

RTI Reinvent the Toilet

**September and October 2015
User Studies:
Ahmedabad, India**

Summary Field Report

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Executive Summary

RTI International is developing an on-site waste treatment and toilet system designed for communal or shared applications as part of the Bill and Melinda Gates Foundation's (BMGF's) Reinvent the Toilet Challenge (RTTC). The RTTC calls for research teams to design and test novel sanitation technologies that treat human waste to remove pathogens, generate renewable resources (e.g., water and biochar), operate off of networked energy or sewer systems, and cost users less than US \$.05/per person/per day. RTI's reinvented toilet (RT) system is designed to be a self-contained unit that collects human waste through a squat plate designed for low water quantity flush, and then separates and treats the waste within the same unit. Urine is treated using electrochemical disinfection, and feces is dried and burned by combustion, in a gasifier. The treated liquid is designed to be reused within the system for flushing and (potentially) cleansing (e.g., handwashing and anal cleansing), and power is generated through the combustion of solid waste.¹

In 2011, BMGF launched the **RTTC** to promote and fund the research and design of novel sanitation technologies that disinfect human waste, generate renewable resources (e.g., water and biochar), operate without external power or sewer infrastructure, and cost users less than US \$.05 daily. RTI and 17 other organizations have received RTTC grants.

RTI demonstrated its first ("pre-alpha") prototype at the [Reinvent the Toilet Fair](#) in New Delhi, India, in March 2014. Between May and September 2014, RTI reassembled the prototype in Gujarat state and, with several partners (the Self Employed Women's Association [SEWA]; an independent researcher from the Public Health Foundation of India [PHFI]; and Network for Engineering, Economics Research, and Management [NEERMAN]), conducted a series of focus group discussions (FGDs) and surveys with target users to identify factors likely to affect the adoption and use of the final RTI system and to inform further development of the RTI prototype. Additionally, RTI and its partners conducted a 1,213 household survey in spring 2015. Taking these findings into consideration, RTI constructed the second (alpha) prototype in Ahmedabad, India, on the campus of the Centre for Environmental Planning and Technology (CEPT) University in summer 2015.

This report presents the findings from a set of 32 FGDs conducted with groups of potential users who were able to observe the alpha prototype on the CEPT University campus in September and October 2015. These FGDs build on previous data collection activities and technical research and development (R&D) efforts. RTI and its partners designed the FGDs in this round to collect information from potential users of the RTI prototype system on a variety of topics:

- water reuse in the RTI system
- menstrual hygiene management (MHM)
- men's practices and preferences
- reactions to particular features of the RTI prototype user interface

RTI's field testing activities (e.g., assessing users' preferences and testing system performance) are currently focused on India with ongoing testing in Ahmedabad, Gujarat. RTI is also developing strong partnerships with local government, research and policy institutes, industry, and nongovernmental organizations (NGOs) focused on improving urban sanitation.

¹ See more information on the RTI system at www.abettertoilet.org.

Table ES-1: User Study Participant Statistics	
Data	Observation
Total participants	320
Male	50%
Female	50%
Hindu	50%
Muslim	50%

Table ES-2: User Study Primary Sanitation Facility		
Facility type	Count	Percentage (%)
Private toilet	34	14.5%
Neighbor's toilet	14	6.0%
Shared toilets*	184	78.3%
Open defecation	3	1.3%
TOTAL:	235	100%

* Shared toilets refer to community and public (municipality-owned and private corporation) toilets. Individuals defined municipality and private corporation (e.g., Sulabh) toilets inconsistently as community or public toilets across focus groups. Results have been pooled to avoid misidentification.

Participants in data collection activities were residents of low-income communities in Ahmedabad, recruited using a convenience sampling methodology. Tables 1 and 2 offer descriptive statistics of FGD participants, including socio-demographic and sanitation access information. Participants were exposed to the RTI toilet prototype, shown a video of the system's waste processing, participated in a question-and-answer session, and took part in theme-based FGDs at the CEPT University campus in Ahmedabad.

SEWA recruited participants and facilitated and moderated the focus group activities, joined by a PHFI researcher during menstrual-hygiene-themed FGDs, and NEERMAN managed data collection and transcription. All partners aided in increasing RTI's understanding of local context and supporting RTI's engagement with participants in Hindi and Gujarati languages.

This report presents the findings from the qualitative focus groups. The results will help to inform near-term technology design and development decisions that the RTI R&D team must make and help to identify key issues for further investigation. However, based on the convenience sampling method used, these results should not be assumed to be representative of a larger population.

Table ES-3 summarizes key user input and feedback on the RTI prototype's treatment technology and user interface. Tables ES-4 and ES-5 provide recommendations on how these findings should be used to guide subsequent steps in the design and development of the RTI system—including both potential changes RTI will consider making to the prototype (in Table ES-4) and future plans for user-focused data collection (in Table ES-5).

Table ES-3: Summary of User Input/Feedback on Prototype Features

Topic	Observation
Highly favored features	<ul style="list-style-type: none">▪ The size of the internal cabin is large enough to conduct most sanitation needs. Users perceive this much space as a luxury.▪ Users view the modern, round design of the squat plate as aspirational.▪ Users view the water availability in the system as a major system benefit.
Overall perceptions	<ul style="list-style-type: none">▪ Safety concerns are tied to interactions with people, not system processing.▪ A desire for gender-separated stalls emerged frequently based on social norms and safety concerns.
Exterior features and footprint	<ul style="list-style-type: none">▪ Users are concerned that the unit footprint will not fit within many community space limitations.▪ The unit's large size is attractive, if space is available in the community.▪ Stairs are too steep to climb safely and may become slippery.▪ Railings provide adequate support.
Interior features	<ul style="list-style-type: none">▪ An automatic flush and spray hose are aspirational features with which user familiarity is low; however, many users expressed a willingness to learn to use these features.▪ The spray hose water pressure was too strong or too weak; many participants felt strongly in one direction, and opinions were highly individualized.▪ The sink's automatic function is aspirational and tied to water conservation.▪ The squat plate bowl's round design is modern; however, users are concerned that it is too shallow (e.g., likely to cause a splash) and narrow (e.g., feet do not fit comfortably) for comfort and cleanliness during use.
Menstrual hygiene management (MHM)	<ul style="list-style-type: none">▪ MHM amenities (e.g., disposal and vending machine) are widely supported,▪ A majority of users view disposal by incineration as the most reliable and safest way to eliminate MHM waste.▪ Some users view reused water as unclean for washing reusable MHM materials.▪ Some women concerned flush water will get contaminated with menstrual blood making recycled water unacceptable for other purposes.
Urinals	<ul style="list-style-type: none">▪ There is a universal desire for a partial door on the urinal to improve privacy and retain ventilation.▪ The urinal height is slightly too high.

Table ES-3: Summary of User Input/Feedback on Prototype Features

Topic	Observation
Water reuse	<ul style="list-style-type: none"> ▪ In general, users accept reused water for applications that do not touch body parts (e.g., flush). Users have a mixed acceptance for applications that do touch the body (e.g., anal cleansing and handwashing). ▪ The use of reused water for external purposes highly varied (e.g., garden, animals, and house/vehicle cleaning). ▪ Many participants highlight information as a critical element in accepting water reuse, suggesting that continued reasoning through social, religious, and health-based norms may reinforce reuse. ▪ The condition and duration of water storage also affect perceptions of water cleanliness. ▪ Widespread water scarcity reinforces the importance of water reuse in the system.
Water availability	<ul style="list-style-type: none"> ▪ Users view water availability as a key benefit of the system, given the widespread scarcity of municipal water. It is an aspirational quality when users do not have to bring water to shared toilet facility. ▪ The presence of available water improves the perception of facility cleanliness.
Demographic-specific	<ul style="list-style-type: none"> ▪ Women: Men and women recognize that women are the most “in need” beneficiaries of this system. ▪ Religion: Hindus and Muslims cite religious guidelines for water use—reasoning for limited use of reused water on body. ▪ Elderly: The steep stair grade makes the unit challenging to access. ▪ Children: The spacious cabin facilitates women with children using the toilet.

Table ES-4: Recommendations for Potential System Adaptation

Feature	Recommendation for potential system adaptation
External features: Stair access	<ul style="list-style-type: none"> ▪ Increase stair depth to decrease steepness. ▪ Add an antislip coating on all stairs.
Internal features: Spray hose Automatic flush Squat plate	<ul style="list-style-type: none"> ▪ Add a pressure variation feature on the spray hose. ▪ Increase the size of the automatic flush button. ▪ Widen the squat plate for foot placement, and deepen the bowl to minimize splashing during use.
Urinal	<ul style="list-style-type: none"> ▪ Add a partition/partial door on the urinal stalls. ▪ Raise the urinal height slightly.
Preference for gender-separated stalls	<ul style="list-style-type: none"> ▪ Consider adding two cabins in one processing unit, divided for separate use by men and women.
MHM pad chute	<ul style="list-style-type: none"> ▪ Consider adding incineration capability for used menstrual products given strong preference for this mode of disposal.

Table ES-4: Recommendations for Potential System Adaptation

Feature	Recommendation for potential system adaptation
Water reuse	<ul style="list-style-type: none"> ▪ Consider adding a separate water source (e.g., municipal water) for some applications for which high reluctance persists for reused water (e.g., washing during menstruation and handwashing)

The user studies conducted provide valuable information on the preferences of users in RTI’s target population; however, the data should not be considered representative, given the sampling and data collection methodologies used. Instead, data such as these should be used to support near-term technology and user interface design decisions that must be made and to guide future, user-focused data collection efforts.

Table ES-5: Recommendations for Future Data Collection

Data collection findings	Recommendation for future data collection
Size of unit footprint	Assess space constraints in different contexts (e.g., residential communities, schools, and construction sites) to determine the physical and perceived constraints of the footprint size.
Lack of familiarity with spray hose/automatic flush	Evaluate information or training that is needed to increase user comfort with the spray hose and flush features.
Desire to flush multiple times after using the toilet	Understand what constraints or information (e.g., messaging) can reinforce single flush uses.
Mixed acceptance of reused water and the role of information	Evaluate the role of information (e.g., messaging and social marketing) in reducing barriers to using recycled water from the on-site processing of liquid waste.

1. Introduction

RTI is developing an on-site waste treatment and toilet system designed for communal or shared applications as part of the Bill and Melinda Gates Foundation's (BMGF's) Reinvent the Toilet Challenge (RTTC). The RTTC is promoting the research and design of novel sanitation technologies that disinfect human waste, generate renewable resources, operate without either a networked sewer system or electricity grid, and cost users less than US \$.05 per day.

The RTI reinvented toilet (RT) system is designed to capture human waste in a self-contained unit and separate the waste for treatment underneath a squat plate, which requires low water quantities to flush.² The urine is treated using electrochemical disinfection, and the solid feces is dried and burned through combustion in a gasifier. The system is designed as a closed loop, in that it uses thermoelectric devices to generate power from the combustion of solid waste—sufficient enough to power the entire system—and treats liquid waste that can be reused.

RTI demonstrated its first prototype at the [Reinvent the Toilet Fair](#) in New Delhi, India, in March 2014. Between May and September 2014, RTI reassembled the prototype in Gujarat state and, with several partners (the Self Employed Women's Association [SEWA]; an independent researcher from the Public Health Foundation of India [PHFI]; and Network for Engineering, Economics Research, and Management [NEERMAN]), conducted a series of focus group discussions (FGDs) and surveys with target users to identify factors likely to affect the adoption and use of the final RTI system and to inform further development of the RTI prototype. Additionally, RTI and its partners conducted a 1,213 household survey in spring 2015. Taking these findings into consideration, RTI constructed the second (alpha) prototype in Ahmedabad, India, on the campus of the Centre for Environmental Planning and Technology (CEPT) University in summer 2015.

In October 2015, RTI and its partners conducted a set of 32 FGDs with groups of potential users who were able to observe the alpha prototype on the CEPT University campus. These FGDs build on previous data collection activities and technical research and development (R&D) efforts. This report provides a summary of the goals of the October 2015 user studies, as well as data collection methodologies and findings. Conclusions and recommendations are provided both for short-term adjustments to be made to the RTI toilet system and for future, user-focused data collection needs.

2. Data Collection Objectives

RTI designed the September/October 2015 user studies to inform ongoing alpha and beta prototype development and to provide input into future user studies by beginning to identify the breath of issues likely to impact future adoption of the RTI system. The focus groups solicited information about potential users' sanitation practices, preferences, and feedback on the RTI system. Users provided feedback in response to the user interface of RTI's pre-alpha prototype, and on its potential for use in shared and public settings.

² See more information on the low water quantity flush and squat plate at <http://abettertoilet.org/roca-sanitario-develops-ultra-low-flush-squat-plate/>.

Primary research objectives for data collection were to conduct qualitative assessments of the following:

- current behaviors, beliefs, and preferences regarding sanitation, with a focus on
 - water reuse in the RTI system
 - women’s menstrual hygiene management (MHM)
 - men’s practices and preferences
- reactions to the interface of the RTI system

3. Methodology

3.1. Data Collection

The user studies took place in Ahmedabad, India (Gujarat state), at the CEPT University campus, where the RTI alpha prototype is installed. RTI and its partners completed a total of 32 focus group sessions—in Gujarati language—between September 18 and October 12, 2015, with approximately 320 focus group participants.

SEWA recruited the participants. SEWA is a community-based, nongovernmental organization (NGO) active in Ahmedabad with operations throughout India. Participants received a small gift for participating in the FGDs. SEWA drew the sample of participants from low-resource communities within Ahmedabad and placed priority on drawing participants from communities with limited improved sanitation options. SEWA recruited participants in community clusters and grouped them by Hindu and Muslim religious affiliation, gender, and approximate age-defined groups as follows:

- Younger (approximately 18–30 years of age)—Men/Women/Mixed
- Middle-age (approximately 31–50 years of age)—Men/Women/Mixed
- Older (approximately 50+ years of age)—Men/Women/Mixed

Approximately 10 adults, usually 5 male and 5 female, participated in each FGD. Several focus groups comprised couples, including men and women in the same FGD. In total, approximately 320 individuals participated in the FGD activities.

Each group of approximately 10 participants came together in a group meeting setting. The agenda included introductions and a review of the consent form. RTI and its partners showed consenting participants a short animation video of how the RTI toilet prototype functions and led them through the prototype toilet that was installed at the CEPT University venue. A question-and-answer discussion of RTI’s waste treatment and toilet technology continued through the tour until all participant questions were answered. Following the video and prototype viewing, RTI and its partners completed the FGDs in approximately 1 hour per session.

FGDs focused on four key themes: water reuse, menstrual hygiene, male practices and preferences, and features of the RTI prototype’s user interface (Table 1); however, all FGDs discussed many basic questions about the unit. SEWA or PHFI staff moderated all sessions, and NEERMAN or SEWA staff assisted in note-taking. In non-mixed gender FGDs, RTI and its partners used male facilitators with male participants and female facilitators with female participants. RTI and its partners recorded all sessions in an audio file where possible and reviewed it during transcription. NEERMAN conducted quality checks by reviewing notes and transcripts provided by the moderators and note-takers.

Table 1: Number of Discussion Groups, by Age, Religion, and Focused Topic

	Water reuse	Menstrual hygiene	Men's practices and preferences	User interface
Mixed gender (mixed age)				
Hindu				4
Muslim				
Mixed gender, younger (approx. 18–30)				
Hindu	2			
Muslim	3			2
Mixed gender, middle-age (approx. 31–50)				
Hindu	2			
Muslim	1			1
Mixed gender, older (approx. 50+)				
Hindu	2			
Muslim				1
Women, younger (approx. 18–30)				
Hindu		2		
Muslim		2		
Women, middle-age (approx. 31–50)				
Hindu		1		
Muslim		2		
Women, older (approx. 50+)				
Hindu		1		
Muslim				
Men younger (approx. 18–30)				
Hindu			2	
Muslim			2	
Men, middle-age (approx. 31–50)				
Hindu			2	
Muslim			1	
Men, older (50+)				
Hindu				
Muslim			1	

3.2. Data Processing and Analysis

After RTI and its partners completed the data collection, NEERMAN compiled the transcripts and unedited notes from the FGDs, and RTI analyzed the data. NEERMAN developed the transcripts using audio recordings and notes. RTI and its partners captured audio in all but several FGDs. Moderators and note-takers provided unedited notes in all but several FGDs with transcripts for analysis, apart from selected local words that were translated for understanding.

RTI conducted a thematic analysis of the focus group transcripts using QSR International's NVivo software. The coding and analysis of transcripts formed broad thematic findings to inform research objectives. A qualitative analysis assessed the frequency of topics discussed and determined the direction and intensity of participant feedback.

This report presents the findings from the qualitative focus groups. The results will help to inform near-term technology design and development decisions that must be made by the RTI R&D team and help to identify key issues for further investigation. However, based on the convenience sampling method used, these results should not be assumed to be representative of a larger population.

4. Analysis Results

This section summarizes findings based on primary research objectives, which seek to identify current behaviors, beliefs, and preferences regarding sanitation, focusing in particular on water reuse in the RTI system, women's MHM, and men's practices, preferences, and reactions to potential features of the RTI system. The following results sections include a discussion of current sanitation facilities, behaviors, and details of preferences related to the RTI technology.

4.1. Community Sanitation

Most of the FGD participants reside in communities that house 25 to 30 families; each household comprises 8 to 12 household members. In these communities, the water and sanitation infrastructure is often shared and in high demand. As a result, sanitation facilities are routinely overloaded or dysfunctional, frequently rendering them inaccessible to multiple families. FGD participants reported frequent fights breaking out over the limited shared resources in each community.

Networks of shared facilities are common, wherein community residents rely on their neighbors, religious centers, or neighboring communities to open their facilities when their own facilities are unusable or unavailable. Using others' toilets, however, came with a lost sense of dignity or convenience for many participants. While many facilities were frequently shared, participants noted that some facilities, such as those located at work sites, were more accessible to men. Additionally, participants discussed exclusive qualities of shared facility networks, as some communities mentioned locking their public toilets and preferring to pass a key among themselves rather than risk outsiders using, and abusing, their facilities.

Most interviewed residents had been living in the same community for multiple generations. Few improvements had been made to their communities over the years because, as many participants noted, politicians resisted permanent improvements to ad-hoc settlements. Participants suggested that politicians frequently promised improvements during election season but offered little in response after the election.

Sewer Infrastructure

The presence of sewer drainage varied across communities; some had no existing drain system installed, but most had sewer connections to their homes. However, issues with the sewage pipes were commonplace; sewage lines mixed with the water supply lines and frequently overflowed, particularly during the rainy season. Respondents noted problems with the gutters and “overflowing feces” as one of the most critical problems their communities faced, as there had been no government response toward cleaning or maintaining the sewage drains.

Water Supply, Quality, and Treatment

Water scarcity was widely recognized as the most critical problem facing each slum community. The majority of participants had access to municipal water supply for 2 hours in the morning from 6 a.m. to 8 a.m., and occasionally an additional 30 minutes in the evening. Some communities had public taps from which women collected water in turns for the ~300 members of their slum, but most communities had private water connections to their housing unit. The greatest challenge was collecting enough water and storing the water in drums and tanks for the remainder of the day. Water pressure was rarely sufficient to reach upper units in multilevel buildings, and unequal access to water during the limited morning time frame was the cause of frequent fights or disagreements.

Women bear the primary responsibility for water collection and storage. Water is stored in separate containers for each purpose (e.g., sanitation, washing and cleaning, bathing, and cleaning clothes). While some communities had common tanks that were filled and shared, water storage was most often managed on an individual household level.

The perceived quality of water varied across communities. Communities with limited sewage pipes reported frequent mixing of waste and water. The municipal water quality was found generally acceptable so long as it remained separate from sewage overflow. Most communities had limited sewage pipes and reported frequent mixing of waste and water, but others reported satisfaction and found no problems with their water quality. Most participants identified water quality primarily by color and smell, and many noted that it was not difficult to tell when water was perceived as dirty. When water was perceived as unclean, coping behaviors were well established; women would allow the dirty water to flow through the pipe first until it became visibly clear enough to be collected and used.

Water was rarely treated, even for drinking. Some participants noted that municipality workers deposited chlorine tablets in community water tanks every 2 weeks, but many residents found the chlorine-treated water to be bitter or perceived it as unhealthy. No participants reported using any water treatment regularly at home. Water was sometimes purified by boiling if a child was sick, and some women boiled water specifically during menstruation to clean absorbents and cloths. When asked why no further treatment was common, most respondents stated that it was difficult enough to collect the water; there was no further time or money to treat the water.

Facility type	Count	Percentage (%)
Private toilet	34	14.5%
Neighbor's toilet	14	6.0%
Shared toilets*	184	78.3%
Open defecation	3	1.3%
TOTAL:	235	100%

* Shared toilets refer to community and public (municipality-owned and private corporation) toilets. Individuals defined municipality and private corporation (e.g., Sulabh) toilets inconsistently as community or public toilets across focus groups. Results have been pooled to avoid misidentification.

4.2. Existing Water and Sanitation Amenities

In most of the slum communities interviewed, residents relied most heavily on public facilities. However, few participants reported relying singularly on one facility type. As no individual facility seemed to fulfill the broad extent of sanitation needs related to price, location, and condition, individuals often substituted facilities at different times of the day and for different sanitation events. For example, some men relied on sanitation facilities at their workplaces during the day, urinated openly, and used public toilets for defecation at other times. As such, Table 2 may understate the level of open defecation or public/shared toilet use; both options were frequently substituted when primary facilities were unavailable.

When faced with a choice between sanitation facilities, participants suggested that perceived water availability, cleanliness, and time required were factors that strongly affected their decisions. Other factors such as monetary cost, privacy, and safety affected use patterns. A functional facility and efficient experience was more highly valued.

Shared Facilities: Public and Community Toilets

FGD participants most commonly used public facilities, as they were the most reasonable option in terms of accessibility, cost, and privacy compared to open spaces and private toilets. However, public facilities were accessible at varying degrees. Municipal governments had constructed public facilities with 5–15 stalls in most communities; otherwise, Sulabh toilets, pay-and-use complexes open to the public, were typically accessible. Notably, participants stated that the combination of these public facilities did not adequately provide facilities for the typical slum community of 300–500 residents.

Most communities accepted public facilities as the “default” sanitation site. These facilities were universally gender-segregated and priced at 2–5 Rs. per use, which the participants judged to be reasonable. The prevailing concerns with public facilities centered on water availability, cleanliness, and wait times.

Public Facility Provisions

Theme-centered FGDs discussed water availability and MHM provisions at shared facilities, as topics are focus areas for the RTI system. Related to water, most municipal public toilet sites had limited water available on site. Thus, community residents commonly carried buckets with them to use for washing purposes in the public toilet. Most frequently, water provisions at the site included one or two storage

tanks that were filled in the morning; once this supply ran out, residents switched to buckets filled from their personal water supply. However, because of the uncertainty of the water tank's supply at the public toilet, many participants reported carrying buckets filled from their own supply. Very few public facilities seemed to have piped water supply, and those that did were frequently contaminated by sewage water. Having to carry water to facilities was widely disliked and perceived as a large burden. Sulabh toilets typically had water in stored tanks, but the availability was uncertain due to the limited supply in the tank and functionality of the water pump motor.

MHM at public facilities was not ideal based on several key factors. Women disliked changing and cleaning menstrual products in municipal facilities due to minimal privacy afforded to them. Some women used Sulabh toilets, but most relied on MORIs for MHM, as they “[felt] shy; so many men are present there.” To gain additional privacy, some women would only use facilities when men left for work.

Designated menstrual product disposal facilities were not available at any public site. Women threw out materials in trash bins at sanitation sites or anywhere outside of the home. Those who used public facilities during menstruation felt embarrassed for having to carry their menstrual hygiene materials to public or open sites. They also carried additional buckets—“minimum two buckets”—to clean themselves during menstruation.

Other provisions at public facilities included urinals and bathing amenities. Urinals were commonly available and free for use at most public facilities. Facilities used for bathing were often available at Sulabh toilets for a cost that ranged between 5 Rs and 10 Rs per user. Respondents mentioned making use of these provisions particularly in colder months because of access to hot water. No bathing provisions seemed to be available at municipality toilets.

Public Facility Conditions

Cleanliness/Maintenance: Overall, public facilities were not widely perceived as clean or well maintained. Cleanliness was the most critical factor affecting the use of municipality toilets. Due to their poor maintenance, many residents traveled further to Sulabh toilets, used MORIs, or openly defecated.

The lack of water availability was strongly associated with the poor cleanliness of facilities. Limited water was linked to people being unable to clean themselves and the facility after use; thus, filth accumulated heavily during the day. Cleaning and maintenance cycles varied by community; some facilities were cleaned on a bimonthly basis, while others were only cleaned when the community raised funds to hire a cleaner or complained sufficiently to mobilize action from the municipal government. In one community, a participant reported that facilities were cleaned every day, but few participants in this community agreed.

Privacy/Safety: The gender segregation of public facilities led to minimal stated concerns regarding privacy or safety. Participants also noted some behaviors, which may be “pre-emptive” behaviors to secure their safety; women tended to switch to in-home MORIs, if available, for urination at night instead of traveling outside to public facilities. Some defecated in open spaces at night that would otherwise be too exposed during the day. Women felt some lack of privacy, or did not feel welcome to use public facilities, during menstruation.

Travel and Wait Time: Distances to and the accessibility of public facilities varied by community and facility type. Municipality toilets were usually more accessible within a community; however, Sulabh toilets were often closer to main roads. In some communities, neither facility was easily reachable; some

participants said they had to travel by rickshaw to the next community to use the toilet, accumulating additional travel and time costs in the process.

As few as 10 stalls were often available for a community of several hundred, and long lines were common at most public toilets. Hours of use were also often restricted at municipal toilets; some were closed at night, and others were perceived as *de facto* unavailable due to the lack of lighting and water supply at late hours. The poor availability of public toilets frequently led to long lines and fights at the sites.

Time costs were important to working individuals, particularly men. During busy mornings, residents would switch between different facility types and locations to minimize travel and wait times at each facility. Public toilet wait lines could last over an hour. Distance was only compromised for cleanliness; it was common to travel to a facility farther away if the closer ones were dirty and deemed unusable.

Monetary Costs: Most municipality and Sulabh toilets cost between 2 Rs and 5 Rs per use. Sulabh toilets typically were slightly more expensive and better kept in communities where both options were present. Conditions in both types of sites were not perceived as adequate. Many residents were willing to pay a higher fee for a cleaner facility. Urination was typically free, and, where available, bathing cost between 5 Rs and 10 Rs per use.

Private Toilets

Private household toilets are uncommon in the slum communities. Aside from the high cost of construction, structural concerns such as space availability and water and sewage connectivity are primary concerns. Most slum structures can only support private toilets on the first floor, as the drainage and water supply lines cannot be supported on upper floors. Many of the participants who did have private facilities mentioned that the facilities were constructed with government financial support. They were typically well functioning but were not always sufficient for large households of 8–12 members. In these cases, men often use public toilets.

Broadly, residents most preferred private toilets but seemed largely willing to accept and appreciate shared facilities in their absence. For those without private toilets, ideal facilities varied somewhat by generation and gender. Younger generations, women in particular, found private toilets aspirational. However, many recognized the challenge to construct in their communities due to deteriorating building structures, poor sewage infrastructure and water connections, government resistance to improving informal settlements, and affordability. Some men went so far as to say, “Once we build a private toilet at home, the municipal people will come and break it. It is not allowed.” (FGD 18) For women, private toilets with running water, or alternatively MORIs, were the ideal facility during menstruation, given the women’s water, privacy, and hygiene-related needs.

MORIs

While few community residents have access to a private household toilet, many have created space for MORIs, informal washing areas, in their homes. These are usually tiled areas, sometimes blocked off with either a curtain or makeshift wall. MORIs are used for a combination of activities including washing clothes and housewares, bathing, urinating, and cleaning during menstruation. Ultimately, although MORIs are constructed in many homes, there is resistance to relying on them for sanitation needs, as cleanliness and privacy are difficult to maintain, and water supply is limited. The burden of maintaining MORIs also falls largely on women.

Urination and other sanitation events are often conducted as a last resort in MORIs, due to the lack of privacy afforded in many spaces, and the lack of hygiene associated with washing and self-cleaning in one space. Women especially report to using MORIs commonly for urination. This is particularly the case when public facilities are either closed or appear unsafe. For some women, their traditions suggest that public facilities are forbidden to be used during menstruation. Children and the elderly often also rely on the MORI as a close and accessible space, but women report challenges in maintaining the cleanliness of the space for other washing activities when it is also used for sanitation. Children sometimes defecate in MORIs, and the waste must be carried out by women and girls. Men appear to have greater ease in urinating in open spaces, rather than the MORI, as open spaces are available and acceptable for men to use.

Open Defecation

Few participants relied solely on open defecation; however, many resorted to it when other facilities were closed or not working. When municipal or public toilets achieve a comparable level of filth to outdoor spaces, residents prefer to openly defecate. Open defecation has become less feasible in many communities, as space has dwindled, and concerns about safety and privacy have increased. Due to space constraints, some participants shared that residents were forced to defecate by the side of the main road or by railway lines. Both spaces exposed them to humiliation and violence (e.g., rocks thrown from trains or car accidents taking place on the main road).

Although open defecation is appealing from a monetary cost perspective, travel and time costs can be substantial. Some community residents must travel between 0.5 km and 2 km to reach open spaces from their communities and carry water with them. Traveling is particularly difficult during monsoon season when there is “too much mud and many mosquitos,” one participant reported.

Primary Users: Men are the primary open defecators in the communities, as women purportedly value privacy, safety, and cleanliness to a greater degree than the men. Of these, privacy is particularly important, as many women noted that they “can only go freely after 10 p.m.” Generally, open defecation is a necessity during the night for those without private toilets.

Children will sometimes openly defecate, but locations vary and are less restricted by privacy concerns. Notably, children are expected to openly defecate only when they are very small and transition to closed facilities if available.

Urination: Open urination is common for men, to a similar degree to women using MORIs. Urination is cost-free at most public/community toilets, so the main motivating factor for open urination is time savings.

4.3. RTI System: Preferences

In all discussion groups, FGD moderators addressed questions geared toward understanding participants’ reactions to the RTI system. These questions centered on features and attributes of the alpha prototype.

MHM

Participants shared discussions regarding MHM throughout the focus group discussions; however, females in the women-only groups shared in greater detail than mixed groups regarding using the RTI system during menstruation. Most of the groups expressed sentiments such as “this is a very good

facility provided here” when reviewing the RTI facility. One respondent noted, in particular, the usefulness of this system for “today’s generation,” given the widespread preference for greater water access along with the tendency of younger girls to prefer pads and routine pad disposal. Participants broadly desired gender-separated units as an assurance of privacy. Female users described their avoidance of community toilets during menstruation specifically because “so many men are present there.”

MHM Product Vending Machine

Female participants universally reacted positively to the MHM product vending machine in the RTI system, suggesting that it would increase the privacy and convenience with which they could access MHM products. Pad use is however a small percentage, as mostly young unmarried women use pads. Married women, older women have the habit of using reusable products. Regardless of the type of absorbent used, women felt that the vending machine was beneficial. Participants suggested that pads available inside the unit afforded women a discreet option for acquiring products, which drew on women’s broadly held discomfort and feelings of embarrassment for carrying menstrual products with them to the toilet. Some women also noted the ease with which they can take care of their menstruation needs at night: “even if at midnight, if something happens, we are not in search for a shop...” Several women suggested that this is an important “emergency” option and is suitable for women who wear disposable pads or reusable, cloth pads. One participant within the MHM focus group noted, “suppose you have gone out in a hurry; instead of spoiling your saree, you can get a pad from this and use it.”

Both male and female participants shared that men understand women’s needs for MHM products and disposal options during menstruation and would therefore not mind sharing a unit with this type of vending machine option installed. Conversely, a few female participants suggested that the MHM vending machine may not be private enough, given that male users may also see the vending machine. One respondent said, “If my husband will see [the vending machine], I don’t have a problem, but if other people will see this, then I have a problem.” Men who were specifically asked about the availability of products within the unit affirmed that the availability of pads for 5 Rs is acceptable. Additionally, men did not note any issues or concerns for themselves with the MHM disposal chute installed in the RTI system.

MHM Product Disposal

Women felt positively about the MHM product disposal feature of the RTI system, and nearly all of the interviewees appreciate the potential of an incinerator option for disposal. Respondents felt that the incineration of MHM products would lead to reduced smell, increased cleanliness, and an improved sense that products were reliably disposed and not accessible to others. One woman noted, “It is better to burn away than have a cleaning person carry it from there. There are prevailing taboos associated with municipal workers carrying waste away, as they will see and handle the menstrual waste; this was also noted as one reason why cleaning people will not perform their tasks. Reliable disposal is a noted benefit of the MHM disposal feature in the RTI system, and female participants broadly supported it.

When discussing the issues regarding MHM disposal, participants frequently cited that religion offered important guidelines on this issue for Hindus and Muslim women, alike. Religious associations with disposal centered on who would be exposed to the material if it was encountered. Exposure to soiled absorbents was widely considered a “sin.” Many Hindu and Muslim women abstain from religious

practice during menstruation. The sight of menstrual absorbents is considered a sin by many women whether seen by people or animals. One Hindu participant aligned her preference to burn the products directly to her faith: “When we throw it out, animals like cows eat that soiled cloth. That is a sin. It is better to burn that cloth.” Participants broadly discussed disposal practices and varied in their opinions. Care is taken with how women dispose of absorbents.

Water Use and Menstruation

Women’s need for water increases during menstruation, given the common practice of regularly washing both reusable cloths and disposable pads after use. Women suggested that the availability of water at the RTI system makes it an attractive facility to use during menstruation; however, several participants noted that women who use reusable cloth products may still face issues in cleaning, transporting, and drying these reusable products. Typically, these practices are limited to inter-household locations (e.g., MORIs).

Many Hindu and Muslim women described their practice of washing used menstrual products before disposal. Among this group, nearly all expressed the challenges of this practice in the RTI unit. Most women did not consider using the water from the toilet flush and spray hose for this purpose. The squat plate is shallow, and the shallow bowl may not provide adequate space. As one woman noted, “...the water [being used for cleaning] may splash out [on genitals].” Despite low familiarity with spray hoses, some participants expressed this as a beneficial tool for cleaning their menstrual products. Several others suggested that a bucket or washing area with a separate drainage area would be appropriate for this practice.

Women were generally comfortable using recycled water for flushing purposes. Despite unanimous acknowledgement that women’s biggest MHM challenge is water, women were, in general, not willing to use recycled water from the RTI system for any aspect of their sanitation routine during menstruation. Many participants, particularly women within the MHM focus groups, were not willing to use the RTI recycled water in ways that would require personal contact. Both Muslim and Hindu participants cited religious guidelines for not wanting to use the reused water, referring to the water as dirty, despite the promise of the technology’s processing. The presence of menstrual fluid in the pretreated liquid waste also raised concerns about using the water. Some participants expressed a fear of falling ill if they shared this unit with sick users. Each respondent desired “fresh” water for handwashing and anal cleansing. These targeted MHM conversations suggest women may not be willing to use the recycled water for cleaning their MHM products, especially prior to disposal.

Cabin Size

Feedback on the overall footprint of the RTI system suggests that while participants liked the spacious interior of the cabin, many were concerned about the footprint of the unit in relation to limited space in their communities. Both men and women participants felt that the unit was too large to fit within their neighborhoods. One participant repeated, “I am telling you if space is there, then this size is perfect, but if at my chawl, or road side zopadpatti...this size will be too big.” Similarly, a few individuals focused on the size in relation to their home, noting that this size is inconsistent with the available space at their place of residence. Some participants joked that the cabin size was close to the size of their entire home.

Most participants liked the interior size, yet they were willing to compromise on the interior space due to space constraints within their community. Individuals also commented that the system provided adequate space for women and children: “For ladies and small children, it is perfect. If a lady makes

child sit on the tub, then she can stand or sit holding him.” Several noted that the interior of the cabin made the unit feel luxurious, which may suggest that size brings aspirational qualities.

Participants expressed uncertainty about the cabin elevation. The height ensured that the cabin would remain dry during a monsoon; however, some participants expressed concern about elderly or disabled users climbing the steps. Several participants requested that the antislip design on half of the stairs be added to each step. Additionally, nearly all participants felt that the depth of the steps could be increased to allow a more comfortable climb. One participant asked if the depth could increase to the full “size of a foot.”

System Perceptions and Features

Cleanliness: Participants widely perceived the RTI unit as clean and comfortable. One participant joked that it provides everything they need: a toilet, a fan, and water. Participants associated the size and “newness” of the facility with the overall cleanliness of the unit. Some participants expressed concern that the unit may not remain clean, however, if it was opened to the public. Others felt that the system’s incineration technology gave promise to reduce trash and will produce fewer foul odors in the unit than other public toilets. Interestingly, several participants noted that the presence of water and its availability within the unit denoted a higher level of cleanliness. This idea was offered in contrast to other public facilities where there is no running water available.

Water Availability

Participants viewed water availability at the RTI unit as a significant aspect, which yielded excitement and some concern. Many participants noted that water availability might eliminate the need for each user to carry his/her own water to the toilet, a practice that is widely disliked. Given the water scarcity in the area, some participants wondered how long the water would last and if it would run out. Others questioned how long the water would remain clean if stored and reused at the system.

Gender-Neutral Design

Men and women alike raised concerns over the RTI system’s current gender-neutral design, in which both genders use the same cabin. Primarily, participants felt that a shared unit would make them less comfortable due to social or religious norms that often separate men and women and the potential for the compromised safety of users, particularly women. Many participants noted that “some kind of harassment may happen.” Some men were wary that a shared unit would increase the interactions they had with women from outside of their households and could increase the potential for negative interpretation of their presence or interactions with other women. Other participants suggested that men and women could misuse the space as a private location to meet. Some men suggested that women simply take longer to use the toilet and, as such, would prefer a separate unit.

A number of male participants also noted the religious barriers to a unisex unit. One male noted, “we cannot use the same water used by that girl for saying namaaz (prayers).” In light of cultural norms, some participants warned that use of the facility would be uneven. For example, the presence of one man in line would, for some communities, prevent a woman from joining the queue and vice versa. Because “ladies and gents both will not stand together,” use of the facility could favor one gender over the other.

User Interface

Participants widely perceived the automatic flush mechanism as easy to operate, but most of the participants were not familiar with the push button used to activate it. Individuals expressed an ability to learn, however, and suggested that the availability of a bucket as an alternative would be useful. Some participants believed that one flush would be sufficient for cleaning the toilet, although many said that two flushes may be necessary. In general, participants expressed a desire to have more than one flush so that it would adequately clean the bowl after use; in many cases, the force of flushes that participants had used before were not strong enough to accomplish this.

Participants viewed the squat plate's round design as modern and highly aspirational; however, participants universally noted that the plate should be wider and deeper. All participants worried that the bowl is not deep enough to prevent splashing during use. Participants also consistently agreed that the width of the plate should increase to provide more room for users' feet. This change, many felt, would not only increase their personal cleanliness for many different types of users—young, old, and heavy—but also increase the hygiene of the area around the toilet.

Participants also viewed the spray hose as an aspirational feature, but most participants were unfamiliar with it. Many individuals again expressed a willingness to learn, yet noted the need for a bucket option. Participants voiced strong preferences regarding the spray hose water pressure; however, the preferences varied substantially. Frequently, participants within the same FGD debated the merits of low vs. high water pressure for the cleanliness and comfort, suggesting that preferences are highly individual. Several suggested that the addition of a way to vary the level of water pressure was important.

4.4. Water Reuse

RTI and its partners asked the participants about the overall acceptability of reused water from the RTI system. A consensus developed quickly in all of the FGDs: water is scarce, and any system that conserves this resource is seen, generally, as positive. Many participants spoke about challenges to gathering enough household water and the inconvenience of carrying water to municipal and community toilets. However, despite positive associations with water availability and a description of the water cleansing process in the RTI unit, many participants debated the water's usability for a variety of applications.

In particular, the information that was shared with participants was particularly important in defining their judgment of the reused water. On one hand, some participants noted how well the water purification process was described, and were assured of the water cleanliness, stating that they do not know as much about the cleanliness of municipal water. On the other hand, some participants felt that the description was too detailed and closely tied the relationship between the reused water and its waste origin. One participant suggested that recycled water would be usable if they knew less about its origins: "Since we know where the water is coming from, we have the problem."

Other participants were swayed by other group members' reasoning for using the water as it relates to their current practices. One participant suggested that the "same thing is used for fertilizer in the village. Are we not eating those grains and pulses?" Another stated, "actually, the water we get from taps and rivers and all is also contaminated [...] but this water becomes pure after going through this process."

In many FGDs, moderators prompted users to suggest what might make the water usable. In addition to information and messaging, several participants strongly advocated for a fresh water option alongside the recycled water as an alternative. Some stated that they were willing to pay extra for this option.

A nuanced debate occurred in some FGDs related to the acceptable use of reused water for purposes that touched the body (e.g., handwashing and anal cleansing) vs. external applications (e.g., gardening and animal hydration). Some participants suggested that the reused water was not clean enough to touch body parts and they could not use the water. Overall, participants seemed slightly more likely to use reused water for anal cleansing than handwashing within the unit. Although general acceptability of water reuse was mixed, nearly all respondents felt that reusing water for the toilet flush was appropriate, as water does not contact the users.

Many participants, Muslim and Hindus alike, tied their inability to use the recycled water to their religious beliefs. Most frequently, this was referenced as problematic for their preparation for religious activities, such as puja and namaaz. One Muslim woman noted that the water makes them “unholy” for these activities. “We cannot use this water. If one drop also falls on us, then we become napak (dirty).” Several men additionally expressed concerns that the reused water was unclean, given the potential for menstrual fluid in it.

Conversely, another Muslim participant made an argument that this water is their cleanest source: “In our Islam religion, it is said air cleans the water and in this case air, fire, and everything is cleaning this water, so there is no problem in using this water for washing hands and all.” A smaller set of individuals displayed initial reservations, but warmed up to the idea in light of FGD conversation: “Initially, we may feel somewhat using this water, but after some time, we will get used to this water.”

Similarly mixed, some participants found the external use of this water acceptable, while others strongly opposed such actions. In particular, respondents noted that plants could die if recycled water was used, yet others concentrated this restriction only to edible plants. Some Hindu participants suggested that the water could not be used on “pure” plants used in puja. Many agreed that the water could be reused for washing cars, watering plants and animals, and farming. One participant made a direct distinction between castes that could use the water for these purposes: “For other castes, this water will do; they can use it.”

4.5. Urinal

Men universally agreed that a partition should be added to the urinals on the unit’s exterior to improve privacy. Many participants noted that a partial door would allow men to urinate in isolation while maintaining ventilation. The importance of privacy at the urinal increased when participants tied their use of the urinals to a gender-neutral unit. Many men felt that women passing the urinals without a partition would be improper and embarrassing. One man specifically said, “ladies will pass through, so there should be a partition.” Another participant added, “if a partition is given, then ladies can pass through without hesitation.” In addition, some men suggested lowering the urinal a couple of inches. The placement on the RTI prototype seemed too high for shorter individuals and younger users.

4.6. Willingness to Pay

RTI and its partners asked many participants if they currently pay to use the toilet and if they would pay to use this facility. The input showed a willingness to pay. Some respondents currently pay between 5 Rs

and 7 Rs per use at a local toilet and would also be willing to pay the same amount to use the RTI unit. Many individuals were willing to pay for the availability of fresh water. Additionally, a near majority of women were willing to pay for the disposal pads within the unit.

5. Recommendations and Conclusions

The findings of the October 2015 user studies provide valuable insights into individuals’ current sanitation behaviors, beliefs, and preferences, and their attitudes toward the RTI system. These findings, summarized in Table 3, will directly affect decisions made regarding adjustments to the user interface for RTI’s beta prototype (see Table 4) and will inform system development in the long term through identifying important features that may affect user adoption. Table 5 summarize key areas that may have adoption implications and thus should be further explored in order to better understand user preferences.

Topic	Observation
Highly favored features	<ul style="list-style-type: none"> ▪ The size of the internal cabin is large enough to conduct most sanitation needs. Users perceive this much space as a luxury. ▪ Users view the modern, round design of the squat plate as aspirational. ▪ Users view the water availability in the system as a major system benefit.
Overall perceptions	<ul style="list-style-type: none"> ▪ Safety concerns are tied to interactions with people, not system processing. ▪ A desire for gender-separated stalls emerged frequently based on social norms and safety concerns.
Exterior features and footprint	<ul style="list-style-type: none"> ▪ Users are concerned that the unit footprint will not fit within many community space limitations. ▪ The unit’s large size is attractive, if space is available in the community. ▪ Stairs are too steep to climb safely and may become slippery. ▪ Railings provide adequate support.
Interior features	<ul style="list-style-type: none"> ▪ An automatic flush and spray hose are aspirational features with which user familiarity is low; however, many users expressed a willingness to learn to use these features. ▪ The spray hose water pressure was too strong or too weak; many participants felt strongly in one direction, and opinions were highly individualized. ▪ The sink’s automatic function is aspirational and tied to water conservation. ▪ The squat plate bowl’s round design is modern; however, users are concerned that it is too shallow (e.g., likely to cause a splash) and narrow (e.g., feet do not fit comfortably) for comfort and cleanliness during use.

Table 3: Summary of User Input/Feedback on Prototype Features	
Topic	Observation
Menstrual hygiene management (MHM)	<ul style="list-style-type: none"> ▪ MHM amenities (e.g., disposal and vending machine) are widely supported, ▪ A majority of users view disposal by incineration as the most reliable and safest way to eliminate MHM waste. ▪ Some users view reused water as unclean for washing reusable MHM materials. ▪ Some women concerned flush water will get contaminated with menstrual blood making recycled water unacceptable for other purposes.
Urinals	<ul style="list-style-type: none"> ▪ There is a universal desire for a partial door on the urinal to improve privacy and retain ventilation. ▪ The urinal height is slightly too high.
Water reuse	<ul style="list-style-type: none"> ▪ In general, users accept reused water for applications that do not touch body parts (e.g., flush). Users have a mixed acceptance for applications that do touch the body (e.g., anal cleansing and handwashing). ▪ The use of reused water for external purposes highly varied (e.g., garden, animals, and house/vehicle cleaning). ▪ Many participants highlight information as a critical element in accepting water reuse, suggesting that continued reasoning through social, religious, and health-based norms may reinforce reuse. ▪ The condition and duration of water storage also affect perceptions of water cleanliness. ▪ Widespread water scarcity reinforces the importance of water reuse in the system.
Water availability	<ul style="list-style-type: none"> ▪ Users view water availability as a key benefit of the system, given the widespread scarcity of municipal water. It is an aspirational quality when users do not have to bring water to shared toilet facility. ▪ The presence of available water improves the perception of facility cleanliness.
Demographic-specific	<ul style="list-style-type: none"> ▪ Women: Men and women recognize that women are the most “in need” beneficiaries of this system. ▪ Religion: Hindus and Muslims cite religious guidelines for water use—reasoning for limited use of reused water on body. ▪ Elderly: The steep stair grade makes the unit challenging to access. ▪ Children: The spacious cabin facilitates women with children using the toilet.

Table 4: Recommendations for Potential System Adaptation	
Feature	Recommendation for potential system adaptation
External features: Stair access	<ul style="list-style-type: none"> ▪ Increase stair depth to decrease steepness. ▪ Add an antislip coating on all stairs.

Table 4: Recommendations for Potential System Adaptation

Feature	Recommendation for potential system adaptation
Internal features: Spray hose Automatic flush Squat plate	<ul style="list-style-type: none"> ▪ Add a pressure variation feature on the spray hose. ▪ Increase the size of the automatic flush button. ▪ Widen the squat plate for foot placement, and deepen the bowl to minimize splashing during use.
Urinal	<ul style="list-style-type: none"> ▪ Add a partition/partial door on the urinal stalls. ▪ Raise the urinal height slightly.
Preference for gender-separated stalls	<ul style="list-style-type: none"> ▪ Consider adding two cabins in one processing unit, divided for separate use by men and women.
MHM pad chute	<ul style="list-style-type: none"> ▪ Consider adding incineration capability for used menstrual products given strong preference for this mode of disposal.
Water reuse	<ul style="list-style-type: none"> ▪ Consider adding a separate water source (e.g., municipal water) for some applications for which high reluctance persists for reused water (e.g., washing during menstruation and handwashing).

Table 5: Recommendations for Future Data Collection

Data collection findings	Recommendation for future data collection
Size of unit footprint	Assess space constraints in different contexts (e.g., residential communities, schools, and construction sites) to determine the physical and perceived constraints of the footprint size.
Lack of familiarity with spray hose/automatic flush	Evaluate information or training that is needed to increase user comfort with the spray hose and flush features.
Desire to flush multiple times after using the toilet	Understand what constraints or information (e.g., messaging) can reinforce single flush uses.
Mixed acceptance of reused water and the role of information	Evaluate the role of information (e.g., messaging and social marketing) in reducing barriers to using recycled water from the on-site processing of liquid waste.

Appendix A

A.1 Development of Data Collection Materials

RTI designed the focus group discussion (FGD) guide and planned FGD data collection. RTI reviewed and adjusted the guides and protocol with the Self Employed Women's Association, Network for Engineering, Economics Research, and Management [NEERMAN]), and an independent researcher at the Public Health Foundation of India (PHFI) prior to conducting the user sessions. NEERMAN completed the final translation of both instruments from English to Gujarati. RTI's Institutional Review Board (IRB) reviewed and approved FGD guides and participant consent forms prior to work starting in Ahmedabad, India.

A.2 Participant Recruitment and Incentives

The Self Employed Women's Association (SEWA) recruited a convenience sample of participants from populations residing in low-resource areas in Ahmedabad. SEWA drew participants from slum communities where it has relationships, and targeted both Hindu and Muslim neighborhoods in both cities. To gather interest in participation, SEWA staff in the chosen slum communities distributed a flyer and disseminated information through small gatherings within the community. SEWA identified community residents interested in participating, clustered them by age and gender, and scheduled designated times. Participation was voluntary. SEWA gave each participant a lunch pail as a gift after his or her participation.

A.3 Training

RTI, NEERMAN, and SEWA completed a series of training days in September in Ahmedabad prior to starting the FGDs. NEERMAN supported the training of data collection teams, with training focusing on orientation and testing of the FGD guide, FGD administration best practices, note-taking best practices, contingency measures, and informed consent. RTI and its partners oriented field supervisors for managing daily documentation procedures, collecting informed consent forms and maintaining confidentiality, and coordinating and communicating with partners. The training session included discussions, question-and-answer sessions, mock FGDs, and practice in FGD administration.

A.4 Research Ethics

Throughout the design and data collection, NEERMAN, SEWA, and RTI adhered to strict ethical guidelines to respect the rights of research participants and to protect participant confidentiality. In early September, RTI's IRB reviewed and approved the FGD guides and procedures, prior to data collection activities.

During interviewer training, RTI and its partners trained individuals to properly administer an oral informed consent to a potential participant. Key components of the informed consent included a description of the study procedures, the right to refuse to participate, and a description of how participant confidentiality is maintained.

Before beginning the FGD sessions, facilitators read the informed consent script to each potential participant and answered any questions about the process. Participants and interviewers then signed the consent forms. Facilitators and note-takers did not record participants' names or other information

that could potentially identify a participant. Facilitators kept completed consent forms, FGD notes, and FGD tape recordings in a secure location during fieldwork.

A.5 Staffing

The FGD work started in Ahmedabad in mid-September and ended in late October 2015. All field study teams were experienced managers and facilitators for qualitative and quantitative data collection, and were familiar with the RTI technology. SEWA provided facilitation for the FGDs. NEERMAN fielded one male and one female note-taker for FGDs. A quality assurance supervisor oversaw both teams. Additional SEWA staff were present to manage the flow of participants, assist in managing FGDs, and provide participants with snacks at the end of the sessions.

A.5.1 Quality Assurance

The study used several methods to ensure the quality of data collection, including field observations, review of FGD notes, and secure storage of notes, tapes, and transcripts. At the end of each day, forms, notes, and transcripts were reviewed and stored safely.