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Research Paper

Climbing the sanitation ladder: latrine promotion and household decision-making in Viet Nam

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ABSTRACT

We examine the relationship between promotion activities and sanitation decisions in the context of a program in the Mekong Delta that encouraged households to switch from fishpond latrines to septic tanks. Before and after the campaign, we surveyed households and promoters. Economic variables were important determinants of septic tank adoption, but whether the decision was woman-led and familiarity with the promoter were strongly predictive as well. Controlling for the pre-existing household decision-making structure, women were more likely to lead the sanitation decision if a promoter spoke to them rather than to a male householder. These household-based findings on the importance of promoters were supported by a supplementary analysis of sales. We found that promoters who were older, trained, and educated were more successful in selling septic tanks. Taken together, these findings highlight the importance of gender equity and trust in the promoter for encouraging last-mile households to invest in new health technologies.

Key words: gender, marketing, rural development, sanitation, septic tanks, social influences

HIGHLIGHTS

- Data from a sanitation promotion campaign that focused on rural women are analyzed to identify predictors of women's participation in sanitation decisions, households' septic tank purchase, and promoters' septic tank sales.
- Adjusting for households' pre-campaign decision-making structures, women were 33% more likely to take the lead in deciding whether to purchase a septic tank if they interacted with a promoter from the campaign.
- Controlling for socioeconomic variables, septic tank purchase was 24% more likely in households with woman-led decision-making on sanitation.
- Promoters sold more tanks if they were older, educated, and acquainted with households, highlighting the role of trust in introducing new health technologies.

GRAPHICAL ABSTRACT

Fishpond Latrine | Septic Tank Latrine

INTRODUCTION

Inadequate sanitation has a devastating impact on health and economic development (Prüss-Ustün *et al.* 2019; Cameron *et al.* 2021). While much of the developing world is making slow progress in reducing open defecation (OD), United Nations Children's Fund and the World Health Organization (UNICEF & WHO 2020) report that Viet Nam has virtually eliminated this practice. OD remains common only among some ethnic minorities living in mountainous areas. Thus, in most rural areas, the government's policy aims to stop the use of unimproved latrines and encourage installation of more hygienic latrines – to 'climb the sanitation ladder'.

This study is set in the Mekong Delta, where there is a long tradition of using 'hanging latrines' built over rivers and fishponds. Although marginally more hygienic than OD in forests or fields, fishpond latrines pose a serious environmental hazard. Most of the study area is subject to frequent flooding, which makes dry pit latrines unsuitable. Septic tank latrines are the most hygienic type of latrine for the local environment. However, they are expensive (USD 400–500 with superstructure) and their advantages are not fully understood. In this setting, how can households be encouraged to invest in a new and costly sanitation technology?

In a comprehensive review of water, sanitation, and hygiene (WASH) models, Dreibelbis *et al.* (2013) found that: 'Most existing models concentrated almost exclusively on individual-level factors that influence behavioural outcomes rather than utilized a broader ecological model approach that positions individual behaviours within a multi-level causal framework'. In response, they developed an 'Integrated Behavioural Model for Water, Sanitation, and Hygiene' (IBM-WASH) that classifies the factors that influence WASH-related behavior over three dimensions (contextual, psychosocial, and technology) and five levels (structural/societal, community, household, individual, and habitual).

As reflected in Sustainable Development Goals (SDG) Target 6.2 (United Nations 2018), inadequate sanitation facilities disproportionately affect women and girls, who face threats related to sexual harassment and violence. The IBM-WASH explicitly takes gender norms, roles, and responsibilities into account but is quiet on the nature of the linkages. The literature reflects the multifaceted relationship between WASH and gender and has evolved over time (Fisher *et al.* 2017; MacArthur *et al.* 2020). It falls into four categories: (1) studies of how WASH programs differentially benefit women (e.g., Hirve *et al.* 2015); (2) implementation of programs that take a gendered approach to improve WASH outcomes (e.g., Ivens 2008); (3) assessments of how WASH programs empowers women; and (4) studies examining how women influence latrine decisions. Our study contributes to the third and fourth categories.

The third category of literature demonstrates the role of WASH programs in women's empowerment. Few studies of this type have been undertaken (Dery *et al.* 2020). However, some case studies provide examples of changes in household decision-making as a result of WASH programs. Carrard *et al.* (2013) developed a framework summarizing the types of gender equality outcomes achieved by WASH programs to date. They concluded that the outcomes could be classified across two dimensions: '(1) whether outcomes relate to individual changes or changes in relationships; and (2) whether outcomes are experienced within the household sphere or in the wider "public" arena'. Their review found that the largest number of outcomes identified in the literature was situated within the household sphere.

The fourth and emerging category of studies examines how inclusion of women in decision-making influences latrine decisions. Using data from the 2008/9 Kenyan Demographic and Health Survey, Hirai *et al.* (2016) concluded that 'women's decision making power … was positively associated with households having better sanitation'. This suggests that engaging women enhances WASH programs' effectiveness. However, this might not be universally true at the household level. For example, Routray *et al.* (2017) examined women's role in sanitation decision-making in the Indian state of Odisha. They found that: 'Households where women were more involved in general decision making processes were no more likely to build a latrine'.

This study contributes to the literature on the impact of WASH programs on gender outcomes at the household level, and the gap identified by Carrard *et al.* (2013) on literature regarding changes in decision-making leadership. We first analyze the effect of promoters on women's participation in sanitation decisions. Then, related to the literature on social influences on technology adoption (e.g., BenYishay & Mobarak 2018), we analyze the determinants of septic tank adoption with attention to whether women having a greater voice in latrine decisions improves sanitation outcomes and the role of promoters. We also analyze the promoter characteristics that predict sales numbers.

METHODS

Between 2017 and 2019, East Meets West (EMW) supported the Viet Nam Women's Union (VWU – an organization with 14 million members) in Ben Tre province in promoting the use of hygienic latrines. The goal of the campaign was to encourage septic tank construction. The campaign operated through VWU volunteers, who promoted septic tanks through door-to-door marketing within their local communities. The promotion was not limited to VWU members and was aimed at all households. The average age of the volunteers was 50 years and 71% of them had at least 9 years of schooling. They were paid a stipend of about USD 2 per household that installed a septic tank. Since civil society organizations are key partners for development programs, it is important to understand the role that VWU promoters play in improving sanitation. We collected quantitative baseline and endline data for this purpose. Ethical approval was provided by the Ethical Review Board for Biomedical Research, Hanoi University of Public Health.

To assess socioeconomic factors associated with septic tank adoption during the campaign, a baseline survey of non-users was undertaken in all of the 25 project communes (with a total population of nearly 250,000 living in 66,500 households, of whom 42% lacked hygienic latrines) in April 2017. The number of interviews in each commune was proportionate to the number of households. Two villages were randomly selected in each commune and the quota for that commune was split equally between the two. Based on lists provided by the village authorities, a total of 1,251 households without hygienic latrines were randomly selected. The survey targeted household heads or their spouses (whoever was available) and covered knowledge, attitude, and practices (KAP) concerning sanitation and hygiene as well as household composition, assets, and finances. In May 2019, we followed up with the same households (i.e., both adopters and non-adopters) on factors related to their septic tank decision-making processes (in addition to updating KAP and socioeconomic data). The survey team also undertook in-depth interviews with key stakeholders and focus group discussions. However, the data and analyses presented in this paper are derived from the quantitative surveys.

Demographic details on the households can be found in the Supplementary Material. Field interviews took 30–45 min and were recorded on tablets using Open Data Kit and downloaded immediately using the 3G network. Supervisors reviewed records in real time and followed up with respondents if data were missing or ambiguous (97% of households had mobile phones). Early interviews were recorded for quality control purposes. We also surveyed 52 promoters to supplement our household-level analysis with an analysis of promoter-level sales. Sales data was verified through EMW's monitoring and evaluation system. Appropriate quality control protocols were in place. Data analysis was undertaken with STATA version 15.

Our research focuses on contextual factors of the IBM-WASH model. Since social enterprises and non-governmental organizations are likely to continue partnering with VWU and similar organizations in other developing countries, it is important to understand the role they play in household sanitation decisions. While there is anecdotal support for the notion that the actions of VWU promoters are important for sanitation campaigns, this is an opportunity to assess the statistical evidence on their role. We conduct three related analyses on (1) the effect of promoters on women's participation in sanitation decisions, (2) the predictors of household septic tank adoption, and (3) the predictors of promoter sales.

Our first analysis investigates whether talking to VWU promoters about septic tanks increased the likelihood of a woman leading the decision to purchase one. For this, we create a binary explanatory variable that equals 1 if the household was visited by a promoter and the promoter spoke primarily with a female member of the household (usually the household head's wife), and equals 0 if the promoter primarily engaged with a male member or did not approach the household at all. The binary outcome variable equals 1 if a female member led the sanitation decision over the study period (regardless of whether the decision was to buy a septic tank or not), and equals 0 if it was a joint decision or a male member led the sanitation decision.

We estimate the relationship between women's decision making and interaction with promoters using both linear and non-linear probability models to control for households' pre-campaign decision-making arrangements and isolate the effect of interaction with VWU promoters as much as possible. Ordinary Least Squares (OLS) estimation results are referred to throughout the paper for ease of interpretation and because all binary outcome variables of interest were in a range such that estimation results of OLS do not differ substantially from limited dependent variable models (Angrist & Pischke 2008). We display equivalent results from a limited dependent variable model (Probit) to show insensitivity of conclusions. For completeness, we also tested sensitivity of results to using a logistic regression approach (Logit model, available upon request) and found that all implications are unchanged.

For the second and third analyses, rather than impose a focus on the role of VWU promoters, we let the data speak for itself and use the least absolute shrinkage and selection operator (LASSO, Tibshirani 1996) to select predictors from the large set of potential explanatory variables. We then regress the outcomes variables (septic tank adoption by households, septic tank sales by promoters) on the LASSO-selected explanatory variables using the linear and non-linear models described above.

RESULTS AND DISCUSSION

Access to septic tank latrines

In April 2017, no households in the sample owned a septic tank latrine (due to the inclusion criterion) but 7% of households used such a latrine, meaning that some households shared a neighbor's facility. At baseline, 84% of the households used fishpond latrines and some 5% of the surveyed households defecated in the fields/forests or in a temporary pit. The remaining 4% used another type of latrine. By May 2019, 38% of households owned a septic tank latrine, and 44% of households were using septic tanks. This increase in ownership of hygienic latrines was associated with major changes in defecation practices. The use of a neighbor's latrine declined by two-thirds. Overall, the use of fishpond latrines was cut almost in half, declining to 44%. OD declined marginally to 4% with a small increase in the use of other toilet types (pour flush, biogas, ventilated pit, or single-vault composting latrine).

Households drew on multiple sources of financing to fund their purchase. The average septic tank purchaser used three sources of financing, highlighting that this is a major investment that requires significant financial planning. The most common sources were savings (used by 70% of households), bank loans (40%), and social programs (34%). Improved convenience, cleanliness, and comfort were the main motivators for 76% of households that bought septic tanks.

Even among the households that chose not to buy a septic tank latrine, the possibility of buying one was a common topic of discussion over the past 2 years. As many as 69% of them said that they discussed buying one, with cost and location being the main points of discussion for half of the households that discussed purchasing. A full 94% of households without a septic tank were not satisfied with their current mode, and just like for households that actually did buy a septic tank, convenience, cleanliness, and comfort were the main reasons that most households (84%) would want to buy one. A lack of money was the reason that 67% ultimately decided against buying one.

The decision to invest in a septic tank was thus a point of deliberation for nearly 1,000 households during the study period, and it was a decision with major financial repercussions. In the following subsections, we investigate the role of household and promoter characteristics in driving that decision.

The effect of promoters on woman-led decision-making

In Table 1, column 1, the large positive coefficient (0.196) in the OLS regression with commune fixed effects tells us that interacting with the VWU was associated with a 20 percentage point increase in probability of a woman leading the septic tank decision. But this simple regression is misleading. It could reflect that to increase their chance of a successful sale, Women's Union promoters targeted women in households in which the women were already known to be empowered to make such decisions (a reverse causality problem). Therefore, we need to control for pre-existing power structure in the household. The survey included several questions for this purpose, drawing from the vignette-based approach of Bernard *et al.* (2018).

Along the lines of Kishor & Subaiya (2005), we asked the respondent about who takes the leading role on several household decisions: children's education and health, durable purchases, weekly food purchases, use of savings, and home construction. Shared decision-making was an answer option for all questions. We justify these as long-term measures of women's influence in the household, unlikely to be changed over a 2-year period by a septic tank campaign. Woman-led decision-making was least prominent for home construction (20%), savings (23%), and durable purchases (27%) and most prominent for food purchases (73%). Woman-led decision-making on children's health and education fell (somewhere in between 36 and 30%, respectively).

Even when we control for proxies for pre-campaign household decision-making arrangements in an OLS regression (Table 1, column 2), women's decision-making on septic tanks is positively correlated with women's interaction with VWU promoters, though the coefficient is about half the previous estimate (10 percentage points). This shows that the relation between a woman's contact with VWU promoters and a woman's influence on the septic tank decision is not simply a result of VWU promoters choosing to approach female householders who were more empowered to begin with. It is consistent with the conclusions of Dery *et al.* (2020) that access to information is a central aspect of empowerment.

Table 1 | Effect of talking to VWU promoters on women's decision-making

	(1)		(2)	
Outcome: Woman-led decision on whether to purchase septic tank	**OLS coefficient**	**Probit coefficient**	**OLS coefficient**	**Probit coefficient**
Wife approached by VWU promoter	0.196*** (0.027)	0.563*** (0.078)	0.098*** (0.024)	0.410*** (0.092)
Woman leads decisions on…				
Home construction			0.456*** (0.046)	1.353*** (0.145)
Children's education			0.018 (0.037)	0.077 (0.145)
Weekly food purchases			−0.102*** (0.031)	−0.449*** (0.133)
Durable purchases			0.229*** (0.047)	0.805*** (0.143)
Use of household savings			0.070** (0.027)	0.261** (0.101)
Children's health decisions			0.021 (0.032)	0.101 (0.132)
Constant	0.130*** (0.016)	−1.063*** (0.060)	0.080** (0.039)	−1.391*** (0.192)
Commune fixed effects	Yes		Yes	
Number of observations	984		984	
Mean dependent variable	0.295		0.295	
Adjusted/Pseudo R^2	0.056	0.046	0.363	0.305

In this table and throughout the rest of the paper, OLS and Probit coefficients imply similar results. For example, in column 2, OLS implies a 9.8 percentage point higher probability of women-led decisions when the wife is approached by a WVU promoter, whereas Probit implies a 9.6 percentage point average marginal effect.
Statistical significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.
Standard errors clustered at the village level.

We observe similar results (a positive relation between interaction with VWU promoters and woman-led septic tank decision) when we change the outcome variable to whether or not the wife first raised the possibility of buying a septic tank. This is additional evidence suggesting that talking to the promoters empowered women to take a leading role in the septic tank decision. All results hold if we add the full set of controls introduced in the next subsection.

To summarize, our interpretation is that there is indeed some reverse causality: promoters were more likely to approach women who already had a major decision-making role in their household. But even controlling for the indicators of pre-campaign decision-making power, there is a positive effect of the VWU interacting with the wife rather than other household members. Contact with a promoter increases likelihood of a woman's decision on sanitation by 33% (9.8 percentage points over the 29.5% mean) – a sign of empowerment (Kabeer 2005).

This also shows that regressions need to control for decision-making structure in the household determinants of septic tank purchase analysis that follows, because female decision-makers are found in households across the economic spectrum. The relationship between economic status and women's decision-making power is far from deterministic, with 18% of poor households having a woman decision-maker on home construction, versus 24% for non-poor households.

Determinants of household septic tank purchase

Our survey yielded dozens of household variables that could be fed into a regression explaining septic tank purchase. To avoid subjectivity in choosing regressors, we use LASSO to select predictors of septic tank purchase. An OLS regression of household septic tank purchase on the variable selected by LASSO is presented in Table 2, along with a list of explanatory variables that were not selected by LASSO.

We identify several socioeconomic predictors that are unsurprising. While household composition and household head's age and education were not significant predictors, households with bigger homes, hard walls, piped water, and fridges were more likely to purchase a septic tank. These all indicate that households with greater economic resources were more likely to purchase a septic tank. In another survey in Ben Tre province, Duy (2019) found that income-related factors were the only socioeconomic aspects that influenced latrine ownership.

Table 2 | Determinants of septic tank purchase

Outcome: Household purchased a septic tank	OLS coefficient	Probit coefficient
Economic predictors		
Household head's age	0.002 (0.002)	0.008
Household head's gender	0.029 (0.034)	0.092 (0.107)
Household head completed primary school	0.044 (0.029)	0.141 (0.095)
Household head completed secondary school	0.025 (0.036)	0.091 (0.113)
Number of elderly household members	0.033 (0.030)	0.101 (0.097)
Household was included in baseline[a]	−0.171*** (0.047)	−0.519*** (0.141)
Home is larger than 100 square meters	0.100*** (0.032)	0.313*** (0.101)
Walls made of hard material	0.099** (0.045)	0.368** (0.151)
Roof made of hard material	0.059 (0.038)	0.237* (0.137)
Floor made of hard material	0.048 (0.043)	0.135 (0.154)
Home in average condition	0.055 (0.033)	0.186* (0.105)
Home is in good condition	0.156*** (0.052)	0.477*** (0.160)
Household owns fridge	0.055* (0.028)	0.164* (0.095)
Other enabling factors		
Woman leads on home construction decisions	0.090** (0.041)	0.362*** (0.130)
Home has piped water	0.090*** (0.038)	0.285** (0.117)
Respondent aware that open defecation pollutes ponds	0.069** (0.027)	0.223*** (0.084)
Septic tank demonstration in commune	0.064*** (0.021)	0.224*** (0.065)
Household knew of septic tank demonstration	0.091* (0.054)	0.268* (0.162)
Close friend was highly satisfied with septic tank pre-baseline	0.165*** (0.031)	0.531*** (0.101)
Commune fixed effects	Yes	
Number of observations	1,220	
Mean dependent variable	0.381	
Adjusted/Pseudo R^2	0.217	0.205

The following variables were not selected by LASSO: household head marital status, household size, number of children, number of women, agricultural household, household savings amount, farmland area, government poverty status, treated water, septic tank demo attendance.

[a]12% of households could not be re-interviewed at endline because they moved from the village or were otherwise unavailable. Being a replacement household was a significant negative predictor of septic tank purchase. But the results hold even if we limit the regression to households that were interviewed in both 2017 and 2019 (i.e., the 1,099 non-replacement households).

Statistical significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Standard errors clustered at the village level.

Because of the detailed survey, we are able to identify several other predictors on which there is less recorded evidence. Table 2 shows that households in which women led on home construction decisions[1] were 24% more likely to buy a septic tank (9 percentage point increase over the 38 percentage point mean). Respondents that identified pollution as a major problem associated with defecation in ponds (i.e., those with more awareness of environmental externalities) were 18% more likely to buy septic tanks (7 percentage points over the mean).

Respondents that had at least one close friend who owned a septic tank prior to the baseline and who was highly satisfied with their purchase were 43% more likely (17 percentage point increase over the mean) to buy a septic tank of their own over the following 2 years. This is suggestive of strong social network effects (Guiteras *et al.* 2015; Shakya *et al.* 2015; Augsburg & Rodríguez-Lesmes 2020). Finally, septic tank demonstrations appear to be important for convincing households to invest in

[1] We use home construction decision-making rather than sanitation decision-making to allow inclusion of the 267 households that did not report any sanitation decisions over the study period.

them. Having a demonstration in the commune was associated with a 17% increase (6 percentage points over the mean) in probability of buying a septic tank.

These non-socioeconomic predictors suggest the importance of trust in the product. When the household had confidence in septic tanks (either because they had seen the product, knew of their environmental importance, or a friend had told them about their satisfaction with them), they were more willing to invest in one. Similarly, iDE (2019) found that trust was a dominant success factor in latrine sales. This is a theme we investigate more in Table 3, which adds additional covariates based on the household's interactions with VWU promoters.

In addition to increasing women's participation in the septic tank decision, it is possible that interaction with promoters had other effects. Table 3 shows the correlation of household septic tank purchase with various promoter variables as reported by the household respondent (once again selected from a large set of possible explanatory variables using LASSO), even after controlling for all of the predictors in Table 2.

Table 3 shows that more important than the content of discussions with promoters was the pre-existing relationship with promoters. Households were 24% more likely (9 percentage points against the 38% mean) to buy a septic tank if they knew their promoter prior to the campaign. The precise details of that relationship (length, nature, geographic proximity) did not matter. Furthermore, it appears that multiple visits (more than two) were helpful in building confidence in the decision to purchase. The number of follow-up visits has also been shown to be important for the success of Community-Led Total Sanitation programs (Harter *et al.* 2019).

For cases in which the household was not already familiar with the promoter, it would be reasonable to expect that the actions of the promoters were more important, and this is what we find. Specifically, when the respondent was not already acquainted with the promoter, the biggest driver of household purchase was whether or not the promoter explicitly advised the household on how to access loans for purchasing a septic tank. Additional evidence on this action is presented in the following subsection, which analyzes promoter sales data.

Determinants of promoter sales

To further investigate the role of promoters in septic tank adoption, we collected survey data from 52 promoters: one promoter in each village and two commune presidents who engaged in promotion. The promoter survey collected information on promoter actions (e.g., average number of visits per household, nature of training and discussions with households) and

Table 3 | Determinants of septic tank purchase including interactions with Women's Union

Outcome: Household owns a septic tank	OLS coefficient	Probit coefficient
Household attended verbal meeting	0.029 (0.024)	0.100 (0.076)
Latrine models were discussed with household	0.016 (0.035)	0.079 (0.111)
Advantages of hygienic latrines were discussed with household	0.004 (0.033)	−0.002 (0.104)
Information about accessing loans for latrines was discussed with household	0.034 (0.041)	0.128 (0.130)
Respondent knew VWU promoter before the campaign	0.094** (0.046)	0.307** (0.150)
WU promoter lives more than 500 m from household	0.026 (0.031)	0.096 (0.100)
Respondent has personal connection with VWU promoter	−0.048 (0.041)	−0.178 (0.131)
Respondent has known VWU promoter for more than 10 years	−0.034 (0.041)	−0.102 (0.124)
WU visited household more than twice	0.057* (0.031)	0.141 (0.095)
Household controls (from Table 2)	Yes	
Commune fixed effects	Yes	
Number of observations	1,220	
Mean dependent variable	0.381	
Adjusted/Pseudo R^2	0.228	0.221

The following binary variables were not selected by LASSO: Awareness of local VWU activities, VWU provided literature on hygienic latrines, VWU discussed dangers of open defecation, Recall of VWU promoter's name.
Statistical significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.
Standard errors clustered at the village level.

characteristics (e.g., gender, age, education). This, linked with septic tank sales data, allows us to assess whether certain profiles of promoters were more effective than others.

Forty of the promoters were women, and the average age was 51 years. The most common economic activity of promoters was agriculture (81%). The average promoter facilitated the sale of 38 septic tanks (total sales ranged from 0 to 91). Nearly 90% of promoters had a septic tank of their own.

We collected detailed data from each promoter, concerning their personal background and their actions taken as septic tank promoters. We have many variables and relatively few promoters, so it would be possible to use the data to perfectly predict sales of each promoter (overfitting). Since we want to learn about what strategies might be effective for future campaigns, we want to avoid overfitting and ensure that our estimates are capable of out-of-sample prediction. To optimize prediction, we once again use LASSO, feeding in all promoter variables (after eliminating highly collinear ones). Table 4 shows a regression of promoter sales on promoter characteristics.

Most promoter demographic characteristics do not seem to matter for sales volume. Promoter's gender and economic status had no bearing on their predicted sales numbers. Similarly, male and female sales agents in Nepal performed at the same level – although they used different sales strategies and were successful with different target groups (iDE 2019). Being older and educated to a primary level were helpful for sales, and holding a leadership position in the VWU had a small positive effect that was not statistically significant. These predictors suggest that promoters were more effective if they were perceived as respectable. What appears to have been even more important is promoter preparation (which, unlike demographic characteristics, is an operational variable). Discussing loan options was significantly positively associated with sales, as was being trained (in particular, being trained on promotion skills). Both factors boosted expected sales by around 20 septic tanks.

CONCLUSION

Septic tank use rose drastically over a two-year period in the 50 study villages, to nearly 44% among a sample of households that previously had no septic tanks. We are unable to identify the causal effect of the campaign on septic tank ownership due to the possibility of concurrent changes that were unrelated to the campaign but increased septic tank use, as well as the impossibility of disentangling promoter efforts from pre-existing likelihood of a successful sale. However, we uncover several findings that suggest pathways through which campaign-related activities encouraged households to switch from fishpond latrines to septic tanks, identifying novel trust-related social factors that are high-leverage and explain a modest but significant share of variation in septic tank decisions.

Table 4 | Determinants of promoter sales

Outcome: Number of septic tank sales facilitated	OLS Coefficient
Promoter age (years)	0.558* (0.284)
Promoter is a woman	−0.183 (9.355)
Promoter has primary education or higher	23.082*** (6.669)
Promoter is non-poor	−8.918 (10.541)
Promoter has a VWU leadership position	10.312 (6.223)
Promoter was trained to promote septic tanks	23.662*** (7.548)
Promoter discussed loan options with households	17.657*** (4.896)
Control for commune size	Yes
Observations	52
Mean dependent variable	37.620
Adjusted R^2	0.223

The following variables were not selected by LASSO: Promoter's marital status, promoter's household composition, secondary education, promoter engages in agriculture, promoter engages in business, promoter's housing conditions, promoter's personality traits, promoter's finances, promoter's main crops, average number of visits per household visited, and promoter discussed hygiene or latrine models with households.

Statistical significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Standard errors clustered at the commune level.

First, there is strong evidence that interacting with the Women's Union promoters empowered women to take the lead on sanitation decisions in their households, and that women's participation in decisions led to more hygienic choices. This corroborates the conclusion of Ljung & Hill (2017) on a similar program in a different location. We came to this conclusion by estimating the impact of interacting with a promoter on the probability of a woman leading the household's sanitation decision, controlling for the pre-campaign decision-making structure in the household to mitigate reverse causality concerns. The effect is large, estimated at 33%. This supports the strategy of partnering with the Women's Union to improve sanitation outcomes in rural areas of Viet Nam.

Second, while the usual economic variables are influential in household decisions, there are several critical predictors that are social in nature, underscoring that buying a septic tank is not the result of a purely financial decision. Trust in the product was proven to be critical, whether that was through having a close friend that could vouch for the benefits of septic tanks, or having a pre-existing familiarity with the village promoter. Knowledge of the environmental hazards of OD and having a septic tank demonstration in the commune were also significant factors, further emphasizing the need for practical knowledge and awareness. The top significant non-economic predictors of septic tank ownership were knowing the promoter before the campaign (25% increase), having a woman decision-maker on sanitation (24% increase), and being aware of pond pollution from OD (18%). The strongest predictor of septic tank purchase (having a close friend that was satisfied with their septic tank, which increased probability of owning a tank by 43%) is something that a campaign cannot directly manipulate. But it suggests that the campaign likely contributed to a virtuous cycle in Ben Tre, with septic tank purchases accelerating as sanitation coverage improved and more households learned about septic tanks from their friends and neighbors.

Third, analyzing sales by each promoter we surveyed, we find that promoter preparation was a stronger determinant of sales than the characteristics of the promoter. Specifically, we find that expected sales were twice as high for promoters who were trained and who explicitly discussed loan options with their target households. While older and educated promoters in leadership positions tended to sell more tanks, the impact of those variables was much smaller than the impact of promoter training and promotion content. This is promising, because promoter training can be improved, while the profile of volunteer promoters cannot be changed for a given village.

In conclusion, promoters served as sanitation advocates for households whose close friends would not make the case to them, and empowered women to participate in decisions. The results from this campaign show that in addition to trust in the promoter, programmatic content matters. Pedagogical emphases on the promoter side (e.g., formal promoter training on financing options) and the household side (awareness of available models and environmental repercussions of OD) are key success factors in campaigns promoting preventative health technologies in settings where they are unfamiliar.

DATA AVAILABILITY STATEMENT

All relevant data are available from an online repository or repositories (https://georgetown.app.box.com/s/4kcyhfl2227rntacm49pdiyfzwgaxmyc).

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