iDE

Sanitation Marketing Improving Health Outcomes

Evidence from a Research Study in Rural Cambodia

iDE has facilitated the sale of over 300,000 improved[1] pour-flush latrines in Cambodia through its sanitation marketing program, reaching over 1.5 million people. Improved latrine coverage in program areas has increased from 29% in 2012 to 67% in 2018, surpassing coverage rates in other parts of the country. However, to date, sector research on the link between latrine coverage and health outcomes has been inconclusive, and most analysis has focused on CLTS rather than market-based programs. A new study conducted by Georgetown University examined iDE's contribution to latrine coverage increases between 2010 and 2014 when it sold its first 140,000 latrines. The study found that iDE's first phase of its sanitation marketing program led to increases in latrine coverage by 19.9 percentage points as well as significant results that after iDE's intervention, rural diarrhea prevalence in intervention areas decreased by 6.5 percentage points.

Introduction

iDE has been implementing market-based WASH programming in Cambodia since a 2009 pilot project. The current program, known as Sanitation Marketing Scale Up, or SMSU, has facilitated the sale of over 300,000 improved latrines through iDE-connected enterprises, reaching over 1.5 million people. Through SMSU, iDE develops affordable, aspirational WASH products; trains local entrepreneurs to manufacture and install them; and recruits and trains independent sales agents to create consumer demand for improved WASH products and services.

A primary tenet of iDE's market-based programming is that households who invest in aspirational WASH products are more likely to use them, thus reaping the health benefits of improved WASH. However, little research has been conducted on how market-based approaches might increase latrine

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[1] While the JMP sanitation ladder has changed with the advent of the SDGs, in this report an improved latrine is defined as a facility that hygienically separates human waste from human contact.

uptake and lead to subsequent health benefits. A recent study from Georgetown University examined primary data iDE collected in annual latrine count surveys in conjunction with secondary data from the Cambodia Socio-Economic Survey (CSES) and the USAID-funded

Demographic Health Survey (DHS) in order to answer the following research questions about the first phase of iDE's sanitation marketing intervention:

1. Did iDE's intervention lead to increases in latrine coverage?
2. Did iDE's intervention lead to improvements in health?

In particular, this study estimated the causal attribution of iDE's intervention on these two outcomes of interest. While our internal data collections have tracked the change in coverage over time, this study provides an externally conducted evaluation of our causal impact.

Study Design

Data Sources

SMSU has three phases of program evolution. The first phase of SMSU ran from 2011 to 2014, the second through June 2018, and the third phase began in July 2018. Across each phase, SMSU has demonstrated its ability to deliver improved sanitation to rural Cambodians at scale. To date, the program has delivered over 300,000 improved latrines to rural households in seven Cambodian provinces. Phase one saw a change in improved latrine coverage rates from 29 percent to 45 percent, having sold 141,030 project-connected latrines. Phase two saw an increase in coverage to 67 percent with 147,000 project-connected latrine sales.

iDE employs extensive data collection methods to track and verify its sales, estimate latrine coverage rates, and follow up on customer use and satisfaction. Since 2012, iDE has conducted six latrine census data collections to estimate latrine coverage with over 200,000 household observations in each survey round. While these surveys are designed to precisely measure latrine coverage rates down to commune level, they are unable to measure the causal attribution of SMSU on coverage rates or health impacts. To better measure the attributable impacts sanitation marketing has had on both coverage and on health, this research study used secondary data sets, corroborated with iDE's primary data, to estimate latrine coverage rates and diarrhea prevalence for children under five during phase one of SMSU. Although sales and coverage have continued to increase since the end of phase one, at the time of research and publication, secondary data sets were only available through 2014.

The CSES by the Cambodian National Institute of Statistics and Data was obtained for 2004, 2009, and 2014. The CSES serves as a primary means for tracking changes in income, possessions, and employment over time, but does not prioritize information on health, and used inconsistent question types when measuring diarrhea prevalence in different years. However, the CSES data closely aligned with iDE's primary data on latrine coverage, and was selected to test against latrine coverage at the commune level. The DHS data provided detailed health data collected at the household level across numerous countries to track changing health profiles globally. In Cambodia, DHS data was obtained

from 2000, 2005, 2010, and 2014. This data provided a more consistent measure of diarrhea prevalence and was used to measure and test against diarrhea prevalence in this analysis at the district level.

Limitations

Studies to date on the relationship between improved sanitation and health outcomes have yielded mixed results. Epidemiological studies show some association between latrine coverage and decreased rates of diarrhea despite considerable heterogeneity and methodological shortcomings. However, recent rigorous studies using randomized control trials have found few to no causal linkages between latrine interventions and decreased diarrhea prevalence. Even less evidence is available around the effectiveness of sanitation marketing interventions in particular, as most studies have looked at CLTS programs.

This study only examines the effects of iDE's intervention during its first phase of sanitation marketing in Cambodia. The outcomes reported in terms of percentage point changes do not capture the full impact as iDE completed its second and has begun its third phase of sanitation marketing. iDE has sold an additional 160,000 latrines, and counting, since the period captured under this study. These results capture interim causal attribution of iDE's intervention, and we would expect to see greater magnitude of change with a full impact study upon program completion.

As shown in the diagram below, the installation of a latrine does not affect the water and hygiene barriers that prevent disease transmission, allowing infection to continue through contaminated water sources and dirty hands. As a result, the installation of an improved latrine may have a zero or highly variable health impact depending on the broader environment in which the child lives.
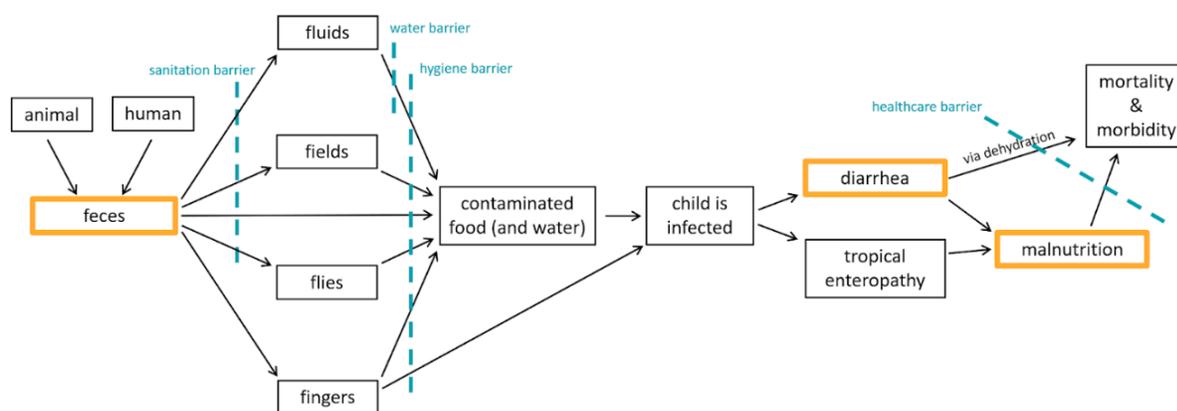
*Pathways are adapted from the standard F-diagram of disease transmission and additional literature.[2]

[2] Cheng et al. (2012). "An ecological quantification of the relationships between water, sanitation and infant, child, and maternal mortality." *Environmental Health.* 11:4. https://www.ehjournal.net/content/11/1/14.
Clasen et al. (2012). "The effect of improved rural sanitation on diarrhoea and helminth infection: design of a cluster-randomized trial in Orissa, India." *Emerging Themes in Epidemiology.* 9(7). https://doi.org/10.1186/1742-7622-9-7.
Humphrey. (2009). "Child undernutrition, tropical enteropathy, toilets, and handwashing." *Lancet.* 374(9694): 1032-35.

Moreover, there are several factors that affect an individual household's ability to purchase a latrine, such as household income, or that can mediate how effectively the sanitation barrier improves health outcomes, such as household hygiene practices and drinking water sources, the presence of livestock, the type of dwelling one lives in, community practices regarding shared latrines, and community-level latrine coverage. These factors were controlled for in the analysis as described in the subsequent section.

Analytical Approach

iDE implemented a market-based sanitation intervention in seven provinces. In the same time period, WaterSHED, another non-profit in Cambodia, began its own sanitation marketing intervention in eight other provinces. In total, eight provinces experienced neither intervention and serve as the "control area" in the analysis. A difference-in-difference model was used to estimate whether sanitation marketing leads to increases in latrine ownership and improvements in health outcomes. This approach compares the treatment group to the control group while simultaneously accounting for trends over time to ensure the estimated effect is due to the treatment only. The estimating equations are specified below:

$$(1) \qquad Y_{(c,p,t)} = \beta_0 + \beta_1 D_p + \beta_2 T_t + \beta_3 (D_p {}^\star T_t) + X_{(c,p,t)} + \epsilon_p$$

$$(2) \qquad Y_{(d,p,t)} = \beta_0 + \beta_1 D_p + \beta_2 T_t + \beta_3 (D_p {}^\star T_t) + X_{(d,p,t)} + \epsilon_p$$

In both equations, standard errors are clustered at the province level and communes are weighted by their population. Equation 1 is estimated using CSES data wherein $Y_{(c,p,t)}$ is the outcome for commune c in province p, D_p is an indicator for whether the province was exposed to iDE's sanitation marketing, T_t is an indicator variable for whether the observation is post-intervention, and $X_{(c,p,t)}$ is a vector of observable characteristics of commune c in province p at time t. For this estimation, pre-intervention data was collected in 2009 ($T_t=0$) and post-intervention data was collected in 2014 ($T_t=1$). The commune characteristics in $X_{(c,p,t)}$ include whether the commune was exposed to the WaterSHED intervention, average level of parental education, average consumption per capita per day, average number of livestock, and the fraction of households who use improved water sources, treat drinking water, have dirt floors, and share their latrine.

Equation 2 is estimated using DHS data and, as such, the outcomes and observable characteristics are at the district level. The outcome variables estimated here are latrine coverage; weight-for-age, weight-for-height, and weight-for-height standard deviations; as well as diarrhea, malnourishment, severe malnourishment, wasting, severe wasting, stunting, and severe stunting prevalence. For this estimation, pre- and post-intervention data were collected in 2010 ($T_t=0$) and in 2014 ($T_t=1$), respectively. In addition, the district characteristics in $X_{(d,p,t)}$ include average levels of parental education, average wealth index score, average number of livestock, and fraction of households who use improved water sources, treat drinking water, have handwashing facilities, have health insurance, have dirt floors, and share their latrine.

Results

Difference-in-Differences Analysis

The table below presents the results from the difference-in-differences analysis with the key results outlined in red. For each outcome of interest, latrine coverage and diarrhea prevalence, we run a model specification without controlling for covariates and one with controls. Latrine coverage results are estimated using CSES data at the commune level while diarrhea prevalence results are estimated using DHS data at the district level.

In Column (2), we find that sanitation marketing increased the latrine coverage rate by 19.9 percentage points, a 105% increase, in iDE's intervention area as compared to the control area, after controlling for commune characteristics. In Column (4) we find that sanitation marketing led to decreases in diarrhea prevalence by 6.53 percentage points, a 61% decrease, in the intervention area compared to the control area, after controlling for district characteristics.

Difference-in-Differences Results				
Outcomes: Latrine coverage rates and diarrhea prevalence				
	Latrine coverage		Diarrhea prevalence	
	(1)	(2)	(3)	(4)
iDE intervention area	0.0338	-0.0410	0.0339	0.0266
	(0.074)	(0.055)	(0.023)	(0.018)
After 2012	0.119***	-0.00848	-0.0139	-0.0103
	(0.029)	(0.032)	(0.037)	(0.031)
iDE intervention area X after 2012	0.140**	0.199***	-0.0735*	-0.0653*
	(0.051)	(0.042)	(0.043)	(0.035)
Data source	CSES	CSES	DHS	DHS
Covariates included[a]	No	Yes	No	Yes
Control mean[c]	0.189	0.189	0.169	0.169
Observations	1120	1100	335	321

* $p<0.10$, ** $p<0.05$, *** $p<0.01$
[a] Covariates include commune averages for father's and mother's years of schooling, consumption per capita per day, whether water is collected from a clean source, whether drinking water is treated, number of livestock, whether the household flooring is dirt, and whether the latrine is shared.
[c] The reported mean is of the control area prior to the intervention.

The full analysis ran several additional model specifications for robustness checks, as well as extensive parallel trends testing to test for balance between our control and treatment groups at baseline. From these results, it is clear that sanitation marketing is a promising intervention that can help achieve greater latrine coverage and decrease childhood diarrhea rates as well within the rural Cambodian context. These findings hold even after controlling for a number of other socioeconomic and sanitation variables that may also contribute to health improvements, such as access to clean drinking water, ownership of livestock, and household construction.

Implications for policy and implementation

This study provides evidence that sanitation marketing can be an effective way to increase improved latrine coverage and that iDE's program contributed to a decrease in diarrhea prevalence in program areas. Drawing on this study, there are several policy and programming implications for donors and implementers.

- **Market-based WASH programs that drive behavior change toward consistent latrine use can positively impact diarrhea prevalence.** Although the ultimate desired outcome is improvements in health, iDE believes that health messaging is not necessarily the most effective delivery approach. Rather, the success of iDE's market-based approach in driving behavior change rests on deep user understanding gathered through the human-centered design (HCD) process. From the HCD research, iDE identifies key drivers of behavior change that often do not include health, such as aspiration, convenience, and cost-effectiveness. While the study focused on diarrhea prevalence, given the short time frame of the data examined in the study, it was not possible to establish links to additional health outcomes, such as stunting and wasting.
- **Additional health benefits may accrue from addressing the water and hygiene barriers to disease transmission.** As the F-diagram illustrates, improved sanitation is only one way to prevent disease transmission. iDE's WASH work in Cambodia also promotes hand hygiene and sells household ceramic water filters through our social enterprise, Hydrologic, however, these transmission barriers were not examined in the current study. Additional research is needed to understand how other transmission barriers may impact health.
- **Significant reduction of diarrhea prevalence can be achieved at lower coverage thresholds.** As sector research points to the non-linear relationship between health impacts and coverage rates it is notable that reductions in diarrhea prevalence were found during iDE's early work in Cambodia when coverage rates were still below a 50% threshold. This suggests that programs can not only achieve impact early in scale-up but also that gains are likely to be even greater as "herd immunity" is reached. More research on threshold effects — and potential impacts from shared or public latrines as a way to meet coverage thresholds — will help the sector better understand the links between latrine coverage and health.

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