Sustaining Sanitation

Long-term effects of a sanitation campaign

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Camp Resources

10 year evaluation of a sanitation campaign RCT in Odisha, India

Preview of findings

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Campaign used:

- Information dispersion,
- Social shaming
- Latrine subsidy for poor households

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Abandonment of latrines significantly higher in treatment villages 6-10 years after intervention

Why Should We Care About Sanitation?

Externalities: Water contamination

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Poor sanitation affects human capital development

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Externalities: Water contamination

Poor sanitation affects human capital development

- Child stunting (Dickinson et al., 2015; Spears et al., 2013; Rah et al., 2015; Schmidt 2014)

- Diarrheal incidence (Duflo et al., 2015; Guiteras et al., 2015; Kumar and Vollmer 2012)

- Time costs (Dickinson et al., 2015; Pattanayak et al., 2010)

Why Should We Care About Sanitation?

Technology adoption (latrines) has been difficult despite cost-effective solutions
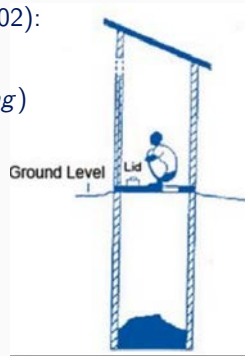
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Important factors in technology adoption (Jaffe et al. 2002):

- Peer effects / imitative adoption behavior
  (Rode and Weber, 2016; Dickinson et al., *forthcoming*)
- Information (Pattanayak and Pfaff, 2009)
- Uncertainty (Isik, 2004)

Ground Level

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  - Used repeated cross-section data
  - Elementary econometrics

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Since 2009, only one working paper exploring impacts longer than 2 years (Duflo et al. (2016 WP)

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- Reduced water consumption persisted two years after social comparison treatment (Ferraro and Price, 2011)

Elements of the RCT:

Community Led Total Sanitation RCT

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- Conducted in 2005
- Bhadrak district in Odisha, India
- 40 villages: 20 treatment, 20 control
- Village wide intervention
- 1086 households; all had children under 5 years old
- Objective: to increase latrine coverage

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- Objective: to increase latrine coverage
- Follow-ups in 2006, 2010, 2016

Photo Credit: Katherine Anderson (WSSCC) 2015
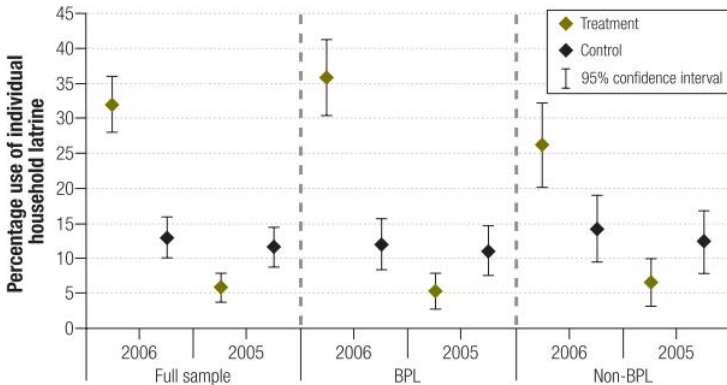
Photo Credit: Jesse Coffie Danku (WASH SNV Netherlands) 2014

Fig. 2. **Latrine ownership in households below and above the poverty line and in the overall sample before and after an IEC sanitation campaign in Bhadrak, Orissa, India, 2005–2006**

Pattanayak SK, et al. Shame or subsidy revisited: social mobilization for sanitation in Orissa, India. Bulletin of the World Health Organization. 2009; 87(8):580-587.

Improved child health outcomes:

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- Height for Age
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Increased reported satisfaction with village sanitation

Dickinson K, et al. Nature's Call: Impact of Sanitation Choices in Orissa, India. Economic Development and Cultural Change. 2015; 64(1):1-29.

Descriptive Statistics

	Mean	Std Dev.
Primary water source is public well or surface water	0.95	
Household primarily uses open defecation	0.92	
Household is below the poverty line	0.69	
Household owns television	0.22	
Household owns bicycle	0.58	
Monthly household savings (Rupees)	24.64	197
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Theoretical Model of Sustained Sanitation Behavior

Two-period model ($t = 1, 2$)

Two types of households ($\theta = P, R$)

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In $t = 1$, household decides whether to adopt latrine or not ($F_1 = 0, 1$)

- Cost of adoption for type $P = l - s$
- Cost of adoption for type $R = l$

In $t = 2$, household decides whether to continue using latrine ($M_2 = 0, 1$)

- Cost of maintenance for both types $= m$

Theoretical Model of Sustained Sanitation Behavior

Let $U_t(W_t(C_t, (.)); \theta)$

where:

C=Household Human Capital Accumulation

$\theta = P$	$\theta = R$	$\theta = P \textbf{ v } \theta = R$
• $U_W^P > 0$	• $U_W^R > 0$	• $U_W^P = U_W^R$
• $W_C^P > 0$	• $W_C^R > 0$	• $W_C^P < W_C^R$
• $C_F > 0$ and $C_M > 0$	• $C_F > 0$ and $C_M > 0$	• No Assumptions

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• $C_F > 0$ and $C_M > 0$	• $C_F > 0$ and $C_M > 0$	• No Assumptions

Theoretical Model of Sustained Sanitation Behavior: Period 1

In period 1, households will purchase a latrine if:

$$W_1^P - (I - s) + \frac{\partial W_1^P}{\partial C} + \delta W_2^P - \delta m > W_1^P + \delta W_2^P$$

$$W_1^R - I + \frac{\partial W_1^R}{\partial C} + \delta W_2^R - \delta m > W_1^R + \delta W_2^R$$

In period 1, households will purchase a latrine if:

$$\overbrace{W_1^P - (I-s) + \frac{\partial W_1^P}{\partial C} + \delta W_2^P - \delta m}^{\text{Payoff to P for purchasing latrine}} > \overbrace{W_1^P + \delta W_2^P}^{\text{Payoff to P for not purchasing latrine}}$$

$$W_1^R - I + \frac{\partial W_1^R}{\partial C} + \delta W_2^R - \delta m > W_1^R + \delta W_2^R$$

Theoretical Model of Sustained Sanitation Behavior: Period 1

In period 1, households will purchase a latrine if:

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$$\underbrace{W_1^R - I + \frac{\partial W_1^R}{\partial C} + \delta W_2^R - \delta m}_{\text{Payoff to R for purchasing latrine}} > \underbrace{W_1^R + \delta W_2^R}_{\text{Payoff to R for not purchasing latrine}}$$

Reordering Terms:

$$\frac{\partial W_1^P}{\partial C} - l + s - \delta m > 0$$

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$$\frac{\partial W_1^R}{\partial C} - l - \delta m > 0$$

Recall that:

$$\frac{\partial W_1^P}{\partial C} < \frac{\partial W_1^R}{\partial C}$$

Reordering Terms:

$$\frac{\partial W_1^P}{\partial C} - l + s - \delta m > 0$$
$$\frac{\partial W_1^R}{\partial C} - l - \delta m > 0$$

Recall that:

$$\frac{\partial W_1^P}{\partial C} < \frac{\partial W_1^R}{\partial C}$$

Implications:

- For sufficiently large s, we expect $\theta = P$ households to be more likely to adopt latrines than $\theta = R$ households
- For small s, $\theta = R$ households are more likely to adopt

In period 2, households that previously adopted latrines will continue using latrine if:

$$W_2^P - m + \frac{\partial W_2^P}{\partial C} > W_2^P$$

$$\underbrace{W_2^R - m + \frac{\partial W_2^R}{\partial C}}_{\text{Payoff of maintaining latrine}} > \underbrace{W_2^R}_{\text{Payoff of abandoning latrine}}$$

In period 2, households that previously adopted latrines will continue using latrine if:

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Reordering Terms:

$$\boxed{\begin{aligned} \frac{\partial W_2^P}{\partial C} - m > 0 \\ \frac{\partial W_2^R}{\partial C} - m > 0 \end{aligned}}$$

Theoretical Model of Sustained Sanitation Behavior: Period 2

In period 2, households that previously adopted latrines will continue using latrine if:

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$$W_2^R - m + \frac{\partial W_2^R}{\partial C} > W_2^R$$

Reordering Terms:

$$\boxed{\begin{aligned} \frac{\partial W_2^P}{\partial C} - m &> 0 \\ \frac{\partial W_2^R}{\partial C} - m &> 0 \end{aligned}}$$

Implications:

- $\theta = P$ households are more likely to abandon latrines than $\theta = R$ households

Outcomes of interest:

- Ever owning a latrine
- Abandoning a latrine
    - Filling latrine
    - Latrine destroyed
    - Stopped using latrine

Difference-in-Difference Specification

$$Y_{it} = \beta_0 + \beta_1 TREATMENT_i$$
$$+ \beta_2 POST2006_t$$
$$+ \beta_3 POST2010_t$$
$$+ \beta_4 POST2016_t$$
$$+ \beta_5 (TREATMENT_i \times POST2006_t)$$
$$+ \beta_6 (TREATMENT_i \times POST2010_t)$$
$$+ \beta_7 (TREATMENT_i \times POST2016_t) + \epsilon_{it} \qquad (1)$$

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+ \beta_6 \left(TREATMENT_i \times POST2010_t \right) \\
+ \beta_7 \left(TREATMENT_i \times POST2016_t \right) + \epsilon_{it}
\end{aligned} \tag{1}
$$

Triple Difference Specification

$$
\begin{aligned}
Y_{it} = {} & \beta_0 + \beta_1 TREATMENT_i + \beta_2 BPL_i + \beta_3 BPL_i \times Treatment_i \\
& + \beta_4 POST2006_t + \beta_5 POST2010_t + \beta_6 POST2016_t \\
& + \beta_7 BPL2006_{it} + \beta_8 BPL2010_{it} + \beta_9 BPL2016_{it} \\
& + \beta_{10} \left(TREATMENT_i \times POST2006_t \right) \\
& + \beta_{11} \left(TREATMENT_i \times POST2010_t \right) \\
& + \beta_{12} \left(TREATMENT_i \times POST2016_t \right) \\
& + \beta_{13} \left(TREATMENT_i \times POST2006_t \times BPL2006_{it} \right) \\
& + \beta_{14} \left(TREATMENT_i \times POST2010_t \times BPL2010_{it} \right) \\
& + \beta_{15} \left(TREATMENT_i \times POST2016_t \times BPL2016_{it} \right) + \epsilon_{it} \quad (2)
\end{aligned}
$$

Triple Difference Specification

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\begin{aligned}
Y_{it} = \beta_0 &+ \beta_1 TREATMENT_i + \beta_2 BPL_i + \beta_3 BPL_i \times Treatment_i \\
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&+ \beta_7 BPL2006_{it} + \beta_8 BPL2010_{it} + \beta_9 BPL2016_{it} \\
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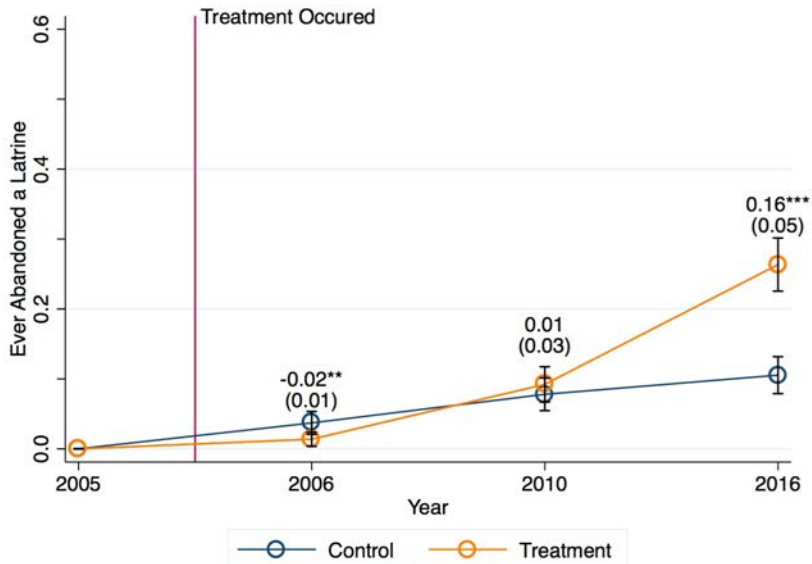&+ \beta_{15} \left(TREATMENT_i \times POST2016_t \times BPL2016_{it} \right) + \epsilon_{it} \quad (2)
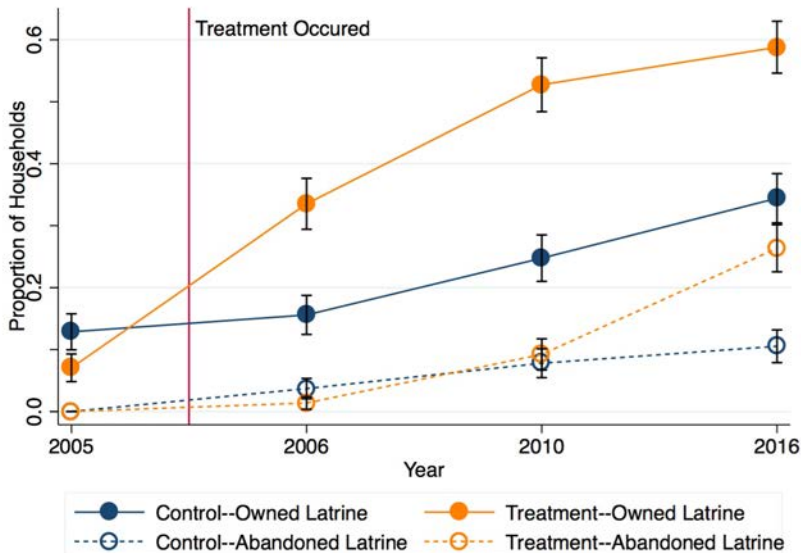\end{aligned}
$$

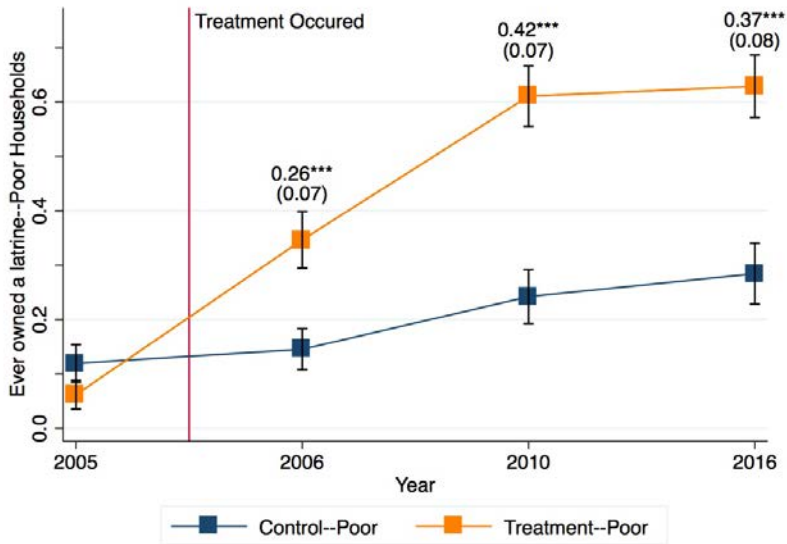# DID Results: Ever Owned A Latrine
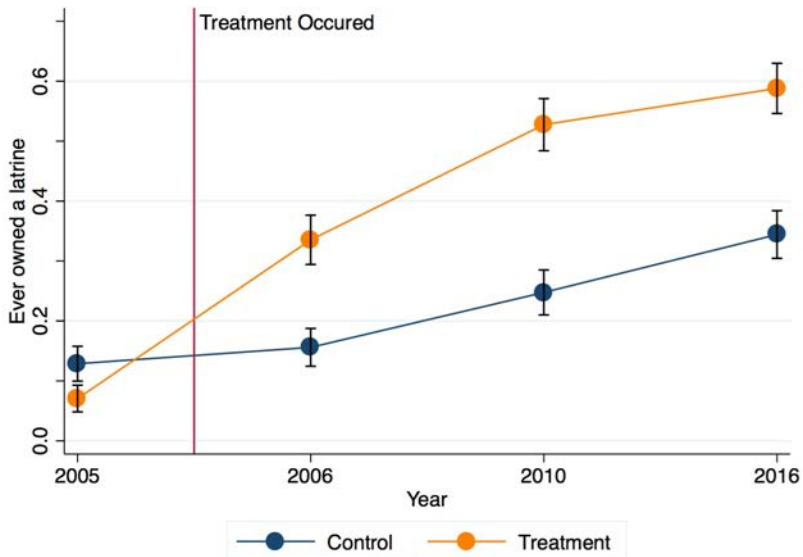
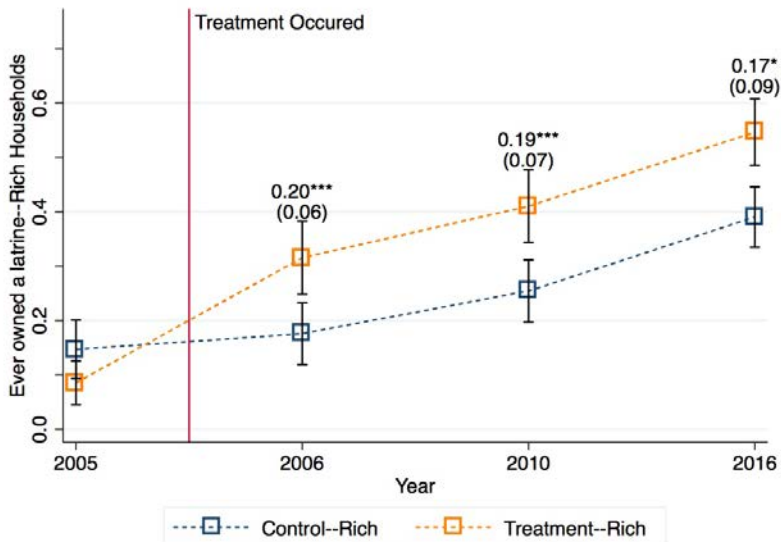## DID Results: Ever Owned A Latrine
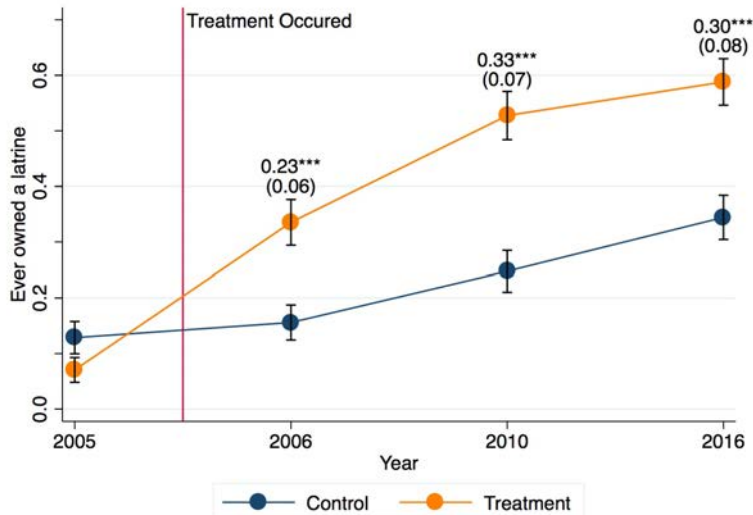
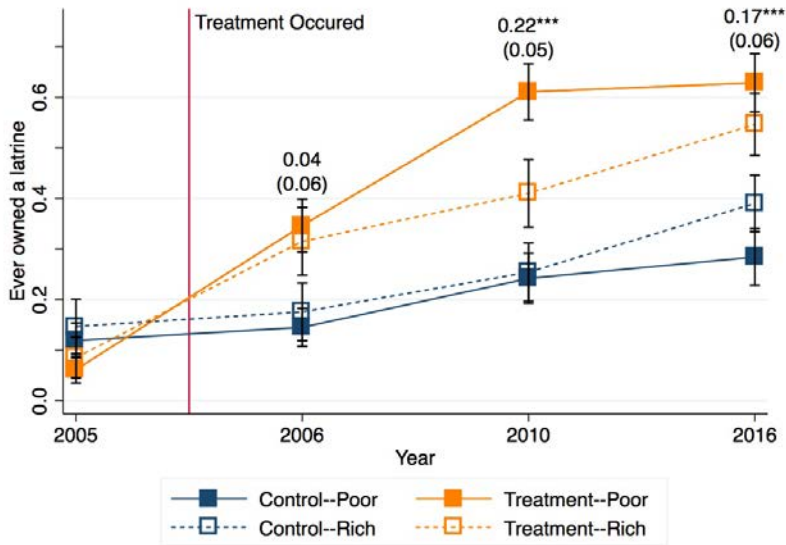## DID Results: Ownership/Abandonment of Latrines

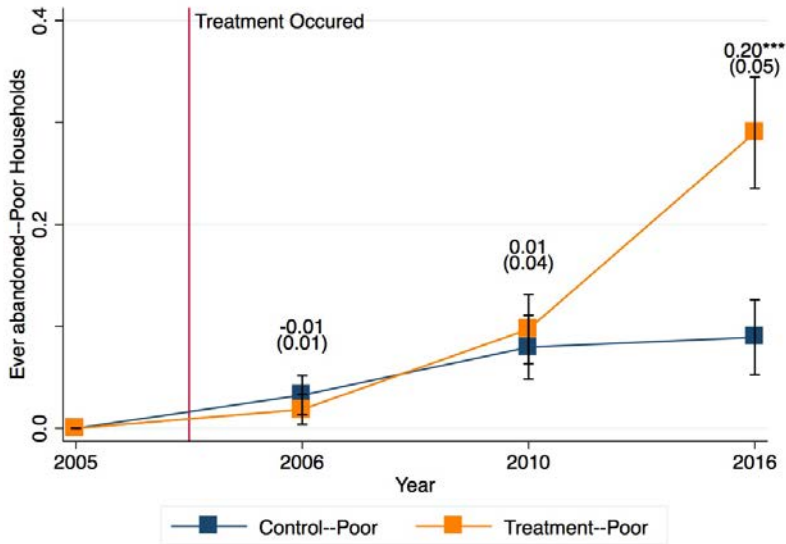## DID Results: Ever Owned a Latrine (Poor)

DID Results: Ever Owned a Latrine (Rich)

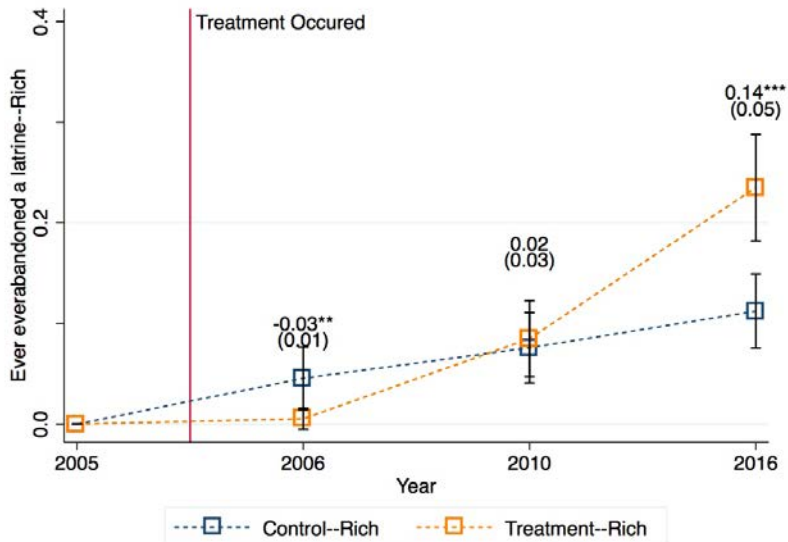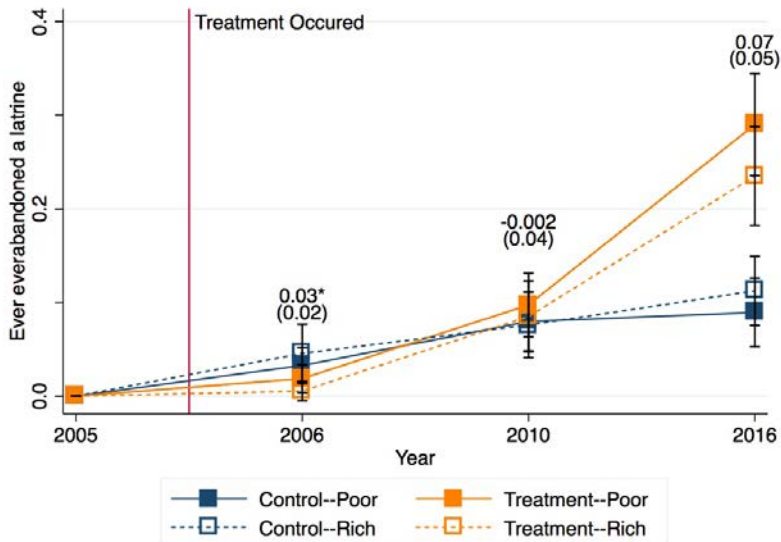## DDD Results: Ever Owned a Latrine (Poor/Rich)

DID Results: Abandoned a Latrine (Poor)

DID Results: Abandoned a Latrine (Rich)

The treatment effect persisted in latrine adoptions over time

- The initial adoption treatment effect was larger for poor households receiving subsides than rich households
- No significant difference in treatment effect between medium (5 years) and long-term (10 years)

Conclusions

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- The initial adoption treatment effect was larger for poor households receiving subsides than rich households
- No significant difference in treatment effect between medium (5 years) and long-term (10 years)

Treatment assignment positively predicted latrine abandonment in the 10 year follow-up, but not before

- This rate of abandonment was higher among poor households (not statistically significant)

Implications

Subsidies important to targeting low-income households to adopt improved sanitation technologies

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Subsidies important to targeting low-income households to adopt improved sanitation technologies

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To have enduring impacts, programs should:

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- Promote technologies on an ongoing basis

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Focus on sustaining behaviors is critical as Modi makes initial latrine adoption nationwide priority

Thank You!

Comments welcome at

jennifer.orgill@duke.edu

DID Results

	(1)	(2)
	Ever Owned a Latrine	Ever Abandoned a Latrine
Treatment*Post2006	0.24***	-0.02**
	(0.06)	(0.01)
Treatment*Post2010	0.34***	0.01
	(0.07)	(0.03)
Treatment*Post2016	0.30***	0.16***
	(0.08)	(0.05)
Observations	4,155	4,174
Number of households	1,086	1,086
Number of villages	40	40
R-squared	0.14	0.10

Robust clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Triple Difference Results

	(1) Ever Owned a Latrine	(2) Ever Abandoned a Latrine
Treatment*Post2006*BPL	0.04	0.03*
	(0.06)	(0.02)
Treatment*Post2010*BPL	0.22***	-0.00
	(0.05)	(0.04)
Treatment*Post2016*BPL	0.17***	0.07
	(0.06)	(0.05)
Observations	4,152	4,109
Number of households	1,085	1,042
Number of villages	40	40
R-squared	0.15	0.10

Robust clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1