Original Article

Reusable sanitary napkins in rural India: a remote quality improvement project for adolescent girls promoting menstrual hygiene health during the COVID-19 pandemic

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Abstract: Medical and public health research supports an ongoing need for health promotion in meeting menstrual hygiene needs, including menstrual hygiene management (MHM) education and the adoption of reusable sanitary napkins. This quality improvement project focuses on menstruation education for adolescent girls in rural Tamil Nadu, India and the promotion of reusable sanitary napkins. Results indicate a significant improvement in MHM knowledge, confidence in managing menstruation, adoption of reusable sanitary napkins, and a decrease in missed school days. These findings support global recommendations for health promotion in India.

Keywords: adolescents and youth, collaboration/partnerships, education (including health education), global health/globalization, health promotion, reproductive health, rural, sanitation/hygiene

Introduction

Women of India face greater challenges than men in accessing water, sanitation and hygiene (WASH) resources to address their daily needs (1). These daily challenges can lead to women adopting unsafe menstrual hygiene management (MHM) practices and missed days of school for adolescents due to lack of feminine hygiene products (2–4). The term MHM is characterized by a diverse range of practices, such as type of absorbent material used and the frequency changed, associated personal cleansing, the methods of washing, drying and storing of reusable pads, and location of menstruation-related changing and washing practices (5).

Managing menstruation can be more difficult for some women than others. Each month women need sanitary napkins or other materials to absorb menstrual flow, along with cash to purchase supplies and privacy to tend to their personal hygiene. Women living in rural India face many hardships, including limited access to running water and bathroom facilities (1). During menstruation the need for both water and bathroom facilities increases. Due to the constant struggle, many women adopt unhygienic practices. Women in rural India also face challenges with access to sanitary napkins, privacy to maintain proper hygiene, and basic education on the principles of menstrual health management (2).

Many factors influence health care in India, including the historical foundation of the caste system, religious beliefs and physical location (6). This study focuses on adolescent girls living in South India, where

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geographical, social and cultural isolation along with deep-rooted caste system influences impact their education and physical health. In the rural towns of Trichy and Tiruvannamalai, Tamil Nadu, adolescent girls are significantly impacted by the lack of MHM resources and menstrual health education. In the state of Tamil Nadu, the current practices as reported by Visions India, an NGO of community health workers for adolescent women, indicates 25% use disposable sanitary napkins, 65% use homemade rags or clothes, and the other 10% use nothing (A. Mohan, personal communication, 5 March 2020). Those who opt to use nothing wash their genital area frequently to keep clean. These practices are largely affected by a lack of structured education programs in schools addressing feminine hygiene and by religious beliefs that see menstruation as a punishment from God (A. Mohan, personal communication, 5 March 2020).

Scientific literature from both women's health and public health highlights the need for improved menstrual hygiene management in rural India. Published studies describe the low level of fundamental knowledge of MHM and the resulting effect that lack of knowledge has on girls attending school (4,7–12), WASH influences (2,3,13), female reproductive infections linked to poor hygiene (1,5) and accessibility to latrines and reusable options with regard to menstrual products (14–16).

Lack of menstrual hygiene knowledge, poor access to sanitary products and poorly equipped school facilities make it difficult for adolescent females in India to complete school (12). Tamil Nadu has one of the highest levels of development, with 6.1 million adolescent girls. Failure for the girls to complete school and enter the workforce has significant economic impact on the country. In 2011, the state government implemented a free sanitary pad program for all girls living in rural areas (12). The program provides three packs of pads once every two months, iron tablets to combat anemia, and menstrual hygiene education from an 'aganwadi' (female community health worker). While the program has the best of intentions, the free sanitary napkins have not been of good quality and the girls would rather use something else. Quality napkins sold at local stores are too expensive and the young women do not have access to reusable sanitary napkins (A. Mohan, personal communication, 5 March 2020). Their inability to manage menstruation at school results in missed days of education, and ultimately can lead to females dropping out of school before graduation (4,7,8).

Following WASH guidelines is important for maintaining safe living environments and promoting optimal physical heath. Multiple studies have shown that lack of access to clean water, lack of sanitation facilities and lack of hygiene products can cause negative physical side effects and disease (2,3,13). Chattopadhyay *et al*. (2) studied over six thousand girls living in poverty pockets of East India. Of those, 82% practiced open defecation and 76% did not use sanitary napkins. These girls had decreased height, low body mass index and small mid-upper arm circumference. Poor WASH practices in India can also lead to the prevalence of trachoma; untreated trachoma can lead to pain and irritation, impaired vision and, in severe cases, blindness (13).

Female reproductive tract infections such as bacterial vaginosis, candida and trichomonas vaginalis have also been linked to poor WASH and MHM practices (1,5). These practices and untreated infections can lead to severe future complications for females, including preterm labor, placenta previa, spontaneous rupture of membranes and even infertility (1,5,17). Due to lack of MHM education, most women are not able to identify these reproductive tract infections in early stages (1).

Lack of bathroom facilities, especially for women, and limited access to sanitary products remain a large problem across India (15). In some rural areas, including Tamil Nadu, there is only one latrine in the community, and that latrine was funded by government money and is for men only (J. Metzger, personal communication, 15 January 2020). The literature identifies that successful sanitation depends on access to water and relies on economic, social and political support (15). Another problem involves proper waste management and disposal of sanitary napkins. There is often debris littering the streets and this can also lead to water contamination and the spread of communicable diseases (14). Providing alternative low-cost reusable sanitary napkins and building more bathroom facilities not only helps improve waste management, but also enhances WASH practices (14–16).

The purpose of this quality improvement (QI) project was to improve the health and wellbeing of adolescent girls age 10–19 living in rural Tamil Nadu, India by implementing an evidence-based intervention aimed at improving feminine health

knowledge and practices through the use of more socially accepted and developmentally appropriate hygiene products. The project specifically aimed to: (a) improve knowledge of feminine hygiene care; (b) increase the menstrual practice needs met; (c) increase the adoption of reusable sanitary products; and (d) decrease the percentage of school days missed due to menstruation.

Methods

Design

This project utilized a single group pre-post design in which MHM knowledge, use of reusable sanitary products, percentage of school days missed due to menstruation, menstrual practices and needs were assessed before and after an MHM intervention among 50 adolescent girls in rural Tamil Nadu, India. The intervention included an MHM education program on feminine hygiene care and the distribution of MHM kits to all participants. The kit included menstrual hygiene educational materials, five reusable sanitary napkins and a privacy drying shield. All participants received the MHM kit and printed educational materials on an individual basis due to COVID-19 restrictions and the need to maintain social distance. The MHM education program attendance and successful reusable sanitary products distribution were examined to identify barriers to implementation of the intervention.

The intervention was conducted in two phases over a 120-day period. Phase 1 was a 30-day period in which 50 adolescent girls were recruited, pre-intervention assessments were completed and the MHM intervention was implemented (4 December 2020–3 January 2021). Phase 2 took place over a 90-day period in which these same adolescents were asked to use the materials in the MHM kit and complete the post-intervention assessment at the end of the period (4 January 2021–3 April 2021). This QI project was deemed exempt from the Institutional Review Board review.

Setting and participants

Participants were adolescent girls (age 10–19 years) who had reached menarche and were living in the rural towns of Trichy or Tiruvannamalai, Tamil Nadu, India. Only adolescents who had access to a computer with internet connectivity and who wanted to try the reusable sanitary napkins were included. The exclusion criteria were an inability to speak, read and understand English, pregnancy, inability to comprehend written materials distributed for the study, inability to physically care for oneself, and inability to provide verbal consent to participate in the MHM intervention and complete the pre- and post-intervention assessments. Participants were selected through door-to-door recruitment. A total of 50 adolescent girls were enrolled and all 50 completed both phases of the project.

Intervention

The intervention consisted of the distribution of an MHM kit and two online MHM pre-recorded education sessions. The MHM kits contained five reusable sanitary napkins, one heavy absorbency and four regular absorbency pads, along with one privacy drying shield. The online pre-recorded sessions focused on hygiene practices that reinforce the WASH protocols, an overview of the menstrual cycle, puberty education and instructions regarding the washing and drying of reusable sanitary napkins. The distribution of materials was a one-time occurrence.

Measures

Participants completed a pre- and post-intervention demographic questionnaire that included current age, age of menstruation onset, school attendance, religious affiliation, running water in home, running water in school, and current practices for managing monthly menstruation.

An MHM knowledge test was also administered before and after the intervention. The 20-item test included items to assess ability to define menstruation as well as items regarding what organs are involved in menstruation, what hormones are involved in menstruation/ovulation, recommended hygiene practice during menstruation, disposal of used menstruation materials, drying of reusable menstruation materials, symptom management of menstruation, and where participants received their current knowledge of menstruation. The knowledge total was calculated based on a correct score ranging from 0 to 20.

Participants also completed a modified version of the Menstrual Practice Need Scale -36 (MPNS-36)

(18) before and after the intervention. The MPNS-36 was the first questionnaire developed to capture perceived menstrual hygiene. The original MPNS-36 includes 54 items and is comprised of six subscales: (a) material and home environment needs; (b) transport and school environment needs; (c) material reliability concerns; (d) change and disposal insecurity; (e) reuse needs; and (f) reuse insecurity. A reliability assessment for the original MPSN-36 indicated acceptable internal consistency of the items constituting each subscale (Cronbach's alphas: 0.47– 0.79). A recent study by Hennegan *et al.* (18), undertaken in Soroti, Uganda, found that higher home-based and school-based subscale scores are associated with greater confidence to manage menstruation at home and school, and higher overall scores are associated with not missing school during the last menstrual period.

A modified version of the MPNS-36 was used for this project on current menstrual practices and needs. The modified version included 31 items of the original 54 items to reduce participant burden and included the following items: (a) Question 1: *I was able to choose the menstrual materials I most wanted to use*; (b) Question 19: *I felt clean during my last period* and a subset of items from the (c) material and home environment needs – 13 items, (d) transport and school environment needs – 5 items, (e) material reliability concerns – 3 items, (f) reuse needs – 5 items and (g) reuse insecurity – 3 items. As with the original version, each item was rated using the 4-point Likert scale: 0 = never, 1 = sometimes, 2 = often, 3 = always. Negatively stated items were reverse coded so that higher scores indicated a more frequent positive experience for all items. Subscale scores were derived by calculating the means of the items comprising each subscale.

As a measure of participant adherence, attendance at time of enrollment and viewing of taped online education was recorded by Visions staff. Participants were given an additional question on the post survey. Question 1: *How many total days of school were missed during Phase 2 (4 January 2021–3 April 2021) due to menstruation?*

Procedures

During Phase 1, participants were recruited by the NGO for the project. Only those adolescent girls who met the eligibility criteria received the MHM intervention. Once the pre-intervention assessment was completed, each eligible participant received the MHM intervention. Project materials were distributed individually to participants by Visions India staff, beginning on 4 December 2020, prior to the start of Phase 2 due to COVID-19 restrictions and the inability to use the Visions training center.

Phase 2 began on 4 January 2021 and ended on 3 April 2021 (90 days). During this time, participants were asked to utilize the distributed materials in the MHM kit, specifically knowledge gained from pre-recorded education sessions, the five reusable sanitary napkins and privacy drying shield. Staff from Visions India completed one check-in with participants during this period. On the final day of Phase 2 (day 120), the participants were asked to complete post-intervention assessments and the completed assessments were collected in person.

Data analysis

Descriptive statistics were used to detail the adolescent characteristics, intervention outcomes and intervention fidelity outcomes. Non-directional statistical tests were performed, with the level of significance for each test set at 0.05. Non-parametric methods were used due to the skewness of the continuous outcomes. The sample size of 50 provided at least 80% statistical power to test for within-adolescent intervention changes, assuming medium effect sizes.

Results

Adolescent characteristics

Table 1 details the characteristics of the 50 adolescent girls who participated in the intervention. The median age was 15 years (range: 12–19), while the median age of menstruation onset was 13 years (range: 11–16). All 50 participants reported attending school. Of note, 46% reported having running water (sink and toilet) in their homes and 89% of the adolescents had bathroom facilities at their school.

Knowledge test and Modified MPNS-36 scores

Table 2 describes the knowledge total score and Modified MPNS-36 scores assessing current menstrual

Table 1. Sample characteristics ($N = 50$).

Characteristic	*Median (Q1, Q3)*
Age, in years	15 (14, 16)
Age at onset of menstruation, in years	13 (12, 14)
	n (%)
School attendance	50 (100%)
Religion	
Hindu	30 (83%)
Catholic	6 (17%)
Sink/toilet at home	23 (46%)
Sink/toilet at school	40 (89%)

Q1, Q3 = 25th, 75th percentile. Religion: $N = 36$ with data available.

practices and needs. The mean correct knowledge total for the pre-test was 12.5 (range: 7–18) compared to 16.3 (range: 10–19) for the post-test. There was statistical significance in adolescent total improvement scores ($p < 0.0001$), with a mean post-pre difference score of 3.7 (range: –2.0–12.0).

In terms of the MPNS-36, higher subscale scores indicated a more frequent positive experience. A significant increase (improvement) in scores was observed for the following subscales: material and home environment needs ($p < 0.0001$), material reliability concerns ($p = 0.0049$), reuse needs ($p = 0.0002$). A significant decrease (reduction) in scores was demonstrated for reuse insecurity subscale ($p = 0.0305$).

There was a significant improvement in the percentage of adolescents who responded often/always to Question 2: *I felt clean during my last period* ($p = 0.0082$), but not to Question 1: *I was able to choose the menstrual materials I most wanted to use* ($p = 1.0000$). Among the 22 respondents who reported never/sometimes for Question 2 during the pre-assessment, 21 (95%) reported either often/always during the post-assessment. Among the 28 who reported either often/always for Question 2 during the pre-assessment, 7 (25%) changed their response to never/sometimes in the post-assessment.

MHM adoption of use and missed school days

Table 3 summarizes the use of different MHM materials and school days missed in the last 90 days due to menstruation. Interestingly, 49 (98%) of the girls used commercial pads before the intervention, but none (0%) reported using commercial pads after the intervention. Conversely, none of the adolescents used reusable pads before the intervention and all (100%) used the reusable pads after the intervention.

A key goal of this project was for girls to miss no school days because of menstruation. Among the 50 participants, 67% reported no days missed before the intervention and 90% reported no days missed after the intervention. There was significant increase in no school days missed post-intervention ($p = 0.0023$). Among the 16 students who missed one or more school days during the pre-assessment period, 12 (75%) had no missed school days and 4 (25%) continued to miss one or more school days during the post-assessment period. Among the 32 students with no missed school days during the pre-assessment period, only 1 (3%) reported one or more missed school days during the post-assessment period.

Discussion

Among the adolescent girls within the project, there was significant improvement in increased MHM knowledge, increased confidence in managing monthly menstruation, adoption of reusable napkins and fewer missed days of school. This is the first time a project like this has been done, focusing on female health improvement within the Dalit community. The majority of the participants in the study identified as Hindu. The Hindu religion continues to have a significant impact on healthcare delivery in India. This section will further discuss how each initial aim was addressed.

Among the participants, the greatest areas of improvement in the pre-post knowledge test were the ability to define menstruation, identifying the hormones involved in menstruation, the correct way to wipe female genitals after urination and defecation, identifying urinary tract and yeast infection symptoms, and dietary modifications to include during menstruation. The participants provided feedback that the pre-recorded PowerPoint slides were easy to follow and the pictures in the slides were helpful for understanding menstrual hygiene material.

The Modified MPNS-36 scores showed an increased confidence in managing menstrual hygiene health. The largest grow-th in confidence was seen

Table 2. Knowledge test total score and Modified MPNS-36 scores ($N = 50$).

Outcome	*Pre*	*Post*	*Post-Pre*	*Paired* t-*test*
	Mean ± SD	*Mean ± SD*	*Mean ± SD*	p-*Value*
Knowledge test				
Total correct score	12.5 ± 2.3	16.3 ± 2.2	3.7 ± 3.1	<0.0001
Modified MPNS-36 subscale scores				
Material and home environment needs	24.3 ± 5.7	33.5 ± 5.1	8.8 ± 6.4	<0.0001
Transport and school environment needs	10.2 ± 3.8	10.7 ± 3.6	0.6 ± 4.1	0.3371
Material reliability concerns	4.9 ± 2.0	6.0 ± 2.1	1.1 ± 2.5	0.0049
Reuse needs	11.6 ± 2.6	13.4 ± 2.4	1.8 ± 3.3	0.0002
Reuse insecurity	5.0 ± 2.0	4.1 ± 2.4	-1.0 ± 2.9	0.0305
Modified MPNS-36	*Pre*	*Post*	*Post-Pre*	*McNemar*
	n *(%)*	n *(%)*	*(%)*	p-*value*
Q1: I was able to choose the menstrual materials I most wanted to use.				1.0000
Often/always	33 (66%)	33 (66%)	0%	
Never/sometimes	17 (34%)	17 (34%)		
Q2: I felt clean during my last period.				0.0082
Often/always	28 (56%)	42 (84%)	28%	
Never/sometimes	22 (44%)	8 (16%)		

SD = Standard deviation; Knowledge test total correct ($t = 8.25$, df = 49, $p < 0.0001$); Materials and home environment ($t = 7.48$, df = 36, $p < 0.0001$); Transport and social environmental needs ($t = 0.97$, df = 44, $p = 0.3371$); Material reliability concerns ($t = 2.95$, df = 48, $p = 0.0049$); Reuse needs ($t = 3.96$, df = 49, $p = 0.0002$); Reuse insecurity ($t = -2.23$, df = 46, $p = 0.0305$). Q1 (McNemar S = 0.0, df = 1, $p = 1.0000$); Q2 (McNemar S = 7.0, df = 1, $p = 0.0082$).

in material and home environment needs and reuse needs. For material and home environment needs, participants reported their reusable menstrual materials were more comfortable compared to the disposal sanitary napkins they were using prior to the study. Participants reported they were significantly more satisfied with the cleanliness of the reusable napkins compared to the commercial napkins. The largest sense of confidence came from comfort in storing menstrual materials until their next period. Each participant utilized the privacy drying shield created for this project. The drying shield was made of black mesh material, fastened to a hanger. This design allowed the girls to hang their materials in a closet or private area. The shield doubled for proper drying of reusable materials during use and storage when the napkins were not being worn. For reuse needs, the participants reported an increased confidence in ability to wash and dry menstrual materials when they wanted to.

All 50 participants reported using reusable sanitary napkins at the end of the project. Feedback from the participants included that the reusable options were comfortable to wear, easy to clean, and provided adequate absorption. All participants preferred the design of the overnight/extra absorbency pad. They felt the design, coupled with the extra layer of cotton wicking material, provided the best leak protection. While the original design was for these pads to be utilized during sleep, the participants chose to wear them to school for extra coverage. This extra absorbency and additional coverage at school allowed the girls to focus on school work and worry less about leaking and needing to find privacy to change menstrual materials. Approximately half of the participants reported they were more comfortable and felt more secure with the overnight pad design versus the daytime lighter flow option.

Table 3. Menstrual hygiene material (MHM) use and missed days of schools ($N = 50$).

Outcome	*Pre-assessment*	*Post-assessment*
	n *(%)*	n *(%)*
MHM use	$N = 50$	$N = 50$
Commercial pads	49 (98%)	0 (0%)
Tampons	4 (8%)	0 (0%)
Homemade rags/pads	1 (2%)	0 (0%)
Reusable pads	0 (0%)	50 (100%)
Vaginal cups	1 (2%)	0 (0%)
Nothing	0 (0%)	0 (0%)
Other	0 (0%)	0 (0%)
Missed school days, in past 90 days	$N = 48$	$N = 50$
0 days missed	32 (67%)	45 (90%)
1 day missed	9 (19%)	4 (8%)
2 days missed	2 (4%)	1 (2%)
3 days missed	4 (8%)	0 (0%)
4 days missed	0 (0%)	0 (0%)
5 days missed	1 (2%)	0 (0%)
Missed school days, in past 90 days	$N = 48$	$N = 48$
0 days missed (goal)	32 (67%)	43 (90%)
1 or more days missed	16 (33%)	5 (10%)

MHM use was a select all that apply for current management. School days missed due to menstruation. Within adolescents, a significant pre- to post-improvement in no missed school days due to menstruation (goal) was observed (McNemar Test: $S = 9.3$, $df = 1$, $p = 0.0023$).

There was a significant increase in no school days missed post-intervention. Prior to the use of reusable napkins, major barriers for managing menstruation at school were lack of privacy and bathroom facilities, lack of disposal areas for commercial napkins, and the worry of leaking during school and associated embarrassment. This project focused on providing high-quality reusable options, designing the pads to fold into themselves for cleaner storing options in backpacks and providing pads with up to eight hours of protection, alleviated the increased need for privacy and toilet facilities that were either limited or nonexistent. Addressing these factors contributed to fewer missed days of school due to menstruation.

The collaboration with the local NGO Visions India allowed for successful participant recruitment and delivery of the intervention for the project. The women working for the NGO had established relationships within the communities of rural Trichy and Tiruvannamalai, serving adolescent females. Feedback from the NGO suggests that many more adolescents and women would like the opportunity to try reusable sanitary napkins and learn more about MHM. The innovative design and implementation of this project lends itself to being replicated in other areas of India or in different countries where there is a need for sustainable, low-cost and efficient means of menstruation management.

Limitations

COVID-19 significantly altered the original design of this project. The principal author had planned to run this QI project on site and in person. Inability to travel during the pandemic meant that the educational portion of the project had to be pre-recorded and watched on iPads provided by Visions India. The staff at Visions India individually collected pre- and post-data at participant homes and oversaw the distribution of the reusable sanitary napkins and privacy drying shields. The transition to an international collaboration with the partnering NGO incurred additional expenses from the lead

author, as well as demanding additional time and resources from the NGO.

Conclusion

The results of this project demonstrate a strong association between MHM knowledge and the use of reusable sanitary napkins, resulting in an increase of confidence in managing menstruation and a decrease of school absenteeism. These interventions have led to an increased sense of autonomy and empowerment among adolescent girls in Tamil Nadu, India. At the start of this project, the biggest limitation was the first author's inability to travel to Tamil Nadu in person, but became one of its greatest strengths, as being conducted by local Tamil women gave them self-agency. These findings support global recommendations (19) for structured MHM education among girls attending school and the promotion of reusable sanitary napkins. Future studies are needed to expand this sustainable model within rural areas and urban poor communities. After the completion of this project, multiple NGOs have reached out about exploring future partnerships in India.

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