Impact of construction of social housing units on malaria vector abundance on Bioko Island, Equatorial Guinea.

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Construction of massive infrastructures that are often associated with urbanization has profound implications on malaria epidemiology and vector control in Africa. In 2017, the government of Equatorial Guinea created new districts on Bioko Island and embarked on the construction of social housing units in these districts. This study evaluated the impact of the construction of the social housing units on vector abundance on Bioko Island. Mosquitoes breeding habitats at the construction sites of 13 new districts were monitored during the construction phase on a weekly basis. Data were captured on the physical characteristics of each breeding habitat, as well as the larval and pupal forms of mosquitoes. Out of the 13 constructions sites in each of the 13 districts, nine construction sites were intervened with the application of a microbial larvicide, *Bacillus thuringiensis israelensis (*VectoBac GR). Two sites in two districts served as controls without the application of the larvicide. Adult mosquitoes were collected using human landing catches in the surrounding communities at both the intervention and control communities. The proportion of breeding habitats with mosquito pupae in the intervention sites dropped from 30% at baseline to an average of 3% after six months of treatment while that of the control sites increased from 0% to an average of 25.8%. A total of 1,651 mosquitoes were collected during this period. 66% were *Anopheles spp*, 20% *Culex spp* and 14% *Aedes spp*. *Anopheles* man biting rates reduced from 5 bites per person per night at baseline in the intervention communities to an average of 2 bites per person per night while that of the control communities increased from zero to an average of 5 bites per person per night. The construction of housing units which led to the increase in vector densities at the surrounding communities was significantly reduced by the application of larvicide. Larval source management as a complementary intervention is necessary at construction sites to reduce vector populations and prevent possible malaria outbreak.

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BACKGROUND

Background

Construction of massive infrastructure is associated with urbanization and has profound implications on malaria epidemiology and vector control in Africa. In 2017, the government of Equatorial Guinea designated new urban districts on Bioko Island and embarked on development constructions. The construction activities with the heavy equipment resulted in the vast earth movement that created potential breeding sites for mosquitoes. To prevent possible malaria outbreak in the surrounding communities, the Bioko Island Malaria Control Project (BIMCP) monitored all the potential breeding sites for mosquito larvae and collected adult mosquitoes in the surrounding communities to determine the type of species and their density. Larviciding with *Bacillus thuringiensis israelensis-Bti* was applied in some construction sites designated as intervention communities and those designated as control communities larvicide was not applied.

Objective

An assessment on the impact of the construction activiites carried on vector abundance on Bioko Island

METHODS

Study site

The study was conducted on Bioko Island, Equatorial Guinea. The Island is located 32 km off the coast of Cameroon with a population of approximately 335,000 people. Malaria transmission occurs throughout the year. The BIMCP is being implemented by Medical Care Development International since 2004 with funding support from, Marathon Oil Noble Energy, Atlantic Methanol, GEPetrol,, Sonagas and the Government of Equatorial Guinea. A total of 11 new urban districts were created in 2017. A baseline of all the potential breeding habitats at the construction sites was established. A tablet based application ArcGIS Collector was used to capture breeding sites characteristics and updated weekly. Two districts, which historically had no collections of the vectors, served as control where larviciding was not applied at the construction sites (Fig 1 with blue colours). Weekly application of the larvicide was carried in the nine intervention districts. The vector densities in the near-by communities were determined by human landing catches (HLC).

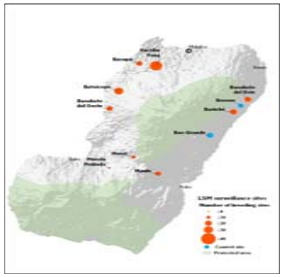

Fig 1 Map of Bioko Island showing construction sites of new districts

Fig 2 monitoring of breeding habitats at the construction sites.

RESULTS

- Of the mosquitoes captured *Anopheles gambiae s.l.* constituted 71%, *Culex spp 20%* and *Aedes spp* 9%. *(Figure 3)*
- Fig 3 shows the percentage of the types of mosquitoes collected each month.
- The average biting rate of *An. gambiae s.l.* in the intervention communities at baseline was five bites per person per night (BPN)
- After four months of the application of the larvicide, at the construction sites, the biting rate dropped to less one BPN
- In the control communities where larvicide was not applied at the construction sites the biting rate was zero at baseline but increased to 12 bites after four months
- Fig 4 shows the average biting rates of *An. gambiae s.l.* each month in both control and intervention communities

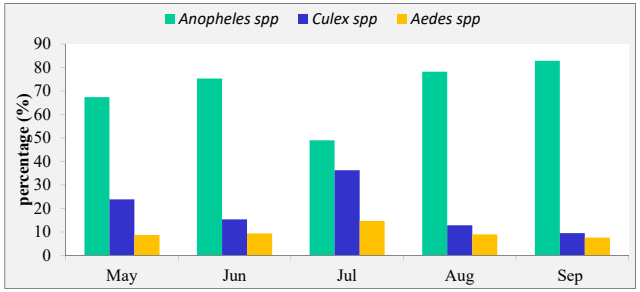

Fig 3. Composition of mosquitoes caught.

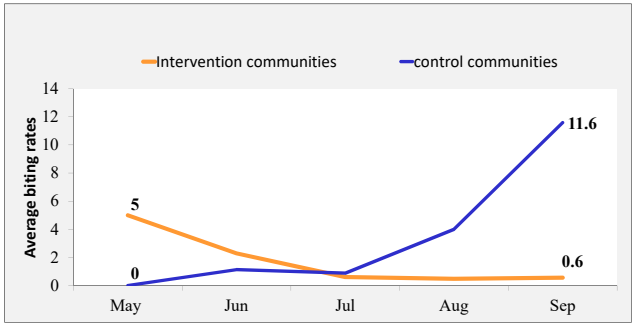

Fig 4. Average monthly biting rates

DISCUSSION

- Mass movement of earth during the construction phase (Fig 5) created breeding habitats for mosquitoes.
- The breeding sites were more conducive for breeding the malaria vectors (71%) than non-malaria vectors (*Culex spp and Aedes spp).*
- The vector densities increased in communities which hitherto had no vectors by 12 fold where larvicide was not applied at the construction sites.

Conclusion

The application of larvicide at the construction sites reduced the vector densities in the surrounding communities that have active construction projects. Vector source management like larviciding should be taken into consideration in communities with ongoing massive constructions

Fig 5. Construction phase

Fig 6. final stage with land scape

REFERENCES

- World Health Organization. 2013. Larval Source Management: a Supplementary measure for malaria Vector Control. An Operational Manual: WHO. Geneva, Switzerland.

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