Saving Neonatal Lives for a Quarter

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(1) > 400,000 children die annually due to neonatal sepsis

Background

- Chlorhexidine Cord Care (CHX) costs only 0.23 USD/dose and prevents neonatal sepsis.
- 3 RCTs in South Asia find that CHX reduces neonatal mortality by 20-35%.
- 2 RCTs in East Africa find no evidence of effectiveness of CHX.

What we do

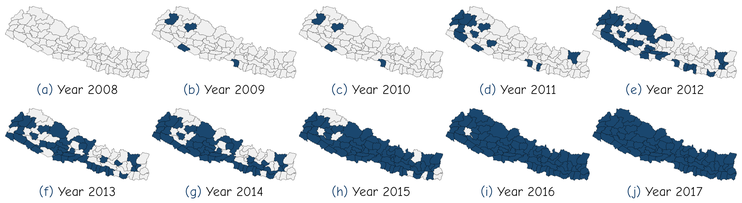
(i) Estimate effectiveness of CHX in a real-world setting at scale.
(ii) Use causal forests to assess treatment effect heterogeneity.
(iii) Derive the optimal targeting policy and compare it to the current policies.

What we find

(i) CHX reduces neonatal mortality by 43%.
(ii) Treatment effect heterogeneity matches patterns across RCTs.
(iii) Optimal policy targeting reduces neonatal mortality more than the current WHO policy.

(2) National roll-out of CHX in Nepal

Figure 1. CHX roll-out (adopted CHX=blue).



(3) TWFE results: CHX reduces neonatal mortality by 1.8ppt

We estimate the following equation with OLS:

$$m_{idt} = \alpha + \beta CHX_{dt} + D'_d\Delta + T'_t\Gamma + X'_{idt}\Lambda + \epsilon_{idt} \quad (1)$$

Table 1. TWDE Regression results. Dependent variable: Mortality ≤1m.

	All	All	P(home birth) <0.5	P(home birth) >0.5
	(1)	(2)	(3)	(4)
CHX	-0.018**	-0.007	0.001	-0.028**
	(0.007)	(0.007)	(0.009)	(0.011)
1[P(home birth)>0.5]		-0.001		
		(0.005)		
CHX × 1[P(home birth)>0.5]		-0.021***		
		(0.008)		
CHX + CHX × 1[P(home birth)>0.5]		-0.028***		
		(0.008)		
Observations	23,465	23,465	10,860	12,605
Control mean of dep. var	0.042	0.042	0.033	0.050
P-val (dif across sample)				0.031

Notes: Asterisks indicate significance at the following levels: * p<0.1, ** p<0.05, and *** p<0.01.

- We assess the role of negative TWFE weights based on de Chaisemartin & D'Haultfoeuille (2020)

(4) Causal forest results: significant treatment effect heterogeneity

Approach

1 Orthogonalize outcome and treatment using a regression forests.
2 Estimate causal forest on residualized treatment and outcome.

Omnibus test of causal forest fit

- Mean prediction =1 ⇒ ATE captured well.
- Differential prediction =1 ⇒ Heterogeneity captured well.

Table 2. Causal Forest Fit & Doubly Robust Average Treatment Effects

A. Omnibus test for forest fit	
Mean Forest Prediction	1.215***
	(0.273)
Differential Forest Prediction	0.806*
	(0.525)
B. Doubly Robust Average Treatment Effects	
Full sample	-0.022***
	(0.004)

Notes: Asterisks indicate significance at the following levels * p<0.1, ** p<0.05, and *** p<0.01. Note that the significance levels in panel A are for the one sided tests. Based on the causal forest implementation in R by Tibshirani et al (2021) Diagnostic test based on Chernozhukov, Demirer, Duflo, and Fernandez-Val (2020).

Figure 2. Distribution of CATEs

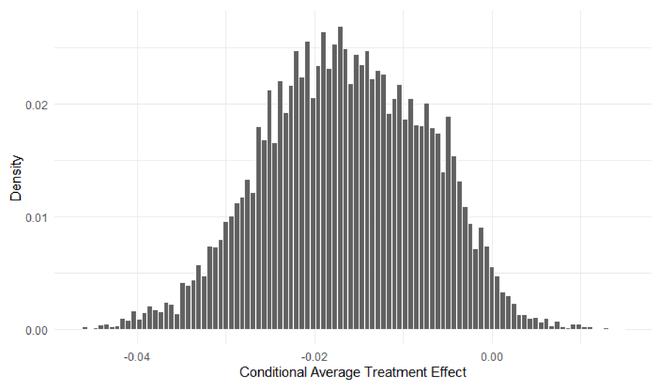


Table 3. Covariate means across quartiles of CATEs

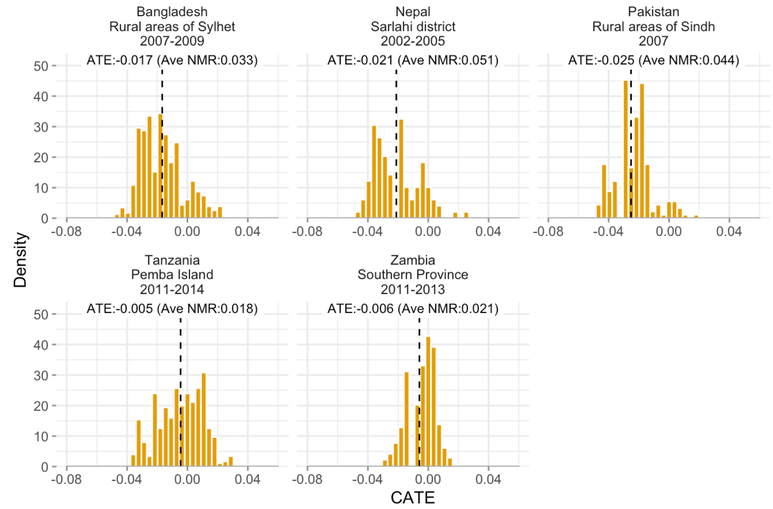
	Quartile First	Fourth	Difference	P-val
Home delivery	0.707	0.240	-0.467	<0.001
Age: 15-19y	0.283	0.088	-0.195	<0.001
Age: 20-24y	0.394	0.491	0.097	<0.001
Age: 25-29y	0.203	0.301	0.098	<0.001
Age: 30-34y	0.088	0.096	0.008	0.117
Age: 35-39y	0.027	0.021	-0.006	0.036
Age: 40-45y	0.005	0.002	-0.003	0.011
Education: No education	0.915	0.131	-0.784	<0.001
Education: Primary	0.081	0.148	0.067	<0.001
Education: Secondary	0.004	0.542	0.538	<0.001
Education: Higher	0.001	0.179	0.179	<0.001
Rural	0.596	0.229	-0.367	<0.001
Baseline NMR	0.049	0.028	-0.022	<0.001

Notes: The table shows covariate means for the first and fourth quartile of the sample based on the estimated CATEs. Baseline NMR is the district level neonatal mortality rate in the five years before treatment started.

(5) Heterogeneity patterns match results across RCTs

- Use trained causal forest to predict treatment effects based on samples for periods and regions corresponding to RCTs.

Figure 3. Distribution of predicted CATEs across samples matching the RCT sites



(6) Optimal policy targeting reduces neonatal mortality more than current policies

- Based on doubly robust scores from causal forest (Athey & Wager, 2021)

Figure 4. Optimal policies

Table 4. Reduced mortality by the WHO policy and by optimal policies

	ATT	ATU	%treated	ΔNMR
A. Pre-defined policies				
WHO policy	-0.038***	-0.013***	32.3	-0.012
	(0.007)	(0.004)		
B. Unconstrained optimal policies				
Individual & district variables	-0.028***	0.020	85.7	-0.024
	(0.004)	(0.018)		
District variables only	-0.029***	0.013	82.3	-0.024
	(0.004)	(0.015)		
C. Constrained optimal policies				
Individual & district variables	-0.051***	-0.008*	31.7	-0.016
	(0.009)	(0.004)		
District variables only	-0.048***	-0.012***	28.4	-0.014
	(0.008)	(0.004)		

Notes: Asterisks indicate significance at the following levels: * p<0.1, ** p<0.05, and *** p<0.01.