

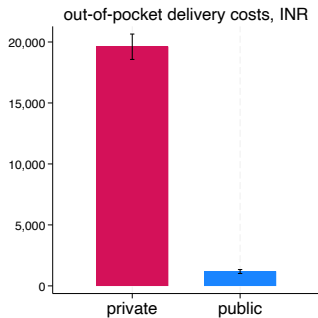
Cheaper and better? Explaining a newborn mortality advantage at public versus private hospitals in India

Nathan Franz

October 6, 2025

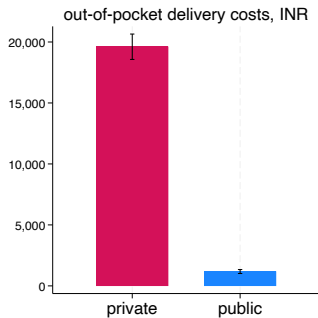
Puzzle: Private facilities have higher costs,

Public facilities are cheaper

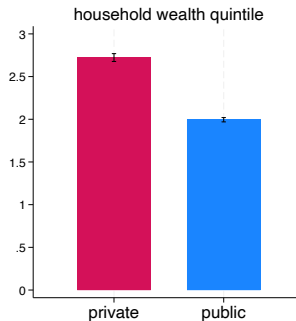


Puzzle: Private facilities have higher costs, richer patients,

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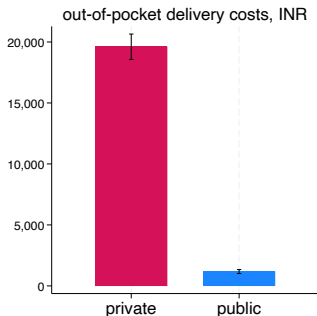


Private patients are richer

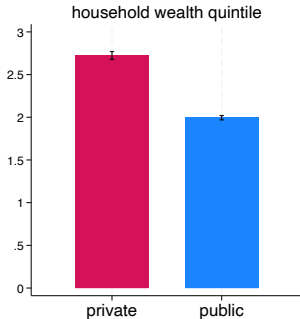


Puzzle: Private facilities have higher costs, richer patients, and worse outcomes than public

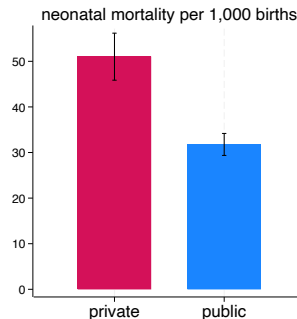
Public facilities are cheaper



Private patients are richer



But **many** more babies die in private facilities



Do private health facilities
harm babies compared to
public facilities in this area?

Competing explanations of worse outcomes in private facilities

- ▶ Causal question: Do public facilities provide more life-saving or less harmful care during labor and delivery than private facilities, reducing neonatal mortality?
- ▶ Confounders:
 - ▶ Individual adverse selection into private facilities: Births at higher risk may select into private facilities
 - ▶ Village access to each sector: More private facilities or fewer public facilities in areas that have worse underlying health

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This paper: Identify public–private mortality effect, even in presence of adverse selection

► Estimate the public–private effect:

1. **Village composition strategy:** Compare mortality across births in villages with different fractions born in private
2. **District borders regression discontinuity strategy:** Border determines which district's public facilities residents have easiest access to
 - increases distance and other costs of public care
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Preview of results

- ▶ Both strategies show private birth increases neonatal mortality over public, by > 25 deaths per 1,000 births
 - ▶ Benchmark: In US, neonatal mortality rate is 3.6 per 1,000 births
 - ▶ In private facilities in this area, neonatal mortality rate is 50 per 1,000 births
- ▶ Services private providers perform after delivery are harmful, as measured by separation of mother and baby after birth
 - ▶ Provider agency matters in a setting of asymmetric information: Patients rely on providers to recommend services, and private providers are incentivized to do more than necessary
 - ▶ “More than necessary” means active harm

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Contribution

- ▶ Public provision of private good
 - ▶ Extensive theoretical (Hart et al., 1997) and empirical literatures (Galiani et al., 2005; Megginson & Netter, 2001) on different goods and different institutional settings
 - ▶ This paper: first evidence that public provision of health care can reduce child mortality relative to private markets in a developing country
- ▶ Provider agency and credence goods with shrouded attributes
 - ▶ If patients don't know what's wrong or how to fix it, doctors don't always follow their patients' preferences (McGuire, 2000); worse if patients can't tell whether they have received good care (Dulleck & Kerschbamer, 2006)
 - ▶ Prior work shows incentives change provider behavior, and more care doesn't always mean better outcomes (Alexander, 2020; Clemens & Gottlieb, 2014; Cohen et al., 2015; Currie et al., 2014; Das et al., 2016; Donato et al., 2017; Einav et al., 2018; Gruber et al., 1999; Lagarde & Blaauw, 2022)
 - ▶ This paper: first evidence of child mortality effect consistent with provider-agency theory
- ▶ Effects of giving birth in a facility
 - ▶ Mixed evidence on mortality effect: decreases (Cesur et al., 2017; Gruber et al., 2014; Okeke, 2023), null or positive effect (Andrew & Vera-Hernández, 2024; Godlonton & Okeke, 2016; Powell-Jackson et al., 2015)
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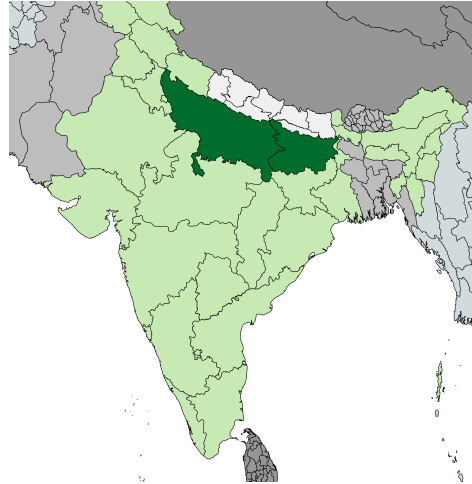
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Background

India has a high neonatal mortality rate; UP and Bihar are worse

- ▶ India's 2020 neonatal mortality rate: 20.1 per thousand births
- ▶ Rural UP and Bihar's: 36.7 per thousand
 - ▶ Worse than all countries but Afghanistan, Pakistan, and Nigeria
- ▶ UP and Bihar have among the least effective regulation of private providers in India



What is a health facility like in rural UP and Bihar?



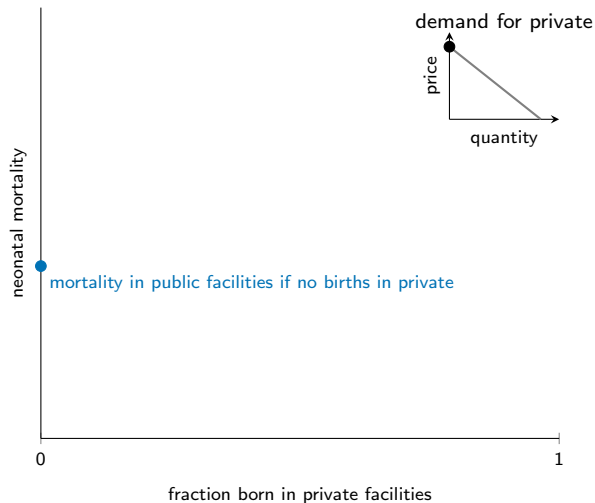
Data

Data: DHS India

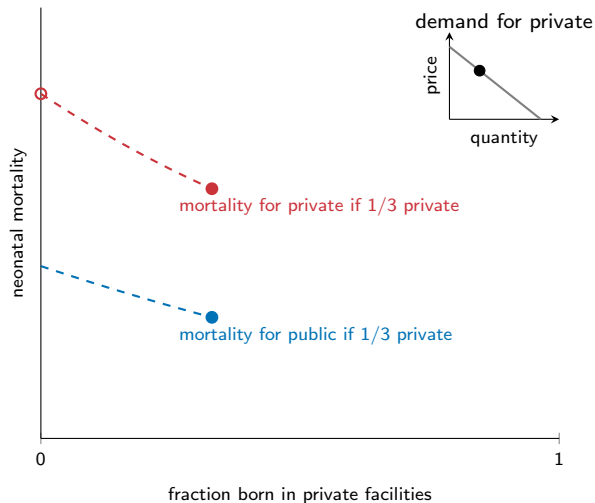
- ▶ **Data.** Demographic and Health Surveys of India, conducted 2015–2016 and 2019–2021
 - ▶ Outcome: neonatal mortality for all births (month-level)
 - ▶ Explanatory variable: sector of delivery facility (public or private), for births in last five years
 - ▶ Mechanisms: treatment during labor and delivery, with sample restrictions
 - ▶ Demographic controls: household and mother characteristics
 - ▶ Distance to borders in RD design: village geographical coordinates
- ▶ **Unit of analysis.** A birth in the five years before the survey whose mother lives in a rural area of Uttar Pradesh or Bihar

Econometric framework to address selection

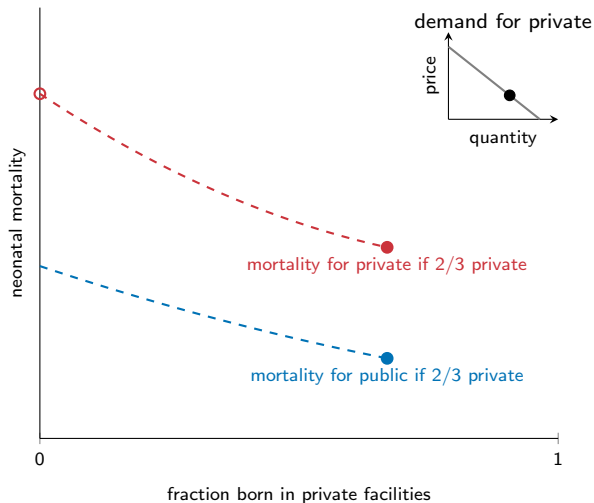
Identifying and addressing adverse selection into private facilities—no mortality effect



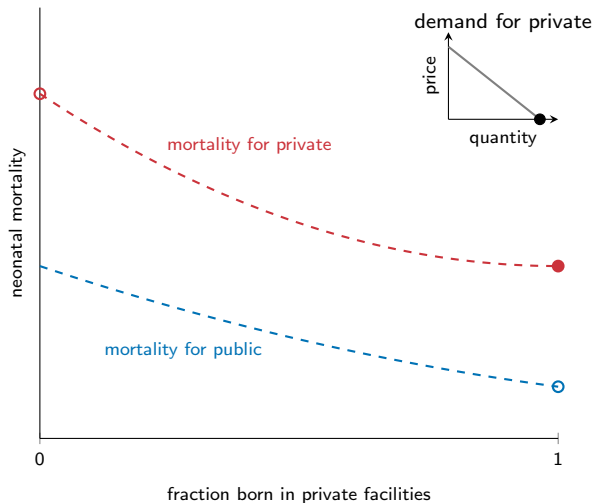
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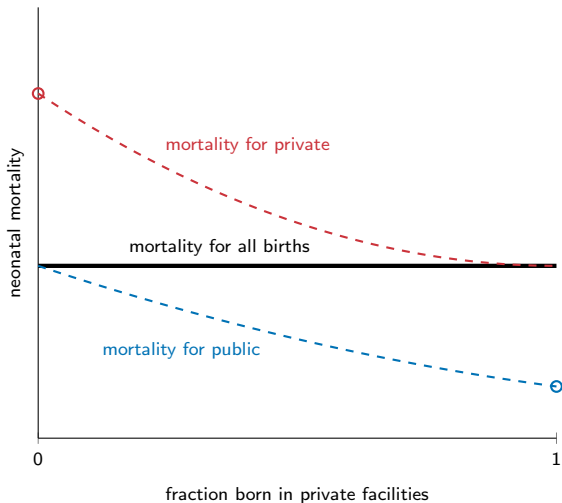
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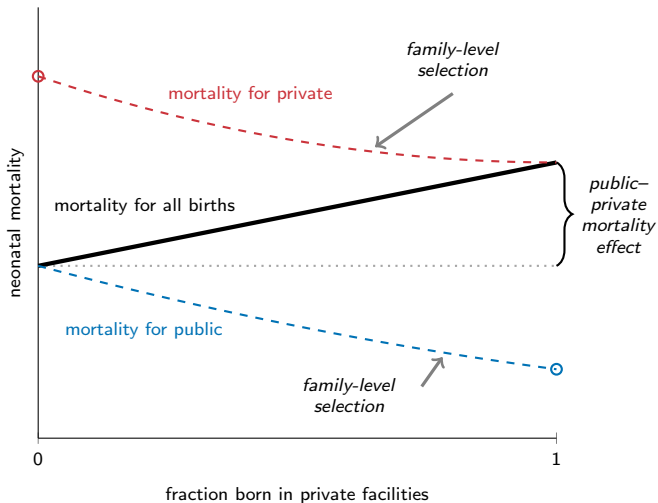
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Even with adverse selection, with no causal effect the mortality line for all births is flat



If there is a public–private effect, the mortality line for all births slopes up



Empirical strategy 1: Village composition regression

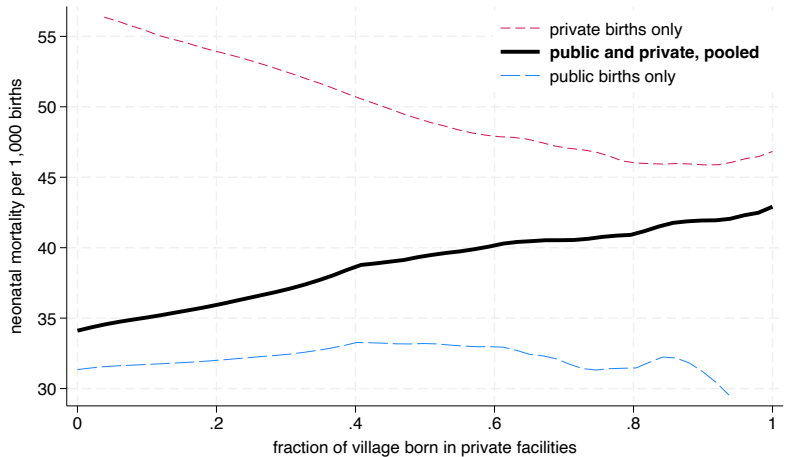
Using variation across villages to estimate mortality effect from model

- Construct fraction of births in each village that take place in private:

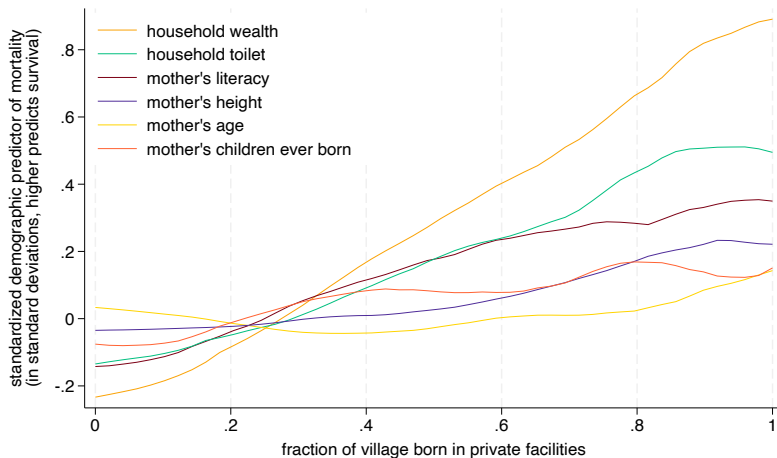
$$\overline{private}_v = \frac{\text{count of births in private facilities in the last 5 years in baby's village}}{\text{count of births in facilities in the last 5 years in baby's village}}$$

- Look at relationship between a baby's mortality and the fraction of its village born in private

Main result 1: Overall mortality line slopes up (OLS: 18.5, SE = 5.8), evidence for private harm



Villages with higher fraction born in private have *better* predictors of health, against direction of effect



OLS regression results: all significant, and more controls increase estimate

$$y_{i,v} = \beta_0 + \beta_1 \overline{\text{private}}_v + f(X) + \epsilon_{i,v}$$

- ▶ household wealth index
- ▶ household electricity access
- ▶ household caste and religion
- ▶ mother's literacy
- ▶ mother's height
- ▶ mother's age at birth
- ▶ mother's anemia
- ▶ sex
- ▶ singleton status
- ▶ birth order × family size

	Neonatal mortality per 1,000 births		
	(1)	(2)	(3)
fraction born in private	18.5** (5.8)	25.6*** (6.9)	28.9*** (6.9)
Mean of dependent var	36.4	36.4	36.4
District-by-month FEs		Yes	Yes
Additional controls			Yes
Observations	33,932	33,932	33,932

Empirical strategy 2: Borders regression discontinuity design

District borders regression discontinuity design looks at places near to and similar to each other

- ▶ People who live near each other have same facility choice set and likely have more similar underlying health
- ▶ At district borders, distance to nearest facility in district and other costs vary, making otherwise similar neighbors choose differently Identification assumptions

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RD setup: Assigning below or above cutoff—compare district-level fractions born in public

- For each district, calculate

$$\overline{public}_d = \frac{\text{count of births in public facilities in own district in last 5 years}}{\text{count of births in facilities in own district in last 5 years}}$$

- Compare to the neighboring district's fraction born in public

- Births in the district with **less public birth** are on the **negative** side of the border

- Births in the district with **more public birth** are on the **positive** side of the border

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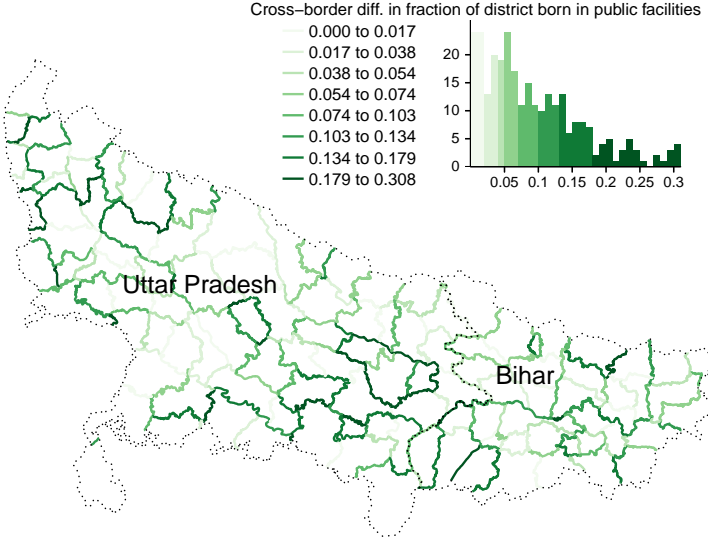
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Study area and identifying variation



RD regression specification

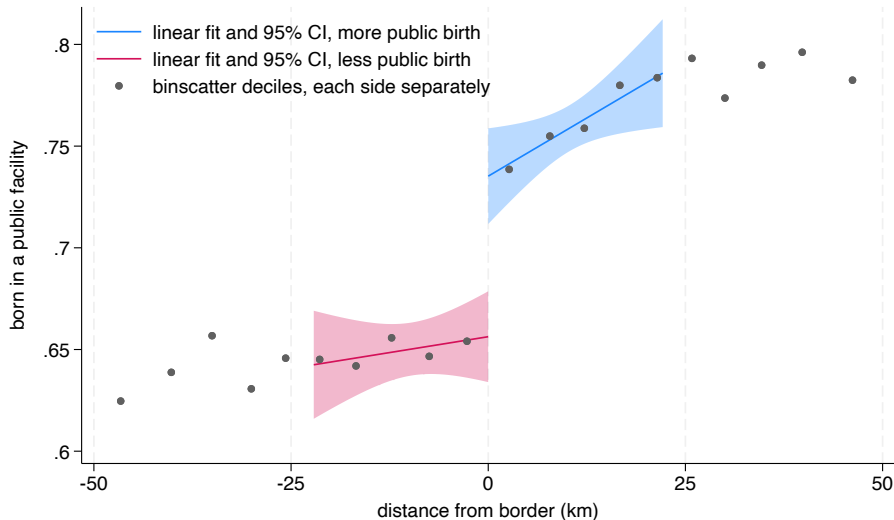
- For birth i with mother living in district pair r

$$y_{i,r} = \beta_0 + \beta_1 d_{i,r} + T_{i,r} \times (\beta_2 + \beta_3 d_{i,r}) + f(X) + \epsilon_{i,r}$$

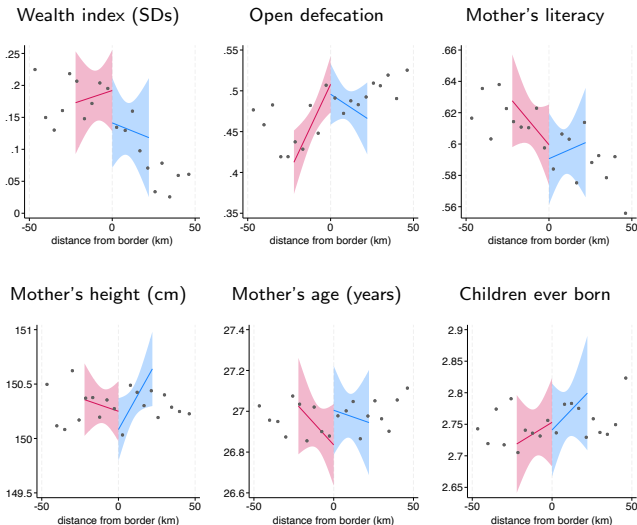
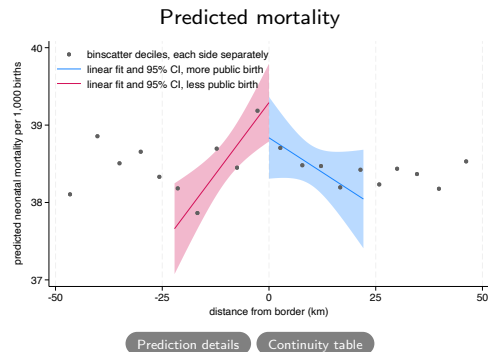
- y : demographic variables, public facility birth, or neonatal mortality
- d : distance to nearest point on border
- T : indicator of being on the side of a district border that has a higher district-level fraction born in public
- $f(X)$: a function of a vector of controls X
 - household wealth index
 - household electricity access
 - household caste and religion
 - household open defecation
 - mother's literacy
 - mother's height
 - mother's age at birth
 - sex
 - singleton status
 - birth order \times family size
 - year of birth
 - survey, state, and district-pair FEs

Method details—following Cattaneo et al. (2019)

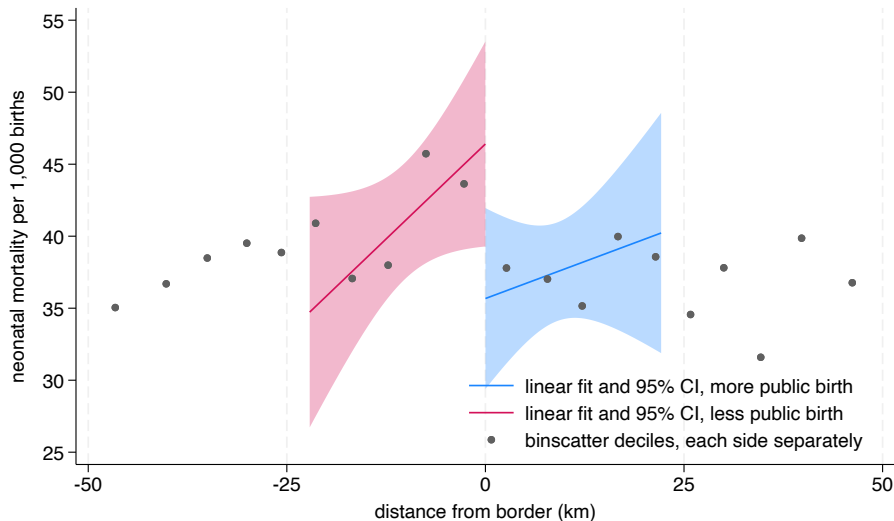
RD first stage—fraction born in public increases by 9.1 (SE: 1.8) p.p. at the border



Continuity tests—births near borders are similar in predictors of mortality



Main result 2: reduced form—mortality decreases by 11.6 (SE: 4.9) per thousand at the border



RD regression results: all show public facility birth reduces mortality

	Neonatal mortality per 1,000		
	(1)	(2)	(3)
Panel a: Reduced-form regressions			
Own district's public birth is higher	-11.6* (4.9)	-10.2* (4.6)	-11.4** (4.4)
Panel b: Two-stage least squares regressions			
Born in a public facility	-151.0* (71.2)	-123.7* (60.6)	-139.9* (58.8)
Mean of dependent var	38.6	38.6	38.6
Survey, state, and district-pair FEs		Yes	Yes
Additional controls			Yes
Observations	51,208	51,208	51,208

2SLS RD effect estimate larger, but not statistically different from village composition estimate

- ▶ This estimate is substantially larger but substantially less certain than the first estimate

borders RD: $\frac{12.4 \text{ per thousand decrease in NNM at border [95\%CI: 0.5–24.2]}{10 \text{ p.p. increase in public birth at border}}$

versus

village composition: $\frac{2.9 \text{ per thousand decrease in NNM [95\%CI: 1.5–4.3]}{10 \text{ p.p. increase in public birth}}$

- ▶ Primarily identifies the sign of effect
- ▶ Village composition estimate is biased downward if unobservables follow observed confounders
- ▶ The RD estimate is for a sub-population of the cross-sectional estimate
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Mechanism: physician agency and separating mothers and babies

Why might we expect a difference in public and private facilities?

- ▶ Private facilities are smaller, less well-trained, and worse resourced (non-representative sample)

	Public sample (N=128)	Private sample (N=17)	Difference in means	
	mean	mean	pub.-pvt.	p-value
number of staff	21.1	3.5	17.6	0.00
fraction with MBBS or RN	0.45	0.12	0.33	0.00
has vaginal speculum	0.72	0.35	0.37	0.00
has ultrasound	0.12	0.06	0.06	0.47
has delivery kit	0.92	0.59	0.33	0.00
has forceps	0.81	0.59	0.22	0.03
has separate exam room	0.65	0.31	0.34	0.01
has sink for handwashing	0.79	0.38	0.41	0.00
has exam table	0.88	0.69	0.19	0.05

Data: facilities used by rural households for natal care in UP and Bihar, IHDS-II

Separation of mother and baby is harmful, and skin-to-skin contact measures non-separation

- ▶ Stylized fact: private sector does a lot, public sector does a little (Bhatia et al., 2020; Chaudhury et al., 2006; Das et al., 2016; Duflo et al., 2012).
- ▶ With many conditions, too-little-too-late is concern; during and after labor and delivery, too-much-too-soon is concern (McNamara et al., 2006; Miller et al., 2016; O’Gara et al., 2013; WHO Immediate KMC Study Group, 2021; World Health Organization, 2018).
- ▶ A perfect data set would have at least
 - ▶ body temperature
 - ▶ blood oxygen
 - ▶ blood glucose
 - ▶ infection exposure
 - ▶ time left unattended
- ▶ ... but separating mother and child makes all of these are worse
- ▶ Measured in the most recent DHS round, by two questions about skin-to-skin contact at birth

Survey questions

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- ▶ ... but separating mother and child makes all of these are worse
- ▶ Measured in the most recent DHS round, by two questions about skin-to-skin contact at birth

Survey questions

Separation of mother and baby is harmful, and skin-to-skin contact measures non-separation

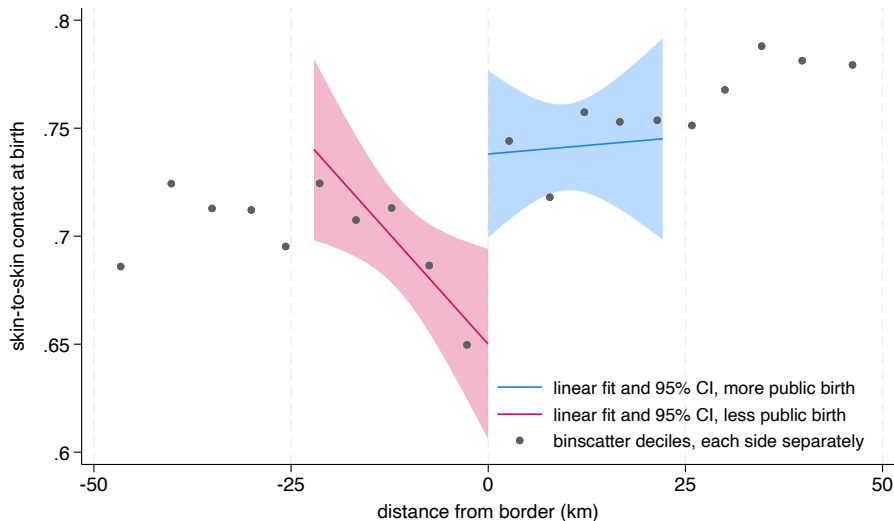
- ▶ Stylized fact: private sector does a lot, public sector does a little (Bhatia et al., 2020; Chaudhury et al., 2006; Das et al., 2016; Duflo et al., 2012).
- ▶ With many conditions, too-little-too-late is concern; during and after labor and delivery, too-much-too-soon is concern (McNamara et al., 2006; Miller et al., 2016; O'Gara et al., 2013; WHO Immediate KMC Study Group, 2021; World Health Organization, 2018).
- ▶ A perfect data set would have at least
 - ▶ body temperature
 - ▶ blood oxygen
 - ▶ blood glucose
 - ▶ infection exposure
 - ▶ time left unattended
- ▶ ... but separating mother and child makes all of these are worse
- ▶ Measured in the most recent DHS round, by two questions about skin-to-skin contact at birth

Survey questions

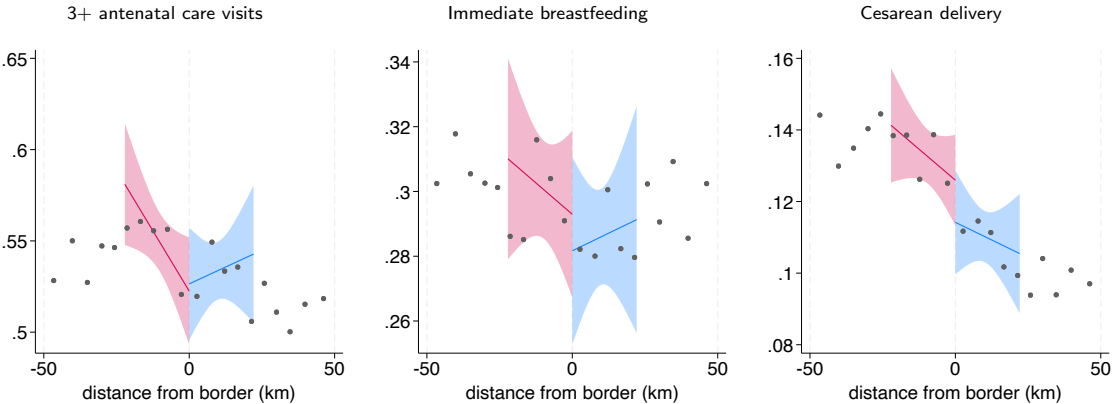
Collage of evidence for non-separation as mechanism

1. RD and cross-sectional evidence to identify candidate mechanisms
2. Cross-sectional mortality regressions, conditional on types of services during and after labor and delivery
3. Village-level regression of public–private gap in mortality on public–private gap in services

RD reduced form—fewer mothers and babies are separated at the border, by 11.4 (3.0) p.p.

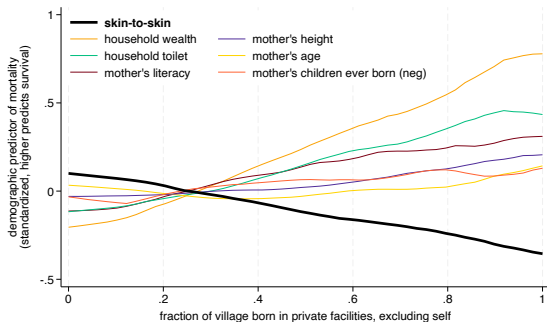


RD reduced form—prenatal care, breastfeeding, and C-section don't change

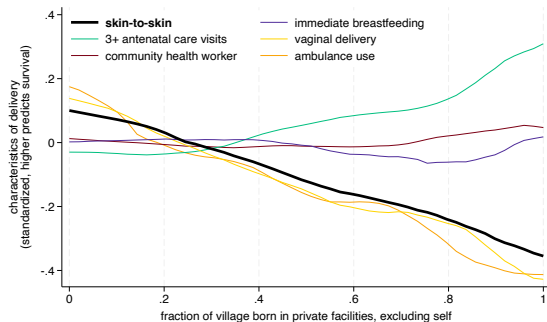


Villages with more births in private are more likely to separate mothers and babies

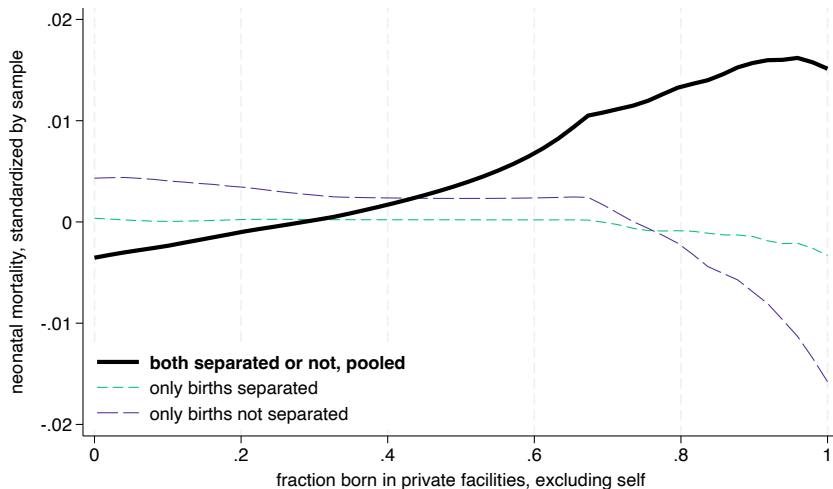
Skin-to-skin contact follows mortality trend...



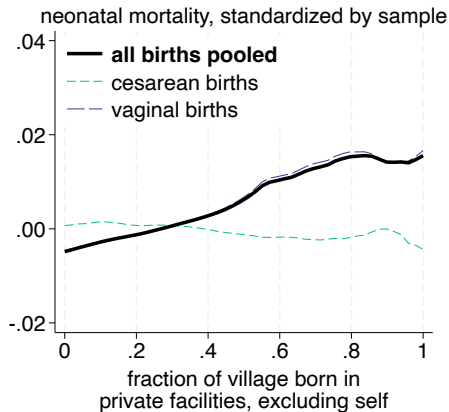
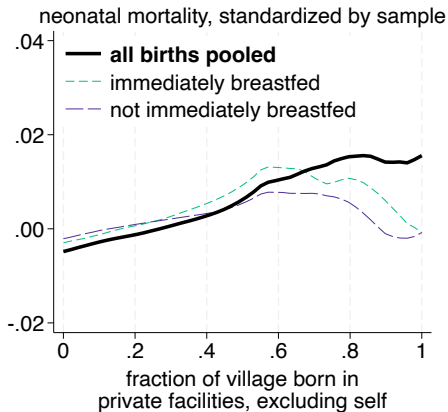
as do ambulance use and vaginal delivery



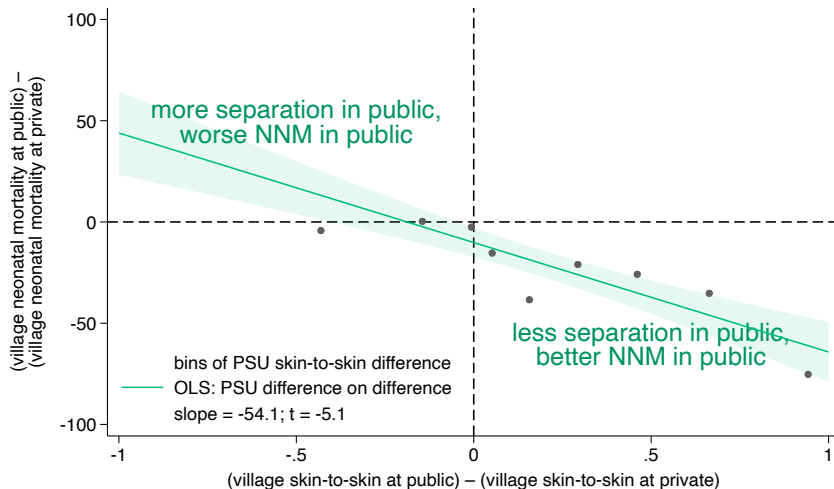
Stratifying by non-separation, private-fraction of births no longer predicts mortality



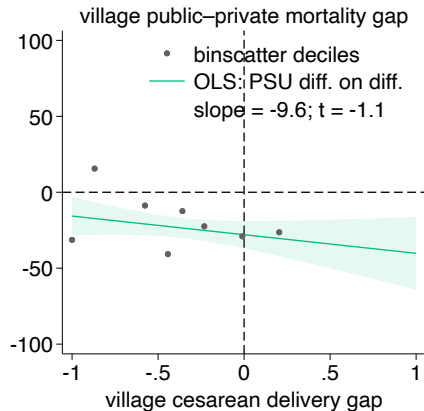
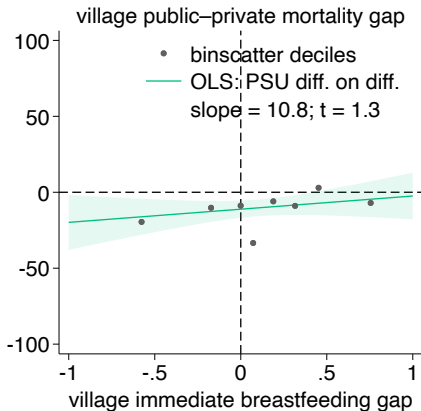
Stratifying by other candidate mechanisms, private-fraction of births still predicts mortality



Villages with no public–private separation gap have no public–private mortality gap



Villages with no public–private gaps in other candidate mechanisms still have public–private mortality gap



Conclusion

Summary of results

- ▶ Develop an econometric model to identify a facility effect, even in the presence of adverse selection
- ▶ Estimate the public–private effect in two complementary ways:
 1. **Village composition strategy:** Compare mortality across births in villages with different fractions born in private
 2. **District borders regression discontinuity strategy:** Compare mortality for otherwise similar births that have been shifted from public to private because of district border
- ▶ Both strategies show private birth increases neonatal mortality over public, by > 25 deaths per 1,000 births
 - ▶ Back-of-the-envelope: If private facility mortality fell by 25 per thousand, would save over 37,000 net newborns' lives each year
- ▶ Services private providers perform after delivery are harmful, consistent with provider-agency theory

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Facilities

◀ Return

Fuzzy RD: Assumptions and potential violations

► Identification assumptions

- **Relevance:** instrument shifts the (binary) treatment; verified in the first stage
- **Independence:** instrument shares no common causes with the outcome
- **Exclusion:** instrument affects the outcome only through treatment
- **Monotonicity:** no “defiers”; treatment uptake is weakly increasing in the instrument

► Possible violations

- **Independence threats:** system strain from higher public use; or public users engage in more protective behaviors outside facility choice. Given public users are otherwise disadvantaged, either threat would *bias toward private*—opposite my results.
- **Monotonicity threats:** crowding at nearby public facilities may deter some would-be users (time/status costs). If deterred users are higher-wage/low-risk, the violation again *biases toward private*.
- **Takeaway:** Main credible violations work against finding a public advantage; observed effects are therefore conservative.

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RD methodology

► Following Cattaneo et al. (2019)

- Compare births within an MSE-optimal bandwidth (< 22 km) around borders Bandwidths
- Use a triangular kernel Kernels

► Estimation details

- Pool both rounds of India's DHS
- Use survey weights, multiplying kernel weights
- Cluster at the village level, following survey design

► Most districts have multiple adjacent districts

- Same birth is repeated in the sample for each adjacent district, with distance to *that* border Nearest border

► Exclude borders with less than top-tercile difference in public birth fraction—9.5 p.p. Other designs

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Model results

► Primitives

- $m_i^{public} = \hat{m}_i$: birth i 's neonatal mortality outcome if delivered in public facility
- $m_i^{private} = \hat{m}_i + \mu_i$: birth i 's mortality outcome if delivered in private facility