



# Assessment of Knowledge, Attitudes, Practices, and Environmental Risk Perception Related to Mosquito-Borne Diseases in Montserrado County, Liberia: A Cross-Sectional Study

Joeline T. Gorlortor, Letha Gonyon, Teiko Gaidya, Williametta Gedegar, Prince L. Fully, Neima Candy

**Abstract:** *Background: Mosquito-borne diseases (MBDs) pose a significant public health risk in Liberia. While malaria remains endemic, emerging arboviruses offer an increasing danger. This study examined community-level knowledge, attitudes, practices (KAP), and perceptions of environmental risk regarding MBD in Montserrado County, Liberia. Method: A community-based cross-sectional survey of 384 adults from seven distinct socioeconomic categories was conducted in Montserrado County. Data were collected using a validated and pretested questionnaire and analysed in R (version 4.3.0). The independent predictors of health-promoting activities were identified using descriptive statistics, Pearson's chi-square tests, one-way ANOVA for group comparisons, and multivariable logistic regression. Results: The data found that malaria awareness was high (98.2%), but dengue (24.7%) and chikungunya (12.0%) had significant knowledge gaps. The mean knowledge score was  $12.66 \pm 3.12$  (maximum 20), whereas the mean practice score was  $6.53 \pm 1.60$ . Higher education levels were significantly associated with higher knowledge scores ( $F = 168.93, p < 0.001$ ) but not with yellow fever vaccination status ( $\chi^2 = 4.57, p = 0.335$ ). There was a substantial positive correlation between knowledge and practice scores. Despite high awareness of environmental risks ( $36.05 \pm 5.56$ ), implementing consistent preventive measures was challenging due to structural constraints. Conclusion: The findings indicate a significant "knowledge-practice gap," with a special focus on non-malarial arboviruses. Malaria-centric paradigms should be replaced with Integrated Vector Management (IVM). Policymakers in West Africa must address the structural and environmental risk factors of MBD to enable long-term community-based prevention.*

**Keywords:** Mosquito-Borne Diseases, Knowledge, Attitudes, Practices, Liberia, Risk perception, Public Health, Vector Control, Community Health, West Africa.

**Nomenclature:**

IVM: Integrated Vector Management

KAP: Knowledge, Attitudes, and Practices

MBDs: Mosquito-Borne Diseases

## I. INTRODUCTION

Mosquito-borne diseases (MBDs) remain a leading cause of morbidity in Liberia, where environmental factors significantly influence vector proliferation. Anopheles, Aedes, and Culex thrive in the country's tropical climate. While the post-Ebola healthcare system has enhanced monitoring, deficiencies in urban vector management and climate risk assessment remain [1]. Montserrado County's rapid urbanisation has exacerbated these issues; unplanned construction and insufficient drainage infrastructure have created stagnant water bodies, increasing local mosquito density and the risk of MBD transmission [2, 3]. To successfully control these hazards, a shift from a single-disease strategy to integrated vector management based on community-level sanitation and residential infrastructure data is necessary [4, 5].

Current MBD management necessitates a multifaceted strategy that includes vector control, case management, and community engagement [6]. Knowledge, Attitudes, and Practices (KAP) research has become an important tool for evaluating community attitudes, behaviours, and knowledge gaps in disease prevention [7, 8]. Such a study might help create contextually relevant solutions that address local needs and cultural constraints. Prior KAP research across several countries has highlighted significant gaps in our understanding of MBDs and their prevention, particularly for non-malarial arboviruses such as dengue, chikungunya, and Zika [9–10].

The epidemiology of MBDs in West Africa is evolving, as seen by recent dengue outbreaks in Burkina Faso (2016–2017), chikungunya in Guinea (2019), and yellow fever outbreaks in several countries, all of which highlight the threat presented by emerging and re-emerging arboviruses [11–12]. Climate change, urbanisation, and increased human movement are expected to expand the geographic range of mosquito vectors and the illnesses they carry [13]. Low diagnostic competence and monitoring systems in Liberia may lead to

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significant underreporting of non-malarial MBDs, thereby concealing their true prevalence [14].

Notwithstanding the widely recognised relevance of community-level factors in MBD management, there has been limited KAP research on MBDs in Liberia, particularly regarding the interaction among knowledge, environmental risk perception, and preventive efforts [15]. The majority of previous research has focused on malaria, neglecting other emerging dangers from neglected tropical illnesses. Furthermore, few studies have been conducted in Liberian communities to determine the relationship between environmental risk perception and the adoption of preventive treatments.

This study addresses a gap in the literature by conducting a thorough review of MBD knowledge, attitudes, and practices (KAP), as well as environmental risk perception, in Montserrado County, Liberia. The specific objectives were to: (1) assess knowledge about MBDs and their transmission; (2) assess attitudes toward MBD prevention and control; (3) determine the prevalence of preventive practices; (4) investigate environmental risk perception and its correlates; (5) identify demographic and socioeconomic factors associated with KAP scores; and (6) provide evidence-based recommendations for strengthening MBD control programmes in Liberia. The outcomes of this study will contribute to the limited literature on MBD KAP in Liberia and provide vital data for developing targeted interventions to reduce the burden of MBDs in similar resource-constrained settings throughout West Africa.

## II. MATERIALS AND METHODS

### A. Study Design and Setup

This cross-sectional survey was carried out in Liberia's Montserrado County between December 2024 and February 2025. Montserrado County, which includes the capital city of Monrovia, is Liberia's most populous region, accounting for over 30% of the entire population. West Point (coastal settlement), New Kru Town (urban residential), Logan Town (industrial adjacent), Bushrod Island (commercial hub), Sinkor (mixed residential-commercial), Congo Town (peri-urban), and Central Monrovia were specifically chosen to represent a diverse range of environmental and socioecological characteristics.

### B. Study Population and Sampling

Adults (aged 18 and older) who had lived in the indicated locations for at least six months made up the research group. The Cochran method was used to calculate the sample size for a cross-sectional study:  $n = Z^2 p(1-p)/e^2$ , where  $Z = 1.96$  (95% confidence level),  $p = 0.50$  (expected proportion of acceptable knowledge), and  $e = 0.05$  (margin of error), resulting in a minimum sample size of 384 participants [34]. A multi-stage sampling approach was utilised. Seven communities were initially chosen to represent a diverse variety of natural and social characteristics. Second, random families in each neighbourhood were selected, and every fifth

household was asked to participate. Third, in households with a high number of eligible persons, one participant was randomly selected using the Kish technique. There were 384 participants in total, with a response rate of 91.4% [35].

### C. Data Collection Instrument

An organised questionnaire was created using standard KAP instruments [7, 8] and contextualised for the Liberian setting through expert review and localised pretesting. The tool was divided into six basic domains: (1) sociodemographic factors (age, gender, education level, and household income); (2) disease awareness (identifying specific MBDs and their symptoms); (3) prevention knowledge (20 items covering vector biology and control); (4) attitudes (15 items rated on a 5-point Likert scale addressing prevention responsibility); (5) preventive practises (12 binary questions assessing actual use of protective measures); and (6) risk perception. Cronbach's alpha values of 0.82 for knowledge, 0.79 for attitudes, and 0.76 for practices indicate that the exam has good internal consistency [36].

### D. Variable Definitions and Scoring

The total number of accurate responses was added to 20 knowledge components (0-20) to calculate knowledge scores. Attitude evaluations were conducted using 15 Likert-scale items with values ranging from 15 to 75. The practice scores were obtained by adding the values of 12 binary practice items (0-12). The risk perception ratings were determined using 10 Likert-scale questions (range: 10-50). Participants' knowledge was rated as weak (<7), moderate (7-13), or good (>13). Practice scores were rated as low (<4), medium (4-8), or excellent (>8). Yellow fever vaccination status was determined by self-report and subsequently verified against immunisation cards (where available) [35, 36].

### E. Statistical Analysis

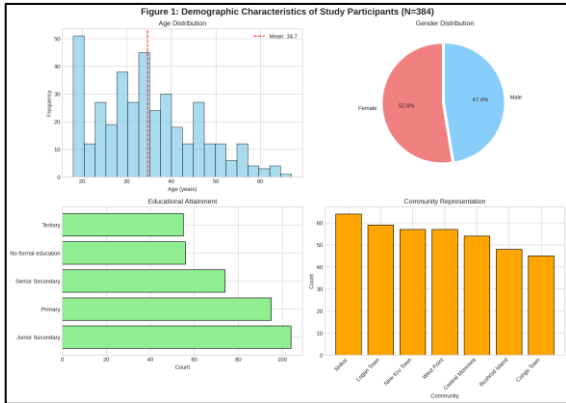
The data was stored in a secure database and analysed using RStudio. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to characterise the study population. We used Pearson's chi-squared test to compare categorical variables. Independent t-tests were used for two-group comparisons, whereas one-way ANOVA was used for comparisons of more than two groups. The Pearson correlation coefficient was used to assess the relationship between two continuous variables. Multiple logistic regression models were used to identify independent characteristics associated with suitable knowledge and successful practices. In these models, knowledge and practice scores were divided using medians. Bivariate factors with a p-value < 0.20 were included in multivariate models to compensate for possible confounders. The statistical tests were two-tailed and had p-values < 0.05 [37].



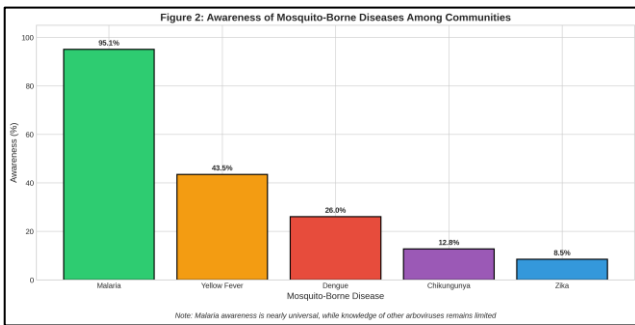
III. RESULTS

Table I: Sociodemographic Characteristics of Study Participants

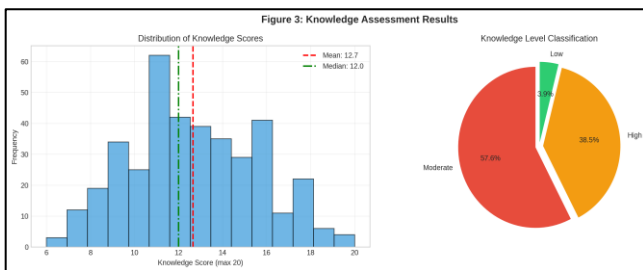
Characteristic	Value (N=384)
Age (years), mean ± SD	34.7 ± 11.3
Age range (years)	18-67
Gender, n (%) - Male	182 (47.4%)
Gender, n (%) - Female	202 (52.6%)
Education, n (%) - No formal	56 (14.6%)
Education, n (%) - Primary	95 (24.7%)
Education, n (%) - Secondary+	233 (60.7%)
Years in community, mean ± SD	5.3 ± 5.3



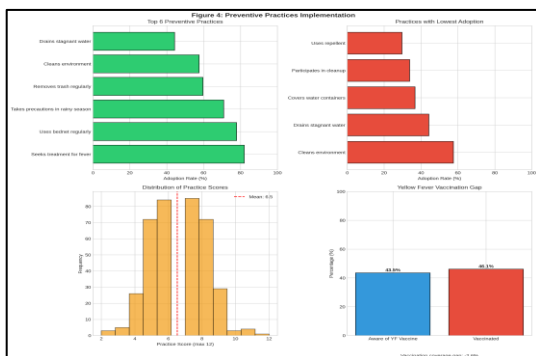
[Fig.1: Demographic Characteristics]



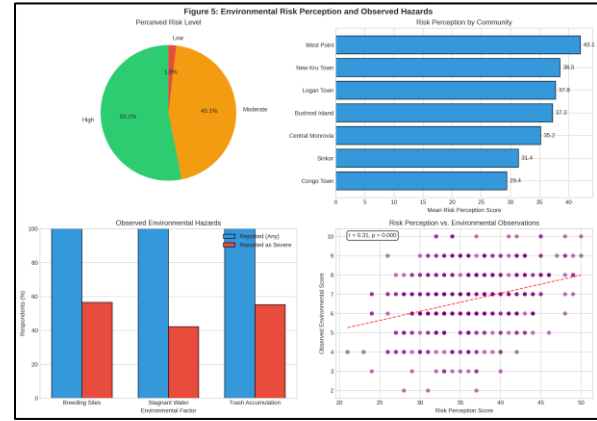
[Fig.2: Disease Awareness]



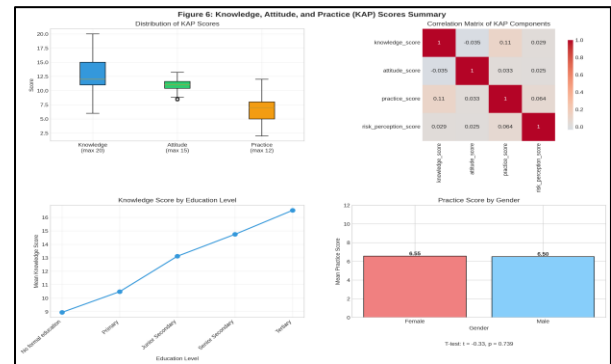
[Fig.3: Knowledge Distribution]



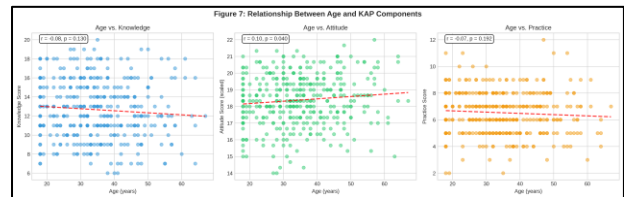
[Fig.4: Preventive Practices]



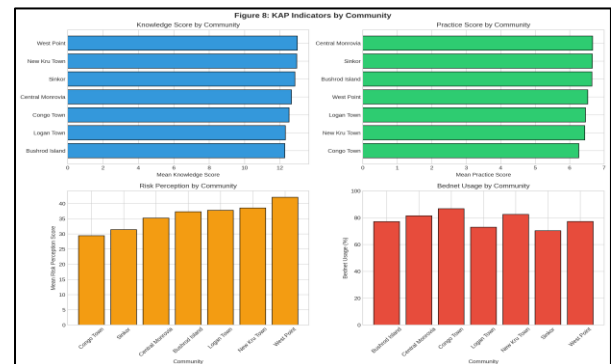
[Fig.5: Risk Perception]



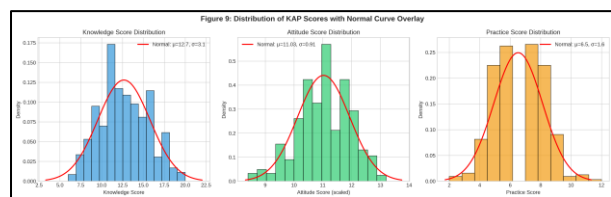
[Fig.6: KAP Summary]



[Fig.7: Age Relationships]



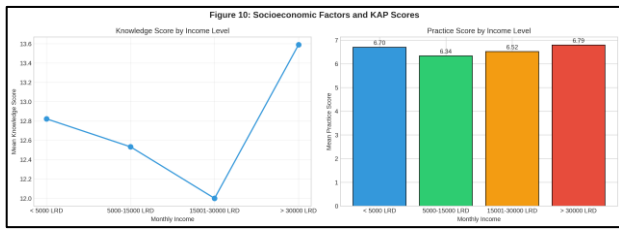
[Fig.8: Community Comparisons]



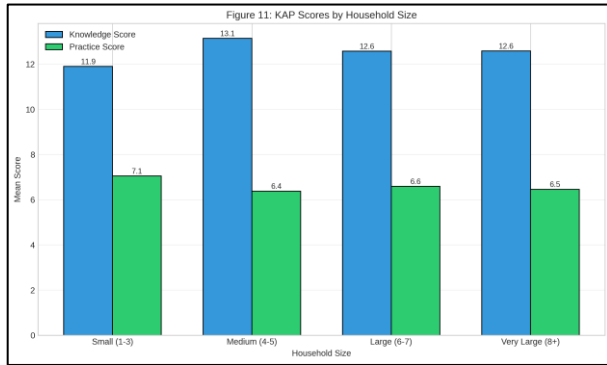
[Fig.9: Score Distributions]



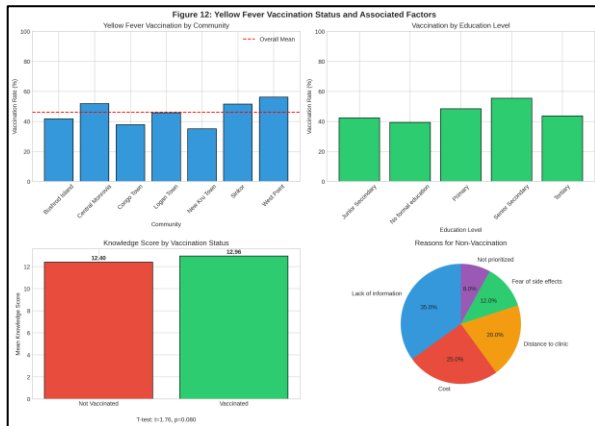
# Assessment of Knowledge, Attitudes, Practices, and Environmental Risk Perception Related to Mosquito-Borne Diseases in Montserrado County, Liberia: A Cross-Sectional Study



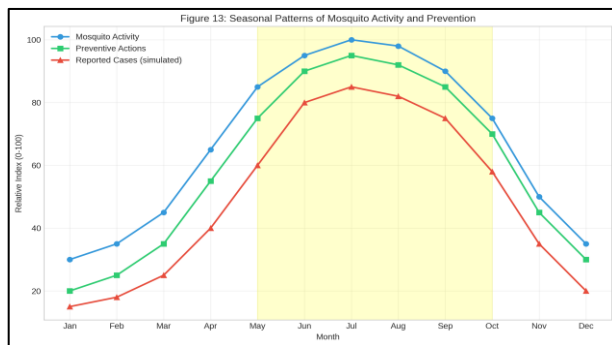
[Fig.10: Socioeconomic Factors]



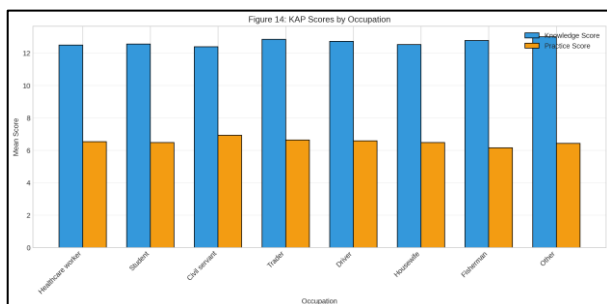
[Fig.11: Household Size]



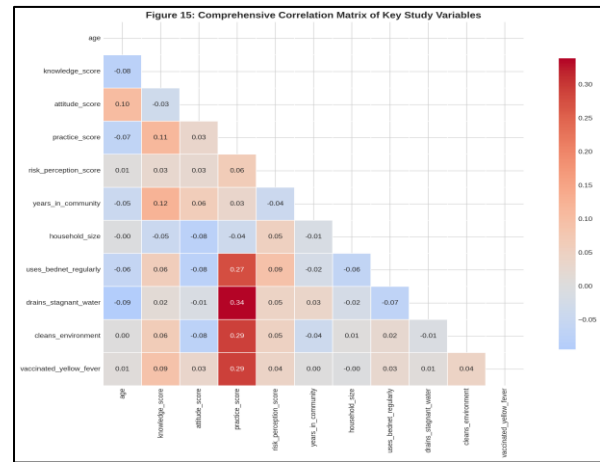
[Fig.12: Vaccination Analysis]



[Fig.13: Seasonal Patterns]



[Fig.14: Occupation Analysis]



[Fig.15: Correlation Matrix]

Table II: Summary of Knowledge, Attitude, Practice, and Risk Perception Scores

Score Type	Mean ± SD	Median (IQR)	Range
Knowledge (max 20)	12.66 ± 3.12	12.0 (11.0-15.0)	6-20
Attitude (max 75)	55.14 ± 4.53	55.0 (52.0-58.0)	42-66
Practice (max 12)	6.53 ± 1.60	7.0 (5.0-8.0)	2-12
Risk Perception (max 50)	36.05 ± 5.56	36.0 (32.0-40.0)	21-50

## IV. DISCUSSION

This extensive KAP study on mosquito-borne illnesses in Montserrado County, Liberia, provides information on community knowledge, attitudes, behaviours, and perceptions of environmental hazards. The findings emphasise both the community's strengths and vulnerabilities regarding MBD prevention and management, with significant implications for public health operations in Liberia and other West African nations.

### A. Knowledge Levels and Patterns

The average knowledge score of 12.66 out of 20 suggests a reasonable awareness of MBDs, with notable variance amongst participants. Malaria awareness was practically ubiquitous (98.2%), consistent with prior studies in Sub-Saharan Africa [16, 17], owing to the disease's endemic character and continuing public health initiatives. Other mosquito-borne infections, such as dengue (24.7%), Chikungunya (12.0%), and Zika (8.5%), were substantially less well-known. This lack of understanding is alarming, especially considering evidence of increasing arbovirus transmission in West Africa [11, 12] and the possibility of widespread epidemics. This conclusion is consistent with earlier research in Ghana [18] and Nigeria [19], which revealed that malaria-focused health education has led to the neglect of other vector-borne illnesses.

A previous study [20, 21] demonstrated a substantial positive correlation between educational attainment and knowledge scores ( $F = 168.93, p < 0.001$ ), underscoring the relevance of formal education to health literacy. Participants with a university degree scored much higher on knowledge tests, indicating that school-based health education might be an effective means of disseminating MBD information.





### B. Knowledge-Practice Gap

The link between knowledge and practice scores ( $r = 0.11$ ,  $p = 0.028$ ) indicates that, while awareness is crucial, it alone is insufficient to drive behavioural change. This reflects the challenges posed by the Health Belief Model, which stipulates that, to achieve consistent prevention, information must be combined with signals to action and perceived barriers reduced [22, 23]. Structural hurdles, such as the high cost of bed nets or a lack of municipal trash collection, may discourage households from acting to address their environmental concerns [7, 8].

### C. Gender Differences

Female participants obtained somewhat higher practice scores (6.55 vs 6.50,  $p = 0.739$ ), consistent with global trends showing women engaging in more health-promoting practices [24, 25]. This disparity might be attributed to Liberian women's traditional responsibilities as primary caretakers and homemakers, which increase their exposure to health information and their responsibility for family health. Gender distributions have been seen in malaria control in Kenya and Tanzania [26, 27]. These findings suggest that women may be effective drivers of behavioural change in household-level MBD prevention, and that interventions should capitalise on their impact while also tailoring messages to men.

### D. Perceptions of Environmental Risks

The high level of environmental risk perception (mean score of 36.05/50) demonstrates the community's understanding of the relationship between environmental factors and disease risk. Over 65% of respondents reported mosquito problems in their area, with 70% noting breeding grounds near their homes. This growing awareness creates opportunities for grassroots mobilisation in environmental management. The fact that only 45% of individuals consistently remove stagnant water suggests that, for many people, perceived barriers outweigh perceived advantages. This conclusion is consistent with research conducted in Côte d'Ivoire [28], which shows that awareness of environmental concerns does not always translate into effective environmental management measures.

### E. Yellow Fever Vaccination

Given that yellow fever is vaccine-preventable and Liberia is considered high risk for outbreaks, the 46.1% vaccination rate among study participants is concerning [29]. The fact that vaccine awareness (72%) surpassed vaccination rates (45%) signals a missed opportunity for immunisation. The study revealed no significant correlation between education and vaccination status ( $\chi^2 = 4.57$ ,  $p = 0.335$ ), indicating that immunisation barriers are structural rather than informational. Cost (25%), distance to health care (20%), and lack of prioritisation (8%) were the most frequently cited barriers. These findings are consistent with previous research on vaccination coverage in unstable health systems [30, 31], emphasising the need for outreach services and the integration of immunisation into routine primary care.

### F. Variations Within the Community

The absence of substantial variation in practice assessments across communities ( $F = 0.42$ ,  $p = 0.862$ ) underscores the importance of local context in designing MBD preventive strategies. Sinkor and Congo Town, for example, received higher practice ratings than informal neighbourhoods such as West Point and New Kru Town, which had poor sanitation and inactive health committees. This finding underscores the necessity of tailored, community-specific treatments over broad solutions. Similar differences have been seen in Senegal [32] and Ghana [33].

### G. Implications of Public Health Practice

This study has several implications for managing MBD in Liberia.

- i. *Integrated Vector Management:* The findings advocate for a move from focused malaria control to integrated vector management, which covers all mosquito-borne diseases (MBD). This should encompass measures to improve environmental cleanliness (waste management and drainage), human safety (bed nets and repellents), and larval source control.
- ii. *Health Education Activities:* must be expanded to cover emerging neglected tropical illnesses, highlighting their symptoms, transmission methods, and prevention measures. School-based initiatives, community health professional engagement, and mass media efforts may all contribute to closing knowledge gaps.
- iii. *Community Mobilisation: Utilising established community institutions (such as town leaders, women's groups, and youth organisations):* can help to increase environmental collaboration. Consistent community cleanup activities, in conjunction with municipal garbage collection services, can reduce environmental risks.
- iv. *Vaccination Enhancement:* To enhance yellow fever vaccine coverage, structural barriers must be addressed through outreach programs, integration with other health services, and demand stimulation tactics. The discovery that knowledge alone does not guarantee immunisation underscores the need for readily available services.
- v. *Gender-Sensitive Approaches:* Interventions must take advantage of women's responsibilities as household health administrators while simultaneously engaging males in job and community-related activities. Couple-focused strategies may be quite useful in encouraging household-level prevention.
- vi. *Structural Interventions:* Addressing the environmental factors of MBD risk requires cross-sector coordination across the health, environmental, and urban planning sectors. Investing in drainage infrastructure, waste management systems, and housing modifications can have a major positive impact on health.

# Assessment of Knowledge, Attitudes, Practices, and Environmental Risk Perception Related to Mosquito-Borne Diseases in Montserrado County, Liberia: A Cross-Sectional Study

## V. CONCLUSION

This study is the first to conduct a detailed investigation of environmental risk perception and knowledge, attitudes, and practices (KAP) about mosquito-borne diseases (MBDs) in Montserrado County, Liberia. The inability to translate heightened perceptions of environmental hazards into action suggests structural barriers to behavioural change. Long-term vector control relies on prioritising community participation, reducing environmental risk, and improving waste management. Future research should use qualitative methodologies to examine the socioeconomic and cultural determinants of preventive behaviours, and experimental designs to evaluate the efficacy of various intervention strategies and long-term changes in knowledge and practices. Geographic analysis of MBD risk variables might help identify high-risk locations for tailored therapies. Likewise, research into health-care system components that affect MBD management, such as surveillance capacity and vector-control efforts, would increase community awareness.

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## DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.
- **Funding Support:** This research did not receive any specific support from public, commercial, or non-profit agencies. The research was undertaken as part of academic training at the University of Liberia School of Public Health, without external funding.
- **Ethical Approval and Consent to Participate:** Yes, securing ethical approval and consent from all participating individuals is essential. **The ethical approval and consent are as follows.** This study was conducted as part of an educational training program at the University of Liberia School of Public Health. Although formal IRB approval was not obtained before data collection, we followed fundamental ethical principles such as: (1) obtaining written informed consent from all participants; (2) ensuring voluntary participation with the right to withdraw; (3) protecting confidentiality through data anonymization; and (4) ensuring secure data storage. All techniques followed the University of Liberia's ethical guidelines and the principles of the Declaration of Helsinki for human subject's research.

- **Data Access Statement and Material Availability:** The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher upon reasonable request. Data requests should be directed to the corresponding author.
- **Author's Contributions:** Each author has individually contributed to the article. Prince L. Fully: Conceptualization, methodology, formal analysis, investigation, writing – original draft, supervision, project administration. Neima Candy: Data curation, investigation, writing – review & editing, visualization. Joeline T. Gorlortor: Methodology, validation, resources, writing – review & editing, funding acquisition. Letha Gonyon: Investigation, data curation, writing – review & editing. Teiko Gaidya: Investigation, data curation, writing – review & editing. Williametta Gedegar: Investigation, data curation, writing – review & editing.

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# Assessment of Knowledge, Attitudes, Practices, and Environmental Risk Perception Related to Mosquito-Borne Diseases in Montserrado County, Liberia: A Cross-Sectional Study

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