Poor Habits of Waste Disposal among Students: Associated Factors and Control Modalities with Indigenous Technologies in RIVCOHSMAT, Port Harcourt.

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Abstract

This research investigated 'Poor habits of waste disposal among students: Associated factors and control modalities with indigenous technologies in Rivers State College of Health Science and Management Technology, Port Harcourt, Rivers State. A cross-sectional, descriptive research design was used with a population of 4331 from which a sample of 433 respondents was drawn. Multi-stage sampling procedure was applied with structured questionnaire as the main instrument for data collection. The data were analyzed with descriptive statistics of simple percentage. The respondents accepted extent of poor habits on solid waste disposal to be moderate (66.36%), high (74.53%) and very high (88.32%). Findings showed the following as among factors predisposing to poor waste disposal habit: 'Very few waste bins at strategic points in the institution' (87.38%), 'Prevalence of informal waste disposal practices' (95.56%), 'Inadequate waste collection services' (95.57%), and 'Lack of monitoring and supervision on behaviour' (73.83%). Findings further revealed some innovative modalities to control poor waste disposal habit as 'Frequent removal of stored waste with organic composition' (74.30%), 'Regular education on actual knowledge for proper orientation on waste disposal' (70.79%) and 'Strict monitoring of someone's habits toward waste disposal' (67.06%). It was recommended that there should be regular monitoring and supervision of solid waste storage and dumpsites to avoid scattering as well as enhancing frequent removal from storage points with automated sensor installation.

Keywords*: Poor habits, innovative control modalities, predisposing factors, solid waste disposal, students*

Introduction

The indiscriminate littering of empty containers on the way or environment in general had been unappealing and unacceptable. Attitude towards solid waste disposal appeared poor in some places, more so, in many African countries. Humans produce just over 2 billion tons of waste each year, that's a lot of unnecessary trash ending up in the world's landfills and waterways. Africa's rapid population growth, quick spring-up centres, fast-developing urban areas and increasing economic activities, have led to unprecedented increase in volumes of waste materials. Consequent upon this was the increasing quantity of hazardous waste materials at and from the dump-sites, a trend that has reached an emergency state throughout the continent of Africa. Stannard (2021) stated that by 2050, global waste is expected to reach 4 billion tons, doubling what it was in 2016. Again, it has been projected that by 2050, the volume of waste will triple from 174 million tons per year (of 2016) to approximately 516 million tons per year across the Africa continent (Tomita et al., 2020). At the meantime, Africa's average waste collection rate is approximately 55% of all the existing waste materials. Nonetheless, it

is observed that over 90% of Africa's waste is disposed of at uncontrolled dumpsites and landfills, which is mostly followed by open burning.

Most importantly, 19 of the world's 50 biggest dumpsites are found in Africa and are mainly seen in Sub-Saharan Africa. Nonetheless, considering the constituents of the municipal solid waste, an average of 57% composition was organic waste and approximately 13% is plastic, being generated in Africa (World Bank, 2012). Sadly, the bulk of organic waste which could provide significant socio-economic opportunities for African countries is currently being dumped in landfills. Yet approximately 70 – 80% of the municipal solid waste generated in Africa is recyclable but only 4% of it is recycled at the moment (World Bank, 2022). Dugbazah et al. (2021) informed that according to the Environmental Protection Agency (EPA), roughly 75% of the waste stream in the United States is recyclable, but only about 30% of recyclable materials actually get recycled.

To reduce the strain increasing worldwide waste is putting on the environment and waste collection services, communities around the globe are turning to smart waste management technologies and solutions. Communities really need to adopt smart waste management technologies that increase efficiency, lower collection costs and divert more trash away from landfills. Smart waste management refers to any system that uses technology to make trash collection more efficient, cost-effective and environmentally friendly. Most of these systems are equipped with the Internet of Things (IoT), a monitoring technology that collects and tracks real-time data, to help optimize waste collection and spur future innovation (Stannard, 2021). Nevertheless, the emergence of recycling in the continent of Africa is driven by public and private sector design and associated with unemployment, poverty, and socio-economic needs (Dugbazah et al., 2021). According to Stannard (2021), some eight (8) innovative technologies revolutionizing waste management include smart waste bins, waste level sensors, AI (artificial intelligent) recycling robots, garbage truck weighing mechanisms, pneumatic waste pipes, solar-powered trash compactors, e-waste kiosks, and recycling Apps. There are state-of- the-art waste collection and processing technique which applies modern screening technology that efficiently sorts recyclable material in a quick but fast pattern. There are also automated sensors-laden technic that trigger instant alerts whenever waste-bin is full and needs removal service already being used in Africa. It is true that challenges of waste management have been daunting but threatening the quality of life in our continent of Africa.

This situation could be salvaged through rigorous solid waste material management by recycling and waste-to-energy generating technologies. Solid waste could be defined as non-liquid, non-gaseous products of human activities, taking the form of refuse, garbage and sludge, and regarded/discarded as being useless/unwanted hard or firm material/substance probably dumped in uncontrolled disposal sites without any further management. The US Environmental Protection Agency (2024) defined "solid waste" as any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Factors associated with solid waste management (SWM) could be classified as social, technical, environmental, fund-raising issues, and economic. On solid waste handling our people including students in health institutions of learning were observed littering their environment with empty sachet-water polythene containers, discarded plastic bottles, take-away food foils, polythene bags, pieces of papers and others. In the Rivers State College of Health Science and Management Technology (RIVCOHSMAT), the researchers observed occasional or intermittent, unsavory aesthetic nature of the premises which is usually worse around the students' hostels, but worst scene at the temporary dumpsite by one of the hostels. Considering the attendant public health implications of this situation, the researchers resolved to investigate "Poor habits of solid waste disposal among students: Associated factors and control modalities with indigenous

technologies in Rivers State College of Health Science and Management Technology, Port Harcourt". The work would specifically consider extent of poor habits on solid waste disposal, factors predisposing to the poor habits, and innovating control modalities on such poor habits.

Research Questions

The stated research questions below would guide the study.

i. What is the extent of poor habits on solid waste disposal among students in Rivers State College of Health Science and Management Technology, Oro-Owo, Rumueme, Port Harcourt**?**
ii. What are the factors predisposing to poor habits of solid waste disposal among students in Rivers State College of Health Science and Management Technology, Oro-Owo, Rumueme, Port Harcourt?
iii. What are the innovating modalities to control poor habits of solid waste disposal among students in Rivers State College of Health Science and Management Technology, Oro-Owo, Rumueme, Port Harcourt?

Methodology

Ten percent of the population (4331) was taken as the sample size (433) in consonant with the views of Bullen (2024), and Olaf College (2024), that in a population that runs into thousands, 10% are representative enough for sample size. A structured questionnaire was used as the main instrument for data collection. We collated a total of 428 copies of the correctly filled questionnaire. The research questions were analyzed using SPSS, applying descriptive statistics of simple percentage.

Results

The analyzed data were presented in Tables 1-3.

Table 1: **Extent of poor habits on solid waste disposal compared with level of its proper practice**

Waste Disposal Status			**Response (Percent, %)**		
Extent of poor habit (A)	**Level of proper practice (B)**	**Numerical category (%, B comparable)**	**Yes (%)**	**No (%)**	**Total (%)**
Tending nil	Excellent	96-100	0 (0)	428 (100)	428 (100)
Infinitesimal	Very good	80-95	7 (1.64)	421 (98.36)	428 (100)
Very low	Good	70-79	113 (26.40)	315 (73.60)	428 (100)
Low	Satisfactory	60-69	201 (46.96)	227 (53.04)	428 (100)
Moderate	Fair	50 - 59	284(66.36)	144 (36.64)	428 (100)
High	Bad	40 - 49	319 (74.53)	109 (25.47)	428 (100)
Very high	Loathsome	20 - 39	378(88.32)	50 (11.68)	428 (100)
Extreme	Savagely	1-19	81(18.92)	337(81.08)	428 (100)

Source: Researcher's field survey, 2024

Table 2: Factors predisposing to habits of poor solid waste disposal among students

S/No.	Variable	Response (Percent, %)		
		Yes (%)	No (%)	Total (%)
1	Very few waste bins at strategic points in the institution	374 (87.38)	54 (12.62)	428 (100)
2	Lack of monitoring and supervision on behaviour towards waste disposal	316 (73.83)	112 (26.17)	428 (100)
3	Inadequate orientation about waste disposal from low public campaign on environmental awareness	153 (35.75)	275 (64.25)	428 (100)
4	Lazy conduct of the persons/students	239 (55.84)	189 (44.16)	428 (100)
5	Assumptions that college authority is responsible	289 (67.52)	139 (32.48)	428 (100)
6	General public attitudes, like lack of civic responsibility, regarding waste disposal	311 (72.66)	117 (27.34)	428 (100)
7	Prevalence of informal waste disposal practices but nil best/most appropriate methods for solid waste management (SWM)	409 (95.56)	19 (4.46)	428 (100)
8	Inadequate waste collection services presenting as excessive solid waste littering	367 (85.75)	61 (14.25)	428 (100)
9	Outcome for lack of strategic plans for municipal solid waste (MSW) management	103 (24.07)	325 (75.93)	428 (100)
10	Low motivation consequent upon the authority little or no implementation of relevant legislations	248 (57.94)	180 (42.06)	428 (100)
11	Insufficient landfill capacity encouraging littering of solid waste	3o8 (71.96)	120 (28.04)	428 (100)
12	Inhibited innovation and the adoption of new technologies	181 (42.29)	247 (57.71)	428 (100)
13	Weak strategic, institutional, and organizational structures on SWM	203 (47.43)	225 (52.57)	428 (100)
14	Outcome for lack of political will among successive governments to deal with SWM, e.g. little or no government financing	358 (83.64)	70 (16.36)	428 (100)
15	Political instability due to conflict with reduced supervision of SWM	128 (29.91)	300 (70.09)	428 (100)
16	Increasing corruption with lack of accountability in SWM systems	314 (73.36)	114 (26.64)	428 (100)
17	Scavengers' activity at open dumpsites	313 (73.13)	115 (26.87)	428 (100)

Table 3: Innovating modalities to control habits of poor solid waste disposal among students

S/No.	Variable	Response (Percent, %)		
		Yes (%)	No (%)	Total (%)
1	Waste vendors offering to lift stored wastes at/from residences with higher frequency	271 (63.32)	157 (36.68)	428 (100)
2	Regular education on actual knowledge for proper orientation towards waste disposal	303 (70.79)	125 (29.21)	428 (100)
3	Strict monitoring of someone's habit towards waste disposal	287 (67.06)	141 (32.94)	428 (100)
4	Ensuring neat pathway to dumpsite	291 (67.99)	137 (32.01)	428 (100)
5	Enforcing waste segregation at source	177 (41.36)	251 (58.64)	428 (100)
6	Manufacture reusable materials but avoid single-use products to reduce waste volumes	282 (65.89)	146 (34.11)	428 (100)
7	Use of high-quality stuff/material for clothing durability	169 (39.49)	259 (60.51)	428 (100)
8	Frequent removal of stored waste with organic composition	318 (74.30)	110 (25.70)	428 (100)
9	Use of sanitary engineered landfilling of residual waste materials	263 (61.45)	165 (38.55)	428 (100)
10	Applying certain renewable energy technologies to decrease solid waste volumes in the house	327 (76.40)	101 (23.60)	428 (100)
11	Opting for cost-effective technologies that require low capital investments, minimal labour intensity and culturally acceptable	285 (66.59)	143 (33.41)	428 (100)
12	Sensor alert (automated) installation to give signal when dustbin get filled	109 (25.47)	319 (74.53)	428 (100)

Discussion

Poor habits toward solid waste disposal

Extent of poor habit and level of proper practice, in solid waste disposal can be classified and/or codified numerically as shown in Table 1 above. The comparison presented extent on undesirable habit, to proper practice, of solid waste disposal in bipolar activity situation. Extent of poor habits on solid waste disposal was outlined as tending to nil, infinitesimal, very low, low, moderate, high, very high and extreme. The last category here (extreme poor habit) ranked with savagely state on scale of proper practice in solid waste disposal, which is primitive as such. The present study revealed the extent of poor habits toward solid waste disposal to be moderate, high, and very high as affirmed by 66.36%,74.53% and 88.32 % of the respondents respectively.

Therefore, extent of poor habit toward solid waste disposal was alarming and sad, indeed. This is typical of the general public attitudes toward solid waste management (SWM) in many large cities in Nigeria, some African countries and other developing nations of the world. In the face

of exponential growth in population and urbanization, there has been associated surge in waste generation, placing immense strain on existing waste management infrastructure.
Francis (2024) had advanced similar views. Effective SWM is a major challenge in cities with high population density. Furthermore, burning of waste, including plastics and other non-biodegradable materials, is a common practice in these areas. The burning of waste releases harmful pollutants into the air, contributing to air pollution and posing serious health risks such as vulnerability to respiratory illnesses and skin conditions to residents, especially children and the elderly living in close proximity to open dumpsites. These informal waste disposal practices both degrade the environment and present unsightly and unsanitary conditions as well as perpetuate social disparities/inequalities in residents at the marginalized localities who bear the brunt of the environmental and health consequences from widespread environmental pollution and health hazards. The sprawling metropolises like Lagos, Abuja, Port Harcourt, Suleja and Aba to historic centres like Kano, and other Nigerian municipalities/cities are grappling with the daunting task of managing the ever-increasing volume of waste generated following rapid urbanization and population growth.

Drainage channels in Abuja, Lagos, Port Harcourt, Kano and some other cities in Nigeria are often littered with solid waste, which equally blocked the drains. For Abuja it typified failure of the Abuja Environmental Protection Board (AEPB) and in Greater Port Harcourt, Rivers State Environmental Protection Agency (RIWAMA) was/is to be blamed. The poor habit of waste disposal such as open dumping and indiscriminate burning, particularly in low-income communities has become rampant. The densely populated low-income communities like Ajegunle in Lagos, Diobu in Port Harcourt, Sabon-Geri in Kano, Karamajiji in Abuja where access to formal waste management services is limited, the lack of adequate waste collection infrastructure and awareness made them engage in quire or abnormal waste management practices. Residents, therefore, resort to dumping solid waste in vacant lots or open spaces, giving the heaps or piled up of garbage strewn along streets, and in drainage channels. Road Runner Recycling Organization (2021) and Penny (2023) stated the sordid nature of textile waste dumps in Ghana. The average American generated around 80 pounds of textile waste every year. Persons with poor habits of solid waste disposal are basically many at the squatter settlements in our urban areas and cities.

Factors predisposing to habits of poor solid waste disposal

The just concluded study had the following as attributing to poor habits of waste disposal: Very few waste bins at strategic points in the institution, inadequate waste collection services presenting as excessive solid waste littering, prevalence of informal waste disposal practices but nil best/most appropriate methods for solid waste management, scavengers activity at open dumpsites, lack of monitoring and supervision on behaviour towards waste disposal, general public attitudes like lack of civic responsibility regarding waste disposal, increasing corruption with lack of accountability in SWM systems and outcome for lack of political will among successive governments to deal with SWM, e.g. little or no government financing amongst others. These findings were as expected by the researchers. The investigators were poised to see higher responses on the variable: 'Lazy conduct of the persons/students', 'Low motivation consequent upon the authority little or no implementation of relevant legislations', 'Inadequate orientation about waste disposal from low public campaign on environmental awareness' 'Inhibited innovation and the adoption of new technologies', and 'Political instability due to conflict with reduced supervision of SWM'. Some respondents (being students) might have avoided affirming the "Lazy conduct" option. The respondents being students of health-based institution of higher learning might have felt that they had basic knowledge and assumed that the particular variable on awareness creation could not be among prime factors for poor habits toward solid waste disposal. It is a truism that

Rivers State, Nigeria and some other countries especially in Africa rarely enforce compliance with relevant legislations; so, many of the respondents thought of not expecting anything new let alone motivation. On the low response on the variable – 'inhibited new and innovating technologies' could be, not knowing or observing such technologies. The respondents might have seen conflict with its associated political instability as not a regular occurrence and could not be an issue in the area of study.

Most of the factors studied here in this research were similar to the findings of Dugbazah et al. (2021), Stannard (2021) and Kumar et al. (2017) all of whom noted geometric population growth as a predisposing factor to poor habits of solid waste disposal, for it came along with increased waste volumes and persons of poor habits on SWM. The increased waste production volume was resultant of growing urban populations and a rise in consumer culture over the past few decades, neither of which is slowing down any time soon. According to Dugbazah et al. (2021), African countries have traditionally managed waste disposal in landfills, indiscriminate dumping, open burning, and recycling. They added that unfortunately, the projected increased levels of waste in Africa, exposure of the public to waste sites, most particularly the poorly managed waste sites, has raised serious health concerns across the African continent. These researchers (2021) also stated that the primary causes of inadequate waste disposal and management in Africa include weak strategic, institutional, and organizational structures. This is perpetrated by limited skills that are essential to waste material management; inadequate budgets; feeble legislation and lack of enforcement necessary for waste management, low public awareness, increasing corruption and conflict leading to political instability; and the lack of political will among several governments to deal with waste material disposal and management, most of which predisposed to poor habits towards solid waste disposal.

Kumar et al. (2017) who undertook their study in India affirmed the following as determinants of inappropriate SWM or barrier to proper SWM, but are indirectly associated with poor habits of solid waste disposal. These included: absence of best and most appropriate methods from waste collection to disposal – insufficient budgets to cover the costs associated with developing proper waste collection, storage, treatment and disposal; lack of training in SWM and limited availability of qualified waste management professionals; lack of accountability in current SWM systems; the lack of strategic MSW plans, waste collection/segregation and a government finance regulatory framework (these 3 as major barrier in India); inhibited innovation and the adoption of new technologies that could transform waste management due to Limited environmental awareness combined with low motivation; and public attitudes to waste. Similarly, Francis (2024) noted that inadequate waste collection services, insufficient landfill capacity, and lack of proper disposal facilities have exacerbated the problem of SWM and indirectly constituted factors responsible for poor habits towards solid waste disposal and as part of the problem.

Innovating modalities to control habits of poor solid waste disposal

The study had investigated new and smart ideologies which could help scaling down extent of poor habits exhibited by some members of the public towards solid waste disposal. Among these were 'Applying certain renewable energy technologies to decrease solid waste volumes in the house' (76.40%), 'Frequent removal of stored waste with organic composition' (74.30%), 'Regular education on actual knowledge for proper orientation towards waste disposal' (70.79%), 'Ensuring neat pathway to dumpsite' (67.99%), and 'Strict monitoring of someone's habits towards waste disposal' (67.06%) among others. The researchers had expected these findings though with higher, massive levels. If the pathway to drop solid waste is blocked or filled with littered waste others coming later would drop theirs along the way without getting to the receptacle or the acceptable dumpsite. Some of the cost-

effective technologies that require low capital investments, minimal labour intensity and culturally acceptable could be observed in the local feet-manipulating-opening technic for local storage bin could help reduce littering.

Other investigators had called for similar acceptance of improved, new technologies. Dugbazah et al. (2021) had recommended to individuals or groups to opt for cost-effective technologies that require low capital investments and minimal labour intensity and uphold culturally acceptable technologies. Furthermore, African countries should manufacture reusable materials and avoid single-use products, where possible, to reduce solid waste volumes but enable recyclability-focused achievement. In addition, certain municipal waste streams such as organic waste, construction and demolition waste, and paper and packaging waste can provide immediate prospects for pursuing value recovery instead of landfill propositions. African countries should pursue bioenergy recovery and higher value product recovery efforts. This should be supported by the renewal, restoration, reclamation, and recycling of mainline recyclables such as plastics, papers, metals, glasses, tyres, and e-waste materials. They advised African countries on the mechanical-biological treatment methods that combine mechanical and biological treatment methods, supported by pre-treatment sorting techniques and emission selection and quality control techniques in their SWM; anaerobic digestion constituting the decomposition of organic waste in the absence of oxygen; and others.

Recommendations

Some strategic measures to surmount habits of poor solid waste disposal as innovating control modalities were herein advanced.

1. The RIVCOHSMAT authority should arrange for regular supervision of students on solid waste storage and disposal including its temporary dumpsites.
2. The institution should also establish monitoring team on poor habits of students toward solid waste disposal.
3. The institution should also establish monitoring team on poor habits of students toward solid waste disposal.
4. The institution management should ensure that there were adequate cleaners in hostels or offices to remove solid waste generated.
5. Orientating the students intermittently about proper waste disposal to control poor habits among should be made a priority by students' union government.
6. Monitoring dumpsite to avoid scattering therein from scavengers by some social organizations like the 'Man O' War should be maintained.
7. Placing storage containers of solid wastes on sensitive scale as sensor gadget to signal when filled especially at sites where storage bins do not quickly get filled should be done.
8. Providing waste containers/bins in strategic point in the college to control poor waste disposal habit among students should be pursued vigorously by top management of the institution.
9. Motivating the students during sanitation days by the student union government to control poor habits of students toward solid waste disposal should be started.
10. Management deliberate policy to control poor habit of solid waste disposal among students should be streamlined and enforced by the institution authority.

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