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Effect of an Educational Intervention on Menstrual Hygiene Knowledge and associated determinants among Female University Students in Uganda

Josephine Namyalo[1,2*], Edward Mukooza[1], Robert Basaza[1,2,3], Emmanuel Otieno[1,3], Timothy Onyango[4], Gloria Seruwagi[5]

[1]*Department of Public Health, Uganda Christian University, Mukono, Uganda*
[2]*Save the Mothers East Africa, Mukono, Uganda*
[3]*Centre for Community Evidence-based Policy Options, Kasangati Uganda*
[4]*Division of Strategy and Research, Uganda Revenue Authority, Kampala, Uganda*
[5]*School of Public Health, Makerere University, Uganda*

Abstract

Menstrual hygiene management is an important public health concern among young women, but there is a paucity of evidence on theory-based interventions at the university level. This study aimed at determining the effect of an educational Intervention on menstrual hygiene knowledge and associated determinants among female university students in Uganda. A quasi-experimental design based on Social Cognitive Theory and Health Promotion Model was used between October-December, 2025. We surveyed 436 participants from Campus A (Intervention group) and Campus B (Control Group). Propensity Score Matching, Difference-in-Differences approach and logistic regression analysis were done. The statistical significance level was $p < 0.05$. A theory-based educational intervention significantly enhanced knowledge and reduced sociocultural barriers. Campus A students displayed a significant improvement in their knowledge (baseline: 5.61 +- 0.99; endline: 6.00 +- 0.91; DiD = 0.807, $p < 0.001$) and less sociocultural barriers (DiD = 0.422, $p = 0.001$). While the hygiene practices of menstruation were better in both groups, the extra impact of the intervention on practices was not significant (DiD = 0.000, $p = 1.000$). The translation of knowledge into practice was not significant implying that there might be other interventions needed in addition to the educational intervention. Findings imply that education is necessary but not sufficient for changing menstrual hygiene practices among the study participants.

Keywords: *Health Education, Health Promotion Model, Menstrual Hygiene, Social Ecological Model, Uganda, University Students.*

Introduction

Menstrual hygiene management is a vital aspect of the health of 1.9 billion girls and women aged 15 to 49 years, particularly in developing countries where access to menstrual products and WASH facilities is limited [1]. Appropriate Menstrual Hygiene Management (MHM) requires not only access to safe and affordable menstrual materials but also appropriate water, sanitation, and hygiene (WASH) facilities, accurate information on menstrual biology and hygiene, and supportive social and institutional conditions. In most of the low- and middle-income countries (LMICs), menstruation is stigmatized and most of the women and girls do not have the resources and knowledge on how to practice safe menstrual hygiene [1].

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****Corresponding Author: njozena@gmail.com***

MHM issues are prevalent in sub-Saharan Africa (SSA). Recent studies have reported a pooled prevalence estimate of good menstrual hygiene practices among adolescent girls of 45%, highlighting the lack of informational, material, and infrastructural assistance in the region [2]. Certain causes linked to the low MHM practices are poor access to water and sanitation, inaccessibility to cheap menstrual supplies, cultural taboos, and poor access to education on menstruation [3-5].

Globally, MHM Intervention studies and activities have reported more on young girls in primary and secondary schools than older girls in tertiary institutions [6-8]. As such, there is limited evidence regarding MHM among female students at the university level.

In Uganda, menstrual hygiene studies have also majorly focused on girls in primary and secondary schools [9]. Indicatively, it has been shown that among secondary school students, there are high rates of poor MHM practices that are associated with infrastructural deficiency, poor sanitary amenity, and insufficient menstrual education [10]. Nonetheless, the literature exploring MHM among female students at tertiary institutions is limited. A cross-sectional study done from a private health-sciences based university showed poor attitude and practice towards menstrual hygiene among female students. However, this study seemed narrow in scope and not grounded in theory, intervention, or time-based research [11].

Reviews of the literature regularly report that MHM interventions have the potential to enhance knowledge and hygiene behaviours, but the evidence base is fragmented, and few of the interventions are articulated using well-defined behavioral frameworks [12-14]. In Uganda, the MENISCUS intervention is one of the few studies that have systematically examined multi-level determinants of menstrual hygiene behaviour and operationalised constructs, including self-efficacy, observational learning, social support, and outcome expectations, using a specified theory of change [10, 15].

The scarcity of studies with rigorous theory informed quasi-experiments among university students, implies that there is little evidence to inform the university health policies, WASH investments, or menstrual health education programs designed with the higher education context in mind.

Objective

The primary objective of this research was to investigate the effect of an educational intervention on Menstrual Hygiene Knowledge and Associated Determinants among Female Students in two selected Universities in Uganda.

Specific Objectives

1. To assess the level of knowledge of menstrual hygiene among female students in two selected Universities in Uganda.
2. To determine factors influencing menstrual hygiene among Female Students in two selected Universities in Uganda.
3. To determine the effect of a health education intervention on the menstrual Hygiene knowledge and practices among Female Students in two selected Universities in Uganda.

Theoretical and Conceptual Frameworks on Menstrual Hygiene Management

This study combined the Social Cognitive Theory (SCT) [16, 17], and Health Promotion Model (HPM) to inform the design and assessment of interventions [18]. The two models have a solid basis in designing MHM interventions that go beyond knowledge acquisition to include motivation, skills development, social norms, and environmental reinforcement. The fact that HPM and SCT are not widely used in current MHM interventions constitutes a serious theoretical gap. The direct response to this gap with the incorporation of

both models in the current research is to allow linking of the intervention components to behavioral constructs and expected outcomes in a systematic way, thus enhancing causal inference, interpretability, and scalability of menstrual hygiene promotion strategies.

The SCT constructs included behavioral capacity where skills and knowledge in effective management of menstruation were taught to the intervention group, self-efficacy through belief in hygienic actions, observational learning through the peer and facilitator learning, reinforcement by teaching the advantages of good practice as well as the interplay of personal, behavioral and environmental factors [16]. The HPM constructs as targets for behavior change interventions include: (1) perceived benefits of action, (2) perceived barriers to action, (3) perceived self-efficacy, (4) activity-related affect, (5) interpersonal influences (including norms, modeling/vicarious learning, and social support), (6) situational influences, (7) commitment to plan of action, and (8) immediate competing demands and preferences (alternative behavior that compete for a person's attention and time). Factors influencing health-promoting behaviour are divided into three categories: "individual characteristics and experiences," "behaviour-specific cognitions and affect," and "behavioural outcome" [17, 18]. In this study HPM constructs included personal experiences and individual aspects such as past practices, socio-demographic and cultural beliefs. Behaviour-specific cognitions include perceived advantages and obstacles, interpersonal factors, and effects of activities. The behavioral results expected were good healthy menstrual hygiene practices. Peer demonstrations were used to capitalize on observational learning (SCT), interactive communication was to increase self-efficacy and perceived barriers (HPM), role-play and group activities were for reinforcement of correct practices (SCT).

Materials and Methods

Study Design and Setting

The study employed a quasi-experimental design with a non-equivalent control group, which was used in order to test the impact of a menstrual health education intervention on female undergraduate students. The study was undertaken from a private University in the Central Uganda (Campus A-intervention group) and a public University in South Western Uganda (Campus B- control group) respectively. Geographical separation minimized contamination. Both groups had comparable characteristics in age, course undertaken, and mode of study.

Study Population

The target population was female undergraduate students. Accessible population was limited to female students who had menstruated in the previous year. The total number of female students was 4,936 (Campus A: 2,036; Campus B: 2,900).

Sample Size Determination

The sample size was based on a previous study by Hennegan et al., in Mukono District, which allowed deriving a minimum of 600 participants [19]. The sample size was adjusted at 10% non-response to obtain a target of 667 participants. Proportional allocation resulted in 276 participants for Campus A and 391 participants for Campus B. The quasi-experimental pre-post design used the formulae for comparing two proportions (intervention and control), assumed 15% between the groups, 5% level of significance, and 80% power, and non-response of 10%. Thus, a sample of 188 participants per group yielded an overall sample size of 376. Therefore, the proposed sample size of 667 participants was substantially above the statistical minimum, offering sufficient power to improve the validity and ability to generalise the findings.

Sampling Technique

Multi-stage sampling technique was used. The two universities were chosen using purposive sampling. The control B is a public University while intervention A is private university. At baseline, a total of 631 respondents were enrolled comprising 276 respondents in Campus A and 355 participants in Campus B. Consecutive sampling was used to recruit participants from each university, with the samples proportionally allocated across faculties. This strategy provided representative sample of the faculties. While at end-line, complete data was obtained from 475 participants, 239 in Campus A and 236 in Campus B. The reduction in number of participants was attributed to attrition, specifically the temporary absenteeism of participants during the end-line data collection period, withdrawal from campus, and incomplete or unmatched responses at end-line that could not be reliably linked to baseline records for analysis. Matching was performed at individual level using the most significant covariates including age, academic year, prior knowledge on menstruation, religion, marital status, living arrangement (who one lives with), parents` level of education, and the occupation of the parents or guardians. This resulted in a final matched sample of 436 participants, of which 218 were in Campus A and 218 in Campus B, reflecting a successful individual-level matching.

Inclusion and Exclusion Criteria

Female undergraduate students of reproductive age who expressed a willingness to take part in the study were recruited; because they were the ones mostly available at campus. Those excluded were individuals who had never menstruated or had not menstruated in the year preceding the research. Post Graduate students were left out because of the nature of their courses being online and modular. Also, medical students were also excluded because it was assumed that they had prior knowledge of menstruation.

Data Collection

The intervention program on menstrual health education was based on the guidelines set by UNICEF [20, 21] and Water Aid. Baseline data was gathered from both campuses. After baseline data collection, the learning intervention was delivered over a 6-week period at Campus A. Ten 45-minute sessions were devoted to the menstrual hygiene knowledge, practices, menstrual disorders, cycle control, and menstrual pain factor reduction strategies as well as health risks of poor hygiene. Health education was provided through mini-lectures, handouts, educational video demonstrations, peer demonstrations, role-play, and group activities.

Endline data were collected three months after the intervention in both the intervention and control universities to measure its effectiveness. Data was collected using a pretested structured self-administered questionnaire. The questionnaire was mapped to SCT and HPM constructs such as knowledge, sociocultural factors and practice at baseline and end-line. A pretest was conducted among 50 students at the Institute of Allied Health and Management Sciences - Mulago. Three experts in reproductive health, public health and academia assessed the clarity and reliability of the tool. Training for research assistants was conducted over 3 days.

Data Analysis

All analyses were conducted in Stata version 15. The outcome variables and demographic characteristics were summed up using frequencies and percentages for categorical variables, while means and standard deviations were for continuous variables. To assess the temporal changes within each group, paired t-tests were performed. These tests compared mean outcome values at baseline and end-line.

To minimize selection bias in a non-randomized design, Propensity Score Matching (PSM) was used. The most significant covariates were matched. Propensity scores were estimated with logistic regression and nearest-neighbor matching was done to match participants in both groups [22]. Participants in the intervention group were then matched one-to-one with individuals in the comparison group who had similar propensity scores. Only those who fit the region of common support and whose matches were appropriate, were selected and the end result was a final analysis sample of 218 Campus A students and 218 Campus B students.

After matching, group equivalence was tested at the baseline. The matched dataset was used to estimate intervention effects using the Difference-in-Differences (DiD) approach, which compared changes in menstrual hygiene knowledge, attitudes, and practices over time between intervention and control conditions in each study. The treatment effect was estimated using logistic regression, and results are presented as odds ratios with 95% confidence intervals; statistical significance was set at $p < 0.05$.

Methodological Rigor

The quantitative quasi-experimental study has scientific rigor strategies that cover internal validity, reliability, and generalisation. The design used was a pre-test-post-test intervention and control study, which allowed evaluation of changes in menstrual hygiene knowledge, socio-cultural attitudes, and practices in relation to the intervention and control, and adjustment for baseline differences between the two groups. This was done by first reading the baseline data at the time before the intervention and then using an educational intervention during six weeks, after which the end-line data was collected three months after the intervention in both groups.

In order to reduce selection bias, comparable universities were purposively chosen as the intervention and control arm, and the identical eligibility criteria were used in both intervention and control groups. Both time points were used to administer standardised, structured questionnaires so as to ensure uniformity of measurement. Training of data collectors was done before data collection, and pre-testing of the tool. This increased the tool's reliability.

The Difference-in-Differences (DiD) analysis was used to estimate the effect of the intervention by controlling for the unobserved time-invariant confounders. Multivariable regression models were also applied where necessary to control for possible baseline covariates.

Results

A total of 667 participants were sampled including 355 in the control and 276 in the intervention group. However, the final matched sample was 436 participants of which 218 were in Campus A and 218 in campus B.

The age distribution was comparable in both campuses (23 +- 2 years, Campus A ; 22 +- 2 years, Campus B), with most of the students being Anglican, single, non-resident in both campuses. Campus A mainly consisted of second-year students; however, the experimental and control populations markedly differed in parental level of education and with whom they were living, as shown in Table 1.

Table 1. Socio-Demographics Distribution of Respondents in Campus A and Campus B

Variables (n,436)	**Campus A (n, 218)**	**Campus B (n, 218)**
Age	Mean =23 years, SD+ 2	Mean = 22 years,SD+2
Religion		
Catholic	71 (32.6%)	76 (34.9%)
Anglican	103 (47.2%)	88 (40.4%)
Muslim	8 (3.7%)	20 (9.2%)
Pentecostals	33 (15.1%)	32 (14.7%)
Others	3 (1.4%)	2 (0.9%)
Current Year		
First year	40 (18.3%)	103 (47.2%)
Second year	164 (75.2%)	105 (48.2%)
Third year	14 (6.4%)	6 (2.8%)
Fourth year	0 (0.0%)	4 (1.8%)
Marital status		
Single	198 (90.8%)	191 (87.6%)
Engaged	16 (7.3%)	25 (11.5%)
Married	4 (1.8%)	2 (0.9%)
Residence status		
Resident	40 (18.3%)	24 (11.0%)
Non-Resident	178 (81.7%)	194 (89.0%)
Ugandan/ International student		
Domestic student	190 (87.2%)	201 (92.2%)
International student	28 (12.8%)	17 (7.8%)
Family type		
Nuclear	131 (60.1%)	153 (70.2%)
Extended	77 (35.3%)	56 (25.7%)
Blended	9 (4.1%)	6 (2.8%)
Not defined/foster	1 (0.5%)	3 (1.4%)
Living with Whom		
Alone	29 (13.3%)	125 (57.3%)
Both parents	119 (54.6%)	61 (28.0%)
Father	4 (1.8%)	3 (1.4%)
Mother	52 (23.9%)	16 (7.3%)
Husband	3 (1.4%)	7 (3.2%)
Other relatives	10 (4.6%)	6 (2.8%)
Others	1 (0.5%)	0 (0.0%)
Parents Level of education		
No formal education	6 (2.8%)	57 (26.1%)
Primary	7 (3.2%)	48 (22.0%)
Secondary	33 (15.1%)	41 (18.8%)
Tertiary	121 (55.5%)	52 (23.9%)
Don`t know	51 (23.4%)	20 (9.2%)
Occupation of parent/guardian		

Self-employed	111 (50.9%)	129 (59.2%)
Employed in public service	57 (26.1%)	38 (17.4%)
Employed in private sector	43 (19.7%)	26 (11.9%)
Others	2 (0.9%)	19 (8.7%)
Don`t know	5 (2.3%)	6 (2.8%)

Comparison of Scores for Knowledge, Sociocultural and Practice Variables

Campus A showed a significant improvement in knowledge and practice scores as well as a non-significant change in sociocultural scores. Campus B, in contrast, demonstrated knowledge and sociocultural score declines, but an improvement in practice scores as shown in table 2.

Table 2. Comparison of Scores for Knowledge, Sociocultural and Practice Variables

University	**Paired Differences**					**t**	**df**	**Sig. (2-tailed)**
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Campus B								
Endline knowledge – Baseline Knowledge	-.413	1.863	.126	-.661	-.164	-3.273	217	.001
Endline Sociocultural Baseline Sociocultural	-.344	1.366	.093	-.526	-.162	-3.717	217	.000
Endline-Baseline Practice	.606	2.487	.168	.274	.937	3.595	217	.000
Campus A								
Endline knowledge – Baseline Knowledge	.394	1.334	.090	.216	.573	4.367	217	.000
Endline-Baseline Sociocultural	.078	1.167	.079	-.078	.234	.986	217	.325
Endline-Baseline practice	.606	1.854	.126	.358	.853	4.822	217	.000

Difference-in-Differences Analysis of Intervention Effect on Knowledge

There was no significant difference in the baseline knowledge scores between treatment and control groups, which implies that they were comparable before the intervention. The DiD estimate indicated that knowledge among students in the intervention campus was statistically significantly greater than that of the students in the control campus at endline (DiD = 0.81, $p < 0.001$) as shown in table 3.

Table 3. Difference-in-Differences Analysis of the Effect of Intervention on Knowledge

Knowledge	**Group**	**Mean**	**SE**	**t**	**P**
Baseline	Control (Campus B)	5.69	—	—	—
	Treatment (Campus A)	5.61	—	—	—
	Difference (T–C)	−0.08	0.10	−0.78	0.438
Endline	Control (Campus B)	5.28	—	—	—
	Treatment (Campus A)	6.01	—	—	—

	Difference (T–C)	0.73	0.12	6.35	0.000
Difference-in-Differences	—	0.81	0.16	5.20	0.000
R-square	0.05				

Difference-in-Differences Analysis of Intervention effect on Sociocultural Factors

The baseline scores of the socio-cultural factors were significant between the treatment and the control group but were no longer significant at the endline. The DiD value showed that the sociocultural attitudes in the intervention campus A were significantly better than in the control campus B(DiD = 0.42, p = 0.001) as indicated in table 4.

Table 4. Difference-in-Differences Analysis of Intervention Effect on Sociocultural Factors

Sociocultural	**Group**	**Mean**	**SE**	**t**	**P**
Baseline	Control (Campus B)	2.055	—	—	—
	Treatment (Campus A)	1.596	—	—	—
	Difference (T–C)	−0.459	0.094	−4.87	0.000
Endline	Control (Campus B)	1.711	—	—	—
	Treatment (Campus A)	1.674	—	—	—
	Difference (T–C)	-0.037	0.079	0.46	0.642
Difference-in-Differences	—	0.422	0.122	3.47	0.001
R-square	0.04				

Difference-in-Differences Analysis of Intervention Effect on Hygiene Practice

After the intervention, menstrual hygiene practice scores in both groups registered an increment of about the same magnitude. However, the DiD estimate revealed that the intervention effect on the hygiene practices was not statistically significant (DiD = 0.00, p = 1.000) as shown in table 5.

Table 5. Difference-in-Differences Analysis of Intervention Effect on Hygiene Practice

Practice	**Group**	**Mean**	**SE**	**t**	**P**
Baseline	Control (Campus B)	6.390	—	—	—
	Treatment (Campus A)	7.596	—	—	—
	Difference (T–C)	1.206	0.134	9.01	0.000
Endline	Control (Campus B)	6.995	—	—	—
	Treatment (Campus A)	8.202	—	—	—
	Difference (T–C)	1.206	0.161	7.48	0.000
Difference-in-Differences	—	0.000	0.210	0.00	1.000
R-square	0.16				

Discussion

This study focused on the effectiveness of a menstrual hygiene education program on menstrual hygiene knowledge and associated determinants among female university students in Uganda.

Findings noted similarities in the socio-demographic characteristics of students in both campuses, with a mean age of 22 years for Campus A and 23 years for campus B, unmarried, non-residents and majorly of Ugandan nationality. This is representativie of many universities in Uganda where majority

students are single, younger and living off campus [23]. In SCT terms, such relative homogeneity implies that the social norms, peer influences, and institutional environments that shape health behaviour are all similar. Nevertheless, variations in year of study, parental education levels and living arrangements were noted between campus A and B, which could have influenced exposure to health information and hygiene behavior in the two groups.

Regarding the knowledge of menstrual hygiene, most of the female students had basic knowledge about menstruation as shown in Table 3. Descriptive and inferential analyses revealed a similar and positive change in menstrual hygiene knowledge in the intervention campus where knowledge scores increased from a baseline mean of 5.61 to an endline mean of 6.00. Furthermore, DiD analysis revealed a significant intervention effect, which is similar to studies conducted by [24-26]. This enhancement is due to improved behavior capability as provided by SCT whereby people learn and develop the knowledge and skills required to adopt a given behavior. Interventions that are based on health education directly address this construct by raising awareness, debunking myths and enhancing cognitive knowledge of health practices.

Paired T-Tests confirmed that practice scores improved significantly (M = 0.606, t = 4.822, $p < .001$), showing that the program successfully translated knowledge into improved menstrual hygiene behavior at Campus A and B. Despite an increase in the score of menstrual hygiene practice between baseline and end-line in the intervention and control groups, the difference between them was not statistically significant with a DiD estimator of 0.000 (SE = 0.210, p = 1.000) This indicates that although the intervention had an effect on practice over time in the experimental group, it did not have a significant effect on the behavior of menstrual hygiene. This finding suggests that other factors play a role in changing practices. The same has been noted in school-based MHM intervention research where general practice had significantly improved but that the differences between intervention and comparison cases were not statistically significant, which highlights the need for other MHM interventions in form of policy, and structural Menstrual interventions [24].

In the present study, the educational intervention increased perceived susceptibility and severity in the intervention group. This indicates that, after the education, the intervention group believed that not practising proper menstrual hygiene would lead to consequences for their menstrual health. The interventional groups' perceived reality increased as a result of the educational materials delivered through mini-lectures, educational video demonstrations, and handouts. Also, role-play and group activities and, the experiences from peer demonstrations had an effect. Johnson et al., indicated that knowledge about menstrual hygiene was significantly correlated with perceived barriers [27]. In contrast a Ghimire et al., study done in Nepal knowledge was correlated to perceived benefits and self-efficacy with improved menstrual hygiene [24].

From a sociocultural influence context, the majority of the students resided outside their home, possibly with limited support from their families to deal with menstrual challenges, and unreliable WASH facilities on campus; as such, they tended to experience varying socio-cultural experiences. This is contrary to a study done in Ghana, where students who lived with their parents received adequate menstrual supplies and support [28]. After the intervention, there was an improvement in the socio- cultural perspectives of students in the experiment group compared to the control group with a DiD value of 0.42, which was significant with a p-value of p = 0.001. This showed that the negative cultural norms of

students from Campus A decreased as compared to those of Campus B. This is in line with SCT that includes reciprocal determinism, whereby attitudes were affected by the interaction between peers and facilitators. The explanation of this is given by HPM in terms of interpersonal influences and perceived barriers lessened, which proves that restrictive beliefs can be challenged by culturally sensitive education. This is consistent with similar findings in studies conducted in Nigeria, and Ghana [29, 30].

Study Limitations

The study's two groups were not exactly similar, however, propensity score matching was applied to minimize the differences between the two groups. Also, the time of 3 months allocated between the intervention and the end-line was minimal, because changing practices requires time. And perhaps only short-term changes in practice were captured although the goal was to capture long long term changes. Further studies focusing on long-term time periods between baseline intervention and end-line should be considered for future MHM improvements.

Conclusion

Findings showed that the intervention had a significant effect on the knowledge of menstrual hygiene and this could have contributed to a significant change in the sociocultural perception of menstruation. Although the MHM practices were positively impacted, without significant changes, implying that there are other interventions that may be required to change practice.

Recommendation

The findings offer strong support that incorporation of behavioural theory in menstrual hygiene programming can yield long-term positive changes in hygienic knowledge and determinants among female students in universities. Further validation of scalable menstrual health promotion interventions should be tested with a similar theory across more diverse higher-education settings and assess longer-term outcomes, including outcomes related to academic participation and psychosocial wellbeing.

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Ethical Review and Approval

Approval to conduct the study was granted from Texila American University. Research ethics clearance was granted by the Research Ethics Committee of Uganda Christian University (UCUREC-2025-1908). Administrative permission was sought and granted from all the institutions where the study was carried out. All participants provided written consent. Data was stored securely and anonymized so that confidentiality and privacy were observed. The participants were compensated for their time and had the freedom to pull out at any given stage without consequences.

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Data Availability

Raw data collected in this study will not be made public owing to the confidentiality agreement with the research subjects. The data will, however, be accessible to interested authors upon request. There is also an opportunity to provide the anonymized data, which can be confirmed by qualified researchers to verify the findings of the research in accordance with the requirements of the confidentiality agreement in the

accepted protocols of ethics. The interested parties can request for access through the secure data-sharing portal of the project.

Competing Interests

The authors declare no competing interest regarding the conduct of this research.

Authors' Contributions

Josephine Namyalo, Edward Mukooza, Robert Basaza, Emmanuel Otieno, Timothy Onyango, and Gloria Seruwagi participated in the conception of the study, development of the study design and guide. All the six authors performed data analyses, interpreted results, drafted the original manuscript, and reviewed the manuscript. All the authors read and approved the final version of the manuscript.

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