.194	0.199	0.199
Number of Observations	62,294	62,294	62,294	62,294	62,294	62,294

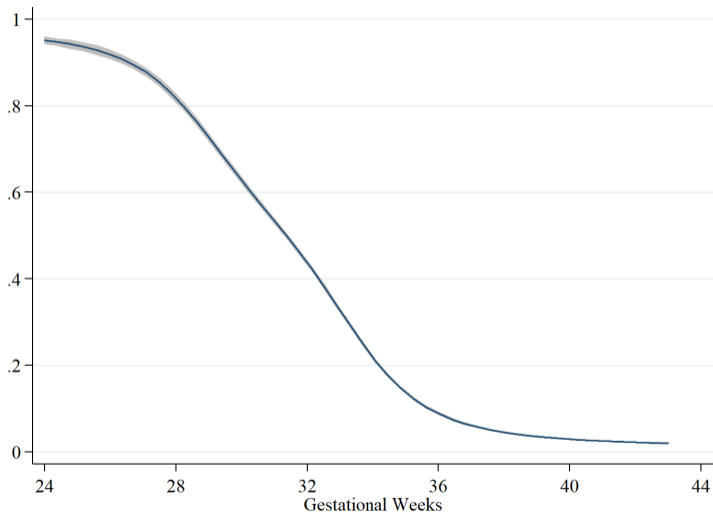
◀ Return

## There are gains to improving the score across the distribution

	LBW					
	Quartile 2		Quartile 3		Quartile 4	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)	Score average (5)	PCA score (6)
	<b>With controls</b>					
Coefficient	-0.0031	-0.0033	-0.0042	-0.0052	-0.0054	-0.0065
Stand. Err.	(0.0036)	(0.0036)	(0.0038)	(0.0037)	(0.0042)	(0.0041)
Adjusted Coeff.	-6.24%	-6.66%	-8.65%	-10.70%	-11.11%	-13.19%
Average Dependent Variable	0.049	0.049	0.049	0.049	0.049	0.049
S.D. Dependent Variable	0.217	0.217	0.217	0.217	0.217	0.217
Number of Observations	104,357	104,357	104,357	104,357	104,357	104,357

[← Return](#)

## Probability of LBW vs. Gestational weeks (2009-12)



[◀ Return](#)



# Physicians or program effects?

	LBW	Prematurity	APGAR < 7
	(1)	(2)	(3)
<b>Panel A. Average Score</b>			
Coefficient	-0.0038**	-0.0037**	-0.0100***
Stand. Err.	(0.0019)	(0.0017)	(0.0024)
Adjusted Coeff.	-7.83%	-9.10%	-21.72%
<b>Panel B. Program Average</b>			
Coefficient	0.0005	-0.0010	0.0066**
Stand. Err.	(0.0021)	(0.0017)	(0.0030)
Adjusted Coeff.	1.03%	-2.44%	14.33%
<b>Panel C. Average Score x Program Average</b>			
Coefficient	0.0018	0.0015*	-0.0015
Stand. Err.	(0.0011)	(0.0009)	(0.0017)
Adjusted Coeff.	3.68%	3.76%	-3.29%
Average Dependent Variable	0.049	0.041	0.046
S.D. Dependent Variable	0.217	0.199	0.210
Number of Hospitals	592	592	592
Number of Observations	104,357	104,357	104,357

[← Return](#)

# Robustness check

	Unhealthy		LBW		Prematurity		APGAR < 7	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)	Score average (5)	PCA score (6)	Score average (7)	PCA score (8)
<b>Panel A. Without controls</b>								
Coefficient	-0.0018	-0.0018	-0.0009	-0.0009	-0.0009	-0.0009	-0.0010	-0.0010
Stand. Err.	(0.0017)	(0.0017)	(0.0010)	(0.0010)	(0.0011)	(0.0012)	(0.0013)	(0.0014)
Adjusted Coeff.	-1.73%	-1.73%	-1.81%	-1.86%	-2.07%	-2.15%	-2.43%	-2.31%
<b>Panel B. With controls</b>								
Coefficient	-0.0015	-0.0015	-0.0007	-0.0007	-0.0007	-0.0008	-0.0009	-0.0008
Standard Error	(0.0016)	(0.0017)	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0013)	(0.0013)
Adjusted Coeff.	-1.46%	-1.45%	-1.54%	-1.57%	-1.75%	-1.79%	-2.07%	-1.96%
Average Dependent Variable	0.105	0.105	0.047	0.047	0.042	0.042	0.042	0.042
S.D. Dependent Variable	0.307	0.307	0.212	0.212	0.201	0.201	0.200	0.200
Number of Observations	259,396							

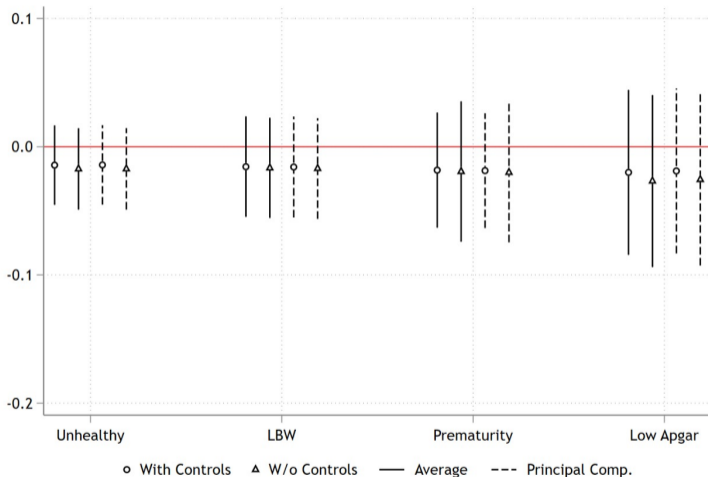
[← Return](#)

# Average marginal effects from logit model

	Unhealthy		LBW		Prematurity		APGAR < 7	
	Health Average Score	Health PCA Score	Health Average Score	Health PCA Score	Health Average Score	Health PCA Score	Health Average Score	Health PCA Score
<b>Panel A. Without controls</b>								
Coefficient	0.0016	0.0023	0.0001	-0.0006	-0.0002	-0.0010	-0.0009	-0.0005
Stand. Err.	(0.0018)	(0.0018)	(0.0010)	(0.0010)	(0.0012)	(0.0012)	(0.0014)	(0.0014)
Adjusted Coeff.	1.30%	1.20%	-1.07%	-1.13%	-0.88%	-0.90%	0.57%	0.52%
<b>Panel B. With controls</b>								
Coefficient	0.0013	0.0012	-0.0006	-0.0006	-0.0003	-0.0003	0.0005	0.0005
Standard Error	(0.0018)	(0.0018)	(0.0010)	(0.0010)	(0.0011)	(0.0011)	(0.0014)	(0.0014)
Adjusted Coeff.	1.21%	1.13%	-1.19%	-1.23%	-0.53%	-0.53%	1.09%	1.02%
Average Dependent Variable	0.109	0.109	0.047	0.047	0.052	0.052	0.046	0.046
Number of Observations	261,820							

[← Return](#)

# Robustness average marginal effects from logit model



95% confidence intervals.

[Return](#)

# Results using other leads different than 3 years

Unhealthy		LBW		Prematurity		APGAR < 7	
Score average (1)	PCA score (2)	Score average (3)	PCA score (4)	Score average (5)	PCA score (6)	Score average (7)	PCA score (8)

## Panel A. Placebo 2 years

Coefficient	-0.0008	-0.0007	-0.0014	-0.0014	-0.0004	-0.0004	-0.0006	-0.0006
Stand. Err.	(0.0020)	(0.0020)	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0014)	(0.0014)
Adjusted Coeff.	0.10%	0.10%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%

## Panel A. Placebo 2.5 years

Coefficient	-0.0015	-0.0015	-0.0004	-0.0004	-0.0011	-0.0011	-0.0010	-0.0010
Standard Error	(0.0017)	(0.0017)	(0.0010)	(0.0010)	(0.0012)	(0.0012)	(0.0014)	(0.0014)
Adjusted Coeff.	0.10%	0.10%	0.05%	0.05%	0.04%	0.04%	0.04%	0.04%

## Panel B. Placebo 3.5 years

Coefficient	0.0000	0.0000	-0.0003	-0.0003	-0.0008	-0.0008	-0.0003	-0.0003
Standard Error	(0.0016)	(0.0017)	(0.0009)	(0.0009)	(0.0012)	(0.0012)	(0.0012)	(0.0013)
Adjusted Coeff.	0.14%	0.14%	0.05%	0.05%	0.04%	0.04%	0.08%	0.08%

## Panel C. Placebo 4 years

Coefficient	0.0016	0.0015	-0.0006	-0.0006	-0.0009	-0.0009	0.0002	0.0002
Standard Error	(0.0016)	(0.0016)	(0.0011)	(0.0011)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Adjusted Coeff.	0.23%	0.23%	0.05%	0.05%	0.05%	0.05%	0.18%	0.18%

[← Return](#)

# Robustness check

	Health score average (1)	Health manage- ment score average (2)	Public health score average (3)	Academic score average (4)	Reading score average (5)	Quantitative score average (6)
<b>Panel A. Without controls</b>						
Coefficient	-0.0060***	-0.0057***	-0.0046**	-0.0063***	-0.0023	-0.0080***
Stand. Err.	(0.0020)	(0.0019)	(0.0020)	(0.0020)	(0.0017)	(0.0019)
Adjusted Coeff.	-6.31%	-5.97%	-4.81%	-6.67%	-2.41%	-8.42%
<b>Panel B. With controls</b>						
Coefficient	-0.0056***	-0.0053***	-0.0043**	-0.0056***	-0.0024	-0.0069***
Standard Error	(0.0019)	(0.0018)	(0.0020)	(0.0018)	(0.0017)	(0.0019)
Adjusted Coeff.	-5.85%	-5.53%	-4.57%	-5.94%	-2.54%	-7.30%
Average Dependent Variable	0.095					
S.D. Dependent Variable	0.293					
Number of Observations	256,805					

[← Return](#)

# Robustness check

	LBW					
	Hospital		Mother			
	Higher incidence of LBW (1)	Lower incidence of LBW (2)	First-time (3)	Non-first-time (4)	Full Continuity of care (5)	Partial Continuity of care (6)
<b>Panel A. Average score</b>						
Coefficient	-0.0073***	-0.0004	-0.0036**	-0.0021	-0.0041**	-0.0031
Stand. Err.	(0.0025)	(0.0017)	(0.0018)	(0.0015)	(0.0020)	(0.0021)
Adjusted Coeff.	-11.66%	-1.02%	-7.42%	-5.58%	-7.14%	-6.50%
<b>Panel B. PCA score</b>						
Coefficient	-0.0073***	-0.0003	-0.0037**	-0.0022	-0.0040**	-0.0031
Stand. Err.	(0.0025)	(0.0017)	(0.0018)	(0.0015)	(0.0020)	(0.0021)
Adjusted Coeff.	-11.56%	-0.88%	-7.47%	-5.66%	-7.01%	-6.56%
Average Dependent Variable	0.063	0.039	0.049	0.038	0.057	0.047
S.D. Dependent Variable	0.242	0.193	0.217	0.191	0.232	0.211
Number of Hospitals	141	451	592	616	529	591
Number of Observations	46,292	58,060	104,357	152,447	26,862	77,487

[← Return](#)

# Robustness check

<b>Antenatal consultations <math>\geq 4</math></b>		
	Score average (1)	PCA score (2)
<b>Panel A. Without controls</b>		
Coefficient	-0.0004	-0.0003
Stand. Err.	(0.0072)	(0.0073)
Adjusted Coeff.	-0.05%	-0.04%
<b>Panel B. With controls</b>		
Coefficient	-0.0017	-0.0016
Stand. Err.	(0.0069)	(0.0070)
Adjusted Coeff.	-0.20%	-0.19%
Average Dependent Variable	0.867	0.867
S.D. Dependent Variable	0.340	0.340
Number of Hospitals	592	592
Number of Observations	104,357	104,357

[← Return](#)



# Antenatal consultations by Predicted Prematurity Rob. Checks

Antenatal consultations > 4				
	Low predicted probability of Preterm		High predicted probability of Preterm	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)
<b>Panel A. Without controls</b>				
Coefficient	-0.0011	-0.0007	0.0179**	0.0184**
Stand. Err.	(0.0047)	(0.0048)	(0.0078)	(0.0078)
Adjusted Coeff.	-0.12%	-0.08%	2.13%	2.20%
<b>Panel B. With controls</b>				
Coefficient	0.0006	0.0009	0.0193***	0.0196***
Stand. Err.	(0.0044)	(0.0045)	(0.0066)	(0.0066)
Adjusted Coeff.	0.06%	0.10%	2.30%	2.34%
Average Dependent Variable	0.901	0.901	0.838	0.838
S.D. Dependent Variable	0.299	0.299	0.368	0.368
Number of Hospitals	397	397	386	386
Number of Observations	35,613	35,613	35,693	35,693

[← Return](#)

# Main outcomes by Predicted Prematurity Rob. Checks

	LBW		Prematurity		APGAR < 7	
	Low predicted Preterm (1)	High predicted Preterm (2)	Low predicted Preterm (3)	High predicted Preterm (4)	Low predicted Preterm (5)	High predicted Preterm (6)
<b>Panel A. Score average</b>						
Coefficient	-0.0027	-0.0045*	-0.0025	-0.0049**	-0.0044	-0.0101***
Stand. Err.	(0.0017)	(0.0023)	(0.0016)	(0.0024)	(0.0034)	(0.0038)
Adjusted Coeff.	-6.50%	-7.79%	-7.93%	-9.83%	-10.00%	-21.53%
<b>Panel B. PCA score</b>						
Coefficient	-0.0026	-0.0045*	-0.0024	-0.0051**	-0.0041	-0.0101***
Stand. Err.	(0.0017)	(0.0023)	(0.0016)	(0.0024)	(0.0034)	(0.0038)
Adjusted Coeff.	-6.43%	-7.81%	-7.81%	-10.15%	-9.42%	-21.41%
Average Dependent Variable	0.041	0.058	0.031	0.050	0.044	0.047
S.D. Dependent Variable	0.199	0.233	0.174	0.219	0.205	0.212
Number of Hospitals	397	386	397	386	397	386
Number of Observations	35,613	35,693	35,613	35,693	35,613	35,693

# Antenatal consultations by predicted Prematurity ML

Antenatal consultations > 4				
	Low predicted probability of Preterm		High predicted probability of Preterm	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)
<b>With controls</b>				
<b>Panel A. Logit</b>				
Coefficient	0.0006	0.0009	0.0193***	0.0196***
Stand. Err.	(0.0044)	(0.0045)	(0.0066)	(0.0066)
Adjusted Coeff.	0.06%	0.10%	2.30%	2.17%
<b>Panel B. Random Forest</b>				
Coefficient	0.0051	0.0056	0.0120**	0.0123**
Stand. Err.	(0.0054)	(0.0054)	(0.0059)	(0.0059)
Adjusted Coeff.	0.58%	0.63%	1.41%	1.44%
<b>Panel C. XGBoost</b>				
Coefficient	0.0022	0.0025	0.0153**	0.0157**
Stand. Err.	(0.0050)	(0.0051)	(0.0065)	(0.0064)
Adjusted Coeff.	0.25%	0.28%	1.80%	1.84%
<b>Panel D. Neural networks</b>				
Coefficient	-0.0072	-0.0068	0.0293***	0.0294***
Stand. Err.	(0.0056)	(0.0057)	(0.0068)	(0.0067)
Adjusted Coeff.	-0.82%	-0.78%	3.42%	3.44%

[← Return](#)

# Antenatal consultations by predicted Prematurity ML

	LBW		Prematurity		APGAR < 7	
	Low predicted Preterm (1)	High predicted Preterm (2)	Low predicted Preterm (3)	High predicted Preterm (4)	Low predicted Preterm (5)	High predicted Preterm (6)
<b>With controls</b>						
<b>Panel A. Logit</b>						
Coefficient	-0.0027	-0.0045*	-0.0025	-0.0049**	-0.0044	-0.0101***
Stand. Err.	(0.0017)	(0.0023)	(0.0016)	(0.0024)	(0.0034)	(0.0038)
Adjusted Coeff.	-6.50%	-7.79%	-7.93%	-9.83%	-10.00%	-21.53%
<b>Panel B. Random Forest</b>						
Coefficient	-0.0034**	-0.0040*	-0.0030*	-0.0036	-0.0029	-0.0097***
Stand. Err.	(0.0015)	(0.0020)	(0.0016)	(0.0022)	(0.0031)	(0.0036)
Adjusted Coeff.	-7.63%	-7.21%	-8.22%	-7.92%	-6.65%	-20.73%
<b>Panel C. XGBoost</b>						
Coefficient	-0.0023	-0.0034	-0.0016	-0.0040*	-0.0024	-0.0097**
Stand. Err.	(0.0016)	(0.0021)	(0.0016)	(0.0021)	(0.0032)	(0.0039)
Adjusted Coeff.	-5.43%	-6.14%	-4.82%	-8.32%	-5.36%	-20.55%
<b>Panel D. Neural networks</b>						
Coefficient	-0.0006	-0.0044*	0.0005	-0.0052**	-0.0036	-0.0121**
Stand. Err.	(0.0016)	(0.0022)	(0.0019)	(0.0021)	(0.0039)	(0.0052)
Adjusted Coeff.	-1.45%	-7.68%	1.39	-10.66%	-8.00%	-26.21%

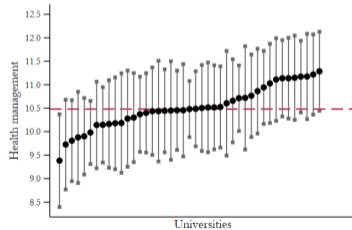
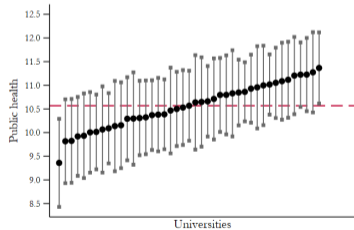
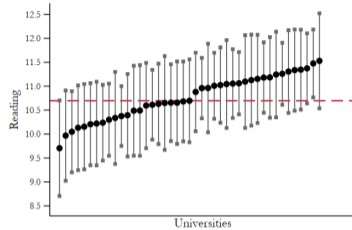
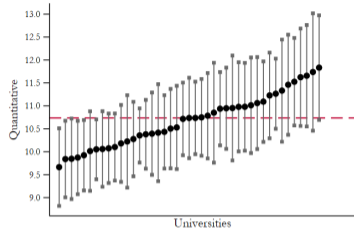
← Return

# Medical procedures

	Number of Medical Procedures (1)	Total cost (2)
<b>Panel A. Main Estimates</b>		
Coefficient	1.8534*	78.80**
Stand. Err.	(1.0300)	(39.07)
Adjusted Coeff.	9.53%	12.86%
<b>Panel B. Placebo (leads) test</b>		
Coefficient	0.8473	29.94
Stand. Err.	(1.0023)	(85.09)
Adjusted Coeff.	5.01%	2.97%

[◀ Return](#)

# Heterogeneity in Saber Pro scores in Medicine programs



— One SD. ● Mean

## The effect is consistent across scores

	Unhealthy				
	Average academic scores	Reading score	Quantitative score	Health Management Score	Public Health Score
<b>Panel A. Without controls</b>					
Coefficient	-0.0063***	-0.0023	-0.0021	-0.0057***	-0.0046**
Stand. Err.	(0.0020)	(0.0017)	(0.0016)	(0.0019)	(0.0020)
Adjusted Coeff.	-6.67%	-2.41%	-2.26%	-5.97%	-4.81%
<b>Panel B. With controls</b>					
Coefficient	-0.0056***	-0.0024	-0.0023	-0.0053***	-0.0043**
Standard Error	(0.0018)	(0.0017)	(0.0016)	(0.0018)	(0.0020)
Adjusted Coeff.	-5.94%	-2.54%	-2.38%	-5.53%	-4.57%
Average Dependent Variable	0.095	0.095	0.095	0.095	0.095
Number of Observations			256,805		

## Stronger effects for hospitals with higher LBW

	Unhealthy					
	Hospital		Mother			
	Higher incidence of LBW (1)	Lower incidence of LBW (2)	First-time (3)	Non-first-time (4)	Teenage mothers (5)	Non-teenage mothers (6)
	<b>Average score</b>					
Coefficient	-0.0061**	-0.0028	-0.0065***	-0.0053***	-0.0066***	-0.0056***
Stand. Err.	(0.0025)	(0.0021)	(0.0023)	(0.0016)	(0.0023)	(0.0017)
Adjusted Coeff.	-5.93%	-3.16%	-5.96%	-6.23%	-5.90%	-6.32%
Average Dependent Variable	0.104	0.088	0.109	0.085	0.113	0.088
Number of Observations	113,298	143,501	104,357	152,447	73,088	183,174

▸ Rob. check

▸ Return



# Robustness check

	LBW					
	Hospital		Mother			
	Higher incidence of LBW (1)	Lower incidence of LBW (2)	First-time (3)	Non-first-time (4)	Full Continuity of care (5)	Partial Continuity of care (6)
<b>Panel A. Average score</b>						
Coefficient	-0.0073***	-0.0004	-0.0036**	-0.0021	-0.0041**	-0.0031
Stand. Err.	(0.0025)	(0.0017)	(0.0018)	(0.0015)	(0.0020)	(0.0021)
Adjusted Coeff.	-11.66%	-1.02%	-7.42%	-5.58%	-7.14%	-6.50%
<b>Panel B. PCA score</b>						
Coefficient	-0.0073***	-0.0003	-0.0037**	-0.0022	-0.0040**	-0.0031
Stand. Err.	(0.0025)	(0.0017)	(0.0018)	(0.0015)	(0.0020)	(0.0021)
Adjusted Coeff.	-11.56%	-0.88%	-7.47%	-5.66%	-7.01%	-6.56%
Average Dependent Variable	0.063	0.039	0.049	0.038	0.057	0.047
S.D. Dependent Variable	0.242	0.193	0.217	0.191	0.232	0.211
Number of Hospitals	141	451	592	616	529	591
Number of Observations	46,292	58,060	104,357	152,447	26,862	77,487

[← Return](#)

## Skilled physicians seem to target mothers with worse predicted child health at birth

Dependent Variable: Antenatal consultations < 4				
Low predicted probability of LBW		High predicted probability of LBW		
Score average (1)	PCA score (2)	Score average (3)	PCA score (4)	
Panel A. Logit				
Coefficient	-0.011*	-0.012*	-0.018***	-0.019***
Stand. Err.	(0.0057)	(0.0058)	(0.0068)	(0.0069)
Relative effect	-7.9%	-8.63%	-12.94%	-13.67%

[▶ Rob. check](#)[▶ ML](#)[▶ Return](#)

Consistently, main results are stronger for mothers with worse predicted child health at birth

Dependent Variable: Unhealthy				
	Low predicted probability of LBW		High predicted probability of LBW	
	Score average (1)	PCA score (2)	Score average (3)	PCA score (4)
<b>Panel A. Logit</b>				
Coefficient	-0.0026	-0.0027	-0.006***	-0.0067***
Stand. Err.	(0.0022)	(0.0023)	(0.0023)	(0.0024)
Relative effect	-3.19%	-3.31%	-8.23%	-8.23%

▶ Rob. check

▶ ML

▶ Medical procedures