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POLICY BRIEF

Towards alternative ways of deploying vector control interventions: from modelling to practice

Key messages

- The vulnerability to vector-borne diseases such as malaria is dependent on the distribution of vectors.
- Resources for malaria vector control interventions implementation are limited and have been dependent on donors. In a move towards the reduction of donor dependency, efficient planning of interventions is critical. The support from donors allows delivery of malaria vector control interventions to cover most parts of the countries uniformly without considering vector density variations. With scarce resources, universal coverage becomes unachievable.
- Modelling indicates that deployment of vector control interventions in unclustered way in targeted small hotspots maximizes the effectiveness of the interventions.
- Stakeholders are advised to test and adopt different intervention deployment strategies of malaria vector control interventions in the field context. This will help us to have alternative ways of addressing malaria in the event of scarce resources.

EXECUTIVE SUMMARY

Exposure to Malaria is dependent on the distribution of vectors at local scales which are more likely to be influenced by mosquito behaviour and ecology. Financial resources for vector control interventions implementation are limited and have been dependent on donors. With scarce

resources, universal coverage becomes unachievable and in a move towards the reduction of donor dependency, efficient planning of interventions is critical.

Model results showed that deployment of vector control interventions in unclustered way in targeted small hotspots maximizes the effectiveness of the interventions. Therefore, stakeholders in malaria vector control are advised to test and adopt different intervention deployment strategies of malaria vector control interventions in the field context.

THE PROBLEM

Vector control has been an important part of the global malaria control strategy with several interventions targeting at reducing the contact between humans and vectors. The reduction of human-vector contacts reduces the population density of vectors and hence, malaria transmission, resulting in reductions in malaria morbidity and mortality. Insecticide treated bednets (ITNs) or Long lasting insecticide treated Nets (LLINs), Indoor residual Spraying (IRS), and larvicide are distributed through different distribution programs, some of which are subsidized to attain high coverage and reach the majority of people. This high coverage allows delivery of interventions to cover most areas uniformly despite vector density variations. When universal coverage cannot be achieved due to scarce resources, spatial arrangement/distribution of deployment of vector control interventions is potentially important for optimizing intervention benefits.

Previous theoretical modelling work has shown that the probability that mosquitoes may encounter areas that are in receipt of a particular vector control intervention while flying is dependent on the spatial distribution of particular interventions[1] and coverage[1 2 3]. When Donors aren't available for support and in a move towards the reduction of donor dependency, there is a risk of malaria resurgence as high coverage of these interventions will no longer be sustained and a shifting pattern from universal coverage to low coverage levels is possible. This shifting pattern of coverage guarantees varied distribution of interventions. To address this gap, mathematical models[4] were used to find how best interventions should be spatially distributed and deployed to maximize their effectiveness.

To find out the best beneficial spatial distribution of interventions, mathematical models[4] [5] which included mosquito movement, and distribution of mosquito resources were developed and used to investigate the effect of spatial distribution of vector control interventions such as interventions of ITNs, Indoor residual Spraying (IRS), and larviciding on their effectiveness in reducing the population of biting mosquitoes. The effects were explored at various intervention coverage levels to provide theoretical evidence on the existence of variability in intervention effectiveness, depending on their spatial distribution in small areas[5]. We found that, to maximize effectiveness when universal coverage is unachievable, malaria vector control interventions should be distributed in unclustered way in hotspot areas.

POLICY OPTIONS

Maximizing the benefits of vector control interventions in periods of donor fatigue and scarce resources is essential. To achieve these maximum benefits, we propose;

1. ***Deploying interventions in unclustered way in targeted small hotspots***

As countries approach malaria elimination, transmission hotspots maintain transmission, especially during high transmission.

Unclustered distribution of

interventions break the gonotrophic cycle, as mosquitoes need to avoid intervention areas to survive and biting mosquitoes are reduced more.

2. Efficiently plan possible best options of intervention deployment

Optimal deployment strategies need to identify the type of settings suitable for a particular intervention, to identify the kind of delivery modes
to be considered, and how to best integrate specific interventions with the health system.

3. Considering patterns of heterogeneity when designing intervention strategies

Considering heterogeneity due to ecological behaviour of mosquitoes which is the main source of variations in malaria risk at local spatial scales is crucial. This can assist not only in determining risk areas for targeted control, but also in determining optimal strategies for deploying interventions to maximize intervention effectiveness.

RECOMENDATIONS

Stakeholders in the malaria vector control need to test and adopt different spatial deployment strategies of malaria vector control interventions in the field context. Testing these theoretical results in the field will help to have alternative ways of addressing malaria in the event of scarce resources.

IMPLEMENTATION CONSIDERATIONS

To deploy interventions in un-clustered way, efficiently plan possible best options of interventions deployment, and consider patterns of heterogeneity when designing intervention strategies, stakeholders in the vector control sector have to well plan, implement, and manage vector control to lower malaria transmission. In the field, theoretical results generated by models can be tested by spatially distributing interventions. In addition, testing and nesting modelling and field research generates evidence for valuable resource management and rational decisions about strategies for local malaria control.

Competing interest

The author has no competing interests.

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