

MUNICIPAL WASTE MANAGEMENT FOR ENVIRONMENTAL SUSTAINABILITY: A CASE STUDY OF UNIVERSITY OF IBADAN, NIGERIA.

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ABSTRACT

One of the factors responsible for increasing solid waste in a rapidly growing urban area is population growth. Poor management of municipal solid waste and similar wastes generated from urban areas can have direct impact on public health. This paper is concerned with environmental and health impacts of the principal facilities for disposal of MSW (Municipal Solid Wastes). The paper is based on an investigative research on the impacts of MSW disposal methods on students' public health in the University of Ibadan, Nigeria. This investigative research makes use of both primary and secondary data collected within the University community. Primary data were collected from administration of self-determined questionnaires to students living in the halls of residence; and secondary data was collected from the University Health Services showing cases of environmental related diseases admitted by the Health Centre between January 2012 and June 2016. From primary data; results show that 51.6% of solid waste generated within the university community is from food; 16.1% from paper; 17.5% HD plastics, 9.9% LD plastics. 45.3% of students have waste baskets 7 feet away from their room, and 88.3% students regularly have open waste baskets closer to their rooms; while 0.4% of students don't have waste baskets at all. IBM SPSS Statistical package, version 21 and Microsoft excel 2013 version were used to analyze both primary and secondary data. The result shows that Gastro Intestinal Diseases (such as dysentery and diarrhea) have more incidences. Malaria has the highest record of occurrence in May, 2016 since 2012. Results further show that the University records approximately 100 persons treated for Gastro Intestinal Diseases every month since January; 2012 and 300 persons every month treated for Malaria fever infections. The paper went further to recommend the need for improvement in the management of municipal waste in the university and the need for a further research into the quality assurances of all sources of water coming to the university. It suggests that the university should adopt a Health Safety and Environment policy towards ensuring a safer environment for both students and staff in the University.

Keywords: Municipal waste management, environmental hazards, environment and health.

1.0: INTRODUCTION

The quantity of municipal waste generated in urban areas in industrialized countries and in institutions is higher than in developing countries. Still municipal solid waste management remains inadequate in educational institutions. Most of the educational institutions face same problems of waste management as it happens in urban cities and towns. The quantity of municipal waste generated from institutions in itself lacks adequate disposal, collection and management methods. Environmental hazards and disasters confronting human health in urban cities and towns remain unchanged to the population health in an educational institution like the University of Ibadan. There is no corresponding planning of waste management in relation to an increase in population growth. This leads to many problems of sanitation. The sanitation required in institutions is carried out by private waste collectors and cleaners who only visit the places in the morning to collect

waste and clean the environment. However, the work of these waste collectors and cleaners are being hindered by the poor waste management techniques and poor disposal methods.

This lack of waste management facilities can cause high health risks and environmental pathologies; arising from it are very important. They are mostly of gastro Intestinal Diseases and water borne infections. In addition, poor drainage of waste water and storm water leads to the proliferation of ponds that are habitats of mosquito vectors of various diseases including malaria (OMS, 1985; Oyeboode, 2013). These various pathologies are the result of many interactive phenomena between health and environmental hygiene. It highlights many health risks associated with poor hygiene (Hibberd et al, 1998; Oyeboode, 2013) including vector-borne diseases and infections (Forget and Lebel, 2002; Oyeboode, 2013). Improper municipal waste disposal and management causes all types of pollution: air,

soil, and water. Indiscriminate dumping of wastes contaminates surface and ground water supplies. In urban areas, municipal solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. Uncontrolled burning of municipal solid waste and improper incineration also contributes significantly to urban air pollution.

Dump sites are known for their smelly and unsightly conditions. These conditions are worse in the summer because of extreme temperatures, which speed up the rate of bacterial action on biodegradable organic materials. Most educational institutions, like University of Ibadan, use such dump sites- open dump sites and dumping refuse by the roadside, rather than properly managed and environmentally safe landfills. Lack of adequate planning and poor institutional policies regarding to wastes contributes to such conditions. There is therefore a considerable public concern over the possible effects of dump sites on the health of people living nearby, particularly those living in students' hostels. Inadequate management of open dumpsites in the University of Ibadan, is an emerging issue in the University community. Most solid wastes are disposed on land- illegally made dump sites. Disposal of solid waste on the land without careful planning and management can present a danger to the environment and the human health. The environment should be clean and less polluted by all means. This means that waste should be managed at all costs to limit its effects on the environment (US Environmental Protection Agency, 2006).

1.1: Objective of the study

This investigative research study is a longitudinal study carried out with an overarching objective of identifying the current situation of waste management in the University of Ibadan academic community; and to find any possible correlation between waste management methods currently being practised in the university academic community and the effects on students' public health. To achieve this objective, we

- a. identified the current problems of waste management in the university through responses supplied by the administration of a semi-structured questionnaire.
- b. observe any possible correlation between poor waste management and public health of students.

- c. through collection and analysis of secondary data, we established frequency counts of public health related illness among students with health records in the university clinic.

2.0: REVIEW OF LITERATURES

2.1: LOCATION OF DUMPSITES

Mustafa (1993) states that dumping sites are the most common way of disposal of municipal solid wastes in the cities. Generally, they are found on the outskirts of the urban areas; resulting to sources of contamination due to the incubation and proliferation of flies, mosquitoes, and rodents. These, in turn are disease transmitters which affect the children's health condition. All these occur in their organic defenses in a formative and creative state. Mustafa further asserted that decomposition of organic compounds by microorganisms is a common phenomenon. Most organic materials, such as food, wood products, or other remnants of plants, decay, finally return to the environment in the form of simple compounds, such as carbon dioxide, water, or ammonia. Surprisingly, it was found that most synthetic organic polymers, including the majority of plastics are extremely resistant to biodegradation. This phenomenon starts to create significant economical and environmental problems when landfills sites overflow with plastics, food wastes and polythene bags.

The location of dumpsites has proved to be a problem to people living within the University of Ibadan community. According to Marc (2006), the location of dumpsites should be properly planned and managed to avoid risks to human health in the environment, at large. Corrective and management measures are likely to be expensive, complex; and they pose serious threats to the environment and its habitants. Dumpsites within the university community are open spaces; some closer to students' hostels and staff quarters. Open dumping is practised in the university- opening refuse for air pollution and serious environmental hazards to the people. Containers are placed at strategic places: some open corners- for dumping of refuse and garbage. This open dumpsite exposes refuse generated to various vector- carrying diseases; hence a threat to public health of people living within the university, especially those whose house and hostels are closer to the dumpsites or refuse

containers. This study was designed to examine environmental and health impacts of the principal facilities for disposal of MSW (municipal solid wastes) on the students' population health in the University of Ibadan.

3.0: STUDY AREA

Our study area was University of Ibadan. The University was the oldest university in the country and is located five miles (8 kilometres) from the centre of the major city of Ibadan in Western Nigeria. The University is situated within the territory of Ibadan North local government. The university has 13 faculties and 11 students' hostels. The university is primarily residential with magnificent students' hostels for male and female students which include two postgraduate hostels.

There are Internet cafés, knowledge Hubs, cafeterias, Laundry Centres, Mini Marts, Press Boards, common-rooms, gymnasias (in some halls), and kitchenettes. Water supply throughout the university is through bore-hole water, well and sometimes from the university main supply. The university tap water from Eleyele River to its water treatment plant for purification and then supply students' hostel for consumption.

4.0: METHODOLOGY

4.1: Research design

This investigative survey study covers the University of Ibadan community. A longitudinal approach was adopted for the study. There are 11 students hostels properly scattered across the university and staff quarters arranged in a patterned form round the students' hostels. The study makes use of well-structured questionnaire to collect data across the 11 student hostels. The aim is to investigate the impacts of solid waste disposal methods and facilities on the student population health. Primary and Secondary data were collected to arrive at the findings on environmental and health impacts caused by poor conditions of principal facilities for disposal of MSW (municipal solid wastes) and similar waste streams in the University of Ibadan. Visits were conducted to all areas of the university where soak-away were located and open drainages constructed. Pictorial records of the state of the sewage disposal system were taken and an examination of the flow of liquid waste moving out of the soak away and drainages into main

roadsides and environment was also taken. Secondly, secondary data were collected from the University's Health Services. Occurrences of environmental related diseases treated by the Health Centre were collected between January 2012 and June 2016. Diseases such as Gastro Intestinal Diseases (dysentery and diarrhea), Respiratory Tract Infections (Asthma and co), Malaria fever, Typhoid and Skin diseases (such as measles, small pox, and skin rashes) were obtained from the records unit of the university health centre. These records were subsequently analyzed with IBM SPSS statistical package version 21 to find the most endemic environmental diseases among students and workers of the university. Thirdly, semi-structured questionnaires with both close and open ended designed questions were administered to 222 students living across the 10 student hostels. This enabled us to obtain solid information about attitudinal behavior of students towards waste disposal and collections, sanitations and management of waste.

4.2: SAMPLING AND MEASUREMENT INSTRUMENT

In this survey study, random sampling method was adopted in such a way that every student residing in the hostel situated on university have the probability of being selected. In this manner, 222 students were sampled and participated in the study. This sample size was a representative population study that provides adequate information that is easy to manage; and it came out with a good result clearer to interpret. It also corresponds to our research questions and aims. Also, through this sampling method, every member of the study area had an equal probability of being selected to be part of the study. The choice on the use of questionnaires as a key data gathering instrument was the authors' desire to obtain data on analysis that could help realize the objectives of the study.

Questionnaires were used to obtain questions on MSW management methods and effectiveness of waste disposal facilities. Through the questionnaire, we were able to obtain the commonest source of wastes among students residing in the hostels and how effectively students participate in environmental sanitation.

4.3: DATA ANALYSIS AND MANAGEMENT

Out of 222 questionnaires administered, 200 questionnaires were adequately filled and suitable for data analysis. Data gathered in the survey were analysed with IBM SPSS Statistical package, version 21, to obtain common source of waste among students residing in the hostels; attitude of students towards environmental sanitation and usage of waste disposal facilities. Microsoft Excel package was used to analyse our secondary data obtained from the University health centre, (JAJA Clinic) to get frequency counts of incidences of environmental related diseases in the university from January, 2012 to June 2016. Pearson Correlation was also used to obtain possible correlation among all environmental related illness admitted at the Jaja Clinic.

5.0: RESULTS AND DISCUSSIONS

5.1: Common Source of Waste: In order to subsequently aid the categorization of municipal solid waste in the University of Ibadan community, part of the questions asked in the self-determined questionnaires is the common source of waste of each student living in the hostels. We studied the common source of waste in the university community and hence results shows that 51.6% of waste in the university are from spoiled food and related food substances; 16.1% from books; 17.5% plastic; 3.6% metals and cans; and 9.9% are from Nylon and polythene substances. The pie chart below presents a pictorial view of the common source of waste among students residing in the hostels.

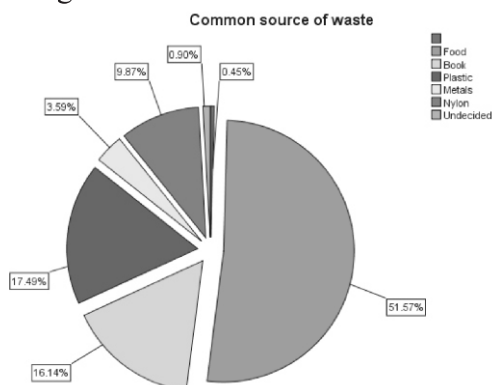


Figure 1: Pie Chart showing sources of waste generated in the university

5.2: Attitude of students towards environmental sanitation: Improving environmental sanitation is known to have a significant beneficial impact on households'

health across all communities (Omolara, Oluwole, and Oluseun, 2012; Taiwo and Ajayi, 2012). Coupled with the increasingly high students population growth is the lack of independent institutional capacity to formulate and adopt strategies to ensure proper environmental sanitation and management within the university community. The university management absolutely depends on cleaners and waste collectors who are contract staff of the university. During public holidays, these cleaners don't come for the usual cleaning and this makes the university environment more dirty before they resume for work on the next working days. Students on their own lack the capacity and will to do environmental sanitation. They find it difficult to empty waste baskets in the absences of the private cleaners. Results obtained from our studies so far reveal that 15.2% students sweep their room once a week; 7.2% sweeps twice a week; 11.2% three times a week, 49.8% sweeps daily and 13.9% sweep occasionally. The bar chart below fully illustrates the graphical view of how students sweep their room and take care of the environment. One resultant effect of this kind of a situation where students have no business with waste disposal and collection but depend on the cleaners is that the waste baskets are filled up to the brim that garbage later fills the ground. In this kind of a situation where only 88.3% of students have open waste baskets that is about 7 feet nearer to their rooms, and majority of the wastes, 51.57%, being food waste. This is a strong indication of diverse organisms carrying vectors that are likely to find comfortable breeding zones around students' community. In fact, this is responsible for the 65.8% rate of mosquito infestation in the university community especially around student rooms. During our survey, 22.1% of students regularly see rats around their hostels, 19.4% see them occasionally, 56.3% don't often see them and 2.3% remain undecided.

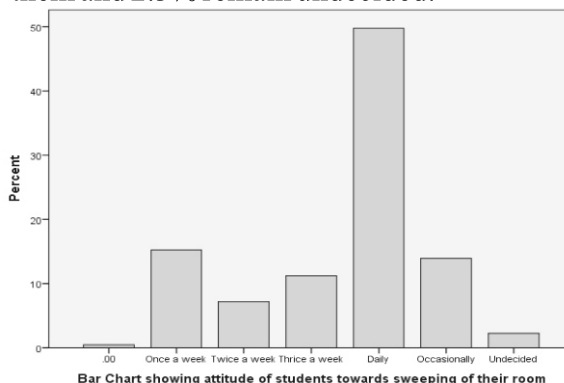


Figure 2: Bar chart showing how regular students sweep their rooms

5.3: Environmental pollution and the use of drainage system in the university:

The ubiquitous pile-up of garbage is a significant contributor to the university's significant rise of the incidence of vector-propagated diseases and high occurrences of malaria spreading anopheles mosquito. Currently, most of the university's drains and soakaways are damaged and left open with liquid waste flowing into the open environment; thereby polluting the university community with stench smells. It was very evident that there are no soakaway systems attached to particular building rather they are linked through open drainages that leave the whole university with very foul smell all the time. In some places, urines, and other liquid waste from toilets and bathrooms flow directly into the open roadsides and walk-ways.

Where special dumps or public "dustbins" and containers are provided, garbage is often dumped outside due to lack of capacity, poor collection, and/or public insensitivity. Open dumpsites within the university allow free access to rodents and flies; and often produce unpleasant and hazardous odours that may cause respiratory tract infections. Garbage can be seen strewn everywhere, scattered, or in small or large piles, around the university. Waste generation in University of Ibadan outstrips its collection and transport.



Two of the open dumpsites (a) adjacent Independence hall, (b). behind Kuti hall, found in the university.

Poor management of MSW is the order in the University of Ibadan. Across the university community, open dumping of refuse is practiced with poor management and lack of adequate waste management facilities. Despite the facts that refuse is being dumped at open dumpsite and along major roadsides, some facing residential halls and some open dumpsites located directly opposite lecture theatres and some in an open space very close to students lounge and relaxation centres. In the university system, the expectation is that adequate waste

management should be practiced but quite unfortunate that the disposal and collections of waste, in fact, the entire waste management process of the university is entrusted into the hands of private contractors who are also employees of Oyo state government- Oyo State Waste Management Agency, OYWMA. Therefore, the collection and sanitation of the university environment is left into the hands of these private waste collection contractors and cleaners who are contract staff employed by contractors by the University management.

Sanitation and disposal of waste baskets across all the students' halls of residence are left to the mercy of these private cleaners who visit student hostels to dispose and collect waste baskets and garbage. The private cleaners also take care of the regular cleaning of students toilets and bathrooms located across the student hostels. Poor conditions of the principal facilities for municipal wastes disposal make these cleaners work in difficult conditions of cleaning the toilets and bathrooms; washing the over-flowing drainages in the hostels. Most of the drainages are filled up to the extent that the cleaners abandoned working with them; water refused to flow in the toilets and bathrooms thereby making disposal of human excreta and urine difficult. This subsequently results to stench smells and odours all over the environment. Septic tanks, drainages and sewage disposal systems too are in bad condition hence liquid wastes are allowed to flow into major roadsides causing environmental pollution and having adverse effect on public health of students and other inhabitants within the university community. The graph below illustrates how often students perceived unpleasant odours around their hostels:

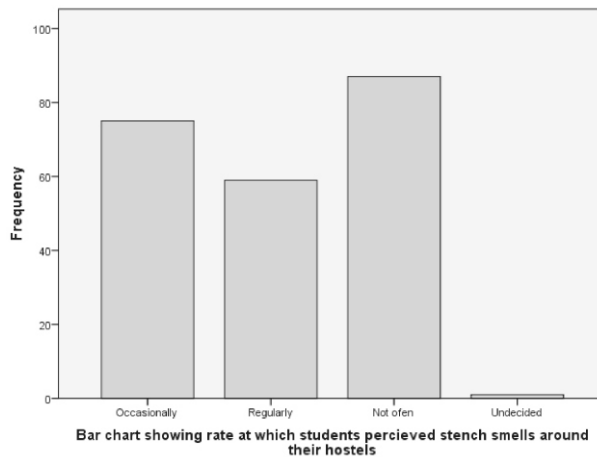


Figure 3: Bar chart showing rate at which students perceived unpleasant odours

From the bar chart above, it is clearer that 26.6% of respondents regularly perceive unpleasant odours; 33.8% perceive stench smells occasionally and 39.2% do not often perceive foul smells. This is in addition to 31.1% of students that conclude that the university has a poor drainage system. In fact, just 28.8% of all the students sort out their wastes before disposing them. And 57.7% do not sort out wastes at all. However, 56.3% of students visits clinic every four months for various environmental related illness ranging from Malaria fever to Skin rash. Out of those that visits clinic every four months, only 32.0% are for Malaria fever.

5.4: Frequency count of environmental related diseases treated at the University Health Centre between January, 2012 and June 2016:

5.4.1: Incidences of typhoid fever among students population: The line graph below in Figure 4 shows the frequency count and incidences of typhoid fever among students of the university. This line graph was deduced from analysis of secondary data collected from the records division of the University Health Centre- popularly known as JAJA Clinic. With the use of Microsoft excel 2013 version, we plotted the graph of number of students per month (from January 2012 to June 2016) against time. From figure 4 below, typhoid fever appears to be high on the increase around July, 2012. It drops throughout 2013 and later rises again between January and March, 2014. From March, 2014 its occurrence rate became more incidental at a fluctuating rate between 2 and 6 persons each month until May, 2016. The highest occurrence rate was recorded in September 2012 and later resurfaces again with increasing rate between January and March, 2014. It increases further between March and May, 2015 with a staggering stability around November, 2015 to March 2016.

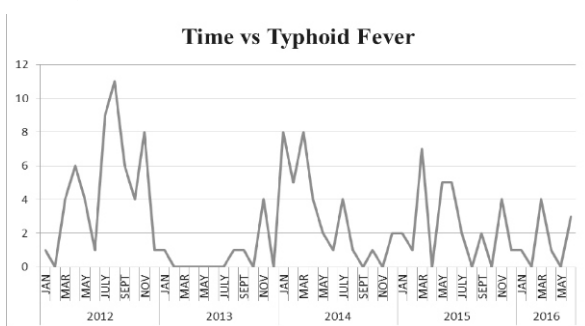


Figure 4: Line graph showing frequency count of Typhoid fever occurrences at JAJA CLINIC

5.4.2: Incidences of skin diseases among students population: Figure 5 below shows the timeline regression of Skin diseases with time among student population in the university. Occurrence rate of skin disease was very low between January and July, 2012. It increases gradually but later dropped in October, 2012. There was a rapid increase in occurrence of skin disease from January to July, 2013 compare to occurrences in 2012. Frequency count of skin disease was at a constant fluctuation until it reaches its peak in April, 2014. It drops rapidly to a lower rate in July, 2014 to further gradually increase to a high rate in April, 2015 and higher in October, 2015. The occurrence of skin diseases flows at a higher rate till April, 2016 without returning to its base rate of January, 2012.

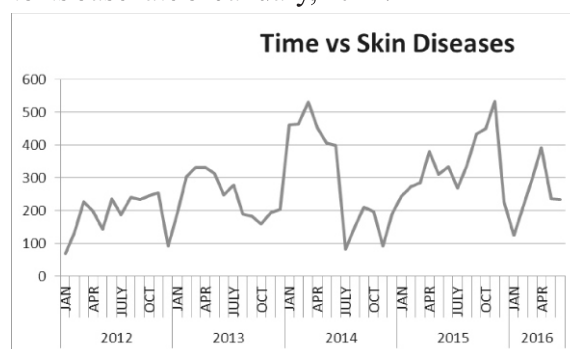


Figure 5: Line graph showing frequency count of Skin diseases occurrences

5.4.3: Incidences of Gastro-intestinal diseases among student population: from Figure 6 below, occurrences of Gastro Intestinal Diseases, (GID), keep increasing throughout our study time-frame with minimum occurrence slightly above 100 persons each month from January, 2012 to June, 2016. The occurrence became higher in April, 2012 and further increases gradually until July 2013. It later reaches its peak in April, 2014. It begins to fall rapidly from July, 2014 but refuses to return to its original monthly occurrence rate. Minimum of 100 persons were treated of GID in January, 2012, January, 2013, July and November, 2014. Cases of GID occurrences were more than 100 every month in the university (except January, 2012, January, 2013, July and November, 2014) since 2012. Occurrences increase gradually from July, 2014 to October, 2015- its second highest occurrence rate since 2012. This rate was kept stable until April, 2016.

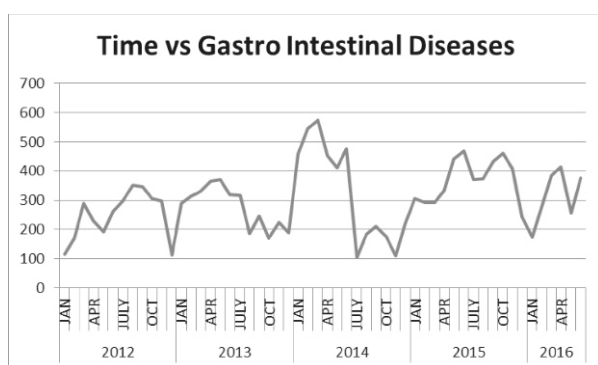


Figure 6: Line graph showing frequency count of GID occurrences

5.4.4: Incidences of Malaria fever among students population: from figure 7 below, Malaria fever occurrences increase between January and April, 2012. After July, 2012 it drops and increases again around April-July 2013. Away from July, 2013 it kept a fluctuating occurrence rate until it reaches May, 2015. The highest rate of occurrence was recorded for first time in May, 2016. There are approximately 300 Malaria fever cases every month since January, 2012.

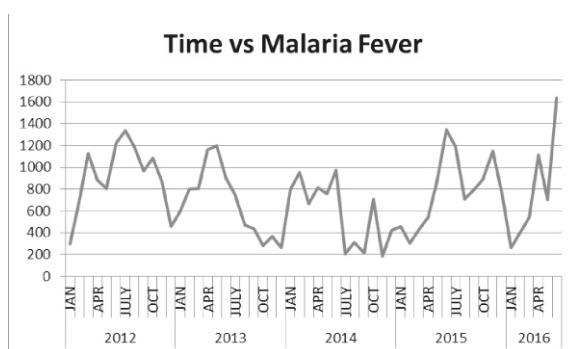


Figure 7: Line graph showing frequency count of Malaria fever occurrences

5.4.5: Incidences of Respiratory tract infections among student population: from figure 8 below, occurrence rate of Respiratory Tract Infections, (RTI), increases with a steep slope from April, 2012 to August 2012. It later falls in October with a little fluctuation between January and July, 2013. It increases sharply to the highest rate in January, 2014 but gradually drops a little around May, 2014 until July when it sharply drops. RTI occurs increasingly at a slow pace until it reaches a higher rate in July 2015. It drops in January, 2016 to its original rate and later starts to gradually increases again in April, 2016.

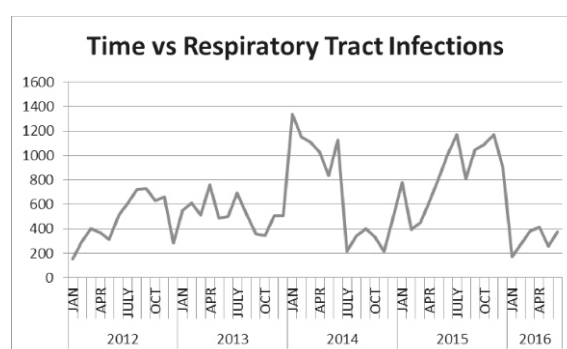


Figure 8: Line graph showing frequency count of Respiratory Tract Infections occurrences in the university.

5.5: Relationship and association between occurrences of environment related diseases in the university:

Table 1: A Pearson correlation table showing the relationship and association among environmental related diseases treated at JAJA Clinic between January 2012 and June 2016.

	Time	Malaria fever	Typhoid fever	Respiratory Tract Infections, RTI.	Gastro Intestinal Diseases, GID.	Skin Diseases
Pearson Correlation	Time	1.000	-.086	-.229	.182	.330
	Malaria Fever	-.086	1.000	.362	.445	.580
	Typhoid Fever	-.229	.362	1.000	.338	.214
	Respiratory Tract Inf.	.182	.445	.338	1.000	.811
	Gastro Intestinal Diseas.	.281	.580	.346	.811	1.000
	Skin Diseases	.330	.419	.214	.813	.912

Records of occurrences of Malaria fever, Typhoid fever, Respiratory Tract Infections, Gastro Intestinal Diseases and Skin diseases obtained from the university Health Centre (JAJA CLINIC) were correlated against time, t= 54 months. The correlation result gives the relationship and association of occurrences of the environmental related diseases in the university community. From the correlation results: for Time and Malaria fever, $r = -0.086$, which indicate that there is negative correlation between time and malaria. The implication of this is that malaria has no significant impact on the public health of students in the university within the time-frame of study. For Time and Typhoid fever, $r = -0.229$. This indicates that there is negative correlation between time and Typhoid fever. The implication of this is that Typhoid fever has no significant impact on the public health of university population within the time- frame of study. For Time and RTI, $r = 0.182$ which indicates that there is positive correlation against time. The implication is that RTI has a significance, but weak, on the public health of

the university population. For Time and GID, $r = 0.281$. There is positive correlation between time and Gastro Intestinal Diseases. This implies that GID has a significant effect on the public health of the university population. For Time and Skin diseases, $r = 0.330$. This is a positive correlation between time and skin diseases. The implication is that skin diseases have an impact on the public health of the university population under study.

The relationship between the occurrences of these environmental diseases among university population can be explained thus: the probability of a person in the university to be sick of Malaria and Typhoid fever at the same time is 36.2%; and the probability of a person to be sick of Malaria and RTI is 44.5%, Malaria and GID is 58%, Malaria and Skin diseases is 41.9%. Typhoid and Respiratory diseases, 33.8%; Typhoid and GID is 34.6%; Typhoid and Skin diseases is 21.4%. Respiratory Tract Infections and GID is 81.1%; RTI and Skin diseases is 81.3%; GID and Skin diseases is 91.2%.

	Model	Std. Error	T	Sig
Malaria fever	-0.13	0.008	-1.743	0.088
Typhoid fever	-1.647	0.801	-2.056	0.045
Respiratory Tract Infections	-0.007	0.012	-0.593	0.556
Gastro Intestinal Tract Infections	0.074	0.053	1.414	0.164
Skin diseases	0.019	0.049	0.388	0.700

Table 2: A model summary table showing effects of environmental diseases on the university student population at every unit increase in time.

From the model table above; Malaria, Typhoid, and RTI has a negative effect with time; -0.13, -1.647, and -0.007 respectively. Therefore, they have no contribution to public health of the university population at every unit increase in time and hence can be rejected. But for Gastro Intestinal Diseases; there is 0.074 increase in occurrences for every unit increase in time and for skin diseases there is 0.019 increase in occurrences for every unit increase in time.

CONCLUSION AND RECOMMENDATION

From our research study, it was discovered that waste management is poorly

regulated in the University of Ibadan community hence it contributes significantly to the public health of the university population, especially students who live in the hostels. Open dumping of refuse is the order of practice in the university. Open dumpsites contribute majorly to environmental pollution and serve as comfortable breeding zones for various species of flies, mosquitos and rodents that are vector carrying organisms. Poor management of sewage and drainage systems also adds to environmental hazards faced in the university community. Most of the open drainage systems are out of capacity to make liquid waste flow in them. Sewage systems, too, need urgent attention as most of them no longer hold waste and hence allowing it to flow to roadsides and the open environment. This eventually results to environmental pollution- stench smells that causes respiratory tract infections (such as

asthma) among the university population. Foul odours are perceived everywhere around the university community, especially areas where soakaway systems are broken down.

Higher occurrence rate of Gastro Intestinal Diseases and Skin diseases suggests the necessity for a research study on the quality of water consumed by members of the university community. All sources of water entering the university must be questioned and researched upon to investigate their quality assurances. Environment at which cafeteria and butteries within the university produce and sell their food must be monitored and regularly screened. Gastro Intestinal Diseases like dysentery and diarrhea are contracted through food produced from a dirty environment, poor drinking water results to skin diseases occurrences and probably Typhoid fever.

The fact that the university management through the Environmental unit of its University Health Services had not taken serious drastic measures towards preventing environmental pollutions by monitoring of the environment where food consumed by its members is produced is a serious issue. This further raises the need for more environmental health research studies in the university and the University management must be involved so that they can understand the essence of the study.

Based on the findings of this investigative research, it became necessary to make these recommendations, which hopefully will be used as policy formulation guide policy makers in environmental and health department of the University Health Services or those concerned with environment and health issues of the university.

There is also a need for a well-structured and adequately equipped environmental health department. This environmental health department can be an arm of the University Health Services so that linkages of environmental issues and public health of both students and workers in the university can be more coordinated, monitored and regularly screened for any immediately observed incidence. There should be regular fumigation of students' hostels and other staff buildings. The fumigation should be done at least once in every academic session. This will

reduce the infestation rate of mosquitoes and other vector carrying flies.

Open dumping of refuse should be discouraged in the university. Covered Waste containers should be provided at strategic locations for dumping of refuse. This will ease waste disposals and collections. It reduces environmental pollution too. Waste baskets should be colour-coded for sorting of waste. This will aid waste collection and transportation within the university.

The university should stop putting the collection of waste in the hands of private contractors of Oyo State Waste Management Agency, (OYWMA). The university should begin an initiative of recycling waste generated within the university. Waste collected in the university can be recycled to produce other important commodities. For instance, food wastes that form the largest, 51.7%, of waste generated in the university can be recycled into organic fertilisers. This implies that the university can be a producer of organic fertilizer. This can add more money to the Internally Generated Revenue of the university.

The university management must provide adequate sewage and liquid waste disposal system for students living in the hostels. This will put an end to liquid wastes being disposed to the open environment. Most of the students pour liquid waste from higher floors to the ground floors. Some of them store liquid waste (providing breeding zones for mosquitoes and other flies) in buckets closer to their living rooms.

The university management must provide covered waste baskets for students to dump garbage instead of open baskets currently in use. The use of open waste baskets in an environment where food waste form the largest part of the waste generated is improper. It gives rooms for various flies and vectors to comfortably breed causing diseases of public health. In addition, immediate repair of all broken down open drainages and soakaway must be put in place.

This research study has been able to give a warning signal of incidences of Gastro Intestinal Diseases and skin diseases in the university community. It therefore raises the necessity of a research study to test and determine the quality assurance of all sources of water entry the university. An enquiry study of the quality of water consumed by members

of the university is needed; cafeteria environments where food is produced must be regularly screened and monitored.

Finally, the University should ensure regular collection of wastes at least every two days intervals. The current trend of collecting waste once a week should be discouraged, especially when open dumpsites is practiced. Research projects in waste management and its effects on public health should always be carried out in the university periodically. Projects aimed at improving the environmental health and lives of students and workers in the university must be funded and implemented by the university. Summarily, as a practical follow up to the outcome of this research study, the university

must begin the initiative of formulating and adopting a “Health Safety and Environment policy”. Policy document of this nature must involve the entirety of the university community; hence environmental safety and health will be seen as a public and collective task and responsibility.

The incorporation of all these measures including adequate education, campaign and sensitization of the general university community including students and staff on their role in combating environmental pollution to prevent health hazards is highly necessary. Thus a holistic approach is required to curb environmental pollution and regularized effective waste management.

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