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Knowledge, Attitudes and Willingness to Pay for Ecological Toilets and Ceramic Water Filters in Trinidad, Bolivia

By

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Environmental Health

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By

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Bachelor of Science
Georgia Institute of Technology
2012

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
In partial fulfillment of the requirements for the degree of
Master of Public Health
In Environmental Health
2015

ABSTRACT

Background Out of all countries in South America, Bolivia is ranked the lowest on the Human Development Index and is the only country with communities that continue to practice open defecation. It also has the least water and sanitation coverage. While appropriate water and sanitation technologies have been previously identified for the context of Trinidad, Bolivia, few programs have found ways to scale-up or demonstrate if demand exists. The purpose of this study was to determine if the residents of Trinidad, Bolivia, who have experienced extreme flooding without adequate sanitation, were willing to purchase ceramic water filters and ecological sanitation through a local microfinance institution, Pro Mujer.

Methods Demographic, socioeconomic, and perceptions of health data were collected at the household level in Trinidad, Bolivia in 2009. Participants were asked about water, hygiene, sanitation practices and willingness to pay for ceramic water filters and two types of ecological toilets.

Results Only 50% of those who reported having a bathroom allowed the surveyor to see it. Among all bathrooms observed, only 60% had toilets. More than 40% of homes that had a bathroom and more than 75% of those that did not have a bathroom at the time of the survey were interested in purchasing ecological toilets. Nearly 60% reported treating their water before drinking, and about 25% of respondents already had a ceramic water filter. Of all respondents, 70% reported an interest in buying a ceramic filter. Lower income households reported higher willingness to pay for both ceramic filters and ecological toilets. Households with color televisions, mobile phones, radios and motorcycles reported greater willingness to pay for ceramic filters and ecological toilets compared to households that did not own these assets. Almost 80% of surveyed households stated they were prepared to solicit credit from the microfinance institution to purchase an ecological toilet despite the high price ($424.33- $636.50).

Conclusions These results indicate that residents of Trinidad, Bolivia are willing to purchase ecological sanitation and ceramic water filters and are interested in using microcredit loans to purchase them. Future research should consider other survey techniques to examine willingness to pay for water treatment and sanitation and compare results to determine if the same results are found.

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INTRODUCTION

The Plurinational State of Bolivia has the lowest coverage of improved sanitation in South America, a status that is correlated with high prevalence of diarrheal disease [1]. Burden of disease data from The Institute for Health Metrics and Evaluation reported that diarrheal diseases were the number two ranked cause for years of life lost in Bolivia in 2010 [2]. Evidence has shown that increased coverage of water and sanitation services will lead to improved quality of life and decreased diarrheal disease and other adverse health outcomes [3]. However, Bolivia is the lowest on the Human Development Index of countries in South America [4], suggesting the nation has few resources to address this need.

Trinidad, a peri-urban community in the lowlands of Bolivia, experiences heavy rainfall during La Niña events, leaving the area with drastic floods that sometimes last for months [5]. In February 2008, President Evo Morales of Bolivia declared a national disaster due to flooding that started in November 2007 [5]. The floods in 2007-2008 affected an estimated 43,000 families and left many of them without adequate water and sanitation [5].

Figure 1 Flooding in Trinidad, Bolivia
(http://www2.ljworld.com/photos/2008/feb/10/)

Ecological sanitation (EcoSan) and ceramic water filters were identified for this community because of their easy use and their compatibility with the context. Ecological sanitation can be an appropriate approach to sanitation for communities that experience floods because they are raised and have lined chambers that won't disperse excreta when flooding occurs [6]. EcoSan toilets are a closed-loop dry sanitation system that use human excreta as fertilizer for agriculture by regularly emptying the above ground chamber portion every six to eight months [7]. With the flooding that Bolivian lowlands experience, this sanitation technology is capable of protecting the environment and not spreading harmful pathogens from fecal contamination. During floods, safe drinking water is at a minimum as piped systems break or become infiltrated by contaminated floodwaters and services may become temporarily unavailable. For this reason, a long-lasting ceramic water filter can be an appropriate point-of-use water treatment strategy so that during times of floods, people can use the water available to them for drinking once it has been purified.

A local microfinance institution in Bolivia, Pro Mujer, was interested in exploring how to make water filters and ecological sanitation more accessible to the families of Trinidad by providing microcredit loans for these products. However, the organization had no insight into how much the members of the community were willing to pay for toilets or filters or their perceptions of the technologies or microcredit loans.

As a part of a grant from the World Bank Development Marketplace to promote sanitation demand and develop sanitation microenterprises in Bolivia, the Center for Global Safe Water (CGSW) at the Rollins School of Public Health of Emory University developed and conducted a willingness-to-pay study for EcoSan toilets and ceramic water filters. This study was designed to examine the knowledge, attitudes and willingness to pay for ceramic water filters and EcoSan toilets among the people in Trinidad, Bolivia, and the factors that affect willingness to pay for these products. The goal of this study was to provide information to Pro Mujer to guide decisions about whether or not to develop microcredit products for households in Trinidad, Bolivia for ceramic water filters and EcoSan toilets.

Through a collaborative effort of CGSW faculty, Rollins School of Public Health MPH candidates and Goizueta MBA candidates, a survey was designed using contingent valuation survey methods. Native Bolivians conducted the survey in summer 2009 in Trinidad, Bolivia where they obtained 410 surveys. Along with the survey, observations of living conditions, sanitation, and drinking water treatment were recorded. Willingness to pay was assessed through a variety of approaches described in the methods section.

LITERATURE REVIEW

Bolivia

Nationally, Bolivia struggles to provide safe water and sanitation, especially to rural populations. Overall, 12% of the population uses surface water or other unimproved sources of water as their drinking source [1]. In rural areas, 28% of Bolivians consume drinking water from unimproved sources, with 23% of rural populations in Bolivia consuming surface water as their primary drinking water source [1].

Bolivia has the lowest level of sanitation coverage in Latin America [1]. Only 47% of Bolivians have access to sanitation, with 46% in urban environments and 64% in rural areas living without sanitation [8]. Roughly one-third (36.5%) of the rural population of 3.5 million people has access to sanitation services leaving approximately 2.2 million without any form of sanitation and many practicing open defecation [8]. From 1990 to 2012, Bolivia suffered a 5% increase in urban-rural disparities in sanitation coverage [1].

Peri-Urban Communities

Participants in this study are residents of a peri-urban area on the outskirts of Trinidad. Members of a peri-urban community suffer the disadvantages of rural communities but also experience some of the benefits of an urban community. Peri-urban communities are those on the geographical edge of a city. In the developing world, there is very little planning focused on peri-urban communities because they

often grow quickly and are outside the jurisdiction of a municipal authority. These communities face considerable challenges such as poverty, environmental degradation, unstable cultures, blurred social boundaries [9], exacerbated by their informal status. These communities are often economically dynamic and easily influenced by their accessibility to urban markets and resources, yet close enough to rural agricultural zones that make them a critical area for natural resource management [9]. While living in urban areas can benefit health in developing countries, those living in peri-urban environments are likely to experience many of the drawbacks of living in a rural environment as well.

Most of the two million people who die annually due to diarrheal disease are children under five years of age in peri-urban or rural communities [10], and the percentage of those affected by diarrheal disease in these areas is increasing [11]. Peri-urban environments typically have populations comprised of diverse backgrounds ethnically, culturally, religiously, and have varying hygiene behaviors. For many people in peri-urban areas, these behaviors include open defecation and unhygienic waste disposal methods [9].

Improved Water Sources

Poor hygiene practices, such as open defecation, can result in reduced water quality after periods of heavy rain or flooding. Pro Mujer believed the need for safe water was apparent to residents of Trinidad, and thus, wanted to offer ceramic water filters to incentivize residents to utilize microcredit. However, improved water may

only benefit health when sanitation is also improved [12]. With incremental improvements in water supply, improvements in sanitation have resulted in height and weight increases due to less diarrhea [12]. It has been recommended that water supply programs consider an intervention at the point of use for water quality [13]. When analyzing the impact of improved water sources, it is vital to consider the transport, storage and possible water contamination that may take place during these steps [13].

Point-of-Use Water Treatment

Water quality can change from the source to the point of use. Factors such as improper storage, poor hygiene during collection or handling of water can result in contamination despite the quality of the source water [14]. Point-of-use (POU) water treatment aims to address water contamination that may occur during transit from the water source or storage until the water is used. POU water treatment prevents pathogen exposure immediately prior to consumption [14]. When water is treated immediately before consumption, diarrheal disease can be reduced by 200% compared to households without POU [13]. There are several forms of POU treatment, including, but not limited to, PUR (a water tap adaptor with a built-in filter), chlorine bleach, and solar disinfection [14]. One study conducted in peri-urban Bolivian communities measured weekly diarrhea in households with and without point-of-use water disinfection and found that children under five in households within the intervention group had significantly less diarrhea than those without POU water disinfection [15].

Ceramic Water Filters

The effectiveness of point-of-use water treatment is highly dependent on compliance. Several previous studies of POU water treatment interventions show that the interventions have been successful at achieving good compliance [16]. Studies of ceramic water filters in Bolivia have reported 88% compliance over 6 months, resulting in a significant 63% diarrheal disease reduction [16]. This type of filter is able to remove turbidity, organic matter and microbes to reduce diarrheal disease rates [17]. Acceptance and continued use of ceramic filters has been observed to be high because of their efficiency and low maintenance [17]. Ceramic filters can provide effective, long-term use. However, if filter parts break and/or are not locally available, use of ceramic filters may decline. A study conducted in rural Bolivia among 50 sample households found the mean willingness to pay for ceramic water filters to be less than 40% of the cost [18].

Improved Sanitation

In addition to improvements in water, improvements in sanitation can help promote positive health outcomes. Incremental improvements in sanitation have resulted in less diarrhea and increases in height and weight of children [12]. Improvements in sanitation have been found to have a greater impact on health, specifically prevalence of diarrhea, than improvements in source water quality alone [12]. Some data have shown that improved sanitation provides "broader and larger benefits to health than improved water supplies" [12]. A well-respected meta-analysis of water,

sanitation and hygiene interventions found that improvements to sanitation have a 5% greater impact on the prevalence of diarrhea than interventions to water quality; a 22% reduction in diarrheal disease due to sanitation interventions was observed compared to a 17% reduction in diarrheal disease due to water quality interventions [13].

Ecological Sanitation

Ecological sanitation (EcoSan) was identified as a compatible approach for improved sanitation for peri-urban areas of Trinidad. These toilets are typically made up of a structure that allows the user to sit above a sealed vault (Figure 2). EcoSan is an approach to sanitation that is based on the belief that treated human excreta can be beneficially used for agriculture [10]. After excretion, an absorbent agent that increases pH, such as ash or lime, should be added to destroy pathogens and decrease the risk of odors and flies [10]. Long storage and high pH and temperature are part of the EcoSan approach to ensure microbial inactivation. An EcoSan system is a closed-loop, sustainable cycle that bridges the sanitation and agriculture gap. The underlying concept is to close the nutrient cycles with as little material and

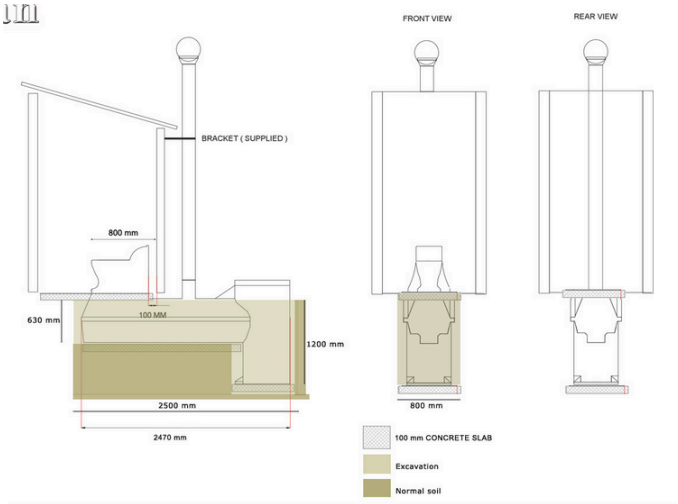

Figure 2. Diagram of an Ecological Sanitation toilet (http://www.ecosan.co.za/Documents/toilet1za.jpg)

energy usage as possible in order to promote food security. EcoSan approaches and technologies may range from natural wastewater treatment to compost toilets.

Benefits of EcoSan technologies are numerous and varied. EcoSan minimizes the introduction of pathogens to the water cycle, conserves resources such as reduced water consumption and places preference on a cost-efficient solution (EcoSan) rather than expensive piped systems. In some countries, where EcoSan has been integrated into houses, EcoSan increases user comfort, provides security for women and girls and promotes a holistic, interdisciplinary approach by incorporating multiple sectors, from water and sanitation to agriculture [19].

EcoSan is comprised of a sitting or squatting toilet that separates urine and feces into separate chambers within the vault [14]. Because the urine is mostly free of pathogens, it can be used to fertilize crops once the high levels of nitrogen and phosphorous have been diluted with water [14]. Meanwhile, excreta must be kept inside the vault for several months to allow sufficient time for the additives to kill pathogens through desiccation and microbial predation [10]. Heat may also play a role in pathogen deactivation, depending on the design of the toilet.

Nitrogen, potassium and phosphorus from urine or excreta can be recycled back to agriculture, and reduce reliance on chemical fertilizers [20]. Recycling phosphorus is especially important because phosphorus shortages are predicted to be so severe that there may be an exhaustion of reserves by 2100 which may result in increased

food prices, food shortages and possibly geopolitical rifts [10]. Sulphur and oil are used in the production of nitrogen fertilizer, and it is estimated that both will be depleted within the next 20 to 30 years, respectively [21]. Through EcoSan, limited agricultural and financial resources can be conserved and food security improved [10].

Ecological Sanitation in Trinidad, Bolivia

While EcoSan may be feasible and appropriate for Trinidad, before offering the product, demand for EcoSan must be assessed. Despite the efforts of national and international organizations to implement sanitation technologies in semi-urban and rural communities around Bolivia, coverage of sanitation and consistent use remain stagnant [8]. UNICEF has found that this is due in part to a need to generate demand for sanitation services, which UNICEF has attempted to address through a Community Led Total Sanitation approach. However, many researchers and organizations feel that this approach to eliminate open defecation undermines human rights because of its utilization of shaming the community [22].

Microfinance

To discourage unhygienic behaviors, access to safe water and sanitation must be available. Unfortunately, and as is the case in Trinidad, Bolivia, many of the populations without access to safe water and sanitation are comprised of people who do not have the financial resources at their disposal to make safe water and sanitation possible. Microcredit loans, provided by microfinance institutions, are

intended to develop the capacity of financial systems and alleviate poverty by finding ways to lend money to poor households [23]. Traditional banking systems do not typically lend to poor households because of their lack of collateral, but microfinance programs restructure their systems to reduce the riskiness of providing small loans without collateral [23]. The use of microfinance has expanded greatly in the recent past; as of 2010, there were 137.5 million poor families worldwide with a microloan [24].

Microfinance in Developing Countries

The "win-win" idea behind microfinance is that while providing credit to poor households, the credit institution can simultaneously make a profit off the interest from the loan [23, 24]. In some scenarios, credit groups are formed where all members are responsible for the repayment of the members of the credit group to ensure the microfinance institution is repaid [25]. Many times, microcredit loans will be available primarily to the women of a community to empower women's decision making in the household [26]. Microfinance institutions attempt to provide loans for a variety of goods such as animals, sewing machines or farming equipment [25]. Microfinance institutions have also recently been criticized for making extreme profits from debt traps, which place stress on the borrower for over-indebtedness and the use of social pressure for loan repayment [24, 27]. These debt traps are believed, in extreme cases, to be linked to suicides.

Microfinance for Water and Sanitation

Microfinance institutions have also provided loans to the poor for water and sanitation products. A study in Hyderabad found that microcredit was an effective manner of providing poor households access to improved water and sanitation services in their homes [28]. While some researchers feel that microfinance for water and sanitation addresses the symptoms of, rather than cause for, a lack of water and sanitation services [29], some programs reported successful microcredit operations [30]. One example of success was a study conducted in India that found microfinance loans have the potential to increase uptake of water treatment solutions for households that are members of microfinance institutions [30]. In a study of policy implementation for microfinance, there was high adoption of loans among those eligible for rural water supply and sanitation in Vietnam [25]. The study also found high demand for use of the loan program; in fact, funding was not sufficient to provide a loan to all households interested in a loan [25].

Willingness to Pay

Willingness to pay for a product, good or service is dependent on many factors. One study observed that willingness to pay for sanitation was highly dependent on the household's current sanitation situation [31]. Another study found that income, age and education were the key determinants of willingness to pay for domestic water supply in Kenya [32]. Regrettably, very few studies provide reliable information on basic attributes such as occupations, incomes or loan use of participants and comparable nonparticipants [23]. Some researchers believe a critical aspect of willingness to pay is the ability to pay, which can be assessed by analyzing the

incomes and assets of consumers [33]. In willingness to pay studies, researchers attempt to identify a household's maximum price for purchasing improved services for a public or private good; if the price exceeds the household's perceived level of affordability, the household will be highly unlikely to utilize the new service or technology [34]. For families with low and variable income, willingness-to-pay literature has demonstrated that unit price payments offer households an advantage by granting a degree of control over water service expenditure [35]. Additionally, the nature of need for the offered service or product must also be understood in order to assess willingness to pay for water and sanitation [33]. A market for a particular product is often prompted by a perceived need.

Methods to Assess Willingness to Pay

Studies of willingness to pay have shown that slight differences in price and consumer purchasing behavior that accompany this willingness can have notable effects on overall sales [36]. In the broadest sense, willingness-to-pay assessment methods can be classified as whether they use survey techniques or are based on simulated or actual price-response data [36]. To understand if a consumer will purchase a product, direct and indirect surveys can be utilized [36]. Direct surveys ask respondents to state how much they might be willing to pay, while indirect surveys, such as discrete choice analysis, ask respondents to rate or rank different products in order to estimate a preference structure [36].

Contingent Valuation

Contingent valuation is one of the most common methods for assessing willingness to pay [37]. A typical contingent valuation question hypothetically asks if one is willing to pay a specific amount for a specific outcome [37, 38]. Contingent valuation is most meaningful when the survey elicits answers to a fixed charge rather than a unit price [33]. The goal of a contingent valuation researcher is to determine how much respondents are willing and able to pay from the respondents' stated preference [39].

This methodology has been critiqued by economists and researchers on several counts [38]. Critiques of contingent valuation claim that it is prone to upward-biased results. Johnston et al. found that "most research finds significant divergence between stated and actual behavior" indicating contingent valuation may result in reported willingness to pay higher than what respondents would truly pay [40]. In spite of these critiques, contingent valuation remains a popular, established method to assess willingness to pay and can generate valuable information for both the public and private sector during the process of policy formation or development of marketing strategies.

A study recently conducted in Sucre, Bolivia, used contingent valuation to estimate willingness to pay for an urban water supply system improvement. Findings included a positive correlation between respondents' household income and willingness to pay [41]. Similarly, contingent valuation was used to measure the value that accompanies characteristics of a new drinking water filter in rural and

urban Kenya [42]. A study assessing willingness to pay for improved water services, conducted in Nigeria, concluded that contingent valuation was a valid form of assessing willingness to pay due to consistency with findings of household preferences [43].

Studies of willingness to pay for POU water treatment have received little attention, especially compared to research on willingness to pay for greater water quantity [37]. Recent research on improved water quantity has found the mean willingness to pay per household for domestic water supply to be 275 Kenyan shillings per month ($2.95) [32]. One study found that low-income households in developing countries generally spend 2-3% of their income on sanitation [31]. People who own their home have been found to be more willing to pay for long-term sanitation investments, such as a toilet [44].

Market Data

Analyzing historical sales data, where real purchase decisions are observed, is another method used to determine willingness to pay[37]. Previous literature reviews of these methods have concluded that classifying willingness-to-pay estimations based on overall market data is infeasible [36]. Feasibility changes when the prices consumers have paid for products are observed at the individual level [36]. Revealed preference data can inform researchers of household valuations of cleaner water when the number of trips to a more expensive improved source is

compared to the number of trips to a free or less expensive unimproved source, given that improvements to source water quality were randomly assigned [37].

Discrete Choice Models

Discrete choice models can be used to evaluate cross-sectional survey data on household decisions [37]. Discrete choice models typically use cross-sectional survey data to examine the relationship between changes to the good or service, such as a water quality improvement or price change, on the demand for the good or service [37]. The models estimate a lower bound of willingness to pay for the product by using the predicted demand probabilities [37]. This model is able to eliminate some of limitations of contingent valuation by analyzing real household choices, such as the decision to purchase a ceramic filter. A disadvantage to this method for assessing willingness to pay is unobservable household characteristics may be correlated with household choices, leading to biased results if the unobservable characteristics variables influence demand [37].

Asset Index

Willingness to purchase a product is often dependent on income, but for populations that have seasonal changes to their income it is helpful to have supplemental information. An asset index can fill this role by providing the surveyor with details of goods the household owns.

Asset indices may provide a better idea of living standards than income or reporting expenditures because there is less probability of problems with recall or measurement [45]. Additionally, a measurement of assets shows how living standards have accumulated and developed over long-term periods of time rather than a brief snapshot of income that might change seasonally or not reflect exchanges of wealth that occur through bartering [45]. An asset index may not be considered appropriate if the outcome of interest is related to the current resources available to the household [46]. Additionally, ownership is unable to provide insight on the quality of the assets [46], for instance, the difference between an older car that has trouble starting or a newer car that can navigate tough roads.

An asset index can be calculated by measuring a number i types of capital, C^i where i= [1,2,…I]. Every type of capital C^i has J types of assets $a^{i,1}$ …$a^{i,J}$. Each asset can be measured with a binary, ordinal or cardinal variable. Then, a weight *w* is assigned to each item and summed to get an estimate of C^i [45]. The weights of each item can be measured in a variety of ways: prices, unit values, or principal component analysis [45].

Principal Component Analysis

A multivariate statistical technique, called principal component analysis, reduces the number of variables into fewer dimensions [46], and can be used in willingness-to-pay studies. This type of analysis takes a set of correlated variables and creates uncorrelated components where each component is a weighted combination of the

initial set of variables [46]. Not all data are appropriate for principal component analysis; categorical variables such as religion are not suitable for principal component analysis because they are qualitative and they need to be converted to a quantitative scale [46]. Categorical variables must be coded as binary variables with variables of low frequencies usually combined [46]. Some studies have excluded households with missing values altogether, and others have given the mean value to a missing data point. When the household is excluded altogether, the statistical power of the study results is often greatly reduced, while attributing a mean score will reduce variation and increase clumping [46].

Significance

To our knowledge, there are no known studies of willingness to pay for ceramic filters and ecological sanitation in Trinidad, Bolivia. This study was developed for the purpose of providing information to organizations that might enable low-income families to purchase products that may result in reduced diarrheal disease. The overall goal of this study was to understand demand and willingness to pay for water and sanitation technologies in communities in Trinidad, Bolivia that have recently experienced flooding. The first specific objective was to describe the demographics of the study households. The second objective was to gain insight into knowledge and attitudes toward EcoSan toilets, ceramic water filters and microcredit loans in the study population. The final objective of the study was to measure if study participants were interested in purchasing ceramic water filters and EcoSan toilets, how much they were willing to pay, and the factors that

influenced their willingness to pay. Ceramic water filters have been available to this study community previously; therefore, how households acquired their filter will be explored to assess willingness to pay for the filters. However, EcoSan toilets have not been readily available to the community, so this is not an option for assessing willingness to pay for this technology because people are not familiar with them. This study may provide future researchers with a model for studying willingness to pay for water and sanitation products.

METHODS

Trinidad, a city of nearly 95,000 in tropical Bolivia, served as the setting for this study. In the summer of 2009, households in peri-urban municipal districts of Trinidad were targeted for survey participation where 410 surveys were administered. We followed a 40 x 10 sampling methodology in which 10 surveys were administered within 40 geographic clusters in Trinidad. Thirty-two municipal districts in Trinidad were covered in the survey. These districts were chosen for inclusion into the survey primarily because of their lack of access to networked sewerage and their vulnerability to frequent flooding. Bolivian research assistants were trained to conduct the survey, and all interviews were conducted in Spanish. All surveys were administered to the self-identified head of household. Ethical permission for this study as IRB-exempt programmatic research was granted by the Institutional Review Board of Emory University initially for data collection and again for secondary data analysis (Appendix A).

Figure 3 Map of Bolivia (http://do-you-know-about.blogspot.com/2012/06/la-paz-bolivia-map.html)

The survey instrument (Appendix B) was developed by a multi-disciplinary team of water and sanitation experts and business, economic and public health graduate students. There were six major survey topics: (1) demographic information, (2)

ceramic filters and willingness to pay for them, (3) ecological sanitation toilets and willingness to pay for them, (4) interest in microfinance loans to construct EcoSan toilets, (5) interest in microfinance to make general household improvements, and (6) observations about household water and sanitation infrastructure and practices. During the survey, participants were first asked about demographic and health information and subsequently about knowledge and attitudes regarding water and sanitation practices, as well as their familiarity with EcoSan toilets. After the first portion of the survey, researchers showed participants an illustration of an ecological sanitation toilet and explained the use and maintenance of the technology. Photographs of each product were shown throughout the survey (Appendix B). Following this explanation, willingness to pay data were collected via contingent valuation questions for the ceramic water filters, an EcoSan toilet with a cement superstructure, and an EcoSan toilet with a wooden (less expensive) superstructure.

The survey instrument attempted to avoid many of the intrinsic pitfalls of contingent valuation surveys through several mechanisms. First, to address the ordering effect of prices, or participant sensitivity of cost values to the initial values offered by the researcher [47], two different versions of the survey with differences in toilet type ordering were used in the ecological toilet section according to the different raw material composition of the superstructure. In survey version A, participants were asked about toilet superstructures built from cement materials prior to toilet superstructures built from wood materials; in version B, the order

was switched (Table 1). These different versions were designed to account for order bias that can exist when participants are first introduced to a lower or higher cost for a product.

Secondly, to address the possibility of strategic bias, participants were introduced to reference price comparison, in which the asking price for a toilet was compared to a product of equivalent worth (Table 2). Lastly, a combination of open-ended questions, hypothetical scenarios, as well as iterative questions was used to assess willingness to pay (Table 2). The variety and reiterative nature of the questions were designed to give the participants the opportunity to adjust their answers as needed so as to capture the true range of cost values elicited by participants.

In this willingness-to-pay portion of the survey, participants were asked if they would purchase the toilet for a set amount, starting with 4500 BOB (Bolivian Bolivianos; $636 USD in 2009) for the cement version of the superstructure and starting with 4000 BOB ($566 USD in 2009) for the wooden version of the superstructure. If the respondent replied with “yes”, the surveyor then moved on to another set of questions, but if he/she replied with “no” the same question was asked for a price of 500 BOB ($71 USD in 2009) less. To understand what portion of respondents were willing to pay for each of the differently priced toilets, any time a participant said “yes” to the higher price of a toilet type, we assumed he/ she would also be willing to pay for the lower price of the same type of toilet. For example, someone who reported willingness to pay for the wood version for 4000 BOB was

also assumed to be willing to pay for the 3500 BOB and 3000 BOB option, even though he/ she was not presented with this question.

All data were collected into a password-secured Excel database and analyzed using SAS® v.9.4 (Cary, NC). Descriptive statistics were extracted into tables and stratified by whether or not the household reported possession of a bathroom. Possession of a bathroom was not explicitly defined to participants and was therefore open to interpretation by the respondent.

To test for significant differences between households with and without a bathroom, a Chi-square test was conducted for all variables stratified by respondents with and without a bathroom. The variables tested included demographics, household assets, knowledge and attitudes about diarrhea, water characteristics, perceptions of sanitation and willingness to pay for an ecological toilet. If any of the compared cell counts was less than five, a Fisher's exact test was conducted.

Additionally, the Chi-square test of multiple comparisons was conducted to assess any association between median household income and likelihood of reporting interest in purchasing an ecological toilet. An analysis of variances, ANOVA, was conducted to determine if there was a significant difference in median income among households that reported interest in purchasing the EcoSan toilet and those that did not express interest. ANOVA was also conducted among those who already had a bathroom but reported willingness to pay for cement version of EcoSan toilets

at different prices. Separate ANOVAs were completed for those without a bathroom, and for the wooden version of EcoSan toilets among those who had a household bathroom and those who did not. A t-test was conducted to compare each price level for each type of EcoSan toilet between households that did and did not have a bathroom.

Annual income data was separated into ranked deciles, with the first decile being the poorest and ascending deciles representing greater annual income. To begin creating deciles, the range of all incomes was divided by ten. This smaller number was then added to the lowest income in the dataset to create the first decile. This method was repeated until all ten deciles had been created. To examine the impact of annual income on differences in willingness to pay, a chi-square test was conducted to test for significant differences in willingness to pay for ceramic filters between the three poorest income deciles and all other income groups. The same procedure was conducted for willingness to pay for EcoSan toilets.

RESULTS

All data were compiled from the 410 households that participated in the survey. The demographics of the study population (age, sex, marital status and highest level of education completed) are described in Table 3. Among those who responded, approximately three-quarters (75%) were cohabitating or married, and almost all were 30 years of age or older (87%). The respondents were mostly male (59%). The majority of respondents had not completed higher education, with 43% of respondents reporting their highest level of education as grade eight or lower.

Questions regarding household assets revealed that more than half (66%) had a mobile phone, and one-fourth (26%) had a landline phone (Table 4). Many could receive public messaging through a color television (83%) or a radio (61%). In regard to transportation, approximately one-third owned a bicycle (31%), more than half owned a motorcycle (59%) and a small portion owned a car (11%). A large percentage of those responding to the survey reported having had a bathroom for their household (90%). When stratified between those who did and did not have a household bathroom, households with any kind of bathroom were found to have significantly greater ownership of refrigerators ($p<0.0001$), color televisions ($p=0.0071$) and motorcycles ($p=0.0040$). Willingness to pay for ceramic filters and EcoSan toilets was also stratified by asset ownership (Figure 4 and Figure 5). For each asset, there was overall greater willingness to pay for ceramic filters than

EcoSan toilets. Certain assets were more highly correlated with greater willingness to pay: radios, color televisions, mobile phones and motorcycles.

To gain insight into how the toilets described in the survey compared to the bathrooms that households already had access to at the time, observations of household bathrooms were recorded for households that were willing to show the bathrooms to the enumerator (Table 5). About three-fourths (77%) of the observed bathrooms were outside the household, but on the property. A similar proportion (70%) of the observed bathrooms consisted of a stall and had a roof (70%). Approximately one-third (36%) of the observed bathrooms had a toilet, and about one-third (36%) also had a door. Most of the sanitary ware were made of wood (43%) or a type of glass (41%).

One purpose of this study was to gain an understanding of the knowledge and attitudes about water and sanitation in this study population. Among those with a household bathroom, a large majority (94%) of respondents stated that they considered diarrhea to be dangerous or very dangerous (Table 6). Of those who did not have a household bathroom, everyone stated that they considered diarrhea to be dangerous or very dangerous (100%). Most households without a bathroom considered their community healthy (79%), while a lower, but comparable, portion of those with a bathroom in their home felt the same (65%). Very few households with a bathroom (10%) and without a bathroom (5.2%) considered their community to be not so healthy or not healthy. There was not a significant

difference among those who did and did not have a household bathroom in how healthy they considered their community.

When asked if EcoSan helps to reduce sickness, 83% of those with a bathroom and 97% of those without a bathroom in their household believed it would reduce sickness (Table 6). About half (53%) thought eating rotten food causes diarrhea. The majority of respondents didn't think failing to cover food, not washing hands before eating, not washing hands after using the bathroom, flies or open defecation would cause diarrhea. Only 2.5% and 2.7% reported not knowing the cause of diarrhea for those with and without a bathroom in the home, respectively. There was a significantly greater portion of people without a household bathroom that believed EcoSan toilets would help reduce sickness ($p=0.017$) and a significantly lower portion of those without household bathrooms thought not covering food would cause diarrhea ($p=0.018$).

To characterize drinking water practices of this population at the time the surveys were administered, the reported frequency and method of household drinking water treatment, as well as primary sources of drinking water, were examined (Table 7). Among those without a bathroom, 49% reported never treating their water before drinking, and 23% stated they always treat their water before drinking. Among those with a bathroom in their home, 45% reported always treating their water before drinking, and 30% said they never treat their water before drinking. Differences in the reported frequency of treating drinking water

between those who did and did not have a household bathroom were found to be significant (p=0.031). In total, 227 respondents reported some type of treatment to their drinking water. The most popular types of water treatment were boiling (50% in homes with a bathroom and 53% in those without) and a type of water treatment other than those mentioned (boiling, bleach/chlorine, filter, or letting it settle) was especially popular among those without a household bathroom (100%). The only significant difference in methods of drinking water treatment between those with and without a household bathroom was for a method other than those mentioned in the survey (p-value<0.0001). Approximately one-third of respondents with a bathroom received drinking water from a piped network (32%) compared to one-fourth of those without a bathroom (28%). Many respondents also reported obtaining drinking water from rainwater in both groups (30% of those with a bathroom and 40% of those without). No significant differences among those with and without a household bathroom were observed for source of drinking water. Water sources were stratified by reported water treatment (Figure 6). Boiling water was the most common manner of water treatment reported by study participants for each of the primary water sources, with rainwater catchment being the only exception. For respondents who reported rainwater catchment as one of their primary water sources, using a fabric, ceramic, or sand filter was the most common water treatment method.

The survey also included questions about perceptions of microcredit loans in this study population (Table 8). The majority (97%) of respondents felt that having

access to the funds was positive and having the 20% required savings was fair (95%). Many reported that they were inclined to solicit the credit through microcredit schemes (79%). More than half reported viewing the requirement of a solidarity group as positive (59%), the guarantee of a solidarity group as positive (55%) and the 3.5% interest rate to be appropriate (61%). However, only 20% thought that the repayment time of seven months was sufficient.

Knowledge of, and interest in, purchasing ceramic water filters was examined (Table 9). Of the 264 respondents who reported knowing the names of specific ceramic water filters (66% of all respondents), 37% had a filter and 63% did not have a ceramic filter. Among all respondents, 33% did not have a ceramic filter. Among those who owned a filter, a little over half (59%) said they were given it during the floods that previously hit their community, a little more than one year prior to data collection. One-third (33%) said they bought their filter. For those that purchased ceramic filters, most (45%) said they spent under 100Bolivian bolivianos (BOB) ($14.14 USD), and a similar proportion (41%) said they spent 1,000-2,500BOB ($141-354). The majority (70%) said they would purchase the filter shown in the photos (Appendix B) during the survey for 200BOB ($28) if they had the money; when asked again, 82% still said they were certain they would pay the amount.

Familiarity, experience and attitudes toward EcoSan toilets were also examined and stratified between those that did and did not have a bathroom in the home (Table

10). Equal proportions of those with a bathroom (28%) and without a bathroom (28%) in the home were familiar with EcoSan toilets. Among those with a bathroom in the home and familiar with EcoSan toilets, most were familiar with them through TV or media campaigns (29%) or through word of mouth from a friend, neighbor or family member (24%). Among those without a household bathroom, they had mainly been introduced to them through government agencies or NGOs (27%) or media campaigns (27%). Very few people with or without a household bathroom had used EcoSan previously. A large portion of the respondents thought pouring material into the toilet after defecation was simple (65% with a bathroom and 88% without a bathroom). Most respondents with a bathroom at home (88%) and without a bathroom at home (97%) thought the EcoSan toilet looked aesthetically pleasing from the pictures they were shown (Appendix B). The majority of respondents, 83% with a household bathroom and 97% without a household bathroom, also thought the use of EcoSan toilets would help reduce sickness. Interest in purchasing an EcoSan toilet varied amongst the groups; 42% with a household bathroom expressed interest and 77% without a household bathroom reported interest in buying an EcoSan toilet. This was significantly different between those with and without a household bathroom (p-value<0.0001).

To better identify how the presence of a toilet influences willingness to pay for an EcoSan toilet, observations of toilet presence in the bathrooms of study households were then used to compare willingness to pay for an EcoSan toilet. Of the 110 respondents who had a toilet in the household bathroom and allowed the surveyor

to see it, 23% were willing to purchase an EcoSan toilet, whereas 56% of the 195 respondents who either did not have or did not show their household bathroom were willing to purchase an EcoSan toilet. Of the 110 with a toilet in their household bathroom (57% of household bathrooms had a toilet), 68% were willing to pay for a ceramic filter.

In order to clarify the nature of financial willingness to purchase an EcoSan toilet, we surveyed willingness to pay using three discrete prices (3000, 3500, 4000 BOB for the wood superstructure and 3500, 4000, 4500 BOB for the cement superstructure) (Table 11). Overall, 43% of households with a bathroom and 77% of households without a household bathroom were interested in buying an EcoSan toilet. Most respondents were interested in purchasing the cement version of the EcoSan toilet for 3,500 BOB (85% for those with a household bathroom and 90% for those without a household bathroom). Between both those with and without a bathroom, less interest was demonstrated in wooden superstructure EcoSan toilets (46% for wooden at 3,000 BOB) compared to cement superstructure EcoSan toilets (86% for cement at 3,500 BOB).

A chi-square analysis of the two survey types (A and B) did reveal statistically significant respondent order bias for both the cement ($p=0.0329$) and wooden ($p=0.0044$) versions of the EcoSan toilets. Of the respondents who were first asked about the cement version in Survey A, 63% indicated that they would pay 4500 BOB. In contrast, of the respondents who were first introduced to the wooden version in

Survey B, only 47% would pay the same amount. Similarly, 40% of the respondents in Survey B indicated that they would pay the maximum value (4000 BOB) for a wooden version, while only 19% of those who were introduced to the wooden version following the cement version were willing to pay the same amount.

To determine if monthly income was a factor in willingness to buy an ecological toilet, we compared annual median reported incomes of those with and without household bathrooms and at the price at which they were willing to buy an EcoSan toilet as well as if they indicated they were not interested in buying an EcoSan toilet (Table 12). An analysis of variance, ANOVA, was performed to determine if the median reported household income levels were significantly different between those interested in buying the EcoSan toilet and those that were not interested in buying an EcoSan toilet by whether or not they already had a household bathroom, but no significant difference was found between the two groups ($p=0.70$). An ANOVA was also run to compare income levels within prices at which persons indicated they would purchase each type of toilet, stratified by groups with a household bathroom or not (i.e. median incomes of those reporting willing to purchase cement for 4500, 4000 and 3500 BOB for those with a bathroom). None of these income comparisons was found to have a significant difference for each version of the superstructure and presence or not of household bathroom ($p=0.13$, $p=0.49$, $p=0.34$ and $p=0.34$ respectively). We then conducted t-tests to compare median incomes of those willing to purchase at each price level per type of toilet between groups with and without a bathroom (i.e. has bathroom and would buy

cement EcoSan toilet for 4500 BOB compared to has no bathroom and would buy cement EcoSan toilet for 4500 BOB). None of these tests showed significant differences in reported willingness to pay by median reported income and having a household bathroom. Willingness to pay for ceramic filters and EcoSan toilets was also stratified by deciles of income (Figure 7 and Figure 8). Approximately 84% of households were in the first three lowest deciles. A significant difference was found in income by deciles (p-value<0.0001). A statistically significant difference was found (p=0.004) in willingness to pay for ceramic filters between very poor households (income deciles one, two and three) and the other less poor households (all greater income deciles). When comparing these same income level groups for willingness to pay for EcoSan toilets, a significant difference was not found (p=0.17)

To identify any trends in how much households were willing to spend on EcoSan toilets by how they became familiar with EcoSan toilets, we compared the price respondents were willing to pay for wood and cement versions of EcoSan toilets with how respondents identified they were first informed of the product (Table 13). Respondents were willing to pay the most money for the wood superstructure when they became familiar with EcoSan toilets from a friend, neighbor or family member. However, there was overall greater reported willingness to pay for the wooden superstructure when they became familiar with EcoSan toilets from the floods. Respondents reported willingness to pay the most money for the cement superstructure if they became familiar with EcoSan toilets from the floods. However, a similarly high willingness to pay for the cement superstructure was

found when respondents were familiar with EcoSan toilets from a friend, family, or neighbor. These avenues of becoming familiar with EcoSan toilets led to the greatest willingness to pay for the cement superstructure in terms of money and highest response.

DISCUSSION

This study examined water and sanitation knowledge, attitudes, practices and willingness to pay for EcoSan toilets and ceramic water filters and acceptability of microfinance loans to purchase these products among low-income neighborhoods in Trinidad, Bolivia that had recently experienced severe flooding. In this study, we found that nearly all respondents had access to what they considered a bathroom, though only 60% of the observed household bathrooms included a toilet. Despite most respondents having access to a bathroom, half of all respondents reported they were interested in purchasing an EcoSan toilet. Nearly three-quarters of respondents were interested in purchasing a ceramic water filter. The results indicate that a market for microcredit for EcoSan toilets and water filters exists, although participants expressed a preference for a longer repayment period than the seven-month repayment plan with which they were presented.

Despite most respondents reporting access to a household bathroom, only 60% of those who allowed the surveyor to observe their bathroom had some type of toilet. The majority of respondents did not associate diarrhea with open defecation or a lack of handwashing, but did report thinking EcoSan toilets help reduce sickness. All respondents of households without a bathroom reported treating their drinking water with a method other than boiling, bleach, a filter, or letting it settle. We unfortunately failed to collect data on what this “other” method may have been.

Despite the expectation of higher income households being more willing to pay for filters and toilets, a higher proportion of low-income households were willing to pay for the filters and EcoSan toilets compared to the proportion of higher income households. This finding is contrary to previously published literature where household income had a positive correlation with willingness to pay [41]. Interestingly, this difference in proportions was only significant for ceramic filters. Because no significant difference between willingness to pay for EcoSan toilets by income group was found, if microcredit loans are offered for EcoSan toilets in the future, the microfinance institution will not need to target a specific sub-population. However, reported incomes, especially the poorest income groups, combined with asset ownership, were not sufficient to pay for the ecological toilets presented. Previous studies have also found that households are unlikely to use the good if the price exceeds the household's perceived level of affordability [34]. While microcredit would make these goods attainable, repayment would be very difficult for this study population, according to the reported annual income; the cost of these EcoSan toilets exceeds the median annual income of the study households and the filters are worth approximately 10% of the median annual income. However, unlike previous literature that found respondents in rural Bolivia were not willing to pay the full amount for filters [18], participants in our study overwhelmingly responded with willingness to pay for the entire amount.

Many respondents in this study chose not to report their household income, and those who did may have unintentionally not provided it accurately; poor

populations of low-income countries often experience changing sources of income [48]. For this reason, assets are an important variable to investigate when estimating willingness to pay in low-income countries, as income data are difficult to collect because these populations have more informal economic activities and are more likely to be self-employed [48]. Using assets as a proxy for living standards has the benefit of only requiring data that can be collected quickly and easily [48]. An asset index is appropriate for this study, according to the published literature, because willingness to pay for a filter or toilet is not related to the resources a household had available to them at the time [46].

Not surprisingly, significant differences in household assets between households with and without bathrooms were observed for more expensive assets such as color televisions, refrigerators and motorcycles. This implies that households with a bathroom may have greater wealth, as assets are a proxy for income in determining the wealth of a household [49]. Since the same four assets (radios, color televisions, mobile phones, and motorcycles) were correlated with greater willingness to pay for EcoSan toilets and ceramic filters, these assets may be good indicators of willingness to pay.

The low rate of household bathrooms with a toilet (60%) suggests that maybe most of these bathrooms were used for bathing. Not all households that participated in the survey allowed the surveyor to observe their bathroom; in fact, only 50% of those with a bathroom showed it to the surveyor. Studies of household bathrooms

in Ghana have shown that there are more household bathrooms with bathing facilities than sanitation facilities [50].

The low level of understanding for causes of diarrhea found in this study population, was expected and supports other literature demonstrating that Bolivians residing in peri-urban areas do not possess knowledge of proper hand hygiene, likely due to a lack of hygiene education [11]. However, it was especially surprising to find that many of the households believed that EcoSan toilets had the ability to reduce diarrhea. The high proportion of those who believed EcoSan toilets could reduce diarrhea may have contributed to greater stated willingness to pay for EcoSan toilets.

Because the majority of respondents reported their household was given their water filter during the floods, it may pose an issue for willingness to pay for an EcoSan toilet and/or ceramic filter. Some respondents were quoted during their survey as saying that they would rather be given the toilet than be given a microcredit loan to purchase the toilet. This attitude of waiting until aid is provided is something both Pro Mujer and the Sumaj Huasi Foundation must take into consideration. Nonetheless, these organizations considered “success” for willingness to pay to be 20% of respondents, and for both the ceramic filter and EcoSan toilet there was far greater willingness to pay than 20%, along with interest in using microcredit (Renata Neri, personal communication, 2015).

The willingness to utilize microcredit for water and sanitation products found in this study supports the results of previous studies that examined interest in using microcredit for water and sanitation services, where, for example, respondents in Hyderabad had a demonstrated interest in using microcredit for increased water supply and improved sanitation infrastructure [28]. This study presented results indicating there was no consensus among study participants in regard to the formation of solidarity groups as a requirement for using a microcredit loan. Some respondents' distrust in their neighbors to repay their loans is not a new finding in the published literature. Other studies have found that microcredit borrowers experience mental stress due to social control mechanisms for loan recoveries [27].

A major strength of our study is the large number of observations it includes. There were 410 households surveyed in the peri-urban areas of Trinidad, Bolivia in 32 municipal districts. Additionally, this study utilized the most common method of assessing willingness to pay, contingent valuation [37]. Contingent valuation was used to its maximum potential by eliciting responses to a fixed charge rather than a unit price [33]. Some previous literature has critiqued contingent valuation for its failure to accurately predict behavior [33]. Despite the critique, using contingent valuation to assess willingness to pay has been determined to be valid and useful, especially in scenarios without a rival product [37]. It is important to note, that though contingent valuation is in the form of a set of hypothetical questions, if the product is later offered to study participants, they should be offered the same product rather than a variation of the one mentioned in the survey.

Unfortunately, the validity and lack of certain data makes some outcomes appear unreliable. Approximately 59% of the income data were missing, and the income data that was provided was self-reported and provided from memory. Many of the jobs the adults of the households rely on for their income have seasonal or unpredictable income, and income was unlikely to be recorded through formal bank services or direct deposit forms.

In addition to the unreliable and missing income data, a chi-square test for order bias was significant. For both types of superstructures of EcoSan toilets, there was greater willingness to pay reported for the superstructure that was presented first. Therefore, being presented the wood or cement version of the superstructure first resulted in different outcomes in willingness to pay. Testing for order bias strengthens the study design, though it implies in this study that willingness-to-pay results may lack a degree of reliability. This data is important to collect and have because it provides a general idea of willingness to pay within the study population, however, the order bias reiterates that by no means are our results exact.

To ensure that consumers purchase at the same rate of stated willingness to pay, marketing should target modes of familiarity that have resulted in reported willingness to pay. For both wood and cement superstructures, hearing about EcoSan toilets from a friend, neighbor, or family member or through the floods yielded the highest rate of willingness to pay. Although the floods are not an avenue

that can be repeated for marketing, word of mouth did demonstrate success in encouraging households to report willingness to pay in this study. To encourage further communication surrounding EcoSan toilets between people in the study population, more people must be informed of EcoSan toilet.

By furnishing the preliminary results to a local NGO and microfinance institution, this study represented an initial step toward influencing policy and addressing nationwide disparities in sanitation in Bolivia.

CONCLUSION

The overall goal of this study was to provide information for Pro Mujer Bolivia and the Sumaj Huasi Foundation to support activities aimed at improving access to basic sanitation and treated drinking water in the peri-urban municipal districts of Trinidad, Bolivia. This study presents thorough analysis of self-reported willingness to buy ceramic water filters and EcoSan toilets.

While additional questions would have been useful in the survey tool, this study was able to capture a large amount of data on a relatively large sample size to measure willingness to pay for water treatment and sanitation products. It was able to capture the attitudes and perceptions of the people of Trinidad, Bolivia about ceramic water filters and EcoSan toilets and showed that (using the organization's definition of 20%=success rate) households with and without bathrooms are willing to purchase ecological toilets and ceramic water filters (Renata Neri, personal communication, 2015). Overall, the more expensive EcoSan toilet with the cement superstructure was preferred to the cheaper, wooden superstructure.

LESSONS LEARNED

- Households are hesitant to provide information regarding their income
- Income data at the household level in low-resource countries is unreliable
- Observational data regarding bathrooms should be collected whenever possible by the enumerators
- Clear definitions should be used in the survey tool so respondents can answer appropriately. For example, when asking if participants have a bathroom, what constitutes a bathroom should have been stated.
- Investigators should have a clear idea of what they want to measure during the study design phase to provide a dataset that is narrow in scope but more complete. In this instance, respondents should have been asked if they had a toilet or not rather than if they had a bathroom or not.

RECOMMENDATIONS

In addition to providing microcredit loans to this community to purchase ceramic filters and EcoSan toilets, organizations that work in the area should consider offering hygiene education to schools to reach populations that are most vulnerable to diarrheal disease.

This study could have benefited from more complete data, especially in regard to income and observations of household bathrooms. Questions should have been asked regarding knowledge of and experience with microcredit and/or banks to understand the respondents' financial competency and be able to assess how that may factor into their willingness to utilize microcredit loans offered to them by local organizations. An interesting variable to consider in future research would be a dichotomous outcome for diarrhea and respiratory infections to link problematic health experiences with willingness to purchase water and sanitation technologies. Research in the future should focus on measuring contingent valuation by repeat measures in a geographic area to assist in forming policy and providing accurate pricing of water treatment and sanitation products.

Since many household bathrooms did not have a toilet, additional analyses could be done to compare all results between households with and without a toilet, rather than households with and without a bathroom. However, this would require greater success in obtaining observational data of household bathrooms than this study was

able to attain. A principal component analysis would also benefit this study [48], to further investigate the wealth of the study population via the assets they reported owning. Different types of asset indices can be made by making certain goods of greater weight, and should be considered, but principal component analysis is among the most common methods and The World Bank's method of choice [49].

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FIGURES

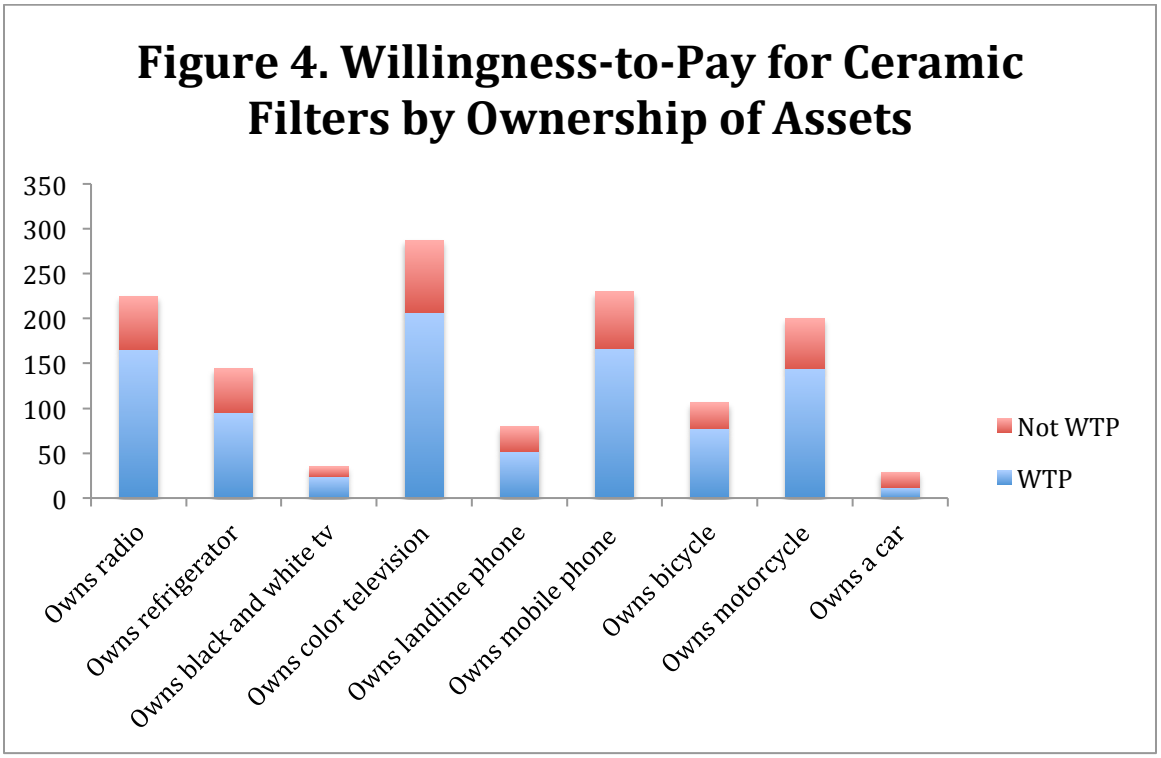


Figure 4. Willingness-to-Pay for Ceramic Filters by Ownership of Assets
350
300
250
200
150
100
50
0
Owns radio
Owns refrigerator
Owns black and white tv
Owns color television
Owns landline phone
Owns mobile phone
Owns bicycle
Owns motorcycle
Owns a car
Not WTP
WTP

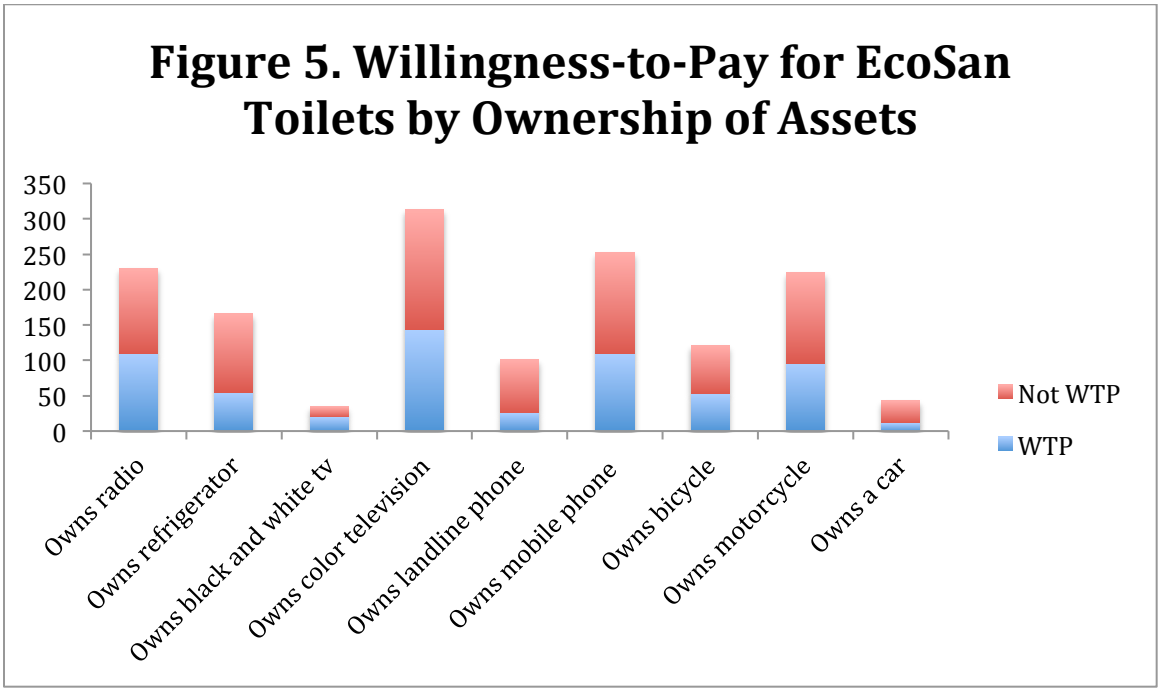


Figure 5. Willingness-to-Pay for EcoSan Toilets by Ownership of Assets
350
300
250
200
150
100
50
0
Owns radio
Owns refrigerator
Owns black and white tv
Owns color television
Owns landline phone
Owns mobile phone
Owns bicycle
Owns motorcycle
Owns a car
Not WTP
WTP

Figure 6. Reported Water Treatment Stratified by Water Source

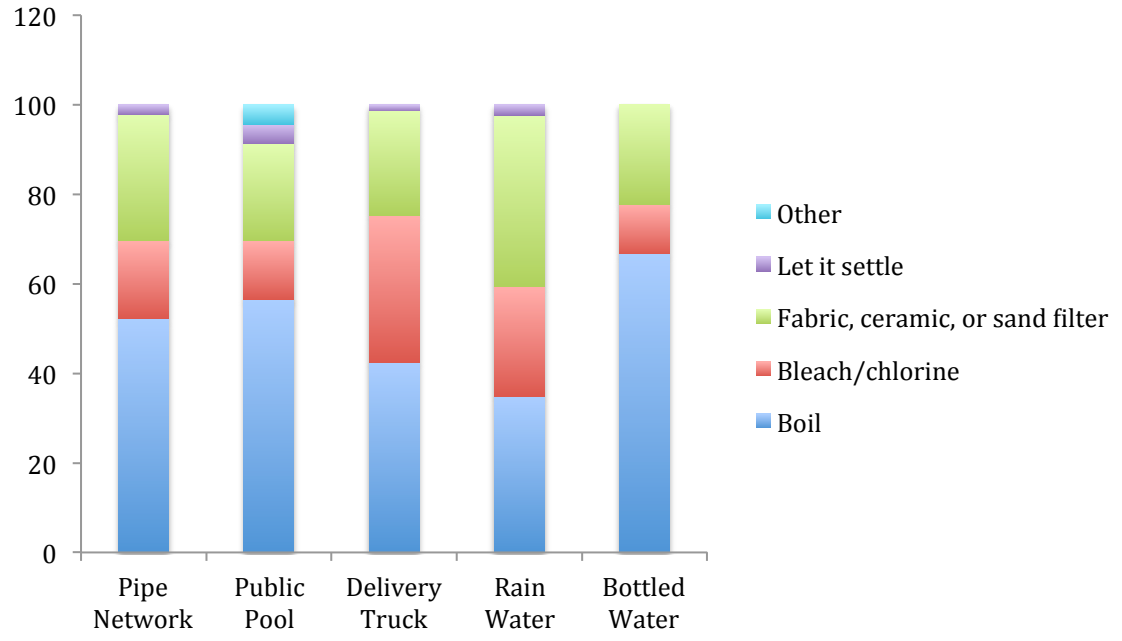
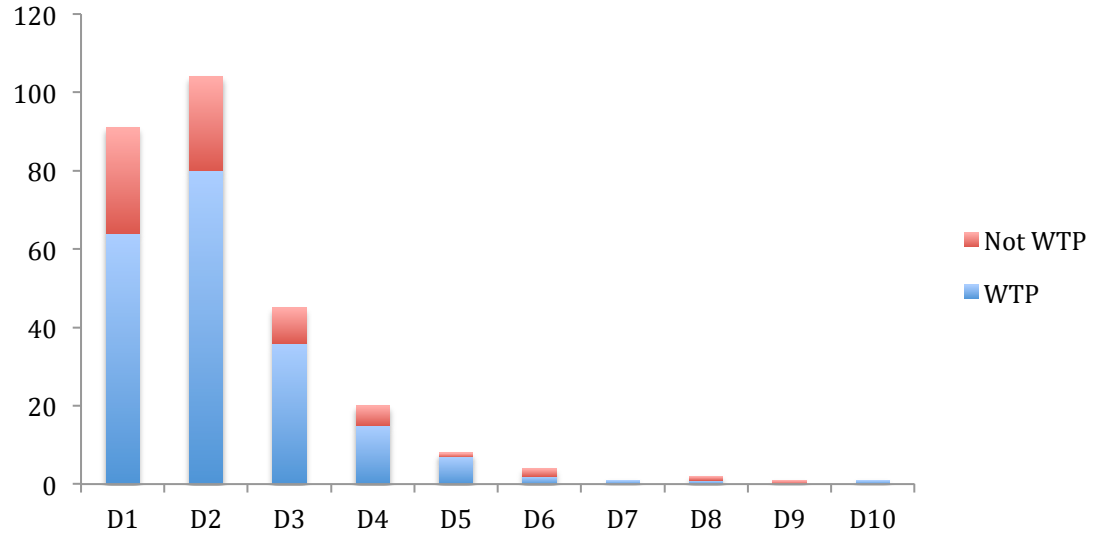


Figure 7. Willingness to Pay for a Ceramic Filter by Income Deciles



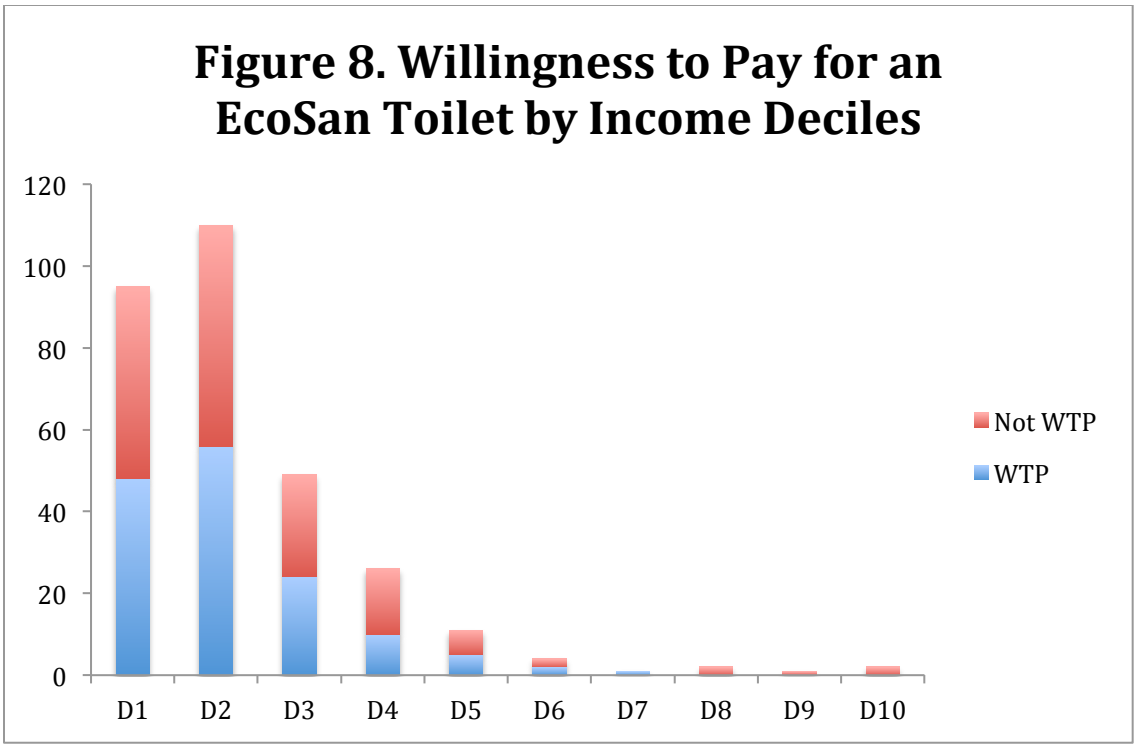


Figure 8. Willingness to Pay for an EcoSan Toilet by Income Deciles
120
100
80
60
40
20
0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
Not WTP
WTP

TABLES

Table 1. Question order differences regarding latrine types

Sample Question	Version A	Version B
#18	Would you be disposed to pay 4,000 BOB[1] for the CEMENT bathroom?	Would you be disposed to pay 3,500 BOB[1] for the WOOD bathroom?
#26	Would you be disposed to pay 3,500 BOB[1] for the WOOD bathroom?	Would you be disposed to pay 4,000 BOB[1] for the CEMENT bathroom?

[1]BOB= Bolivian Bolivianos ($0.14 USD in 2009)
4,000 BOB= $566
3,500 BOB= $495

Table 2. Types of willingness to pay questions in survey instrument

Question Type	Sample Question	Answer Options
Open-ended	How much would you be willing to pay for this [collection and cleaning service] monthly?	_____BOB[1]
Hypothetical	Supposing that YOU HAVE the necessary money RIGHT NOW to pay for the CEMENT bathroom… Would you be disposed to pay 4,500 BOB[1]? Consider tha the price includes materials and labor for 7-10 workdays.	Yes No N/A Don't know
Set Answers	Was your experience of using the ecological toilet very good, good, regular, bad, or very bad?	Very good Good Regular Bad Very bad
Price Comparison	Let me mention to you some references… With… (the price of their preferred bathroom): -- 4,500 BOB[1]- you can buy a lot of land --4,000 BOB[1]- you can buy a used motorcycle --3,500 BOB[1]- you can buy a gas kitchen Are you disposed to use the ____ BOB[1] that could otherwise be used to ____(reference) to pay for the construction of the cement/wood bathroom?	Yes No N/A Don't know
Iterative	Are you absolutely sure that you would pay ___BOB[1] (max willing to pay) for the WOOD bathroom?	Yes No N/A Don't know

[1]BOB= Bolivian Bolivianos ($0.14 USD in 2009)

Table 3. Characteristics of head of household interviewed, Trinidad, Bolivia, 2009

	% (Frequency)			
	Has Bathroom[1]	No Bathroom	Totals	p-value[2]
Marital Status of respondent				
Single	14 (49/362)	8.3 (3/36)	13 (53/402)	0.11
Married	37 (134/362)	22 (8/36)	36 (143/402)	
Cohabitating	37 (135/362)	61 (22/36)	39 (158/402)	
Divorced	1.4 (5/362)	2.8 (1/36)	1.5 (6/402)	
Separated	4.1 (15/362)	2.8 (1/36)	4.0 (16/402)	
Widowed	6.6 (24/362)	2.8 (1/36)	6.5 (26/402)	
Education level of respondent				
Grade 8 or less	43 (133/310)	32 (11/34)	43 (148/348)	0.0062
Grade 9-12	35 (110/310)	62 (21/34)	38 (131/348)	
University and/or grad school	22 (67/310)	5.9 (2/34)	20 (69/348)	
Sex of respondent				
Male	57 (205/357)	75 (27/36)	59 (232/396)	0.041
Female	43 (152/357)	25 (9/36)	41 (164/396)	
Age of respondent (years)				
17-29	13 (40/320)	26 (9/34)	14 (49/358)	0.026
30-59	73 (235/320)	71 (24/34)	73 (262/358)	
60-80	14 (45/320)	3 (1/34)	13 (47/358)	

[1]Not all questions were answered by all participants

[2]P-values calculated using Pearson's chi-square test, with Fisher's Exact Test when counts were less than five, to compare all responses for each category

Table 4. Assets of surveyed households in Trinidad, Bolivia, 2009

	% (Frequency)			
	Has Bathroom	No Bathroom	p-value[1]	Total
Household assets				
Owns radio	62 (220/357)	55 (21/38)	0.56	61 (243/397)
Owns refrigerator	46 (166/357)	13 (5/38)	<0.0001	43 (172/397)
Owns black and white tv	10 (34/357)	13 (5/38)	0.67	9.8 (39/397)
Owns color television	85 (302/357)	66 (25/38)	0.0071	83 (328/397)
Owns landline phone	27 (97/358)	18 (7/39)	0.29	26 (104/398)
Owns mobile phone	68 (242/357)	51 (20/39)	0.059	66 (263/398)
Owns bicycle	32 (116/357)	18 (7/39)	0.093	31 (124/398)
Owns motorcycle	61(218/356)	36 (14/39)	0.0040	59 (233/397)
Owns a car	12 (42/356)	5.1 (2/39)	0.29	11 (44/397)

[1]P-values were calculated using Pearson's chi-squared test, with Fisher's Exact Test when counts were less than five, to compare for significant differences between households with and without a bathroom for each asset

Table 5. Observed characteristics of household bathrooms in study areas, Trinidad, Bolivia, 2009

	% (Frequency)
Interested in buying EcoSan	50 (182/387)
Has a bathroom and showed it	50 (194/385)
Where is the bathroom?	
Inside the house	23 (43/188)
Outside the house, on the lot	77 (144/188)
Outside the house's lot	0.53 (1/188)
What components does the bathroom or latrine have?	
Stall	70 (135/194)
Door	58 (112/194)
Stairs	2.6 (5/194)
Roof	70 (135/194)
Toilet	57 (110/194)
Toilet with tank	4.1 (8/194)
Urinal	1.0 (2/194)
Lavatory pan	0.52 (1/194)
Slab with hole	5.2 (10/194)
Hole only	6.7 (13/194)
If it has a sanitary apparatus, what type does it have?	
Toilet/seat	98 (169/172)
Slab with hole	1.7 (3/172)
What material is the sanitary apparatus made of?	
Concrete	1.3 (2/155)
Fiber-cement	5.2 (8/155)
Glass slab	41 (64/155)
Fiberglass	9.7 (15/155)
Wood	43 (66/155)

Table 6. Knowledge and attitudes about hygiene, sanitation and diarrhea, in study households, Trinidad, Bolivia, 2009

	%(Frequency)		
	Has Bathroom	**No Bathroom**	**p-value[1]**
Consider diarrhea:			
very dangerous	27 (97/354)	29 (11/37)	1.0
dangerous	67 (236/354)	70 (26/37)	
more or less dangerous	2.3 (8/354)	-	
little dangerous	2.3 (8/354)	-	
not dangerous	1.1 (4/354)	-	
Doesn't Know	0.28 (1/354)	-	
Considers community:			
very healthy	2.5 (9/355)	5.3 (2/38)	0.23
healthy	65 (231/355)	79 (30/38)	
more or less healthy	22 (78/355)	11 (4/38)	
not so healthy	8.2 (29/355)	2.6 (1/38)	
not healthy	2.0 (7/355)	2.6 (1/38)	
doesn't know	0.28 (1/355)	-	
Thinks EcoSan helps reduce sickness	83 (294/354)	97 (37/38)	0.017
Thinks water not boiled causes diarrhea	46 (165/359)	61 (23/38)	0.12
Thinks eating rotten food causes diarrhea	52 (186/358)	66 (25/38)	0.15
Thinks not covering food causes diarrhea	17 (61/358)	2.6 (1/38)	0.018
Thinks not washing hands before eating causes diarrhea	14 (50/359)	7.89 (3/38)	0.45
Thinks not washing hands after using the bathroom causes diarrhea	9.2 (33/359)	11 (4/38)	0.77
Thinks flies cause diarrhea	6.3 (22/359)	7.9 (3/38)	0.72
Thinks open defecation causes diarrhea	3.3 (12/359)	5.3 (2/38)	0.63
Thinks other things cause diarrhea	15 (52/358)	11 (4/38)	0.63
Doesn't know what causes diarrhea	2.5 (9/359)	2.7 (1/37)	1.0

[1]P-values calculated using Pearson's chi-square test, with Fisher's Exact Test when counts were less than five, to compare all responses for each category

Table 7. Reported water sources and treatment practices among surveyed households, Trinidad, Bolivia, 2009

	% (Frequency)		
	Has Bathroom	**No Bathroom**	**p-value[1]**
Water treated before drinking			
always	45 (155/345)	23 (8/35)	0.031
usually	4.1 (14/345)	0 (0/35)	
sometimes	9.6 (33/345)	20.0 (7/35)	
rarely	2.3 (8/345)	5.7 (2/35)	
never	30 (105/345)	49 (17/35)	
doesn't know	0.58 (2/345)	0 (0/35)	
Of 227 who reported some type of water treatment, method to treat:			
boil	50 (104/210)	53 (9/17)	0.98
bleach/chlorine	29 (60/210)	12 (2/17)	0.17
fabric, ceramic, or sand filter	23 (49/210)	29 (5/17)	0.79
let it settle	1.4 (3/210)	0 (0/17)	1.0
other	0.48 (1/210)	100 (17/17)	<0.0001
Receives drinking water from:			
piped network	32 (117/363)	28 (11/39)	0.61
public pool	13 (47/363)	10 (4/39)	0.80
delivery truck	26 (95/364)	18 (7/40)	0.23
rain water	30 (109/364)	40 (16/40)	0.19
bottled water	10 (38/364)	7.5 (3/40)	0.56

[1]P-values calculated using Pearson's chi-square test, with Fisher's Exact Test when counts were less than five, to compare all responses for each category

Table 8. Opinions of microcredit among surveyed households, Trinidad, Bolivia, 2009

	% (Frequency)
Is disposed to solicit this credit	79 (122/155)
Thinks that having access to the solicited amount is positive	97 (142/147)
Thinks the requirement to form a Solidarity group seems positive	59 (85/144)
Thinks the guarantee that is among the members of the Solidarity group seems positive	55 (80/145)
Thinks the 20% required savings seems positive	95 (138/145)
Considers the interest rate to be appropriate	61 (86/142)
Thinks the repayment time is sufficient	20 (30/147)

Table 9. Ceramic filter attitudes among surveyed households, Trinidad, Bolivia, 2009

	%(Frequency)
Knows specific ceramic filters?	
Yes and has exact same one	19 (75/403)
Yes but has another model	5.5 (22/403)
No but has another model	1.5 (6/403)
Yes but doesn't have a filter	41 (167/403)
No and don't have a filter	32 (127/403)
Of those who own filter: How did you obtain the filter?	
Given to us during floods	59 (56/95)
It was bought	33 (31/95)
Other	7.4 (7/95)
Among those who bought a filter: How much did you pay for the filter?	
1-100 BOB	45 (10/22)
101-999 BOB	14 (3/22)
1,000-2,500 BOB	41 (9/22)
This filter costs BOB 200. If you had the money, would you buy one right now?	
Yes	70 (253/360)
No	30 (107/360)
Are you sure you would pay 200?	
Yes	82 (208/253)
No	18 (45/253)

[1]BOB= Bolivian Bolivianos ($0.14 USD in 2009)

Table 10. Perception of ecological toilets among surveyed households in Trinidad, Bolivia, 2009

	% (Frequency)		
	Has Bathroom	No Bathroom	p-value[1]
Is familiar with eco toilets	28 (101/362)	28 (11/39)	0.98
Among those familiar, how are they familiar?			
TV or media campaign	29 (29/101)	27 (3/11)	1.0
Friend, neighbor, or family member	24 (24/101)	18 (2/11)	1.0
Govt agency or NGO	3.0 (3/101)	27 (3/11)	0.012
Other	15 (15/101)	0 (0/11)	0.62
Has used EcoSan in the past	6.7 (24/357)	18 (7/39)	0.036
Thinks pouring dirt/ ash/ limestone in toilet after each defecation is simple	65 (233/359)	88 (35/40)	0.0057
Thinks emptying containers for feces and urine is simple	46 (165/358)	74 (29/39)	0.0012
Thinks eco toilet is adequate for children	59 (210/354)	89 (33/37)	0.0002
Thinks the shown eco toilet pictures are aesthetically pleasing	88 (310/354)	97 (37/38)	0.094
Thinks the use of eco toilets helps reduce sickness	83 (294/354)	97 (37/38)	0.036
Is interested in buying EcoSan	42 (150/357)	77 (30/39)	<0.0001

[1]P-values calculated using Pearson's chi-square test, with Fisher's Exact Test when counts were less than five, to compare all responses for each category

Table 11. Households reporting willingness to pay for an EcoSan toilet

	%(Frequency)		
	Has Bathroom	No Bathroom	p-value[1]
Are you interested in buying an EcoSan toilet?			
No	57 (196/346)	23 (9/39)	< 0.0001
Yes	43 (150/346)	77 (30/39)	
Cement superstructure			
Would buy cement for 4500 BOB[2]	54 (81/150)	47 (14/30)	0.55
Would buy cement for 4000 BOB[3]	67 (100/150)	53 (16/30)	0.21
Would buy cement for 3500 BOB[4]	85 (127/150)	90 (27/30)	0.58
Wood superstructure			
Would buy wood for 4000 BOB[3]	27 (41/150)	23 (7/30)	0.82
Would buy wood for 3500 BOB[4]	35 (52/150)	23 (7/30)	0.29
Would buy wood for 3000 BOB[5]	42 (63/150)	40 (12/30)	1.0

[1]P-values calculated using Pearson's chi-square test, with Fisher's Exact Test when counts were less than five, to compare all responses for each category
[2]4,500 BOB= $637
[3]4,000 BOB= $565
[4]3,500 BOB= $495
[5]3,000 BOB= $425

Table 12. Median reported incomes of households reporting willingness to pay for an EcoSan toilet, Trinidad, Bolivia, 2009

	Has Bathroom			No Bathroom			
	Median Reported Income (Range[1]) in BOB[2]	# Income Respondents[3]	p-value[4]	Median Reported Income (Range[1]) in BOB[2]	# Income Respondents[3]	p-value[4]	p-value[5]
Are you interested in buying an EcoSan toilet?							
No	2500 (600-7500)	149/196	0.70	2500 (1000-22500)	7/9	0.70	0.43
Yes	2275 (700-7220)	118/150		2008 (330-8306)	28/30		0.75
Cement							
Would buy cement for 4500 BOB[2]	2400 (800-6550)	61/81		1900 (1200-7300)	13/14		0.46
Would buy cement for 4000 BOB[2]	2238 (750-5500)	18/19	0.13	1890 (1680-2100)	2/2	0.34	0.46
Would buy cement for 3500 BOB[2]	1890 (800-5370)	25/27		2658 (330-9100)	10/11		0.39
Wood							
Would buy wood for 4000 BOB[2]	2200 (600-6550)	35/41		2758 (1200-3300)	6/7		0.75
Would buy wood for 3500 BOB[2]	1925 (1300-7290)	10/11	0.49	-	-	0.34	-
Would buy wood for 3000 BOB[2]	3000 (750-6300)	11/11		700 (300-8306)	5/5		0.7

[1]range is 5-95%

[2]BOB= Bolivian Bolivianos ($0.14 USD in 2009)

700 BOB= $99; 1890 BOB= $267; 2758 BOB= $390

3,000 BOB= $425; 3,500 BOB= $495; 4,000 BOB= $565; 4,500 BOB= $637

[3]not all respondents who said yes to interested in buying EcoSan also provided their income

[4]P-value calculated using Analysis of Variance (ANOVA) to compare all median reported incomes for each version of the toilet by bathroom presence

[5]P-value calculated using t-test to compare median reported income between households with and without bathroom

Table 13. Impact of mode of familiarity on price willing to pay for an ecological toilet

	EcoSan Toilet					
	Wood Superstructure			Cement Superstructure		
	3000 BOB[1]	3500 BOB[2]	4000 BOB[3]	3500 BOB[2]	4000 BOB[3]	4500 BOB[4]
Among those familiar, how are they familiar?						
TV or media campaign	4	2	2	8	7	6
Friend, neighbor, or family member	5	5	5	10	9	6
Govt agency or NGO	1	1	1	2	1	1
Floods	6	5	3	11	8	7
Other	1	1	0	4	3	3

[1]3,000 BOB= $425

[2]3,500 BOB= $495

[3]4,000 BOB= $565

[4]4,500 BOB= $637

Numbers indicate how many households reported willingness to purchase toilet at each price by how they first heard of ecological toilets and accumulate as price decreases

APPENDIX A

Dear Ms. McDavid,

Thank you for requesting a determination from the IRB. Based on our review of the materials that yo have submitted, we have determined that your proposed project "Knowledge, Attitudes and Willingness to Pay for EcoSan Latrines and Ceramic Water Filters in Trinidad, Bolivia" does not require IRB review as it does not meet the definition of "research" with "human subjects" as set forth Emory policies and procedures and federal rules, if applicable. You propose to undertake a seconda data analysis of survey data that was collected in 2009, pertaining to gaining an insight into knowledg and attitudes toward EcoSan latrines, ceramic water filters and microcredit loans in Trinidad, Bolivia. Specifically, the aims of this undertaking are to understand the knowledge and attitudes that contribute towards households' willingness to purchase EcoSan latrines and ceramic water filters. Y have confirmed that the data that will be used for this undertaking does not have any of the 18 HIPA identifiers present in the dataset, and names of geographic locations will not be included in the dataset. In addition, you have affirmed that while Christine Moe and Andrew Wang will know who the survey participants were, you will be the only person who will be working directly with the dataset tha is owned by the Center for Global Safe Water. There will be no interaction with any subjects, nor will there be any attempt to contact any of the respondents.

Please note that this determination does not mean that you cannot publish the results. This determination could be affected by substantive changes in the study design, subject populations, or identifiability of data. If the project changes in any substantive way, please contact our office for clarification.

Thank you for consulting the IRB.

Jennifer Truell, MA

IRB Analyst Assistant

APPENDIX B

Cement EcoSan Toilet

Wooden EcoSan Toilet

EMORY ROLLINS SCHOOL OF PUBLIC HEALTH

FUNDACION SH SUMAJ HUASI

HOUSEHOLD SURVEY

Center for Global Safe Water, Sumaj Huasi Foundation

Household Code: _____

Department: _____

Province: _____

Municipality/District: _____

Community: _____

Street Corner: _____

House number: _____

Names and last names of the boss of the family:

Name of the interviewer: _____

Date: _____ of _____ of 2009

Start time (00:00 - 24:00): _____

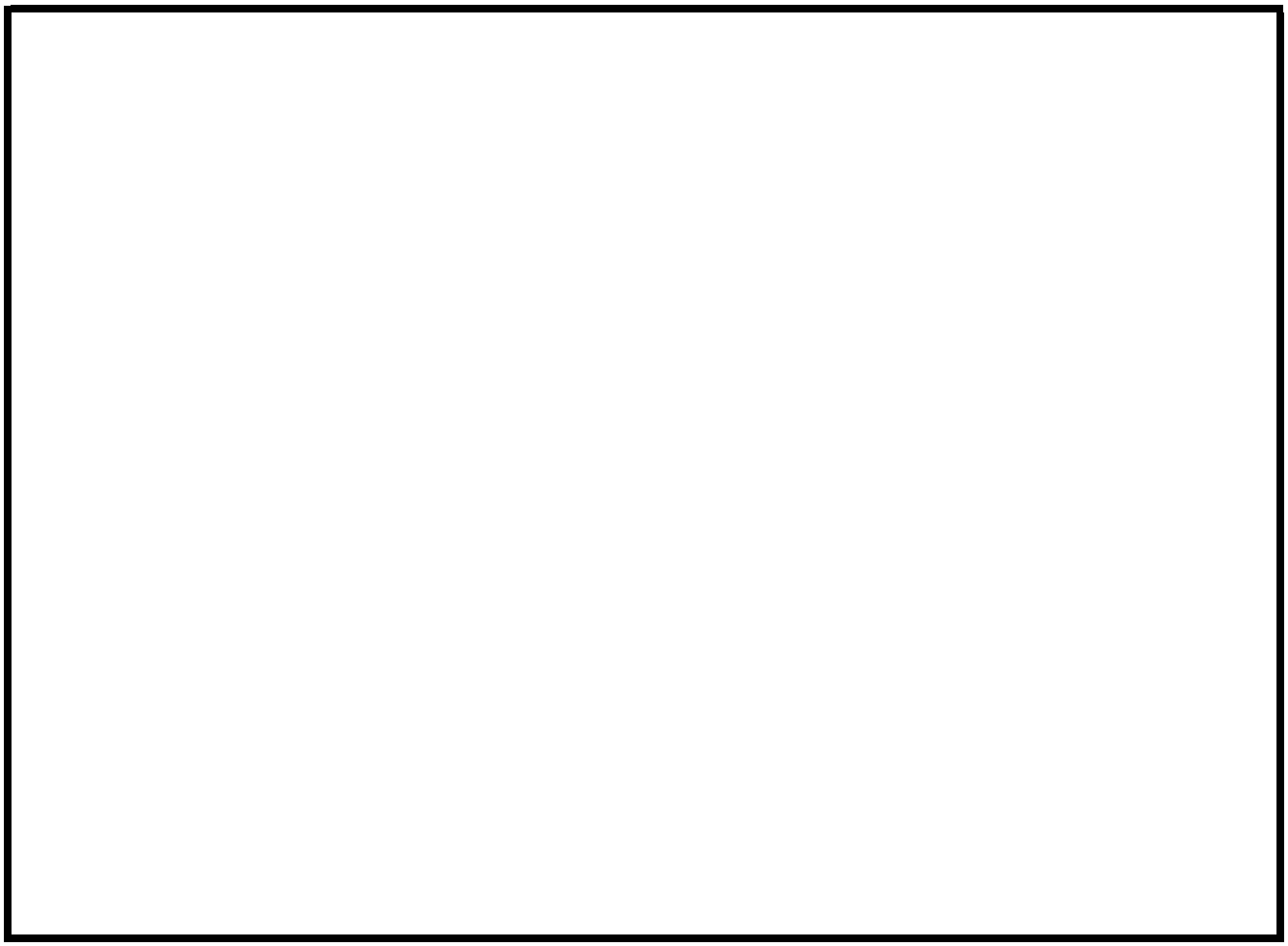
End time (00:00 - 24:00): _____

Beginning

I1	Is your family responsible to pay for the home improvements on your house?	Yes No - End of the interview	1 2	

SKETCH

DRAW THE LOCATION OF THE INTERVIEWEE'S HOUSE
(Detail streets and lots)



Census

Code	Paternal Last Name	Maternal Last Name	Names	Date of Birth			Age	Sex	Place of Birth	Marital Status	Relationship with the boss of the family	Education	Ethnicity / Native Language
				day	mo	yr	years	1-M 2-F	1-Beni 2-Chuq. 3-Cocha. 4-La Paz 5-Oruro 6-Pando 7-Potosi 8-S. Cruz 9-Tarija	1-Single 2-Married 3-Cohabitating 4-Divorced 5-Separated 6-Widowed	1-Boss 2-Child 3-Spouse 4-Sibling 5-Aunt/Uncle 6-Niece/Nephew 7-Parents 8-Cousin 9-Grandchild 10-Step-parents 11-In laws 12-Others	00-00 None 01-08 Primary 09-12 Secondary 13-17 University 18+ Grad school 64 Pre-school	1- Aymara 2- Castellano (Spanish) 3- Chiquitano 4- Guaraní 5- Mestizo (Spanish) 6- Quechua -88 Others -99 Don't know
A													
B													
C													
D													
E													
F													
G													
H													
I													
J													
K													
L													
M													
N													
O													

Labor

Code	Descibe the principal work performed in the last month	Work Code	Receive Income (1-Yes 2-No)	Frequency of Income (1-Daily 2-Weekly 3-bi-weekly 4-Monthly 5-By contract -88-Others)	Quantity	Perform other activity that generates income (1-Yes 2-No)	Describe the other work that generates income	Work Code	Receive Income (1-Yes 2-No)	Frequency of income (1-Daily 2-Weekly 3-bi-weekly 4-Monthly 5-By contract -88-Others)	Quantity
A											
B											
C											
D											
E											
F											
G											
H											
I											
J											
K											
L											
M											
N											
O											

***Work Codes:**

1-Farmer	5-brick mason	12-home-maker	16 - Secretary
2-Peddler	9-taxi driver	13-unemployed	17- Rent money
3-Small business person	10-student	14-retured	-96 - Others
4-domestic worker	11-minor/under age	15-military service	

Water Treatment				
A1	What is the principal source of water to drink and cook in the house? **(E: Multiple Options)**	Pipe network Public pool Delivery Truck Water well with pump (manual or electric) without pump (with a bucket) Perforated well (with manual or electric pump) Spring/waterfall protected waterfall (concrete chamber) unprotected waterfall Collection of rain water Neighor's house with a connection to pipe network River, lake, canal, etc. Bottled water Other (specify) _____ Don't know	A B C D E F G H I J K L X Z	==> A4
A2	Is water treated before drinking? Yes => How frequently is the water treated before drinking: always, usually, sometimes rarely, or never?	Always Usually Sometimes Rarely Never N/A Don't know	1 2 3 4 5 -96 -99	==> A4 ==> A4 ==> A4
A3	Which of these methods do you use to treat the water to drink?	Boil it Add bleach/clorine Fabric filter Water filter (of ceramic or sand) Solar/UV radiation Let it settle Others _____ N/A Don't know	A B C D E F X Y Z	
A4	Do you know the ceramic filters?	Yes, I have one exactly the same as the one described Yes, but I have another model of filter No, but I have another model of filter No, but I don't have a filter No, and I don't have a filter Don't know	1 2 3 4 5 -99	===> A7 ===> A7 ===> A7
A5	How did you obtain this model of filter?	Given to us during the floods It was bought Other (specify) _____ N/A Don't know	1 2 -88 -96 -99	===> A7
A6	How much did you pay for this filter?	Approx. amount _____ Bs N/A Don't know	 -96 -99	===> S1

DESCRIPTION OF CERAMIC FILTERS

The filter that you observe in the photograph (show photo #1) consists of two plastic containers and two ceramic filters in charge of filtering the water. This filter should be located on a horizontal surface, protected from the sun.

For its use, you should fill the top container with water and leave it to filter for some time; the filtering process is quicker if the top container is full, the filters clean, and the water previously settled. The filtered water is collected in the bottom container and can be served via the incorporated spout.

Every month you should clean the ceramic filters with a cloth, being careful that you don't break it. You shouldn't use detergent or soap. The ceramic filters should be replaced every year.

Now I would like to know if you have any question about the design, function, and/or maintenance of the filters.

A7	The filter that I have described costs Bs. 200. Supposing that YOU HAVE Bs. 200 to buy the filter RIGHT NOW…would you buy one right now?	Yes No N/A Don't know	1 2 -96 -99	 S1 S1
A8	Are you sure that you would pay Bs. 200 for the filter?	Yes No N/A Don't know	1 2 -96 -99	

Household Sanitation

S1	Does your house have a bathroom?	Yes No	1 2	===> S4
S2	**(E: Only for those who do NOT have a bathroom)** Where do you all do your business?	Open air Bathroom shared with another house Public bathroom Stream/hose **(Ask: if uses stream/hose, investigate)** ¿Where do you discharge it? Others (Specify) _____ N/A Don't know	1 2 3 4 -88 -96 -99	
S3	**(E: Only for thse who do NOT have a bathroom)** How much time do you have to walk to find a place to do your business?	Number of minutes _____ N/A Don't know	 -96 -99	===> S8
S4	What type of bathroom does your house have? **(E: ask, and later collaborate with the observations)**	Dry Toilet septic tank simple pit (no floor or ventilation tube) with floor of local material with slab and without ventilation tube with slab and ventilation tube Latrine Ecological Toilet paid toilet with two chambers elevated with drum in metal hut paid toilet with solar chamber Bathroom with hydraulic sweep connected to an absorption well/tank connected to a septic chamber and absorption well discharges to the surface (canal/ravine/river) connected to sewage system Other (specify) _____ Don't know	 11 12 13 14 15 21 31 32 33 41 42 43 44 -88 -99	
S5	Do you share the bathroom with other households?	Yes, various households use it No, only our household uses it N/A Don't know	1 2 -96 -99	===> S7
S6	How many households share the bathroom in your house?	Number of households _____ N/A Don't know	 -96 -99	
S7	Do all the members of the household use the bathroom?	Yes No N/A Don't know	1 2 -96 -99	===> S9

S8 Who doesn't use the bathroom?

Why don't they use it? **Why?** **(E: indicate why for each one that doesn't use it)**

Kids less than 5 years	A	_____
Kids between 5-15	B	_____
Adults (>18 yrs)	C	_____
Elderly (>60 yrs)	D	_____
Others (specify)	X	

Why don't they use it?
01…Don't know how to use it
02…Uncomfortable
03…Afraid to use it
04…Not accustomed to using it
05…The seat is too tall
06…Can't stand up
07…Never at home
08…It doesn't have a door
09…A lot of bugs
10…Offensive odor
11…Located too far from the house
12…Prefer to defecate in the open air
-88 Other (specify)
-96 N/A
-99 Don't know

S9	**(E: if there are babies less than one year)** Usually, What do you do with the feces of the babies less than one year of age?	Nothing Throw it in the toilet Bury it in the ground Throw it in the trash Other (specify) _____ Don't take care of a baby (N/A) Don't know	1 2 3 4 -88 -96 -99	

Bathroom for the household (E: Only for those that have a bathroom. If they don't have a bathroom, continue to the next section)				
B1	**(E: Read the options)** Who constructed the bathroom in your house?	It was done totally by ourselves We contracted the help of a government agency or NGO It was done totally by others Don't know	1 2 3 -99	===> B4
B2	What entity helped you construct or constructed totally your bathroom or letrine?	_____ N/A Don't know	 -96 -99	
B3	What did the donor agency help you with to construct the bathroom or latrine? **(E: multiple answers)**	Construction materials Materials for the stall The toilet seat A prefabricated stall Specialized labor Food Other (Specify) N/A _____ Don't know	A B C D E F X Y Z	
B4	How much did your family spend to construct the bathroom or latrine?	Approx. amount _____ Bs We didn't spend anything because it was done (N/A) Don't know	 -96 -99	 ===> B6 ===> B6
B5	Did you receive any finances to help with the construction expenses for your bathroom or latrine? **which?**	Yes **(E: indicate which)** _____ No Don't know	1 2 -99	
B6	Are you very satisfied, satisfied, more or less satisfied, little or not satisfied with the characteristics of your bathroom or latrine?	Very satisfied Satisfied More or less satisfied Little satisfied Not satisfied Don't know	1 2 3 4 5 -99	
B7	What characteristics do you not like about your bathroom?	_____ Don't know	 -99	

E1	Are you familiar with the ecological toilets?	Yes No Don't know	1 2 -99	 ===> E6 ===> E6
E2	How do you know them? **(Mark all that apply)**	TV or media campaign Friend, neighbor, or family member Government agency NGO Emergency/floods Businesses: Sumaj Huasi or Tarope Fairs Other (Specify) _____ N/A Don't know	A B C D E F G X Y Z	
E3	Have you had the opportunity to make use of this type of bathroom previously?	Yes No N/A Don't know	1 2 -96 -99	 ===> E6 ===> E6 ===> E6
E4	Where did you have the opportunity to use this type of ecological toilet? **(E: Mark all that apply)**	Friend Neighbor Family member Fair Emergency / flood Other (specify) _____ Don't know	A B C D E X Z	
E5	Was your experience of using the ecological toilet very good, good, regular, bad, or very bad?	Very good Good Regular Bad Very bad Don't know	1 2 3 4 5 -99	

EXPLANATION OF THE ECOLOGICAL TOILETS (Version B)

What you see in the photos are precisely two of the models of ecological toilets that we would like to submit to your evaluation. The structure of the stall can be fabricated of wood (show photo #2) or bricks and cement (show photo #3)
The toilet seat is of fiber glass (show photo #4) and its funciton is the only thing that differentiates it from any other type of bathroom, in that these ecological toilets do not require water for their operation. They are especially designed to separate the feces from the urine in isolated containers (show photo #4).
Beneath the stall, is found the storage chamber for collection of the urine and feces (show photo #4) where the plastic containers for urine and feces are located (show photo #5). This storage chamber is directly connected to a ventilation tube that liberates the bad odors and impedes flies from entering the storage chamber (show photo #3).

MODE OF USE AND MAINTENANCE

The appropriate use and maintenance of the ecological toilet is the responsibility of all the users.
For the appropriate use of the ecological toilets, it is necessary to place a recipticle with a drying mixture to the side of the toilet bowl, making sure that this drying mixture does not moisten (show photo #6). This mixture consistes of dirt with lime or ash, and should be poured on top of the feces after every defecation. This will alow for the rapid drying and decomposition of the feces, and will also eliminate bad odors.
It is also recommended to place a trashcan inside the bathroom stall to throw away sanitary napkins and any other type of trash that is generated in the bathroom. The trashcan should have a top in order to minimize the bad odor of the trash and to not attract flies.
To clean the outside of the toilet bowl, you should use a damp cloth, in order to avoid water faling into the feces containers or moistening the drying mixture. To clean the inside of the toilet bowl, it is best to use a dry brush.
How often you need to change the urine and feces containers, depends on how fast they fill up. For a family of 5-6 people, the urine container should fill up approximately every week. You should be watchful of the containers so that they don't overflow, and for that reason it is recommended that the containers be translucent.
The feces container has a greater capacity, and for that, it should be emptied more sporadically. It should be emptied in a place distant from the house, where the decomposing fecal material can be buried. For a family of 5 to 6 people, it could fill up every month or so.
It is possible to develop collection services for the solids and liquids, but in case you perfer this option, you would have to pay the corresponding amount.

I would now like to know if you have any question about the design, function, and/or mantenance of these bathrooms.

	Do you consider that…?			
E6	…the mode of use, meaning that you have to pour dirt/ash/limestone in the toilet after each defecation, is something simple or complicated?	Simple Complicated Don't know	1 2 -99	
E7	… the mode of maintenance, meaning that you have to empty and clean the containers for the feces and urine is simple or complicated?	Simple Complicated Don't know	1 2 -99	
E8	…this type of bathroom is adequate or inadequate for the kids?	Adequate Inadequate Don't know	1 2 -99	
E9	…the shown models are pretty or ugly?	Pretty Ugly Don't know	1 2 -99	
E10	…the use of ecological toilets helps or doesn't help to reduce/eliminate sickness?	Helps Doesn't help Don't know	1 2 -99	
E11	Are you interested in buying an ecological toilet?	Yes No Don't know	1 2 -99	==> E13
E12	Why not?	_____ Don't know	 -99	==> M8

E13	Would you feel comfortable emptying and cleaning the collection containers for urine and feces?	Yes No N/A Don't know	1 2 -96 -99	==> E17
E14	Would you pay for the collection and cleaning service?	Yes, definitely Yes, but it depends on the price No, I would prefer to be in charge of the cleaning No, definitely Other (Specify) _____ N/A Don't know	1 2 3 4 -88 -96 -99	 ===>E17 ===>E17 ===>E17 ===>E17
E15	How much would you be wiling to pay for this serivce of recollection, monthly?	_____ Bs N/A Don't know	 -96 -99	
E16	Are you sure that you would pay (E: the suggested amount) for the service of recollection and cleaning, monthly?	Yes No N/A Don't know	1 2 -96 -99	
E17	Supposing that YOU HAVE the necessary money RIGHT NOW to pay for the WOOD bathroom… Would you be willing to pay Bs. 4,000? Consider that the price includes materials and labor for 7-10 work days.	Yes No N/A Don't know	1 2 -96 -99	===>E21
E18	Would you be disposed to pay Bs. 3,500 for the WOOD bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E21
E19	Would you be disposed to pay Bs. 3,000 for the WOOD bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E21
E20	(If you are not willing to pay any of the previously suggested prices) Why not?	_____ N/A Don't know	 -96 -99	 ===>E25 ===>E25
E21	Let me mention to you some references…With… (E:price of their preference): · Bs. 4,000 you can buy a used moto · Bs. 3,500 you can buy a gas kitchen · Bs. 3,000 you can pay for a year of school for a child Are you disposed to use the Bs. _____ that could otherwise be used to _____ (E:reference) to pay for the construction of the WOOD bathroom?	Yes No N/A Don't know	1 2 -96 -99	 ===>E23 ===>E25
E22	(If you are not disposed to pay any of the previously suggested prices) Why not?	_____ N/A Don't know	 -96 -99	===>E25
E23	Are you finally sure that you would pay Bs. _____ (max agreed on price) for the WOOD bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E25 ===>E25
E24	(If you are not sure that you would pay this price) Why not?	_____ N/A Don't know	 -96 -99	

E25	Now, imagine that you don't have the option to buy the WOOD bathroom, and we are offering the CEMENT one… Supposing that YOU HAVE the necessary money RIGHT NOW to pay for the CEMENT bathroom… Are you disposed to pay Bs. 4,500? Consider that the price includes materials and labor for 7-10 work days.	Yes No N/A Don't know	1 2 -96 -99	===>E29
E26	Are you disposed to pay Bs. 4,000 for the CEMENT bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E29
E27	Are you disposed to pay Bs. 3,500 for the CEMENT bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E29
E28	(If you are not disposed to pay any of the previously suggested prices) Why not?	_____ N/A Don't know	 -96 -99	===>E33
E29	Let me mention to you some references….With… (E:the price of their prefered bathroom): · Bs. 4,500 you can buy a lot of land · Bs. 4,000 you can buy a used moto · Bs. 3,500 you can buy a gas kitchen Are you disposed to use the Bs. _____ that could otherwise be used to _____ (E:reference) to pay for the construction of the CEMENT bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E31 ===>E33
E30	(If you are not disposed to pay any of the previously suggested prices) Why not?	_____ N/A Don't know	 -96 -99	===>E33
E31	Are you finally sure that you would pay ___ (max amount willing to pay) for the WOOD bathroom?	Yes No N/A Don't know	1 2 -96 -99	===>E33 ===>E33
E32	(If you are not sure that you would pay this amount) Why not?	_____ N/A Don't know	 -96 -99	
E33	Supposing now that you have the opportunity to choose and buy the bathroom of your choice according to the following pr Bs. _____ (E:max agreed on price) for the CEMENT one and Bs. _____ (E:max agreed on price) for the WOOD one Which of the bathrooms would you buy?	Cement Wood None N/A Don't know	1 2 3 -96 -99	 ===> M8 ===> M8 ===> M8
E34	Why would you prefer to buy the _____ (E:chosen model) bathroom? (E: Mark all that apply)	It gives me more privacy It's prettier It endures more time It's cheaper Other (Specify) _____ N/A Don't know	A B C D X Y Z	

MICROCREDITS - for the bathroom of your preference

Assume that we are giving you the opportunity to access a microcredit loan of Bs. _____ (credit amount closest to suggested price) with a respected microfinance institution. This credit should be repaid in 7 months or 14 biweekly quotas, with a monthly interest rate of 3.5%. This implies that you should pay Bs. _____ (see the table-biweekly payment) biweekly. This amount includes "life insurance" for Bs. _____ (credit amount closest to suggested price), meaning that if you should die, your family would receive that amount of money. You will have also free medical services and a 20% savings of Bs. _____ (see table – savings) after the last payment.

The requirement to solicit this credit is to form Solidarity Group; this group consists of 4 or 5 friends who promise to respond to one another in case someone is not able to comply with the corresponding payment. You choose your group, generally people who you trust to comply with their biweekly payments. Because if they don't pay comply, you and the rest of the group has to pay for that. Your Solidarity Group will meet biweekly to cancel the quotas and have an informative chat about microfinance.

Loan amount Life Insurance	3.50% Bimonthly payment (Bs.)	20% Savings
3,000	266	600
3,500	311	700
4,000	355	800
4,500	399	900

M1	Are you disposed to solicit this credit?	Yes No N/A Don't know	1 2 -96 -99	
	Do you consider that...?			
M2	…having access to the solicited amount is an advantage or disadvantage?	Advantage Disadvantage N/A Don't know	1 2 -96 -99	
M3	… the repayment time is sufficient or short?	Sufficient Short N/A Don't know	1 2 -96 -99	
M4	…the interest rate is appropriate or high?	Appropriate High N/A Don't know	1 2 -96 -99	
M5	… the requirement to form a Solidarity Group seems positive or negative?	Positive Negative N/A Don't know	1 2 -96 -99	
M6	…the guarantee that is among the members of the Solidarity Group seems something positive or negative?	Positive Negative N/A Don't know	1 2 -96 -99	
M7	…the 20% required savings seems something positive or negative?	Positive Negative N/A Don't know	1 2 -96 -99	
MICROCREDITOS - for home-improvements				
M8	Currently or in the last year, have you all done any home-improvements?	Yes No Don't know	1 2 -99	==>M14
M9	Of what type were they?	imrovements of the walls improvements of the floor improvements of the kitchen improvements of the bathroom construction of a new room construction of a 2nd or 3rd floor construction of a ceiling Others: (specify) _____ N/A Don't know	1 2 3 4 5 6 7 -88 -96 -99	

M10	How was the work done?	Auto-construction Contracted/Paid for Others _____ N/A Don't know	1 2 -88 -96 -99	
M11	Approx. how much was spent on it?	Approx amount _____ Bs N/A Don't know	 -96 -99	
M12	How was the work paid for?	In parts With savings With an informal loan With a formal loan Others_____ N/A Don't know	1 2 3 4 -88 -96 -99	M14 M14 M14
M13	With which institution did you ask for the formal loan?	Pro Mujer Crecer Agrocapital Prodem Los Andes Fie Banco Sol EcoFuturo Others: _____ N/A Don't know	1 2 3 4 5 6 7 8 -88 -96 -99	
M14	Do you consider more home-improvements necessary?	Yes No Don't know	1 2 -99	=> V1
M15	What would be the first home-improvement that you would do?	improve the walls improve the floors improve the kitchen imrove the bathroom construct a new room construct a 2nd or 3rd floor construct a ceiling build a fence Other: (specify) _____ N/A Don't know	1 2 3 4 5 6 7 8 -88 -96 -99	
M16	Does your family have the COMPLETE resources to do these home-improvements?	Yes No N/A Don't know	1 2 -96 -99	
M17	Are you disposed to ask for a loan from a Bank or Microfinance Institution to do these improvements?	Yes No N/A Don't know	1 2 -96 -99	
M18	What amount of credit would be sufficient?	Amount _____ Bs N/A Don't know	 -96 -99	
M19	What repayment period would be convenient to repay your loan? **(E: Read the options)**	6 months 8 months 1 year 1 1/2 years 2 years More than 2 years Other: (specify) _____ N/A Don't know	1 2 3 4 5 6 -88 -96 -99	
M20	How often would you be able to pay your quota?	Weekly Biweekly Monthly Other: (specify) _____ N/A Don't know	1 2 3 -88 -96 -99	
M21	How would you like to gaurantee your credit?	Official documents for the house Personal gaurantee Papers for other lots of land With my household goods With the gaurantee of friends With my business Other _____ (especificar) N/A Don't know	1 2 3 4 5 6 -88 -96 -99	

Characterization of the Household				
V1	How do you live in your house?	own house family house rent "Anticretico" Don't know	1 2 3 4 -99	
V2	How did you obtain your household?	Bought - own money Brought - family loan Bought - loan from institution bought - loan from 3rd parties inheritance Invasion Other (specify) _____ Don't know	1 2 3 4 5 6 -88 -99	
V3	Does your family have an official documents for the house, and if so, which ones?	Property title Inscripción en derechos reales Minuto de compra y venta Folio real Inheritance documents None No sabe	1 2 3 4 5 6 -99	
V4	What are the monthly fixed prices for all of the family in……..? **(E: approx. in Bs)**	a. Food _____ Bs b. Education (Lunch/Transport) _____ Bs c. Transportation (gas, taxi) _____ Bs d. Health/medicines _____ Bs e. Household/Rent _____ Bs g. Water _____ Bs h. Light _____ Bs j. landline/phone cards for cell _____ Bs k. Others _____ Bs **l. Total (E: Sum in the office)** _____ Bs	-99 -99 -99 -99 -99 -99 -99 -99 -99 -99	
V5	Do you receive remittances from a relative who lives in another part of the department, or another department, or outside the country?	Yes No Don't	1 2 -99	 ===> V9 ===> V9
V6	In the last six months, how much have you received?	Amount _____ (Bs, Euro, USD)	-99	
V7	How many years have you lived in this district?	_____ years We have always lived here Don't know	 -96 -99	 ===>V11
V8	Where did you live previously?	a. In another district of the same province _____ b. In another province of the same department _____ c. In another department _____ Don't know	-99	

V9	Was your family (or the residents of this house) displaced from this house because of the floods last year?	Yes No Don't know	1 2 -99	 ===>V14 ===>V14
V10	Where were you displaced?	_____ Don't know	 -99	
V11	For how long?	_____ No sabe	 -99	
V12	How many rooms does your house have (including living room dining room, and bedrooms, and not counting the bathroom?	Total _____	-99	
V13	How many rooms are used for sleeping	Number of rooms _____	-99	
V14	What type of combustible do you typically use in your house to cook?	Electricity Gas Firewood Other _____ Don't know	1 2 3 -88 -99	
V15	I am going to mention a series of artifacts and comodities… could you tell me which ones you have in your house THAT WORK? **(E: Read all, and mark those mentioned)**	Refrigerator Radio Black and White TV Color TV VHS/DVD Sound equipment Landline Phone Celular telephone Bicycle Motocycle Car Truck Agricultural Vehicle Motorboat Wagon pulled by animals	A B C D E F G H I J K L M N O	
Health				
L1	Would you say your community has a very healthy, healthy, more or less healthy, little healthy, no healthy?	Very healthy Healthy More or less healthy Little healthy No Healthy Don't know	1 2 3 4 5 -99	
L2	Do you consider that diarrea is very dangerous, dangerous, more or less dangerous, little dangerous or not dangerous?	Very dangerous Dangerous More or less dangerous Little dangerous Not dangerous Don't know	1 2 3 4 5 -99	
L3	**(E: DO NOT READ THE OPTIONS)** What do you believe causes diarrea? **Anything else?**	Water Eating rotten/perished foods Not covering foods Not washing hands betore eating Not washing hands after using the bathroom Flies Defecation in the open air Others (specify) _____ Don't know	A B C D E F G X Z	

Observations				
O1	Predominant material for the walls of the house **(E: Aspects to observe)**	Natural walls No walls Palm Wood Rudimentary walls Bamboo Straw with mud Adobe Triplex Carton Reused wood Stacked bricks Finished walls Cement Rocks with cement Bricks with cement Cinderblocks Covered adobe Pebbled Corrugated iron Other (specify) _____	 11 12 13 21 22 23 24 25 26 27 31 32 33 34 35 36 37 -88	
O2	Predominant material of the ceiling of the house **(E: Aspects to observe)**	Natural ceiling No ceiling Straw/palm leaves Grass Rudimentary ceiling Thatched mat Palm Wood-paneled Plastic Carton Finished ceiling Metal Wood Corrugated Tin Tiles Cement Other (specify) _____	 11 12 13 21 22 23 24 25 31 32 33 34 35 -88	
O3	Predominant material of the floor of the house **(E: Aspects to observe)**	Natural Floor Dirt/Sand Rubble Manure Rudimentary Floor Wood panels Wood Bamboo Finished floor Parquet Asphalt Ceramic Cement Carpet Other (specify) _____	 11 12 13 21 22 23 31 32 33 34 35 -88	
O4	Can you show me your bathroom? **(E: Ask permission to see the bathroom**)	Yes Did not give permission Does not have bathroom (N/A)	1 2 3	 ===>END ===>END
O5	Where is the bathroom/latrine located?	Inside the house (where they eat and sleep) Outside the house, but inside the lot Outside the lot where the house is located	1 2 3	===>O7
O6	Which components does your bathroom or latrine have? **(E: Aspects for observation. Mark all that apply.)**	Stall Door Steps Ceiling Toilet Seat WC Urinal Lavatory pan Hole in floor Ventilation tube **(E: observe)** What diameter? _____ cm Hole	A B C D E F G H I J K	
O7	What is the principal material for the walls of the bathroom or latrine? **(E: Aspects for observation)**	Corrugated Tin Bricks Cinderblocks Sun-dried mud Tapia Wood Mud with straw Plastic Other (specify) _____ The bathroom does not have walls (N/A)	1 2 3 4 5 6 7 8 -88 -96	

O8	What is the principal material for the ceiling of the bathroom or latrine? **(E: Aspects for observation)**	Corrugated tin Clay Tiles Straw Other (specify) _____ The bathroom does not have a ceiling (N/A)	1 2 3 -88 -96	
O9	What type of sanitary aparatus does it have? **(E: Aspectos por observación)**	WC/ Toilet Seat Turkish hole The bathroom does not have a sanitary aparatus (N/A)	1 2 -96	
O10	What material is the sanitary aparatus? **(E: Aspects for observation)**	Concrete Cement fiber Granite Glass slab Fiberglass Wood The bathroom does not have a sanitary aparatus (N/A)	1 2 3 4 5 6 -96	=> O13
O11	Does the toilet seat have an adequate lid? **(E: Aspects for observation)**	Yes No Does not have a toilet seat (N/A)	1 2 -96	
O12	Does the toilet seat look clean or dirty? **(E: Aspects for observation)**	Clean Dirty Does not have a toilet seat (N/A)	1 2 -96	
O13	Are the walls clean or dirty? **(E: Aspects for observation)**	Clean Dirty Does not have walls (N/A)	1 2 -96	
O14	Are there flies inside the bathroom? **(E: Aspects for observation)**	Yes (more than 5) Yes (less than 5) No	1 2 3	
O15	what material is the door? **(E: Aspects for observation)**	Corrugated tin Wood Fabric Plastic Other (specify) _____ Does not have a door (N/A)	1 2 3 4 -88 -96	==>O18
O16	Does the bathroom/latrine door have some kind of aparatus to help keep it closed? **(E: Aspects for observation)**	Yes No Does not have a door (N/A)	1 2 -96	
O17	What material are the steps? **(E: Aspects for observation)**	Stones Concrete Wood Other (specify) _____ Does not have steps (N/A)	1 2 3 -88 -96	
O18	Does it seem like the bathroom is used like a bathroom? **(E: Aspects for observation)**	Yes No	1 2	
O19	Is there excreta or trash around the inside or outside of the bathroom or latrine? **(E: Aspects for observation)**	Yes No	1 2	
O20	Is the floor wet? **(E: Aspects for observation)**	Yes No	1 2	
O21	Where is the toilet paper deposited? **(E: Aspects for observation)**	Open depository Closed depository Inside the sanitary aparatus On the floor Other (specify) _____	1 2 3 4 -88	
O22	Can bad odors be detected in or around the bathroom or latrine? **(E: Aspects for observation)**	Yes No	1 2	
O23	In the case of the paid latrine, What characteristics does the latrine have?	Una cámara Dos cámaras No es letrina abonera	1 2 -96	
O24	Is the trash other than toilet paper thrown in the toilet hole? al hoyo de la letrina? **(E: Aspects for observation)**	Sí No	1 2	

Hora de termina (00:00 - 24:00): _____