

The impact of climate change on malaria in coastal Ghana

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What is the issue?

Malaria is a major health challenge in the coastal communities in Ghana. Across the country as a whole, the disease affects about 50% of children under five years and accounts for over 32% of hospital cases (NMCP, 2009). Moreover, most people in coastal communities live in unplanned settlements which have inappropriate waste generation and disposal sites, and poor and choked drainage systems. This creates numerous places for mosquitoes to breed. Climate change and variability have exacerbated these environmental conditions, with heavy rainfall and increasing temperatures further supporting mosquito breeding and malaria prevalence. In response, the IDRC-funded *Climate change adaptation research and capacity development in Ghana* project sought to strengthen public health malaria policies through better understanding how past, present and future climatic factors affect malaria prevalence and to inform strategies that can be used to prevent the disease.

What did we do?

The project investigated community perceptions of climate change and malaria, and links between them, in order to guide activities aimed at reducing the influence of climate change on prevalence of the disease. Five focal group discussions were conducted in the district of Ga-mashie, 240 questionnaires were administered, and 22 health personnel were interviewed in selected coastal hospitals.

Scientific evidence of past, present and future climate impacts on malaria prevalence in three

Key messages

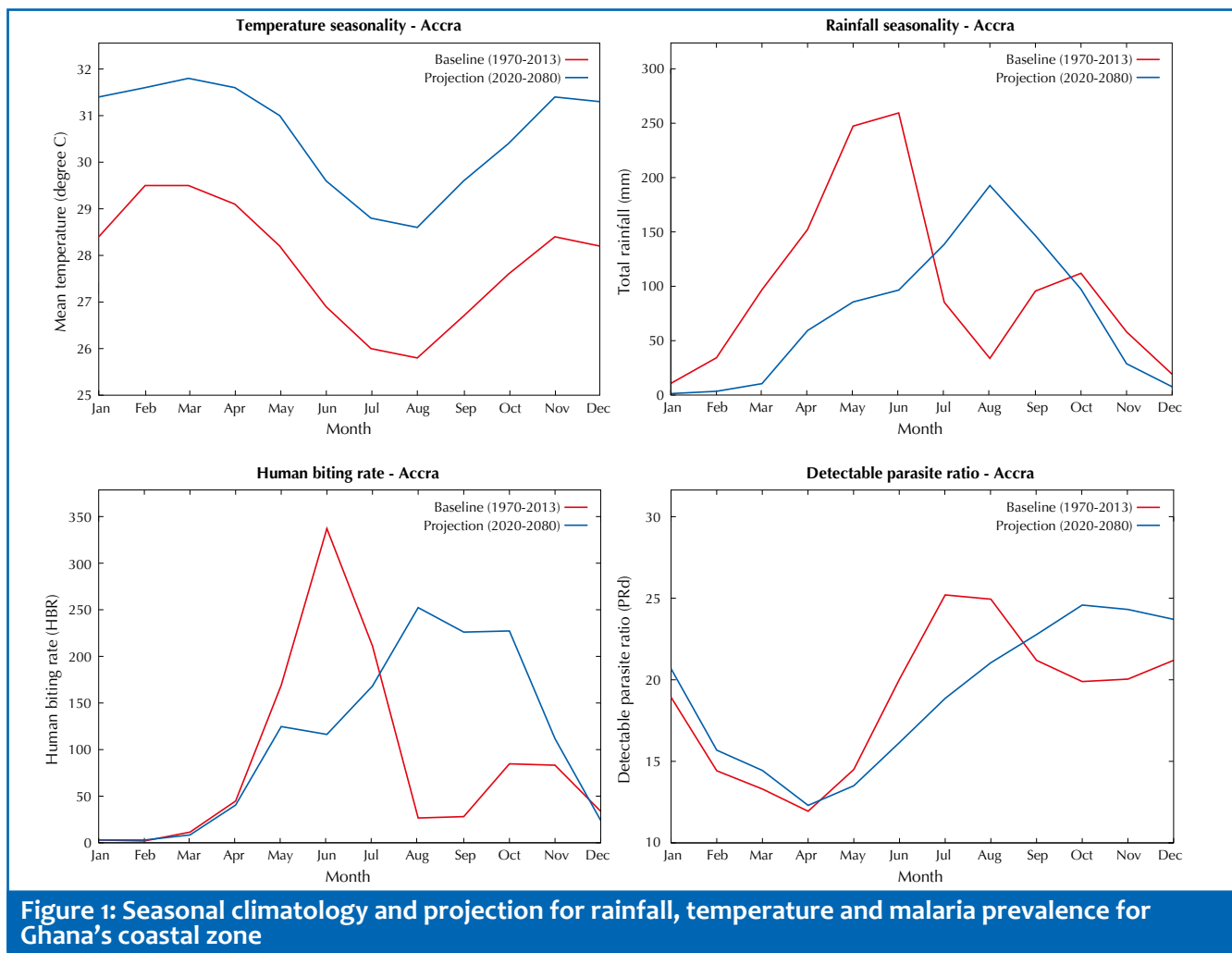
- In coastal cities of Ghana, malaria prevalence is affected by climate-related factors such as flooding and a warmer climate.
- Environmental conditions are critical in malaria transmission, with mosquitoes adapting to breed in non-traditional locations, such as blocked surface drains.
- Community and institutional involvement in clearing the environment of potential mosquito breeding sites, coupled with health education and improved malaria control programs, are critical for reducing malaria incidence.
- Between 2020 and 2080, it is anticipated that the peak malaria transmission season (May-July) will shift by around 1-2 months due to a corresponding shift in the peak rainfall patterns.
- In the long term (2020-2080), however, it is projected that malaria disease prevalence will decrease with reduced rainfall and temperatures above 35°C, conditions which make breeding difficult for mosquitoes that transmit malaria.

coastal cities of Ghana were investigated using the VECTRI disease model developed by the International Centre for Theoretical Physics in Trieste, Italy (Tompkins and Ermert, 2013).

This model uses temperature and rainfall as its primary inputs, and also factored population density and growth rate. Using the model, the human biting rate (the number of mosquito bites per person per year) and the detectable parasite ratio (the proportion of infected hosts with detectable malaria) were computed and compared.

What did we learn?

- Female anopheles mosquitoes, the main transmitters of malaria, are now adapting to non-traditional breeding environments, such as water-filled surface drains. Environmental conditions have therefore become the critical issue for malaria transmission in the study area. Frequent flooding and indiscriminate waste disposal create a conducive environment for malaria transmission.
- Malaria is climate-change driven. Cases are mostly recorded when rainfall reaches its peak during the months of May-July; this is likely to shift in the future due to changes in the rainfall pattern (Figure 1).
- Projected malaria prevalence (2020-2080) is however expected to decrease due to more droughts and a rise in temperatures above 35°C (Figure 1), conditions which make breeding difficult for mosquitoes that transmit malaria.
- Malaria mostly affects children under five years, whose overall immunity is less developed, and women, who are frequently outdoors in the evenings – when mosquitoes are most active – carrying out responsibilities such as petty trading, fish processing and cooking.
- Insecticide treated mosquito nets (ITNs) have been distributed to the communities as a control measure. However, about 70% of the households do not use them, finding the nets too uncomfortable to use or instead preferring to keep them for visitors rather than protecting themselves.





Campaigns delivered through youth theatre have improved support for environmental cleanliness

Stories of change

The project has rolled out a number of intervention programs to promote malaria prevention in coastal communities in Ghana. These include a number of educational campaigns on climate change and malaria prevention delivered through youth theatre, radio discussions, as well as community sensitization meetings. Furthermore, climate change community clubs of 150 members each have been formed in James Town and Agblosshie communities. This has led to improved social support for environmental cleanliness, as community members understand that preventing the build-up of stagnant water will reduce mosquito breeding, thereby reducing malaria prevalence.

The Agblosshie club has collaborated with Zoom Lion, a major private waste management company, to clear drains in the communities under the supervision of Accra Metropolitan Assembly engineers.

In James Town, research findings showed that heavy rains and environmental conditions favor malaria transmission, with mosquitoes breeding in pools of water that collect in plastic waste. As a result of the club's sensitisation activities, however, there is increased community awareness and commitment to maintaining clean surroundings in order to reduce these breeding

grounds. This community also collaborated with Zoom Lion and the Accra Metropolitan Assembly for waste collection and disposal, and over 800 households were provided with bins for organic and inorganic waste separation. For a monthly cost of approximately US\$5, the waste is then collected and removed from the community by local youth who were hired to deliver the door to door waste collection services. In addition to their wages, they can generate further income from the sale of organic manure and plastics to local recycling companies.

What are the policy implications?

Climate change is expected to have an impact on malaria prevalence. Increasing temperatures and flooding in the short-term are likely to increase the incidence of malaria, hence control efforts have to be targeted to improve environmental and sanitation conditions. In the long term (2020-2080), however, climate models predict drought due to changing precipitation patterns and temperatures above 35°C, which will see a decrease in the incidence of malaria.

Prevention activities must be year round and should include refuse clearing, drainage expansion and de-silting of choked drains. Providing environmental and sanitation education should also be considered and district by-laws on environmental cleanliness should be strengthened. Other malaria control measures should include destruction of mosquito breeding sites through improved drainage and introduction of fish in ponds to feed on the mosquito larvae,



Waste collection and disposal is a source of income for young people



Sensitization in primary schools has highlighted the links between climate change, environmental cleanliness and malaria

mass indoor and outdoor spraying of insecticides, and continued offering of health education programs on the use of the treated mosquito nets. Finally, existing malaria control programs should be extended to all coastal communities.

What next?

- What can be done to stem the spread of Anopheles mosquitoes in new, non-traditional breeding habitats?
- Further studies are needed to determine the effect of increasing population on the human biting rate and number of malaria cases. It should also be investigated whether the predicted human biting rates and

corresponding detectable parasite ratios (from the VECTRI model) are consistent with on-the-ground observations.

- Better understanding of the spatial and seasonal distribution of malaria in Ghana is necessary. How will the geographic risk areas for malaria increase or decrease with climate change?
- To what extent do the social intervention and malaria control programmes need strengthening?

Need more information?

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References

Ermert V., Fink A.H. and Paeth H. (2013) The potential effects of climate change on malaria transmission in Africa using bias-corrected regionalised climate projections and a simple malaria seasonality model. *Climatic Change*, 120, pp. 741-754.

Manzanas R., Amekudzi L.K., Preko K., Herrera S. and Gutierrez J.M. (2014) Precipitation variability and trends in Ghana: An intercomparison of observational and reanalysis products. *Climatic Change*, 124, pp. 805-819.

National Malaria Control Program. (2009) *National Malaria Control Program Report*. Ministry of Health, Ghana.

Tompkins A.M. and Ermert V. (2013) A regional-scale, high resolution dynamical malaria model that accounts for population density, climate and surface hydrology. *Malaria Journal*, 12 (65), pp. 1-24. <http://bit.ly/11AE0ka>.

Tay S.C.K., Danuor S.K., Morse A., Caminade C., Badu K. and Abruquah H.H. (2012) Entomological survey of malaria vectors within the Kumasi Metropolitan Area – a study of three communities: Emena, Atonsu and Akropong. *Journal of Environmental Science and Engineering*, 1 (2), pp. 144-154.



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