Feasibility and acceptability of menstrual underwear in a conflict and population displacement prone setting of Kalehe, Democratic Republic of the Congo

Chantale Bisimirwe
Médecins Sans Frontières
Sifa Maombi
Médecins Sans Frontières
Sylvie Nabuki
Médecins Sans Frontières
Lucie Mubelelwa
Médecins Sans Frontières
Augusto E Llosa
Médecins Sans Frontières
Liliana Palacios
liliana.palacios@barcelona.msf.org
Médecins Sans Frontières

Article

Keywords:

Posted Date: June 29th, 2025

DOI: https://doi.org/10.21203/rs.3.rs-6938601/v1

Additional Declarations: No competing interests reported.

Abstract

Menstrual hygiene management remains a critical yet often neglected issue in humanitarian setting. Reusable menstrual underwear (MU) offers a potentially sustainable and discrete solution, particularly where access to disposable products is limited. However, evidence of its feasibility an acceptability in low-income settings is scarce. This mixed-method study assessed the acceptability and usability of MU among adult women in five rural localities of Kalehe, Democratic Republic of Congo. Participants received four MU, a hygiene kit, and instructions and were followed up three months later through a survey (n = 124), and focus group discussions (n = 87). MU was highly accepted, with 94.3% of women reporting satisfaction and 98.4% preferring it to their usual MHM method. Participants praised MU's comfort, hygiene, and ease of use. Key challenges included absorbance, insufficient quantity distributed, difficulties with drying, and concerns about product durability. Misinformation was reported but were largely mitigated by trust in MSF. Recommendations included improving MU quality, tailoring sizing, and expanding distribution—especially to adolescents. In conclusion, MU was feasible and a well-accepted MHM option in this low-resource, conflict-affected setting. This pilot highlights the importance of integrating user-centered feedback to refine design and implementation. Given the good acceptability in this community, the inclusion of MU in non-food emergency kits for internally displaced persons should be evaluated next.

Background

Menstruation is a natural process. Every month, more than two billion people in the world menstruate.[1] The World Health Organization (WHO) has called to recognize menstruation as a health matter rather than a merely hygiene issue, since it carries physical, psychological, and social elements.[2] A safe, comfortable, and decent management of menstruation often possess significant challenges for women and girls in low-income settings where health systems are fragile.[3–5] Obstacles include insufficient information, low access to acceptable menstrual products, and lack of private spaces for changing, washing, drying, and disposal of menstrual health management (MHM) products, among others.[6] The consequences of poor MHM include negative health outcomes[7,8] such as reproductive tract infections,[9] bacterial vaginosis, urinary tract infections,[10,11] and even impacts on mental health.[12]

The choice of menstrual absorbent products strongly affects how women in underserved contexts experience their menstruation.[13] Factors such as menstrual flow, time of day, physical location, social environment, cost, and availability strongly determine the user's selection of MHM products.[14–17] Disposable menstrual materials are often preferred, as they are perceived to be easier to manage while maintaining privacy and hygiene standards.[18] However, single-use products are less sustainable, require an optimal waste management system, and might incur higher costs.[19,20] Reusable MHM products—such as pads, menstrual underwear (MU), and cups—are viable alternatives, provided that users have access to a safe and private space to change, and, more importantly, to soap and water to clean them properly.[21–24] MU, which consists of a female underwear incorporating an absorbent pad, may serve as a good option thanks to its good absorbency, discreteness, and ease of use.[19]

MHM in a context of population displacement becomes even more critical, as barriers to menstruation health are exacerbated.[25–27] Shame, infections, and poor sanitation conditions are aggravated in unstable and crowded humanitarian settings.[28–30] Moreover, monthly distribution of menstrual materials increases costs for already constrained humanitarian agencies.[31] Recent literature highlights major gaps in MHM research in this context and calls for partnerships and coordination with humanitarian responses.[32,33] For the specific case of MU, only one qualitative study explored their use in a refugee camp in Greece, showing that it was accepted as a complimentary product by Middle Eastern populations.[19]

The Democratic Republic of the Congo (DRC) has suffered one of the most severe humanitarian emergencies worldwide.[34] The country has been wracked by decades of conflict, which has led to millions of people forced from their homes. Besides civil unrest, DRC has a particularly fragile health system compared to other countries in Africa,[35] further deteriorated due to a recent Ebola outbreak,[36] COVID-19 pandemic,[37] and Mpox resurgence[38], in addition to frequent measles[39] and cholera epidemics[40]. Over 10% of all internally displaced persons (IDPs) worldwide are found in the Eastern provinces of DRC,[41] 60% of which are women[42].

Médecins Sans Frontiers (MSF) is established in Eastern DRC, with missions in South Kivu and Maniema provinces, which have been the scene of armed conflict over the past decade. As part of MSF's healthcare and access to essential goods activities and, in an effort to fill the MHM gap, MSF distributed MU to national staff members at the coordination office, which is located in Bukavu, the capital of South Kivu. Data collected after 2–4 months showed high levels of acceptability, encouraging MSF to pilot the MU among women in communities supported by the Kalehe project, which aimed to improve the overall health of the population in this mountainous region in the North of South Kivu. This study aimed to explore beliefs and norms surrounding MHM and to assess the use and acceptability of MU in this complex setting, with the ultimate goal of evaluating whether MU should be included in non-food item kits for displaced persons in future MSF interventions.

Methods

Study site and population

The study was part of the menstrual health component of the MSF medical humanitarian intervention in DRC. It took place between February and June 2022 in five localities of the Health Area (*Area de Santé*) of Ramba, which is part of the Bunyakiri Health Zone, Kalehe territory, in South Kivu Province, DRC. The Ramba Health Area had an estimated population of 49,945 people in 2019. The selected localities were Citazungulwa, Musenge, Nyamashea, Makutano/Ramba and Chitebeka (Fig. 1).

The population in Kalehe is mostly rural and have been previously displaced due to conflict, but there had not been recent displacement at the time of the study. They belong mostly to the Hutu, Tembo, and Shi ethnises, and are protestant, catholic, or part of the Eglise de réveil. People live from subsistence agriculture (e.g.; cassava, peanuts), palm oil extraction, and small livestock farming. For the study, women 18–50 years of age, resident in the area, who menstruate and were neither pregnant nor menopausal were selected for participation.

Study design and intervention

This was a mixed-methods design which included an individual survey and focus group discussions (FGD) to further explore any issues identified in the survey results. Prior to the study, 18 group discussions on sexual and reproductive health were held with women in the study area. The goal of these sessions was to explore beliefs and taboos related to menstruation and related hygiene practices, two topics which are not typically part of the MSF field activities. Additionally, the conversations served to present the MU and gather interest in participating in the study.

Those who fulfilled the inclusion criteria received four MU (Cocoro®) of sizes from XXS to XXL, according to measured hip circumference; along with oral and printed pictorial instructions on how to use them available in French, Kinyarwanda and Kiswahili (A and C Fig. 2). The pilot team also provided a hygiene kit composed of a bucket, soap for washing MU, and a plastic bag to carry the dirty MU (B, Fig. 2).

Data collection

Participants were asked to be available for data collection three months after the distribution of MHM materials. The individual surveys were paper-based and consisted of closed-ended and a few open-ended questions to collect information on participant demographics, MU use, and feedback on the overall experience (e.g.; fit, comfort, comparison to other MHM products, recommendations for improvement, etc). A target of 100 women for the survey was calculated to achieve a minimum of 10% precision with 5% probability of type 1 error, assuming 20% loss to follow-up due to the instability of the context. Women were summoned for the survey in two or three different dates based on their availability. FGDs were conducted following a topic guideline and the data was collected on paper in the local language. The target was 10 FGDs of 9–10 women who were sampled purposively based on age and locality. Topics such as overall satisfaction with the MU, challenges faced, recommendations for improvement, and comparison to their usual MHM method were discussed.

Data analysis

Survey data was digitized, and all descriptive analyses presented here were conducted using Stata V14.2 (College Station, Texas: StataCorp). Data from the FGDs was digitized and translated into French for analysis and English for presentation of results. The team performed a thematic analysis in Excel through inductive coding, following the steps: 1) familiarization with the data, 2) selection of keywords, 3) coding, 4) theme development, 5) interpretation of themes and codes.

Ethical considerations

Oral consent for participation in the survey and FGD were obtained from study participants. Surveys and FGD were held in a private area by local midwives and health promotion agents who were trained and supported by experienced mixed-methods researchers. Data were pseudonymized, password protected and stored in a secured institutional server to protect participant confidentiality. The study was exempted from full review by the MSF Ethics Review Board and it was approved by the Direction Provincial de la Santé in South Kivu and the Ministry of Health in DRC.

Results

Out of the women who attended the pre-study group discussions, 150 met the inclusion criteria for the pilot study and received the study materials.

Survey

Socio-demographic characteristics

Among the women who received the MU and the hygiene kit, 124 (82.7%) participated in the follow-up survey, with a median of 24 from each locality (IQR = 21–32) and a median age of 29 years (IQR = 18–55). Nearly half of participants reported no formal schooling, and an inverse relationship was identified between age and level of education (Fishers exact, $p < 0.01$), as shown in Table 1.

Instructions and MU use

No women reported problems following the MU pictorial or verbal instructions and 97.6% found them “useful” (Table 2). When asked about their overall experience, the majority (94.4%) were satisfied with the MU and only 5.7% provided a neutral response, without significant variance by age group. Most women (91.9%) did not report any negative aspect or inconvenience related to the MU, although 3.2% reported being afraid of or experiencing secondary events, such as abdominal pain or cramps, increase in menstruation duration, heat, and blood clots. Additionally, 4.8% expressed concerns about rumours that it could lead to sterility.

Table 2
Summary of responses to the individual survey

N = 124			**n**	**%**
Instructions and MU use	Understanding of instructions	Easy	112	90.3
		Normal	12	9.7
	Utility of instructions	Useful	121	97.6
		Somewhat useful	3	2.4
	Overall experience	Satisfactory	117	94.3
		Neutral	7	5.7
	Challenges	None	114	91.9
		Secondary effects or fear of them	10	8.1
Comparison to other MHM methods	Overall product comparison	Better	122	98.4
		Same/worse	2	1.6
	Overall menstruation experience	Easier	107	86.3
		Same	15	12.1
		More difficult	2	1.6
	Outperformed aspects	Absorption	66	53.2
		Comfort	20	16.1
		Non-irritation	16	12.9
		Other	22	17.7
Future use				
	Would continue to use	Yes	123	99.2
	Recommendations *(multiple answers per participant)*	Increase MU numbers	88	70.9
		Improve kit	44	35.4
		Improve MU quality	27	21.7
		Enhance sensitization	3	2.4

Over 97% of women agreed to statements of MU being hygienic, comfortable, easy to clean, allowing to continue life as normal, not emitting odour, having good absorbance, not staining, and not irritating, while the lowest rating (79.8% agreement) was for a remark stating that it was easy to find a place to dry the MU without shame or comments from the community.

Comparison with other MHM methods

All survey respondents except one reported usually using a loin cloth padded with additional cloth for MHM. Compared to their usual MHM method, 98.4% answered that the MU was a better product. For 98.6% of the women, the main areas where the MU outperformed their usual MHM were absorption, comfort, and non-irritation. By contrast, when comparing the overall menstruation experience, there was more variability, with 12.1% answering that the experience was similar or more difficult (1.6%) than when using their usual method.

Future use

All but 2 women (1.6%) responded that they would continue to use the MU, the main reasons being was because they "liked it" (44.4%), "found it useful" (19.4%), "comfort" (8.1%), "convenience" (8.1%), "advantages over the usual method" (4.0%), and "felt protected" (4.8%). One woman stated that she would not use the MU in the future due to abdominal cramps.

The most common recommendations for improvement were related to the intervention itself, such as to provide more than four MU (59.7%), to distribute it more broadly in the community (16.1%), and to give a larger bucket and more soap (35.5%). A fifth of the women (21.8%) advised improving MU quality, specifically mentioning absorbency, fit, breathability, overall quality, and colour. Among participants, 2.4% mentioned that rumours and doubts should be addressed better.

Focus group discussions

A total of 100 women were purposively selected for participation in FGD and 87 (87%) participated in a total of 9 FGDs, in groups of 9–10. Two thirds of participants identified as ethnically Hutu (66.7%), 31.0% as Tembo, and 2.3% as Shi; and mostly as protestant (80.5%), followed by evangelist (16.1%) and catholic (3.4%). Ages ranged from 18–43, with 55% being 30 years of age or younger.

Satisfaction with MU

In general, the women expressed gratitude for addressing what they considered a neglected issue. In line with quantitative results, participants were generally satisfied with the MU, referred to as "kaleso" the Kinyarwanda term for panty. Even though it was the first time they used this product, they felt it was easy to use and comfortable. However, women with heavy periods were displeased with the product's absorbency. The overall feeling was that the MU was hygienic, easy to wash, and as simple to dry as other underwear. Most stated that in the absence of rainy weather they dried the MU outdoors "without shame", but a few did so indoors out of fear that they would be stolen.

Challenges encountered

The most frequent complaint was about the MU's absorbance. Women reported that to avoid leaks, they required to change the MU every 3 hours, concluding that the absorbent material needed improvement. Several women declared needing on average two to four MU per day over five days, so the number of MU received was not enough. As the

absorbent part of the MU typically required one day to dry, they shifted back to their usual MHM method. Overall, all groups agreed that the number of MU per women should be higher to completely rely on them for MHM.

« I changed them four times a day because the underwear absorbed for less than three hours"

Another MU-related issue was poor fit due to having received the incorrect size during distribution or the shape of the product. Difficulties with cleaning the MU were also reported. Access to clean water proved particularly challenging given the high frequency in which women had to wash the MU. There were also comments about discoloration and loss of elasticity after a few washes.

"I received a large size of underwear, and it caused blood to leak quickly."

"The underwear received is too long and narrow in the rear causing a wedge; I think the underwear is adapted to the size of white women".

Rumours and stigma

Rumours related to the use of MU in the study area were also discussed. For instance, hearsay that MU could cause sterility, abortion, or COVID-19 infection, and that the product was demonic. Participants said that the rumours were countered by previously built trust in MSF, which they saw as an organization that provides medical services to the community and would not distribute anything harmful. Moreover, some women who wore the MU became pregnant despite their use, thus, contradicting the comments. Besides the negative speculation, participants expressed a great desire from other women in the community to receive and try out the MU.

I used the underwear during 3 months, and on the fourth I became pregnant, so the [rumours] circulating in the community about the underwear are false

Recommendations for improvement

Women suggested upgrading the MU's quality. Particularly on absorbance and pad size, as well as on their durability, since they reported material elasticity loss or color fading. In terms of distribution, participants would like to receive more MU units and be able to choose their own size. The main advice for the hygiene kit was to include a larger bucket (i.e.; at least of 15L capacity) and a clothesline. Lastly, participants advocated to reach other women in the distribution, specifically adolescents.

"*I thank MSF for giving me these menstrual panties. I ask that in the future, MSF also consider adolescent girls, as they are the most vulnerable."*

Discussion

This study evaluated the acceptability of reusable MU in a rural community in DRC, where access to health care and menstrual commodities is scarce due to ongoing conflict. The target population were adult women who lived in the Ramba Health Area in Kalehe, where MSF has a humanitarian mission. After four months of use, they revealed a largely positive view of MU but also shared key insights to improve the use of MU. Women's participation in the study reflected strong interest and commitment to MHM, a topic often neglected as it only affects women and is rarely recognized as a pressing health issue.

The study survey revealed that almost all participants used a cloth padded loincloth as their regular MHM system. This method, widely common in low-income countries, is often associated with ineffectiveness in containing heavy flows and lack of comfort.[43] The introduction of MU was perceived by 98% of participants as an improvement, with

favourable reactions to comfort, absorbency, and ease of use. This results are aligned with previous studies in low-income settings on the acceptability of reusable menstrual products, such as sanitary pads[44] and menstrual cups,[45] in which user satisfaction was driven by improved comfort and the effective containment of the menstrual flow. Additionally, the majority of the participants found the MU easy to wash, indicating that the difficulties stemmed from lack of access to clean water.

While most women reported advantages on the overall menstrual experience when using the MU compared to their usual MHM method, 12% noted no change, or a worse experience (1.6%). These findings suggest that the product does not fully meet the needs of some women, especially those with heavy menstrual flows. Not having enough MU units and absorbency were the most common concerns raised in both the survey and FGDs, highlighting the need to provide more MU, improve them, or adjust recommended usage time. In addition to frequent changing and washing, many women found it difficult to dry the MU during rainy periods or in private, particularly in stigmatized environments. Similar concerns were reported in Malawi, where reusable pads were introduced and only 20.3% of the women dried them outside, even though that was their usual practice.[46] The need for privacy to dry the MU was also a drawback in a refugee camp with poor infrastructure or cold climates.[19]

Beyond absorbency, women commented on the quality of the underwear material, noting its deterioration after several washes. Another request was to adapt the MU sizing and cut to fit African women better. Lastly, women suggested improvements for the kit, as they preferred a larger washing bucket and they requested a drying cord to avoid using surfaces in an open area.

User feedback is essential to adapting innovative MHM products to local contexts, where usability is key for adoption.[47] Such feedback helps refine designs, address cultural concerns, and improve functionality, enhancing both acceptability and long-term sustainability.[48] WHO and UNICEF emphasize that MHM solutions in emergency settings must be environmentally appropriate and developed with direct user input to ensure dignity and effectiveness.[2,49] Real-world, holistic feedback —like that gathered in this pilot, which considered the MU, the kit, and the local environment—helps ensure product relevance. This is especially critical in low-resource settings, where even small problems, such as fabric durability or ease of use, can affect uptake.[50] For instance, a study in peri-urban Lusaka, Zambia, found that sociocultural beliefs and inadequate school facilities hindered adolescent girls' menstrual hygiene, underscoring the need for culturally sensitive, context-specific solutions.[51] Thus, these suggestions are not just upgrades, they are essential elements of a broader care system that upholds women's health, dignity, and hygiene in challenging environments.

Another important study outcome was that communication is key to introduce new MHM products, as with any public health innovation.[52,53] Our experience in this setting showed the importance of sensitization sessions, which were a unique opportunity to grasp how women of different ages understand menstruation, how comfortable they are speaking about it, and how open they were to try a new product. Besides transparent conversations prior to the study, the oral and written instructions were clear to the participants and guaranteed a good use of the MU. However, MU remains to be assessed in a mass distribution context, where group sensitization sessions or detailed instructions might not be possible due to time and budget constraints.

Effective, timely communication and community awareness were also crucial to minimize rumours around MU. Similar to another study in Ghana,[54] this required culturally-sensitive engagement normalizing menstruation, as well as the involvement of trusted community stakeholders. Besides MSF's efforts to prevent false beliefs, participants heard that the MU could cause sterility, and induce abortions or disease. These rumours were particularly common among older people, religious leaders, and men, most likely due to lack of conversations about MHM on top of the

novelty of the product and the modernity that it represents. However, most women expressed their trust in MSF thanks to their long-term presence in the area and their support to the communities affected by armed confrontations and displacement.

Our study had several limitations. First, although the sample for the evaluation was demographically diverse and participation was high (83% for the survey and 87% for the FGD), the group consisted of women who attended the MHM sensitization sessions, thus potentially being biased towards women who are open to incorporate new menstrual products. Moreover, women younger than 18 years old were excluded to ease the informed consent process and because this was the first time that a sensitive topic as MHM was addressed in the community. Interestingly, this was something that concerned the participants, as they saw adolescents as the most vulnerable group. Additionally, as the goal of the pilot was to consider including MU in kits for IDP, having feedback from communities in active sate of forced displacement would be an important next step. Lastly, men's views would have been valuable, as they are key players of the social dynamics and support systems.[55,56] Thus, future studies that include adolescents, men, and that are set in different settings should be carried out to generalize the present findings. Second, since the product was provided for free, social desirability bias might have influenced the responses, despite a robust informed consent process encouraging honesty responses. However, this limitation is partly mitigated by the alignment between survey results and FGDs, where participants could speak more freely.

In summary, our findings demonstrate high acceptability of the MU among adult women of Kalehe, DRC. The study obtained important local information to adapt future MHM interventions in humanitarian settings, where the reusability of the product can be especially beneficial due to the low access to resources. The study participants advised to distribute a higher number of MU per woman and provided relevant suggestions to improve the acceptability of the MU product and the hygiene kit. Most participants unanimously expressed their satisfaction with MU and their intention to continue using it. The new product was perceived as an effective solution to improve MHM and the users would recommend it to their peers. This pilot represents an important step toward integrating MHM alternatives into non-food emergency kits for IDP interventions by MSF. More importantly, the study raised MHM awareness in the community for the first time, combating false beliefs associated to menstruation.

Declarations

Competing interests

All authors declare no financial or non-financial competing interests.

Author Contribution

LP conceived the pilot study, ChB, SN and SM run the information, distribution sessions, and collected the data, LM run FGSs and supervised data collection, AELl conducted data analysis and contributed to the interpretation of the findings, ChB, SN and SM drafted the manuscript, LP and ALl reviewed the manuscript for substantial intellectual content. All authors read and approved the final manuscript.

Acknowledgement

This work was supported by Inclusive Innovation at Médecins Sans Frontières (MSF), a partnership between MSF UK and MSF Sweden. We also thank the Referents of the medical and WASH department of MSF OCBA for providing advice when requested. The authors are also grateful to their peers for constructive comments that helped improve the manuscript.

Data Availability

The datasets generated and/or analysed during the current study are not publicly available due to internal regulations on data protection for MSF but are available from the corresponding author on reasonable request.

References

1. UN Women. Period Poverty – why millions of girls and women cannot afford their periods. https://www.unwomen.org/en/news-stories/explainer/2024/05/period-poverty-why-millions-of-girls-and-women-cannot-afford-their-periods#:~:text=Every%20month%2C%20more%20than%20two,their%20menstrual%20health%20and%20hygiene. (2024).
2. World Health Organisation. WHO statement on menstrual health and rights. 1–2 https://www.who.int/news/item/22-06-2022-who-statement-on-menstrual-health-and-rights (2022).
3. Rossouw, L. & Ross, H. Understanding period poverty: Socio-economic inequalities in menstrual hygiene management in eight low-and middle-income countries. *Int. J. Environ. Res. Public. Health* **18**, 1–15 (2021).
4. Phillips-Howard, P. A. *et al.* Menstrual hygiene management among adolescent schoolgirls in low- and middle-income countries: research priorities. *Glob. Health Action* (2016) doi:10.3402/gha.v9.33032.
5. Kuhlmann, A. S., Henry, K. & Wall, L. L. Menstrual hygiene management in resource-poor countries. *Obstet. Gynecol. Surv.* **72**, 356–376 (2017).
6. Sumpter, C. & Torondel, B. A systematic review of the health and social effects of menstrual hygiene management. *PLOS ONE* **8**, e62004–e62004 (2013).
7. Mohd. Tohit, N. F. & Haque, M. Breaking the cycle: addressing period poverty as a critical public health challenge and its relation to sustainable development goals. *Cureus* (2024) doi:10.7759/cureus.62499.
8. Jaafar, H., Ismail, S. Y. & Azzeri, A. Period poverty: A neglected public health issue. *Korean J. Fam. Med.* **44**, 183–188 (2023).
9. Torondel, B. *et al.* Association between unhygienic menstrual management practices and prevalence of lower reproductive tract infections: a hospital-based cross-sectional study in Odisha, India. *BMC Infect. Dis.* **18**, 473 (2018).
10. Borg, S. A. *et al.* The association between menstrual hygiene, workplace sanitation practices and self- reported urogenital symptoms in a cross-sectional survey of women working in Mukono District, Uganda. *PLoS ONE* **18**, 1–20 (2023).
11. Das, P. *et al.* Menstrual hygiene practices, WASH access and the risk of urogenital infection in women from Odisha, India. *PLoS ONE* **10**, (2015).
12. Regional Health– Americas, T. L. Menstrual health: a neglected public health problem. *Lancet Reg. Health - Am.* **15**, 100399 (2022).
13. Sommer, M., Kjellén, M. & Pensulo, C. Girls' and women's unmet needs for menstrual hygiene management (MHM): the interactions between MHM and sanitation systems in low-income countries. *J. Water Sanit. Hyg. Dev.*

3, 283–297 (2013).

14. Asumah, M. N., Abubakari, A., Aninanya, G. A. & Salisu, W. J. Menstrual hygiene management among adolescents: a qualitative study in the West Gonja municipality of the Savannah Region, Ghana. *Pan Afr. Med. J.* **41**, (2022).
15. Sahiledengle, B. *et al.* Menstrual hygiene practice among adolescent girls in Ethiopia: A systematic review and meta-analysis. *PLoS ONE* **17**, 1–26 (2022).
16. Pednekar, S., Some, S., Rivankar, K. & Thakore, R. Enabling factors for sustainable menstrual hygiene management practices: a rapid review. *Discov. Sustain.* **3**, 28 (2022).
17. Mohammed, S. & Larsen-Reindorf, R. E. Menstrual knowledge, sociocultural restrictions, and barriers to menstrual hygiene management in Ghana: Evidence from a multi-method survey among adolescent schoolgirls and schoolboys. *PLoS ONE* **15**, e0241106 (2020).
18. Wilbur, J. *et al.* Qualitative study exploring the barriers to menstrual hygiene management faced by adolescents and young people with a disability, and their carers in the Kavrepalanchok district, Nepal. *BMC Public Health* **21**, 476 (2021).
19. VanLeeuwen, C. & Torondel, B. Exploring menstrual practices and potential acceptability of reusable menstrual underwear among a Middle Eastern population living in a refugee setting. *Int. J. Womens Health* **10**, 349–360 (2018).
20. Aujla, M., Logie, C., Hardon, A. & Narasimhan, M. Environmental impact of menstrual hygiene products. *Bull World Health Organ* **103**, 223–225 (2025).
21. Tai Kuncio. *Pilot Study Findings on the Provision of Hygiene Kits with Reusable Sanitary Pads*. https://data.unhcr.org/en/documents/details/69059 (2018).
22. Van Eijk, A. M. *et al.* Exploring menstrual products: A systematic review and meta-analysis of reusable menstrual pads for public health internationally. *PLoS ONE* **16**, 1–26 (2021).
23. CARE international Uganda. *Ruby Cups: Girls in Imvepi Refugee Settlement Taking Control*. 1–29 https://careuganda.org/wp-content/uploads/2021/06/Ruby-Cups-Girls-in-Imvepi-Refugee-Settlement-Taking-Control_CARE-Uganda_2018.pdf (2018).
24. van Eijk, A. M. *et al.* Menstrual cup use, leakage, acceptability, safety, and availability: a systematic review and meta-analysis. *Lancet Public Health* **4**, e376--e393 (2019).
25. UNFPA. 5 reasons why menstruation support is critical in a humanitarian crisis. https://www.unfpa.org/news/5-reasons-why-menstruation-support-critical-humanitarian-crisis (2024).
26. Schmitt, M. L. *et al.* Understanding the menstrual hygiene management challenges facing displaced girls and women: Findings from qualitative assessments in Myanmar and Lebanon. *Confl. Health* **11**, 1–11 (2017).
27. Kemigisha, E., Rai, M., Mlahagwa, W., Nyakato, V. N. & Ivanova, O. A qualitative study exploring menstruation experiences and practices among adolescent girls living in the nakivale refugee settlement, Uganda. *Int. J. Environ. Res. Public. Health* **17**, 1–11 (2020).
28. Tellier, M. *et al.* Practice Note: Menstrual Health Management in Humanitarian Settings. in *The Palgrave Handbook of Critical Menstruation Studies* (eds. Bobel, C. et al.) 593–608 (Springer Singapore, Singapore, 2020). doi:10.1007/978-981-15-0614-7_45.
29. Majed, R. & Touma, H. *Menstrual Hygiene Management among Syrian Refugee Women in Bekaa*. 1–37 https://policy-practice.oxfam.org/resources/menstrual-hygiene-management-among-syrian-refugee-women-in-the-bekaa-621005/ (2020).

30. Calderón-Villarreal, A., Schweitzer, R. & Kayser, G. Social and geographic inequalities in water, sanitation and hygiene access in 21 refugee camps and settlements in Bangladesh, Kenya, Uganda, South Sudan, and Zimbabwe. *Int. J. Equity Health* **21**, 1–18 (2022).
31. Patel, K. *et al.* A systematic review of menstrual hygiene management (MHM) during humanitarian crises and/or emergencies in low- and middle-income countries. *Front. Public Health* **10**, (2022).
32. McCarthy, L. J. & Roura, M. Experiences of menstrual health and hygiene in humanitarian and emergency settings. *Eur. J. Public Health* **33**, 2023–2023 (2023).
33. Sommer, M. Menstrual hygiene management in humanitarian emergencies: Gaps and recommendations. *Waterlines* **31**, 83–104 (2012).
34. OCHA. Democratic Republic of the Congo: Humanitarian Response Plan 2023 at a Glance. *OCHA* https://www.unocha.org/publications/report/democratic-republic-congo/democratic-republic-congo-humanitarian-response-plan-2023-glance (2023).
35. WHO. *Democratic Republic of the Congo: WHO Health Emergency Appeal*. (2025).
36. Wells, C. R. *et al.* The exacerbation of Ebola outbreaks by conflict in the Democratic Republic of the Congo. *Proc. Natl. Acad. Sci. U. S. A.* **116**, 24366–24372 (2019).
37. Mugisho, G. M., Hwali, L. M. & Nfuamba, F. L. Subjective well-being and households ' resilience strategies to COVID-19 pandemic in South Kivu , Eastern Democratic Republic of Congo. *Res. Sq.* (2022) doi:10.21203/rs.3.rs-1897769/v1.
38. Beiras, C. G. *et al.* Concurrent outbreaks of mpox in Africa—an update. *The Lancet* **405**, 86–96 (2025).
39. Gignoux, E. *et al.* Risk factors for measles mortality and the importance of decentralized case management during an unusually large measles epidemic in eastern Democratic Republic of Congo in 2013. *PLoS ONE* **13**, e0194276 (2018).
40. Kayembe, H. C. N. *et al.* The spread of cholera in western Democratic Republic of the Congo is not unidirectional from East–West: a spatiotemporal analysis, 1973–2018. *BMC Infect. Dis.* **21**, 1261 (2021).
41. Jacobs, C., Lubala Kubiha, S. & Katembera, R. S. The upward spiral towards local integration of IDPs: Agency and economics in the Democratic Republic of the Congo. *Refug. Surv. Q.* **39**, 537–543 (2022).
42. CARE Rapid Gender Analysis. *Democratic Republic of Congo (DRC)-Mudja, Munigi and Kanyaruchinya IDP Camps in North Kivu Province*. https://reliefweb.int/report/democratic-republic-congo/care-rapid-gender-analysis-democratic-republic-congo-drc-mudja-munigi-and-kanyaruchinya-idp-camps-north-kivu-province-march-2023 (2023).
43. Hennegan, J., Dolan, C., Steinfield, L. & Montgomery, P. A qualitative understanding of the effects of reusable sanitary pads and puberty education: implications for future research and practice. *Reprod. Health* **14**, 78 (2017).
44. Hennegan, J., Dolan, C., Wu, M., Scott, L. & Montgomery, P. Schoolgirls' experience and appraisal of menstrual absorbents in rural Uganda: a cross-sectional evaluation of reusable sanitary pads. *Reprod. Health* **13**, 1–12 (2016).
45. Beksinska, M. E. *et al.* Acceptability and performance of the menstrual cup in South Africa: A randomized crossover trial comparing the menstrual cup to tampons or sanitary pads. *J. Womens Health* **24**, 151–158 (2015).
46. Hinton, R. G. K. *et al.* Menstrual hygiene management in two districts of Malawi. Preprint at https://doi.org/10.1101/2024.04.12.24305724 (2024).
47. Don Norman. *The Design of Everyday Things*. (MIT Press, 2013).

48. World Health Organization. *Practical Guidance for Scaling up Health Service Innovations*. https://iris.who.int/bitstream/handle/10665/44180/9789241598521_eng.pdf (2009).
49. UNICEF. *Guidance on Menstrual Health and Hygiene*. https://www.unicef.org/documents/guidance-menstrual-health-and-hygiene (2019).
50. Bazzano, A. N., Martin, J., Hicks, E., Faughnan, M. & Murphy, L. Human-centred design in global health: A scoping review of applications and contexts. *PLoS ONE* **12**, e0186744 (2017).
51. Sambo, J., Nyambe, S. & Yamauchi, T. A qualitative study on menstrual health and hygiene management among adolescent schoolgirls in peri-urban Lusaka, Zambia. *J. Water Sanit. Hyg. Dev.* **14**, 15–26 (2024).
52. Carlfjord, S., Lindberg, M., Bendtsen, P., Nilsen, P. & Andersson, A. Key factors influencing adoption of an innovation in primary health care: a qualitative study based on implementation theory. *BMC Fam. Pract.* **11**, 60 (2010).
53. Scott, S. D., Plotnikoff, R. C., Karunamuni, N., Bize, R. & Rodgers, W. Factors influencing the adoption of an innovation: An examination of the uptake of the Canadian Heart Health Kit (HHK). *Implement. Sci.* **3**, 41 (2008).
54. Montgomery, P., Ryus, C. R., Dolan, C. S., Dopson, S. & Scott, L. M. Sanitary Pad Interventions for Girls' Education in Ghana: A Pilot Study. *PLoS ONE* **7**, e48274 (2012).
55. Nirere, G. Why boys and men need to be included in menstrual health and hygiene discussions. https://www.afripads.com/blog/why-boys-and-men-need-to-be-included-in-menstrual-health-and-hygiene-discussions/ (2023).
56. Save the Children. *Menstrual Hygiene Management Operational Guidelines*. https://resourcecentre.savethechildren.net/document/menstrual-hygiene-management-operational-guidelines (2015).

Table

Table 1 is not available with this version.

Figures

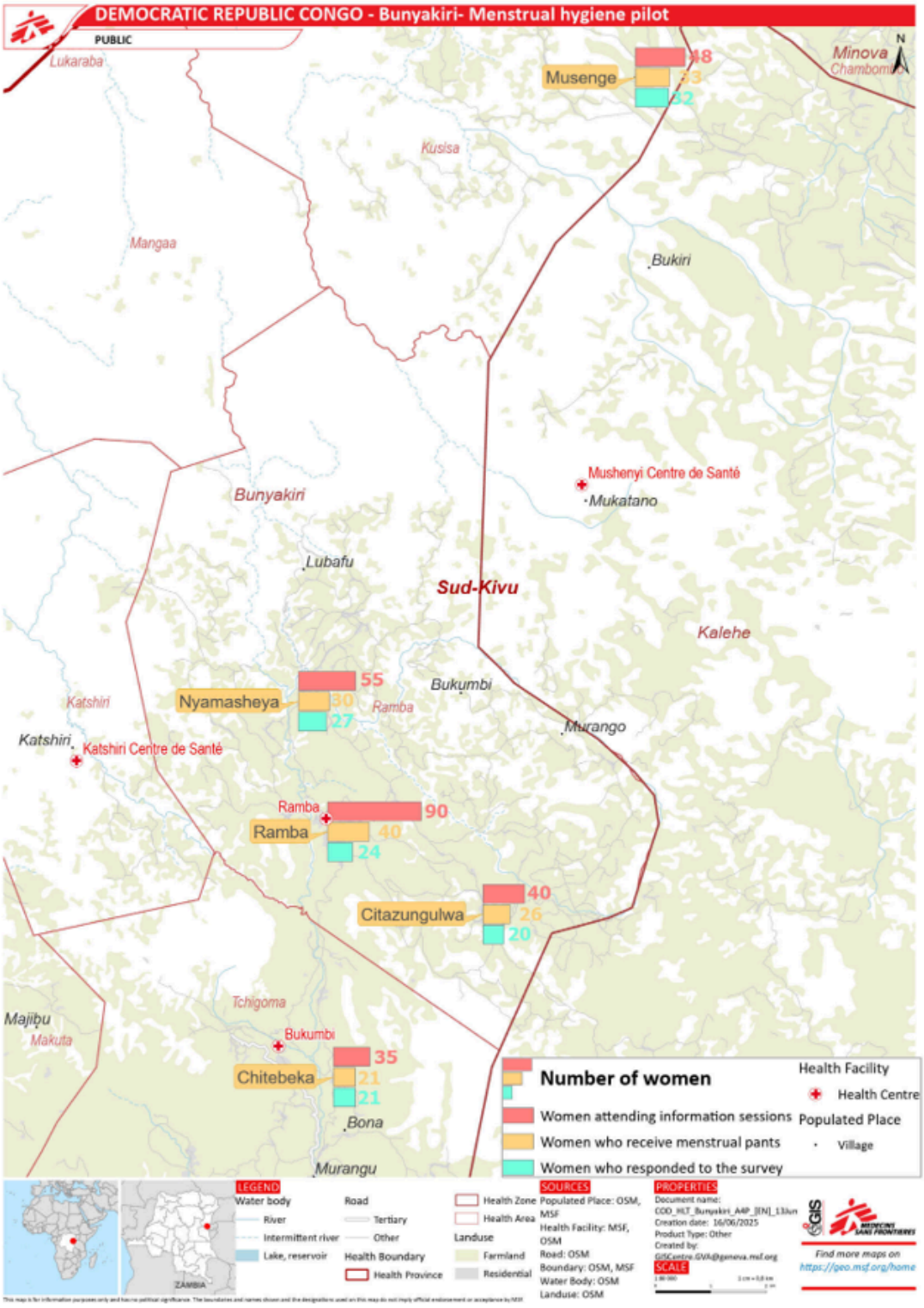

Figure 1

Study site map

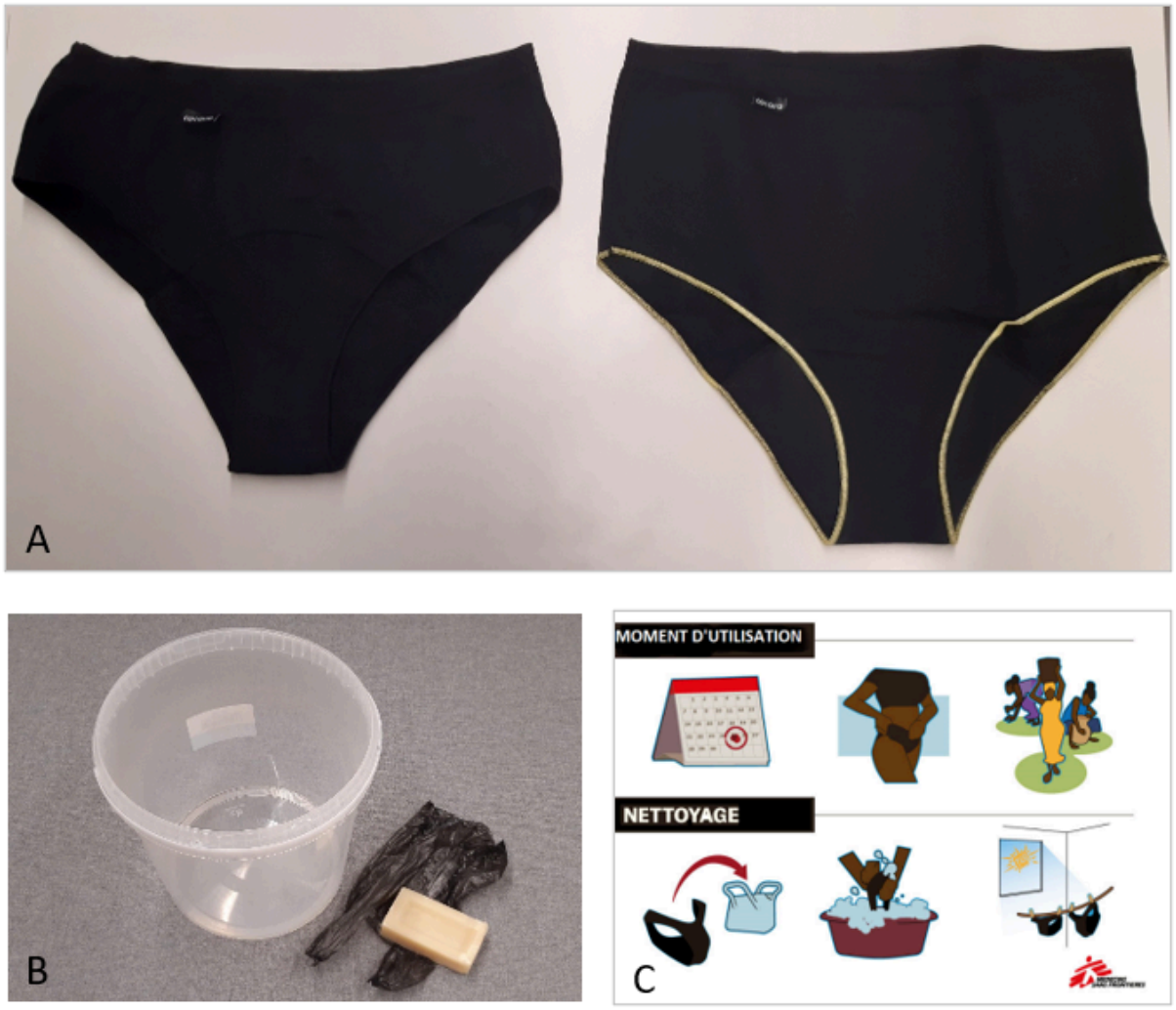

Figure 2

Materials provided for the study: A) Cocoro® MU in sizes XXS and XXL; B) Hygiene kit: soap, bucket, and plastic bag; C) Pictorial instructions on when and how to use the MU, and how to clean them.