

proportion

Female Latrine Lighting and Locking Systems

Prototyping and testing at IDP camps in Konduga and Gwoza, Maiduguri State

Final Report by Emmanuella Ezike, Proportion Global

July, 2023

Commissioned by IRC Airbel

Table of Contents

Section 1: Executive Summary

- Project Overview & Research questions
- Prototyping Objective & Key findings

Project Overview & Research Questions

Insufficient lighting and insecure locking mechanisms in latrines at IDP campsites contribute to significant safety concerns for female clients. These issues not only threaten personal security but also pose health risks due to improper sanitation practices and the potential for sexual and gender-based violence.

To address these critical issues, IRC launched a crowdsourcing challenge, inviting public submissions on how to make latrines in refugee camps more secure through better lighting, locking, and alerting solutions. From numerous innovative proposals, two solutions were selected as the most promising: one focusing on enhanced lighting and the other on locking mechanisms.

Key Research Questions

Client Experience

What factors affect the desirability of lighting and locking systems for female clients at IDP campsite in Maiduguri, Nigeria?

Operability

What installation considerations exist for both lighting and locking solutions at different location?

Link to Grouping of Research Question:Link here

Prototyping Objective & Key Findings

Prototyping Objective

The Objective of the prototyping test is to introduce a lighting and locking system to a small group of users, observe their interactions with it, and gather feedback on their perceptions and experiences. This will help us better understand the installation process and enhance the client experience.

Key Findings

- Female clients (women and girls) highly desire the lighting and locking solutions. Before the lighting system, clients used buckets beside their tents or avoided using the latrine entirely at night. Among the variations, the lighting without a contact switch was the most preferred, with a recommendation to increase the lumen output. The locks gave clients with a sense safety and security when using the latrine..

- For operability and installation, key considerations include:
  - The design of the latrine
  - Distance between the latrines and clients tents
  - Environmental factors such as heavy rain
  - The safety and security of the prototypes within the camps

Section 2: Methodology

- Test location & Characteristics
- Client segment
- Prototyping Plan & Tools
- Human Centered Design Approach
- Installation consideration

Test Sites in Maiduguri

Two locations and four sites were selected for the testing exercise to encompass a variety of camp structures and populations. The goal is to formulate solutions and recommendations that address extreme conditions, thereby solving for less extreme situations.

Location	Site 1	Site 2
Gwoza	20 Housing IDP Camp	Wakane IDP Camp
Konduga	Boarding House IDP-Zone A	Boarding House IDP-Zone B

Research Site Characteristics

Location/Sites	GWOZA		KONDUGA	
	20 Housing IDP	Wakane IDP	Boarding School IDP- Zone B	Boarding School IDP- Zone A
Camp structures	Disperse tents, There is a large field behind the latrine.	The campsite is in a school zone. Close to a village separated by a sizeable eroded dry gully.	The camp tents are clustered together, latrines are close to camp marketplace	The camp tents are clustered together
Population	About 5453 female clients	About 7315 female clients	~29,250 (General population)	~29,250 (General population
Sanitation infrastructure	Fewer toilet blocks latrines within 50 feet range	Several Mixed used(Bathroom + Latrine) Structures . Closet Latrine within 100 feet range	There are several toilet blocks that are short distances apart, i.e., adjacent to each other. The latrines have a privacy screen.	Proximity to two(2) additional male and female latrines. This location has more traffic than the previous location
Type of construction	Zinc and wood	Zinc and wood No roofing	Zinc and wood	Zinc and wood
Number of cubicles	-6 drop holes in the toilet block	-6 drop holes in the toilet block	-5 drop holes	-5 drop holes
Distance from Tent/Shelter	20-27 feet	Over 200 feet	About 10-11 feet	About 7-10 feet

Client Segment

Women & Girls: In Gwoza, a total of 20 female clients were recruited and interviewed. In Konduga, 14 clients were interviewed. Some participants were recruited before the interviews, while others were organic clients who interacted with light and the locking solution and were willing to participate.

Service providers: Four (4) typical installers were engaged in Gwoza and Konduga.

Research Site	Gwoza	Konduga
A1. Single women who had interacted with both lighting and locking solution	5	3
A2. Married Women who had interacted with both lighting and locking solutions	3	4
B1. Girls aged 9-13 who had interacted with lighting and locking solution	1	2
B2*. Adolescent Girls aged 14-17 who had interacted with lighting and locking solution	6	1
B3. A Younger woman aged 18-24 who had interacted with lighting and locking solution	4	3
C. A female client with a visual impairment	1	1
Total	**20**	**14**

B2*an additional client segment resulting from high turnout

Human Centered Design Approach

Qualitative Research

Testing was done in ~2-3 days at each camp location to introduce the prototypes to clients. Each client had between ~24 to 48 hrs (2 nights) to interact with prototypes. The approach employed for getting feedback and relevant insights includes;

- Observed installation of the lighting and locking system at four (4) sites.
- A 30-minute debrief interview with a typical Installer
- Two (2) clients audio self-demonstration using latrine at night. Client captured their thoughts, experiences, and reflections with the prototype.
- A 30- to 40-minute client interview with five client segments (at least one client for each segment).

Synthesis & Analysis

- Synthesis and Analysis of qualitative data to identify common themes across observations and interviews to answer the research questions.

Link to Plan & Research tools: Here

Installation Consideration

Installation of solution in 2-3 toilet blocks at each location with different physical characteristics

Prototypes
Two(2) lighting solution variations with daylight sensors that light up from dusk to dawn.

- Variation 1: Lighting system with a contact switch that remains dim while the latrine door is open but brightens when a client enters and closes the contact latch
- Variation 2: Lighting solution with no contact switch. The light stays on throughout the night.
- One(1) locking solution

Location	Site	Toilet block 1	Toilet block 2
Gwoza	**Wakanow IDP Camp**	Lighting: Variation 1 + Locking solution	Lighting variation 2 + Locking solution
	20 Housing IDP	Lighting: Variation 1 + Locking solution	Lighting: Variation 2 + Locking solution

Image: Gwoza installation-20 housing

Installation Consideration cont'd

	Site	Toilet block 1	Toilet block 2	Toilet block 3
Konduga **Boarding school IDP**	Zone B	Lighting: Variation 1 + Locking solution	Lighting variation 2 + Locking solution	Lighting: Variation 1 (Only)
	Zone A	Lighting: Variation 1 + Locking solution	Lighting: Variation 2 + Locking solution	Lighting: Variation 1 (Only)

*Based on initial observations from the first installation at Gwoza, an additional toilet block was added to test whether the latch lock for the light with a contact switch could be used as a locking solution and determine clients' preferences.

Image: Konduga installation- Zone B

Section 3: Key Findings

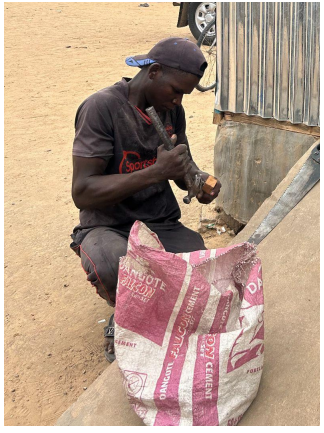
- Operability
  - Installer persona
  - Learnings & insights for the Lighting system
  - Learnings & insights for the Locking system

- Client Experience
  - Client latrine journey map
  - Learnings & insights for the Lighting & Locking system

Section 3.1: Operability

- Installer Persona
- Learnings & insights for the Lighting system
- Learnings & insights for the Locking system

Operability



Persona Name
Ali Mohammed

Audience Segment
Typical Installer

Who am i?
Carpenter/Engineer
37 years

My Quote

"My preference would be the solar light without contact switch because it is easier to install than the other type. The women do not need to touch anything, and it has a sensor. Once you come in, the light is already bright"

My Motivation

Supporting vulnerable populations especially women and children. I am also from this town so working for my people motivates me

My perception of Clients Challenge

+ Clients have been complaining that there is light in the town but no light in the latrine, and they do not have a torchlight to use in the latrine at night.

+ Because there is no light, some of the clients will stay at the side of their tents because of fear of harassment, animals and reptiles to relieve themselves instead of using the latrine.

Persona_Typical Installer

My Challenges

+ This is my first time installing this type of lighting solution, I would like additional training even with the manuals.

+ Some aspects of the lights are too fragile. There are some parts of the light that we tried to fix, but they got broken.

My Expectations

+ These lighting and locking solution helps to address the concerns of the clients and can be installed in more remote locations that need the lighting most.

+The lights and locks are sustainable and last longer.

Installation Considerations

Key Insights: Lighting prototype

What installation considerations exist for different toilet block sizes, locations, and construction?

+ **The Design of the latrine**
  Most of the toilet blocks already have the structures installed, e.g., zinc and wood door frames often made of hardwood, making installation difficult and time-consuming. Installers had to chip some wood out of the door frame or add wood to install the lights with contact switches..

+ **Environmental Factors**
  Both locations often face harsh weather conditions, such as heavy rainfall and strong winds. Installers expressed concerns about potential damage to the solar panels and exposed batteries due to water damage or being blown away. Some latrines were observed to have no roof, making the light system more susceptible to damage.

+ **Easy of Installation**
  Installation time, required expertise, and materials vary for each light variation. Lights with contact switches take a longer to install and require more knowledge and materials than lights without. The installation team had strong preference for the lights without contact switches, because of the ease of installation.

+ **Safety and Security of the Prototypes**
  Vandalism and theft are common concerns. It's important to consider a lighting solution that reduces the likelihood of being stolen by locals and damaged by children, who might see it as an intriguing toy or a means to a quick payout.

Key Insights: Lighting prototype cont'd

Installation Considerations cont'd

What installation considerations exist for different toilet block sizes, locations, and construction?

+ **Camp size and presence of facilities**
  Camps with a larger population of female clients and fewer functioning latrines would face challenges with congestion and overcrowding when the lights are installed. Installers noted a potential increase in latrine segregation amongst clients when a lighting solution is installed in any location. Clients were also observed to use the facilities with prototypes more frequently during the day.

+ **Distance Between Latrines & Tent**
  The distance between clients and the latrine typically affects usage. Clients with a latrine nearby are likely to use the facility with or without a lighting solution. However, clients farther away from the latrine are less likely to use it without an additional light source.

+ **Presence of Trained Installation Team**
  Although some training was provided, most installers noted that it was insufficient, even with the manual. Additionally, the training was administered only to IRC staff. On-ground technicians had to rely on the staff for guidance and support.

+ **Replacement Parts**

  In Konduga, three out of the five lights were not functioning, and the team lacked the necessary parts to replace them. Replacement parts, such as batteries or solar panels, were not available for either of the lighting systems.

Resources and Environment

Key Insights: Lighting prototype

What person-power, skills, training, and materials are needed for installation?

+ In addition to the manual, additional training and guidance are needed for the installation of lights with contact switches. Installers noted a preference for physical training sessions
+ There are two to three trained installation teams per toilet block (6 cubicles) per day, with an average installation time of 30-40 minutes for a single light with contact switches and 10-20 minutes for lights without contact switches.
+ Additional materials needed, beyond those provided, include nails, extra wood, and glue for the solar panel replacement parts for both types of lights.
+ Foundational knowledge of carpentry and electrical installation is required for the installation process.

Resources and Environment

Key Insights: Lighting prototype

How does the colour of light (Yellow, Warm White, Cool White) influence the attraction of flies?

+ Given the current lumen output, lights are less likely to attract insects or generate heat regardless of the light color.

Quote

"*The light is fluorescent; it is amber, which doesn't attract insects. It will also not attract any heat because it is just 5 volts, which is low*"

Installer

What are the energy requirements for different lighting solutions, and how feasible are they in off-grid or remote locations?

+ Solar was the preferred source of energy for all locations, especially for remote field sites with little or no access to electricity, but the availability of fully functioning latrine blocks is a vital consideration

Installation Consideration

Key Insights: Locking prototype

What installation considerations exist for different toilet block sizes, locations, and construction?

+ All locations visited have similar designs and construction, although the doors' orientations differ. The latch arm and receiver for the locking solutions were too large for the door frame. Where wood was available, the installer added some, but otherwise, some parts of both features of the locks were not fully attached to the frame."

+ General guidelines for installation are necessary to ensure uniformity across all locations and toilet blocks. Each installer had a different method of installing the locks. In some locations, locks had to be reinstalled afterwards to achieve consistency, which still needed to be improved in other places.

What elements of the locking prototypes are vulnerable to damage, theft, malfunction, or degradation?

+ Due to the high commercial value of metal at the sites, both features (latch arm and receiver) are susceptible to theft. Two of the locking prototypes were stolen the day before the interviews, although they were subsequently replaced. This vulnerability indicates a risk of theft and resale by locals to "Ajaguda people.".

+ The Latch-arm is prone to malfunction when improperly installed. Observations showed that some of the latch arms were loose and lacked support, which can cause the screws to loosen and damage the prototype.

.

Resources and Environment

Key Insights: Lighting prototype

What person-power, skills, training, and materials are needed for installation?

+ Additional installation materials, such as nails and extra wood, are required
+ Basic carpentry skills are necessary. However, no further skills or training were identified as necessary.
+ The same installation team is engaged for both lights and locks. Typical installation time ranges from 20 to 30 minutes, depending on the door frame design and type of wood, with a team size of 1-2 persons.

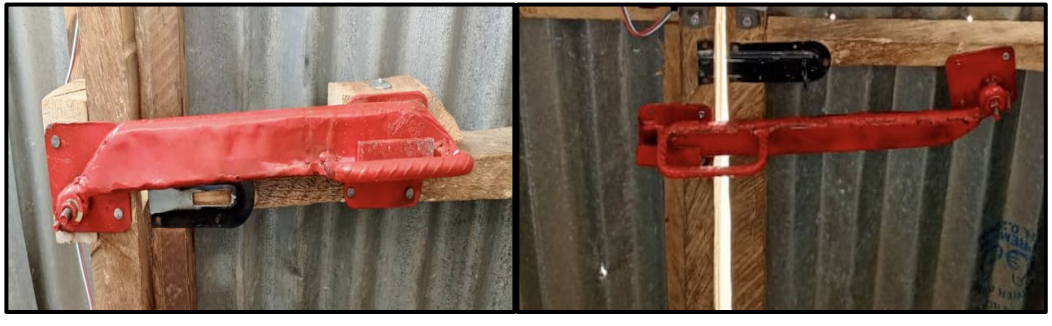
How do the prototypes compare across these factors to other locks available on the market?

+ Other prototypes are perceived to be less durable than the locks despite being easier to install. However, the locks are preferred for their superior quality.
+ The size of the locks remains a concern among the installation team.

Images from Observation + Installation Video

a. Light with Contact Switch

Video link: here



b. Locking prototype - Two locations, two different installation style

c. Light with No Contact Switch

Section 3.2: Client Experience

- Client Experience
  - Client latrine journey map
  - Learnings & insights for the Lighting & Locking system

User Journey

Before Lighting and locking system

Name
Hadija Namubiru

Client Segment
Married women
30 years

Typical latrine use time

I prefer to use the latrine at night between 8pm and 12 mid-night when I have finished all my house work and my children are as sleep

Challenges

"I don't have a the solar torchlight and my house is too far from the latrine "

Clients find it challenging to access the latrine at night due to fears of harassment, encounters with reptiles, or being accosted by witches

Thoughts

"There is no light around the camp, can I really go alone to the latrine at this time"

Clients experience constant fear and sadness when unable to use the latrine at night without any source of light.

Actions

"I have a small bucket, let me use it"

Most clients consider alternatives like using buckets, nylon bags, or areas closer to their tents to relieve themselves, keeping these outside to dispose of during the day.

Expectations

"One day we would have light in our camps too"

Clients are hopeful about the idea of having lights in and around the latrine, which would improve nighttime usability

User Desirability

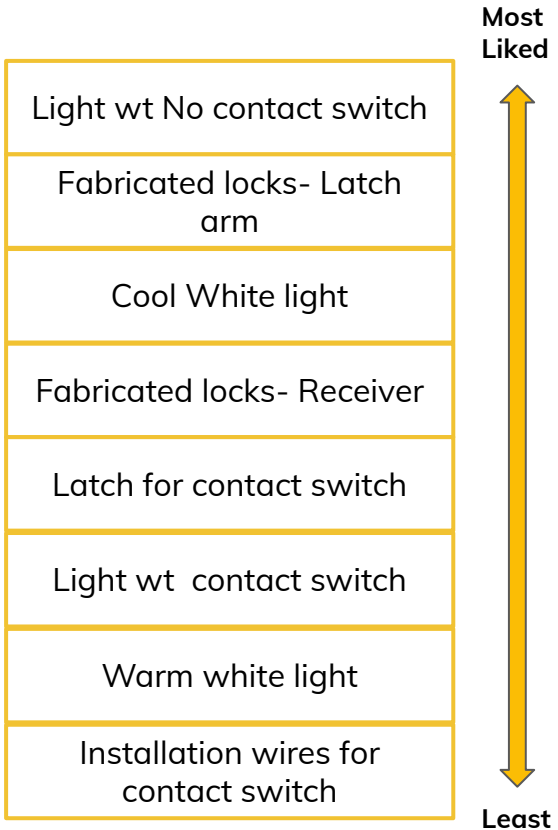
Key Insights: Lighting prototype

What are Client preference for lighting options?

+ Most women and girls prefer the light with a no-contact switch because it stays on all night and requires less effort to use.

.

- + Clients (Women & girls) often do not notice or use the latch for the contact switch when in the latrine, especially when installed with the fabricated locks.
- + Girls experienced difficulty using the latch installed in the latrine due to fear of damaging it and a lack of know-how.
- + Some clients did not get the opportunity to use the light with a contact switch at full lumen output after installation due to malfunctioning and damage of the prototype..
- + All clients noted fear of vandalism and theft by children and hoodlums for both lighting solutions but were more concerned about the light with a contact switch because the wires are exposed.



Features Card Sorting

Functionality

Key Insights: Lighting prototype

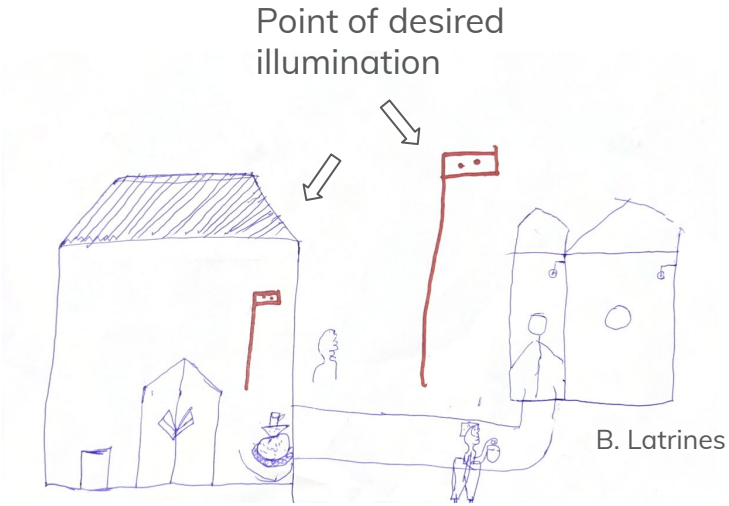
What is the relative importance of in-cubicle light to lighting surrounding the exterior of the latrine?

+ All women and girls would prefer additional lighting closer to their houses and mid-point between their homes and their latrines, regardless of the distance.

+ All Clients prefer lighting that casts far enough for them to see from their tents as a guide along the path to the latrine to eliminate the fear of getting to and from the latrine.

+ Clients note that the light wt contact switch casts farther than the light wt no contact switch at full lumen output but far enough to be desirable for them

+ The functionality of the latrine does not change with the introduction of the light, but it increases traffic in the latrines and promotes multiple client use (i.e. both male and female clients using the latrines together)



Functionality

Key Insights: Lighting prototype cont'd

What is the preferred lighting level (lumen output) for in-cubicle lighting?

+ Clients complained of low lumen output for the light without a contact switch and the dim state of the light with a contact switch. They further noted that it limits their ability to see the drop holes or notice and alert them of people outside the latrine.

+ Strong preference for cool white light over the warm/yellow light, amongst different client segment because it increases alertness to the external environment and and enhances visibility inside the latrine.

+ Differentiating lighting color was not important to clients.

+ Clients who experienced the full output of the light without a contact switch preferred its lighting level.

+ Clients with visual impairments struggled with the change from dim state to full lumen output for the **light wt a contact switch**, noting the sudden brightness as difficult for their eyesight.

Light wt contact switch

Light wt no contact switch

Ease of use

Key Insights: Locking prototype

How easy is it to operate the locking mechanism for different user groups, including children, the elderly, and individuals with disabilities?

+The locking mechanism was straightforward with minimal force, and when installed properly, the locks are user-friendly for all groups, particularly children, older clients

How intuitive is the locking solution relative to the needs of the female clients?

+ Clients demonstrated good knowledge of how to use the locks across all facilities. The lock requires minimal effort to engage and disengage if installed appropriately.

What elements of the locking design affect the usability of the lock by female users

+ The locking mechanism's shape was easy to grip and manipulate, especially for users with smaller hands or reduced grip strength, although the size of the locks was difficult for younger clients.

+ The locks were positioned at a height that is easily accessible to users of varying heights, ensuring they can be operated easily.

+The locks provide a strong sense of security regarding some of the clients' concerns, such as harassment or unauthorized access.

Perception of Safety & Sense of Privacy

Key Insights: Lighting & Locking prototype

Are insects or other creatures attracted to the light that might be problematic for users?

+ Clients did not encounter insects or creatures using either lighting system.

+ Most latrines also have a protective net across the openings, likely preventing insects and flies from entering.

What are the safety considerations of using this light?

+ Proper insulation of wires to prevent tampering or theft, which could damage the wiring or the light and affect functionality.

Perception of Safety & Sense of Privacy

Key Insights: Lighting & Locking prototype

What are the strengths and limitations of the locking prototype in responding to the types of security concerns most affecting women when using the latrine?

+ The locking prototype provides a physical barrier that enhances privacy and security, addressing concerns related to unauthorized entry and privacy invasion.

+ The locking prototype is vulnerable to vandalism or theft, especially in areas with security concerns or where the parts are considered valuable

How does the illumination of the latrine affect the privacy of the clients?

+ Clients define privacy as being able to use the latrine at any time without interruption or fear. They feel comfortable with either light shades on them.

+ Neither lighting solution produces undesirable heat or sound to the clients.

+ The lights do not alert other clients to latrine occupancy; clients will either push or knock on the door to determine if it's occupied.

Client Experience

Adolescent girls intersecting with Emotion cards

Self-Demonstration

Card sorting

Section 3.2: Design recommendation

- High opportunity areas for the Lighting & Locking system

Opportunity Areas

User Desirability

Here are few main areas of potential opportunity to improve the desirability of the light that can be further explored

- How might we make the lighting solution universally desirable amongst all clients segment
- How might we improve the lighting level (lumen output) for in-cubicle lighting for clients
- How might we eliminate the fear female clients face with using the latrine at night

Recommendation

- Consider installing the light without a contact switch and modifying its colour. Clients prefer a cool white light with a similar lumen output as the contact switch at full capacity.
- Provide additional lighting for clients at mid-point between their tents and latrines, especially for campsites where the latrines are farther from the tent.

Opportunity Areas

Installation Consideration

Here are few main installation opportunity for the lighting solution that can be further explored

- How might we ensure the lights are protected from damage during different seasons?
- How might we ensure that lights can be installed at various locations and toilet blocks?

Recommendation

- To prevent water from contacting the batteries, place protective, waterproof, and weather-resistant enclosures at the back of the light
- Design a universal mounting system for the solar panel that can be easily adapted to different types of toilet blocks and locations.
- Consider installation for mixed-use latrines, i.e., latrines and bathrooms, which clients sometimes use as a lavatory.
- Lights should have replacement parts for each feature to ensure the installation team can handle technical issues before and after installation.

Opportunity Areas

Resources and Environment

Here are few consideration for resources for both systems that can be further explored

- How might we equip all installation teams with the necessary skills, training, and materials both before and after installation?
- How might we create a system that ensures uniformity in installation across all sites?

Recommendation

- In addition to the manual, the installation team should be given physical or ToT (Training of Trainers) methods for knowledge transfer. For remote sites, where physical training isn't available, preference should be given to pre-recorded videos.
- Create a guideline for installing the locks that can be shared across teams at different locations..
- Make provisions for materials such as nails and wood for existing latrine structures..
- Train the installation team to fix damaged and malfunctioning lighting systems.

Opportunity Areas

Safety and security of the prototypes

Here are few main areas of potential opportunity for addressing the safety and security challenges of the lighting and locking systems that can be further explored

- How might we enhance the safety of the lights and locking systems across multiple sites?

Recommendation

- Reduce the size of the locks to make them less desirable for theft.
- Use camp structures as safe houses for some of the prototypes to ensure ownership and accountability.
- Consider a simple light design that attracts less attention to the latrines.

Section 4: Lessons and Conclusion

- What worked? What didn't quite go as planned?
- Appendix

Lessons and Conclusion

What worked? What didn't quite go as planned?

+ At some sites, more clients interacted with the light and were willing to participate in the interviews.

+ Clients were receptive to the visual aids but initially found card sorting challenging to understand.

+ Clients needed to understand the self-demonstration exercise fully

+ Language barriers were challenging, and some client responses and nuances might have been lost due to interpretation bias.

+ Some clients only interacted with one variation due to the malfunction of the light both before and after installation.

+ Due to a tight travel schedule at Gwoza, Clients had less time to interact with the light and participate in the interview.

Appendix

+ Prototyping Plan

+ Pictures

+ Data (notes)