

# Benefit-Cost Analysis of Community-Led Total Sanitation: Incorporating Results from Recent Evaluations

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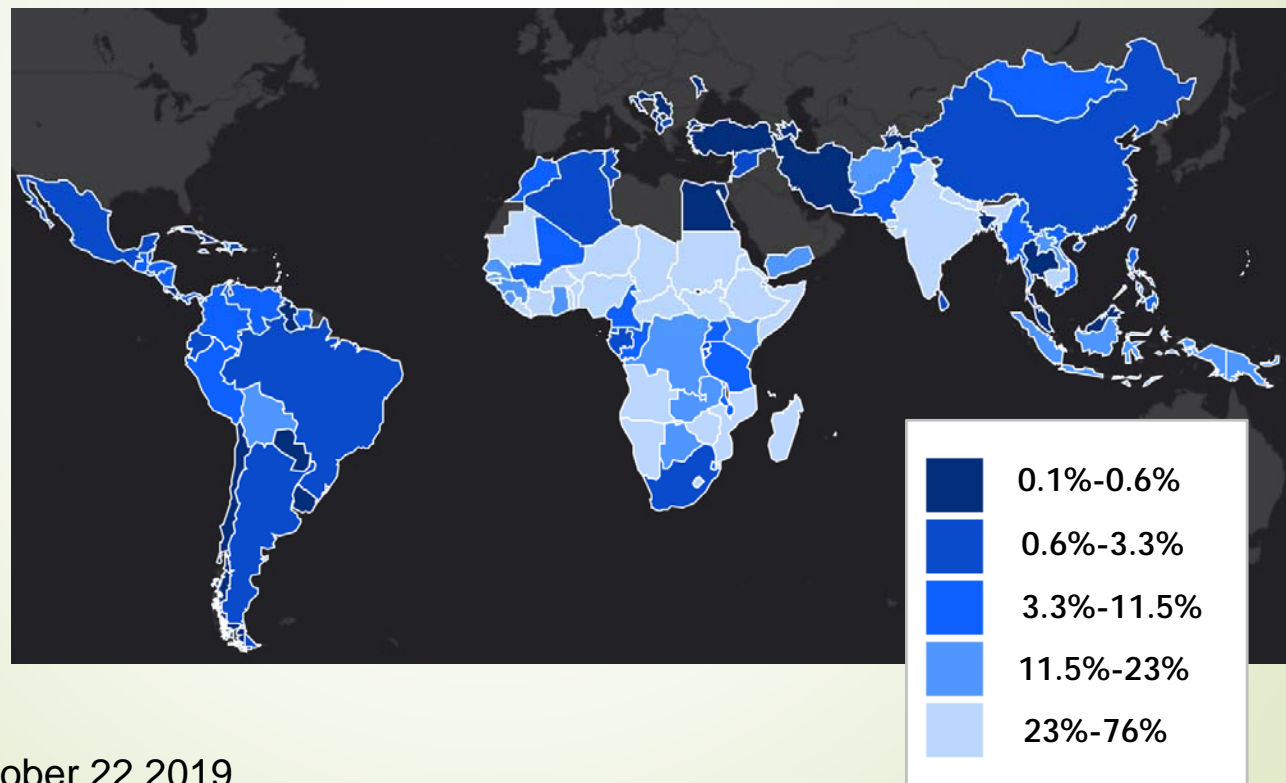
# Contribution

- ▶ Models the impact of sanitation externalities
- ▶ Parameter estimates based on recent sanitation evaluations
- ▶ Analysis at regional and village level
- ▶ Villages modeled with heterogenous responses

# Results

	<b>Without Externalities</b>	<b>With Externalities</b>
<b>Benefits</b>	<b>\$1,935,580</b>	<b>\$2,156,275</b>
<b>Costs</b>	<b>\$1,325,790</b>	<b>\$1,325,790</b>
<b>Benefits - Costs</b>	<b>\$609,790</b>	<b>\$830,485</b>
<b>B/C ratio</b>	<b>1.5</b>	<b>1.6</b>
<b>ERR</b>	<b>12%</b>	<b>16%</b>

## Rural Open Defecation (percent of population)





# Causal Chain: CLTS → Outcomes

Community-Led Total Sanitation (CLTS)

Household Latrine Construction

Latrine Use/Reduced Open Defecation

Community Social Norm

Diarrhea Outcomes

Other Health Outcomes

Non-Health Outcomes

**Documented Change:**

Briceño et al. (2017)  
Cameron et al. (2013)  
Clasen et al. (2014)  
Elbers et al. (2012)  
Gutieras et al. (2015)  
Hammer & Spears (2016)  
Pattanayak et al. (2009)  
Patil et al. (2014)  
Pickering et al. (2015)

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Patil et al. (2014)  
Pickering et al. (2015)

**Documented Change:**

Pickering et al. (2015)

**Documented Change:**

Cameron et al. (2013) (diarrhea)  
Hammer and Spears (2016) (diarrhea)

Cameron et al. (2013) (Mucus/blood in stool)  
Hammer and Spears (2016) (Height-for-age)  
Pattanayak et al. (2009)/Dickinson et al. (2015) (mid-arm circumference, height-for-age, weight-for-age)  
Patil et al. 2014 (acute lower respiratory illness, enteric parasite)  
Pickering et al. (2015) (height-for-age, blood in stool, diarrhea mortality)  
Pattanayak et al. (2009)/Dickinson et al. (2015) (time savings)  
Pickering et al. (2015) (women's privacy and safety at night when defecating)

# Assumptions

- ▶ 200 villages, 100 households, 5 people per households
- ▶ 1 child <5, 2 children 5-14, and 2 adults  $\geq 15$
- ▶ Low- and Medium-uptake 40% and High-uptake 20%
- ▶ Latrine uptake 5-35%
- ▶ Latrine usage 15-40%
- ▶ Diarrheal incidence 0.5-2.11 per year
- ▶ Mortality rate .02-.07%
- ▶ 10 year life span, declining use after 5 years

# Benefits and Costs

- Benefits
  - Health:
    - Diarrhea, stunting, malnutrition, schistosomiasis, soil-transmitted helminth infections and trachoma
  - Non-health
    - Time savings, privacy, dignity, aesthetics, safety, and convenience
- Costs
  - Participation costs
  - Programmatic costs
  - Latrine costs



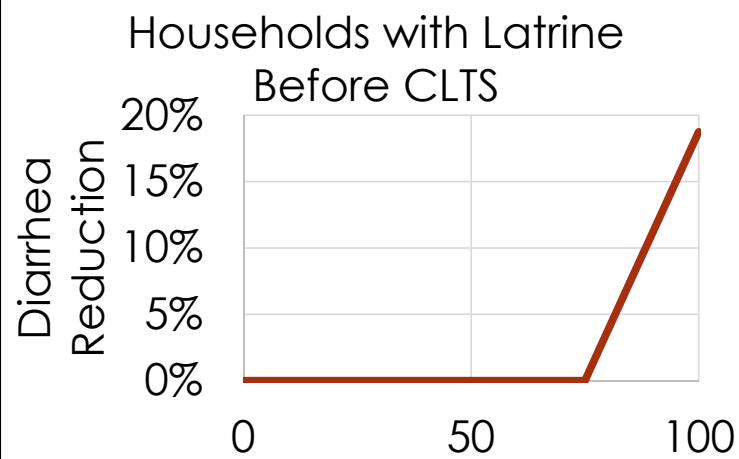
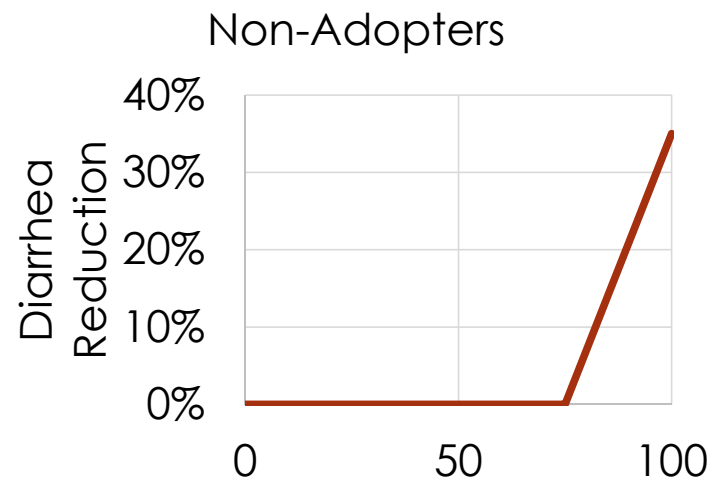
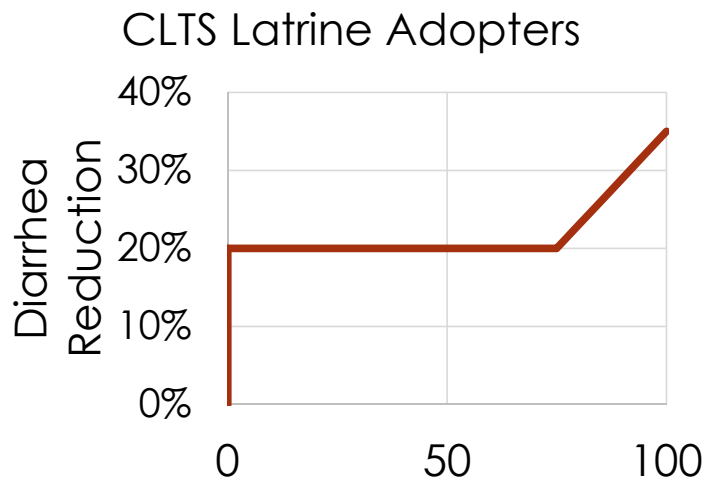
# Valuation Assumptions

## Benefits

- VSL: Int'l \$60,000
  - VSL target = VSL base \* (Income target/ Income base) elasticity
  - Income base of: Int'l \$2,000
- Cost of Illness: Int'l 2-300
  - Treatment of diarrhea in SSA:
    - Medical costs, staff costs, transport costs, health system costs
- Value of time:
  - ≥15 50% of the local unskilled wage
  - 5-14 25% of the local unskilled wage
  - 0% for <5

## Costs

- Management Int'l \$1,500
- Training Int'l \$2,500
- Local actor Int'l \$200
- Latrine construction Int'l \$50
- Operation and maintenance Int'l \$5



# Outcomes

11/18

	Low-Uptake Village	Medium-Uptake Village	High-Uptake Village	All Villages (n = 200)
<b>Without Externality</b>				
<b>Cases Avoided</b>	52	155	360	~28,600
<b>Premature Deaths Averted*</b>	.024	.07	.17	~15
<b>Hours Saved</b>	12,260	26,630	73,970	~6,000,000
<b>With Externality</b>				
<b>Cases Avoided</b>	52	155	480	~36,000
<b>Premature Deaths Averted*</b>	.024	.07	.23	~17
<b>Hours Saved</b>	12,260	26,630	73,970	6,000,000

BCA workshop October 22 2019

\*Refers to non-fatal diarrhea cases.

# Benefits

	Low-Uptake Village	Medium-Uptake Village	High-Uptake Village	All Villages (n = 200)
<b>No Externalities</b>				
<b>Benefits</b>	\$3,415	\$9,350	\$22,865	\$1,935,580
<b>Mortality Benefits</b>	\$1,430	\$4,290	\$10,015	\$858,185
<b>Morbidity Benefits</b>	\$900	\$2,695	\$6,290	\$539,080
<b>Time Savings</b>	\$1,085	\$2,365	\$6,560	\$538,315
<b>Externalities</b>				
<b>Benefits</b>	\$3,415	\$9,350	\$28,380	\$2,156,275
<b>Mortality Benefits</b>	\$1,430	\$4,290	\$13,335	\$991,090
<b>Morbidity Benefits</b>	\$900	\$2,695	\$8,485	\$626,870
<b>Time Savings</b>	\$1,085	\$2,365	\$6,560	\$538,315

# Costs

	Low-Uptake Village	Medium-Uptake Village	High-Uptake Village	All Villages (n = 200)
<b>Costs</b>	\$5,810	\$6,580	\$8,365	\$1,325,790
<b>Program Costs</b>	\$4,900	\$4,900	\$4,900	\$980,000
<b>Time Costs</b>	\$535	\$535	\$535	\$107,265
<b>Capital Costs</b>	\$270	\$805	\$1,880	\$161,175
<b>O&amp;M Costs</b>	\$100	\$340	\$1,050	\$77,350

# Net-Benefits

	Low-Uptake Village	Medium-Uptake Village	High-Uptake Village	All Villages (n = 200)
<b>No Externalities</b>				
<b>Net Benefits</b>	(\$2,395)	\$2,770	\$14,200	\$609,790
<b>BC ratio</b>	0.6	1.4	2.7	1.5
<b>ERR</b>	-7%	11%	35%	12%
<b>Externalities</b>				
<b>Net Benefits</b>	(\$2,395)	\$2,770	\$19,750	\$830,485
<b>BC ratio</b>	0.6	1.4	3.4	1.6
<b>ERR</b>	-7%	11%	49%	16%

# Addressing Uncertainty

- Guidelines
  - Qualitative: 3 types of villages
  - Numerical Sensitivity Analysis
  - Probabilistic Sensitivity Analysis

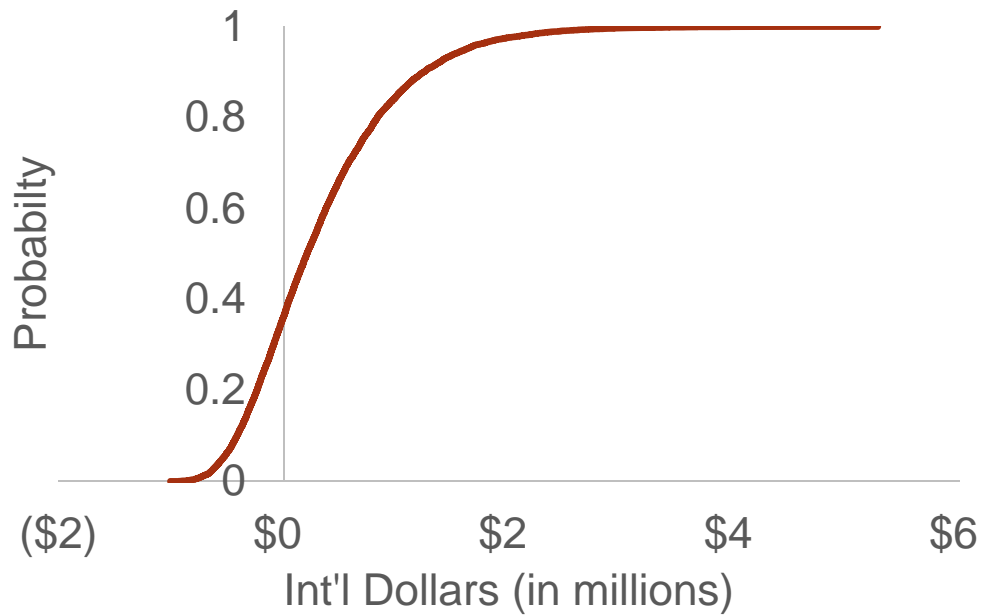
## Effectiveness Scenarios

	Base Case (200 villages)	Poor Effectiveness (200 villages)	Enhanced Effectiveness (200 villages)
<b>No Externalities</b>			
<b>Net Benefits</b>	\$609,790	\$168,865	\$989,520
<b>BC ratio</b>	1.5	1.1	1.7
<b>ERR</b>	12%	6%	17%
<b>Externalities</b>			
<b>Net Benefits</b>	\$830,485	\$279,205	\$1,385,530
<b>BC ratio</b>	1.6	1.2	2
<b>ERR</b>	16%	8%	23%

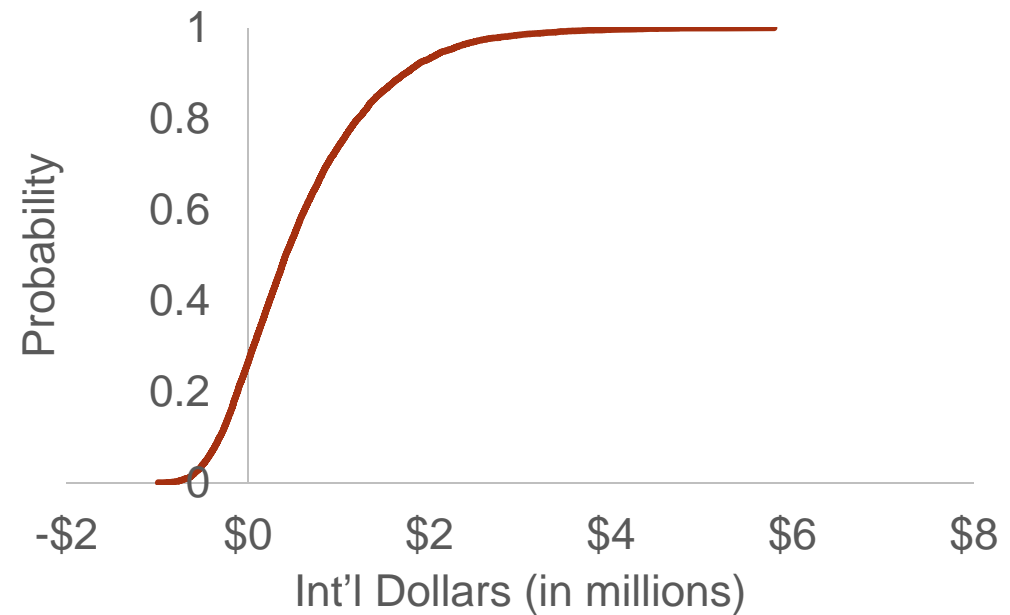


# Monte-Carlo Simulation

### Cumulative Distribution of NPV with no Externality



### Cumulative Distribution of NPV with Externality



# Conclusions

- Positive Net Benefits
- Sensitive to intervention quality
- Require more information on externalities
- Evidence base is not designed to inform economics analyses
- Numerous unquantified benefits