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Research article

Impact of Female-Unfriendly Sanitation on Adolescent Girls' Well-being and Education in Khulna City

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ABSTRACT

This study investigates the impact of female-unfriendly sanitation infrastructure on the health, dignity, and educational outcomes of adolescent girls in Khulna City, Bangladesh. Drawing on a cross-sectional survey of 150 students across public, private, and semi-government secondary schools, the research employs descriptive statistics, chi-square tests, and correlation analysis to examine relationships between sanitation conditions and menstrual health, school attendance, and academic concentration. Findings reveal significant disparities in toilet cleanliness, availability of sanitary disposal facilities, and access to water and soap-conditions that disproportionately affect girls in private institutions. Notably, 38.7% of respondents reported discomfort during menstruation due to inadequate facilities, while 41.3% experienced reduced classroom concentration. Although all schools provided sanitary products, only two-thirds offered them free of charge, highlighting equity gaps. The study underscores the urgent need for gender-sensitive WASH interventions in school infrastructure, emphasizing the importance of clean, private, and well-equipped toilets to support girls' health, reduce absenteeism, and promote inclusive education. Policy recommendations include targeted investment, inclusive budgeting, and participatory monitoring to ensure that schools become empowering spaces for all students.

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Introduction

In recent years, access to gender-sensitive sanitation in educational institutions has emerged as a critical factor influencing school attendance, health, and the overall well-being of adolescent girls (Alam, 2022). In Bangladesh, where menstruation remains a stigmatized topic and infrastructural gaps persist, the absence of female-friendly toilets in schools acts as a silent but powerful barrier to education (National Hygiene Survey, 2018). Multiple studies have confirmed that during menstruation, girls experience discomfort, embarrassment, and psychological stress in the absence of clean, private, and well-equipped toilets, (Marni Sommer, 2016). Research across South Asia and sub-Saharan Africa has found that these challenges can lead to absenteeism, reduced participation, and even early dropout (Sisay, 2014) ; (Nese Yilmaz, 2018). In Bangladesh, although educational policies have increasingly promoted female participation, the infrastructural reality in many urban and peri-urban schools does not align with this vision (Ahsan, 2023). Evidences show that semi-government and private schools often lag behind public institutions in implementing comprehensive WASH (Water, Sanitation, and Hygiene) services (Clarijs ME, 2023). According to (Hae Won Kim, 2022)menstrual hygiene management is still underfunded and poorly monitored across school systems, disproportionately affecting marginalized girls.This study aims to assess the state of female-friendly sanitation in three types of secondary schools in Khulna City, Bangladesh: public, private, and semi-government. By exploring how sanitation conditions impact adolescent girls' health, dignity, attendance, and academic focus, it also gathers their firsthand recommendations, offering policy insights rooted in lived experience.

Materials and Methods

This study employed a quantitative cross-sectional design to evaluate the impact of sanitation infrastructure on the health and education of adolescent girls. Structured questionnaires were administered to collect self-reported

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data on menstrual hygiene practices, sanitation conditions, health issues, and academic outcomes. The design was chosen to establish statistical correlations between sanitation variables and dependent outcomes such as school absenteeism and academic performance. The study was conducted in Khulna City Corporation (KCC), Bangladesh. Three secondary schools were purposively selected across wards 14 and 16: PMG High School, Khulna Government Model School & College, Haji Foyez Uddin Girls High School. These schools were chosen to reflect diversity in school type (private, public, semi-government) and socioeconomic variation. The target population comprised 550 female students from classes six to ten. The final sample size of 150 students was determined using Yamane's Formula (It is about sample size, Taro Yamane's formula (1967), which is widely used in social sciences for calculating sample size from a known population. The formula is: $n = N / (1 + Ne^2)$) with a 7% margin of error. Altogether 550 students are considered as study population. This study conducted purposive sampling for adolescent age group, then through cluster sampling the three schools are selected. After that convenience sampling was conducted to collected data from female adolescents and then the female students are selected randomly. A structured questionnaire was developed, pretested, and refined based on the results of a pilot survey. The questionnaire covered demographic data, menstrual hygiene practices, sanitation access, school absenteeism, and perceptions of school infrastructure. Data were collected over 30 days through interview with students aged 11 - 17 years. To ensure validity, tools were informed by WASH-related global indicators. Dependent variables are school absenteeism (number of days missed due to menstruation/sanitation-related issues), menstrual hygiene management (access, privacy, comfort, disposal facilities), and academic performance (self-reported achievement and concentration). The independent variables include socio-demographic factors (age, class, household income), school type (private, public, semi-government), and sanitation conditions (cleanliness, water availability, toilet privacy, and soap access). Collected data were coded, edited, and analyzed using SPSS (v25) and Microsoft Excel. Descriptive statistics (frequencies, percentages) and inferential tests, including Chi-square analysis, Correlation, and Logistic Regression, were used to determine relationships between sanitation variables and educational/health outcomes. GIS software was utilized to map the locations. Prior informed consent was obtained from participants and school authorities. Respondents were assured of anonymity and the right to withdraw at any time. Data confidentiality was strictly maintained. The relevant jurisdiction at Khulna University granted ethical clearance.

Results

This study involved a survey of 150 adolescent girls aged between 11 and 17 years from three secondary schools in Khulna City. Among them, 66.7% belonged to the younger age group of 11–14 years, while 33.3% were between 15 and 17 years old. Respondents were fairly evenly distributed across classes six through ten, with slightly higher representation in classes seven and ten (22% each), and a lower proportion (16.7%) in class eight. In terms of school type, 32.7% of the participants attended private institutions, 34% were from public schools, and 33.3% were enrolled in semi-government schools. However, all schools had separate toilets designated for female students. A positive indicator is that only 29.3% of respondents reported having access to five or more toilets. The majority (66.7%) stated that their schools had only one or two functional toilets for girls, raising concerns about the adequacy of facilities.

Table 01: Distribution of Respondents by School Type and Toilet Availability

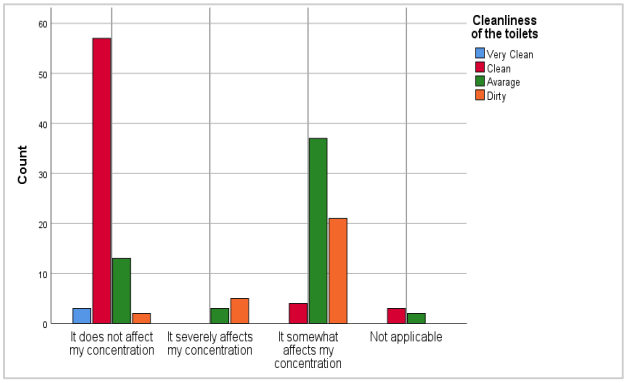
School Type	Frequency	Percentage	Toilets Availability	Frequency	Percentage
Private	49	32.7%	1–2 Toilets	100	66.7%
Public	51	34%	3–4 Toilets	6	4%
Semi-Government	50	33.3%	≥5 Toilets	44	29.3%

Source: Field Survey 2024

Cleanliness emerged as a significant issue. Only 2% of the girls rated their school toilets as "very clean," while 42.7% found them to be "clean." A concerning 36.7% described them as "average," and 18.7% characterized the facilities as "dirty." When asked about cleaning frequency, 44% mentioned the toilets were cleaned twice weekly, 39.3% said three times, and 16.7% noted that cleaning was rare, indicating inconsistent hygiene maintenance. Regarding hygiene-related resources, 68.7% of respondents reported the presence of sanitary disposal facilities such as bins, while 31.3% confirmed their absence. The availability of water for personal hygiene was encouraging, with 92.7% indicating that water was always available, although a small number of students (6.7%) said it was occasionally unavailable. However, access to soap or hand-wash materials was less consistent; only 67.3% of students reported reliable soap availability, while 22% found it to be rarely available, and 10.7% said it was not available at all. In terms of privacy, 90.7% of respondents felt the toilets provided a standard level of privacy. Yet, only 9.3% rated them as "very private," suggesting a need for further improvements in design and layout. Despite all students confirming that their schools provided sanitary products, such as pads or tampons, only 66.7% received them free of charge. In comparison, the remaining 33.3% had to purchase them, raising concerns about menstrual equity across school types.

Table 02: Access to Menstrual Hygiene and Water Facilities

Facility Type	Frequency	Percentage
Sanitary Bins Available	103	68.7%
Sanitary Bins Not Available	47	31.3%
Water Always Available	139	92.7%
Water Occasionally/Not Available	11	7.3%
Soap Regularly Available	101	67.3%
Soap Rarely/Never Available	49	32.7%



Source: Field Survey 2024

Figure 01: Sanitation Facilities affects concentration during school hours

The study also examined how sanitation conditions affected girls' attendance during their menstrual periods. A small number, just 0.7%, avoided school entirely during menstruation due to poor sanitation. However, 38.7% of the girls admitted that they attended school but felt uncomfortable during their period due to inadequate facilities. About 7.3% reported that they sometimes left school early during menstruation, and 53.3% stated that sanitation conditions had no impact on their attendance**.** Comfort using the school sanitation facilities varied. While 49.3% of girls felt comfortable using them, 37.3% reported feeling somewhat uncomfortable, and 5.3% felt very uncomfortable. Alarmingly, 8% of girls said they did not use the toilets at all. When asked if sanitation conditions affected their concentration in class, half of the respondents said there was no impact, while 41.3% indicated that their concentration was "somewhat affected." A smaller group (5.3%) reported that their concentration was severely affected by inadequate toilet facilities.

Table 03: Types of School (Chi-Square)

Variables	Types of School			Test Statistics (df)	P Value	Effect Size
	Private	Public	Semi-governmental			
Cleanliness of the toilets						
Very Clean	0(0.0%)	0(0.0%)	3(2.0%)			
Clean	0(0.0%)	23(15.3%)	41(27.3%)			.623e(.001)
Average	21(14%)	28(18.7%)	6(4%)	126.81c(6)	.001	
Dirty	28(18.7%)	0(0.0%)	0(0.0%)			
Adequate sanitary disposal facilities						
No	48(32%)	0(0.0%)	0(0.0%)			.985e(.000)
Yes	1(0.7%)	51(34%)	51(33.3%)	167.6c(2)	.000	
Availability water for personal hygiene						
Always Available	38(25,3%)	51(34%)	50(33.3%)	21.08c(4)	.000	.286e(.000)
Sometimes Available	1(0.7%)	0(0.0%)	0(0.0%)			
Sometimes Unavailable	10(6.7%)	0(0.0%)	0(0.0%)			

[a] *χ^2 test reported (for more than 2×2 table)*
[b] *Yates's continuity correction reported (for 2×2 table)*
[c] *Fisher's exact test reported (expected cell less than 5)*
[d] *Phi reported (for 2×2 table)*
[e] *Cramer's V reported (for more than 2×2 table)*
$^{*}p \leq 0.05$; $^{**}p \leq 0.01$;

The chi-square analysis revealed significant connections between school type (private, public, semi-governmental) and major sanitation-related conditions affecting adolescent girls in Khulna City. Toilet cleanliness varied considerably across school types, with a statistically significant result ($\chi^2 = 126.81$, df = 6, p = .001) and a strong effect size (Cramer's V = .623), indicating that students in private schools were more likely to report dirty toilets. In contrast, semi-governmental schools showed relatively better conditions. Similarly, the adequacy of sanitary disposal facilities was strongly linked to school type ($\chi^2 = 167.6$, df = 2, $p < .001$), with an exceptionally high effect size (Cramer's V = .985), suggesting that private schools overwhelmingly lacked proper disposal mechanisms, while semi-governmental schools provided them more consistently. The availability of water for personal hygiene also showed a significant relationship with school type ($\chi^2 = 21.08$, df = 4, $p < .001$), with a moderate effect size (Cramer's V = .286); students from private schools were

more likely to experience inconsistent or unavailable water supply, whereas public schools had better access. These findings highlight major disparities in sanitation infrastructure across school types, emphasizing the urgent need for targeted interventions to ensure equitable access to clean, safe, and hygienic facilities for all students, especially adolescent girls.

Finally, students provided a wide range of suggestions for improving school sanitation. The most common recommendation was to improve cleanliness (28.7%), followed by increasing the number of toilets (14.7%), and ensuring regular availability of water and sanitary disposal facilities. A notable group (13.3%) called for a combination of improvements, including free sanitary product provision, better disposal systems, and privacy enhancements.

Table 04: Testing of Relationship Between Variables

		Types of School:	Number of toilets for female students	Cleanliness of the toilets	Adequate sanitary disposal facilities (bins_etc.)	Impact of school sanitation conditions on attendance during menstruation	Health issues related to inadequate toilet facilities	Overall academic performance
Type of School	**Pearson Correlation**	1	-.006	-.782**	.850**	-.664**	-.452**	-.385**
	Sig. (2-tailed)		.945	.000	.000	.000	.000	.000
	N	150	150	150	150	150	150	150
Number of toilets for female students	**Pearson Correlation**	-.006	1	-.132	.474**	-.065	.039	-.201*
	Sig. (2-tailed)	.945		.108	.000	.432	.636	.013
	N	150	150	150	150	150	150	150
Cleanliness of the toilets	**Pearson Correlation**	-.782**	-.132	1	-.755**	.654**	.460**	.301**
	Sig. (2-tailed)	.000	.108		.000	.000	.000	.000
	N	150	150	150	150	150	150	150
Adequate sanitary disposal facilities (bins etc.)	**Pearson Correlation**	.850**	.474**	-.755**	1	-.611**	-.360**	-.430**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	150	150	150	150	150	150	150
Impact of school sanitation conditions on attendance during menstruation	**Pearson Correlation**	-.664**	-.065	.654**	-.611**	1	.688**	.384**
	Sig. (2-tailed)	.000	.432	.000	.000		.000	.000
	N	150	150	150	150	150	150	150
Health issues related to inadequate toilet facilities	**Pearson Correlation**	-.452**	.039	.460**	-.360**	.688**	1	.365**
	Sig. (2-tailed)	.000	.636	.000	.000	.000		.000
	N	150	150	150	150	150	150	150
Overall academic performance	**Pearson Correlation**	-.385**	-.201*	.301**	-.430**	.384**	.365**	1
	Sig. (2-tailed)	.000	.013	.000	.000	.000	.000	
	N	150	150	150	150	150	150	150

***. Correlation is significant at the 0.01 level (2-tailed).*

**. Correlation is significant at the 0.05 level (2-tailed).*

Discussion

The findings reveal a persistent sanitation gap that undermines the well-being and educational progress of adolescent girls in Khulna City. Despite efforts to universalize gender-sensitive WASH in schools, disparities in sanitation quality and menstrual support services persist across different types of institutions. While all schools had separate toilets for female students, the quantity and quality of these facilities remain major concerns. The fact that two-thirds of respondents reported having only 1–2 toilets for all female students indicates a structural inadequacy that can lead to overcrowding, long queues, and avoidance. This aligns with national reports showing limited gender-segregated sanitation coverage in Bangladeshi schools (Ahsan, 2023). The study revealed notable disparities in sanitation conditions among school types in Khulna City. Private schools were more likely to have unclean toilets and lacked adequate sanitary disposal facilities, whereas semi-governmental schools fared relatively better. Public schools demonstrated better access to water for personal hygiene. These findings highlight critical gaps in gender-sensitive infrastructure, especially impacting adolescent girls. Urgent, targeted interventions are needed to ensure equitable access to safe and hygienic

facilities across all educational institutions. The link between toilet cleanliness and health outcomes was clear. Students using "dirty" or "average" toilets were significantly more likely to report menstrual discomfort. While 66.7% experienced no issues, one-third faced hygiene-related health problems, reflecting both physical and psychological distress, as shown in studies by (Kim, 2022) and (Marni Sommer, 2016). Nearly half of the respondents admitted their concentration was affected by inadequate sanitation. Students described feelings of embarrassment and discomfort, particularly during menstruation, with 38.7% saying they felt uncomfortable attending school. This finding echo prior research in Sub-Saharan Africa and India, where menstrual hygiene challenges are linked to absenteeism and learning disruptions (Sisay, 2014), (Marni Sommer, 2016). Notably, only 0.7% avoided school completely, suggesting resilience among students; however, this resilience comes with costs, such as discomfort and reduced focus, which can build up over time into educational disadvantages. Despite progress, key hygiene supplies remain inconsistent. Soap was unavailable for 32.7% of respondents—an essential yet basic tool for infection control. Similarly, while 92.7% had access to water, the remaining students faced periodic shortages. Disposal bins necessary for menstrual management were missing in nearly one-third of schools, causing embarrassment and increased infection risk. Students in private schools were less likely to receive free sanitary products, raising equity concerns. Although public and semi-government schools had relatively better provisions, they still did not guarantee universal coverage. This supports previous findings that government support often fails to reach all types of institutions equally (Clarijs ME, 2023).

Conclusion

The study emphasizes how poor, female-unfriendly sanitation facilities significantly affect adolescent girls in Khulna City. Although all surveyed schools have toilets, issues with cleanliness, privacy, water supply, and disposal systems are common. The results clearly show a link between inadequate sanitation infrastructure and health problems, emotional stress, and academic difficulties such as trouble concentrating and irregular attendance during menstruation. Most girls continue attending school despite these hardships, but this resilience should not be mistaken for acceptance. Instead, it reflects a silent endurance hiding systemic neglect. When sanitation fails to uphold girls' dignity and hygiene, it unintentionally hinders their right to education and well-being. Solving this problem requires more than just infrastructure; it calls for empathy-driven policies, inclusive budgets, and ongoing monitoring to create schools that are truly inclusive and empowering for all students.

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Conflict of Interest

The authors declare no conflict of interest

Credit Author Statement:

Irin Azhar Urme: Conceptualization, Supervision, Investigation, Writing – Review & Editing, Writing Final Draft.

Fariha Tasnim: Investigation, Data Collection, Formal Analysis, Writing – Original Draft.

Md. Ahad Hossain: Formal Analysis, Data Curation, Formatting.

Asif Khan: Formal Analysis, Data Curation, Formatting.

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