

## **RBM Vector Control Working Group**

### **Larval Source Management Work Stream**

#### **Progress on 2012 Work Plan – Lucy Tusting, London School of Hygiene & Tropical Medicine, UK**

A summary of the main conclusions from the previous meeting was given along with an update on the Cochrane Review of LSM. The Cochrane Review has been peer reviewed and the search updated. The analysis is being revisited with support from the Cochrane Infectious Diseases Group in Liverpool, and it is hoped that the review will be accepted for publication later this year.

Status of 2012 products:

1. Operational Manual on LSM.
  - The manual is to be a joint WHO-RBM publication.
  - First draft completed in April 2012.
  - Draft submitted to WHO in December 2012.
2. LSM country case studies
  - Four case studies on Khartoum, Mauritius, Dar es Salaam and India are complete.
  - Available on the RBM website.
3. Decision-making tool
  - First draft complete.
  - To be finalised alongside Operational Manual.

#### *Discussion*

The LSM Operational Manual has been sent by WHO to three independent reviewers. Monitoring and evaluation systems for LSM are important. There is much that can be learnt from LSM outside Africa (e.g. elimination of *An. gambiae* from Brazil). We need to work on assessing the cost efficiency of LSM and how best to allocate resources.

**4<sup>th</sup> Larval Source Management Work Stream Meeting**  
**13.00-15.00, Wednesday 30<sup>th</sup> January 2013**  
**Salle V, IFRC, Geneva**

**Chair: Steve Lindsay**  
**Rapporteur: Lucy Tusting**

***Summary of main conclusions***

1. 26 countries are conducting Larval Source Management (LSM), therefore the priority is not whether LSM should be used, but the emphasis of the Work Stream should be on providing guidance on where and how best to implement and evaluate LSM so that it is used effectively and efficiently.
2. LSM is playing a role in elimination in many countries (e.g. Morocco) and is likely to do so elsewhere, especially as malaria declines and if long-lasting insecticidal nets (LLINs) and indoor residual spraying (IRS) and are perceived by local communities as less necessary, where residual outdoor transmission is maintained or hotspots remain. There is scope for LSM in Africa and elsewhere.
3. LSM should also play a role in integrated vector management (IVM), with opportunities for sectors outside health to contribute e.g. those involved in water management. LSM in USA evolved from malaria and other disease control into general mosquito abatement and as Africa develops this is likely to be a natural progression.

***Update on Work Plan – Steve Lindsay, Durham University, UK***

The main conclusions from the 3<sup>rd</sup> meeting were summarised and an update on the 2012 Work Plan given.

*Case studies:* Four case studies have been completed and are available on the RBM website:

1. Khartoum, Sudan – Hmooda Toto Kafy (NMCP, Sudan).
2. Dar-es-Salaam, Tanzania – Prosper Chaki (IHI, Tanzania).
3. Mauritius - Shahina Aboobakar (MoH, Mauritius).
4. India - Rajander Sharma (NVDCP, India).

Information on LSM in Malindi from Charles Mbogo is also available at

[http://www.rbm.who.int/partnership/wg/wg\\_itn/docs/ws6/ChMbogo-LSMinUrbanMalindi.pdf](http://www.rbm.who.int/partnership/wg/wg_itn/docs/ws6/ChMbogo-LSMinUrbanMalindi.pdf)

***LSM Operational Manual***

- March 2012: It was agreed that the LSM manual would be better as a WHO document; funding was offered by GMP.
- May 2012: First draft completed and submitted to WHO and four reviewers for preliminary review.
- October 2012: Draft manual circulated to LSM Work Stream members nominated in February 2012 for input.
- December 2012: Revised draft of manual submitted to WHO for further review.

### *Decision-making tool*

- First draft complete: 'When and where to use Larval Source Management (LSM) for malaria control and elimination in Africa.'
- 27 page A5 document designed for program managers to decide when and where to use LSM.
- To be completed once the LSM Operational manual is finalised, so that the two documents exactly correspond

### ***Update on Cochrane Review – Steve Lindsay, Durham University, UK***

The Cochrane Review of LSM aims to compare mosquito LSM for malaria control with no LSM, applied either alone or in combination with other interventions. Progress over the past year has been as follows:

- February 2012: Preliminary analysis complete; entomology data to be added.
- March 2012: Analysis completed; first draft submitted for peer review.
- July 2012: Peer review and editors comments received. Major revisions required.
- October 2012: Search updated to include studies published since first search in October 2010; further work on finalising analysis begins with financial support from Cochrane Infectious Diseases Group.
- Spring/summer 2013: Submit again version for peer review.

### *Discussion*

- Three years ago, LSM was not considered by WHO and many others as an intervention that could play any significant role in malaria control, however this situation is changing (LSM has featured in the 2012 World Malaria Report).
- Guidance is greatly needed for LSM; the Operational Manual should be disseminated by WHO to countries as soon as possible.
- It was suggested that it would be valuable to consider a LSM manual for dengue and other mosquitoes also. However it was highlighted that malaria is the focus for RBM and that since larviciding for dengue requires a different approach to malaria, this may overcomplicate the manual. A draft larviciding manual for dengue has also been recently submitted to WHO and manuals are also planned for IVM. There is a rich body of literature on general mosquito abatement from the USA, both historical and contemporary, for example the Florida Mosquito Control Association has recently published a manual on larviciding.
- There was some discussion over whether the main outputs and conclusions of the Cochrane Review will be incorporated in the Operational Manual. It was confirmed that, since the review is still in progress, its conclusions have not been included in the manual. Nonetheless, the manual could be updated online at a later date. It was suggested that this may not be necessary as the main objective of the review is a 'how to' document, not an advocacy statement. Furthermore, WHO has already published an interim position statement on larviciding. It was agreed that the Cochrane review and manual should run in parallel.
- The case study of LSM from Khartoum is an excellent example of IVM.
- Many countries are carrying out LSM today however not all programs have been rigorously evaluated in terms of impact on clinical outcomes.

***Next steps for LSM – Steve Lindsay, Durham University, UK***

The following discussion points were proposed:

1. Is there further need for operational indicators of success? We have described how to evaluate LSM in the Operational Manual, but is there a need for further guidance here?
2. Should we recommend specific branded products for LSM? WHOPES currently only has a list of recommended formulations, so for specific products one has to delve into the WHOPES meeting reports.
3. What (if anything) should we be doing to encourage LSM? Such as capacity building for environmental management (e.g. training courses for program managers run by entomologists and engineers).
4. What (if any) further research on LSM is needed?

*Discussion*

- There was some discussion of the role of LSM in resistance management, in targeting outdoor transmission and in reducing nuisance biting by *Culex* spp. to improve quality of life. In the USA, malaria was one of the main drivers of LSM and programmes then evolved into the general mosquito abatement programs of today; this may be a logical progression for sub-Saharan Africa.
- 26 countries are conducting LSM but this is often not carried out as part of the NMCP, but at a municipal level for general mosquito abatement (e.g. in Lusaka). This might explain the lack of published data on LSM; perhaps WHO could help to assemble a directory of these efforts to ensure that information is systematically collected?
- It should be remembered that WHO does not necessarily oppose LSM; rather, WHO aims to base policy on evidence and in the case of LSM this is incomplete. It was highlighted that current WHO insecticide resistance strategies are based on very little evidence. The Cochrane Review and case studies will help inform the debate. However, LSM is so context-specific that locally derived data are crucial to determine whether LSM is appropriate in that particular ecology and program environment. A tool for rapidly assessing whether LSM is appropriate will be useful, taking into account current levels of insecticide resistance, the status of other malaria control interventions and other factors, in order to carefully plan control programs.
- Methodology to assess the relative contribution of different interventions is required, especially because larviciding is often used to complement LLINs and IRS. This is technically difficult however, without removing an intervention.

*WHOPES-recommended products*

- Many countries are adopting LSM, however it is not clear which products should be used since the WHOPES website does not list recommended products clearly on its website. It would be useful to have a list of specific branded products.
- There was discussion on larvicidal products that may be registered in a country but are not WHOPES-approved. It was suggested that a list of such products be compiled and the manufacturers encouraged to submit for WHOPES approval. This could encourage manufacturers of other products to submit for WHOPES testing and provide clear guidance

to program managers. One member of the Work Stream has already compiled a draft list of larvicides which numbers over 300; this will be circulated to the Work Stream for further input.

- The Operational Manual should give guidance on quality control for microbial larvicides.

*What should we be doing to encourage rational use of LSM?*

- There is scope for LSM in the context of urban agriculture (see Systemwide Initiative for Malaria and Agriculture (SIMA)) and farmers could be trained in LSM particularly for urban agriculture where microdams and furrows have been shown to offer anopheline vector breeding sites.
- Borrow pits should be targeted for LSM and this should be highlighted at the forthcoming colloquium on housing and malaria organised by Habitats for Humanity and Harvard University.
- The concept of sanitary engineering (to reduce production of mosquito breeding sites in infrastructure projects) should be introduced into African universities and schools. WHO contacts with country NMCPs could be used to make connections in countries. Collaborations already exist for IVM and these can be drawn upon. Associations such as the South African Civil Engineering Associations could also be used as a starting point to offer training in larval source management to engineers.

*What (if any) further research on LSM is required?*

- Tests for resistance to larvicides could be helpful. The 2005 WHOPEP 'Guidelines for laboratory and field testing of mosquito larvicides' may need expanding to fill this gap.

***How to make LSM work for IVM – Silas Majambere, Ifakara Health Institute, Tanzania***

LLINs and IRS target indoor transmission, whilst missing transmission by vectors such as *An. arabiensis*. There is also evidence of behavioural resistance, together with physiological insecticide resistance to all classes of insecticide available for LLINs and IRS. LSM is currently being used in a number of countries in Africa; therefore the question is not *whether* LSM should work, but *how* LSM can work wherever it is being undertaken. Countries therefore need guidance on how and when to integrate LSM in IVM and how to navigate around current business-driven models. The WHO Interim Position statement does not cover this in sufficient detail.

LSM has specific requirements including an understanding of the local ecology, strong management and strong entomological capacity and should be implemented in the context of 'sustained control' rather than 'scaling up for impact'. There are specific areas where LSM could complement LLINs and IRS, including areas where outdoor transmission or resistance are problematic or hotspots remain, as in Fillinger & Lindsay (2011). There are also questions over who should implement LSM. Ideally, NMCPs should have a LSM with full involvement of the local community, and where personnel are incentivised or paid. The involvement of insecticide suppliers should be limited to logistical or technical support. NMCPs should involve all other sectors working with water. There is also a need to monitor adult entomological outcomes and for impact assessment to be conducted by independent institutions.

### **LSM for malaria elimination – Birikinesh Ameneshewa, WHO-AFRO, Zimbabwe**

An introduction to LSM was given and the settings where it might be best utilised were outlined. For elimination, there are opportunities for LSM where breeding sites are localised, easily identifiable and in locations where transmission is focal. LSM may be needed for elimination since complete interruption of transmission is difficult to achieve. For example, LSM can help with outdoor biting, especially where *An. arabiensis* is a dominant vector or where *An. gambiae* or *An. funestus* are maintaining residual low-level outdoor transmission. Local support for LLINs and IRS may decline as malaria declines and is perceived as less problematic and lower compliance may undermine their effectiveness. LSM can also be important in the prevention of reintroduction.

#### *Discussion*

- Opportunities for LSM advocacy were discussed. For example, if LSM can contribute to LSM elimination in settings such as Haiti this could be helpful. CDC has attempted LSM in Haiti but failed to secure support for this outside vector control experts.
- LSM was mentioned in all of the WHO case studies on malaria elimination. LSM is likely to play a crucial role in malaria elimination.
- LSM has contributed to malaria elimination in Morocco.

### **Actions and 2013 Work Plan**

- A list of specific products available for LSM should be drawn up with information on WHOPES status.
- As well as training program managers in LSM it is important to engage with those in the areas of urban agriculture, 'healthy homes', sanitary engineers and others outside the health arena:
  - Make contact with relevant contacts in water etc. through WHO/IVM, SIMA, habitat for humanity, Danish architecture networks and through associations e.g. South African Civil Engineering Association.
- Publish and disseminate the LSM Operational Manual as soon as possible.

## Participants

	Family name	Name	E-mail address
1	Abeku	Tarekegn	<a href="mailto:t.abeku@malariaconsortium.org">t.abeku@malariaconsortium.org</a>
2	Amajoh	Chioma	<a href="mailto:amajohc@yahoo.com">amajohc@yahoo.com</a>
3	Aultman	Kathryn	<a href="mailto:kate.aultman@gatesfoundation.org">kate.aultman@gatesfoundation.org</a>
4	Babaley	Magali	<a href="mailto:babaleym@who.int">babaleym@who.int</a>
5	Becker	Norbert	<a href="mailto:norbertbecker@web.de">norbertbecker@web.de</a>
6	Boutsika	Konstantina	<a href="mailto:konstantina.boutsika@unibas.ch">konstantina.boutsika@unibas.ch</a>
7	Briët	Olivier	<a href="mailto:olivier.briet@unibas.ch">olivier.briet@unibas.ch</a>
8	Brown	Andrea	<a href="mailto:anbrown@jhuccp.org">anbrown@jhuccp.org</a>
9	Chang	Moh Seng	<a href="mailto:mohseng.chang@gmail.com">mohseng.chang@gmail.com</a>
10	Chimumbwa	John	<a href="mailto:mchimumbwa@gmail.com">mchimumbwa@gmail.com</a>
11	Chitnis	Nakul	<a href="mailto:Nakul.Chitnis@unibas.ch">Nakul.Chitnis@unibas.ch</a>
12	Clayton	John	<a href="mailto:john.clayton@micron.co.uk">john.clayton@micron.co.uk</a>
13	DeChant	Peter	<a href="mailto:peter.dechant@valent.com">peter.dechant@valent.com</a>
14	Gimnig	John	<a href="mailto:hzg1@cdc.gov">hzg1@cdc.gov</a>
15	Gordon	Scott	<a href="mailto:scott.gordon@osd.mil">scott.gordon@osd.mil</a>
16	Helinski	Michelle	<a href="mailto:m.helinski@malariaconsortium.org">m.helinski@malariaconsortium.org</a>
17	Hernandez Rodriguez	Mavy	<a href="mailto:mavyshr@infomed.sld.cu">mavyshr@infomed.sld.cu</a>
18	Hoyer	Stefan	<a href="mailto:hoyers@who.int">hoyers@who.int</a>
19	Ichimori	Kazuyo	<a href="mailto:ichimorik@who.int">ichimorik@who.int</a>
20	Invest	John	<a href="mailto:john.invest@btinternet.com">john.invest@btinternet.com</a>
21	Jany	William	<a href="mailto:wjany@clarke.com">wjany@clarke.com</a>
22	Kafy	Hmooda	<a href="mailto:hmoodak@yahoo.com">hmoodak@yahoo.com</a>
23	Kolaczinski	Jan	<a href="mailto:jan.kolaczinski@theglobalfund.org">jan.kolaczinski@theglobalfund.org</a>
24	Konate	Lassana	<a href="mailto:konatela@yahoo.fr">konatela@yahoo.fr</a>
25	Krause	Steve	<a href="mailto:Steven.Krause@valentbiosciences.com">Steven.Krause@valentbiosciences.com</a>
26	Lindsay	Steve	<a href="mailto:s.w.lindsay@durham.ac.uk">s.w.lindsay@durham.ac.uk</a>
27	Lines	Jo	<a href="mailto:Jo.Lines@lshtm.ac.uk">Jo.Lines@lshtm.ac.uk</a>
28	Lluberas	Manuel	<a href="mailto:lluberas@hdhudson.com">lluberas@hdhudson.com</a>
29	Lucas	John	<a href="mailto:jlucas@olyset.net">jlucas@olyset.net</a>
30	Lucas	Bradford	<a href="mailto:Bradford_lucas@abtassoc.com">Bradford_lucas@abtassoc.com</a>
31	Macdonald	Michael	<a href="mailto:macdonaldlm@who.int">macdonaldlm@who.int</a>
32	Majambere	Silas	<a href="mailto:smajambere@ihi.or.tz">smajambere@ihi.or.tz</a>
33	Malamud-Roam	Karl	<a href="mailto:kmr@AESOP.Rutgers.edu">kmr@AESOP.Rutgers.edu</a>
34	Managido	Meshesha Balkew	<a href="mailto:meshesha_b@yahoo.com">meshesha_b@yahoo.com</a>
35	Mandike	Renata	<a href="mailto:renata@nmcp.go.tz">renata@nmcp.go.tz</a>
36	Martinez Arias	Aramis	<a href="mailto:amarias2010@yahoo.es">amarias2010@yahoo.es</a>
37	Mathenge	Evan	<a href="mailto:emathenge@kemri.org">emathenge@kemri.org</a>
38	Mbogo	Charles	<a href="mailto:cmbogo@kemri-welcome.org">cmbogo@kemri-welcome.org</a>
39	Mnzava	Abraham	<a href="mailto:mnzavaa@who.int">mnzavaa@who.int</a>
40	Mothobi	Tjipo	<a href="mailto:tmothobi@gbchealth.org">tmothobi@gbchealth.org</a>

41	Murugasampillay	Shiva	<a href="mailto:shivam@who.int">shivam@who.int</a>
42	Nakamura	Masatoshi	<a href="mailto:mnakamura8823@gmail.com">mnakamura8823@gmail.com</a>
43	Newman	Robert	<a href="mailto:newmanr@who.int">newmanr@who.int</a>
44	Overgaard	Hans	<a href="mailto:hans.overgaard@umb.no">hans.overgaard@umb.no</a>
45	Peat	Jason	<a href="mailto:jason.peat@ifrc.org">jason.peat@ifrc.org</a>
46	Peter	Rosemary Jane	<a href="mailto:rose.peter@arystalifesciences.com">rose.peter@arystalifesciences.com</a>
47	Quiniou	Philippe	<a href="mailto:ph.quiniou@gmail.com">ph.quiniou@gmail.com</a>
48	Reithinger	Richard	<a href="mailto:reithinger@rti.org">reithinger@rti.org</a>
49	Rowland	Mark	<a href="mailto:mark.rowland@lshtm.ac.uk">mark.rowland@lshtm.ac.uk</a>
50	Rydzanicz	Katarzyna	<a href="mailto:katarzyna.rydzanicz@microb.uni.wroc.pl">katarzyna.rydzanicz@microb.uni.wroc.pl</a>
51	Seddon	Ron	<a href="mailto:rseddon@leasemaster.com.pg">rseddon@leasemaster.com.pg</a>
52	Sharma	Rajander	<a href="mailto:ranjandersharma@gmail.com">ranjandersharma@gmail.com</a>
53	Skovmand	Ole	<a href="mailto:ole.skovmand@insectcontrol.net">ole.skovmand@insectcontrol.net</a>
54	Teuscher	Thomas	<a href="mailto:teuschert@who.int">teuschert@who.int</a>
55	Tusting	Lucy	<a href="mailto:lucy.tusting@lshtm.ac.uk">lucy.tusting@lshtm.ac.uk</a>
56	Van Erps	Jan	<a href="mailto:vanerpsj@who.int">vanerpsj@who.int</a>
57	Vontas	John	<a href="mailto:vontas@biology.uoc.gr">vontas@biology.uoc.gr</a>
58	Weinmueller	Egon	<a href="mailto:egon.weinmueller@basf.com">egon.weinmueller@basf.com</a>
59	Williams	Jacob	<a href="mailto:jacobwilliams@rti.org">jacobwilliams@rti.org</a>
60	Wirtz	Robert	<a href="mailto:rwirtz@cdc.gov">rwirtz@cdc.gov</a>
61	Yadav	Rajpal Singh	<a href="mailto:yadavraj@who.int">yadavraj@who.int</a>
62	Zaim	Morteza	<a href="mailto:ZaimM@who.int">ZaimM@who.int</a>

<b>Agenda</b>		
12.00 – 13.00	Lunch	
	Poster viewing	
13.00 – 13.20	Welcome	Steve Lindsay
	Summary of 3 <sup>rd</sup> meeting, Geneva, February 2012	
	Update on Cochrane Review	
	Progress on 2012 work plan: 1. Country case-studies 2. Operational manual 3. Decision-making framework	
13.20 – 13.35	How to make LSM work for IVM	Silas Majambere (IHI)
13.35 – 13.50	LSM for malaria elimination	Birkinesh Ameneshewa (WHO-AFRO)
13.50 – 15.00	Discussion: Next steps for LSM	All
15.00 – 15.30	Afternoon break / coffee and tea	
	Poster viewing	