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THE IMPACTS OF POOR SANITATION ON MALARIA INCIDENCE AMONG RESIDENTS OF PAYNESVILLE, MONTSERRADO COUNTY, LIBERIA

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ABSTRACT

Compared to the other parts of the globe, malaria remains a major health problem in Liberia, especially in urban areas like Paynesville, Montserrado County. This study looks at how poor sanitation is linked to the rise in malaria cases in this community. We focus on the ways inadequate waste disposal, stagnant water, and poor drainage creates the perfect breeding

grounds for mosquitoes, which in turn, increases malaria transmission. Using field surveys, interviews, and local clinic health records, we gathered data to understand how these environmental factors contribute to malaria outbreaks. The results show a clear connection between unsanitary living conditions and higher rates of malaria, particularly during the rainy season when stagnant water is more common. These findings highlight the urgent need for better sanitation infrastructure and public health education to help reduce the spread of malaria. We believe that both government and local communities must take immediate action to address these issues as a critical step in fighting malaria in urban Liberia.

KEYWORDS: Poor Sanitation, Malaria, Mosquito Breeding, Public Health, Waste Management, Environmental Health.

INTRODUCTION

Malaria remains a significant public health issue in Liberia, contributing to high morbidity and mortality rates, especially in urban areas such as Paynesville. According to the **Liberia Malaria Indicator Survey (2020)**, malaria transmission is exacerbated by environmental conditions that favor mosquito breeding, the primary carriers of the disease. International efforts, including those led by the **World Health Organization (2022)**, have helped to reduce transmission globally, but local challenges such as poor sanitation continue to persist. Urban crowding, lack of adequate waste disposal, and seasonal rains create ideal conditions for mosquito proliferation.

In Paynesville, inadequate waste management, poor drainage systems, and stagnant water are common issues in many neighborhoods. These unsanitary conditions lead to the accumulation of garbage and water, which provide fertile breeding grounds for mosquitoes. Without proper sanitation, residents are continuously exposed to higher risks of contracting malaria. The link between environmental conditions and malaria transmission incidence has been well-documented, but in urban settings like Paynesville, where rapid population growth and urbanization outpace infrastructure development, the issue is exacerbated (Klinkenberg, E., et al., (2004).

This study seeks to explore the relationship between poor sanitation practices and the incidence of malaria among residents of Paynesville. By examining local environmental factors and health records, we aim to identify specific sanitation-related risks that contribute to the high prevalence of malaria in the area. Additionally, the findings of this research will provide insights into potential interventions that could help reduce malaria transmission through improved sanitation and public health measures (Beier, J. C., et al., (2008).

Addressing poor sanitation as part of the broader strategy to combat malaria could lead to more effective and sustainable disease control efforts. As previous studies have shown, integrated approaches that combine sanitation improvement with health education and vector control are crucial in urban areas where malaria transmission remains a significant concern. Through this study, we hope to shed light on the importance of environmental health in the fight against malaria, particularly for vulnerable urban populations like those in Paynesville (Keiser, J., et al., (2004).

LITERATURE REVIEW

Malaria in urban areas like Paynesville is often exacerbated by poor sanitation practices, especially the mismanagement of waste and the absence of proper drainage systems. In communities such as Whein Town in Paynesville, unmanaged waste serves as a breeding ground for mosquitoes, this significantly increases malaria transmission rates.

A local clinic has reported that over 50% of their weekly cases are related to malaria, largely attributed to the nearby waste dumpsite. This demonstrates a clear connection between poor sanitation and high malaria incidence. See can also World Bank report released in June 2019. (**FrontPage Africa, IWA**).

Rainfall patterns significantly affect the transmission of malaria. During the rainy season, poor drainage systems in Paynesville exacerbate water stagnation, further increasing the breeding of *Anopheles* mosquitoes. Studies in Liberia and other tropical regions have shown that malaria incidence peaks during the rainy season, correlating with the increase in mosquito population due to accumulated stagnant water (Kamara, F. M., (2019 & BMC Public Health). Seasonal variation and factors associated with malaria prevalence among children in Liberia.

Research in Accra, Ghana, according to **Biomed Central** underscores this link, where informal settlements with poor sanitation experienced higher malaria transmission rates than areas with better infrastructure.

Ineffective waste management systems have been widely documented as one of the critical factors in malaria outbreaks in urban settings. Improper disposal of solid waste leads to blocked drainage systems and stagnant water, which provide prime breeding grounds for mosquitoes. In Paynesville, areas near open dumpsites experience higher incidences of malaria compared to cleaner neighborhoods. This pattern echoes findings from a study in Dakar, Senegal, where inadequate urban sanitation was strongly associated with an increase in vector populations and malaria cases (WHO, 2022 & Robert V, et al. 2003).

Research highlights the importance of integrated vector management (IVM), which combines improved sanitation with mosquito control strategies like IRS, ITNs, and health education. Studies conducted in urban areas of Kenya and Tanzania reveal that integrated approaches focusing on both environmental management and vector control have significantly reduced malaria transmission. For Paynesville, adopting similar strategies-addressing both sanitation and mosquito control—could substantially lower malaria incidence. (**Keating, J., et al., 2004).**

Poverty plays a pivotal role in the sanitation crisis and subsequent malaria burden in Paynesville. Limited resources restrict access to adequate housing and waste disposal, contributing to environmental degradation and increased health risks.

Similar to Paynesville, a study from Burkina Faso found that malaria hotspots were linked to lower socioeconomic status, poor housing conditions, and inadequate access to clean water (Tusting, L. et al., 2017).

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METHODOLOGY

The study employed a **descriptive cross-sectional study design** to assess the relationship between poor sanitation and malaria incidence among residents of Paynesville, Montserrado County, Liberia. To assess the relationship between poor sanitation and malaria transmission within the community, structured questionnaires were distributed to residents of Paynesville (Levin, K. A. 2006). The design was aimed at collecting quantitative and qualitative data from respondents, focusing on their experiences, observations, and perceptions of how inadequate sanitation infrastructure and practices contribute to malaria transmission in the community. By collecting data at a single point in time, the study captures a snapshot of current environmental sanitation conditions, health behaviors, and the prevalence of malaria within the target population (Merrill, R. M., et al., 2006). This design allowed for an evaluation of both individual and environmental factors that contribute to the spread of malaria, providing insights into how poor sanitation exacerbates the incidence of the disease. During field visit to assess the environmental conditions, some variables such as drainage quality, waste management practices were noted (Tusting, L. S., et al., (2013). The study population consisted of all residents of Paynesville City, which had an estimated population of approximately 400,000 males and females, according to the 2014 census.

SAMPLE SIZE AND SAMPLING TECHNIQUES

The estimated population of Paynesville City, based on the 2014 census, was 400,000. To determine the appropriate sample size, the researcher applied the scientific formula: $\mathbf{n = Z^2 \times P(1-P) / SE^2}$, where *n* represents the unknown sample size, Z^2 is 1.96 (the Z-score), *P* is the probability of selection, *1-P* (or *q*) is the probability of not selecting, and SE^2 is the standard error. A 0.5 margin of error was used for this calculation.

For this study, a sample size of 400 respondents (male and female) between the ages of 18 and 55 years was chosen, with participants selected from various streets in Paynesville. A multi-stage sampling technique was employed. First, a stratified sampling method was used to select houses from each street. Then, a purposive sampling technique was applied to select 400 respondents, comprising 180 males and 220 females, who volunteered to participate.

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Additionally, a proportionate sampling technique ensured that 50% of the sample consisted of married respondents from Paynesville City.

RESEARCH INSTRUMENT

The sample for this study consisted of 400 respondents, aged 18 to 55 years, who were randomly selected from Paynesville City. A self-structured questionnaire, titled the *Environmental Sanitation Questionnaire (ESQ)*, was developed and used for data collection. The questionnaire was divided into three sections (A, B & C): Section A gathered demographic information about the respondents, Section B addressed the research questions, and Section C focused on the variables under investigation.

RELIABILITY OF THE INSTRUMENT

Reliability refers to the accuracy of data by their stability, repeatability and precision. The corrected version of the questionnaire was administered on (20) respondents (men and women) from Rock Hill community Paynesville city who are not part of the selected respondents. In order to determine the reliability of the instrument, the tested instrument was analyzed using Cronbach's Alpha reliability at 0.05 level of significance with the result of 0.85. . This is to reflect whether the instrument when used on the actual subjects would be found reliable or not. The instrument was reliable according to the result above (Tavakol, M., et al., 2011).

DEPICTION OF THE STUDY ZONE

Liberia has 15 counties. Monserrado is one of the counties. Paynesville City is located in Montserrado County, Liberia, and lies to the east of the capital, Monrovia. It is one of the most populous urban areas in the country and serves as a key suburb to the capital city. Geographically, Paynesville is situated at an elevation of approximately 91 meters (299 feet) above sea level, and it covers an area characterized by both urban and semi-urban environments **(LISGIS)**. 2014).

The city's landscape includes a mix of residential neighborhoods, commercial areas, and pockets of undeveloped land. It is traversed by several important roads, including the major highway leading from Monrovia to the interior of the country. Paynesville experiences a tropical monsoon climate, with distinct wet and dry seasons, which influence local environmental conditions, such as flooding and poor drainage, particularly in areas with inadequate sanitation infrastructure (African Development Bank Group. (2018).

Several streams and water bodies flow through Paynesville, contributing to challenges related to water management and sanitation, making the city vulnerable to issues like waterborne diseases, including malaria. Its proximity to Monrovia and rapid urbanization has led to significant population growth, placing increased pressure on sanitation services and infrastructure (OCHA). 2016).

PROCEDURE FOR DATA COLLECTION

The researcher obtained an official letter of introduction from the Head of the Department of Environmental Health at the International Academic Management Association (IAMA) University for Identification Purposes. This letter was presented to the Mayor of Paynesville City. Prior to data collection, the researcher conducted a familiarization and awareness tour of the selected communities and sought the consent and support of household heads. The questionnaire was distributed by the researcher and assistant researchers in the mornings before residents left for work or the market, and in the evenings, particularly on weekends or during relaxation hours. To ensure a high response rate and the accuracy of the data, the questionnaires were collected immediately after completion.

PROCEDURE FOR DATA ANALYSIS

The collected instruments were analyzed using frequency counts and percentages, with pie charts and bar charts employed to represent the demographic data. A correlation matrix was used to analyze the research questions, while multiple regression analysis was applied to test the hypotheses at a 0.05 level of significance.

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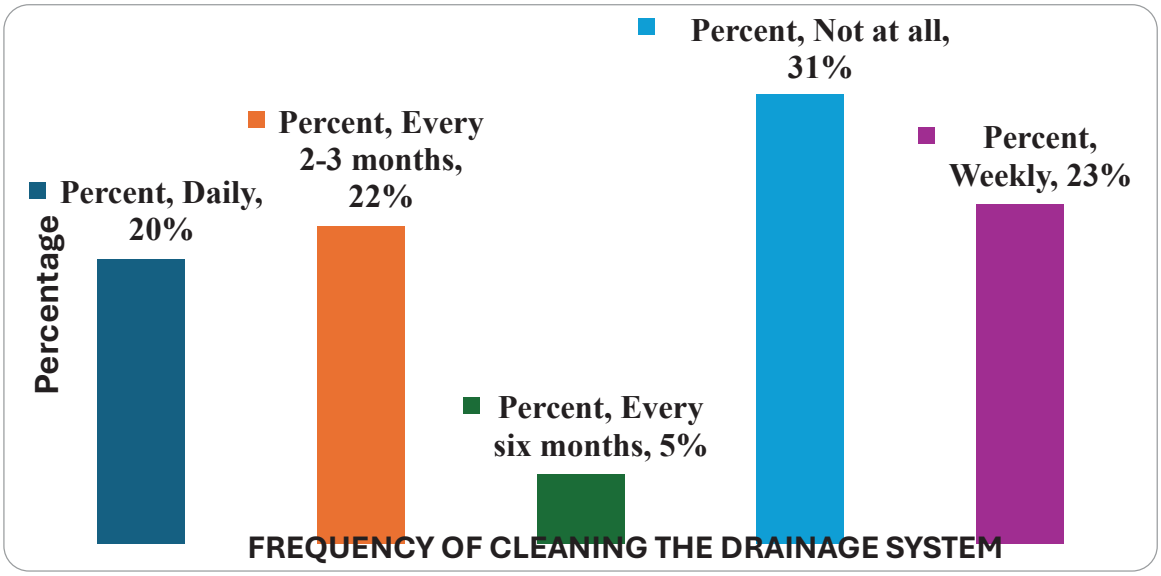
RESULTS

The result reviled that poorly managed drainage systems and the proximity of residential areas to stagnant water sources created by the people living in Paynesville are the primary contributors to malaria incidence rate among the people of Paynesville City. These findings underscore the importance of addressing environmental management in malaria control efforts. Please see the below table that will justify this result:

Frequency of Cleaning the Drainage System of the Respondents



This above table presents **123** respondents, accounting for 31% are not cleaning the drainages around their houses at all, **93** respondents, representing 23% do clean the drainages weekly, **87** respondents, representing 22% clean the drainages every 2-3 months, **78** respondents, representing 20% do clean on the daily basis and **19** respondents, representing 5% do clean the drainage every six months. From the above projection, the researcher discovered that in addition to other influencing factors, failure by the majority of the community dwellers of Paynesville, Montserrado County to clean the drainage system in and around their houses have resulted to increasing the mosquito population, thereby increasing the malaria incidence rate in Paynesville city & it environ.

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Summary Of Joint Contribution Of Perceived Environmental Sanitation 'Components' In the Control of Malaria incidence rate Among Residence of Paynesville, Montserrado County.

Model	Sum of Square	Df	Mean square	F	Sig. P. value	Remark
Regression	685.836	4	186.459	98.409	.000	Sig
Residual	387.460	395	1.806			
Total	1073.296	399				

Also as indicated in table above, it was found that the linear contribution of perceived environmental sanitation component was tested significance on Distribution of insecticides treated nets, Wearing protective clothing, Residual house spraying, Door to door sensitization, frequency of cleaning the drainage system, in the control of malaria incidence among the people of Paynesville. Indicating that about 61.7% of the variance was accounted for by the independent variables.

Below is the inter-co relational matrix of the relationship between poorly managed drainage systems and the proximity of residential areas to stagnant water sources components in the control of malaria transmission among Paynesville residence.

The table revealed that frequency of cleaning the surrounding bushes and grasses of the respondents (r=-0.6120, N=400,P<0.05), frequency of cleaning the drainage system (r=-0.7605, N400, P<0.05), availability of the drainage system around the house (r=-0.8999, N400, P<0.05), frequency of cleaning the toilet facilities (r=-0.0370, N400, P<0.05), presence of small farmland in areas of residence (r=-0.0692, N400, P<0.05).

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This implies that frequency of cleaning the surrounding bushes and grasses, frequency of cleaning the drainage system, availability of the drainage system around the house, frequency of cleaning the toilet facilities, presence of small farmland in areas of residence had positive relationship in the control of malaria and other diseases among the people of Paynesville City-Liberia.

Correlation matrix showing perceived environmental sanitation components in the control of malaria and other diseases among the people of Paynesville City.

	Malaria	Frequency of Cleaning the Surrounding Bushes and Grasses of the Respondents	Frequency of Cleaning the Drainage System of the Respondents	Availability of the drainage system around the house of the respondents	Frequency of cleaning the toilet facilities	Presence of small farmland in areas of residence
Malaria	1					
Frequency of Cleaning the Surrounding Bushes and Grasses of the Respondents	-0.6120	1				
Frequency of Cleaning the Drainage System	-0.7605	0.1993	1			
Availability of the drainage system	-0.8999	0.2396	0.7750	1		

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around the house						
Frequency of cleaning the toilet facilities	0.0370	0.0689	0.0086	-0.0107	1	
Presence of small farmland in areas of residence	-0.0692	-0.0338	0.0086	-0.0299	-0.0181	1

Correlation is significant at 0.05 (2-tailed); N=400

DISCUSSION/CONCLUSION OF RESULTS

The findings were discussed in line with the research question and hypotheses, which implies that frequency of cleaning the surrounding bushes and grasses, frequency of cleaning the drainage system, availability of the drainage system around the house, frequency of cleaning the toilet facilities, presence of small farmland in areas of residence the people of Paynesville were positively correlated with impact of poor sanitation influencing the incidence of malaria. This implied that all the variables had positive relationship in the control of malaria incidence among residence of Paynesville, Montserrado, Liberia. This finding is in line with the study on sanitation in Nigeria cities pointed a common practice in many cities in the country. Most of the solid wastes were located close to the markets and public places. Improper disposal of collection of wastes promote the breeding f mosquitoes, rodents and pathogens that can cause and transmit diseases such as malaria, cholera and diarrhea (Ayotanmo et al., 2004). A study conducted in Sierra Leone examined the influence of environmental factors on malaria transmission and assessed the effectiveness of interventions such as long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) in reducing transmission rates. The research was especially important in evaluating how socio-environmental factors contribute to malaria risks in regions with high endemicity, such as sub-Saharan Africa (Klinkenberg, E., et al., (2020). Another study was conducted in the Niger Delta region of Nigeria, specifically pointing to the challenges associated with pollution, land degradation, and how these factors influence

the health and livelihoods of local communities. The study highlighted the adverse environmental effects resulting from oil spills and gas flaring, which contribute to the degradation of ecosystems and increase health risks incidence, including diseases such as malaria, due to stagnant water from oil blockages, which can create breeding grounds for mosquitoes (Ayotamuno, M. J., et al., (2004).

Therefore based on the research findings or result of the study, it can be concluded that malaria incidence is influenced by poor sanitation activities among the people of Paynesville, Monserrado. Liberia, evidence by the all variables in the study that showed significantly positive.

Conflict of Interest Statement

I the author and the co- authors declare no contending or competing conflict of interests related to this paper title: "The Impacts of Poor Sanitation on Malaria Incidence Among residence of Paynesville, Montserrado County, Liberia."

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