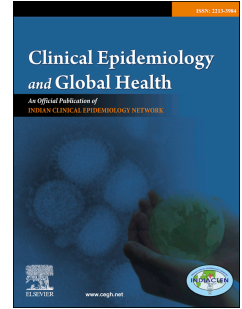


Journal Pre-proof

Is menstrual cup a sustainable and safe alternative in menstrual hygiene management? A qualitative exploratory study based on user's experience in India

Kripalini Patel, Subhralaxmi Dwivedy, Nishisipa Panda, Swagatika Swain, Sanghamitra Pati, Subrata Kumar Palo



PII: S2213-3984(22)00255-X

DOI: <https://doi.org/10.1016/j.cegh.2022.101212>

Reference: CEGH 101212

To appear in: *Clinical Epidemiology and Global Health*

Received Date: 6 September 2022

Revised Date: 17 December 2022

Accepted Date: 26 December 2022

Please cite this article as: Patel K, Dwivedy S, Panda N, Swain S, Pati S, Palo SK, Is menstrual cup a sustainable and safe alternative in menstrual hygiene management? A qualitative exploratory study based on user's experience in India, *Clinical Epidemiology and Global Health* (2023), doi: <https://doi.org/10.1016/j.cegh.2022.101212>.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2022 Published by Elsevier B.V. on behalf of INDIACLEN.

Title Page

Title of the manuscript: Is menstrual cup a sustainable and safe alternative in menstrual hygiene management? A qualitative exploratory study based on user's experience in India

Running Title: Menstrual cup user's experience in India

Authors' Details:

Kripalini Patel^a, Subhralaxmi Dwivedy^b, Nishisipa Panda^c, Swagatika Swain^a, Sanghamitra Pati^a, Subrata Kumar Palo^a

^a ICMR-Regional Medical Research Centre, Nalco Nagar, Chandrasekharapur, Bhubaneswar, Odisha, India-751023

^b Public Health Foundation of India, Plot No 47, Institutional Area, Sector 44, Gurugram, Haryana, Delhi, India-122002

^c Indian Institute of Public Health, 267/3408, Mayfair Road, Jayadev Vihar, Bhubaneswar, Odisha, India 751013

Address of the corresponding author:

Subrata Kumar Palo,
Scientist-D,
ICMR-Regional Medical Research Centre,
Nalco Nagar, Chandrasekharapur, Bhubaneswar, Odisha 751023
Email id: drpalsubrat@gmail.com

Total word count in main text: 3071 (Excluding figure, table, references and abstract)

Total number of references: 26

Number of Tables: 02

Figures in the manuscript: 01

1 **Is menstrual cup a sustainable and safe alternative in menstrual hygiene management?**

2 **A qualitative exploratory study based on user's experience in India**

3 **Abstract:**

4 **Introduction:**

5 Menstrual cup (MC) is the least popular alternative for Menstrual Hygiene Management
6 (MHM) among the reproductive age group women in India. While studies across the globe
7 have shown its usefulness over the conventional sanitary pads, there is a dearth of studies on
8 use and satisfaction status among the MC users from Low- and Middle-Income Countries.
9 Our study intends to explore the experiences and challenges encountered by the MC users.

10 **Method:**

11 A qualitative explorative study among 26 MC users was carried out telephonically using an
12 In-Depth Interview Guide (IDI). The interviews were audio-recorded followed by
13 transcription and translation. Data were analysed using thematic analysis method. MAXQDA
14 (VERBI Software, Berlin, Germany) software was used for analysis.

15 **Result:**

16 The age of participants ranged 25 to 37 years with a mean age of 29.6 (\pm 0.91) years and their
17 average duration of MC use was 2.4 (\pm 0.34) years. MCs were found to be more economical,
18 safe, convenient, and environment friendly compared to sanitary pads. The motivation to use
19 MC was ingrained with the detrimental experiences of using sanitary pad. However, MC
20 users had concerns about the lack of easy accessibility to cups, availability of appropriate size
21 cup and support system for guidance and awareness.

22 **Conclusion:**

23 MC is an effective and convenient period product that has potential to be an alternate method
24 for MHM. However, it needs more awareness, promotion for wider use leveraging existing
25 platforms. Future research is recommended to study the socio-cultural aspect about the
26 acceptability of MC in rural India.

27 **Key words:** Menstrual cup, Menstrual hygiene management, Sanitary pad, Reproductive age,
28 India

29

30 Introduction:

31 Across the globe, women and girls have their own menstruation management practices, based
32 on personal preferences, available resources, economic status, indigenous customs, cultural
33 beliefs, and knowledge or education¹. In Low- and Middle-income countries (LMICs), many
34 adolescent girls witness physical discomfort and psychological distress due to lack of
35 effective and affordable menstruation management products²⁻⁶. Access to appropriate,
36 affordable hygiene menstrual products and their utilization are important to manage menstrual
37 hygiene⁷. Sanitary pads, tampons, and menstrual cups (MC) have been introduced and
38 promoted to achieve better menstrual hygiene. Among them, disposable sanitary pads are the
39 most widespread and popular among women and girls⁸. However, they aren't always the best
40 option because of the associated problems such as leakage, disposal problems,^{9, 10} along with
41 recurrent monthly expenses².

42 While several nations, notably South Africa, Kenya, and India, provide free or subsidised
43 sanitary pads to girls and women, as part of their Menstrual Hygiene Management (MHM)
44 policies², role of MC as an alternative needs to be studied. The first commercially used MC
45 was invented and patented in the United States way back in the 1930 and recently in 2021, the
46 first novel MC was designed and launched in India¹¹. MC is a bell-shaped device made up of
47 high-grade medical silicone. It is put inside the vagina during the period. It collects about 10-
48 38 ml of blood and needs to be emptied at an interval of 4-12 hours, depending on the
49 menstrual flow. Its cost ranges between Indian rupees ₹500 to ₹2,000. While the device needs
50 to be boiled once a month, it can last for 5–10 years if properly maintained, thus is also
51 environment friendly compared to other products¹².

52 The usefulness of MC has been reported in many high-income countries,^{13, 14} however,
53 emptying the MC in public toilets or schools poses as a challenge¹⁵. Studies in low-income
54 countries have reported that the MC use among adolescent girls and women is influenced
55 from the peer and social media. However, the analysis on feasibility of using MC was missing
56 in those studies^{2, 16}.

57 In India, according to NFHS-5, 77.3% of girls and women use sanitary pads for managing
58 their hygiene and sanitation during menstruation¹⁷. Even a century after its invention, the MC
59 is the least popular alternative for Indian women, and its adoption is much lower compared to
60 sanitary pads¹⁸. According to a descriptive survey in Mangalore, India, whereas 82% of 300
61 women were aware of MCs, only 2.6% use them¹⁹.

62 According to a systematic review and meta-analysis on the safety and acceptability of MC, it
63 can be adopted as a safe product for menstrual management. Authors suggested for future
64 research to examine the facilitators towards MC use and document any adverse outcomes¹⁵.
65 There is limited study that explicitly describe about the experiences of MC users, specifically
66 in LMICs. This study intends to explore the experiences and challenges encountered by the
67 women using MCs.

68 **Material and Method:**

69 **Study design, setting and participants:**

70 A qualitative explorative study among a total of 26 MC users was carried out using the In-
71 Depth Interview (IDI) guide. All participants had experience of using MCs for a minimum of
72 three consecutive menstrual cycles. Initially, five eligible participants were identified from the
73 host institute, after doing an exploratory survey. Further, other participants were identified
74 and recruited using snowball sampling technique. Our study participants belonged to the
75 states of Odisha (n=8), Agartala (n=9) and Assam (n=9), India. All study participants were
76 professionals, working and residing in cities like Delhi, Mumbai, Bhubaneswar and Rourkela.

77 **Data collection procedure, management, and analysis:**

78 The participants were interviewed telephonically by the trained researchers in Odia or Hindi
79 language using the IDI guides. In order to enhance the credibility of the findings, we followed
80 the source and investigators triangulation approach. We have presented detailed information
81 regarding the participants' income and profession. However, women were basically from –
82 public and private sectors – participated in this study. The researchers who collected data
83 were females (NP, KP and SD) and from nursing, public health and physiotherapy
84 backgrounds. All the researchers had completed their master's degree in public health and
85 have work experience in the field of public health, social and behavioural health and equity
86 for more than two years. The senior researcher also provided training to the researchers
87 regarding the data collection method.

88 IDI guide comprised of questions along with probes and prompts to elicit their willingness to
89 use MCs, their experiences while using, and the challenges they faced. Data collection was
90 continued till we obtained the data saturation and when no new information was emerged. The
91 interviews were audio-recorded followed by transcription of verbatim and translation into

92 English. Data were analysed using the qualitative thematic analysis method and MAXQDA
93 (VERBI Software, Berlin, Germany) software.

94 **Ethical consideration:**

95 The study was approved by the institutional ethics committee of the ICMR-Regional Medical
96 Research Centre, Odisha, India. Prior to the interview, participants were clearly told about the
97 purpose and the voluntary nature of their participation with flexibility to withdraw at any
98 point in time. Verbal consent was obtained from each respondent.

99 **Result:**

100 **Participant characteristics:**

101 The study participants belonged to the age group between 25 to 37 years with a mean age of
102 29.6 (\pm 0.91) years. Their average duration of their MC use was 2.4 (\pm 0.34) years. All
103 participants were well educated with minimum of master's degree in different disciplines and
104 working in different professional fields. Among 26 participants, 13 (50%) were married and
105 one had a living child.

106 Table 1: Characteristics of participants

Sl. No.	Characteristics	(n)
1	Age (years, mean \pm SD)	29.6 (\pm 0.91)
2	Average duration of MC use	2.4 (\pm 0.34)
3	Marital Status	
	Married	13
	Unmarried	13
4	Average income	
5	State-wise	
	Odisha	8
	Agartala	9
	Assam	9
6	Current location	
	Delhi	8

	Mumbai	9
	Bhubaneswar	4
	Rourkela	5
7	Profession	
	Private	24
	Public	2

107

108 Table 2: Emerged codes and categories

109 Results from this study have been identified and depicted under four overarching categories

110 (1) Reason for adopting MC, (2) Experience of using MC (3) Challenges to ensure a

111 sustainable use of MC and (4) Perceived barriers in adopting MC. The findings are presented

112 under each category, supported with quotes from the respondents.

113 **1. Reason for adopting MC:**

114 Majority of the participants claimed that, MCs were long-lasting, reusable and pocket-friendly

115 products compared to sanitary pad. Monthly they had to spend INR 150-200 for purchasing

116 sanitary pads for one cycle, whereas a single MC costing about INR 300 could be used for

117 more than five years. One participant mentioned that:

118 “Even a small sanitary pack of 6 pads costs about 150 bucks” (P9)

119 Further, some participants expressed their concern that wearing sanitary pads, led to

120 development of unpleasant rashes which was worse during Summer. Despite this, all had used

121 sanitary pads because of lack of their awareness and non-availability of a safe alternative.

122 “I easily got rashes while using pad. During periods, rashes start during initial 3 days

123 and last for 10 days. That was very painful and embarrassing. That’s the sole reason

124 why I switched to MC” (P21)

125 Feeling of bulkiness in the underpants, moist sensation, and efforts to place the pad precisely

126 inside the underwear, were reasons for dissatisfaction.

127 “I was never ever comfortable using sanitary pads. Even though advertisement on

128 television show how you can perform activities comfortably while using sanitary pad,

129 I could hardly relate to it in reality.” (P14)

130 A few participants expressed their concern regarding disposal of used pads. Changing pads at
131 regular interval poses a major challenge, specifically when they were outside home.

132 “Especially women who go to office and work, it makes their lives very easy. There’s
133 no headache of disposing and changing.” (P8).

134 Also, majority explained that the MCs are not just only a sustainable product but eco-friendly
135 too compared to sanitary napkins and tampons. One participant mentioned:

136 “Many reasons for adopting MC. First, it is eco-friendly. I try such things which are
137 environment friendly and ecologically sustainable. So, I started using MC.” (P13)

138 **2. Experience of using MC**

139 **2.1. Positive experiences:**

140 According to participants, using MC was easy, convenient, and comfortable. Further,
141 compared to sanitary pads, MC use was more convenient and comfortable, when they go
142 outside because of no need for discarding and changing. According to a participant, there was
143 a “sense of freedom” while using a MC and performing daily routine activities.

144 “When you use a MC, you don’t even realize that you’re bleeding, you don’t feel
145 anything. No stream gushing out when you move or shake. That’s so comforting.”
146 (P24)

147 While majority of the participants stated that they had never experienced a leakage issue with
148 MC, a few had encountered this issue during their initial days of use. The reason they cited
149 was because of the lack of adequate knowledge on its insertion and non-availability of a
150 perfect size cup. This problem gradually got solved with experience in due course.

151 “I have not experienced any leakage issue till now. I have travelled a lot using the cup.
152 During nights also, there is no leakage problem. The best part is I don’t feel that
153 something is inside.” (P5)

154 **2.2. Negative experiences:**

155 A few participants narrated their apprehension on using a MC. The reasons for apprehension
156 were lack of proper information on how to use a MC and absence of a support system in case
157 anything goes wrong while using. One health care participant expressed her experience about
158 the difficulty in inserting the MC among sexually inactive girls. According to another

159 participant, during her initial days of MC use, when it was not correctly placed, she felt a
160 pricking sensation which was uncomfortable.

161 “If it is not placed properly and fully inside, I felt like something is pricking me.”
162 (P13)

163 Only a few participants mentioned about the difficulty in removing the inserted MC. While
164 most could remove it on the first try, some managed to remove after many attempts. This
165 caused them stress and anxiety during the early days. According to a participant,

166 “Inserting a MC was easy. But removing it was too difficult and pathetic. I was inside
167 the washroom for an hour struggling to remove. I literally cried. Then I asked my
168 friend, and she helped me. (P12)

169 Another issue with MC was in knowing and getting an appropriate sized one. A few
170 participants stated that despite trying for all available sizes, none fitted them properly and
171 resulted in leakage. In this regard, one participant commented:

172 “Yes, fitting of MC is an important issue. For me, S is too small, M is too big. Once I
173 used M size and it popped out. (P26)

174 Among the participants, some still could not switch over completely to the MC due to their
175 lack of complete trust/confidence on MC. So, they used an additional protection layer even
176 after inserting a cup, especially when they would go out. The reason was they never found an
177 appropriate size MC, that was thoroughly comfortable. Moreover, enormous patience,
178 practice, and familiarity with the product is required in getting an appropriate sized one.

179 “I even use a panty liner along with the cup during the first two days of my
180 menstruation.” (P23)

181 **3. Challenges to ensure a sustainable use of MC**

182 The MC users encountered substantial challenge in ensuring sterilization of MC when they
183 were outside home. Further, when they were in a hurry, it was not feasible to use a MC.
184 Hence during such events, they preferred sanitary pad. Another significant challenge was
185 inadequate knowledge on the use of MC and its sterilization process. Even though the
186 participants had gathered information by searching from social media, they felt it to be
187 inadequate.

188 "The shocking part was, when I consulted a gynaecologist about my leakage, she said
189 she does not know about MC. If a doctor is not aware, then who will help us?" (P19)

190 Furthermore, due to non-availability of MCs in local markets and pharmacies, users don't feel
191 MC as a suitable alternative. Only online availability of the product hinders its accessibility to
192 many.

193 "I remember that once I was travelling and while handling the cup, I dropped it in the
194 toilet and lost it. I went to pharmacy shops and even a mart, but couldn't find." (P20)

195 **4. Perceived barriers in adopting MC**

196 Participants stated that MC is cost-effective and economical due to its reusability, however,
197 its initial cost would be a barrier among low socio-economic group of women to afford its
198 purchase. Free distribution of MC along with education and training on its usage could help
199 the women and adolescent girls across all groups to adopt.

200 "Affordability is a major factor. No doubt it is a onetime investment, but that onetime
201 investment is also huge for many. A good silicon-based MC will cost around 1000/-
202 INR." (P23)

203 Young unmarried girls may not be comfortable in inserting a MC because of existing taboos
204 around menstruation and virginity. Further, lack of toilet with adequate water supply would
205 create challenge in using MC.

206 "You can use a sanitary pad in public toilets, because you are not coming in contact
207 with anything. But while using a MC, you need a clean washroom along with adequate
208 water supply." (P23)

209 Further, MCs are not widely used due to a lack of knowledge among the reproductive age
210 group women as the product is not widely available, lack of any awareness campaign and
211 advertisements about the product.

212 "Lack of information and awareness is a huge issue. Even though sanitary pads are
213 advertised so much, still people are not open to use it, then how would we expect
214 people to use MC, when there is no advertisement?." (P8)

215 Based on the factors influencing for adopting and using MC, a conceptual framework is
216 outlined in figure-1. The factors are depicted under three categories as Dependable factors,
217 Independent factors and Mediating factors.

218 Our study also observed the differences between the practice of sanitary pad and MC. The
219 differences under various characteristics are presented in Table-3. As all the participants
220 stated that before adopting a menstrual cup as a sanitary product, they were using a sanitary
221 pad. While using the sanitary pad they have faced a series of challenges, and discomfort for
222 which they adopted MC as an alternative. We have presented table 3 to compare both
223 products which helps readers to get the detailed information regarding various context-
224 specific factors associated with both the products.

225 Figure 1: Conceptual framework on factors associated with adoption and usage of MC.

226 **Discussion:**

227 This qualitative study was based on the experiences and perceptions of MC users to
228 understand whether MC could be an alternative method in menstrual hygiene management.
229 While most of the findings towards MC use were found positive and encouraging compared
230 to conventional sanitary pad, there were also a few shortfalls with MC use. The MCs were
231 found to be more economical, safe, convenient, and environment friendly. The motivation to
232 use MC among participants was ingrained in the detrimental experiences of their earlier use of
233 sanitary pad such as developing rashes, bad odour, discomfort, and disposal issue. While most
234 of those concerns got addressed after switching over to MC, still a few users were worried
235 about the lack of availability of appropriate size cup for them, often causing leakage. Most of
236 such MC related issues got resolved in due course with experience of using.

237 Other studies from India and other countries have also reported the benefits of MC use.
238 Similar to our finding, studies from LMICs have demonstrated MC use to be practical, safe
239 and convenient^{3, 20}. In a study from Canada, researchers have revealed that females using MC
240 were having higher satisfactory rate²¹. In a clinical investigation study in South Africa, MC
241 was found to be better in terms of quality and comfort compared to sanitary pads/tampons²².
242 According to a study from Kenya, once the MC is properly inserted and placed, the user felt
243 active and confident,¹² which were consistent with our finding. Another study from Africa
244 reported that, MC helps to alleviate physical and social distress²³. Similar to our findings, a
245 study from Gujarat, India, indicated that females between 20 to 50 years preferred using MC

246 because it was convenient, had less odour and least side effects²⁴. As the product is available
247 only online, so it has been accessible only for the educated adult group. Further, the adoption
248 of MC minimises the economic burden and menstrual waste compared to the use of sanitary
249 pads¹⁹. Moreover, 70% of the participants intended to continue using MC as stated in a
250 systematic review and meta-analysis¹⁵.

251 While most of our participants expressed their concern about the leakage issue during their
252 initial days of MC use, they blamed it on incorrect insertion and positioning of the cup and
253 non-availability of an appropriate size cup. According to a study among school-aged girls,
254 sanitary napkins are mostly used due to a lack of awareness on MC²⁵. Non-availability of MC
255 in local markets and pharmacies limits their options for MHM. Further, present study reveals
256 that removing MC was difficult at times, which is consistent with previous research^{13, 24}.

257 Oster and Thornton reported that MCs have the benefit of being easy to clean and requiring
258 less water, so they can be considered in locations with restricted water supplies¹⁶. In contrast
259 to this, we found that adequate water supply along with clean washroom facility is essential
260 for MC use. In Indian context, there are taboos existing on MHM and it is still considered to
261 be unhygienic. That is why our participants mentioned the need of adequate water to properly
262 clean the MC for reuse.

263 Present study revealed that emotional support is essential during the initial use of MC; yet,
264 due to sociocultural orientation of menstruation, women may be reluctant to seek help.
265 Moreover, they were judged by the peers for inserting a product into the vagina when sanitary
266 pad is available. In contrast to our finding, a study from Nepal reported that peer exposure
267 could increase in MC adoption¹². Existing literature also suggest that sustainable MHM by
268 adopting MC could be achieved through strategies like strengthening communication,
269 creating health support groups, and involving community health care workers²⁶. Another
270 study suggested that as compared to sanitary pad and tampon, menstrual cup is a safe,
271 sustainable and cheaper. However, proper advertisement is highly required in order to change
272 the existing practice of using menstrual product among women²⁷. MC is an eco-friendly
273 menstrual management alternative which offers an affordable and sustainable period product.
274 It has ecological, economic, and environmental benefits. A “sense of freedom” among MC
275 users has transformed their lifestyle, and empowered them. Our study advocates for
276 government initiatives on availability of affordable MC, provision of comprehensive training
277 on techniques, hygiene safety, promotion of awareness using electronic and print media for

278 wider acceptability of MC. Present study participants were adults, well educated, employed,
279 empowered, and belonged to middle or upper socio-economic strata. Thus, the
280 generalizability of the results across other groups needs to be done cautiously. The findings of
281 the present study have excellent value for adding knowledge to the existing literature. The
282 evidence generated from this study will aid policymakers, healthcare professionals and
283 program implementers to learn more about the potential advantages and disadvantages of
284 using a MC hence can create awareness among women which could ultimately help in better
285 reproductive health outcomes. This study has some limitations. Participants were educated,
286 employed, empowered, and belong to the middle or upper socio-economic strata of the
287 society. Thus, the generalizability of the results with uneducated and low socio-economic
288 groups can be difficult. Further, our study could not explore the complexities of using MC
289 among virgin girls.

290 *Implication of policy and practice*

291 The results of our study offer evidence regarding the experiences of women who have
292 adopted MC as an MHM product. It is critically significant to have a clear reproductive policy
293 guideline on the education, training, and capacity building of women regarding their choices
294 for menstrual products and its usage. The evidence generated from this study will aid
295 policymakers and healthcare professionals to learn more about the potential advantages and
296 disadvantages of using a MC, hence can create awareness among women for a better
297 reproductive health outcome.

298 **Conclusion**

299 MC is an effective and convenient alternative period product for MHM among urban
300 educated and self-independent women. Though some initial challenges such as proper
301 insertion, removal and ensuring product hygiene were encountered, they got resolved with
302 time. Future research exploring the socio-cultural aspects along with proper strategies would
303 improve the acceptability and MC use.

304 **Acknowledgement:**

305 We would like to thank all the participants for their valuable time to share their experiences
306 with us.

307 **Declaration of Competing Interest:**

308 The authors declare no competing interests that could have appeared to influence the work
309 reported in this paper.

310 **Funding:**

311 This research did not receive any specific grant from funding agencies in the public,
312 commercial, or not-for-profit sectors.

313 **Bibliography:**

314 1 Sommer M. Utilizing participatory and quantitative methods for effective menstrual-
315 hygiene management related policy and planning. In UNICEF-GPIA international conference
316 2010 Apr 24 (Vol. 2010).

317 2 Mason L, Nyothach E, Van Eijk AM, Obor D, Alexander KT, Ngere I, Laserson K,
318 Phillips-Howard P. Comparing use and acceptability of menstrual cups and sanitary pads by
319 schoolgirls in rural Western Kenya. *International Journal of Reproduction, Contraception,*
320 *Obstetrics and Gynecology.* 2019;8(8):2974.

321 3 McMahan SA, Winch PJ, Caruso BA, Obure AF, Ogutu EA, Ochari IA, Rheingans RD.
322 'The girl with her period is the one to hang her head'Reflections on menstrual management
323 among schoolgirls in rural Kenya. *BMC international health and human rights.* 2011
324 Dec;11(1):1-0.

325 4 Ranabhat D, Nepal S, Regmi B. Menstrual Hygiene Practice and School Absenteeism
326 among Rural Adolescent girls of Kalikot district. *Nepal Medical College Journal.* 2019 Dec
327 31;21(4):258-64.

328 5 McCammon E, Bansal S, Hebert LE, Yan S, Menendez A, Gilliam M. Exploring young
329 women's menstruation-related challenges in Uttar Pradesh, India, using the socio-ecological
330 framework. *Sexual and Reproductive Health Matters.* 2020 Jan 1;28(1):1749342.

331 6 Sivakami M, van Eijk AM, Thakur H, Kakade N, Patil C, Shinde S, Surani N, Bauman A,
332 Zulaika G, Kabir Y, Dobhal A. Effect of menstruation on girls and their schooling, and
333 facilitators of menstrual hygiene management in schools: surveys in government schools in
334 three states in India, 2015. *Journal of Global Health.* 2019 Jun;9(1).

- 335 7 Sornapudi SD, Shrivastava M, Soni S, Jha S. Adoption, use and environmental impact of
336 feminine hygiene products among college going girls of Udaipur, India. *Int J Curr Microbiol*
337 *App Sci*. 2018;7(9):3719-25.
- 338 8 Eti M, Shreya MS, Sailakshmi MP. Knowledge about menstrual cup and its usage among
339 medical students. *International Journal of Reproduction, Contraception, Obstetrics and*
340 *Gynecology*. 2019 Dec 1;8(12):4966-71.
- 341 9 Chauhan S, Kumar P, Marbaniang SP, Srivastava S, Patel R, Dhillon P. Examining the
342 predictors of use of sanitary napkins among adolescent girls: A multi-level approach. *Plos*
343 *one*. 2021 Apr 30;16(4):e0250788.
- 344 10 Appleton S, Morgan WJ, Sives A. Should teachers stay at home? The impact of
345 international teacher mobility. *Journal of International Development: The Journal of the*
346 *Development Studies Association*. 2006 Aug;18(6):771-86.
- 347 11 Chatori, Aundh Camp Deccan Khadkikondhwaswargate, and Gallisport Automobile
348 Business Real Estate. 2022. First Designed in India Innovative 'Menstrual Cup' Launched on
349 International Women s Day Care.
- 350 12 Pokhrel D, Bhattarai S, Emgård M, Von Schickfus M, Forsberg BC, Biermann O.
351 Acceptability and feasibility of using vaginal menstrual cups among schoolgirls in rural
352 Nepal: a qualitative pilot study. *Reproductive Health*. 2021 Dec;18(1):1-0.
- 353 13 North BB, Oldham MJ. Preclinical, clinical, and over-the-counter postmarketing
354 experience with a new vaginal cup: menstrual collection. *Journal of women's health*. 2011 Feb
355 1;20(2):303-11.
- 356 14 Stewart K, Greer R, Powell M. Women's experience of using the Mooncup. *Journal of*
357 *Obstetrics and Gynaecology*. 2010 Apr 1;30(3):285-7.
- 358 15 Van Eijk AM, Zulaika G, Lenchner M, Mason L, Sivakami M, Nyothach E, Unger H,
359 Laserson K, Phillips-Howard PA. Menstrual cup use, leakage, acceptability, safety, and
360 availability: a systematic review and meta-analysis. *The lancet public health*. 2019 Aug
361 1;4(8):e376-93.
- 362 16 Oster E, Thornton R. Determinants of technology adoption: Peer effects in menstrual cup
363 take-up. *Journal of the European Economic Association*. 2012 Dec 1;10(6):1263-93.

- 364 17 Ministry of Health and Family Welfare, Government of India. 2019. "National Family
365 Health Survey (NFHS-5)."
- 366 18 George AM, Leena KC. Experiences of the Women Using Menstrual Cup on Free Will–A
367 Qualitative Inquiry. *Online J Health Allied Scs.* 2020;19(3):10.
- 368 19 Ballal S, Bhandary A. Menstrual cup: awareness among reproductive women. *International
369 Journal of Reproduction, Contraception, Obstetrics and Gynecology.* 2020 Apr 1;9(4):1382-8.
- 370 20 Brocklehurst C, Bartram J. Swimming upstream: why sanitation, hygiene and water are so
371 important to mothers and their daughters. *Bulletin of the World Health Organization.*
372 2010;88:482-.
- 373 21 Howard C, Rose CL, Trouton K, Stamm H, Marentette D, Kirkpatrick N, Karalic S,
374 Fernandez R, Paget J. FLOW (finding lasting options for women): multicentre randomized
375 controlled trial comparing tampons with menstrual cups. *Canadian Family Physician.* 2011
376 Jun 1;57(6):e208-15.
- 377 22 Beksinska ME, Smit J, Greener R, Todd CS, Lee ML, Maphumulo V, Hoffmann V.
378 Acceptability and performance of the menstrual cup in South Africa: a randomized crossover
379 trial comparing the menstrual cup to tampons or sanitary pads. *Journal of Women's Health.*
380 2015 Feb 1;24(2):151-8.
- 381 23 Boosey R, Prestwich G, Deave T. Menstrual hygiene management amongst schoolgirls in
382 the Rukungiri district of Uganda and the impact on their education: a cross-sectional study.
383 *The Pan African Medical Journal.* 2014;19.
- 384 24 Kakani CR, Bhatt JK. Study of adaptability and efficacy of menstrual cup in managing
385 menstrual health and hygiene. *Int J Reprod Contracept Obstet Gynecol.* 2017 Jun
386 24;6(7):3045-53.
- 387 25 Mathiyalagen P, Peramasamy B, Vasudevan K, Basu M, Cherian J, Sundar B. A
388 descriptive cross-sectional study on menstrual hygiene and perceived reproductive morbidity
389 among adolescent girls in a union territory, India. *Journal of family medicine and primary
390 care.* 2017 Apr;6(2):360.
- 391 26 Hyttel M, Thomsen CF, Luff B, Storrusten H, Nyakato VN, Tellier M. Drivers and
392 challenges to use of menstrual cups among schoolgirls in rural Uganda: a qualitative study.
393 *Waterlines.* 2017 Apr 1:109-24.

394 27 Medhi A, Nigam S, Pendharkar O, Hedge A, Borkar R. Menstrual Cups: The Sustainable
395 Future for Women Hygiene in India. SocArXiv, 2021 Apr 15. doi:10.31235/osf.io/3vutf.

396

Journal Pre-proof

Table 1: Characteristics of participants

Sl. No.	Characteristics	(n=26)
1	Age (years, mean \pm SD)	29.6 (\pm 0.91)
2	Average duration of MC use	2.4 (\pm 0.34)
3	Marital Status	
	Married	13
	Unmarried	13
4	Average income	
5	State-wise	
	Odisha	8
	Agartala	9
	Assam	9
6	Current location	
	Delhi	8
	Mumbai	9
	Bhubaneswar	4
	Rourkela	5
7	Profession	
	Private	24
	Public	2

Table 2: Emerged codes and categories

Categories	1. Reason for adopting MC	2. Experience of using MC	3. Challenges to ensure a sustainable use of MC	4. Perceived barriers in adopting MC
Codes	Affordability, side effects, discomfort, disposal issue	Positive experiences, negative experiences	Sterilisation, accessibility and availability, lack of knowledge	Affordability, lack of awareness, social taboos, access to hygienic place

Table 3: Comparison between Sanitary pad and Menstrual cup

Condition/Situation	Sanitary pad	Menstrual Cup
Cost	<ul style="list-style-type: none"> • Need to be purchased frequently (every month). • Per cycle cost is around 100-150 INR (monthly) 	<ul style="list-style-type: none"> • Need to be purchased once for about 5 years. • Initial cost is high (300-1000 INR) but economical in long run (can be used up to 5 years)
Availability	<ul style="list-style-type: none"> • Easily available in pharmacies and supermarkets. • Free distribution of sanitary pad by Government and NGOs 	<ul style="list-style-type: none"> • Available only through online business platforms.
Side effects	<ul style="list-style-type: none"> • Possibility of side effects such as rashes, infection 	<ul style="list-style-type: none"> • No major side effect
Disposal	<ul style="list-style-type: none"> • Each used pad needs to be disposed as a biological waste. • Less water is required for changing to a new pad. 	<ul style="list-style-type: none"> • Disposal is not required. • Needs proper cleaning with adequate water for reuse.
Effect on Environment	<ul style="list-style-type: none"> • Non-biodegradable product, not environment friendly. 	<ul style="list-style-type: none"> • More eco-friendly compared to sanitary pads.
Convenience	<ul style="list-style-type: none"> • More convenient when outside home. 	<ul style="list-style-type: none"> • Clumsy to handle when outside home (workplace and public place).
Sterilization	<ul style="list-style-type: none"> • Not needed (one-time use). 	<ul style="list-style-type: none"> • Requires proper sterilize and storage.
Perception	<ul style="list-style-type: none"> • No such negative perception (used externally). • No apprehension of any major problem. 	<ul style="list-style-type: none"> • Losing virginity (among adolescent girls and unmarried women). • Initial apprehension about wrong placement, removal problem.
Comfort	<ul style="list-style-type: none"> • Discomfort with bulky feeling. 	<ul style="list-style-type: none"> • Very comfortable when a fitting sized MC is properly placed.
Experience/guidance	<ul style="list-style-type: none"> • Not required 	<ul style="list-style-type: none"> • Very much required (identifying the proper size, proper placement, removal, sterilization and storage).

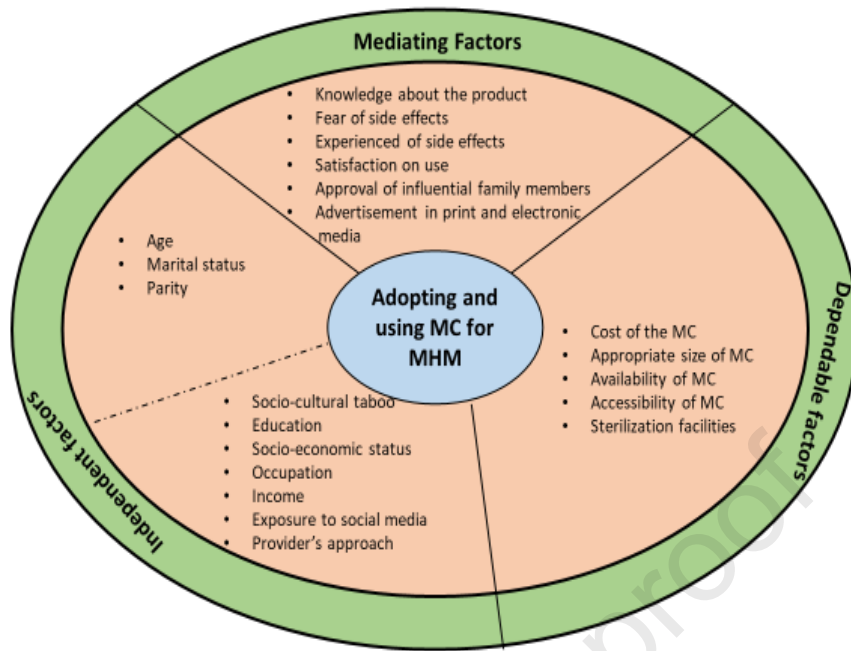


Figure 1: Conceptual framework on factors associated with adoption and usage of MC.