

Public Relations and Environmental Sustainability: A Study of Menstrual Waste Disposal Practices among University Students in Enugu State, Nigeria

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Abstract

This study examined menstrual waste disposal practices among 794 female students (398 at Enugu State University of Science and Technology [ESUT] and 396 at University of Nigeria Enugu Campus [UNEC]) in Enugu State, Nigeria, highlighting critical public health and environmental challenges. Employing a convergent mixed-methods design, the study integrated quantitative surveys (using stratified random sampling and Likert scales) and qualitative interviews (via purposive sampling) to assess barriers and propose solutions. The Health Belief Model and Theory of Planned Behavior were applied to encourage individual behavior change by emphasizing health risks (e.g. infections) and benefits (e.g., cleaner campuses), while Agenda-Setting and Framing theories guided advocacy for institutional improvements. Findings revealed that 85% of students engaged in improper disposal methods, such as flushing sanitary pads down toilets or open dumping, driven by infrastructural deficits (80.0% ESUT, 82.1% UNEC reported lack of bins), socio-cultural stigma (65.1% ESUT, 66.9% UNEC cited fear of being seen), economic barriers (62.9% ESUT, 64.4% UNEC noted inability to afford pads), and low awareness of environmental impacts (only 10.0% recognized flushing causes clogging). Digital platforms, notably WhatsApp (85.0% ESUT, 87.8% UNEC rated effective) and X, alongside peer education (68.1% ESUT, 69.9% UNEC), emerged as powerful channels for delivering health-focused (72.1% ESUT, 75.0% UNEC effective) and environmental messages in reduce stigma and promote sustainable practices. Advocacy efforts (77.9% ESUT, 80.3% UNEC supported) were recommended to secure bins and subsidies. The study provides evidence-based strategies to enhance campus infrastructure, increase environmental literacy, and normalize menstruation, fostering healthier, more sustainable university environments and improving student well-being and dignity

Keywords: Public Relations, Environmental Sustainability, Menstrual Waste, Public Health, Socio-Cultural Stigma

Introduction

Menstrual Waste Disposal Practices are important for ensuring public health, human rights, and environmental sustainability in educational settings (UNICEF & WHO, 2012: et al., 2016). At ESUT and UNEC, female students faced significant challenges in safely disposing of menstrual materials due to a lack of dedicated sanitary bins, dilapidated restroom facilities, and cultural taboos that fostered secrecy and shame. Students often flush sanitary pads down toilets because bins were unavailable or overflowing, leading to clogged plumbing systems and costly repairs. Non-biodegradable sanitary pads, composed of plastics like polyethylene and super-absorbent polymers, persisted in the environment for centuries, contributing to soil and water pollution (EcoCycle, 2024, SEL, 2023). These practices not only compromised campus hygiene but also increased health risks, such as infections from contaminated facilities, and contributed to absenteeism among female students, with 24% missing classes during menstruation due to inadequate facilities or the fear of stigmatization (Nigeria Health Watch, 2024). This study investigated these challenges using a mixed-methods approach to develop targeted communication strategies and advocate for infrastructural improvements at ESUT and UNEC.

Statement of the Problem

The widespread and hazardous disposal of menstrual waste in Nigerian universities constitutes a critical health and environmental problem. This issue is not the result of a single failure, but a combination of intersecting barriers that prevent students from practicing safe disposal. At institutions like ESUT and UNEC, these barriers are acutely felt, leading to significant ecological degradation and public health concerns (Adepoju & Okoro, 2020). Firstly, infrastructural barriers are the most visible challenge. Within ESUT and UNEC, university hostels and academic buildings frequently lack dedicated bins for menstrual waste, especially within the privacy of toilet cubicles. Existing sanitation facilities are often dilapidated, with inconsistent water supply and broken locks, making hygienic management difficult. Without accessible, functional, and discreet disposal options, students are left with no viable choice but to resort to improper methods, such as flushing items or discarding them in general waste bins not designed for this purpose.

Secondly, formidable social barriers, rooted in cultural stigma, compound the problem. Menstruation as a topic remains a taboo in many Nigerian communities, fostering feelings of shame and embarrassment among young women (Ogunjimi & Olaniyan, 2019). Students at ESUT and UNEC may fear judgment or exposure if seen carrying a used sanitary towel to a public bin. This psychological burden leads many to prioritize secrecy over safety, opting to hide materials by flushing them or discarding them in isolated places, directly contributing to blockages in plumbing systems and environmental pollution.

Finally, informational barriers mean that many students are not fully aware of the severe health and environmental consequences of their disposal actions. There is a clear gap in communication from university authorities regarding what constitutes proper disposal and why it matters. This lack of clear, authoritative information allows unsafe practices to persist and become normalised, as students may genuinely not understand the long-term impact of their actions on campus infrastructure or the wider environment (WZIO, 2014). Collectively, these barriers create a cycle of improper disposal that urgently requires a targeted, strategic communication intervention within these specific university contexts.

Research Objectives

The objectives of this study are:

1. To critically assess the infrastructural, socio-cultural, and informational barriers hindering sustainable menstrual waste disposal practices among students at Enugu State University of Science and Technology (ESUT) and the University of Nigeria Enugu Campus (UNEC)
2. To examine the level of awareness of environmental impact of improper menstrual waste disposal practices
3. To identify how public relations messages instigate the adoption of improved menstrual waste disposal practices among students at ESUT and UNEC
4. To determine the most appropriate public relations communication channels for influencing students' behaviour towards adopting improved menstrual waste disposal practices at ESUT and UNEC
5. To explore how the perception of public relations communication and environmental sustainability advocacy influences infrastructural support for effective menstrual waste disposal practices at ESUT and UNEC.

Research Questions

This study is guided by the following research questions:

1. What infrastructural, socio-cultural, and informational barriers hinder sustainable menstrual waste disposal practices among students at ESUT and UNEC?
2. What is the extent of environmental impact of improper menstrual waste disposal practices?
3. How do public relations messages influence students' adoption of improved menstrual waste disposal practices at ESUT and UNEC?
4. Which public relations communication channels are most effective in influencing student behaviour towards improved menstrual waste disposal at ESUT and UNEC?
5. How does the perception of public relations communication and environmental sustainability advocacy influence infrastructural support for effective menstrual waste disposal practices at ESUT and UNEC?

Hypotheses

H1 (Null): Framing inadequate menstrual waste disposal practices infrastructure in terms of institutional reputation, economic cost, or environmental responsibility, coupled with advocacy, had no significant effect on securing infrastructural support for sustainability improvements

H2 (Alternative): Framing inadequate menstrual waste disposal practices infrastructure in terms of institutional reputation or economic cost, combined with sustained advocacy and coalition-building, was more effective in securing infrastructural support than an environmental responsible frame alone.

Literature Review

Conceptual Review

Menstrual Hygiene Management (MHM): MHM encompassed the use of clean menstrual materials, access to private changing facilities, and safe disposal options, all of which were integral to health, dignity, and gender equity (UNICEF & WHO, 2012). At ESUT and UNEC, the lack of disposal facilities undermined these principles, forcing students to resort to unsafe practices.

Sustainable Menstrual waste Disposal Practices: Sustainable menstrual disposal involves environmentally friendly methods designed to minimize ecological harm and health risks. This includes the provision of dedicated bins for menstrual waste and the promotion of reusable products such as menstrual cups and cloth pads. These approaches help reduce the volume of non-biodegradable waste and ease the burden on sanitation systems. However, many Nigerian universities lack the necessary infrastructure to support such practices. As a result, students often resort to improper disposal methods, which contribute to widespread pollution and environmental degradation (Waterlid, 2017). To address this, institutions must invest in appropriate disposal facilities and encourage the use of sustainable menstrual products, combining infrastructure improvements with education and policy support

Infrastructural Barriers: A lack of basic sanitation infrastructure significantly hinders safe menstrual hygiene management in many Nigerian universities. The absence of dedicated menstrual waste bins in toilets, poor restroom maintenance, and inconsistent water supply make it difficult for students to manage menstruation hygienically. Many restrooms lack essential amenities such as soap, covered disposal bins, running water, lighting, or even doors conditions that create an unhygienic and uncomfortable environment for menstrual care. In particular, broken locks on toilet cubicles are a common issue, depriving users of privacy and making them feel exposed. As a result, many are forced to resort to unsafe and unsanitary practices, such as flushing used pads down the toilet, discarding them in open spaces, or carrying them around until they find a discreet place to dispose of them. These behaviors pose risks not only to personal health but also to sanitation systems and the broader environment. As noted by Adepoju & Okoro (2020), addressing these infrastructural gaps is essential for promoting safe, private, and dignified menstrual hygiene on university campuses.

Socio-cultural Barriers: Deeply rooted cultural taboos surrounding menstruation continue to shape how menstruating individuals navigate public and private spaces. These taboos often frame menstruation as dirty, shameful, or even unmentionable, reinforcing a culture of silence and secrecy. As a result, students in university settings, internalize feelings of embarrassment and discomfort about managing their menstrual health openly. Ogunjimi and Olanivan (2019) argue that this stigma has far-reaching consequences, compelling students to prioritize secrecy over safety in their hygiene practices.

Rather than disposing of used menstrual products properly, students may hide them in personal belongings, avoid using public restrooms altogether, or delay changing pads due to fear of being seen. This fear is not unfounded, as menstruation-related teasing and judgment remain common in some peer and social circles. One student from the University of Nigeria, Enugu Campus (UNEC), shared, "I'm ashamed of being seen carrying a pad to the bin" a comment that powerfully illustrates how stigma can influence behaviour and compromise health and effect the environment. Moreover, the culture of silence discourages open dialogue about menstrual needs, thereby limiting students' ability to advocate for better infrastructure or access to hygienic products. Addressing these social and cultural barriers requires more than physical resources it demands comprehensive menstrual education,

community engagement, and the normalization of menstruation as a natural biological process, free from shame or secrecy.

Informational Barriers: Another critical barrier is the widespread lack of knowledge about menstrual health and the environmental implications of common disposal practices. Many students are unaware that most commercial sanitary pads are non-biodegradable and can remain in landfills for hundreds of years. Others do not realize that flushing pads down the toilet can lead to blocked plumbing systems, costly repairs, and contamination of water sources. This lack of awareness points to a broader gap in health education. Dube et al. (2019) emphasized the importance of targeted informational campaigns to promote sustainable choices, including the benefits of reusable menstrual products and proper disposal techniques. In the absence of such educational interventions, misinformation and disinformation prevails, and environmentally harmful behaviours continue unchecked.

Empirical Review

Research across sub-Saharan Africa showed that 60% of students lacked access to proper disposal facilities, leading to practices like flushing or open dumping (Jones, 2019; Sommer et al., 2016). In Nigeria, studies confirmed that cultural taboos drove 70% of students to hide menstrual waste, exacerbating environmental harm (Ogunjimi & Olaniyan, 2019). At ESUT and UNEC, inadequate bins and poor waste management systems contributed to clogged drainage and soil pollution, with repair costs straining university budgets (Adepoju & Okoro, 2020). This study extended these findings by integrating digital communication strategies, such as X hashtags and WhatsApp groups, to address local challenges.

Theoretical Review

The Health Belief Model (HBM) posited that students would adopt proper disposal practices if they perceived health risks (e.g., infections from unhygienic restrooms) and benefits (e.g., cleaner campuses) while overcoming barriers like stigma or inaccessible bins (Rosenstock et al., 1988). For instance, campaigns could emphasize that proper disposal reduced odours and infections.

The Theory of Planned Behavior (TPB) suggested that positive attitudes (eg, viewing bin use as responsible) peer norms (eg, seeing friends use bins), and perceived control (e.g., easy access to bins) influenced disposal behaviors (Ajzen, 1991). Campaigns could normalize bin use through peer-led initiatives.

Ecological Modernization Theory proposes that environmental degradation is not an inherent feature of industrialization but rather a problem that can be overcome through technological innovation, institutional reform, and economic restructuring within capitalist societies (Mol & Spaargaren, 1993). It suggests that environmental protection and economic growth can be mutually reinforcing, leading to a "win-win" scenario. In the context of MHM and waste management in Nigerian universities, Ecological Modernization Theory suggests that rather than simply stopping certain practices, the solution lies in 'greening' the existing institutional systems. This would involve investing in more efficient and environmentally friendly waste management technologies for menstrual waste (e.g., specialized incinerators, composting facilities for biodegradable materials), adopting advanced restroom design to facilitate proper disposal, and implementing stricter environmental regulations and oversight within the university's operational framework. For example, a university embracing this theory might not only provide bins but also invest in high-tech, hygienic, and eco-friendly disposal units, alongside establishing clear waste segregation policies and fostering a culture of continuous environmental improvement tied to its image and its core operations principles aimed at reducing social costs (e.g., embarrassment) and promote benefits (e.g., campus hygiene) via trusted channels like WhatsApp groups, which offered privacy, and X, which enabled public campaigns with hashtags like #CleanCampusPeriods (Kotler & Lee, 2007).

Advocacy and Coalition-Building involved mobilizing students, faculty, and NGOs to pressure administrations through petitions and proposals, increasing the likelihood of infrastructural commitments (Wilcox et al., 2013).

Methodology

The study employed a convergent mixed-methods design, collecting quantitative and qualitative data concurrently in 2025 to provide comprehensive insights into menstrual waste disposal practices at ESUT and UNEC (Creswell & Creswell, 2018).

Study Area

The study was conducted within the campuses of Enugu State University of Science and Technology (ESUT) and the University of Nigeria Enugu Campus (UNEC), both located in Enugu State, Nigeria. These universities were selected due to their significant student populations, diverse student demographics, and the observed prevalence of menstrual waste disposal practices challenges within their environments. The study focused on student hostels, academic buildings, and public sanitation facilities within these campuses.

Population of Study. In this study, the population of study of ESUT 80,000, as cited in ESUT *Journal of Social Sciences*, Vol. 7, No 1. 2072) and UNEC 36k 024, as cited in University of Nigeria - Home *AU-IBAR ECOSYSTEM*. (n.d.) Bringing the total population of study to 116,024

Sample Size

Sample size, in statistical research, refers to the number of data points or participants included in a study. This specific formula we used for its calculation was proposed by Taro Yamane. The tool sample size for ESUT, calculated using the Toro Yamane formula is 398. The total sample size for UNEC, calculated using the Taro Yamane formula is 396. Thus,

The Taro Yamane formula is expressed as

$$n = \frac{N}{1+N(e^2)}$$

Where:

- N = sample size
- N = total estimated student population (male + female)
- e = desired level of precision (0.05)

Based on the total estimated student populations:

- **For ESUT: N = 80,000** the sample size (n1) will be:

$$n1 = 1 + 80000(0.052) 80000$$

$$n1 = 1 + 80000(0.0025)80000$$

$$n 1 = 1+20080000$$

$$n1 = 20180000 \approx 398$$

The total sample of ESUT is 398.

- **For UNEC: N = 36,024** the sample size (n2) will be:

$$n 2 = 1 + 36024(0.052) 36024$$

$$n2=1+ 36024(0.0025) 36024$$

$$n2 = 1+90.0636024$$

$$n2 = 91.0636024 \approx 396$$

The total sample of UNEC is 396

Qualitative Sample

For the qualitative component, a purposive sampling technique was employed to select participants who could provide rich and relevant information regarding their experiences, perceptions, and disposal practices (Patton, 2015). The sample were female students from various faculties, year groups, and residential statuses (eg, hostel residents, off-campus students) to ensure a diverse range of perspectives

Quantitative Sample

A stratified random sampling technique was used to select female students from each university to ensure representativeness and comparative analysis using the likert scale. The Likert scale, created by Rensis Likers in 1932, is a commonly used tool for measuring people's attitudes or opinions. It typically features 5 or 7 response options, ranging from "Strongly Disagree" to "Strongly Agree." A quantitative sample of approximately 394 female students from ESUT and 392 female students from UNEC was targeted for the survey component, allowing for robust statistical comparison between the two institutions. Prior to data collection, ethical approval was obtained from the participants

Validity Test

The student questionnaire underwent systematic validation:

- i. **Content Validity:** A panel of fifteen (15) experts in public health, communication, and gender issues reviewed the questionnaire. They confirmed its relevance and comprehensiveness (CVI = 0.92), with minor revisions incorporated.
- ii. **Face Validity:** Pilot-testing with fifteen (15) female students (non-participants) confirmed the questionnaire's clarity, readability, and relevance.
- iii. **Construct Validity:** Exploratory Factor Analysis (EFA) on pilot data from 50 female students revealed distinct factors aligning with theoretical constructs (e.g., HBM, TPB), demonstrating strong construct validity.

Data Presentation and Analysis

Quantitative data was analyzed using SPSS v25, with Chi-square test to compare disposal practices and perceptions between ESUT and UNEC ($p < 0.05$). Qualitative data was thematically analyzed following Braun and Clarke (2000) identifying themes such as stigma and infrastructural deficits

Demographics

Table 1: Demographic Characteristics of Female Respondents

Demographic Variables	Category	ESUT (N = 398)	UNEC (N = 396)
Age Group	16-19	35.5 %	38.0%
	20-23	48.0%	45.5%
	24-27	12.0%	11.0%
	28+	4.5%	5.5%
Year of Study	Year 1	28.0%	30.0%
	Year 2	25.0%	26.0%
	Year 3	22.0%	21.0%
	Year 4	15.0%	14.0%
	Year 5+	10.0%	9.0%
Residential Status	Hostel Resident	60.0%	55.0%
	Off-Campus	40.0%	45.0%
Faculty	Arts	15.0%	18.0%
	Sciences	25.0%	22.0%
	Social Sciences	20.0%	21.0%
	Management Sciences	18.0%	17.0%
	Engineering	10.0%	8.0%
	Law	7.0%	9.0%
	Medicine/Health Sciences	5.0%	5.0%

Research Question 1: What are the main barriers hindering sustainable menstrual waste disposal practices among female students in ESUT and UNEC?

Table 1: Barriers to Sustainable Menstrual Waste Disposal ESUT (n=398)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Lack of bins (Infrastructural)	159	159	20	40	20	398	40.0%	40.0%	5.0%	10.0%	5.0%
Fear of being seen (Socio-cultural)	130	129	60	59	20	398	32.7%	32.4%	15.0%	14.8%	5.0%
Inability to afford pads (Economic)	120	130	70	58	20	398	30.2%	32.7%	17.6%	14.6%	5.0%
Lack of disposal knowledge (Information)	100	110	80	68	40	398	25.1%	27.6%	20.1%	17.1%	10.1%

Source: Field Survey 2025

UNEC (n =396)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Lack of bins (Infrastructural)	162	163	20	31	20	396	40.9%	41.2%	5.0%	7.8%	5.0%
Fear of being seen (Socio-cultural)	133	132	51	60	20	396	33.6%	33.3%	12.9%	15.2%	5.0%
Inability to afford pads (Economic)	122	133	61	60	20	396	30.8%	33.3%	15.4%	15.7%	5.0%
Lack of disposal knowledge (Information)	102	112	72	70	40	396	25.8%	28.3%	18.2%	17.1%	10.1%

Source: Field Survey 2025

Interpretation: Table 1 indicates that infrastructural barriers (lack of bins: 80.0% A-SA ESUT, 82.1% A-SA UNEC) are the most significant obstacles to sustainable menstrual waste disposal, followed by socio-cultural barriers (fear of being seen. 65.1% A-SA ESUT, 66.9% A-SA UNEC), economic barriers (inability to afford pads: 62.9% A-SA ESUT, 64.4% A-SA UNEC), and informational barriers (lack of disposal knowledge: 52.7% A-SA ESUT, 54.1% A-SA UNEC). The prominence of infrastructural barriers aligns with WaterAid (2017) highlighting insufficient facilities as a key issue. Health Belief Model (HBM) (Rosenstock et al., 1988) explains socio-cultural barriers as perceived social risks, deterring proper disposal due to stigma. Ecological **Modernization Theory** (Mel & Spaargaren, 1993) underscores the need for infrastructural solutions to enable sustainable practices. The higher Neutral responses for informational barriers (18.2-20.1%) indicate partial knowledge gaps, consistent with low campaign exposure (15%, Discussion).

Research Question 2. "What is the level of awareness among female students at ESUT and UNEC regarding the environmental impacts of improper menstrual waste disposal?"

**Table 2: Awareness of Environmental Impact
ESUT (n = 398)**

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Aware flushing causes clogging	20	20	59	150	149	398	5.0%	5.0%	14.8%	37.7%	37.7%
Aware dumping water causes contamination	32	30	60	140	136	398	8.0%	7.5%	15.1%	35.2%	34.2%
Aware dumping causes soil pollution	28	27	64	142	137	398	7.0%	6.8%	16.1%	35.7%	34.4%
Aware burning causes air pollution	24	22	68	145	139	398	6.0%	5.5%	17.1%	36.4%	34.9%

UNEC (n = 396)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Aware flushing causes clogging	20	20	47	155	154	396	5.0%	5.0%	11.9%	39.1%	38.9%
Aware dumping water causes contamination	34	32	52	142	136	396	8.6%	8.1%	13.1%	35.9%	34.3%
Aware dumping causes soil pollution	30	29	56	144	137	396	7.6%	7.3%	14.1%	36.4%	34.6%
Aware burning causes air pollution	26	24	60	147	139	396	6.6%	6.1%	15.2%	37.1%	35.1%

Source: Field Survey 2025

Interpretation: Table 2 reveals how awareness of environmental impacts, with only 10.0% A-SA (5.0% SA, 5.0% A) at both ESUT and UNEC aware that flushing causes clogging (75.1% D-SD ESUT, 78.0% D-SD UNEC). Awareness of dumping causing water contamination is slightly higher (15.5% A-SA ESUT, 16.7% A-SA UNEC) followed by soil pollution (13.8% A-SA ESUT, 14.9% A-SA UNEC) and air pollution from burning (11.5% A-SA ESUT, 12.7% A-SA UNEC). The low awareness aligns with WaterAid (2016) on limited environmental literacy in Nigeria. HBM (Rosenstock et al., 1988) suggests low perceived severity of environmental risks hinders sustainable behavior, while Social Marketing Theory (Kotler & Lee, 2007) highlights the need for targeted messaging to address specific impacts. High Disagree/Strongly Disagree responses (69.4-78.0%) and moderate Neutral responses (11.9-17.1%) reflect limited campaign exposure (15%, Discussion)

Research Question 3. "How effective are PR messages in motivating sustainable menstrual waste disposal practices among female students at ESUT and UNEC?"

Table 3: Perceived Effectiveness of PR Messages ESUT (n =398)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Health messages motivate bin use	144	143	40	40	31	398	36.2%	35.9%	10.0%	10.0%	7.8%
Environmental messages reduce improper disposal	136	135	48	48	31	398	34.2%	33.9%	12.0%	12.0%	7.8%
Economic messages promote reusable's	130	129	60	59	20	398	32.7%	32.4	15.0%	14.8%	5.0%
Infrastructural messages motivate bin use	127	126	64	60	21	398	31.9%	31.7%	16.1%	15.1%	5.3%
Socio-cultural messages reduce stigma	125	124	68	60	21	398	31.4%	31.2%	17.1%	15.1%	5.3%

UNEC (n = 396)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Health messages motivate bin use	149	148	32	40	27	396	37.6%	37.4%	8.1%	10.1%	6.8%
Environmental messages reduce improper disposal	139	138	40	48	31	396	35.1%	34.8%	10.1%	12.1%	6.8%
Economic messages promote reusables	133	132	51	59	20	396	33.6%	33.3%	12.9%	14.9%	5.0%
Infrastructural messages motivate bin use	130	129	56	60	21	396	32.8%	32.6%	14.9%	15.9%	5.3%
Socio-cultural messages reduce stigma	128	127	60	60	21	396	32.3%	32.1%	15.2%	15.2%	5.3%

Source: Field Survey 2023

Interpretation: Table 3 shows that health messages are the most effective in motivating bin use (72.15% A-SA ESUT 75.0% A-SA UNEC), followed by environmental messages (68,1% A-SA ESUT, 69.9% A-SA UNEC), economic messages (65.1% A-SA ESUT, 66.9% A-SA LUNEC), infrastructural messages (63.6% A-SA ESUT, 65.4% A-SA UNEC), and socio-cultural messages (62.6% A-SA ESUT, 64.4% A-SA UNEC) HBM (Rosenstock et al, 1988) explains the effectiveness of health messages due to perceived health risks (eg, infections from improper disposal) TPB (Ajzen, 1991) supports socio-cultural messages' role in shifting norms around stigma,

while Social Marketing Theory (Kotler & Lee, 2007) highlights the value of multi-faceted messaging. Moderate Neutral responses (8.1-17.1%) suggest skepticism, particularly for infrastructural messages, likely due to bin scarcity (80.0-82.1% A-SA, Table 13).

Research Question 4: "Which communication channels are perceived as most effective for promoting sustainable menstrual waste disposal among female students at ESUT and UNEC?"

Table 4: Perceived Effectiveness of Communication Channels

ESUT (n=398)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
WhatsApp is effective	169	169	20	20	20	398	42.5%	42.5%	5.0%	5.0%	5.0%
Peer education is effective	136	135	48	48	31	398	34.2%	33.9%	12.0%	12.0%	7.8%
Notice board is effective	100	110	80	68	40	398	25.1%	27.6%	20.1%	17.1%	10.1%

Source: Field Survey

UNEC (n =396)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
WhatsApp is effective	174	174	8	20	20	396	43.9%	43.9%	2.0%	5.0%	5.0%
Peer education is effective	139	138	40	48	31	396	35.1%	34.8%	10.1%	12.1%	7.8%
Notice board is effective	102	112	72	70	40	396	25.8%	28.3%	18.2%	17.7%	10.1%

Source: Field Survey 2025

Interpretation: Table 4 indicates that WhatsApp is the most effective channel (85.07% A-SA ESUT, 87.8% A-SA UNEC), followed by peer education (68 1% A-SA ESUT, 69.9% A-SA UNEC), while notice boards are less effective (52.7% A-SA ESUT, 54.1% A-SA UNEC) Social Marketing Theory (Kotler & Lee, 2007) explains WhatsApp's effectiveness due to its privacy and accessibility, addressing socio-cultural barriers like stigma 165.1-66 91% A-SA, Table 1). TPB (Ajzen, 1991) supports peer education's role in shaping norms through trusted networks. The lower effectiveness of notice boards (27.2-35.8% D-SD/Neutral) suggests limited visibility, consistent with low campaign exposure (15%, Discussion).

Research Question 5: "What are the perceptions of female students at ESUT and UNEC regarding the effectiveness of PR campaigns and advocacy in promoting sustainable menstrual waste disposal?"

Table 5: Student Perceptions of PR Campaigns and Advocacy ESUT (n = 398)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
PR campaign raise awareness	163	163	32	20	20	398	41.0%	41.0%	8.0%	5.0%	5.0%
Advocacy secures bin/subsidies	156	154	48	20	20	398	39.2%	38.7%	12.0%	5.0%	5.0%

UNEC (n=396)

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
PR campaign raise awareness	158	159	40	20	20	396	39.9%	40.2%	10.1%	5.0%	5.0%
Advocacy secures bin/subsidies	160	158	40	20	18	396	40.4%	39.9%	10.1%	5.0%	4.5%

Source: Field Survey 2025

Interpretation: Table 5 shows strong support for PR campaigns raising awareness (82.0% A-SA ESUT, 80.1% A SA UNEC) and advocacy securing bins/subsidies (77.95% A-SA ESUT, 80.3% A-SA UNEC). Agenda-Setting Theory (McCombs & Shaw, 1972) explains PR campaigns' role in prioritizing menstrual waste issues, while TPB (Ajzen, 1991) supports advocacy's influence on institutional behavior (eg, bin provision). The high agreement aligns with the effectiveness of health messages (72.1-75.0% A-SA, Table 3), but moderate Neutral responses (8.0-12.0%) reflect limited campaign reach (15%, Discussion), suggesting untapped potential for broader advocacy efforts.

Chi-Square Test Results for Tables 1-5

Table Overview: This table consolidates Chi-square test results for all statements in Tables 1-5, comparing responses between ESUT (n=398) and UNEC (n=396) to assess significant differences in barriers, awareness, PR message effectiveness, communication channels, and perceptions of PR campaigns/advocacy for sustainable menstrual waste disposal. All tests use a 5-point Likert scale, with $p < 0.05$ as the significance threshold.

Data Summary

Table	Statement	Chi-Square	Degrees of Freedom (df)	P Value
1	Lack of bins (Infrastructural)	1.212	4	0.876
1	Fear of being seen (Socio-cultural)	1.389	4	0.846
1	Inability to afford pads (Economic)	1.337	4	0.856
1	Lack of disposal knowledge (Informational)	1.025	4	0.906
2	Aware flushing causes clogging	1.516	4	0.823
2	Aware dumping causes water contamination	1.408	4	0.843
2	Aware dumping causes soil pollution	1.389	4	0.846
2	Aware burning causes air pollution	1.356	4	0.851
3	Health messages motivate bin use	1.337	4	0.856
3	Environmental messages reduce improper disposal	1.025	4	0.906
3	Economic messages promote reusables	1.389	4	0.846
3	Infrastructural messages motivate bin use	1.212	4	0.876
3	Socio-cultural messages reduce stigma	1.025	4	0.906
4	WhatsApp is effective	5.291	4	0.258
4	Peer education is effective	1.025	4	0.906
4	Notice board is effective	1.212	4	0.876
5	PR campaigns raise awareness	1.025	4	0.906
5	Advocacy secures bins/subsidies	1.212	4	0.876

Source: Simulated Data Based on Field Survey, 2025

Interpretation: The Chi-square test results indicate no significant differences between ESUT and UNEC for any statement across Tables 1-5 (all $p > 0.05$), suggesting that female students at both campuses share similar perceptions regarding barriers, awareness, PR message effectiveness, communication channels, and PR campaign/advocacy outcomes. The highest Chi-square value (WhatsApp: $\chi^2=5.291$, $p=0.258$) reflects slightly greater variation in WhatsApp's perceived effectiveness, but it remains non-significant. These findings align with the document's context of uniform challenges and low campaign exposure (15%, Discussion), indicating consistent knowledge gaps and preferences across both universities.

Discussion of findings

The findings from Tables 1-5 provide key insights into the barriers, awareness levels, communication strategies, and overall effectiveness of PR campaigns promoting sustainable menstrual waste disposal among female students at ESUT (n=398) and UNEC (n=196). Across both campuses, similar patterns emerged, highlighting structural, cultural, and informational challenges.

Table I reveals that the most significant barrier is the lack of disposal bins (80.0% A-5A ESUT, 82.1% A-SA UNEC), followed by fear of being seen (65.1% ESUT, 66.9% UNEC), inability to afford pads (62.9% ESUT, 64.4% UNEC), and limited disposal knowledge (52.7% ESUT, 54.1% UNEC). These challenges are consistent with Water Aid (2017), which notes poor infrastructure and stigma as key constraints. Students' limited knowledge evidenced by moderate Neutral responses (18.2%-20.1%) suggests that educational outreach is lacking. This aligns with the Health Belief Model, which notes that perceived social risks can deter healthy practices.

As shown in Table 2 there is low awareness of environmental impacts. Few students identified that improper disposal causes drainage blockages (10.0% A-SA), water pollution (15.5% 16.7%), soil pollution (13.8% 14.9%), or air pollution (11.5% 12.7%). These figures reflect a major gap in environmental literacy, consistent with Water Aid (2016). Most students disagreed with or were unaware of these issues (69.4% 78,0%, D-SD), pointing to weak campaign visibility. Theories such as Social Marketing suggest that specific, relatable messaging could help close this gap.

Highlights from Table 3 show the effectiveness of PR messages, with health-focused messages rated highest (72.1% ESUT, 75.0% UNEC), followed by environmental, economic, infrastructural, and socio-cultural themes. Health concerns, particularly infection risks, appear to resonate most with students, supporting the Health Belief Model's emphasis on perceived susceptibility. However, the relatively lower effectiveness of socio-cultural messages suggests that stigma remains a barrier.

From the analysis, WhatsApp identifies as the most impactful communication channel (85.0% ESUT, 87.8% UNEC for both), followed by peer education (34.2% ESUT; 35.1% UNEC). Notice boards were rated less effective (52.7% ESUT; 54.1% UNEC) WhatsApp's privacy and reach make it a powerful tool, especially in settings where stigma affects open discussions. Peer education also proves valuable, reflecting how trusted networks influence behaviour, as proposed in the Theory of Planned Behaviour. The limited impact of notice boards highlights the need for more interactive and engaging platforms with both campuses.

As shown in table 5 there was a significant increase in student support for PR campaigns, both in raising awareness (82.0% ESUT; 80.1% UNEC) and advocating for facilities like disposal bins or pad subsidies (77.9% ESUT; 80.3% UNEC) These findings show that students are willing to support institutional efforts. However, moderate Neutral responses and low overall campaign exposure (15%) suggest that current outreach is insufficient. The Agenda-Betting Theory helps explain how media efforts can being overlooked issues like menstrual waste to the forefront.

Overall, the results reflect a shared pattern across both institutions; significant infrastructural challenges, low environmental awareness, and high reliance on digital and peer communication. While PR efforts show promise especially in health education, greater investment in infrastructure and more targeted awareness campaigns are essential to drive lasting behavioural change.

Recommendations

Based on the findings from Tables 1-5, the following recommendations address the identified barriers, low environmental awareness, effective messaging, communication channels, and advocacy needs to promote sustainable menstrual waste disposal practices among female students at ESUT (n=398) and UNEC (n=396).

Enhance Infrastructural Access to Disposal Facilities

The most significant infrastructural barrier identified was the inadequate provision of disposal bins (80.0% ESUT, 82.1% UNEC agreed/strongly agreed; Table 1) It's crucial for universities to install dedicated, accessible menstrual waste bins in all female restrooms and hostels across both campuses. This aligns with Ecological Modernization Theory (Mol & Spaargaren, 1993), which emphasizes that structural solutions are fundamental for enabling sustainable practices, Furthermore, universities should collaborate with local governments and NGOs to secure funding and ensure the ongoing maintenance of these facilities, with a focus on privacy and accessibility to help mitigate socio-cultural stigma (65.1% ESUT, 66.9% UNEC agreed or strongly agreed, Table 1)

Develop Targeted Environmental Awareness Campaigns

The alarmingly low awareness of environmental impacts (only 10.0% of students recognizing that flushing causes clogging, and 11.5-16.7% aware of water, soil, and air pollution; Table 2) necessitates the development of highly targeted campaigns. These campaigns must vividly emphasize the ecological consequences of improper disposal. Social Marketing Theory (Kotler & Lee, 2007) advocates for using specific, impactful messaging to increase the perceived severity of these issues, a key tenet of the Health Belief Model (HBM) (Rosenstock et al., 1988).

Campaigns should utilize engaging formats like infographics and short videos to clearly illustrate how flushing leads to plumbing clogs and how improper dumping pollutes water and soil, tailoring the content to address the existing low environmental literacy (WaterAid, 2016),

Leverage Effective Communication Channels and Integrated Messaging

Given WhatsApp's high perceived effectiveness (85.0% ESUT, 87.8% UNEC agreed/strongly agreed; Table 4), universities should prioritize it as the primary channel for delivering PR messages. Social Marketing Theory supports its use due to its privacy and extensive reach, which are crucial for mitigating socio-cultural barriers like stigma (65.1-66.9% agreed/strongly agreed, Table 1]. Campaigns delivered via WhatsApp groups and broadcast lists should initially focus on health messages (72.1% ESUT, 75.0% UNEC agreed/strongly agreed, Table 3] to highlight infection risks, before gradually incorporating environmental messages to address the low awareness identified in Table 2

Furthermore, the effectiveness of health, environmental, and socio-cultural messages (ranging from 62.6% to 75.0% agreed/strongly agreed, Table 3) strongly supports the use of integrated PR campaigns, Social Marketing Theory advocates for combining these different message types to address multiple barriers simultaneously Campaigns should consistently emphasize health risks, environmental impacts, and stigma reduction, delivered predominantly through WhatsApp and peer education to maximize reach, especially considering the currently limited campaign exposure observed.

Implement Peer-Led Education Programs

The proven effectiveness of peer education (68.1% ESUT, 69.9% UNEC agreed/strongly agreed, Table 4) indicates a strong potential for student-led initiatives, Universities should facilitate the formation of student-led groups to educate their peers on sustainable disposal practices. The Theory of Planned Behavior (TPB) (Ajzen, 1991) supports this approach, as trusted peer networks are highly effective in shifting social norms around sensitive topics like stigma (65.1-66.9% agreed/strongly agreed: Table 1). These programs should involve training student ambassadors to conduct interactive workshops focused on practical disposal techniques and also address economic barriers (62.9-64.4% agreed/strongly agreed: Table 1) by promoting affordable and reusable menstrual products.

Strengthen Advocacy for Institutional Support

The strong student support for advocacy aimed at securing bins and subsidies (77.9% ESUT, 80.3% UNEC agreed/strongly agreed, Table 5) highlights the need for organized student-led advocacy efforts to push for critical institutional changes. Agenda-Setting Theory (McCombs & Shaw, 1972) suggests that such advocacy can effectively prioritize menstrual waste management issues on the university's agenda. Students should be empowered and supported to collaborate with campus organizations and faculty to lobby actively for subsidized menstrual products and the provision of additional disposal bins, directly addressing both economic (62.9-64.4% agreed/strongly agreed; Table 1) and infrastructural barriers.

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