

# Knowledge and practice toward menstrual hygiene management and associated factors among visual impaired adolescent girls: a case of two selected institutions in Rwanda

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## Abstract

**Background:** Menstruation is a universal and normal phenomenon during the reproductive age of females; adolescence is an essential period where females are preparing and adjusting themselves to manage their menstrual bleeding safely and cleanly. Menstrual hygiene management (MHM) is an issue that is insufficiently acknowledged and has not received adequate attention among visually impaired adolescent girls (VIAGs).

**Objectives:** The purpose of this study was to determine the knowledge and practice of MHM and associated factors among VIAGs of selected institutions in Rwanda.

**Design:** This study consisted of a cross-sectional study design using a quantitative approach.

**Methods:** A cross-sectional study was conducted in April and May 2021 on 92 VIAGs. They were recruited from educational institutions in two Provinces in Rwanda. Voluntary participation and confidentiality were assured. Socioeconomic and demographic data, menstruation, and menstrual hygiene questionnaires were used to obtain the required information. Statistical Packages for the Social Sciences (SPSS) for Windows version 25 was used. Descriptive statistics, Chi-square test, and logistic regressions were used for data analysis.

**Results:** The study reached 92 respondents. The majority of the respondents, 67.4% had a poor level of menstruation and menstrual hygiene knowledge while only 32.6% had a good level of menstruation and menstrual hygiene knowledge. Also, it is confirmed that the majority of respondents, 52.1% had a good level of practice, while 47.8% had a poor level of menstrual hygiene practice. The multivariable analysis revealed that factors associated with the menstrual hygiene practice were as follows: the mother's education (odds ratio (OR): 5.979; 95% CI: [1.700–21.032];  $p$  value: 0.005) and level of knowledge of menstruation and menstrual hygiene (OR: 0.132; 95% CI: [0.028–0.622];  $p$  value: 0.010).

**Conclusion:** The knowledge and practice of MHM among VIAGs were poor. Recommendations included the need for mothers to assist their daughters in improving learning and practice of menstrual hygiene, as well as the integration of MHM into school curricula. Further research is suggested to better understand MHM among Rwandan adolescent girls, both visually impaired and non-blind.

**Keywords:** adolescence, menarche, menstrual hygiene management, menstruation, visually impaired girls

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## Background

Menstruation is a natural and normal event during the reproductive age of females, marking an important phase in adolescence as girls prepare themselves to manage their menstrual bleeding safely and hygienically.<sup>1-3</sup> Globally, around 26% of the world population (52% of the female population) are of reproductive age, and over 800 million women aged between 15 and 49 are menstruating.<sup>4,5</sup> Still most adolescent girls enter their puberty phase without preparing themselves due to poor information.<sup>1,6,7</sup>

According to the World Health Organization (WHO) and UNICEF's Joint Monitoring Programme for drinking water, sanitation, and hygiene, menstrual hygiene management (MHM) is defined as the use of clean menstrual products to absorb or collect menstrual blood, with the ability to change these materials in a private setting as needed during the menstrual period.<sup>2</sup> This process includes washing the body with soap and water as necessary and having access to safe and convenient facilities for the disposal of used menstrual products. It also involves understanding the fundamental aspects of the menstrual cycle, enabling women and girls to manage it with dignity, without experiencing discomfort or fear.<sup>2,8,9</sup>

Unfortunately, around 10% of women worldwide are exposed to genital infections, with approximately 75% having a history of such infections, often due to pregnancy and poor genital hygiene.<sup>10-13</sup> In low- and middle-income countries, more than half of women use homemade materials for menstrual management, with studies showing that many girls in Ethiopia, for example, did not use commercial products for menstrual hygiene and often isolated themselves during menstruation.<sup>13-15</sup> Poor menstrual knowledge, limited access to absorbent materials, and inadequate facilities at school have been linked to increased absenteeism among girls.<sup>4,7</sup>

Studies conducted in Africa have determined that adolescent girls often lack appropriate knowledge and practices related to menstruation, with low usage of sanitary pads and reliance on cloth or toilet paper to manage menstrual blood.<sup>1,16-18</sup> In fact, around 1 in 10 adolescent girls did not attend school during their menstrual periods, with some even dropping out of school at puberty due to misconceptions, cultural beliefs, and lack of access to sanitary materials and facilities.<sup>10,19-21</sup>

For visually impaired adolescent girls (VIAGs), maintaining proper menstrual hygiene is particularly challenging due to their disability, and they often require daily assistance in managing their activities.<sup>22,23</sup> Menstruation is a critical aspect of their health, and effective management is essential to prevent infections related to poor hygiene.<sup>12,24-26</sup> According to the WHO, 19 million children are visually impaired, with 1.4 million being irreversibly visually impaired, emphasizing the need for tailored interventions to support their personal and psychological development.<sup>12,18,24</sup>

In Rwanda, MHM remains an overlooked aspect of reproductive health. Many schools lack adequate facilities for MHM, with only 37% of primary schools having improved water sources, 52% improved sanitation, and 37% equipped with handwashing facilities with soap.<sup>25</sup>

This study aims to address the pressing need to support VIAGs in managing their menstrual hygiene effectively. Despite considerable research on reproductive health and MHM among adolescent girls globally, there is a significant gap in studies focusing on VIAGs.<sup>27,28</sup> Understanding their specific challenges, habits, and needs is crucial for developing tailored interventions. These girls, like their peers, wish to talk openly about their bodies and menstruation, replacing feelings of shame with confidence, pride, and dignity.<sup>19,29,30</sup>

However, due to their visual impairment, they face additional challenges in maintaining menstrual hygiene, which can lead to health complications, school absenteeism, and social isolation.<sup>11,12</sup> This study, therefore, seeks to explore the knowledge, attitudes, and practices of MHM among VIAGs, addressing these gaps in research.

By examining the current knowledge and practices of MHM among VIAGs, the study aimed to provide valuable insights that will inform targeted strategies and interventions. It explored the factors influencing these practices and proposed recommendations to ensure that VIAGs receive the necessary support to maintain their health and dignity during menstruation. Expected outcomes include data-driven interventions that promote effective MHM, contributing to the overall physical, emotional, and educational well-being of VIAGs. These findings are vital in bridging the research gap and improving MHM practices,

ultimately enabling VIAGs to lead healthier and more empowered lives.

## Objectives of the study

### General objective

The broad objective of this study was to determine the knowledge and practice of MHM and associated factors among VIAGs of selected institutions in Rwanda.

### Specific objectives

The specific objectives of this study were as follows: to assess the knowledge about MHM among VIAGs, to determine the practice of MHM among VIAGs, and to identify the factors associated with the practice of menstrual hygiene among VIAGs.

## Materials and methods

### Study design

This study consisted of a cross-sectional study design using a quantitative approach. It was conducted on VIAGs studying at Rwamagana Home de la Vierge des Pauvres and Kibeho Institute for the Blind Children in the academic year 2020–2021.

### Study setting and population

In Rwanda, there are currently four schools where individuals with visual impairments can receive education up to the secondary level and access the minimum necessary study materials. These schools include Kibeho School for the Visually Impaired in the Southern Province, HVP Gatagara Rwanda (Rwamagana), Musanze Blessing School of the Blind and Groupe Scolaire Gahini, both located in the Eastern Province.<sup>31</sup> For this study, Rwamagana Special School (Gatagara Home de la Vierge des Pauvres, GHVP) and Kibeho Educational Institute for Blind Children were selected because they have the specific population needed to address the research questions.<sup>31–33</sup>

Both institutions offer primary and secondary education and adhere to the official curriculum established by the Ministry of Education. These schools primarily support visually impaired

children from across Rwanda and work in collaboration with families and the government to enhance knowledge and skills. However, many of these families face economic challenges and often show limited interest in the education of their visually impaired children.<sup>32</sup>

The study focused on visually impaired girls aged 10–25 years, selected from a total population of 52 visually impaired students at GHVP Rwamagana and 47 VIAGs from Kibeho Educational Institute for Blind Children.

### Sample size calculation

The single population proportion was used to determine the sample size.

The formula used to calculate the sample size.

With a confidence level of 95%, the sample size was calculated using Yamane's formula.<sup>34,35</sup>

$$n = \frac{N}{1 + Nxe^2}$$

Therefore,

$n$ : sample size;  $e$ : precision = 0.05;  $N$ : study population = 99 VIAGs.

$$n = \frac{99}{1 + 99 \times 0.05^2} = 80 \text{ VIAGs}$$

$n = 80$  VIAGs (sample size of both schools).

To ensure the adequacy of the sample size and to account for any potential non-responses or drop-outs, a 20% buffer was added to the original sample size, resulting in an expected total of 96 VIAGs from both schools. This adjustment was made to enhance the reliability and validity of the study findings by ensuring a sufficient number of participants. The sample size for each school was then calculated proportionally based on the population of visually impaired girls at each institution.

Sample Size Rwamagana GHVP:

$$n1 = \frac{96 \times 52}{99} = 50 \text{ VIAGs}$$

Sample Size Kibeho Institute for the Blind Children:

$$n2 = \frac{96 \times 47}{99} = 46 \text{ VIAGs}$$

However, during data collection, the researchers were able to reach a total of 92 VIAGs. The shortfall from the expected sample size was primarily due to the COVID-19 outbreak, which resulted in some students falling ill and others being unavailable at the time of data collection.

#### *Sampling techniques*

The sample size was selected from the total population using simple random sampling; all classes and eligible girls were given an equal opportunity to participate in the study.

The researcher tossed papers to identify the starting class and continued until all classes were determined. The VIAGs who met the criterion were given the opportunity to pick a paper from the box and those with paper written on Yes were selected to participate. This continued until the desired sample size was achieved. Moreover, every VIAG had an equal chance of being selected. Because the students are visually impaired, there was one female teacher who facilitated the sampling procedure.

#### *Inclusion criteria*

VIAGs are available at the institution in the academic year 2019–2020. Aged between 10 and 25 years old who had menarche prior to the time of data collection and who voluntarily consented to participate.

#### *Exclusion criteria*

Those who were critically ill or very busy were excluded.

#### *Data collection procedures and tools*

Before commencing data collection, all data collectors received training on the study objectives, procedures, and ethical considerations. During data collection at each school, COVID-19 preventive measures were respected. An electronically fully structured interview (conducted in Kinyarwanda or English) took place in two classrooms, with the presence of one female teacher and one data collector to ensure accuracy and reduce potential bias. The VIAGs selected for the survey were identified with the assistance of teachers and the discipline committee.

The researcher explained the purpose of the study to the participants and guided them on how the questionnaire would be completed. For each respondent, the researcher read aloud the questions and response options, while the trained data collector accurately recorded the answers provided. This process ensured that the visually impaired participants could fully engage with the questionnaire, and having a teacher/guardian present helped confirm the responses, further minimizing any potential bias.

The study primarily relied on data collected using a fully structured questionnaire to capture accurate and relevant information from the participants. The questionnaire consists of three main parts: Part 1 includes sociodemographic and economic data including age, sex, educational level, mother's occupation and education level, and number of sisters. Part 2 includes multiple choice and closed questions on knowledge of menstruation and menstrual hygiene. Part 3 includes multiple-choice and closed questions about the practice of menstrual hygiene.

The study instrument was developed based on different publications like the United Nations Children's Fund (UNICEF) Guidelines published in 2018 and modified the questionnaire from other publications to Rwanda context and it was translated into Kinyarwanda for better understanding to the respondents.<sup>8,36</sup> Also, the questions were linked to research objectives. Furthermore, the reliability of the tool was established by pre-testing the questionnaire on 20 VIAGs. This helped to ensure that the questionnaire was well-organized, consistent, clear, and acceptable. During data collection, the investigator checked the questionnaire daily for completeness. The completed questionnaire was also rechecked by the principal investigator to maintain the quality of the data.

The reporting of this study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (Supplemental Material).<sup>37</sup>

#### *Data analysis and management*

The scoring calculation for menstrual hygiene information was based on guidelines from UNICEF, WHO, and peer-reviewed literature on

MHM.<sup>2,38,39</sup> To assess knowledge, we considered sources of menstrual information, awareness about menstruation, and awareness of sanitary materials. Practices were evaluated based on the use of sanitary materials, frequency of changing pads/cloth, cleaning and drying underwear, genital hygiene, disposal of used materials, and daily activities.

Adequate MHM was determined through a scoring system, with each question assigned one point. Scores were converted to a percentage scale, categorizing the level of knowledge and practice: scores <70% indicated “inadequate,” 70% and above indicated “adequate.”<sup>2,40</sup> The collected data were double-entered into SPSS version 25 for accuracy, then cleaned and analyzed [https://www.ibm.com/docs/en/SSLVMB\\_25.0.0/pdf/en/IBM\\_SPSS\\_Statistics\\_Brief\\_Guide.pdf](https://www.ibm.com/docs/en/SSLVMB_25.0.0/pdf/en/IBM_SPSS_Statistics_Brief_Guide.pdf). *Descriptive statistics* were employed to summarize the characteristics of the participants, as well as their knowledge and practices related to MHM. Measures of central tendency like means were used for continuous variables, while frequencies and percentages were applied for categorical variables. *Bivariate analysis* was conducted to explore potential associations between independent variables (e.g., age, educational level, accessibility to MHM materials) and the dependent variable (adequate MHM practices). Pearson’s Chi-square tests were used to test for statistical significance, with a *p* value of less than 0.05 considered significant.

Variables that were found to be significantly associated with the outcome in the bivariate analysis (*p* < 0.05) were included in the multivariate model. *Multivariate logistic regression* was then employed to identify independent predictors of adequate MHM. The *selection criteria for variables* included all those with a *p* value < 0.2 in the bivariate analysis, following the backward elimination method. This approach ensured that potential confounders were accounted for, even if they did not reach strict statistical significance in the bivariate stage.

The *variable input method* used in the logistic regression was stepwise, where variables were entered based on their significance level and retained if they improved the model fit. The model’s goodness-of-fit was evaluated using the Hosmer–Lemeshow test, with a non-significant *p* value (*p* > 0.05) indicating an adequate fit.<sup>41</sup> In

addition, multicollinearity was checked using variance inflation factor (VIF), ensuring that all VIF values remained below the commonly accepted threshold of 10.<sup>42</sup> *Results were presented* using odds ratios (ORs) with 95% confidence intervals (CIs) to interpret the strength of association between independent variables and adequate MHM practices. Visual presentations of data included tables, graphs, and charts for clearer interpretation. All questionnaires will be securely stored for 5 years before destruction.

## Results

### *Socioeconomic and demographic characteristics of respondents*

Table 1 shows that 58.7% of the 92 respondents were aged 15–25 years, while 41.3% were younger. Most were in primary school (46.7%), with only 8.7% in advanced secondary level. Catholics made up 59.8%, and Muslims 3.3%. Menarche occurred between 12 and 15 years for 44.6%, while 13.0% experienced it after 15. In addition, 53.3% of mothers were illiterate, with 64.1% engaged in farming. Half (50.0%) of the respondents were in the third Ubudehe category.

### *Knowledge about menstruation and menstrual hygiene among VIAGs*

Table 2 shows that 72.8% of the 92 respondents heard about menstrual hygiene (MH) before menarche, while 27.2% learned about it after. Mothers were the primary source of information (38.0%). Most respondents (46.7%) recognized menstruation as a natural body process, and 41.3% correctly identified that menstruation lasts 2–7 days. In addition, 58.7% knew conception was possible during menstruation. However, only 32.6% demonstrated a good level of knowledge overall. Most respondents (82.6%) correctly knew that girls could cook during menstruation, and 81.5% understood they could attend school.

### *Practice of menstrual hygiene among VIAGs*

Table 3 presents that 91.3% of the 92 respondents used sanitary pads during menstruation, while only 2.2% used a new cloth piece. Most (79.3%) cleaned their genitalia regularly during menstruation, but 20.7% did not. Over half (55.4%) used water alone to clean, while only 1.1% used detergent. Half of the respondents



**Table 1.** Distribution of socioeconomic and demographic characteristics of respondents.

Variable	Frequency	Percentage
Age (in years)		
Below 15	38	41.3
15 and above	54	58.7
Educational level		
Primary level	43	46.7
O level	41	44.6
A level	8	8.7
Religion		
Catholic	55	59.8
Protestant	34	37.0
Muslim	3	3.3
Age of menarche		
Less than 12 years	39	42.4
12–15 years	41	44.6
Above 15 years	12	13.0
Elder sister(s)		
No sisters	30	32.6
1–3 sisters	29	31.5
Above 3 sisters	33	35.9
Mother's education		
Illiterate	49	53.3
Literate	43	46.7
Mother's occupation		
Agriculture	59	64.1
Teacher	12	13.0
Public servant	12	13.0
Other/business	9	9.8

(50.0%) changed pads twice daily, and 71.7% showered daily. Notably, only 38% of dried underwear is outside in sunlight. In addition,

53.3% cleaned their genitalia at every pad change, and 57.6% disposed of pads in routine waste. Overall, 52.1% demonstrated good menstrual hygiene practices.

#### *Bivariate analysis: Practice of MHM*

Using bivariate analysis, the following variables were found significant as shown in Table 4: Age of respondents, level of education, mother's education, mother's occupation, family's Ubudehe category, number of elder sisters, and overall level of knowledge on menstruation and menstrual hygiene.  $N=92$  VIAGS.

#### *Multivariate analysis: Factors associated with the practice of MHM*

Table 5 reveals that factors associated with the practice of MHM among the 92 VIAGs were the mother's education and level of knowledge of menstruation and menstrual hygiene.

VIAGs whose mothers were literate were 5.979 times more likely to practice good menstrual hygiene than those whose mothers were illiterate (OR: 5.979; 95% CI: [1.700–21.032];  $p$  value: 0.005). In addition, VIAGs who had poor level of knowledge of menstruation and menstrual hygiene were 0.132 times less likely to practice good menstrual hygiene than those who had good knowledge (OR: 0.132; 95% CI: [0.028–0.622];  $p$  value: 0.010).

#### **Discussion**

The findings from this study showed that the majority of the 92 respondents (67.4%) had a poor level of knowledge regarding menstruation and menstrual hygiene, while only 32.6% had a good level of knowledge. Similar studies conducted in Bangalore, India, and Ankara reported similar results, indicating that VIAGs tend to have insufficient knowledge about MH.<sup>18,43,44</sup> However, a study done in Mangalore<sup>5</sup> revealed a higher percentage of girls (46.7%) with good knowledge, suggesting that other factors such as educational support or local awareness programs might be more effective in that region. It is crucial to consider that differences in sociocultural contexts, access to educational resources, or parental involvement may account for the variations in knowledge levels observed.

**Table 2.** Knowledge about menstruation and menstrual hygiene among VIAGs.

Variable	Frequency	Percentage
When did you hear about MH?		
Before menarche	67	72.8
After menarche	25	27.2
Source of MH information		
Mother	35	38.0
Father	11	12.0
Elder sister	8	8.7
Friend	19	20.7
At school	19	20.7
Cause of menstruation		
Natural or physiological body	43	46.7
Disease	20	21.7
Others	29	31.5
Duration of menstruation		
Less than 2 days	33	35.9
From 2 to 7 days	38	41.3
More than 7 days	21	22.8
A girl can conceive during menstruation		
Yes	54	58.7
No	18	19.6
I don't know	20	21.7
Menstruation is a sign that a girl		
Is still child	19	20.7
Entered puberty	34	37.0
Became adult	39	42.4
Abnormal vaginal discharge can be a sign of poor menstrual hygiene		
Yes	35	38.0
No	36	39.1
I do not know	21	22.9

(Continued)

**Table 2.** (Continued)

Variable	Frequency	Percentage
The main characteristic of poor menstrual hygiene		
Bad smell	67	72.8
Pain during urination	12	13
I do not know	13	14.2
Source of bleeding during menstruation		
Urinary bladder	5	5.4
Uterus	29	31.5
Vagina	43	46.7
Can a girl cook during menstruation?		
Yes	76	82.6
No	12	13.0
I don't know	4	4.3
Can a girl go to school during the period?		
Yes	75	81.5
No	14	15.2
I don't know	3	3.3
Is menstruation a curse of womanhood?		
Yes	26	28.3
No	62	67.4
I don't know	4	4.3
How do you know the side of pads if you use it?		
Not using pads	2	2.2
By non-blind colleagues	50	54.3
By taking it and feeling smooth part	35	38.0
Overall level of knowledge on menstruation and menstrual hygiene		
Poor level	62	67.4
Good level	30	32.6
MH, menstrual hygiene; VIAGs, visually impaired adolescent girls.		

**Table 3.** Practice of menstrual hygiene among VIAGs.

Practices of menstrual hygiene	Frequency	Percentage
Materials used for absorbing blood		
Sanitary pads	84	91.3
New cloth pieces	2	2.2
Some combination	6	6.5
Cleaning regularly external genitalia during menstrual periods		
Yes	73	79.3
No	19	20.7
Material used to clean external genitalia during menstruation		
Only water	51	55.4
Ordinary soap and water	36	39.1
Detergent and water	1	1.1
Non-precise	4	4.3
How many times do you change sanitary pads during menstruation?		
Once a day	18	19.6
Twice a day	46	50.0
Three times a day or above	28	30.4
Respondents' showering during menstruation		
First day	22	23.9
Second day	1	1.1
Third day	1	1.1
Last day	2	2.2
Every day	66	71.7
Drying underwear during menstruation		
Outside the house in the sunlight	35	38.0
Inside the house	42	45.7

(Continued)

**Table 3.** (Continued)

Practices of menstrual hygiene	Frequency	Percentage
Under the bed	7	7.6
Outside house without sunlight	8	8.7
Cleaning genital organs every time you change the pads		
Yes	49	53.3
No	43	46.7
Respondents' disposal of used pads/cloth		
Burn it	12	13.0
Throw it in routine waste	53	57.6
Throw it in a traditional toilet	24	26.1
Other	3	3.3
Do you come to school during menstruation?		
Yes	74	80.4
No	18	19.6
The presence of a separate room/place in school to change disposable pads/clothes during menstruation		
Yes	92	100
Overall level of menstrual hygiene practice		
Poor level of practice	44	47.8
Good level of practice	48	52.1
VIAGs, visually impaired adolescent girls.		

Other studies conducted in Chennai and Turkey<sup>12,45</sup> proved differently that minimum girls had poor knowledge on menstrual hygiene.

The finding of the current study that only 31.5% of respondents knew the source of menstrual blood as the uterus mirrors results from a multi-variate analysis study in India, where only 17.9% knew the correct source.<sup>21</sup> This suggests a widespread gap in basic reproductive health



**Table 4.** Distribution of practice of menstrual hygiene: bivariate analysis.

Variables	Practice of MH %(n)		p Value
	Good practice	Poor practice	
Age (in years)			<0.001
Below 15	8.7 (8)	32.6 (30)	
15 and above	39.1 (36)	19.6 (18)	
Level of education			0.038
Primary level	15.2 (14)	31.5 (29)	
O level	26.1 (24)	18.5 (17)	
A level	6.5 (6)	2.2 (2)	
Religion			0.26
Catholic	25 (23)	34.8 (32)	
Protestant	21.7 (20)	15.2 (14)	
Muslim	1.1 (1)	2.2 (2)	
Age at menarche			0.106
Less than 12years	13(12)	27.2(25)	
12–15years	23.9(22)	20.7(19)	
Above 15years	8.7(8)	4.3(4)	
Mother's education			<0.001
Illiterate	4.3 (4)	48.9 (45)	
Literate	43.5 (40)	3.3 (3)	
Mother's occupation			<0.001
Agriculture	18.5 (17)	45.7 (42)	
Teacher	13 (12)	0	
Public servant	10.9 (10)	2.2 (2)	
Other/business	5.4 (5)	4.3 (4)	
Family's Ubudehe category			<0.001
Category 1	1.1 (1)	12 (11)	
Category 2	6.5 (6)	28.3 (26)	
Category 3	38 (35)	12 (11)	
Category 4	2.2 (2)	0	

*(Continued)*

**Table 4.** (Continued)

Variables	Practice of MH %(n)		p Value
	Good practice	Poor practice	
Number of elder sisters			<0.001
No sisters	4.3 (4)	28.3 (26)	
1–3 sisters	18.5 (17)	13 (12)	
Above 3 sisters	25 (23)	10.9 (10)	
When have you heard of menstruation			0.984
Before menarche	38 (35)	34.8 (32)	
After menarche	14.1 (13)	13 (12)	
Source of menstruation information			0.658
Mother	21.7 (20)	16.3 (15)	
Father	5.4 (5)	6.5 (6)	
Elder sister	4.3 (4)	4.3 (4)	
Friend	8.7 (8)	12 (11)	
At school	7.6 (7)	13 (12)	
Overall level of knowledge on menstruation and menstrual hygiene			0.012
Poor level of knowledge	26.1 (24)	41.3 (38)	
Good level of knowledge	21.7 (20)	10.9 (10)	

knowledge among visually impaired girls. The poor knowledge level observed might be attributed to the limited role of mothers in providing reproductive health education, as many were found to be illiterate. This suggests that mothers' education level plays a crucial role in transmitting accurate information about menstrual health. Furthermore, the absence of structured inclusive menstrual health education programs in schools, combined with the lack of exposure to mass media and reduced father–daughter communication, may contribute to the girls' lack of knowledge.

In terms of menstrual hygiene practices, this study found that 52.1% of the respondents demonstrated good practice, contrary to studies carried out in Ethiopia, Nepal, and India, where adolescent girls generally displayed poor menstrual hygiene practices.<sup>1,11,46</sup> The difference in practices might be influenced by variations in access to sanitary materials, education on menstrual hygiene, or cultural beliefs. For example, in

some cultures, restrictions during menstruation might hinder access to proper hygiene practices.

Interestingly, this study found no significant association between age and menstrual hygiene practices ( $p=0.424$ ), unlike an Indian study where older girls practiced better hygiene.<sup>47</sup> This difference could be explained by the unique challenges faced by VIAGs, where the opportunity to learn practical skills may not necessarily correlate with age due to visual impairment.

Furthermore, this study showed that factors such as the respondent's level of education, mother's occupation, family income, number of elder sisters, and sources of information did not significantly influence menstrual hygiene practices. These findings were consistent with a study conducted in Mangalore,<sup>5</sup> which also reported no significant associations between these factors and MH practices. However, in contrast, a study in Ethiopia found a significant link between family

**Table 5.** Multivariate analysis: factors associated with the practice of menstrual hygiene.

Variables	NAOR (95% CI)	<i>p</i> Value	AOR (95% CI)	<i>p</i> Value
Age (in years)				
10–14	1.00		1.00	
15–25	0.133 (0.051–0.349)	<0.001	1.774 (0.435–7.238)	0.424
Level of education				
A level	1.00		1.00	
Primary level	6.214 (1.110–34.799)	0.038	0.514 (0.065–4.044)	0.527
O level	2.125 (0.382–11.828)	0.389	0.729 (0.107–4.995)	0.748
Mother's education				
Illiterate	1.00		1.00	
Literate	0.007 (0.001–0.032)	<0.001	5.979 (1.700–21.032)	0.005
Family's Ubudehe category				
Category 1	1.00		1.00	
Category 2	3E+00 (3E–01–23.638)	0.4132	1.016 (0.022–47.301)	0.994
Category 3	35 (4.051–302.371)	<0.001	1.233 (0.233–6.534)	0.805
Category 4	2,412,520,554 (0–2E+09)	2.00E+09	0.186 (0.033–1.061)	0.058
Number of elder sisters				
No sisters	1.00		1.00	
1–3 sisters	0.067 (0.018–0.243)	0.365	2.527 (0.593–10.771)	0.21
Above 3 sisters	0.616 (0.216–1.756)	<0.001	1.588 (0.397–6.347)	0.513
Overall level of knowledge				
Good level	1.00		1.00	
Poor level	3.167 (1.268–7.907)	0.014	0.132 (0.028–0.622)	0.01
NAOR: Non Adjusted Odd ratio; AOR: Adjusted Odd Ratio.				

income and MH practices.<sup>16</sup> This suggests that while financial resources might be critical in some settings, they may not have the same influence in contexts where basic sanitary materials are provided by schools or community programs.

The most critical finding from this study was that a mother's education and level of knowledge about menstruation and MH were significant predictors of good menstrual hygiene practices.

VIAGs whose mothers were literate were 5.979 times more likely to practice good menstrual hygiene than those whose mothers were illiterate (OR: 5.979; 95% CI: [1.700–21.032];  $p=0.005$ ). This aligns with studies from Ethiopia and India,<sup>16,21</sup> suggesting that mothers' literacy levels play a pivotal role in ensuring girls adopt proper menstrual hygiene practices. This emphasizes the importance of maternal education as a determinant of adolescent health behaviors.

Moreover, VIAGs with poor MH knowledge were 0.132 times less likely to practice good menstrual hygiene than those with good knowledge (OR: 0.132; 95% CI: [0.028–0.622];  $p=0.010$ ), reinforcing that knowledge is a key factor in promoting healthy practices. Similar findings in Ethiopia indicate that targeted educational interventions could be effective in improving menstrual hygiene practices.<sup>1</sup>

### Study limitation

The limitations of this study include challenges related to generalizability, COVID-19 impact, and sample size. Given the cross-sectional quantitative methodology and the limited sample size drawn from two selected institutions, the findings are not generalizable to all VIAGs across Rwanda; rather, they reflect the specific contexts of the institutions under study. In addition, the study was conducted during the COVID-19 pandemic, which introduced restrictions and delays that may have impacted the study's timeline and participants' accessibility, potentially influencing data collection and overall study execution. The relatively small sample size may also have constrained the study's ability to capture a comprehensive range of factors associated with MHM among VIAGs.

### Conclusion and recommendations

This study assessed knowledge and practices of menstrual hygiene among VIAGs, finding that while knowledge was generally low, menstrual hygiene practices were good, particularly among girls whose mothers were literate or who had a better understanding of menstruation. To support VIAGs, an organized curriculum and standardized teaching protocols on MHM should be introduced in schools for visually impaired girls, alongside community and school campaigns to promote awareness. Health professionals can further contribute by educating communities to dispel menstrual misconceptions and guide proper hygiene practices. Future research could compare menstrual hygiene practices between visually impaired and non-visually impaired girls or explore these practices across varied age groups and settings.

### Declarations

#### *Ethics approval and consent to participate*

The study was reviewed and approved by the University of Rwanda Institutional Review Board

(UR IRB) with ethical clearance number UR-CMHS-IRB No 142/CMHS IRB/2021. Permission to conduct the research was also obtained from the selected institutions involved in the study. This study was conducted in accordance with the WMA Declaration of Helsinki—Ethical Principles for Medical Research Involving Human Subjects.<sup>48</sup> Participation in the study was entirely voluntary, and all participants were provided with detailed information about the study to ensure they could make an informed decision. Verbal informed consent was obtained from participants aged 18 years and above due to the nature of their visual impairment, which could limit their ability to provide written consent; this verbal consent process was carefully recorded by the research team. For participants under 18 years of age, consent was obtained from their legal guardians, who provided signed consent on behalf of the minors.

#### *Consent for publication*

Not applicable.

#### *Author contributions*

**Marie Laetitia Ishimwe Bazakare:** Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Validation; Visualization; Writing – original draft; Writing – review & editing.

**Bernard Ngabo Rwabufigiri:** Conceptualization; Formal analysis; Methodology; Supervision.

**Cyprien Munyanshongore:** Conceptualization; Data curation; Formal analysis; Methodology; Project administration; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing.

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### Competing interests

The authors declare that there is no conflict of interest.

### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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### Supplemental material

Supplemental material for this article is available online.

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## Appendix

### List of acronyms and abbreviations

CMHS	College of Medicine and Health Sciences
IRB	Institutional Review Board
LMICs	Low- and Middle-Income Countries
MHM	Menstrual Hygiene Management
MINEDUC	Ministry of Education
GHVP	Gatagara Home de la Vierge des Pauvres
SNV	Netherland Development Organization
SPSS	Statistical Package for Social Sciences
UNICEF	United Nations Children’s Fund
UR	University of Rwanda
VIAGs	Visual Impaired Adolescent Girls
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSSCC	Water Supply and Sanitation Collaboration Council
%	percentage
<	less than
>	more than

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