Using human-centered design to co-design dedicated menstrual health spaces with menstruators in Bidi Bidi refugee settlement, Uganda: Learnings for further adaptation and scale in humanitarian settings

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Abstract

Background:

Menstruators in low- and middle-income countries struggle to manage their menstruation safely, hygienically, and with dignity. This is exacerbated in humanitarian settings with limited access to products and safe, private spaces for changing, washing, and disposing of menstrual products. To address these challenges, Youth Development Labs (Y Labs) used a human-centered design approach to co-design the Cocoon Mini, a safe, physical structure for managing menstruation in the Bidi Bidi Refugee Settlement in Uganda.

Methods:

The study comprised five phases, including secondary research, design research, rough prototyping, live prototyping, and a pilot study. A total of 340 people participated in interviews, focus groups, and co-design sessions. Solution prototypes were created, evaluated, and iterated upon in each successive project phase. The final intervention design, the Cocoon Mini, was evaluated qualitatively for feasibility and acceptability during a three-month pilot using semi-structured interviews with menstruators utilizing Mini structures, other community members, and Mini supervisors.

Results:

Our results show widespread desirability and acceptability of the Cocoon Mini among menstruators and other community members. Overall, 95% of menstruators stated the space had made menstrual health management easier, primarily by providing designated disposal bins, solar lights, and additional water sources. The Mini provided an increased sense of physical and psychological safety in knowing where to manage menstruation. Furthermore, the Mini demonstrated that an intervention could be run and maintained sustainably at the household level in humanitarian contexts, without continued external stakeholder intervention. Each Mini structure cost approximately $360 USD to build and maintain and served 15-20 menstruators, leading to a cost per person of $18-$24. Additionally, each incinerator attached to the Mini structure used to dispose of soiled menstrual products cost $2110 USD.

Conclusions:

Menstruators lack access to safe, private spaces for menstrual health and product disposal in humanitarian settings. The Cocoon Mini provides a solution for the safe and effective management of menstruation. Customizing and scaling up dedicated MH spaces like the Cocoon Mini should be considered a high-priority intervention in humanitarian settings.

Background

Menstruators across low and middle-income countries (LMICs) face frequent challenges managing their menstruation safely, hygienically, and with dignity. With limited access to sanitary pads, washing
supplies, and safe, private, physical spaces, menstrual health (MH) remains a pressing problem [1–6]. Furthermore, this issue disproportionately impacts those in humanitarian settings due to both environmental factors (such as water shortages, crowded conditions, and poor facilities) and systemic factors (such as economic hardship and insufficient MH education) [7–9]. MH has historically been an overlooked component in both acute and protracted emergency situations, as it is not considered immediately life-threatening [9–11].

MH has gained more attention in humanitarian settings in recent years, however there is little consensus on what constitutes a comprehensive MH response beyond simple distribution of menstrual products [7]. A comprehensive response may be defined by both ‘hardware’ and ‘software’ solutions [12]. Hardware solutions refer to material and physical interventions, such as building physical infrastructure for privacy and safety, whereas software solutions refer to interventions addressing social stigma and the psychosocial impacts of poor menstrual health [13, 14]. The range of challenges menstruators may face in humanitarian settings differ according to the preceding emergency, geographical location, and cultural beliefs about menstruation; therefore, there is a need to tailor programs to the specific contextual nuances [15]. Historically, residents of humanitarian spaces, especially women and girls, have not been extensively engaged or consulted in the design of sanitation facilities, resulting in well-documented shortcomings in the design of services for them.

This study takes place in the Bidi Bidi Refugee Settlement of northwest Uganda. This settlement is split into five zones (Zones 1 through 5) and spans 292 square kilometers in the West Nile area of Uganda in the Yumbe district. The settlement was established in 2016 to accommodate the rapid influx of South Sudanese refugees fleeing violent civil war [16]. As of the end of 2021, the settlement is home to nearly 250,000 people and is the largest refugee settlement in Uganda [17]. This project was conducted in the Ariwa I and Ariwa II village clusters within Zone 5. These sites were selected due to a strong local presence of project partners and a documented lack of appropriate water and sanitation services for residents, particularly menstruators. Within Zone 5, 39% of households are not able to collect enough water to meet their needs, 4% of households openly defecate, and 6% do not have access to a designated bathing facility [18].

With support from the Office of the Prime Minister and the International Rescue Committee, research and design organization YLabs partnered with Alight, a humanitarian sector non-profit organization, and Kuja Kuja, a global data collection firm, to co-design and evaluate safe menstrual health spaces and services with settlement residents and stakeholders, In this paper, we describe how we adapted a five-phase human-centered design (HCD) approach to guide the development of a low-cost, scalable, physical structure for managing menstruation. After designing initial prototypes of these structures, 20 private and accessible MH spaces were built in the settlement during the summer of 2021. Each structure, called a Cocoon Mini, served between 15–20 menstruators. A three-month pilot was then conducted to assess the desirability, acceptability, and feasibility of the Cocoon Mini as an intervention to support safer, more dignified menstrual health practices.
Methods

This project consisted of five phases to research, co-design, test, and pilot safe spaces and services for managing menstruation among displaced populations. These phases included: 1) Secondary Research, 2) Design Research, 3) Rough Prototyping, 4) Live Prototyping, and finally, 5) a three-month Pilot (Fig. 1).

We employed HCD methods to gain comprehensive user insights about participants’ knowledge, attitudes, and perspectives on MH. HCD is a creative, iterative, and participatory innovation process that seeks to engage participants in designing, developing, and testing potential solutions [19–21]. The approach relies on real-world prototyping and rapid iteration of potential solution ideas based on participant feedback. HCD emphasizes a process of rapidly generating and then testing a range of ideas to answer, with minimal material and monetary investment, essential questions about a potential solution’s desirability and feasibility [19–21]. Each research phase informs the final design by selecting and refining low-fidelity prototypes until one final high-fidelity intervention is implemented and evaluated during a pilot phase.

Phase One: Secondary Research

At the start of 2020, we conducted secondary research to identify cultural and infrastructural challenges menstruators face in managing their menstruation within humanitarian settings. This included a literature review and interviews with 22 MH and water, sanitation, and hygiene (WASH) experts globally, as well as six key stakeholders within the Bidi Bidi Settlement, to understand critical challenges associated with implementing MH interventions. Additionally, a supplementary evidence review was undertaken to specifically understand menstruators’ behavior and social norms regarding the disposal of menstrual products, as this remains one of the most significant sources of shame and barriers to privately managing menstrual health. We investigated menstrual product disposal preferences and behaviors, as well as the impact of these current disposal methods on the individuals, community, and environment.

Phase Two: Design Research

Design research aims to uncover people's needs, priorities, and behavioral drivers in order to inform the design of products and services. We sought to understand the cultural context surrounding menstruation, the challenges of daily life in the settlement that impact MH, and the most desired components of an intervention to improve MH. In September 2020, the YLabs and Kuja Kuja teams conducted design research in the Bidi Bidi Settlement with 61 community members, of which 41 were menstruators, 10 were men and boys, and 10 were health and humanitarian workers. We used in-depth interviews, focus groups, and activities such as card sorting and journey mapping to better understand menstruators’ support networks and available resources. Card sorting was used as a quick way of understanding how menstruators prioritize the challenges they face while managing menstruation, while the journey mapping
exercise was conducted to understand the impact of menstruating in a resource-constrained environment.

**Phase Three: Rough Prototyping**

Based on the findings from design research, four rough prototypes were created and tested to address both hardware (i.e. physical spaces and materials) and software (i.e. education and sensitization) solution components. The purpose of rough prototyping is to test essential questions about the desirability and feasibility of early solution concepts with minimal materials. We use rough prototypes to learn directly from our users about how they would change the idea in order to quickly iterate and improve potential solutions. In working groups, we invited the same participants from the design research phase to provide input on these prototypes. Physical models, illustrations, and voice recordings were used to help participants immerse themselves in the features and scale of the prototypes (Fig. 2) and provide feedback on their desirability, cultural acceptability, and feasibility.

**Phase Four: Live Prototyping**

Once these ideas were refined based on interview feedback, the most promising concepts were advanced into live prototyping. Live prototyping seeks to test high-fidelity prototypes of materials and products in a real-life setting. We invited 86 new individuals, which included 58 girls, 13 boys, and 15 community stakeholders, to engage with high-resolution prototypes, use them over several weeks, and give feedback to the design team for further improvement. During the three-week live prototyping period, participants took part in a pad-making enterprise and used the first prototype of a physical space for managing menstruation. We analyzed the supply chain for materials to make both pads and physical structures, spoke with stakeholders on the feasibility of procurement and building, and asked participants under what conditions they would use these spaces and services, and how important they were to daily life.

**Phase Five: Pilot**

The prototype with the highest desirability for use expressed from participants, and feasibility for implementation by settlement stakeholders and community leaders, was tested during a three-month pilot from May to July, 2021. The prototype, called a Cocoon Mini, is a safe and private MH space that provides access to a private latrine, bathing facility, and product disposal options.

A total of 20 Minis were constructed in May 2021 in Ariwa I and Ariwa II, which are located approximately 10 kilometers apart. Minis were built in homestead compounds, rather than public areas, to allow for more privacy during use. Each Mini directly served 15–20 menstruators residing in the chosen homestead, though the facility was available for all menstruators in the community at large to use. Homesteads were chosen using three criteria: first, that they are located at least 200 meters from each
other to ensure equitable distribution of Minis across the community; second, that they are located at least 100 meters from a pre-existing main water source to provide easier access to those without convenient water access; and third, that they were built near respected community members who could serve as supervisors and ensure that the space was adequately maintained.

We conducted semi-structured interviews with 109 menstruators with Minis in their homesteads, 64 other community members (both men and women) without Minis in their homesteads, and all 20 Mini supervisors. Throughout the pilot, Mini supervisors were interviewed twice, one to two months apart, to determine if the spaces had incurred damage over time. Convenience sampling was employed to recruit menstruators who had used the spaces and were available to participate and provide feedback on usability. Simple random sampling of community members without Minis in their homesteads was used to gauge community acceptance of the space.

A qualitative interview guide was developed for each of the three types of participants in order to elicit information about their overall experience using the Cocoon Mini or their opinions of the space to gauge acceptability. A range of semi-structured questions were included to see what participants liked and disliked about the space, the Mini’s impact on their daily lives, and any concerns they may have about integrating the space into their community. Additionally, two open-ended questions were further quantified into frequencies with percentages to assess the total number of menstruators who reported that the Mini has made MH easier for them and which Mini features had the most impact. Supervisors were asked questions about cleaning and maintaining the Mini space. Interviews were conducted in English, Bari, or Juba Arabic by members of the Kuja Kuja team at participants' homes or a location of their choosing. Throughout the project, COVID-19 protection measures were taken to ensure the safety of all.

Interviews were translated into English and de-identified transcripts were uploaded into a secure site for data management. Transcripts were then analyzed using a blended approach of deductive and inductive coding thematic analysis to identify and explore patterns of meaning across the interviews. The research team developed an initial thematic coding framework based on the structured questions from the interview guide, specifically to assess the Mini’s desirability, acceptability, sustainability, and potential for impact. The team coded all transcripts and modified the scheme using the initial coding structures until no new codes were identified.

YLabs team members met through a series of remote meetings with the Kuja Kuja field team for further validation, discussion, and consensus of the results. The research team also took additional open-ended field notes throughout the building process and pilot to assess implementation and maintenance feasibility. These notes included informal discussions and observations that were incorporated into the analysis.

We obtained written and verbal informed consent for all participants. In the case of minors, assent was obtained from parents to conduct the interviews. The study protocol was reviewed and approved by the Research and Ethics Committee of Makerere University of Public Health in Kampala, Uganda.
Results

Phase One: Secondary Research

Stakeholders within the settlement spoke of exposed, crowded toilet and bathing facilities in schools and in the community. Using these facilities, especially at night, often left girls and women vulnerable to sexual and gender-based violence. Long-lasting water shortages, coupled with scarcely available clean water and limited access to soap, made bathing a challenge. Pad procurement and cleaning also prove challenging. Menstruators typically rely on humanitarian organizations for access to new pads. When supply is disrupted, they are likely to switch to homemade cloth pads or re-use pads before they are fully dry, which often leads to infection. Water and soap shortages force menstruators to wear pads longer than intended or dispose of reusable pads sooner.

Product disposal is particularly challenging, as it has not historically been part of the MH infrastructure in humanitarian settings. Evidence from the literature demonstrates the importance of discreet disposal solutions on menstruators’ psychological well-being, ability to stay in school or at work, and the overall impact on environmental toxicity and chemical pollution [22–27]. Without formal disposal options, menstruators are forced to venture out to discard products in forest areas, open grounds, or bodies of water, away from the public eye, and sometimes before sunrise or after sunset [1, 28]. This puts them at risk for violence [29]. Safer but potentially incomplete disposal options, such as pit latrines, may leave them vulnerable to shaming and verbal harassment if their materials are found by others in the community. Menstruators also shared a deep fear of used products being found and used for witchcraft [1, 2, 30].

Phase Two: Design Research

Insights generated during design research with residents of the settlement aligned with three themes: information and education, products and supplies, and supportive physical infrastructure.

First, participants explained that sexual education focused predominantly on abstaining from sex to avoid pregnancy, leaving little room for discussion on menstruation, puberty and bodily autonomy. During interviews, girls asked questions regarding the physiology of menstruation, how to stay clean and manage pain during menstruation, and the risk of pregnancy during the menstrual cycle. Men and boys shared that they are largely excluded from conversations on MH, which creates mystery, stigma, and rumors around the topic.

“Girls should not cook while menstruating because, if men know, some of them will not want to eat your food.” - Menstruator, age 16

Second, the supply chain of sanitary pads into the settlement has been severely disrupted with the withdrawal of humanitarian organizations due to the COVID-19 pandemic. This has forced menstruators to sell food rations in order to afford sanitary pads. Menstruators may also re-use pads immediately after
washing before they have dried, or use makeshift materials in place of pads, both of which can lead to infection.

“I buy the pads from the market. If there’s no money to buy sanitary I sell off food ratios to get the money.” - Menstruator, age 19

“Here, [humanitarian] partners give disposable pads. And once they are done, you have none.” - Menstruator, age 18

Finally, girls articulated that existing spaces for managing menstruation are not suiting their needs. Public areas for MH are clearly marked as such, making their menstruation status conspicuous to the community. Attendants control both the spaces and the provision of MH products and often deny girls access or privacy, making these spaces unsafe for use. This, in turn, may cause anxiety and limit physical mobility, as there are few suitable places outside the home to manage menstruation.

“There are girls who have faced harassment because they went [to the public MH space] without getting permission from the attendant. The attendant chased them away and they did not get any help.” - Menstruator, age 17

Phase Three: Rough Prototyping

Based on these insights and themes, four prototypes were developed to address challenges related to education, menstrual products, and supportive infrastructure.

To generate conversation and increase education around menstruation, we tested the idea of a monthly community storytelling event. During the event, young women and girls would share their experiences with menstruation and sexual health along with educational content and sanitary product demonstrations. Female participants felt comfortable sharing their own stories in this space, but believed men should have a separate conversation to learn about menstruation that is facilitated by a health worker or older male figure with accurate information. Furthermore, such an event would require an ongoing investment in both compensation for attendance and sensitization efforts with parents and husbands of participants to garner full community support. Ultimately, we were not able to take this idea forward due to new COVID-19 restrictions limiting community gatherings at that time.

To increase access to products and supplies, we created the LaunchPad, a community-run social enterprise that would hire and upskill menstruators to make reusable pads (Fig. 3). The pads would then be sold to other menstruators in the community, allowing those involved to turn a small profit and develop new skills. Participants liked the idea of sustaining their own demand for sanitary products but still felt it necessary to partner with humanitarian non-governmental organizations (NGOs) to ensure the quality of the product. We advanced this idea to live prototyping to explore this further.

To provide more supportive physical infrastructure for managing menstruation, we tested the idea of both a large community space (the Cocoon Maxi) and a smaller homestead space (the Cocoon Mini). The
Maxi was intended to serve as a multi-purpose center that offered programs and services especially for young women and girls, peer group support, and access to secure latrines. However, in speaking with community stakeholders, we learned that securing construction materials and approval for the land from government and humanitarian actors could take six months or longer. The Mini, on the other hand, faced fewer logistical barriers to construction given its smaller footprint and location within homesteads, making this idea more feasible.

**Phase Four: Live Prototyping**

Based on the interest they generated during rough prototyping, the LaunchPad and the Cocoon Mini advanced to the live prototyping phase with higher-fidelity mockups of these ideas.

Testing for The LaunchPad began with a workshop for tailors in the community to create reusable pads and carrying cases. These were then distributed to a group of young women and girls along with an instructional pamphlet that illustrated steps on how to wear, use, wash, and dry the pads. We surveyed all participants over the course of three weeks and found that, although desirability for the program was high, girls were concerned about maintaining their reusable pads without regular access to water and spaces for drying. Furthermore, because of fluctuations in pad distribution by NGOs, the supply and demand of pads remain inconsistent in the settlement, which could compromise the business model of uninterrupted sales. Ultimately, the sustainability of the program could not be confirmed and we were unable to advance this prototype to the pilot phase.

Next, we tested the Cocoon Mini in a live setting. Three Cocoon Mini structures were constructed with privacy walls, locks on doors, and solar lights, in accordance with user feedback from rough prototyping. As a result, the majority of participants reported an improved sense of safety. Water access and washing areas provided a strong motivation to use the space, as they made bathing and cleaning reusable pads more convenient. Participants articulated the importance of local ownership in the construction and maintenance of the site in order to foster a sense of communal responsibility.

“*I can now bathe three times a day when menstruating because of easy access to water and the privacy of the bathroom. The one we had before had holes in it, so I was not able to bathe during the day due to fear that people may see me.*” - Menstruator, age 15

Participants also noted a lack of discreet product disposal options. The most commonly used option is a pit latrine, which does not completely dispose of products and often collapses when overfilled. Participants like that incinerators allow for complete disposal, but do not feel comfortable carrying their products to current burn sites, which are often far away. Many participants requested an incinerator be attached to each Mini, though this posed logistical and financial challenges. Two incinerators were therefore constructed alongside one Mini structure in either village to reduce travel time to existing incinerators.
Girls and women have refused to take the waste products to be burned at the current site of the incinerator in [another village]. They said they are feeling ashamed to carry and even collect because it looks unhygienic. - Mini Supervisor, female

Phase Five: Pilot

Due to its reported improved sense of safety and feasibility for construction, the Mini prototype was selected for a three-month pilot program. Construction materials, including iron and plastic sheets, timber, cement, and pipes, were procured in nearby Yumbe town. Metal frames and doors for drying bins were also fabricated in Yumbe. A local hardware shop owner served as foreman for the project by mobilizing a team in Yumbe to transport materials to the settlement. Each of the 20 Mini cost approximately $360 USD in materials and labor. Each Mini served 15–20 menstruators, leading to a cost per person of $18–24 USD. The two incinerators installed cost an additional $2110 each.

Male community members were recruited and paid to aid professional plumbers in digging and backfilling pipe trenches. Later, they also assisted masons in building the latrines by framing sites, laying foundations and bricks, digging drainage trenches, and constructing walls. Men stated that they appreciated the opportunity to learn construction skills, receive compensation, and have more water access points. Furthermore, their involvement increased exposure to and acceptance of the idea of a designated menstrual health space.

Each structure was built alongside a pre-existing pit latrine by attaching a bathing structure made out of iron sheets. All Minis incorporate a 1.7-meter vertical high privacy wall constructed from plastic tarps that span the length of both the latrine and bath shelter to increase users' privacy (Fig. 4 and Fig. 5). In addition, each Mini was outfitted with locks on all the doors, portable solar lights, and a disposal bin. An additional water source tap was also built next to every Mini for ease of washing products and bathing access. Covered drainage pipes were provided to redirect wastewater away from the bath shelter. In both Ariwa I and II, one Mini was fitted with an incinerator to assist with product disposal once the waste bins were full.

A total of 193 individuals were interviewed during the pilot, including 109 menstruators with direct access to a Mini within their homestead, 64 other community members without a Mini in their homestead, and all 20 Mini supervisors (Table 1).
Achivements

Achievements of the pilot study are highlighted in Table 2. Overall, the 20 Cocoon Minis served an estimated 300 menstruators throughout the pilot, and showed high desirability and acceptability among menstruators, community members, and supervisors. Overall, 94% (102/109) of menstruators expressed that they approved of the Cocoon Mini space. Supervisors and community members also had positive reactions to the Mini as they relayed the importance of having a space dedicated for MH.

“Most people [in the community] appreciate having the Mini in the community because it has improved the hygiene and sanitation of girls.” Menstruator, age 24

“I would be willing to [to build a Mini] if I would have money because it is helping girls, families, and those women and girls in the neighborhood”-Male community member

The Minis improved water access and introduced a designated waste disposal system, making MH easier and more accessible for menstruators. Overall, 95% (104/109) of menstruators with a Mini in their homestead stated the space has made menstrual hygiene management easier for them. When menstruators were asked an open-ended question on which Mini features made MH easier to manage, nearly all participants cited water access (96%), followed by the disposal system (47%). Lighting within and surrounding the MH space was another feature that was highly valued, as it allowed menstruators to use the Mini at night.

Table 1
Study Sample Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mini Users from Selected Homesteads (n = 109)</th>
<th>Community Members (n = 64)</th>
<th>Mini Supervisors (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–18</td>
<td>41 (37.6%)</td>
<td>24 (37.5%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>19–24</td>
<td>39 (35.7%)</td>
<td>30 (46.9%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Above 24</td>
<td>29 (26.6%)</td>
<td>10 (15.6%)</td>
<td>20 (100%)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>109 (100%)</td>
<td>52 (81.3%)</td>
<td>6 (30%)</td>
</tr>
<tr>
<td>Male</td>
<td>0 (0%)</td>
<td>12 (18.7%)</td>
<td>14 (70%)</td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arwia I</td>
<td>51 (46.8%)</td>
<td>28 (43.6%)</td>
<td>9 (45%)</td>
</tr>
<tr>
<td>Arwia II</td>
<td>58 (53.2%)</td>
<td>36 (56.3%)</td>
<td>11 (55%)</td>
</tr>
</tbody>
</table>
“The Mini has made MH easier because bathing is possible now with access to water, a disposal bin, and light to use at night hours.” - Menstruator, age 31

The added water tap access provided menstruators with the flexibility to bathe more frequently and at more hours of the day or night at their convenience. Menstruators in the study reported improved hygiene practices and decreased feelings of physical discomfort from not wearing products longer than intended. Having regular and dependable access to the Mini’s water source increased menstruators’ confidence in consistently and adequately managing their menstruation while participating in daily activities.

“There is change in my daily life because we now have excess water that can allow us to maintain personal hygiene during menstrual flow.” - Menstruator, age 22

The designated disposal bins were also a critical component of the Minis, as they reduced users’ stress of seeking a place for disposal and allowed them to change and dispose of their used products more frequently. Regularly, menstruators cited no longer needing to throw away their used materials in the bush or look for safe places for disposal. However, they would only use the disposal bins after installing a padlock to the bin at each site. The padlock served as a vital component of the utility of the disposal bin, giving menstruators a sense of peace knowing that their disposable pads would not be tampered with by others in the community.

“Girls are scared of disposing of used pads in the bin on assumption that kids will open and spread them around, as it is not locked.” - Supervisor, Male (before padlock was added)

“The Cocoon Mini has helped me because I no longer dispose of used pads in the bush as usual since the Mini spaces are in the villages.” - Menstruator, age 26 (after padlock was added)

Our results have indicated how a physical space dedicated to MH can have an effect not only on improving menstruators’ hygiene practices but also influence their physical and psychological safety. During the three-month pilot, there were no reported safety incidents from menstruators, community members, or supervisors. The Mini was seen as a space where menstrual status could easily be concealed from boys and men, so they were no longer easy targets of ridicule or belittlement. The Mini’s high privacy walls, locking doors, and lights improved menstruators’ sense of privacy and security from possible intrusion.

“The privacy wall, doors, and locks make me feel safe because they offer protection while using the space.” - Menstruator, age 15

“I like the Mini because it’s private. No one can know or see you inside.” - Menstruator, age 26

Before the Minis were built, menstruators reported being restricted to their home during menstruation, as access to essential changing and bathing facilities or bathrooms was lacking within the community. Strategically placing Minis throughout the community improved menstruators’ autonomy and spatial mobility, as they could freely move within the community to markets, health centers, and schools because they could confidently access any available Mini.
“When I am going to school I can access any Mini within the community to bathe and change rather than coming home.” - Menstruator, age 21

“[The Mini] made it easier because when I’m going to the market, I can change in any Mini space within the community.” - Menstruator, age 21

Menstruators would also often have to sacrifice significant time and energy during the days of their active cycle in order to accommodate their flow, including fetching water or searching out for disposal or washing facilities. By having water access closer to bathing areas, menstruators can now save valuable time and energy that they otherwise would spend by traveling long distances to fetch water and waiting in long lines.

“I no longer go to fetch water from far, but rather go to bathe and change within the Mini.” - Menstruator, age 17

“Sometimes our bathroom may be very busy, but now I can just go to bathe in the Mini and go to school or the market” - Menstruator, age 21

By creating a safe, dedicated household space for menstruation, participants reported speaking more openly about MH after observing and actively participating in MH best practices regularly. In total, 47% of menstruators reported having more discussions about MH with men and boys since the creation of the Mini space. Having a physical space for men and boys to ask about, and for menstruators to directly refer to, made menstruators feel more comfortable and confident talking about MH to other community members. They liked explaining the importance of the Mini features.

“Those days, I used to fear talking about menstruation, but since the creation of this space, it became easier to explain to men about periods.” - Menstruator, age 20

“[The Mini] has made me learn more, especially about bathing frequently during menstruation, which I could also talk about to other people [like men].” - Menstruator, age 18
Table 2
Summary of Achievements

<table>
<thead>
<tr>
<th>Achievement</th>
<th>Description</th>
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<tbody>
<tr>
<td>Widespread desirability and acceptability of the Mini</td>
<td>The Mini was highly desired by menstruators and community members due to its safety features and water accessibility. The Mini was also the first-ever physical space dedicated specifically to helping menstruators manage their menstruation in this community.</td>
</tr>
<tr>
<td>Improved menstrual hygiene management practices</td>
<td>The design features of the Mini, including the waterline, disposal system, and lights, contributed to improved MH practices. Menstruators could now change, bathe, and wash and dispose of their products more frequently.</td>
</tr>
<tr>
<td>Increased physical and psychological safety</td>
<td>The privacy of the Mini gave menstruators an increased sense of physical and psychological safety. Menstruators reported reduced anxiety in knowing where and when they could manage their menstruation without the threat of intrusion.</td>
</tr>
<tr>
<td>Autonomy and spatial mobility</td>
<td>The accessibility of the Minis provided menstruators with the flexibility and capability to manage their menstruation at their convenience. Menstruators were also able to freely move within the community, knowing they had multiple spaces to manage their menstruation instead of having to return home to do so.</td>
</tr>
<tr>
<td>Destigmatization of menstruation</td>
<td>The Minis often sparked conversations between men and menstruators, allowing for open dialogue about menstruation to occur, often for the first time.</td>
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</table>

Challenges and Learnings

The pilot study highlighted several operational challenges that could impact the feasibility of the intervention if scaled (Table 3). Heavy rains in the settlement delayed work, as the settlement’s roads are of poor quality, and vehicles run the risk of getting stuck when they flood. This led to a delay in material delivery. Additionally, the project’s timeline was heavily impacted by events that occurred within the settlement, and by the COVID-19 pandemic. We recommend considering external events that might increase construction time, as anything from food distribution schedules to rain will halt all progress on construction.

The Minis were built to be as safe and sturdy as possible while also complying with policies set forth by the Office of the Prime Minister, which discouraged the use of permanent structures. Still, it is important to note that menstruators and community members desired structural permanence. Temporary or makeshift structures are prevalent in the settlement and are prone to rapid degradation; however, psychologically, the permanence of a space imparts value, especially for communities who have experienced much transition. Thus, it is crucial to menstruators that the spaces they use are durable and long-lasting, and many requested that stronger and more durable materials be used. Over the three-month
pilot, a small number of supervisors and menstruators reported minor damage and deterioration to the Mini space from weather and termites.

“The materials are plastic sheets, iron sheets, timber, and cement. I don’t like the structure because it’s temporary. Next time, let them make a permanent structure with its latrine such that everyone can feel free to use and it lasts longer.” - Menstruator, age 21

“Tarpaulin at the privacy walls are tearing off [from strong winds] and termites have started eating the joining poles.” - Supervisor, Female

Although menstruators appreciated the addition of a disposal bin, an incinerator at each Mini would have ensured the complete destruction of their used products. Spaces that offer disposal options need to take into account that menstruators will not have peace of mind unless their discarded products cannot be uncovered, seen, or tampered with. Literature and evidence from the field show that menstruators prefer to have an incinerator on-site so they are not required to carry their product from the Mini to a separate incinerator when the disposal bin is full. Most menstruators were afraid of being seen carrying used menstrual products to the incinerator site and being teased by men and boys.

I would change the idea of having a bin and rather install an incinerator so that waste can be burnt within, since girls fear to collect the waste product.

- Menstruator, age 15

“Girls and women refuse to collect the waste products to be burned at the site where the incinerator is. They said that they have fear and shame of carrying the waste so boys or other people may laugh at them. Let them rather have incinerators at all the Cocoon Mini sites so waste can be easily burned.” - Supervisor, Male

Although the Minis provided a safe, private space for menstruators, we found that the structures still require free supplies in order to be fully functional, as not all menstruators owned the necessary MH materials. Many menstruators reported that they or their peers do not have the funds to supply their own pads and soap and thus felt excluded from using the Mini. Many menstruators requested that all Minis should be supplied with basic MH supplies. When asked an open-ended question on which MH materials Mini should include, the top three answers were soap (56%), buckets (46%), and sanitary pads (38%). While providing MH supplies was out of the financial scope of this study, future projects may benefit from including these commodities.

“Is there any plan of delivering items like soap, pads, knickers (underwear), and buckets at the Minis to support us? We do not have money for purchasing them from markets.” - Female community member, age 19

While the Mini served as a hardware solution by offering a physical space for MH, it was notably lacking a direct software component. Menstruation is still associated with feelings of shame, sexualization, and uncleanliness in many communities. Despite data showing that the Mini made it easier to talk about
menstruation more openly, nearly all menstruators reported that they would still not feel safe with boys and men using or being around the Mini, for fear that they would humiliate them or expose their menstrual status to the public. This fear led to some menstruators not using the space.

It’s in our culture men and boys are not supposed to see or know anything about menstruation unless married [couples] are to share among themselves

- Menstruator, age 19

“[I don’t use the Mini] because I have fear that people from outside may laugh at me since the space is inside their compound.” - Female community member, age 23

“Nothing would make me feel safe around menstrual hygiene management with boys and men because I fear they might expose me in public.” - Menstruator, age 24

Menstruators also reported feelings of fear, shame, and embarrassment when they had to walk with buckets and soap to and from the Mini, and other community members would see their supplies.

“My mother does not use the Mini because she feels ashamed to move with buckets, underwear, pads, and soaps at the neighborhood’s compound.” - Menstruator, age 19

Furthermore, we found there was a lack of awareness and availability of accurate information around SRH and MH among menstruators. A pervasive fear in the settlement was that sexually transmitted infections (STIs) could be contracted from using the communal Mini space due to hygiene concerns amid its increased usage.

“My sister doesn’t use the space because many people from different households are using and she is fearing that she may get infected [with STIs].” - Menstruator, age 26
Table 3
Summary of Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational and logistical barriers</td>
<td>Procurement of materials, impassable roads, and unplanned settlement events impacted the project’s timeline.</td>
</tr>
<tr>
<td>Structural permanence</td>
<td>Psychologically, structural permanence imparts value. It is essential to menstruators that the Minis are durable and built with materials to withstand wear and tear, which requires a larger financial investment.</td>
</tr>
<tr>
<td>Inadequate disposal options</td>
<td>Spaces that offer disposal options need to consider that menstruators will not have peace of mind unless their discarded products are safe from tampering and are destroyed at the disposal site.</td>
</tr>
<tr>
<td>Lack of MH supplies</td>
<td>Not all menstruators who visit the Minis have the necessary materials for maintaining their hygiene, and this makes them feel excluded from using the Mini.</td>
</tr>
<tr>
<td>Lack of software solution to complement hardware solution</td>
<td>Sensitization around MH and educational SRH forums for both boys and girls are needed in order to prevent stigmatization and misinformation around MH, STIs, and general hygiene.</td>
</tr>
</tbody>
</table>

Discussion

This is the first study to co-design and evaluate safe spaces for menstrual health management among a displaced population. The Cocoon Mini served as a proof of concept that such a space could largely be run and maintained on the local level without the need for continued heavy stakeholder engagement. Overall, the pilot project was widely accepted by menstruators and other community members and resulted in great improvements in menstruators’ confidence. Furthermore, the Minis helped alleviate the psychosocial stress menstruators experienced using unsafe spaces and increased their autonomy and spatial mobility by providing easily accessible changing, washing, and disposal spaces throughout the community.

This research identified five impactful components of menstrual health spaces: disposal and drying bins, lighting within and surrounding the MH space, privacy walls, locks, and water access. Along with these features, menstruators also desired that their menstrual health space be gender-segregated and have at-source disposal technology, ideally an incinerator. These components can be replicated in other contexts after being customized for cultural and infrastructural considerations, and will also be critical to the scaling and future adaptations of Mini spaces. Community buy-in and ownership of the Mini were also fostered by involving local men in the construction of the Mini.

While the physical structure and design attributes of the Mini played a pivotal role in ensuring menstruators’ safe experience, the stigma around menstruation was still pronounced in the community. Age-old beliefs and traditions tend to be perpetuated through generations without being questioned. Our
findings indicate that a systems-based approach including both hardware and software solutions is vital to ensure lasting change. Potential software solutions to accompany implementation of hardware solutions like the Cocoon Mini include social and behavioral interventions that foster dialog and challenge traditional beliefs. To ensure long-term, lasting change, targeted sensitization forums where comprehensive SRH issues can be openly discussed by men and women alike are necessary [32]. With open dialogue and sensitization training, men and boys can understand menstruation and, ideally, gradually become advocates for the well-being of the women and girls in their community [32].

The Cocoon Project has the potential to expand far beyond the bounds of the Bidi Bidi Settlement with the scalability of the Mini spaces interlinked with the sustainability of the solution itself. Using HCD to understand each community’s specific needs would allow for nuanced customization of the Minis based on cultural beliefs and available infrastructure. Furthermore, local ownership of Mini construction, management, and maintenance allowed for agency and decision-making power to be concentrated within the community rather than with partners or project staff.

**Limitations**

There are certain limitations of the pilot that are important to note. First, Kuja Kuja staff, who are members of the Bidi Bidi community, recruited participants, conducted interviews, and transcribed answers into English. Though the familiarity between interviewers and participants likely provided a more comfortable atmosphere for interviews, we recognize that it may have also introduced social desirability bias into the study. Second, the Mini users recruited for this study were chosen from a convenience sample, and the sample size was limited by available resources and time constraints. We recognize that data may not be representative of all members of the community. Third, pilot data collection was conducted only over a short three-month period, with some interviews taking place early on after the Mini was built, limiting our ability to assess long-term changes. Finally, the Bidi Bidi Settlement is well-established and has some pre-existing infrastructure; therefore, our study findings and implementation strategy may not be generalizable to other humanitarian settings that are more emergent.

**Future Research**

There are further opportunities to research the widespread effects of the Minis. Our data suggested that a dedicated space to privately manage their menstruation may improve safety for menstruators. Longer-term research should explore if the Minis could ultimately play a role in reducing gender-based violence within the settlement. Secondly, our qualitative findings indicate that the use of Minis could potentially reduce school/work absenteeism. A more formal testing of this hypothesis could provide valuable insight into understanding the impacts of safe MH spaces. Lastly, the HCD approach in designing the Minis with the support of the Bidi Bidi community members presents a co-design methodology for future projects seeking to center community engagement and capacity-building, potentially decreasing reliance on NGOs and aid partners, while promoting skill-building and independence in humanitarian contexts.
Conclusions

Limited access to safe, private spaces for MH is a pressing problem for menstruators in humanitarian crises, as the design of current sanitation facilities does not address the challenges of menstruation. The Cocoon Mini, co-designed with a refugee population, is a promising option for menstruators to be able to manage their menstruation safely and effectively, and potentially have a meaningful impact in their lives beyond MH, for a relatively small financial investment. Therefore, MH facilities like the Cocoon Mini should be considered a high-priority intervention in humanitarian settings.

Abbreviations

HCD
Human-centered design
LMICs
Low and middle-income countries
MH
Menstrual health
NGO
Non-governmental organizations
STIs
Sexually transmitted infection
WASH
Water, sanitation, and hygiene
YLabs
Youth Development Labs

Declarations

Ethics approval and consent to participate: This study was performed in line with the principles of the Declaration of Helsinki. This study was reviewed and approved as Protocol 785 by the Research and Ethics Committee of Makerere University of Public Health in Kampala, Uganda

Consent for publication: Not applicable.

Availability of data and materials: The datasets analyzed during the current study are available from the corresponding author on reasonable request.

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**Authors' contributions:** JK and JL led the design of the study. AB and JK led the analysis and interpretation of the data with support and supervision from NI and JL. AB took the lead in drafting the manuscript and GP was a major contributor. JL and NI supervised the drafting of the manuscript. All authors provided critical feedback and contributed to the final manuscript. The authors read and approved the final manuscript.

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**Figures**

**Figure 1**

Overview of Phases of HCD Phases and Study Approach

**Figure 2**

A rough prototype of a safe, public space for MH

**Figure 3**

LaunchPad sanitary pad, carrying case, and instructional pamphlet
Figure 4

Rendering of the Cocoon Mini highlighting key features

Figure 5

A built Cocoon Mini in Bidi Bidi Settlement