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ENVIRONMENTAL SANITATION PRACTICES AND HEALTH IMPLICATIONS AMONG UNDERGRADUATE STUDENTS IN UNIVERSITY OF BENIN

BY

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Abstract

Environmental sanitation is a key determinant of health in institutional settings, where overcrowding, waste disposal, water supply and hygiene practices can influence the spread of preventable diseases. This study assessed environmental sanitation practices and health implications among undergraduate students of the University of Benin, Benin City. Three research objectives, three (3) research questions were raised and one hypothesis was formulated and tested at 0.05 level of significance. A descriptive survey research design was adopted. The population comprised 47,165 undergraduate students of the University of Benin across Ugbowo and Ekenwan campuses for the 2024/2025 academic session. A sample of 386 respondents was selected using a multi-stage sampling technique. Data were collected using a self-structured questionnaire titled Environmental Sanitation and Health Implications Questionnaire (ESHIQ), containing 10 sanitation-practice items and 4 health-implication items. The instrument was validated by the researcher's supervisor and two other experts in the Department of Health, Safety and Environmental Education, University of Benin. Reliability was established using the test-retest method on 20 students who were not part of the main study. Pearson product-moment correlation yielded a reliability coefficient of 0.82. Data were analysed using frequency, percentage, mean, standard deviation and chi-square test of association. Findings revealed that good sanitation practices were generally observed, with a grand mean of 2.11 on a 3-point scale. Malaria (30.1%), diarrhoea (20.5%) and skin infection (15.0%) were the most common health implications reported. Chi-square analysis showed a significant association between environmental sanitation practices and health implications, X^2 (1, N = 386) = 55.15, p < .001, phi = .38, indicating that environmental sanitation practice was significantly associated with health implications among students. The study concludes that gaps in communal sanitation continue to expose students to preventable illnesses. It was recommended that the university sustain health education programmes and improve sanitation facilities to strengthen communal sanitation practices.

Keywords: Environmental sanitation, Health implications, Hygiene, Undergraduate students and University of Benin

Introduction

Environmental sanitation is a fundamental determinant of population health, particularly in institutional settings such as universities where large numbers of students live, study and eat in close proximity. The World Health Organization (2018) defines sanitation as access to and use of facilities and services for the safe disposal of human urine and faeces, and emphasises that inadequate sanitation is directly linked to the transmission of diarrhoeal diseases, intestinal helminth infections, typhoid, cholera, trachoma and vector-borne diseases such as malaria. Poor sanitation also contributes to environmental pollution, contamination of water sources and degradation of living conditions, which collectively increase the burden of communicable diseases. In low- and middle-income countries, the health burden attributable to unsafe water, sanitation and hygiene remains disproportionately high, with children, adolescents and young adults in congregate settings being particularly vulnerable. Prüss-Ustün et al. (2019) estimated that in 2016, inadequate water, sanitation and hygiene (WASH)

accounted for about 829,000 deaths from diarrhoeal diseases, equivalent to 60% of all diarrhoeal deaths, and for 1.6 million deaths in total when diarrhoea, respiratory infections, malnutrition and other WASH-related outcomes were combined.

Global monitoring reports indicate that access to adequate water, sanitation and hygiene services in educational institutions remains a significant challenge. UNICEF and WHO (2022), in the Joint Monitoring Programme (JMP) data update on WASH in schools, reported that globally 29% of schools still lacked a basic drinking-water service, 28% lacked a basic sanitation service, and 42% lacked a basic hygiene service, affecting 546 million, 539 million and 802 million schoolchildren respectively. This deficit undermines the attainment of Sustainable Development Goal 3 on health and well-being and Goal 6 on clean water and sanitation. In Nigeria, the Federal Ministry of Water Resources (2018), in the National Action Plan for the Revitalization of the Water, Sanitation and Hygiene (WASH) Sector, acknowledged that a substantial proportion of the population still lacks access to basic sanitation and that open defecation, poor drainage and indiscriminate waste disposal remain widespread.

University students constitute a particularly vulnerable group due to their living conditions and behavioural patterns. Overcrowding in hostels, shared toilet and bathroom facilities, irregular water supply, poor waste management and stagnant water around residences create an environment conducive to the transmission of infections. Contaminated food and water, coupled with inconsistent hand hygiene, increase the risk of diarrhoeal diseases, while blocked drains and indiscriminate dumping of waste promote mosquito breeding and consequently increase malaria transmission. Furthermore, poor ventilation, dusty environments and open burning of waste expose students to respiratory irritants. Wolf et al. (2023) estimated that in 2019, safe WASH could have prevented 1.4 million deaths and 74 million disability-adjusted life-years, with 69% of diarrhoea and 14% of acute respiratory infections attributable to unsafe WASH, which confirms that the pathways described above faecal contamination, stagnant water and poor hygiene remain major drivers of illness in congregate settings.

The health implications of poor environmental sanitation Practices among undergraduate students are both immediate and long-term, and they extend beyond physical illness to academic and psychosocial consequences. The WHO (2018) guidelines on sanitation and health established that unsafe sanitation accounts for a significant proportion of diarrhoeal diseases, soil-transmitted helminth infections, and skin and eye infections. In university settings, malaria remains the most frequently reported sanitation-related illness due to stagnant water and poor drainage serving as breeding sites for Anopheles mosquitoes, while diarrhoea, cholera and typhoid result from faecal contamination of food and water and improper waste disposal. Beyond morbidity, these illnesses lead to increased use of self-medication, frequent visits to university health centres, absenteeism from lectures, reduced academic performance and lower quality of life. Wolf et al. (2022) found in a systematic review and meta-analysis that interventions to improve drinking water, sanitation and handwashing with soap reduced the risk of diarrhoeal disease in children in low and middle-income settings, which supports the argument that improving sanitation practices in institutions can reduce illness.

Despite the well-established link between environmental sanitation and health in the general population, there is limited recent empirical evidence from the University of Benin that specifically measures environmental sanitation practices among undergraduates and tests its association with health implications. Most existing studies in Nigeria have been descriptive, focusing on either sanitation practices or health problems in isolation, without statistically testing whether sanitation practices are associated with health outcomes. This leaves a critical gap in evidence needed for targeted campus health policy and health education programming. The University of Benin, located in Benin City, Edo State, South-South Nigeria, is one of Nigeria's first-generation federal universities established in 1970. It has two main campuses, Ugbowo and Ekenwan, with a large and diverse student population drawn from all geopolitical zones of the country and beyond. The total enrolment exceeds 70,000 undergraduate and postgraduate students, of whom 47,165 were undergraduates in the 2024/2025 academic session. The university operates several on-campus hostels that accommodate thousands of students, while a large

proportion of undergraduates also reside in off-campus private hostels and surrounding communities due to accommodation deficits. Like many public universities in Nigeria, the University of Benin faces sanitation challenges related to high student population density, ageing infrastructure, inconsistent water supply, pressure on shared toilet facilities, inadequate waste collection and blocked drainage systems, especially during the rainy season. These conditions make the university an important setting for investigating the relationship between environmental sanitation and student health, and findings from such a setting are relevant to similar federal institutions across the country.

It is against this background that this study was conducted to assess environmental sanitation practices and their health implications among undergraduate students in the University of Benin, guided by the need to determine the level of environmental sanitation practices among students, identify the common health implications experienced, and examine whether environmental sanitation significantly predicts health implications among students, with the corresponding null hypothesis that there is no significant association between environmental sanitation practices and health implications among undergraduate students in the University of Benin.

Purpose of the Study

The study was guided by the following objectives:

1. To determine the level of environmental sanitation practices among undergraduate students in the University of Benin.
2. To identify the common health implications experienced by undergraduate students in the University of Benin.
3. To examine whether environmental sanitation practices are significantly associated with health implications among undergraduate students in the University of Benin.

Research Questions

The following research questions guided the study:

1. What is the level of environmental sanitation practices among undergraduate students in the University of Benin?
2. What are the common health implications experienced by undergraduate students in the University of Benin?

Hypothesis

The following null hypothesis was formulated and tested at 0.05 level of significance:

$H_0$1. There is no significant association between environmental sanitation practices and health implications among undergraduate students in the University of Benin.

Methodology

A descriptive survey research design was adopted for this study. The design was appropriate because the study sought to describe environmental sanitation practices and health implications and to test the association between sanitation and health without manipulating any variable. The population comprised 47,165 undergraduate students of the University of Benin across Ugbowo and Ekenwan campuses for the 2024/2025 academic session. A sample of 386 respondents was selected using a multi-stage sampling technique. Stage 1 involved stratification of the population by faculty. Stage 2 involved systematic sampling to select 12 faculties. Stage 3 involved simple random sampling to select 0.82% of students from each selected faculty, which yielded 386 respondents (0.82% of 47,165 = 386.8). This procedure ensured representation across faculties and campuses. The instrument for data collection was a self-structured questionnaire titled Environmental Sanitation and Health Implications Questionnaire (ESHIQ). It had two sections: Section A covers Environmental sanitation practices, 10 items measuring personal and communal sanitation practices; and Section B covers Health implications with 4 items measuring self-reported health implications in the last six months. They include malaria, diarrhoea, skin infection and respiratory infection using Yes / No items, plus a No illness option. Section A was rated on a 3-point scale: Always = 3, Sometimes = 2, Never = 1. The criterion mean was 2.00. A grand mean of 2.00 and above was

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interpreted as good practice, while a grand mean below 2.00 was interpreted as poor practice. For classification of respondents, a total practice score was computed from the 10 items (range 10–30). Respondents scoring at or above the midpoint of 20 were classified as having good practice, while those scoring below 20 were classified as having poor practice.

Face and content validity were established by the researcher's supervisor and two other experts in the Department of Health, Safety and Environmental Education, University of Benin, Benin City, Edo State, Nigeria. Reliability was established using the test-retest method on 20 students who were not part of the main study, with an interval of two weeks between administrations. Pearson product-moment correlation coefficient was computed for the two sets of scores. A reliability coefficient of 0.82 was obtained, which was considered acceptable for the study. Data were collected by the researcher with two trained research assistants after obtaining ethical approval from the relevant university authorities. Respondents were informed of the purpose of the study, and their consent, confidentiality and anonymity were protected. Data were analysed using descriptive statistics of frequency, percentage, mean and standard deviation to answer Research Questions 1 and 2. Chi-square test of association was used to test the hypothesis at the 0.05 level of significance, using SPSS version 26. Phi coefficient was computed as a measure of effect size.

Results

Research Question one: What is the level of environmental sanitation practices among undergraduate students in the University of Benin?

Table 1 shows the practice of environmental sanitation. Items were rated on a 3-point scale: Always = 3, Sometimes = 2, Never = 1.

with a maximum of 2.00.

Table 1: Practice of environmental sanitation among undergraduate students (N = 386)

S/N	Item	Always	Sometimes	Never	Mean	SD
1	I dispose of waste in the designated bins.	**180**	**150**	**56**	**2.32**	0.68
2	I wash my hands with soap after using the toilet	190	164	32	2.41	0.61
3	I keep my room clean	170	154	62	2.28	0.70
4	I avoid open defecation	200	160	26	2.45	0.58
5	I use safe drinking water	140	179	67	2.19	0.74
6	I clean the toilet after use	110	174	102	2.02	0.81
7	I participate in communal sanitation	110	73	203	1.76	0.92
8	I clear stagnant water around my residence	120	88	178	1.85	0.88
9	I report broken sanitation facilities	110	58	218	1.72	0.95
10	I use mosquito nets where necessary	140	145	101	210	0.79
	Grand mean				2.11	0.76

Criterion Mean = 2.00

Table 1 shows that good sanitation practices were generally observed, because the grand mean of 2.11 is above the criterion mean of 2.00, and the grand standard deviation of 0.76 shows moderate variation among respondents. Specifically, personal hygiene items had high means. Avoid open defecation (M = 2.45, SD = 0.58), wash hands with soap after using the toilet (M = 2.41, SD = 0.61), dispose waste in designated bins (M = 2.32, SD = 0.68), keep room clean (M = 2.28, SD = 0.70), use safe drinking water (M = 2.19, SD = 0.74), use mosquito nets (M = 2.10, SD = 0.79) and clean toilet after use (M = 2.02, SD = 0.81). These means above 2.00 indicate that most students always or sometimes practise them, and the relatively low standard deviations, especially for open defecation and hand washing, show that responses were fairly consistent. In contrast, communal items had means below the criterion mean of 2.00: clear stagnant water around residence (M = 1.85, SD = 0.88), participate in communal sanitation (M = 1.76, SD = 0.92) and report broken sanitation facilities (M = 1.72, SD = 0.95). This

shows that most students never or only sometimes practise these communal items, and the high standard deviations show wide disagreement among respondents.

Research Question 2: What are the common health implications experienced by undergraduate students in the University of Benin?

Table 2 shows the common health implications reported by the students.

Table 2: Common health implications among undergraduate students (N=386).

Health Implication	Frequency	Percentage
Malaria	116	30.1
Diarrhoea	79	20.5
Skin infection	58	15.0
Respiratory infection	42	10.9
No illness	91	23.5
Total	**386**	**100**

Table 2 shows the common health implications reported by undergraduate students in the University of Benin in the last six months. The table shows that 295 students, representing 76.5%, reported at least one illness linked to poor environmental sanitation, while only 91 students, representing 23.5%, reported no illness. This indicates that illness is common among students and sanitation-related diseases remain a major health problem. Malaria had the highest frequency, with 116 students, representing 30.1%. This is the most common health implication and suggests the presence of stagnant water, poor drainage and mosquito breeding sites around hostels and lecture areas. Diarrhoea followed with 79 students, representing 20.5%. This implies unsafe drinking water, poor food hygiene and improper waste disposal. Skin infection was reported by 58 students, representing 15.0%, which may be due to overcrowding in hostels, shared toilet facilities and poor personal and environmental hygiene. Respiratory infection was reported by 42 students, representing 10.9%, which may be associated with dusty environments, poor ventilation and improper waste burning. Furthermore, the pattern shows that vector-borne and water-borne diseases, particularly malaria and diarrhoea, account for more than half (50.6%) of all reported cases, confirming that poor communal sanitation, stagnant water and waste accumulation are major predictors of ill health among undergraduate students. Malaria was the most common health implication (30.1%), followed by diarrhoea (20.5%), skin infection (15.0%) and respiratory infection (10.9%). Only 23.5% of the students reported no illness in the last six months.

Test of Hypothesis

H1: There is no significant association between environmental sanitation practices and health implications among undergraduate students in the University of Benin.

Table 3 shows the chi-square test of association between environmental sanitation practices and health implications.

Table 3: Chi-square test of association between environmental sanitation and health implications (N = 386)

Environmental sanitation	Presence of illness	No illness	Total	X^2	df	p-value	Decision
Good practice	147(63.4%)	85(36.6%)	232	55.15	1	0.000	Significant
Poor practice	148(96.1%)	6 (3.9%)	154				
Total	295(76.4%)	91(23.6%)	386				

Table 3 shows the test of hypothesis of association between environmental sanitation Practices and health implementations among undergraduate students in University of Benin. The result showed a statistically significant association between environmental sanitation practices and health implications, X^2 (1, N = 386) = 55.15, $p < .001$. The critical X^2 value at the 0.05 level of significance with 1 degree of freedom is 3.84. Since the calculated value (55.15) is greater than the critical value, the null hypothesis is rejected. Analysis of the cross-tabulation shows that students with poor environmental sanitation practices had a higher proportion of illness. Out

of 154 students with poor practice, 148 (96.1%) reported presence of illness, compared to 147 out of 232 (63.4%) with good practice. Conversely, only 6 (3.9%) of those with poor practice reported no illness, compared to 85 (36.6%) of those with good practice. The effect size, using the phi coefficient (phi = .38), indicates a moderate association, implying that poor environmental sanitation substantially increases the likelihood of illness. This implies that environmental sanitation practice is significantly associated with health implications among undergraduate students in the University of Benin. The word associated is used here in the statistical sense for a cross-sectional survey, not as evidence that poor practice alone caused illness.

Discussion of the Findings

The finding on the level of environmental sanitation practices, showed that students generally observe good sanitation practices, with a grand mean of 2.11 above the criterion mean of 2.00, indicating a fairly good level of personal hygiene consciousness. The high means for avoiding open defecation (2.45), hand washing with soap (2.41) and waste disposal in designated bins (2.32) suggest that personal hygiene messages are well received. However, the poor practice recorded for communal sanitation items such as reporting broken facilities (1.72), participating in communal sanitation (1.76) and clearing stagnant water (1.85) shows a gap between personal and communal responsibility. This gap is consistent with the World Health Organization (2018) guidelines on sanitation and health, which emphasise that sanitation must be addressed as part of locally delivered services and broader development programmes, not only as individual behaviour. It also aligns with the Joint Monitoring Programme finding (UNICEF & WHO, 2022) that many schools and institutions still lack basic sanitation and hygiene services, even where individual hygiene knowledge is present, because facilities, maintenance and shared responsibility are weak.

On the common health implications experienced by students, the high prevalence of illness (76.4%) is a concern, with malaria (30.1%) as the most common, followed by diarrhoea (20.5%), skin infection (15.0%) and respiratory infection (10.9%). This pattern confirms that vector-borne and water-borne diseases still dominate sanitation-related morbidity. This corroborates the WHO (2018) guidelines, which identified malaria and diarrhoeal diseases as leading environmental health burdens in sub-Saharan Africa linked to poor sanitation. It is also consistent with Prüss-Ustün et al. (2019), who found that inadequate WASH accounted for 60% of diarrhoeal deaths, and with Wolf et al. (2023), who found that 69% of diarrhoea and 14% of acute respiratory infections were attributable to unsafe WASH. The fact that only 23.6% reported no illness in the last six months indicates that sanitation-related illnesses remain a major public health problem in this setting, consistent with the JMP (UNICEF & WHO, 2022) finding that a large proportion of schools still lack basic WASH services.

With regard to whether there is a significant association between environmental sanitation practices and health implications, the chi-square result revealed a statistically significant association between environmental sanitation practices and health implications, X^2 (1, N = 386) = 55.15, $p < .001$, phi = .38. This shows that environmental sanitation is significantly associated with health status. Students with poor practice had a much higher illness rate (96.1%) compared to those with good practice (63.4%). This aligns with the WHO (2018) guidelines on sanitation and health, which emphasised that improved sanitation reduces transmission of diarrhoeal diseases and malaria. It also supports Wolf et al. (2022), who found that WASH interventions reduced diarrhoeal disease risk. The moderate effect size (phi = .38) suggests that the association is not only statistically significant but also practically meaningful, and improving sanitation practices could substantially reduce disease burden in the University of Benin. Because the design was cross-sectional and health implications were self-reported, the result should be interpreted as association, not as proof that poor practice alone caused illness. Other factors include hostel density, water supply, drainage and health-seeking behaviour which may also contribute.

Conclusion

The study investigated environmental sanitation practices and health implications among undergraduate students in the University of Benin. Based on the findings, it is concluded that undergraduate students generally observe

good environmental sanitation practices, particularly in personal hygiene behaviours such as avoiding open defecation, hand washing with soap after toilet use, waste disposal in designated bins and keeping rooms clean. However, significant gaps remain in communal sanitation practices such as reporting broken sanitation facilities, participating in communal sanitation exercises and clearing stagnant water around residences. It is also concluded that sanitation-related illnesses remain highly prevalent among undergraduates, with malaria, diarrhoea, skin infections and respiratory infections being the most common health implications reported. More than three-quarters of the students reported at least one illness in the last six months, indicating that poor environmental conditions still pose a major health risk in the university environment. Furthermore, environmental sanitation practice was found to be significantly associated with health implications. Students with poor sanitation practices were significantly more likely to report illness compared to those with good practices, with a moderate strength of association. This confirms that poor environmental sanitation substantially increases vulnerability to communicable diseases.

Recommendations

Based on the findings and conclusion of this study, the following recommendations are made:

1. The university health education unit should sustain and intensify awareness programmes on environmental sanitation, with emphasis on communal responsibility and not just personal hygiene.
2. The university management should improve and regularly maintain sanitation facilities, especially in hostels, toilets, waste disposal areas and drainage systems.
3. Regular inspection of sanitation facilities and prompt clearing of stagnant water and waste accumulation should be institutionalised to reduce mosquito breeding and disease transmission.
4. Students should be actively involved in communal sanitation activities through hall representatives and environmental clubs to promote ownership of sanitation.
5. Further research should examine the role of specific sanitation facilities and behavioural factors in preventing illness among students in other tertiary institutions for wider generalisation. Future studies should use longitudinal designs and clinical verification of illness to strengthen causal inference.

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Declaration

Author Contributions

First Author: Conceptualization, supervision, investigation, methodology design, and review and editing of final manuscript.

Second Author: Methodology validation, data curation, formal analysis, statistical analysis and interpretation, writing, original draft, and writing, review and editing.

Third Author: Literature review, data collection assistance, and review and editing of manuscript.

All authors contributed to the research, read and approved the final manuscript for publication.

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Conflict of Interest

The authors declare no conflict of interest and no competing interests.

Ethics Declaration

The authors affirm that this study was conducted in accordance with ethical research standards and institutional regulations. Permission for data collection was obtained from the relevant authorities in the study institution. All participants were duly informed, and confidentiality and anonymity were maintained.

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