

NICOLETTI et al.

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**40<sup>th</sup> WEDC International Conference, Loughborough, UK, 2017**LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND  
SUSTAIN WATER, SANITATION AND HYGIENE SERVICES**A less expensive toilet: the impact of targeted subsidies on  
latrine purchases in Cambodia***C. Nicoletti, R. Macaranas, G. Lestikow & D. Hudner (USA)*

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*iDE's sanitation marketing efforts in Cambodia have resulted in over 250,000 sales of improved pour-flush latrines. Despite the overall efficacy of this approach, iDE recognizes that market actors are not necessarily incentivized to reach the poorest segments of the market. iDE and Causal Design utilized a randomized controlled trial, in which poor households in treatment villages were offered partial subsidies, financing and cash-only options, while control-village households were offered only financing or cash-only purchase options, to test which financing mechanism leads to the greatest coverage change among poor households, while having the least distortionary effect on the market. The study finds uptake rates among poor households increased by 14-16 percent compared to the control group, while there was no significant effect on non-poor households. This study provides compelling evidence for the impact, as well as increased cost-effectiveness, of well-targeted subsidies on latrine uptake among lower-income households in a market-based approach.*

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**Introduction**

Since late 2011, iDE's sanitation marketing efforts in Cambodia have resulted in over 250,000 sales of improved pour-flush latrines across seven provinces. iDE facilitates these latrine sales through a network of Latrine Business Owners (LBOs) and sales agents, called "Sanitation Teachers. Since program inception, iDE has seen improved latrine coverage across those seven provinces nearly double, from 29 percent to 56 percent. During this time, iDE has expanded its sanitation marketing programs to six other countries, including Bangladesh, Nepal, Vietnam, Ghana, Burkina Faso and Ethiopia – with over 500,000 total latrine sales taking place as a result.

iDE's unique approach to sanitation marketing builds both demand and supply capacity in order to drive rapid increases in coverage rates. In Cambodia, this includes training LBOs to produce quality, hygienic latrines, while also equipping a cadre of Sanitation Teachers to sell the latrines at a market rate that allows sufficient margins for LBOs to profit and for Sanitation Teachers to be paid a commission. Despite the overall efficacy of this approach, iDE recognizes that market actors are not necessarily incentivized to reach the poorest, who are often unable or unwilling to pay full market price for a high-quality latrine.

To address this problem, iDE has explored two mechanisms for cutting down barriers to latrine purchases by poor households: targeted subsidies and sanitation financing. To determine the impact of these two mechanisms on latrine uptake among both poor and Non-Poor households, iDE and research partner, Causal Design, designed and implemented a pilot study utilizing a randomized controlled trial (RCT) evaluation design in which poor households in treatment villages were offered partial subsidies, financing and cash-only options, while control-village households were offered only financing or cash-only purchase options. This paper lays out the study's primary findings and, in doing so, answers the following questions:

1. Do targeted, partial latrine subsidies increase latrine sales to poor households?
2. Do targeted, partial latrine subsidies affect latrine sales to non-poor households?
3. Are targeted subsidies or sanitation financing options—or a combination of the two—the most cost-effective means of increasing latrine sales to poor households?

We begin this paper by laying out the RCT design, and follow with an overview of the study's main findings as they relate to the three questions above. We end by detailing some of the challenges faced during the pilot and suggesting areas for future research.

## **Pilot and study design**

### **Designing the RCT**

The objective of this study was to test the potential for sanitation financing and targeted subsidies to increase latrine purchases among the lowest income households in Cambodia. To accomplish this, the study built on iDE's existing sanitation marketing program, which has already established a supply and sales chain in and around the pilot area villages. The pilot took place in 166 villages across three districts of Kandal Province in Cambodia, and ran from November 2015 until August 2016.

The study utilized the Cambodian government's national system for identifying low-income households in order to determine eligibility for targeted subsidy. This program, known as ID Poor, assesses households' wealth and places them in one of three categories: ID poor 1 (IDP 1), ID poor 2 (IDP 2) and Non-Poor, with IDP 1 being the poorest. Using this system, the Sanitation Teacher offered vouchers to IDP 1 households to purchase a latrine at a \$25 USD discount (on a \$56 USD market price), while offering IDP 2 households the opportunity to purchase a latrine with a \$12.50 USD discount. Non-poor households could purchase latrines at the market price of \$56 USD. The study uses stratified random assignment of 166 villages (15,721 households) into two treatment classifications across three districts of Kandal Province. Subsidies offered to each of the IDP categories were only offered in the treated villages, while financing and cash-only purchasing options were available to both treatment arms.

### **The mechanics of subsidies and financing**

iDE-trained Sanitation Teachers sold latrines in either group or door-to-door sales presentations. In both treatment and control villages, households were given the opportunity to purchase a latrine by either paying cash or by applying for a 12-month loan from a local Microfinance (MFI) partner. If the purchaser chose to pay cash, the household paid a \$5 USD deposit and was instructed to pay the latrine business the balance due in cash at the time of installation. In the case of a credit purchase, the household paid the deposit at the time of sale and began payments to the MFI in the month following installation. Loan requests were submitted by Sanitation Teacher to the MFI branches, where a credit officer (CO) assessed the credit-worthiness of the household. If the MFI declined a household's request for a loan, the household was given the opportunity to purchase the latrine with cash.

In treatment villages, IDP households who wished to receive a subsidy were required to show a copy of their official IDP card, which was then photographed and verified using the national IDP database. Upon confirmation of the household's IDP status, the sales agent provided the purchaser with a discount voucher and instructed the buyer to retain the voucher until the latrine was delivered and properly installed. Once installation was complete, they were told to pay the difference between the market price of the latrine and the value of the subsidy and give the voucher to the latrine business or to the MFI if the latrine was purchased on credit. The business owner or the MFI then submitted the voucher to iDE as proof of installation. Upon receipt, iDE paid the value of the voucher to the respective LBO to complete the market price transaction.

### **Data sources**

#### ***Pre-Pilot Latrine Count (Baseline)***

Before the pilot, the field team conducted a count of households without latrines within the three districts of Kandal Province: Khsach Kandal, Lvea Aem, and Mukh Kampul. iDE-trained research assistants carried out a census of all pilot area households and gathered information on the household's IDP status, access to and ownership of latrines, type of latrine, self-reported diarrheal incidence and reason for not owning a latrine. We also used the latrine count as an opportunity to capture information on the villages. Research assistants met with local officials to record the total village population and the number of IDP 1 and IDP 2 households. They also spoke with the officials regarding sanitation programming conducted in the village over the previous two years. The research assistants recorded instances of free or subsidized latrine offerings or any negative experiences with latrine sales, including latrine orders which were never delivered or deposits

which were not returned. This data collection occurred between September 15 and October 1, 2015 and was overseen by 15 research assistants affiliated with iDE.

**Latrine order records**

iDE’s STs submit latrine orders directly from the field for every latrine being ordered by households using a front-end mobile application called TaroWorks. The order records are synced to iDE Cambodia’s management information system (MIS) built on Salesforce, where the order is then dynamically assigned to a latrine producer for order fulfillment. The order record includes the customer’s IDP status, the price and subsidy status of the latrine, whether payment was made through cash or financing, and if an order was ultimately cancelled. The order record also includes the date, location, individual ST associated with each sale and the latrine producer assigned to fill it. For customers using financing, the order record also includes whether loan applications were successful. The MIS is being used by sales- and supply-side field teams for managing sales, monitoring progress towards targets, and ensuring deliveries are occurring within a reasonable amount of time after the order is placed. Latrine orders are then verified using a quality lot control sampling procedure to ensure accuracy in reporting total scale and to prevent fraud among STs and latrine producers. Order records were analyzed over the course of the pilot using dynamic Salesforce reports and dashboards. For the final regression analysis, however, order records were exported from the MIS and analyzed in Stata. The data covers ten months from November 2015 to August 2016. During this period, a total of 1,778 latrine sales order records were made through the pilot.

**Contextual data**

In addition to the order records used in the analysis, the analysis drew on two other data sources to better understand the context of the sales. First, we conducted qualitative debriefs during and after the program with iDE staff and Sanitation Teachers to best understand their experience while selling. Second, we conducted a household survey at the end of the pilot to gather information on demographics, knowledge of latrine pricing and offerings, experience of latrine sales, perceptions of financing, perceptions and attitudes towards subsidy, and general market knowledge. This survey specifically targeted “potential” customers from the baseline, whose experience would be most relevant to the pilot program. The survey was conducted in September and October 2016, and included 300 households in 60 villages (30 treatment and 30 control). Respondents were selected randomly from all households captured in the baseline latrine count.

**Results**

**Smart subsidies’ impact on poor and non-poor latrine purchases**

The principal aim of this study was to determine how targeted subsidies impact latrine uptake among poor households. iDE was also interested in capturing any market-distortion effects that affect the propensity of non-poor households to purchase latrines. This section presents data and analysis suggesting that well-targeted subsidies do significantly increase poor households’ latrine purchases with minimal impact on non-poor household decision making.

In terms of the absolute number of latrines, sales to IDP households were more than five times greater in treatment villages than in control villages (399 sales vs 77 sales). When stratified by IDP designation, IDP 1 sales in treatment villages were 6.5 times those in control (196 vs. 30) and IDP 2 sales in treatment villages were 4.3 times of those in control (203 vs. 47).

<b>Table 1. Comparison of completed toilet sales, by payment type and experimental group</b>										
<b>Payment type</b>	<b>Full Price Cash</b>		<b>Full Price Credit</b>		<b>Subsidy + Cash</b>		<b>Credit</b>		<b>Total</b>	
	<b>T</b>	<b>C</b>	<b>T</b>	<b>C</b>	<b>T</b>	<b>C</b>	<b>T</b>	<b>C</b>	<b>T</b>	<b>C</b>
IDP 1	1	12	-	16	183	2	12	N/A	196	30
IDP 2	1	27	2	20	173	N/A	27	N/A	203	47
Non-Poor	255	223	101	121	N/A	N/A	N/A	N/A	356	344
Total	257	262	103	157	356	2	39	-	755	421

While the descriptive statistics above show a large difference in uptake of latrines between the treatment and control groups, the study ultimately relies on rigorous quantitative methods to better estimate the impact of subsidies. The evaluation uses a single difference (treatment effect) model at the village level that accounts for a number of potentially confounding factors to estimate the difference in uptake between treatment and control. Additionally, the randomization of treatment assignment across villages also substantially increases the confidence that the estimations are an accurate representation of the true effect of the subsidy. Truncated results from the total toilet sales treatment effects model are presented below.

<b>Table 2. Treatment effects model results: toilet sales</b>				
	<b>Non-poor</b>	<b>IDP 1</b>	<b>IDP 2</b>	<b>All HHs</b>
Treatment	0.116 (0.857)	2.094*** (0.423)	1.989*** (0.391)	4.199*** (1.275)
Constant	-3.375 (2.148)	-4.331*** (1.441)	-3.479*** (1.042)	-11.18*** (3.515)
Observations	150	150	150	150
R-squared	0.509	0.359	0.434	0.510
Robust standard errors in parentheses. [ *** p<0.01, ** p<0.05, * p<0.1 ]				

The finding of the regression analysis shows that there were statistically significant differences in the number of latrines ordered and sold. On average, the targeted subsidy was found to increase total latrine orders across all households in the treatment arm by approximately 4.2 latrine sales per village compared to control villages. Given that during the pilot the average number of sales orders per village in the control group was approximately 8.3 latrines, this suggests that the treatment would effectively increase the number of latrine orders by 66 percent. Disaggregating the data, however, shows that this effect is primarily driven by increased sales among both IDP 1 and IDP 2 households. There appears to be no statistically significant difference between rates of sales orders between non-poor households in the treatment and control. Therefore, the Smart Subsidy program, on average, increases the number of actual sales to IDP households compared to the treatment group but does not have any measureable impact on the number of actual sales to non-poor households.

In addition to looking at absolute number of latrines sold, we carried out a similar set of analyses to estimate the effect of targeted subsidy on latrine coverage among the population and among sub-populations (IDP 1, IDP 2 and Non-Poor). Statistically significant estimates were observed for IDP households specifically and villages as a whole, while Non-Poor households in the treatment did not show statistically measurable changes compared to the control group. This is unsurprising given the results observed in unit sales in the previous analysis above. Treatment group villages saw, on average, an increase in uptake among IDP 1 households of 16.9 percent. Similarly, uptake rates among IDP 2 households increased by 14.7 percent compared to the control group. Among all valid customers, the research found an increase in uptake rates of 14.3 percent per village. No significant change was observed in non-poor households.

These quantitative findings, combined with qualitative results, from the household survey, showing very few households were aware of the targeted subsidy (14 percent) and household’s high trust and support for the IDP program more generally, suggest that well-targeted subsidies do have the potential to drastically increase sanitation uptake among poor households while maintaining the integrity of the sanitation market for households that are not eligible for discounts. As with any such intervention, though, subsidies come with a price tag. The next section explores whether the additional sales made and lower cancellation rates as a result of these subsidies are enough to offset the additional costs incurred by the project.

**The cost-effectiveness of smart subsidies**

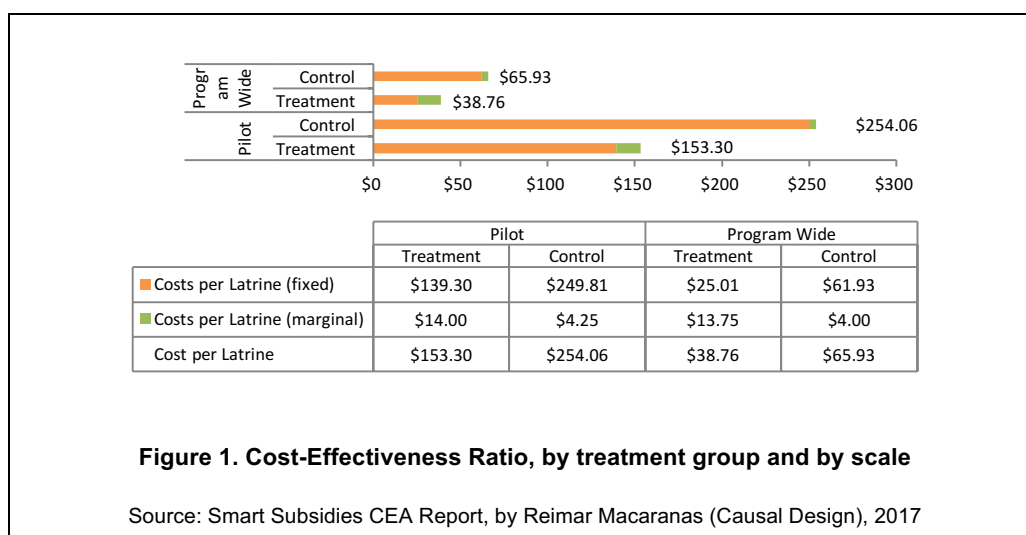
iDE and its research partners also carried out a separate cost-effectiveness analysis in order to understand the relative costs and outputs when comparing the treatment and control arms of the pilot. The analysis

generally looks at the cost-effectiveness ratio (CER)—calculated per latrine sold—for each arm of the pilot as well as for scaled-up, program-wide versions of the treatment and control arms. The CER only reflects iDE costs and does not consider the total economic value of the latrines. The ratio takes the form below and is calculated separately for each of the arms.

$$CER = [Total\ Fixed\ Costs + (Marginal\ Costs * Number\ of\ Latrines\ Sold)] / Number\ of\ Latrines\ Sold$$

When applying the CER to the pilot, the number of latrines sold comes from Salesforce data collected throughout the program. The results for treatment and control villages are calculated separately: Treatment represents the CER for the latrine pilot arm that offered subsidies; Control represents the group that did not receive subsidies; and Full Pilot represents the combined cost-effectiveness of both arms.

Costs are divided into two primary categories, fixed and marginal. Fixed costs represent the operational, administrative, and staff costs required to implement the program over ten months. Given that the two arms were implemented concurrently, the analysis is unable to directly attribute exact fixed costs to one arm or the other. Instead, it makes the assumption that effort from fixed costs were distributed equally between the treatment and control groups. Marginal costs are comprised of the added cost of selling a single latrine. For the treatment group, the marginal cost includes commission paid to the Sanitation Teacher, the average subsidy value paid out, and the average cost to process a loan across the pilot. Marginal costs for the control group consist solely of Sanitation Teacher commissions and average loan-processing costs. Figure 1 shows the CER analysis for the pilot program and for the program-wide versions of both treatment and control programs.



Using this methodology, the CER is calculated across the two groups. As shown in Figure 1, despite having a marginal cost of almost \$10 USD more than the control group, the substantial difference in final sales of latrines in treatment villages results in a lower fixed cost per latrine, and thus to a lower CER for the treatment group. In terms of absolute numbers, sanitation teachers in the treatment group effectively sold 755 latrines at an average cost of \$153.30 USD per latrine compared to the control group, in which sanitation teachers sold 421 latrines at an average cost of \$254.06 USD per latrine. For the program-wide estimates, the smart subsidy program runs about \$39 per latrine compared to the control group which is about \$66 per latrine – the lower per unit costs are attributable to economies of scale.

This analysis, combined with the RCT, shows that in a direct comparison of sanitation coverage outcomes, the latrine subsidy pilot is able to increase sanitation coverage more efficiently than unsubsidized efforts and is able to do so without adversely affecting sales to non-poor customers.

### Operational insights

In addition to the findings related to the main hypotheses of the study, iDE gleaned a number of operational insights while implementing this RCT, some of which are common to rigorous evaluations more generally, and some of which were unique to the specific pilot program:

- **Previous experience with sanitation subsidies in target areas.** Kandal province has seen several previous latrine programs, including approaches that incorporated poorly targeted subsidies. These prior

experiences may have impacted households' perception of subsidies, although qualitative data suggests that most households did understand that the targeted subsidies in this study would not be extended to non-poor households at a later time.

- **Sales agent motivation.** Sales agents may have put more effort into sales in treatment villages, since they knew they could use subsidies as a sales tool. This means that to a certain degree the research is not testing just the difference between pricing in treatment and control, but sales agents' ability to sell in treatment and control settings.
- **Increasing indebtedness of rural Cambodians:** There is increasing evidence of over-indebtedness of the Cambodian population. The program conducted a quick household survey with 73 participants in the pilot area and found that 66 percent of respondents already have at least one MFI loan and 38 percent of loan respondents owed multiple lenders. Additionally, Sanitation Teachers provided feedback throughout the pilot about the increasingly negative perception of MFIs in the villages.
- **Slow loan processing resulted in preference for cash sales.** The loan approval and processing time was much slower than anticipated. The contract with the pilot's MFI partner estimated loans would be processed within 7 days. However, loan processing took 19 days on average. This led to increased loan order cancellations by the household. Generally, the longer households wait for their latrine, the more likely they are to cancel.
- **Looking forward: effectively targeting subsidies.** The IDP system in Cambodia represents an almost ideal system for targeting subsidies. For the most part, system records were up to date, and iDE staff and Sanitation Teachers were able to quickly confirm household eligibility. Such systems are not common in the developing world, so others attempting to imitate this approach will need to proceed cautiously when designing their subsidy verification and study protocols. Poorly targeted subsidies have the potential to both undermine markets and pollute the literature that attempts to gauge their impact.

## Conclusions and opportunities for future research

The targeted subsidies pilot and the associated RCT provide compelling evidence for the impact of well-targeted subsidies on latrine uptake among lower-income households in a market-based approach. Low-income households that find it difficult to purchase a latrine at full market price showed much more willingness to buy when sales agents offered them partial subsidies. In order to build on these conclusions, and to inform more impactful sanitation work moving forward, future research could seek to answer the following questions:

- What is the subsidy level that optimizes the use of scarce resources (funding and manpower) for increasing sanitation coverage at scale among poor households?
- How can implementers achieve the same results—increasing poor household purchases while minimizing market distortions—in environments where clear and verifiable distinctions between poor and non-poor do not exist?

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