PERSPECTIVE

Dengue Fever: Addressing Ghana's Emerging Public Health Crisis

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ABSTRACT

This study explores the public health concerns, challenges, and solutions surrounding dengue fever reemergence in Ghana. Several environmental factors such as open drainage system, improper waste disposal, improper storage of water influence the transmission of dengue disease in Ghana. Ghana is also dealing with issues related to increased global commerce and tourism, inadequate sanitation such as open drainage system, improper waste disposal and inadequate mosquito control measures which could lead to increased vulnerability to dengue outbreaks. Poor healthcare infrastructure, poverty, geographical inaccessibility, a shortage of skilled healthcare workers, lack of awareness among community members, and weak vector surveillance system further exacerbate the issue. Thus, there is an urgent need for coordinated efforts among policymakers, healthcare professionals, and the general public. Increasing public awareness through co-creation approaches, strengthening laboratory diagnostics, investing in healthcare professionals training, scaling up integrated vector management activities stakeholders can mitigate the risk of severe dengue complications in Ghana.

Keywords: Ghana, Disease transmission, Aedes aegypti, Vector control, Dengue vaccine

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INTRODUCTION

Dengue is a febrile illness of arboviral origin transmitted by the species of mosquito- *Aedes aegypti.*[1] It is characteristically endemic in urban and semi-urban areas of tropical and subtropical climates with clinical manifestations ranging from asymptomatic infection to severe infection such as undifferentiated fever, dengue hemorrhagic fever (DHF), and shock with multi-organ dysfunction. Dengue fever is endemic in nearly 127 countries,[2,3] and over 80 nations having the largest number of dengue cases. Although dengue outbreaks have been reported in many parts of the world, there is a paucity of data on dengue incidence or prevalence in African countries. DENV transmission is prevalent in 34 African countries, with DENV-2 the most frequent serotype, followed by DENV-1. Dengue has been documented in Togo, Burkina Faso, Côte d'Ivoire, and Nigeria[4], but there is limited evidence on the dengue virus in the neighbouring country, Ghana[5].

However, recently about 36 cases of dengue have been confirmed in the Eastern and the Central part of Ghana.[2] The Ghana Health Service issued a press release on July 14, 2024, announcing the detection of confirmed Dengue fever cases among patients exhibiting acute febrile illnesses following the case update on the July, 17, 2024 at the Noguchi Memorial Institute Medical Research (NMIMR).[2] Though, several studies on dengue fever vaccine development and vector control are ongoing globally, this study, explored the public health concerns, challenges, and solutions surrounding dengue fever reemergence in the tropical region of Ghana.

Risk factors and Public Health Concerns associated with Dengue reemergence in Ghana

Dengue fever is caused by the dengue virus (DENV), which has four distinct serotypes: DENV1, DENV2, DENV3, and DENV4. Infection with one serotype does not provide immunity against the others, leading to an increased risk of severe disease upon subsequent infections.[6] Studies indicate that neurological complications can occur in approximately 2.64% of hospitalized dengue patients, emphasizing the potential severity of the disease.[7]

Environmental factors: Several environmental factors can contribute to the spread of dengue fever in Ghana. Heavy rainfall, poor sanitation, and stagnant water create ideal breeding conditions for mosquitoes.[4] The rainy season, which typically runs from June to October in Ghana, coincides with peak dengue transmission periods. Urbanization has also played a critical role; as cities grow and populations become denser, the risk of dengue outbreaks increases.[2,5]

Social factors: Ghana is also dealing with issues related to increased global commerce and tourism, as well as other social issues and inadequate mosquito control measures which could lead to increased vulnerability to dengue outbreaks by fostering an environment that favours the survival of Aedes species and the spread of the viruses responsible for causing chikungunya, dengue, and zika illnesses.[8,9] Numerous investigations have demonstrated that the dispersion of the Aedes mosquito population is significantly influenced by the growth of urban development[5], Studies reveal that urban regions have higher populations of adult Aedes aegypti mosquitoes (1.97 Aedes/ovitrap/week) than suburban areas (1.44 Aedes/ovitrap/week) and rural areas (0.89 Aedes/ovitrap/week).[10] Furthermore, compared to suburban regions (1,428/3,069, 46.5%) and rural areas (738/2,423, 30.5%), more possible breeding sites have been discovered in urban areas (2,136/3,374, 63.3%).[11] In Ghana, inadequate sanitation such as open drainage system, improper waste disposal, improper storage of water, etc, has been highlighted as a contributing factor to the production of small stagnant pools. These conditions, caused by inadequate sanitation, provide perfect breeding grounds for the propagation of Aedes mosquitos. Aedes mosquitos lay their eggs in household containers that can hold water and spread the dengue virus while feeding on human blood.[4,12]

Healthcare and surveillance challenges: Efficient and reliable diagnosis of dengue fever requires early discovery of life-threatening cases, case verification, and differential diagnosis with other infectious disorders.[13] However, in many impoverished nations, like Ghana, reliable diagnostic techniques such as PCR and serological assays may be inaccessible, resulting in misdiagnosis or delayed diagnosis. Furthermore, poor healthcare infrastructure, poverty, geographical inaccessibility, a lack of medical insurance, and a shortage of skilled healthcare workers, such as doctors, nurses, and laboratory technicians, impede early identification and management of dengue infections in Ghana.[14] Furthermore, there is a high risk of inadequate management or incorrect treatment of dengue fever patients due to a lack of awareness among healthcare personnel or an overreliance on antibiotics, which are ineffective against viral diseases as well as further burden the healthcare system by fostering antimicrobial resistance. These variables, taken together, contribute to Ghana's difficulty in effectively controlling and managing patients' load in healthcare system. Furthermore, inadequate vector surveillance results in reactive instead of proactive and preventive interventions, resulting in ineffective vector management approaches. Significant variability in the type and quantity of mosquito traps, uneven sampling techniques, irregular spacing, and varying trap installation frequencies between programs all contribute to these issues. Inadequate funding, a lack of surveillance skills, poor cross-jurisdictional cooperation, and varied standardized processes for mosquito surveillance within and between regions all contribute to the problem. Furthermore, there is often little or no formal or informal collaboration with relevant organizations, uni-

versities, health agencies, and nearby mosquito-control regions, including the local population responsible for curtailing dengue fever outbreaks, prevention, and control.[2,6,15] To lower the burden of dengue within the national health system, it is necessary to increase diagnostic capability, engage in healthcare staff development, and implement integrated vector surveillance.

CHALLENGES AND OBSTACLES

Vector control related factors: The effective implementation of the integrated vector management (IVM) strategy as advocated by the WHO and the National Vector Borne Diseases Control Programme (NVBDCP) in Ghana is challenged by a range of structural and environmental factors. Such factors include cost of insecticides and vaccine researches, e, widely used urban drainage systems with little or no prior health impact evaluations, inadequate garbage management, deforestation, inefficient irrigation and water supply systems, increased worldwide trade and travel, and global warming which ultimately results in virus proliferation and persistence in the environment.[16] Besides, in Ghana, the extensive use of household insecticide coils has led to resistance to all insecticides except pirimiphos-methyl.[17] Thus, developing novel formulations and compounds will be critical to Ghana's vector control efforts.

Lack of resources: According to Moise[18], these technical challenges are further greatly influenced by systemic limitation in financial and human resources. Unstable and low funding structure undermine routine vector control activities and responsiveness of public health surveillance systems to recognize novel diseases transmitted by mosquitoes and intervene appropriately, promptly, and efficiently.[13] Furthermore, many communities lack facilities and skilled employees with entomological capabilities, undermining essential mosquito control activities such as efficient collection of specimens, vector identification, tracking spatial distribution of mosquitoes, presence of disease causing mosquito species, disease burden in the locality, and continuing of these activities.[13,18] Although dengue vaccines have been developed, their availability and effectiveness differ across region in Ghana due to financial, logistical challenges, and uncertainties regarding vaccination efficacy in those with prior dengue exposure. This restricted availability to vaccinations impedes comprehensive vaccination campaigns.[14]

Community's lack of awareness: Lack of interest or concern, as well as limited public understanding of the significance and nature of mosquito management, and a lack of political will further undermines the cooperative mosquito surveillance and control measures in Ghana. It additionally implies limited access to put traps on private land, as well as poor family involvement with mosquito control activities such as cleaning stagnant water containers.[18] Furthermore, a lack of knowledge about dengue symptoms and prevention among populations may deter healthcare-seeking behavior.[14]

SOLUTIONS AND STRATEGIES

The WHO's Global Strategy for Dengue Prevention and Control (GSPC) aspires to bring down dengue mortality to zero by 2030.[19] Management of a dengue fever outbreak can be categorized into: preparedness and response. Outbreak preparedness principally involves vector control, vaccine development, and community awareness.[16]

Vector control strategies: The vector control measures involve understanding the local vector ecology and patterns of disease transmission, using insecticides sparingly, monitoring the distribution, density, and species diversity of mosquitoes across the targeted region, using easier entomological survey models and indices as alert mechanisms to prevent cases of dengue fever from going unreported, having an extensive knowledge of the disease burden and potential outbreaks, and implementing novel vector control strategies like using Wolbachia-infected mosquitoes as investigated in the United States.[14,16,20–23] It has also been demonstrated that using window screens, lengthy sleeves, insect repellents, insecticide-treated bed nets, vaporizers, coils, and other personal and household protective devices can effectively lower the rate of dengue infection.[19]

Community Engagement strategies: Public education through the provision of instructional materials, especially through school outreach and doorstep visits, to make sure the community is aware of how to properly remove mosquito breeding sites and take personal protective measures are critical strategy to address some of the barriers of mosquito and its vector control.[18] Using community co-creation techniques can empower communities by encouraging a sense of accountability and ownership for dengue prevention initiatives. Finding particular community needs and preferences through local knowledge and insights can result in initiatives that are more contextually appropriate. Additionally, it might encourage communities to adopt new behaviors, which would improve the implementation of preventive measures.[23] Such initiatives may also include collaborating with pertinent agencies such as community health workers, community gatekeepers, local non-profit organization in vector control by involving them in distributing resources and limiting operational costs; boosting individual accountability and lowering disinterest in household mosquito-control efforts, especially through interactions with others; fortifying community support to increase political will and support for additional and reliable funding; and more efficient and long-lasting control of mosquitoes across service boundaries.[18] Burkina Faso's community-based dengue prevention and control program is a good model for Ghana to follow.[24] In the

model, community members, leaders, and a theatrical troupe were chosen and educated to impart knowledge and conduct dengue awareness events. The awareness sessions were delivered in the form of interactive play, actor-audience interaction, a question-and-answer session, and community clean-up initiatives in public locations. Door-to-door visits, school instruction, and a self-awareness evaluation were also used to raise students' understanding of dengue prevention and control. This contextually appropriate, low-cost initiative demonstrates the possibility of community engagement in dengue prevention.

Policy: While various vaccines have been developed and vaccines are under trial globally, their applicability remain limited to highly endemic countries. There is currently no specific, effective, and safe dengue vaccine due to the complexity of conducting long-term studies to evaluate vaccine efficacy and safety.[25] Unfortunately, Dengvaxia is the only DENV vaccination that is currently recommended by WHO in high endemicity areas, and thus, do not include Ghana.[26,27] As a result, Ghana's public health response to dengue requires integrated approaches such as vaccine development, Vector control, training of healthcare professionals and community engagement to control and reduce its burden on public health given the country's resource constraints.

Conclusion

Dengue fever is a significant public health threat in Ghana, compounded by weak diagnostic infrastructure, inadequate vector surveillance, limited awareness and systemic resource constraints. These challenges hinder early detection and effective case management, resulting in increased complications such as dengue haemorrhagic fever and dengue shock syndrome. To combat dengue fever effectively in Ghana, there is an urgent need for coordinated efforts among policymakers, healthcare professionals, and the general public. Increasing public awareness about the symptoms and risks of dengue through co-creation approaches is essential for community ownership and sustained prevention efforts. By strengthening laboratory diagnostics, investing in healthcare professionals training, scaling up integrated vector management activities stakeholders can improve public health outcomes and mitigate the risk of severe dengue complications in Ghana.

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