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**TRANSFORMATION TOWARDS SUSTAINABLE
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Demand for plastic latrine slabs in rural Kenya and Tanzania

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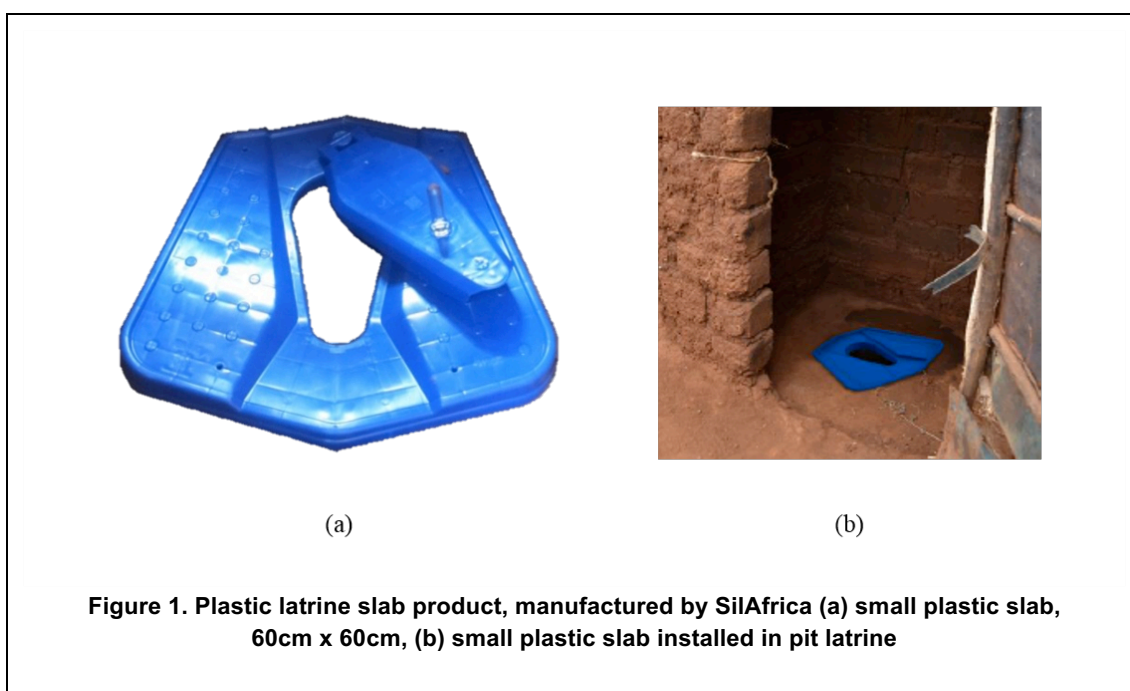
Plastic latrine slabs provide a cleanable surface and a coverable squat hole opening. They are a simple option for upgrading unimproved pit latrines. To measure consumer demand for plastic slabs in rural areas, we conducted i) a voucher-based real-money sales trial in Tanzania in 2015 (n=569) and ii) a real-money auction in Kenya in 2017 (n=322). In Tanzania, 60% of respondents were willing to pay 1 USD, and only 4% were willing to pay 12 USD (compared to the market price of 18 USD). In Kenya, 93% of respondents were willing to pay 1 USD, with only 1% willing to pay the market price of 16 USD. These findings show that there is demand for plastic slabs but at a lower price than what is commercially available. Amongst households who purchased the plastic slabs, 67% had installed them nine months later in Tanzania, versus 58% ten months later in Kenya.

Introduction

Open defecation levels in Kenya and Tanzania are relatively low. Approximately 85% and 83% of rural residents in Kenya and Tanzania, respectively, have access to pit latrines (WHO/UNICEF, 2017). Most of these pit latrines, however, do not meet the UNICEF-WHO Joint Monitoring Programme (JMP) specification for improved facilities (WHO/UNICEF, 2017). According to the JMP, only 42% of Kenya's and 12% of Tanzania's rural populations use improved latrines (WHO/UNICEF, 2017). The World Bank estimates that limited access to sanitation costs both Kenya and Tanzania approximately 1% of their gross domestic product and that these costs are disproportionately borne by the poor (WSP, 2012a, 2012b). Accelerated improvements in sanitation are needed in both countries in order to meet target 6.2 of the sustainable development goal (SDG) by 2030.

The Kenyan sanitation market offers few affordable latrine slab options to rural households, and plastic slabs are mostly produced for emergency relief. In Tanzania, the Government's National Sanitation Campaign promotes locally manufactured non-structural concrete latrine platforms (called SanPlats) but sales remain low (Brandberg, 1997; Robinson, 2011; Roma, Rheingans, & Stich, 2014; Rosensweig, Perez, & Robinson, 2012). In 2013, the World Bank and International Finance Corporation's (IFC) Selling Sanitation project partnered with large plastics manufacturing firms in Kenya to develop a range of plastic latrine slabs (*Figure 1*) designed to be cheaper, more durable, and lighter than other slabs in the market (Water Global Practice, 2017; WSP & IFC, 2013). These plastic slabs have a smooth, cleanable surface, a safe squat hole opening, and a foot-operated cover to keep out flies and reduce smell. They were proposed as a simple option for upgrading unimproved pit latrines into improved ones.

This study sought to estimate consumer demand for plastic slabs in rural Kenya and Tanzania by i) measuring willingness to pay (WTP) and ii) assessing installation rates.



Methodology

Study population

In Tanzania, the study was conducted from January to March 2015 in 40 villages across two districts: Kilosa district in the central Morogoro region and Ludewa district in the southern Njombe region. Both regions had been targeted by the National Sanitation Campaign. An initial assessment determined that baseline levels of improved sanitation coverage were 19% in Kilosa and 3% in Ludewa. In Kenya, the study was conducted in 30 villages across Busia and Nyeri counties from January to April 2017. Both counties had been exposed to a pilot campaign on improved sanitation.

Households were eligible to participate if (i) they had an unimproved pit latrine, (ii) they were not sharing a latrine with another study participant, and (iii) the head of household was at least 18 years old. In Kenya, a household was not eligible if their latrine pit was full (contents were at least 0.5 meters from the latrine floor). The study included a total of 569 households in Tanzania and 322 households in Kenya.

Willingness to pay

In Tanzania, discount vouchers with different price reductions for the plastic slab (15%-12 USD, 30%-10 USD, 45%-8 USD, 60%-6 USD, 75%-4 USD, or 90%-1.4 USD) were randomly assigned to participating households. Village retailers were stocked with the slabs. Households were instructed to redeem their vouchers before a specified date and with their pre-stocked retailer. The redemption rates were then used to calculate the WTP at each discount level.

In Kenya, we used the Becker Degroot Marschack (BDM) auction method to conduct a real-money auction for the small plastic slab (60cm x 60 cm) manufactured by SilAfrica in Nairobi, Kenya (Becker, Degroot, & Marschak, 1964). Each household bid its own money for the slab and won if the bid was above a randomly chosen price hidden inside a sealed envelope. Households who won the auction paid the price named in the envelope, not the amount they bid. This approach reduces tendency to overstate or understate willingness to pay. Three weeks before the slab auction, enumerators showed the plastic slab to participants, described its features, provided a brochure, and informed them of the market price (16 USD). They also performed a mock auction with a bar of soap. Participants were informed of the auction price points (1 USD to 16 USD, in increments of 1 USD) and encouraged to decide on a WTP bid price in collaboration with their household members. Households who won the auction paid in cash or via mobile payments (M-Pesa) within the same day.

Interventions

We hypothesized that information on environmental contamination, peer experience, and physical presence of the product may influence WTP. In Tanzania, half the villages were randomly selected for “seeding”: plastic slabs were installed for free in two randomly selected households. In addition, 20 villages were randomly selected for measurements of faecal indicator bacteria on latrine floors (i.e., swabbing). Within 10 days of swabbing, households were notified via text message of the faecal contamination level, associated health risks, and suggestions on how to improve their latrines, details described here (Peletz et al., 2017). In Kenya, households were randomized into two groups: in the first group, the slab was physically present during the auction, while the second group only saw a picture during the auction.

Installation rates

In Tanzania, 63% of participants who had redeemed their voucher were visited in person 4 months later to ask about slab installation and usage. Another 5 months later, 16% of households who had not installed the slab were re-surveyed over the phone. In Kenya, 66% of participants who had won the auction were re-surveyed 10 months later by phone or SMS to assess installation rates.

Ethical approvals

In Tanzania, the National Institute for Medical Research (NIMR/HQ/R.8a/Vol. IX/1916, Appendix 10.4a), the Commission for Science and Technology (No. 2015-172-NA-201573, Appendix 10.4b), and the Stanford University, USA, Internal Review Board (Protocol ID 32426, IRB 346) approved the sales trial protocol. In Kenya, the study was reviewed and approved by AMREF Ethics and Scientific Review Committee (Ref: AMREF-ESRC P155/2014).

Results and discussion

A summary of results by country is provided in Table 1 below.

Country	Kenya	Tanzania
Market price	16 USD	18 USD
Proportion of respondents willing to pay 1 USD	93%	60%
Proportion of respondents willing to pay 5 USD	55%	26%
Proportion of respondents willing to pay market price	<1%	< 4%
Average willingness to pay	4.70 USD	Could not be calculated with the voucher study method
Installation rate amongst purchasers after 9-10 months	58% (10 months after purchase)	67% (9 months after purchase)

Willingness to pay

The sales trial in Tanzania showed moderate interest in the plastic latrine slab (Figure 2). 60% of respondents were willing to pay 1 USD, with only 4% willing to pay 12 USD (the market price being 18 USD). The WTP auction in Kenya showed higher interest in the plastic latrine slab: 93% of surveyed households bid on the slab (i.e., $WTP \geq 1$ USD). Half of respondents were willing to pay 5 USD, but less than 1% were willing to pay the market price of 16 USD. In Kenya, the mean WTP was 4.70 USD and median was 4.90 USD; this could not be calculated for Tanzania due to the voucher study method. Both studies show that rural households have demand for plastic latrine slabs but at a much lower price than commercially available.

Purchase rates

In Tanzania, 30% of households (171/569) redeemed their vouchers, though redemption rates were greater at higher discount levels (Figure 2). Financial constraints were the primary reason for not redeeming vouchers: many surveyed households claimed they were interested in purchasing the slab but were unable to pay even at the discounted price. In Kenya, 47% (151/322) of households won the auction and 91% (137/151) of auction winners bought the slab, while 12 reported they did not have the money and 2 could not make the decision to buy without additional consultation.

Interventions

None of the three interventions had a significant impact on WTP. In Tanzania, seeding and swabbing did not have any influence on WTP for the plastic slabs. In Kenya, there was no significant difference in WTP between households who physically saw the slab and those that saw a picture during the slab auction. In addition, WTP in Tanzania was not significantly different between villages that participated in the National Sanitation Campaign and those that did not.

In Tanzania, wealthier households were more likely to redeem their vouchers at nearly all price points, while in Kenya WTP was significantly higher for households that had mobile money account (M-Pesa).

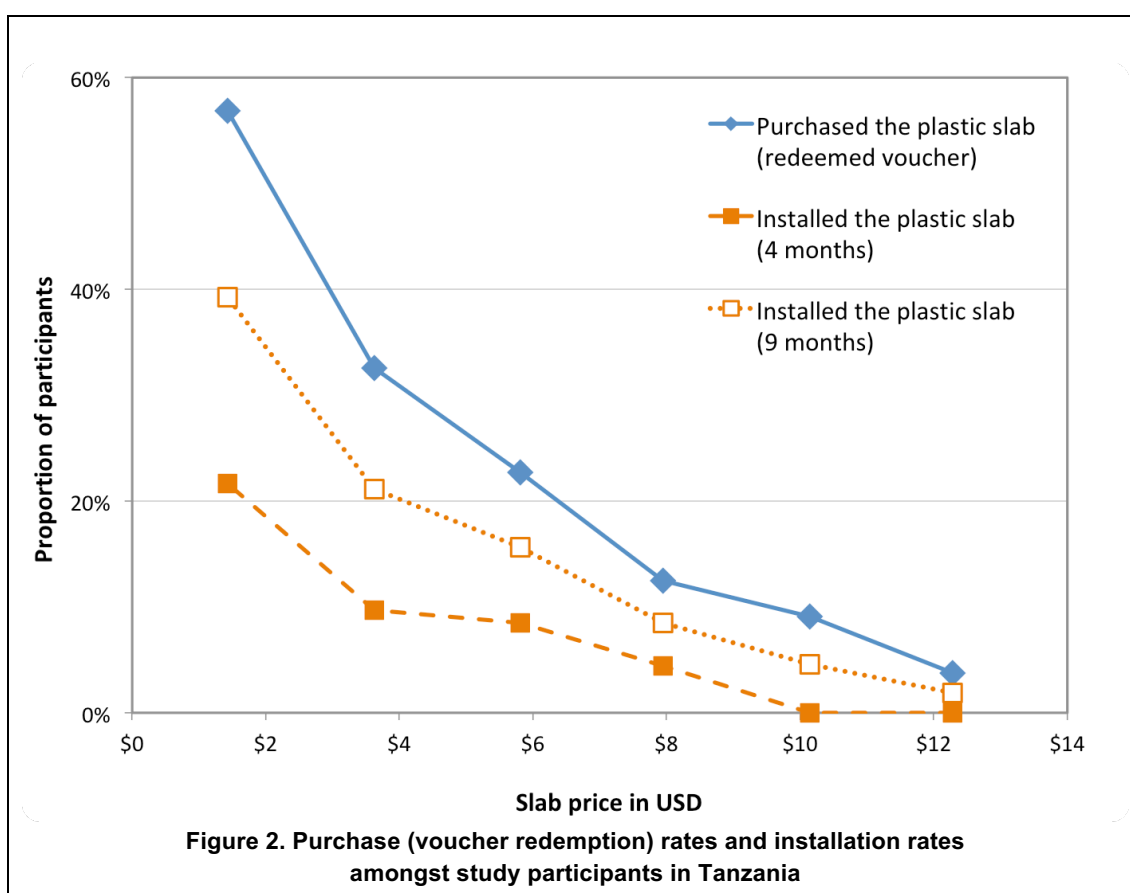
Installation rates

At the time of the first follow-up survey in Tanzania, 34% of interviewed households that redeemed their voucher had installed the plastic latrine slab. This proportion had increased to 67% five months later. Households who had not installed the slab explained that they were waiting to build a new latrine or to improve the current one. Lack of financial resources was also cited as a reason for not installing the slab. These explanations are consistent with the gradual increase in installation over time, as funds become available. Overall, our findings indicate that in contrast to other health products (e.g., mosquito net, water filter), a latrine slab is not always readily usable as its installation may hinge on additional investments.

Figure 2 shows redemption and installation rates at different price points. As the price of the slab decreases, more households are able to afford it and in turn, to install and use it. This trend would justify the use of subsidies to lower the price and allow more households to use the slab. However, it is important to note that the gap between purchase and installation rates widens as the price of the slab decreases. This divergence indicates that over-inclusion (i.e., the proportion of households owning the slab without using it) is higher at lower price points. The optimal subsidy amount would be one that maximizes usage while minimizing over-inclusion.

In Kenya, follow-up surveys found that 58% of households who won the auction had installed the plastic slab ten months later, while 29% were planning to install it within the next three months. Consistent with Tanzania, we found that some households need time before they are able to install the slab. A participant from Busia county noted *“I did not want to install the slab in a pit that is almost full”*, while another participant from Nyeri county stated *“I plan on installing the slab in three weeks. I am still digging my new latrine.”*

For Kenya, the comparison of purchase and installation rates at different price points showed that slab usage levelled off below 3 USD, resulting in a substantial increase in over-inclusion (data not shown). These results suggest that subsidizing plastic latrine slabs in Kenya below 3 USD may not be justifiable.



Conclusion

Our findings show that households are willing to purchase plastic slabs at a lower price than commercially available. Therefore, further efforts are needed to align product prices with consumer WTP. One way to achieve this is to lower the cost of plastic latrine slabs by providing partial subsidies to poor and marginalized households. Although national policies in Kenya and Tanzania discourage sanitation subsidies, a recent evaluation of strategies to improve sanitation for poor rural families in Bangladesh found that combining sanitation campaigns with subsidies increased hygienic latrine ownership (Guiteras, Levinsohn, & Mobarak, 2015). This contrasts with stand-alone sanitation campaigns that do not improve latrine coverage (Guiteras et al., 2015). Studies also show that subsidies promote the purchase of other health products by poor households (Dupas, 2014a, 2014b). If this strategy is used, the optimum subsidy amount should be determined to both maximize usage and minimize over-inclusion. Lastly, many households in both countries preferred building new latrines before installing their slabs, indicating that simple upgrades may not be the best strategy to improve toilets. Therefore, other improved latrine solutions should be considered.

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