



# EVALUATION OF DOMESTIC LIQUID WASTE MANAGEMENT SYSTEM IN THE VOLTA REGION OF GHANA. (A CASE STUDY OF HOHOE TOWNSHIP)

AUSTIN D. AMOAKO, SETH Y. AHIABOR, ERNEST ADZIM, ISAAC ADJOKATSE, PROSPER ADIKU, JOHN MACHATOR, FELIX AMOFA, FORGIVE AWO NORVIVOR

(Received 22 September 2023; Revision Accepted 30 October 2023)

## ABSTRACT

The study evaluated liquid waste management in the Hohoe Township in the Hohoe Municipality in the Volta Region of Ghana. Knowledge level of the respondents on liquid waste management as well as health effects of poor liquid waste management were addressed in detail. The study was also geared towards the improvement of liquid waste management and disposal at the community and household levels by way of encouraging modern system of disposal and treatment facilities as well as providing awareness about existing disposal systems in the area. The significance of the study was to create awareness in Hohoe township on the relationship between liquid waste and disease associated with its poor management. The targeted premises of one hundred (100) respondents were selected in the study area by which simple and accidental sampling procedures were used based on the views and comments of the respondents. Results from the study indicates that majority of respondents 87(87%) confirmed that, the latrines are not regularly dislodged while 13(13%) of the respondents stated that the latrines are dislodged regularly while majority of the respondents (55%) dispose domestic liquid waste on to the ground to avoid dust. It was concluded that environmental sanitation management is not only about solid and hazardous waste management but requires Integrated Waste Management approach. Individual households and the Environmental and Health department of the Hohoe municipal Assembly must pay attention to the management of liquid waste in the municipality. The study revealed lack of commitment in dealing with the problem including the introduction of scientific and engineered methods of liquid waste disposal.

**KEYWORDS:** Waste water, Excreta, Disease, Health, Environment, Municipal

## INTRODUCTION

The most important urban issues facing the globe today are those related to drainage and sewer systems, particularly in sub-Saharan Africa (Yazdanfar & Sharma, 2015).

Since the sewer and drainage systems are essential component of the urban water infrastructure, they must be maintained and operated with caution in a sustainable and logical manner (Mohammadi et al., 2019). Providing a system that complies with environmental requirements for the populace is the

**Austin D. Amoako**, Environmental Science Year IV Candidate – University of Ghana Graduate School - IESS

**Seth Y. Ahiabor**, Fred N. Binka School of Public Health - University of Health & Allied Sciences – Ghana

**Ernest Adzim**, Environmental Science Year IV Candidate – University of Ghana Graduate School - IESS

**Isaac Adjokatse**, Environmental Science Year IV Candidate – University of Ghana Graduate School - IESS

**Prosper Adiku**, Environmental Science Year IV Candidate – University of Ghana Graduate School – IESS

**John Machator**, Global Communities Ghana – USAID En - WASH Project.

**Felix Amofa**, Fred N. Binka School of Public Health - University of Health Allied Sciences.

**Forgive Awo Norvivor**, Department of Family and Community Health - University of Health & Allied Sciences - Ghana.

primary goal of the technical administration of these networks (Smith et al., 2020). This calls for in-depth network understanding as well as routine network maintenance. Many African towns now have outdated drainage systems, which puts the locals at risk of unplanned breakdowns that could interfere with surface operations as well as sewage service (Tscheikner Gratl et al., 2020). Particularly in areas where groundwater is primarily utilized for potable water, major concerns include sewer leaks, backups, network overflows, and deteriorating infrastructure (Jagai et al., 2017).

Liquid waste management has become one of the public health issues for some years now due to the health-related problems it poses to human and the environment. Improper liquid waste management results into health-related problems such as typhoid fever, cholera, malaria, worm infestation, bad odour, and other liquid waste related diseases (UNICEF, 2019). Liquid waste includes human excreta (faeces and urine), domestic effluent that is waste generated from kitchen, bathrooms and sinks, factories wastewater, surface waste water that is rainwater, streets washing, public drains and gutters. Among all these, it is the human excreta and domestic effluent that pose so much public health and environmental problems. Some of the excreta related diseases are caused by viruses, bacteria and parasites. Diseases are spread through contamination of foods and water or through contact with contaminated soil, the pathogenic organisms enter the body through the mouth or skin. In other to control excreta related diseases, it is necessary to have environmental safeguard including sewage management. The necessity of the safe disposal of sewage or human excreta is one of the first essentials to the protection of public health. The goal of improved sanitation is to prevent disease causing organism which are present in excreta from being transmitted to other people. In other to design an effective sanitation programme, it is important to understand how these organisms are transmitted. In most communities in Hohoe town, people do not give much attention to the liquid waste as done to solid waste by the Zoom Lion and the Environmental Health and Sanitation Unit.

According to Kumar and Samadder (2017), "waste is any unwanted material that is generated as a result of human activities or body metabolisms." This definition includes all waste types that are formed as by-products of biological processes and human activity, such as solid, and liquid.

The type of waste under discussion is liquid waste and how it is managed in order not to pose any health problem to human life. Liquid waste includes the following: human excreta as the main objective (faeces and urine), domestic effluent that is wastewater from the kitchen, bathrooms and sinks, factories wastewater and surface wastewater that is rainwater, street washing, public drains and gutters. Among the four, it is the first two that pose so much

of a problem and much attention is normally given to them by the health inspectors by Atindanbilah (2003). In Ghana today, the concern with waste management involves the necessity for the safe disposal of night soil or human excreta and that of wastewater produce from our homes and industries, such as restaurants and other places where liquid waste is produced. In part of Hohoe township, liquid waste management practices are not effective as compared to solid waste. The rate of waste generation and its management in the Hohoe municipality is a matter of concern to the Assembly. With the increasing influx of people and the rapid urbanization, huge amount of human and industrial waste is generated at an alarming rate.

Wastewater is normally dislodged into open earth's drains which are not maintained in most of the urban settlements of which Hohoe township is no exemption. The result is the choked drains and small ponds or streams in addition, the odour and the stench emanating from such places or areas pollute the air, very much unpleasant, affect the aesthetic beauty of the environment and above all pose public health threat. This study therefore seeks to evaluate the liquid waste management systems with the Hohoe municipality of the volta region of Ghana.

## LITERATURE REVIEW

Many studies have been conducted and a lot has been said and written about liquid waste. To say, liquid waste does not only limit itself to human excrements, but all sort of wet refuse as described by Atindanbilah (2003), that wet refuse is composed of human excreta (faeces and urine), domestic effluent (wastewater from kitchen, bathrooms, and sinks), factories waste water and surface water (rain water, street washing, public drains and gutters).

According to Hall (1992), human and animal excreta contain nutrients like those of artificial fertilizer and therefore could be incorporated into composts. Composting too is a good soil conditioner which can improve the fertility and the dependency on imports. In USA for instance, 91% aluminum is recycled annually.

Ghana Environmental Protection Agency (EPA-2001), states that industrial wastewater treatment in Ghana is minimal. Some industries and abattoirs carry out some primary treatments. Most of the treatment facilities in Ghana are for treating faecal sludge and sewage. Sewage treatment systems receive waste from sewerage system while faecal sludge treatment plants are fed by trucks carrying waste from septic tanks, public toilets. Following a monitoring survey on the number, status, treatment methods and distribution of both faecal sludge and sewage treatment in Ghana is well managed and treated. Kumasi being an inland city in Ghana, is not highly industrialized as compared to Accra. Thus, industrial wastewater is not significant in quantitative terms. The principal generators of industrial waste water in Kumasi are the two breweries, a soft drink bottling plant and an abattoir. Together, they

generate about 1000 m<sup>3</sup> of effluent daily, all of which end up in the city's drains without treatment. Light industrial activities in the so call' Suame-magazine suburb and sawdust from these sawmills also generate significant amount of oil and leachate respectively which add to environmental pollution.

WHO, (1998) on Environmental Health Action Plan, stated that, the presence of improper waste management in communities contributes to the high risk of disease transmission, this does not only deal with liquid waste only, but all sort of waste generated in our communities. WHO (1998) further reported that in several African, American and European societies, human excreta, refuse are all regarded as repugnant substances best kept away from the sense of sight and smell. Therefore, products which come into direct or indirect contact with refuse or excreta is likely to be considered tainted or defiled in some way.

Rego (2005), noted that diarrhea is one of the main causes of death and disease among children under the age of five experience three episode of diarrhea per a year. This can be traced proximity to open sewage and other waste is a major cause of childhood diarrhea and inadequate waste collection and management can make this situation worse.

Tóth (2015), asserted that many of the acute health problem in developing countries especially those countries where malnutrition and food borne diseases are common due to poor standard of sanitation and personal hygiene. They observed that children are practically prone to diarrhea and other intestinal diseases or infections which add to mental and physical growth or even death. Most of their problems are mostly associated with improper liquid waste management, which pollutes sources of drinking water which is not treated before drinking.

Tong & Elimelech (2016), stated that, "the relationship between liquid waste management and public health needs emphasizing". This explains why it is important to the public health officer to enforce

the laws. The public health officer must therefore enforce the laws conferred on him to deter people from using sources of water bodies as final disposal sites of human excreta which ends up contaminating water sources and eventually destroying the aesthetic beauty of the environment and serves as major sources of illness.

According to Biswal (2013), "when sewage is discharged into large bodies of water which contains adequate quantities of dissolved oxygen, oxidation takes place without offensive odour arising" This assertion was further explained in the Environmental Control and Public Health team that raw domestic sewage in fresh state is typically light grey in colour to brown in colour. The team explained that, in it, however, the biodegradation of its organic content is constantly in progress. They emphasized that if the rates of oxygen demand exceed the rate at which oxygen can dissolve from sewer atmosphere, anaerobic conditions will result, and the wastewater will rapidly turn a black colour and hydrogen sulphide will be formed. The team indicated that sewage system is to maintain a healthy local environment. This includes the avoidance of local flooding and the minimizing of river pollution by preventing wastes from running directly into the river. However, according to Adjibolosoo (Daily Graphic-May, 11, 2007, p.9), it is common nowadays to see faecal matter in the gutter of a city. He further observed that this condition is more pronounced in gutters constructed within the premises of the stations in the city. He went on further to explained that certain measures need to be put in place to ensure cleaning of gutters looking at the attitude of a section of Ghana populace, especially those who have made these stations their abode.

Mensah and Larbi (2005), also stated that "The disposal of liquid waste has been an intractable problem throughout Ghana". He went on further to explain that landfills in Ghana are primarily open dumps. This is because several landfills are in ecological and hydrological sensitive areas which are generally operated below the recommended standards of sanitary practices.

## METHODOLOGY

### Study setting



Source: Map of study area.

The study was carried out in the Hohoe municipality within the volta region of Ghana. It covers a total land area of 1,172 km<sup>2</sup>, and makes up 5.6% of the region's total land area. It is situated nearly in the center of the region in latitudes 6° 45'N and 7° 15'N and longitudes 0° 15'E and 0° 45'E. Its capital, Hohoe, is about 220 kilometers from Accra, the national capital, and around 78 kilometers from Ho, the regional seat. The municipality's topography is primarily undulating and located in the rainy semi-equatorial climate zone. It experiences an annual rainfall of 1,016 mm to 1,210 mm. The rainy season lasts from late April through October. All year round, the temperature is high, ranging from 26°C in the coldest months to roughly 32°C in the summer. The Municipality is located in an ecological zone that transitions from forest to savannah. The forest gave rise to the transitional zone's vegetation. Savannah forests and tall grasses cover the majority of the western plains.

### Research Design

A cross-sectional research design was employed in this study. This design was found appropriate as it draws sample as it occurs in its natural setting. The sample size for the study was one hundred (100) respondents were drawn proportionately from four selected communities within the municipality namely Adabraka, Kpeme, Zongo and Baika. From each community, twenty-five (25) households were randomly selected and a respondent from these household was chosen.

### Ethical statement

To discuss the goals of the study, its significance, the anticipated time commitments from participants, a meeting of the study's participants was held. The purpose of the study was explained to all participants, after which written and verbal consent was received from each participant. All participants were assured of anonymity and the confidentiality of the information received from them. Permission also was sought from the Hohoe Municipal Assembly that is responsible for waste management in the municipality.

### Research Instrument

Researchers' structured questionnaire and interviews was used to assess knowledge, perception on matters liquid waste management within the Hohoe municipality. The questionnaire was validated by experts in the field. The interview unveiled an in-depth knowledge about liquid waste management in the municipality and thought to be important to the research which enable the researchers to describe what is currently happening in Hohoe municipality to determine the attitude of the inhabitant of the community on liquid waste management practices in the township of the Hohoe municipality in the volta region of Ghana. To ascertain the reliability of the data collection instruments, a pretest was done which yielded a Cronbach's alpha value of 0.68.

### Data Analysis

Descriptive statistics (frequencies, means, and percentages) were used to describe some demographic characteristics and responses to the questions. Results were presented in a form of bar charts, pie charts and tables for easy interpretation.

**Results and Discussion.****Table 1: Socio-demographic characteristics of respondents**

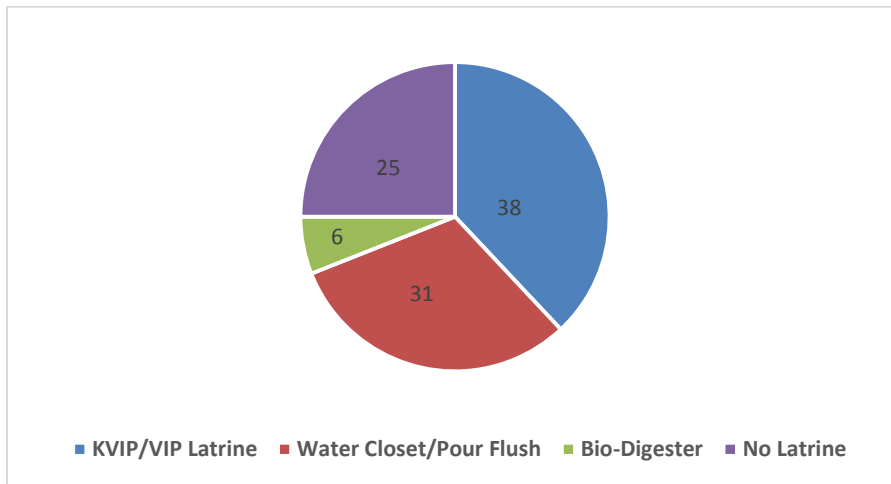
<b>Variables</b>	<b>Frequency (N = 100)</b>	<b>Percent %</b>
<b>Sex</b>		
Male	17	17
Female	83	83
<b>Age in years</b>		
21 – 30	23	23
31 – 40	35	35
41 – 50	18	18
51 – 60	16	16
61 and above	8	8
<b>Marital status</b>		
Single	47	47
Married	53	53
<b>Religion</b>		
Christian	42	42
Muslim	24	24
Traditional	34	34
<b>Level of education</b>		
None	20	20
Basic education	33	33
Senior/Higher	47	47

The majority of respondents were male with a percentage 17% and 83% being female (Table 1). The modal age of the respondents was 31-40 years with 35% of respondents being in this age group. Formal education was received by 80% of the respondents consisting of 33% Basic and 47%

Senior/Higher education. The remaining 20% of the respondents do not receive formal education. Majority of respondents (53%) were married while the minority (47%) were single. Respondents were of the following religious background: Christian (42%), Traditional (34%) and Muslim (24%).

**Table 2: Types of household latrines**

	<b>Frequency</b>	<b>Percentage (%)</b>
KVIP / VIP latrine	38	38%
Water Closet / Pour Flush	31	31%
Bio-Digester	6	6%
No Latrine	25	25%
<b>Total</b>	<b>100</b>	<b>100%</b>



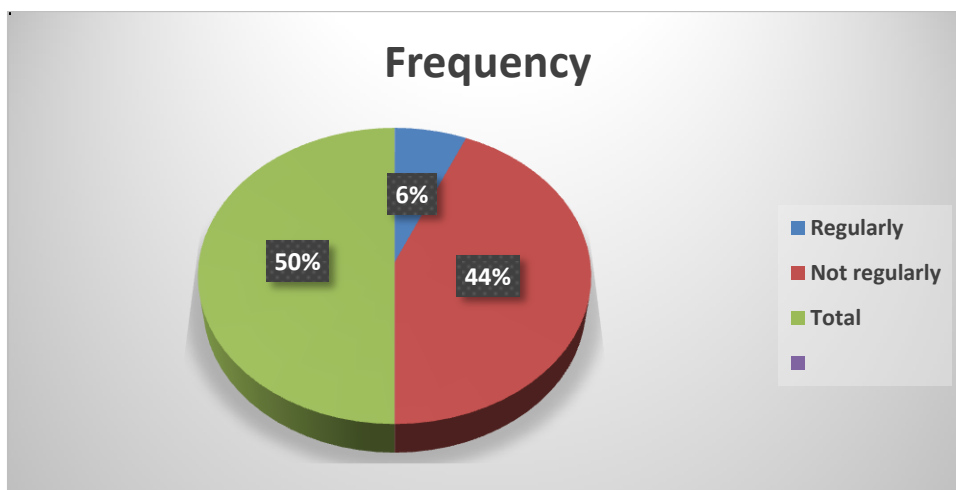
**Figure 2: Types of household latrines**

Figure 2 indicates that majority 25(25%) of the people in the community do not have latrine facilities in their house, while the minority 6 (6.0%) form those who have pour flush in their houses while a significant number of households which represent

31% also have water closet in their houses. This was done to know the number of toilet facilities that could be dislodged and those that need no dislodging. However, water closet and pour flush representing 37% use both water closet and pour flush which need to be dislodged.

**Table 3: Types of Dislodging Methods**

Types of public latrine	Frequency	Percentage %
Assembly Cesspool Emptier	10	27.1
Private Cesspool Emptier	16	43.2
Connected to Public Drains	6	16.2
Discharged into the bush with pump.	5	13.5
<b>Total</b>	<b>37</b>	<b>100</b>



**Figure 3: Types of Dislodging Methods**

Figure 2 indicates that, majority 16(43.2%) and 10(27%) representing 70.2% of the respondents engage either private or assembly cesspool emptier to dislodge their water closets if full. The worrying part which poses threat to public health with the risk

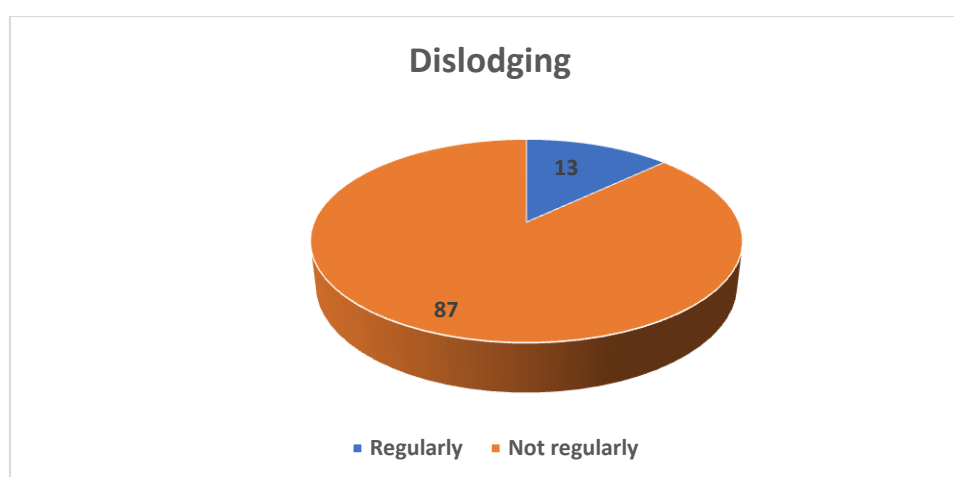
of exposing the public to faeco oral related diseases such as typhoid, dysentery, cholera etc is the connection of septic tanks to public drains and discharge into the bush representing 16.2% and 13.5% respectively.

**Table 4: Dislodging toilet facilities**

Response	Frequency	Percentage (%)
Regularly	13	13
Not regularly	87	87
<b>Total</b>	<b>100</b>	<b>100</b>

Table 4 shows that majority of respondents 87(87%) confirmed that, the latrines are not regularly dislodged while 13(13%) of the respondents stated that the latrines are dislodged regularly. This result is justified by interview conducted in the study area where the municipal authorities agreed that people pay money for dislodging but it must be scheduled

because of insufficient cesspool emptier or break down which takes months and in some cases a year to be fixed. Again, the authorities (Environmental Health Officer) argued that some District Assemblies in Ghana either don't have cesspool emptier or the existing one is broken down forcing individuals to dislodge into public drains in the rainy season.

**Figure 4: Dislodging toilet facilities.****Table 5: Disposal of domestic wastewater**

Responses	Frequency	Percentage %
Drains	25	25%
Sinks	5	5%
Catch pit/Bush	15	15%
On ground	55	55%
<b>Total</b>	<b>100</b>	<b>100%</b>

From table 5, Majority of the respondents 55(55%) and 25(25) confirmed that their wastewater is poured on the ground and gutter respectively which leads to water stagnation which can breed mosquitoes and algae on the ground which makes the environment unsightly. This reflects the true characteristic of Ghanaians as far as liquid waste management is concerned; wastewater is poured on the ground mostly to prevent dust. However, this act attracts

houseflies hence transmitting diseases to humans when settled on food. Malaria is also not left out when wastewater is poured in open drains hence serving as breeding ground for mosquitoes. Again, 5(5%) said they dispose in sinks. This practice would help reduce breeding of mosquitoes and algae growth. This agrees with what EPA Ghana (2001) it states that household wastewater treatment in Ghana is minimal.

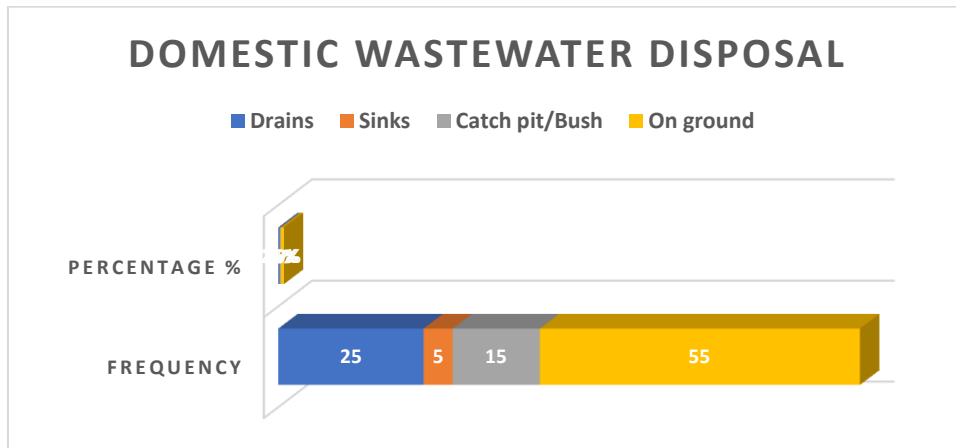


Figure 5: Disposal of domestic wastewater.

Table 6: Public Health effects of improper liquid waste management

Responses	Frequency	Percentage %
Malaria	65	65%
Typhoid Fever	13	13%
Cholera	17	17%
Diarrhea	5	5%
<b>Total</b>	<b>100</b>	<b>100%</b>

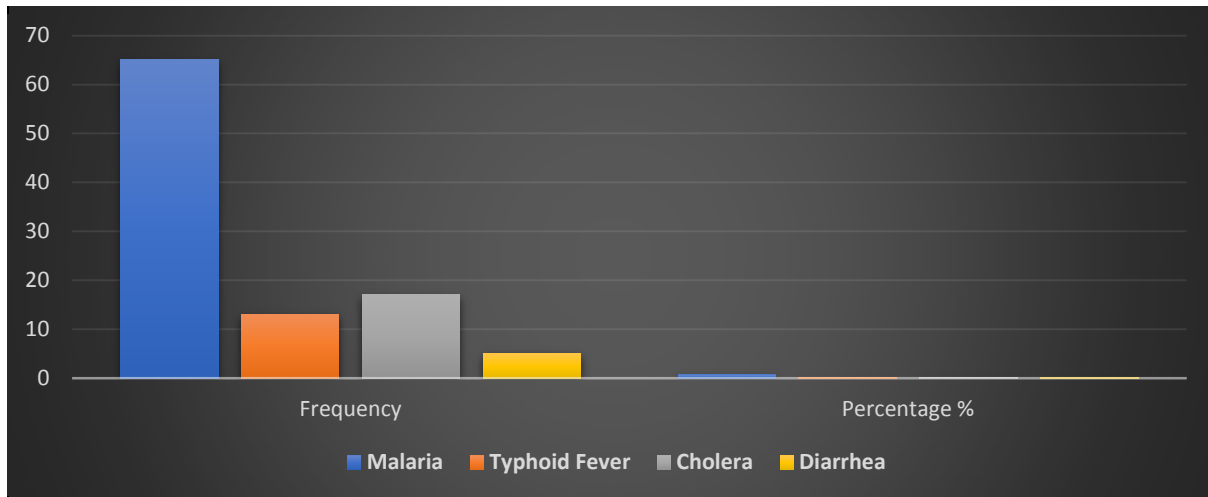


Figure 6: Public Health effects of improper liquid waste management.

From Figure 6, majority of the respondents 65(65%) confirms that, the outcome of improper liquid waste management will lead to the outbreak of malaria as the result of mosquitoes bleeding while 17(17%) and 13(13%) of the respondents stated Cholera and Typhoid fever respectively as the outcome, one of the respondents (nurse) stated that, Typhoid fever and Malaria are major cases recorded at the Hohoe Municipal Hospital since they are jointly the main reported cases at the hospital including diarrhea representing 5% as the main cause of illness among

children. This indicates that, individuals need to be educated on the dangers associated with improper liquid waste management as far as Typhoid, Cholera and other feaco-oral diseases are concerned. On the other hand, it can also be argued that it shows a positive indication of the Environmental Health Officers in relation to health education specifically Malaria as most of the responds rightly mentioned it as the major outcome of poor liquid waste management.

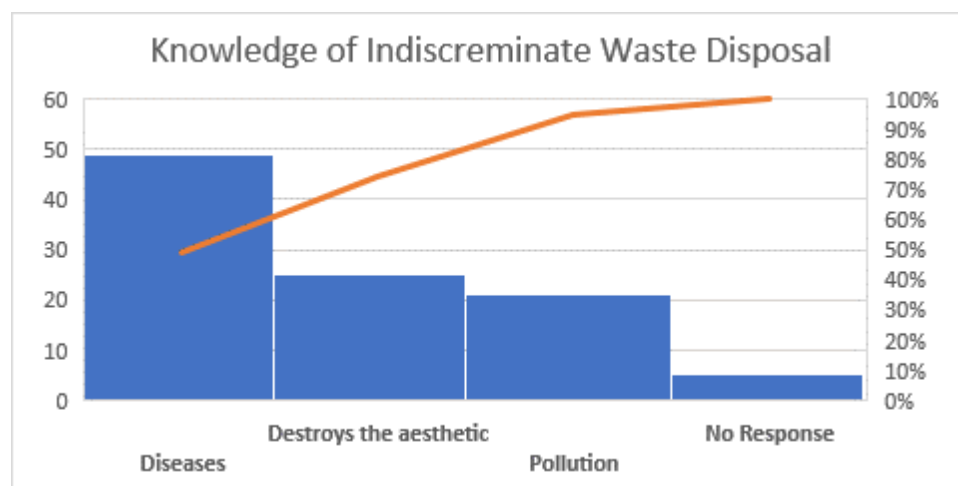


**Table 6: Respondents Knowledge of impacts of indiscriminate disposal of liquid waste**

Diseases	Frequency	Percentage %
Diseases	49	49%
Destroys the aesthetic	25	25%
No Response	5	5%
Pollution	21	21%
<b>Total</b>	<b>100</b>	<b>100%</b>

With reference to table 6, it is observed that, majority (49%) of respondents know indiscriminate disposal of liquid waste which leads to diseases whilst 25% are also concerned with the destruction caused by

indiscriminate waste disposal to aesthetic nature of the environment whilst 21% believed it causes pollution.



**Figure 7: Knowledge of the impacts of indiscriminate disposal of liquid waste**

**CONCLUSION AND RECOMMENDATION**

The study revealed that much attention is normally given to solid waste than liquid waste because liquid waste is mostly not noted to be a source of disease infection within the municipality. Environmental sanitation management is not only about solid and hazardous waste management but requires Integrated Waste Management approach. The Hohoe municipal assembly and environmental actors such as the Environmental Protection Agency (EPA) should pay much attention to liquid waste management in all endeavors as this study reveals lack of commitment in dealing with the problem. The only way is the introduction of scientific and engineered methods of liquid waste disposal. In smaller communities, households, wastewater and run-off are not considered in any way as they drain onto the narrow lanes to create gullies and unto lower areas in the bush to create ponds which may be used by other people elsewhere or can even serve as a breeding place for mosquitoes which can cause malaria through their bites.

**REFERENCES**

Adjibolosoo, Savior, May 11, 2007. Poor disposal of faecal matters. Daily Graphic (No.150045) p.9

Biswal, S., 2013. Liquid biomedical waste management: An emerging concern for physicians. Muller Journal of Medical Sciences and Research, 4(2), 99-106.

Environmental Protection Agency (E.P.A), (Daily graphic, 2001)

Petersen, P. E., 2003. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. Community Dentistry and oral epidemiology, 31, 3-24.

World Health Organization, and UNICEF., 2000. Global water supply and sanitation assessment.

- Hall, J. E., 1992. Treatment and use of sewage sludge. *The Treatment and Handling of Wastes*. Chapman and Hall, London, 63-82.
- Mensah, A., and Larbi, E., 2005. Solid Waste Disposal in Ghana. WELL Factsheet November 2005.
- World Health Organization (E. P. A. Action Plan, 1998)
- Rego, R. F., Moraes, L. R. S., and Dourado, I., 2005. Diarrhea and garbage disposal in Salvador, Brazil. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 99(1), 48-54.
- Tóth, A. J., 2015. Liquid waste treatment with physicochemical tools for environmental protection.
- Tong, T., and Elimelech, M., 2016. The global rise of zero liquid discharge for wastewater management: drivers, technologies, and future directions. *Environmental science and technology*, 50(13), 6846-6855.
- Yazdanfar, Z., and Sharma, A., 2015. Urban drainage system planning and design—challenges with climate change and urbanization: a review. *Water Science and Technology*, 72(2), 165-179.
- Malek Mohammadi, M., Najafi, M., Kermanshachi, S., Kaushal, V., and Serajiantehrani, R., 2020. Factors influencing the condition of sewer pipes: State-of-the-art review. *Journal of Pipeline Systems Engineering and Practice*, 11(4), 03120002.
- Tscheikner-Gratl, F., Caradot, N., Cherqui, F., Leitão, J. P., Ahmadi, M., Langeveld, J. G., and Clemens, F., 2019. Sewer asset management—state of the art and research needs. *Urban Water Journal*, 16(9), 662-675.
- Jagai, J. S., DeFlorio-Barker, S., Lin, C. J., Hilborn, E. D., and Wade, T. J., 2017. Sanitary sewer overflows and emergency room visits for gastrointestinal illness: analysis of Massachusetts data, 2006–2007. *Environmental Health Perspectives*, 125(11), 117007.
- UNICEF., 2019. WASH in Health Care Facilities: Global Baseline Report 2019. United Nations Children's Fund. Retrieved from <https://www.unicef.org/media/69111/file/WASH-in-HCFs-Global-Baseline-2019.pdf>
- Smith, J., Johnson, A., and Williams, R., 2020. Environmental Compliance in Network Administration. *International Journal of Sustainable Technology*, 3(2), 45-58.