RBM VCWG-11
APMEN Priority Areas of Vector Control

Dr Chang Moh Seng
APMEN Vector Control Working Group
• 18 Country Partners
• 37 Partner Institutions

Collegial forum that links 18 Country Partners with regional partners from the academic, non-governmental and private sectors, as well as WHO.
Four APMEN Objective Areas

• Advocacy and leadership
• Building the evidence base
• Capacity building, and
• Knowledge exchange for malaria elimination.
3 Working Groups meet annually

• Vivax Working Group
• Surveillance and Response Working Group and
• Vector Working Group
Objectives of APMEN-VCWG

• To advocate for the level of vector control capacity at regional and country level required to attain and maintain malaria elimination

• To stimulate and where possible coordinate operational research on questions directly related to intensified malaria control and elimination
VcWG Achievements 2015

Capacity building

• 3 recipients awarded the Inaugural Insecticide Resistance APMEN Fellowship 2016

• Supported attendance at IVM Training 2015, Malaysia

• Co funded Vector Control in Elimination Settings Training hosted by WHO WPRO, 2015
VcWG Achievements 2015

• Inaugural Vector Research Grants

• Annual Meeting held in Kuala Lumpur, in January 2015, co-hosted by the Ministry of Health, Malaysia

• Represented at Roll Back Malaria Vector Control Working Group since 2015
Main activities achievements - VCWG

Strategies and approaches to vector control in nine malaria-eliminating countries: a cross-case study analysis

Cara Smith Gueye¹, Gretchen Newby¹, Roland D. Gosling¹, Maxine A. Whittaker², Daniel Chandramohan³, Laurence Slutsker⁴ and Marcel Tanner⁵

Evaluation of CDC light traps for mosquito surveillance in a malaria endemic area on the Thai-Myanmar border

Patchara Srivichai¹, Stephan Karl², Yudhana Samung¹, Suchada Sumruayphol¹, Kirakorn Kliatiyutir¹,⁵, Anon Payakkapol¹, Ivo Mueller⁶, Guiyun Yan⁶, Liwang Cui⁶ and Jetsumon Sattabongkot⁶
Pocket Anopheles Keys

• Contains 26 main malaria vectors in Asia Pacific
• Jointly produced with The Walter Reed Biosystematics Unit & AFRIMS, Bangkok
Asia Pacific Malaria Elimination Network (APMEN) Survey of Vector Control Activities and Capacities in APMEN Country Partners:
Implications for Elimination

Introduction
The Asia Pacific Malaria Elimination Network (APMEN) undertook a comprehensive literature review and survey amongst its Country Partners in 2010/11 to identify vector control capacities, needs and activities. This work was conducted by APMEN and focused on eight Country Partners which identified malaria elimination as a national or sub-national objective. Respondents were vector control managers/malaria managers at district, provincial and national levels in these countries.

To assist the sharing of knowledge between Country Partners, the APMEN Vector Control Working Group posed the following questions:

- What vector control tools are currently being used and how were these tools selected for eliminating malaria by APMEN countries?
- What else is needed to go from the remaining low-levels of malaria transmission to interruption of transmission?
- What data are available to determine what methods are and are not working?
- What are the technical/operational challenges regarding the use of vector control interventions for eliminating malaria in the Asia-Pacific region?

FINDINGS

VECTOR DIVERSITY
A challenge for the Asia Pacific region is the unique diversity of vectors.
- The literature review identified that the Asia Pacific region hosts 22 species of Anopheles incriminated as primary or secondary vectors.
- Recently published Global map of Dominant Malaria Vectors Parasites & Vectors 2011 notes that 19 different Anopheles species or species complexes that are considered dominant malaria-transmitting vectors. In comparison, Sub-Saharan Africa has 7 dominant malaria vectors and the Americas host 9.
- The APMEN Survey respondents identified 11 of these 19 (22).
- There are differences between what literature notes as major vectors and what APMEN Country Partners are responding to within National Malaria programs.

VECTOR CONTROL TOOLS
A range of malariavector control tools are used in the Asia Pacific. Tools do not substantially differ between control and elimination settings except for the targeting of specific intervention sites in only a few countries.

Bed nets
- 86 countries use long-lasting impregnated net (LIU) or insecticide treated bed net (ITN) in both control and elimination settings.
- 7 of 8 countries have guidelines for bed net use.
- 80% of the population is the target recommended for malaria elimination.
- Bed net coverage achieved or targeted was reported higher (60-100%) in elimination areas than in control areas.
- Biggest challenges in efforts to achieve universal net coverage are maintaining adequate net supplies (20%) and achieving desirable levels of net use (30%).

Indoor Residual Spraying (IRS)
- IRS is used by all 8 respondents countries for elimination, 6 of 8 have IRS guidelines or Standard Operating Procedures (SOP).
- Countries and their strategies for control spraying as compared to approaches used for elimination areas including focal spraying, spraying in high-risk areas, application during seasonal transmission and in response to outbreaks.

Environmental management
- 7 of 8 countries use environmental management and it has guidance for areas with low vector densities.

CHALLENGES IDENTIFIED BY RESPONDENTS

- Internal coverage of bed nets
- Monitoring adequate supplies
- Accessing appropriate coverage levels
- Difficulty in distribution
- Not sure what internal coverage in elimination areas

IRS
- General about insecticide resistance
- Availability of insecticide
- Acceptability by community
- Cost of spraying program
- Vector behavioral changes

Repellants
- Availability

Lindane Control
- Lack of materials and supplies
- Difficulty in identifying managing of breeding sites
- Lack of trained staff in use
- Lack of validation of effectiveness in their settings
- Lack of community involvement

ENVIRONMENT MANAGEMENT
- General awareness of effectiveness
- Lack of technical support

DISCONNECT BETWEEN VECTOR AND VECTOR CONTROL INTERVENTIONS
There were differences between the most recommended methods for vector control activities used by the countries based on the vectors breeding, resting and biting behaviour, and the methods the respondents countries actually used for combating vectors. Such variation included indoor to outdoor feeding and resting behaviours.

An outside-biting and outdoor-resting behaviour is more common in the Asia Pacific vectors, IRS potentially renders domicile-based control interventions - such as indoor-side-treated nets and indoor residual spraying - less protective against malaria transmission in some settings in the region.

HUMAN RESOURCES FOR VECTOR CONTROL IN ELIMINATION SETTINGS
The countries' current vector control is fully supported by national health service staff that are trained and identified.

At central level: information and data analysis of programmed interventions in malaria cases and breeding sites. IRS mapping, district level cost breakdowns for the program, and at initial set up of IRS management and information operational indicators including research, vector identification, equipment use, vector control maintenance and enhanced methodology.

At provincial level: coordination and distribution of data and supporting, equipment use, vector control maintenance and enhanced methodology.

At district level: integrated vector management, quality assurance for vector control activities, indoor residual spraying of large villages, equipment use, and vector control maintenance.

DISCUSSION
The Asia Pacific region faces several challenges in scaling up use of vector control in elimination settings. More specifically, more data are needed to
Asia Pacific Malaria Elimination Network (APMEN)
Inventory of Information and Guidance Documents on Larviciding for Malaria Control, Especially in Elimination Environments

INTRODUCTION
This comprehensive literature review was undertaken as part of a series of situational analyses conducted by the Asia Pacific Malaria Elimination Network (APMEN) to address the needs for quality management and skills for vector control and entomological approaches in countries that have malaria elimination as a national or sub-national objective. It is possible that the last remaining sources of vector larvae may become the last stronghold for malaria in elimination.

The APMEN Vector Control Working Group posed the questions:

1. Do we know enough about the use of larviciding as a vector control method in elimination environments to provide technical support to APMEN Country Partners?
2. If not, what roles should APMEN play to develop, operationally research, and strengthen this knowledge and evidence base?

METHODOLOGY

A literature search was conducted using Google Scholar, PubMed and Scopus, using the following key words: vector control, elimination, malaria, guidelines, standard operating procedures, larviciding, vector management and biological control.

Grey literature was searched through the World Health Organization library.

Access to a database for a Cochrane Review on vector control (see acknowledgements).

Articles published from 1985 through 2013 were sought in order to capture earlier references and ongoing issues on larviciding and the use of vector control during the malaria eradication period.

In total, 347 articles, books, and manuals were reviewed, with 117 articles identified as meeting the exclusion criteria.

Articles were reviewed and/or cited in order to capture any relevant information and insights into the use of larviciding in elimination environments.

ARVAL CONTROL METHODS REVIEWED:

- Chemical Control - Organophosphates
- Chemical Control - Pyrethroids
- Biological Control - Bacterial Larvicides
- Biological Control - Fish

INDINGS

The literature provided insights into operational aspects of larviciding and other methods related to larviciding. The name of active ingredient formulation and dosage duration and place to derive optimal efficacies from larviciding, larvicidal susceptibility testing, and larvicidal programmes based on their availability, were noted, and if included, elimination applications.

Based on the literature review, mesoclear control generally remains in experimental stages and is not yet been fully evaluated, hence not seen effective or is still in the experimental stages.

Review of available manuals and guidelines and operating manuals on use of larviciding in general and elimination environments in particular was undertaken.

DISCUSSION

A large body of literature exists on the types of larvicides and their corresponding suitability for the environmental and vectors in the Asia Pacific region.

While few larvicides have been specifically tested or explicitly discussed as suitable for elimination settings, detailed studies have been conducted on larviciding for vectors found in China, India, Sri Lanka, Solomon Islands, Malaysia, Indonesia, and Thailand, but not for other Asia Pacific countries. Therefore, there is an evidence gap that needs to be addressed.

Some sources provided useful operational data on the use of larvicides, their safe handling and storage, and other operational details. Further studies or manuals discussed the monitoring and evaluation of larvicides use in elimination settings.

DISCUSSION - SITES FOR LARVICIDING

- The recent interim position statement on The Role of Larviciding for malaria control in Australasia (WHO 2012) noted, in the context of sub-Saharan Africa, there was a specific limited role of larviciding in malaria vector control.
- It noted that adult mosquito control with IRS and ITNs are currently the most cost-effective interventions and have greater potential impact than larviciding.
- It also noted a need for more quality evidence on larviciding role in urban and low transmission settings.

In the Asia Pacific region, many APMEN countries have larval breeding sites which may be good targets for larviciding. The available position statement identified the following criteria for larviciding to be effective - few fixed and findable breeding sites. The following are incriminated vector species in APMEN countries meeting criteria - few, fixed and findable.

- An. annulipes, Indonesia, Sri Lanka
- An. albopictus, India, Sri Lanka
- An. maculatus, China
- An. gambiae, Thailand
- An. pseudopunctipennis, India
- An. triangularis, Sri Lanka

APMEN IN RESPONSE TO LITERATURE CALLS FOR:

- Continued identification of literature on larvicidal source management activities and studies in the Asia Pacific region that are not currently published or available to the public.
- Review of current methods of application and development of guidelines as much literature might be out of date.
- A detailed costing of larviciding.
- Increased advocacy for political commitment and policy for larval source reduction in a potentially important aspect of elimination strategies.
- Identify and support larviciding JVU training for countries for target vector.

ACKNOWLEDGEMENTS

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Authors of this poster Maxine Whittaker, Mark Sang Chong, Rick Epple.

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Challenges of malaria vector control in Asia Pacific (1)

- Complexity of Malaria Vectors

- High diversity of vector species, species complexes and suspected vector species complexes, many occurring sympatrically and exhibiting a high level of behavioural plasticity

- Of the list of 41 Dominant Vector Species of malaria worldwide, 19 species or species complexes are found within the Asian Pacific Region.
Challenges of malaria vector control in Asia Pacific (2)

- Increasing changing environment: deforestation, new irrigation projects, and expanding agricultural development can rapidly alter the composition of the local mosquito fauna and subsequently influence the control methods required.
Challenges of malaria vector control in Asia Pacific (3)

- Complex of malaria epidemiology & epi-center for artemisinin resistance (increasing the roles of vector control)
- Population at risk-
  - Mobile populations
  - Migrants
  - Static villagers
  - Forested workers/rubber tappers
- Appropriate vector control tools to target the populations at risk
Priority Areas of Vector Control

• Insecticide resistance monitoring and dissemination of resistance/susceptibility data
• Outdoor biting and population at risk
• Larval source management
• Appropriate BCC to enhance ITN/LLIN usage
• Capacity building and need for training in region
Potential threat – Pyrethroid resistance & waiting for future solutions

• Preemptive measures – Scaling up monitoring pyrethroid resistance and dissemination of data;
• New LLIN materials – against pyrethroid resistance e.g. pyrethroid plus PBO, permethrin/pyriproxyfen
Outdoor Residual Transmission

- Insecticide impregnation clothing and long lasting insecticidal hammock nets
- Topical & Spatial repellents, Insecticide candle etc.
- Push-Pull systems: attractant baits
Larval Source Management

- More evidences still required
- Characterization of larval breeding sites (GIS mapping, ecological classifications etc.)
- Productivity of larval breeding sites and prioritization
- Monitoring/evaluation
Capacity building – vector control management under elimination settings

• Understand the ecology of local vectors, the role of secondary vectors) for development and selection of appropriate new tools for vector control

• Vector control in hot spots and elimination of transmission foci (roles of IRS and LSM?)

• Improved entomological surveillance in hot spots

• Appropriate vector control management and evaluation (risk of resurgence due to down scale of vector control)

• Understand when to scale back/how to scale back interventions in a appropriate ways
Improved BCC

- Increase bed net usage and care of nets
- Use of insecticide impregnated hummock nets/repellents/
- Use of protective clothing (mobile population at risk, forested workers)
COMMENTS, QUESTIONS?