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Relevance of Adequate Sewage disposal on Disease Prevalence Amongst Sub-urban Communities in Delta State: a Case of Uvwie

IGERE, B. E. [1,2,*], ***EYETAN, T. E.*** [3], ***OJOH, C. O.*** [3]

[1] *Department of Biological Sciences, Microbiology Unit Dennis Osadebay University Asaba, Delta State, Nigeria*

[2] *Biotechnology and Emerging Environmental Infections Pathogens Research Group (BEEIPREG), Department of Biological Sciences, Microbiology Unit, Dennis Osadebay University Asaba, Nigeria.*

[3] *Department of Urban and Regional Planning, Dennis Osadebay University Asaba, Delta State*

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ABSTRACT

The study investigated Relevance of Adequate Sewage disposal on Disease Prevalence Amongst Sub-urban Communities in Delta State: a Case of Uvwie. The study used combined expo-factor and survey research designs, collecting medical case reports from Uvwie and distributing questionnaires to five communities. The dataset included medical records from the Central Hospital in Ekpan from 2023. The questionnaires were distributed using systematic sampling to ensure coverage. A total of 180 questionnaires were distributed evenly across five communities, with 36 per community and each fifth building. The data was analysed with Multiple Regression. The physicochemical properties of sewage discharged in a specific area revealed the ability of disease-causing microorganisms to grow rapidly. These may infect nearby populations. The most common illness was diarrhoea, and the least common was typhoid. Diarrhoea is common in Effurun, but dysentery is unlikely, whereas dysentery is prevalent in Uviwe. The study found a significant correlation ($P<0.05$) between indiscriminate sewage disposal and disease prevalence in Uvwie (R-value = 0.799). The study attributed 64% of disease prevalence to indiscriminate disposal and 36% to climate. The indiscriminate disposal of sewage contributes to the spread of diseases. Approximately 48.9% of survey respondents believe sewage causes breathing problems. Furthermore, 45% of respondents recommend treating sewage before disposal, while 17.8% suggest cleaning gutters. The study emphasises the importance of effective sewage disposal management and makes recommendations for improving regulatory agencies, enforcement mechanisms, and agency-Public Health Department collaboration.

1. INTRODUCTION

The beauty of any environment lies on its good sanitary condition as well as the wellness of components. This is so because, when an environment is clean, the lives of the citizenry are not threatened by illness and disease (Igere et al., 2020). Proper sewage disposal and the dumping of waste (liquid)

*Corresponding author, e-mail: eyetantega@yahoo.com
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from our homes, industries and public outfits at a specific place or in government provided sewer possess potential of reducing associated health risk to the public (Opara and Berchtold, 2008; Igere et al., 2022a; Ojoh et al., 2023). Any relative failure or non-compliance to global sewage disposal as well as reuse acts may reveal potential health implications both within local communities and the world which may also be associated with the health status of the populace. Some recent records from related global investigators have shown that four out of every 10 human subjects are without adequate sanitation and sewage disposal especially in Nigeria. It is feared that this figure may increase to half the world's population between 2025-2030 (GWP, 2020). It is also envisioned that people suffering from water-borne diseases associated with poor sewage disposal occupy half the world's hospital beds.

In Uvwie, Delta State, a site specific picture reveals neglect on the relevance of sewage in recent time which has shown implications on inhabitants. This observation has been stressed by the Delta State Government which enabled the establishment of Delta State Environment Protection Agency (DELSEPA) and Delta State waste management board in 2001 to monitor environmental quality, ensure a clean and safe environment, avoid indiscriminate sewage disposal and ensure environmental wellness. However, despite the government efforts at making the environment clean in Uvwie, the populace seems to remain care-free/careless about their environment and wellness. Many of them seem not to be aware of the interrelatedness of sewage disposal structure and diseases distribution in any environment. Furthermore, victims of environmental related diseases such as malaria fever, typhoid fever, dysentery, cholera and diarrhoea is on the increase (Igere et al., 2022b; Opara and Berchtold, 2008). Some related investigators have reported that such increase may be associated with environmental pollution via poor sewage system, structure and practice.

In major Uvwie residential area, the impact of poor sewage system and practice has also affected constructed buildings (in area of Orumarho and Alegbo), arising from over-flow of surrounding tank thus, resulting a breeding site/hub for bacteria, parasites and viruses flies, cockroaches, rodents as well as other aquatic lifes'(Reynolds, 2000; Efe and Ojoh, 2013). In addition, the indiscriminate discharge of sewage has also impacted water quality of immediate environment, ecosystems damage as a result of its organic and nutrient content, promoting oxygen depletion and proliferation of algae and other aquatic plants (Okereke et al., 2016). In spite of the aforementioned potential health implications of poor sewage disposal practice within the study area, there remains dearth of document on study. It is as a result of the above this study was conducted to assess the relevance of sewage disposal on disease prevalence Uvwie, Delta State. The study address following questions: what are the diseases associated to improper disposals of sewage? What are the management measures put in place to regulate indiscriminate sewage discharge? Are the inhabitants of Uvwie aware of the implication of sewage in their environment? Are the techniques/ methods

used or proffered by government adequately creating awareness about the health implication of poor sewage management?

2. CONCEPTUAL ISSUES

This study is premised on the concepts of Ecological Sanitation (ECOSAN), and Responsible Environmental Behaviour (REB). Ecological Sanitation is an integrated sanitation strategy developed through traditional knowledge and biological science in which natural processes are utilized to transform human waste into useful minerals (Esrey et al., 2001). Historically, ecological sanitation are based on natural processes and as such have been understood and practised by indigenous cultures for centuries. The first international conference on ecological sanitation (ECOSAN) was held in Nanning, China in 2001 and included scientist and promoters from Europe, Africa, Asia and latin America. Since that time ECOSAN have been initiated around the world. ECOSAN's view point sees human waste as opportunity. When properly designed and operated, ECOSAN system provides a hygienically safe, economically and closed-loop system converting human waste water into nutrient. The main objectives of ECOSAN are:

- To reduce the health risk related to sanitation, contaminated water.
- To prevent the pollution of surface and ground water.
- To reuse nutrients or energy content of waste (International Waste Association, 2003).

Esrey et al. (2001) asserted that ECOSAN can be defined as a system that prevent disease, promote health, protect the environment and conserves water, recover and recycles nutrient and organic matter. Thus, the most important advantages of ecological sanitation concept are improvement of health by minimizing the introduction of pathogens from sewage disposal, promotion of a holistic inter-disciplinary approach etc. It is become increasingly apparent that parasitic organisms are not only common and integral part of the ecosystem but they also influence the abundance of population (man or plant). These pathogens can cause their host severe health problems (Hudson et al., 2002).

According to Morgan (2004) sewage systems have been developed in many countries but ECOSAN facilities can reduce the environmental pollution that sewage system cause. Approximately, 90% of sewage systems in developing countries do not treat waste prior to discharge causing pollution and increasing health risks (Winblad, 1997). Thus, this concept recognizes excreta and waste water from household not as waste but as resources that can be used again.

Responsible Environmental Behaviour (REB) concept

REB is the actions taken by individuals or a group of individuals to do what is right to protect the environment that take into account, in a conscious way, the perennial and harmonious relationship between these actions and the environment (Cottrell and Graefe, 1997; Kurtycz, 2005). Other investigators see REB as a self-determined behaviour aimed at consciously influencing

the environment positively (Emmons, 1997) (see Fig 1).

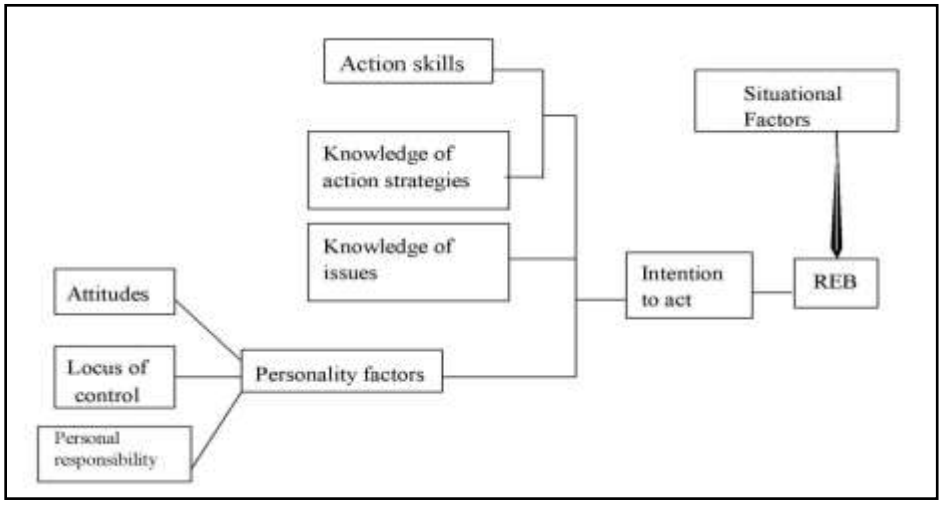

Fig 1: Model of Responsible Environmental Behaviour
Source: Hines et al. (1987)

Responsible environmental behaviour is concerned with doing what is right. But to do what is right is not easy if one does not know the value scale of what is right and what is wrong. There is a wealth of evidences to suggest that three categories of factors contribute to REB (Hungerford and Volk, 1990; Kurtycz, 2005). These are; (i) cognitive factors which include the levels of understanding of environmental issues and how to take action (ii) psycho-social factors that include attitude towards environmental issues, and sense of responsibility to do something to reduce environmental degradation and (iii) demographic factors such as gender and the level of educational attainment. Hines et al. (1987) conceptualized the relationship between the factors.

The central assumption in this study is the need to understand the way people think before we can effectively communicate information for responsible environmental behaviour. From the study, it is evident that awareness, the capacity to act and acceptance of the norm of sound environmental practices are responsible for the responses. A communication model is developed from the standpoint of the study. Therefore the model is based on the following principles:

- Definition of the problem and the need to solve the problem.
- Definition of responsible environmental behaviour.
- Translate REB to the interests and perception of the individual.
- Kind of communication useful to creating the necessary awareness.

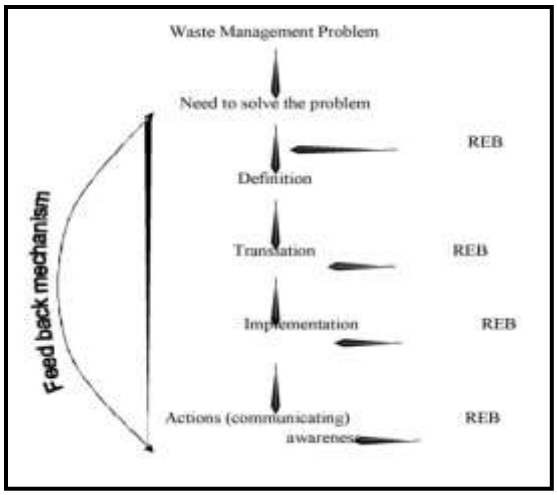

Fig 2: The Communication Model allows us to understand the complex framework in which environmental awareness practices take place.

3. MATERIALS AND METHODS

The study was conducted in Uvwie Local Government Area of Delta State (Latitudes $5^{o}33^{1}$N, $5^{o}35^{1}$N and longitudes $5^{o}29^{1}$E, $5^{o}45^{1}$E) (see Fig 1). It is a modal town, surrounded by other towns, villages and communities. The impact of the location has attracted high population and thus has increase the rate of sewage disposal. The area is characterized by hydromorphic soils, which is a mixture of coarse alluvial and colluvial deposits (Efe, 2002; Efe et al., 2013). Thus, the soils are poorly drained and accumulated with water because it is near the Atlantic coast, having a high water table close to the surface. Owing to the closeness to water table, if sewage is indiscriminately disposed it will pollute the water for drinking. Uvwie's population increased from 146,000 in 1991 to 191,472 in 2006. As a result, as the population grows, so will the volume of sewage produced.

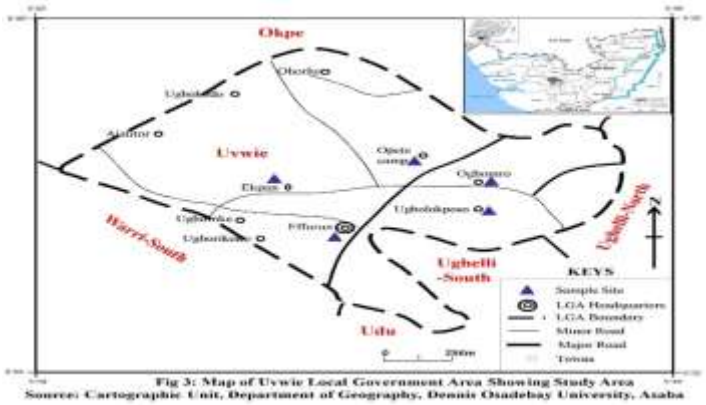

Fig 3: Map of Uvwie Local Government Area Showing Study Area
Source: Cartographic Unit, Department of Geography, Dennis Osadebay University, Asaba

The study adopted the expo-factor and survey research designs. This involved the use of medical case reports from Uvwie and the administration of questionnaire. The data includes medical records of diseases from the Central Hospital in Ekpan for year 2023. The

study area comprised several communities, including Ekpan, Effurun, Ogbomro, Ugbolokposo, and Opete Camp (see Fig 1). All other areas within these communities have identical land use types and housing patterns. The rationale for these selections is to ensure adequate spread; Efe (2005) used a similar approach to study areas of the metropolis and obtained significant results. In all, a total of 5 communities were selected for the study. The systematic sampling technique was adopted for the distribution of questionnaires and assessment of some physicochemical parameters. Disease distribution and occurrence data were collected from designated Hospital within study area such as: Data on diarrhoea reports, typhoid and dysentery cases reported by place of diagnoses were obtained from the central hospital in Ekpan. The medical record contains the number of patients treated for diarrhoea, typhoid and dysentery in 2023. The diseases data were extracted from medical records and contained diarrhoea, typhoid and dysentery in-patient and out-patient cases in 2023. The reasons for the choice of the hospital for data collection include reliability, and consistency in record keeping. A total of one hundred and eighty (180) questionnaires were distributed to the five communities. Thirty-six questionnaires were distributed to respondents in each community and every fifth building in the area.

The respondents represent 0.1% of the total population. The questionnaires were further administered to adult respondents who are educated in each community and in the case where the respondent was found to be not literate; an interpreter in the local language was made to mediate between the researcher and the respondent. The study used a test to retest method to ensure the reliability of ten questionnaires. The Pearson product moment correlation coefficient (PPMC) was used to establish the instrument's reliability. Three questions were selected to test the questionnaires' reliability. The questionnaires were validated through criticisms and amendments, and final copies were sent for field administration. Collected data were presented in tables, figures and analysed in percentages, simple descriptive analyses of the distributions and cross tabulation of variables were carried out. The data on sewage and prevalence of disease were analysed using a Multiple Regression. The Multiple Regression technique is a useful tool to analyse the rate of change that are caused in the variable by the independent variables. The data were entered in the Statistical Package for Social Sciences (SPSS) version 22 and double checked before analysis.

4. RESULTS AND DISCUSSION

The figures 4a-f below shows some of the physicochemical parameters analysed during the study including redox potential, conductivity, resistivity, total dissolved solids and salinity of released sewage within the study area. The report has shown the potential for the proliferation of diverse microbial potential pathogens. Such pathogens when exposed to human may result disease situation especially amongst the population that is in close contact with the potential pathogen.

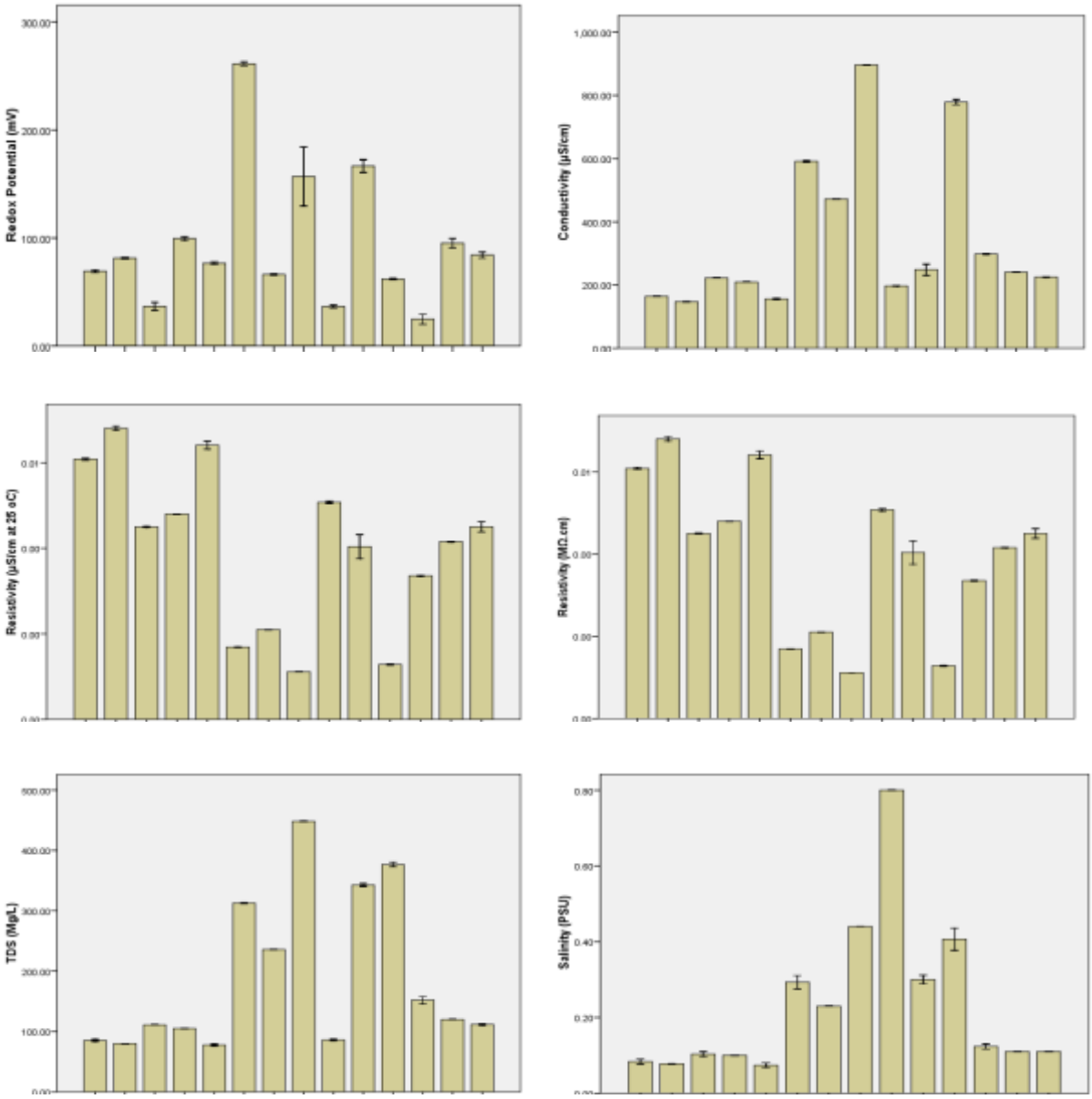

Fig 4: Physicochemical Parameters Analysed Of Released Sewage

Effect of inadequate sewage disposal

Table 1: Education

Education	**No of Respondents**	**%**
Primary Education	69	38.3
Secondary Education	83	46.1
Tertiary Education	28	15.6
Total	**180**	**100**

Source: Field work, 2023

Table 1 shows that 84.4% of the respondents has attained the basic education (primary education and secondary education) requirement and a very few (15.6%) of them

have acquired tertiary (university, polytechnic and colleges) education. Improving the level of education may increase the awareness and knowledge of the urban poor residents regarding environmental risks and hazards that may eventually influence them to improve the quality of their environmental management systems (Murad et al., 2012).

Table 2: Income rate per month

Income	**No of Respondents**	**%**
Less than ₦30000	32	17.8
₦31000-₦50000	94	52.2
₦51000-₦80000	31	17.2
₦81000 and above	23	12.8
Total	**180**	**100**

Source: Field work, 2023

Table 2 shows that 30% of the respondents are high income earners while 70% are low income earners. This implies that in Uvwie the standard of living is still on the low. Thus, the money required for proper sewage management and treatment is a problem. This is contrary to the assertion by Chen (2010) stating that Urban regions in general have higher income levels that are seen as primary factors to affect waste generation and management.

Table 3: Disposal of sewage

Frequency	**No of Respondents**	**%**
Monthly	32	17.8
Annually	56	31.1
Biannually	77	42.8
Rarely	15	8.3
Total	**180**	**100**

Source: Field work, 2023

Table 3 shows the response of respondents towards their sewage disposal. 42.8% of the respondents were of the view that they dispose their sewage biannually while, 8.3% have a contrary view that they rarely do dispose their sewage. This is an implication that the most inhabitants of Uvwie dispose their sewage biannually. Poor sanitation poses a high wealth risk to communities (US EPA, 2004).

Table 4: Factors militate against proper sewage disposal and management

Factors	**No of Respondents**	**%**
Income	27	15
Education	42	23.3
Infrastructure and facilities	71	39.5
Population	40	22.2
Total	**180**	**100**

Source: Field work, 2023

Table 4 shows the response of respondents towards factors that militate against proper sewage disposal and management. 39.5% of the respondents were of the view that infrastructure and facilities is the basic factor that hampers proper sewage disposal while, 15% are of the view that income hinders the disposal of sewage. It is very often believed that the people with low levels of income have a tendency to degrade the environment by practicing improper methods of environmental management systems (Murad et al., 2012). Sewage treatment facilities can be major sources of pest and vector mosquitoes (Whelan, 1988; Efe and Ojoh, 2013).

Table 5: Effects of poor sewage management

Effects	**No of Respondents**	**%**
Diseases	101	56.1
Groundwater pollution	55	30.6
Poor aesthetic view	24	13.3
Total	**180**	**100**

Source: Field work, 2023

Table 5 shows the response of respondents on effects of poor sewage management. 13.3% are of the view that aesthetic view of the environment is altered through poor sewage management while, 56.1% of the respondents were of the view that the effect of poor sewage management is the prevalence of diseases. Proper sewage disposal from our homes, industries and public outfits at a specific place or in government provided sewer will reduce the risk of diseases to public health (Opara and Berchtold, 2008).

Prevalence of diseases

Table 6: Diseases suffered from indiscriminate sewage disposal

	Severity scale/percentages							
Diseases	**1**	**%**	**2**	**%**	**3**	**%**	**Total**	**%**
Dysentery	54	30	72	40	54	30	180	100
Typhoid	90	50	54	30	36	20	180	100
Diarrhea	36	20	54	30	90	50	180	100

Source: Field work, 2023

Table 6 and Fig. 5 show the scale of severity, where 3 is high influence, 2 is moderate influence and 1 is low influence. Indiscriminate disposal of sewage contributes to disease in varying ways. In the distribution of sewage contribution to diseases, 50% of the respondents see diarrhoea as one major disease resulting from indiscriminate sewage disposal while, 90% of the respondents are of the view that typhoid is the least disease associated to sewage disposal. Lack of potable water and poor sewage effluent are responsible for billions of such cases of diarrhoeal illness which kill two million children each year (Talaro and Talaro, 2002).

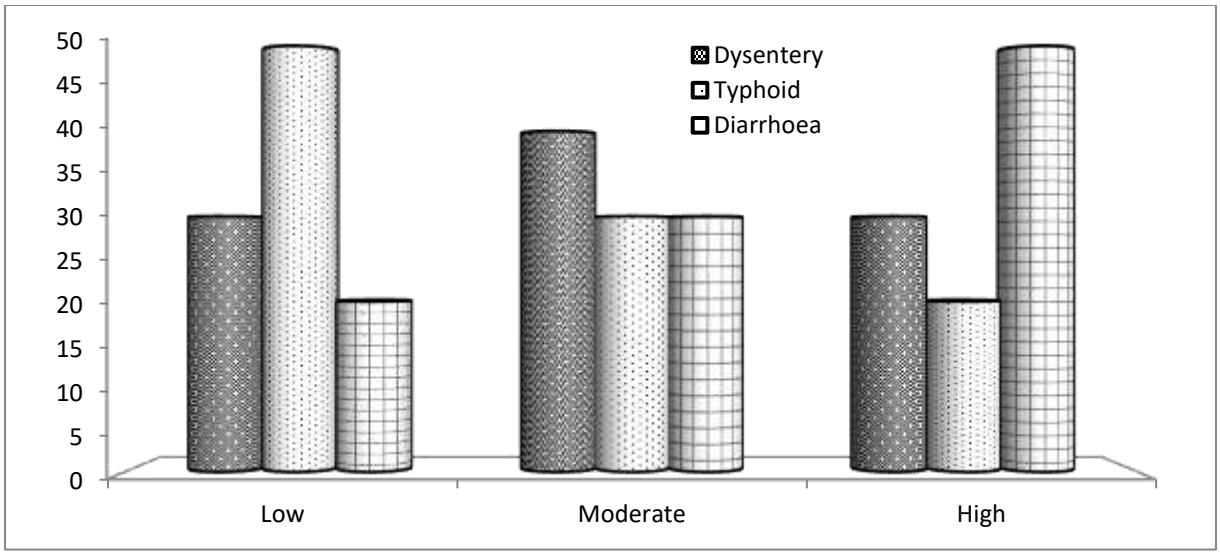

Fig 5: Percentage contribution of occurrence of diseases

Table 7: Disease distribution in Uvwie

Communities	**Typhoid**	**Diarrhoea**	**Dysentery**
Ekpan	48	31	77
Effurun	23	13	9
Ogbomro	37	78	11
Ugbolokposo	18	19	24
Opete camp	6	27	1
Total	**132**	**168**	**122**

Source: Ekpan Central Hospital Records, 2023

Table 7 reveals that in Uvwie the high prevalence of diarrhoea is highest. However, there is a low prevalence of dysentery. The infectious agents associated with diarrhoeal disease are transmitted chiefly through the faecal-oral route (Byers et al., 2001). Most of the illnesses resulting from exposure to inadequately treated sewage are relatively high they can become serious in more vulnerable populations, including pregnant women, young children, the elderly, and people with suppressed immune systems (Gerba et al., 1996).

Relationship between sewage and diseases

Table 8: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	Remark
1	**.799[a]**	**.638**	**.634**	**.403**	**.638**	**155.760**	**2**	**177**	**.000**	Significant

a. Predictors: (Constant), Dysentery Prevalence in Uvwie, Typhoid Prevalence in Uvwie

Source: SPSS Output

Table 8 shows the model summary of the relationship between indiscriminate sewage disposal and diseases. There is a strong correlation between sewage and disease at R

of 0.799 where 64% of diseases is attributed to indiscriminate sewage disposal at an r^2 value of 0.638. However, the remaining 36% of disease prevalence could be attributed to climatic factors. At P<0.05, the model is significant. Thus, the null hypothesis is rejected and the alternative hypothesis is accepted stating that the prevalence of disease is significantly dependent on sewage disposal in Uvwie.

Table 9: Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Partial	Part
1	(Constant)	3.159	.168		18.805	.000	2.828	3.491		
	Typhoid Prevalence in Uvwie	.580	.045	.677	12.993	.000	.668	.492	.699	.588
	Dysentery Prevalence in Uvwie	.174	.044	.205	3.930	.000	.087	.261	.283	.178

a. Dependent Variable: Sewage
Source: SPSS Output

Table 9 shows the standardized beta coefficient table. At P<0.05, the beta symbols for typhoid and dysentery are positive, meaning that as indiscriminate disposal of sewage continues so also the prevalence of diseases increases.

Table 10: Sewage affects respiratory organs

Perception	**No of Respondents**	**%**
Strongly agreed	88	48.9
Agreed	63	35
Undecided	12	6.7
Disagreed	9	5
Strongly disagreed	8	4.4
Total	**180**	**100**

Source: Field work, 2023

Table 10 shows the response of respondents towards the effect of sewage on respiration. 48.9% of the respondents were of the view that sewage affects respiration while, 4.4% have a contrary view that indiscriminate disposal of sewage does not result to respiration difficulty.

Table 11: Sewage contaminates water sources

Perception	**No of Respondents**	**%**
Strongly agreed	65	36.1
Agreed	42	23.3
Undecided	3	1.7
Disagreed	13	7.2
Strongly disagreed	57	31.6
Total	**180**	**100**

Source: Field work, 2023

Table 11 shows the response of respondents towards the effect of sewage on water sources. 36.1% of the respondents were of the view that sewage pollutes water sources while, 1.7% where indifferent on the issue. Contaminated water (sewage) is one of the path ways of transmitting typhoid and para – typhoid, this occurs if a person handles, eat or drink food and water respectively that have been contaminated with sewage contain the bacteria (Reynolds, 2000).

Sewage management

Table 12: Methods to manage sewage

Methods	**No of Respondents**	**%**
Cleaning of gutters	32	17.8
Building sewers	67	37.2
Treatment before disposal	81	45
Total	**180**	**100**

Source: Field work, 2022

Table 12 shows the response of respondents on method of managing sewage. 45% of the respondents were of the view that the best way to manage sewage is to treat it before disposal while, 17.8% suggested that the cleaning of gutters is the way sewage can be managed. Poor maintenance of the sewerage system by the local bodies and development authorities (in their respective areas of maintenance) has resulted in blocking and overflowing of sewers, open manholes and back-flows (Whelan, 1981). However, lack of environmental awareness appears to be a very important factor that influences people to degrade the environment (Murad et al., 2012).

Residents in Uvwie, Delta State dispose of their sewage biannually, posing a significant health risk to the community. The lack of infrastructure and facilities impedes proper sewage disposal, reflecting income levels that tend to harm the environment through inadequate environmental management systems. Sewage disposal without regard for aesthetics can change the appearance of the environment, increase the proliferation of pathogenic microbes, and increase the prevalence of diseases like typhoid, dysentery, and diarrhoea. Effurun has the highest prevalence of diarrhoea among pregnant women, young children, the elderly, and people with weakened immune systems. The study discovered a link between indiscriminate sewage disposal and the prevalence of diseases in the community. To manage sewage, global standard treatment measures should be recommended, and compliance with global standards must be maintained.

The study emphasises the importance of proper management methods for utilising indiscriminate sewage disposal in Nigeria. Recommendations include strengthening regulatory agencies' ability to monitor and enforce regulations, identifying appropriate enforcement mechanisms, and encouraging greater collaboration between regulatory agencies and the Public Health Department. Planners should take a strategic approach to

*Corresponding author, e-mail: eyetantega@yahoo.com
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permitting developments and new sewage treatment plants, allowing for a single large treatment plant to serve multiple communities while lowering costs associated with monitoring, operation, and maintenance. Sewage plants should create a comprehensive Sewage Rehabilitation, Operation, and Maintenance Plan for their existing plants to ensure compliance with the original design specifications. An environmental monitoring and management programme should supplement the plan, and stakeholders should work with appropriate financing mechanisms such as development banks, private sector financing and appropriate sewage and water service charges.

5. CONCLUSION

The study examined the effect of inadequate sewage disposal on the prevalence of disease in Uvwie, Delta State. Literatures as well as data from the study have proven a positive relationship between indiscriminate sewage disposal and the prevalence of diseases. Indiscriminate disposal of sewage has a profound effect on the environment, wealth and health of the populace. Management measures necessary to mitigate indiscriminate disposal of sewage were suggested. Therefore, both the government and environmental agencies should keep up to the challenges of sewage management for a healthy environmental.

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Conflict of Interest

Authors declared none

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