

Minutes of the meeting of the Larval Source Management work stream 6th RBM VCWG meeting

9.00am to 11.00am, Wednesday 9th February 2011

International Federation of the Red Cross and Red Crescent Societies, Geneva, Switzerland

Work stream leader: Steve Lindsay, LSHTM

Rapporteur: Lucy Tusting, LSHTM

Approximate number of partners present: 40

1. Summary of the outputs of the meeting

1. Network of interested RBM partners established, this will become the 8th work stream in the RBM vector control working group
2. Draft consensus statement on LSM
3. Outline agenda of this work stream for the next 12 months:
 - o LSM webpage to be added to RBM website established containing consensus statement, executive summary of LSM, key documents on LSM effectiveness & training and outline of the agenda of this work stream over the next 12 months
 - o Decision-making framework to identify where LSM will work
 - o Country case studies: narratives of successes & failures
 - o WHO Training Manual on LSM (1st draft)
4. Outline research priorities
5. Future meeting of interested partners planned at ASTMH Philadelphia 2011
 - a) present examples of where LSM has worked
 - b) present draft decision-making framework for LSM & get feedback to fine tune
6. Funding is required from partnership to support secretariat & working group.

2. Introductions

- Steve Lindsay of the London School of Hygiene and Tropical Medicine welcomed the group and gave an overview of the agenda, highlighting that LSM is not simply relevant to Africa.
- The ongoing **WHO/CDC/LSHTM project to review the efficacy and costs of LSM** (which includes the preparation of a Cochrane Review) was introduced. As part of this project, the input of those directly involved with LSM in malaria-endemic countries is welcomed, in order to build up case-studies of present-day LSM successes and failures and to collect unpublished data on the effectiveness of LSM. To simplify this, a questionnaire will shortly be sent to a number of individual national malaria control programmes. The partners present at the meeting were given a copy of this questionnaire and asked to comment on it.
- Partners were asked to describe **the current status of LSM worldwide:**

- *LSM is known to be actively used now in:* Angola, Australia, Brazil, Cape Verde, Eritrea, Europe, Ghana, India, Indonesia, Kenya, Mauritius, Mozambique, Nigeria, Saudi Arabia, Solomon Islands, Sudan, Tanzania, US, Yemen, Zambia
- *Counties interested in using LSM:* Bioko, Botswana, Burkina Faso, Ethiopia, Sri Lanka, Uganda
- *Institutions interested in LSM:*
 - Private sector - Anglogold Ashanti, mining and sugar industries
 - Public sector - AMCA, IHI, Kemri, MRC, PEEM, RBM, RTI, WHO.
- The point was raised (Karl Malamud-Roam, IR-4 Project, USA) that habitats and vectors must also be considered, not simply political boundaries, as the ecology of the vector species is relevant to how successfully LSM can be implemented.

3. Discussion of consensus statement on LSM

- It was agreed by all partners that **a consensus statement on LSM is required**. Different statements may be required for different audiences.
- Possible **formats** were discussed, with Karl Malamud-Roam proposing a full page and Pete McIlroy (PMI, Tanzania) suggesting that it was important to be concise. Toto Hmooda (National Malaria Control Programme, Sudan) suggested that one page would not be enough to give sufficient evidence to individual countries. Steve Lindsay reiterated that a consensus statement must be short and that WHO should finance a document addressing other concerns in more detail.
- **Points to raise within the statement:**
 - LSM is effective in certain situations. The statement should include a clear definition of LSM at the outset.
 - **Local, unpublished knowledge** should be utilised (Karl Malamud-Roam). Good research should be combined with case studies on where LSM is working. Steve Lindsay stated that the Cochrane review will be very detailed and that a further statement on where LSM could be used is necessary.
 - Tom McLean (Innovative Vector Control Consortium, UK) emphasised that **a policy can be very simple to be effective** (eg. test all febrile cases with RDT and give an ACT if positive). Therefore, what research needs to be done today in order that such a statement on LSM can be made? Steve Lindsay replied that keeping a statement simple is difficult as the range of vector habitats is complex. While there is solid evidence for the type of habitat where LSM works, there are also grey areas. In sum; '**move ahead with LSM where confident, and do more research where less confident**'.
 - Graham White (Armed Forces Pest Management Board, USA) suggested that the long term needs for LSM will reflect the fading efficacy of LLINs and IRS as insecticide resistance spreads, but that currently LSM is not pragmatic where LLINs and IRS are effective. However Peter DeChant (Valent BioSciences Corporation, USA) highlighted the long time frame necessary for developing capacity and suggested that not advocating LSM where adult control is effective essentially negates resistance as a problem.
 - A major 'take-home' message within the statement should be that LSM is not a stand-alone strategy and therefore should be **integrated with other methods of vector control** when used.

- The consequences of publishing a consensus statement were questioned by Tom McLean and Pete McIlroy, who argued that if LSM is used as a result of the statement, it must be used effectively. LSM will not work everywhere and there exist considerable 'unknowns' where our knowledge of its likely success is limited. If this group is to advocate LSM, it must therefore be sure where not to advocate its use. Steve Lindsay emphasised that LSM is technically complex and therefore takes time, effort and guidance to implement well; public failure might be damaging.
- The following draft consensus statement was discussed. It was agreed that it would be circulated via email amongst partners to be finalised.

Consensus statement

Larval Source Management (LSM) will work best and be most cost-effective in areas where larval habitats are seasonal, relatively few and well-defined, where habitats are accessible by ground crews, and in cooler parts of Africa where larval development is prolonged. These conditions occur frequently in the tropics, and thus this method can be an effective tool for malaria control in selected eco-epidemiological conditions such as areas of low to medium transmission intensity, areas of very focal transmission or epidemic prone areas. Such conditions are common in urban environments, desert fringe communities, highland settlements and rural areas with high population densities.

It is not a strategy for country wide application, and should not be the primary tool selected in areas of intensive transmission. Nevertheless, LSM has the potential to be integrated into control programmes after LLINs or IRS have reduced transmission to moderate or low levels of transmission and therefore should be considered in the consolidation phase of control and elimination programs where it can be targeted in space and time. LSM will provide additional protection when combined with LLINs/IRS and help manage insecticide resistance and outdoor transmission.

Adapted from Fillinger & Lindsay (submitted)

4. Discussion of outline agenda for LSM work stream over the next 12 months

- It was firstly agreed by partners that a **new LSM work stream** should be established, the ultimate aim of which should not be to create a research agenda, but to improve malaria control in country. Konstantina Boutsika (Swiss TPH & Secretariat, RBM VCWG) suggested that this work stream could be added to the VCWG working group.
- **Products** required within the next 12 months were proposed:

1. CASE STUDIES - NARRATIVES OF PRESENT-DAY SUCCESSES AND FAILURES

- Steve Lindsay proposed that case studies should be written describing present day successes and failures with LSM (since many of those present have considerable experience in LSM). These could be available on the RBM website and help inform where LSM is likely to be effective.
- There was general agreement (Charles Mbogo (MRI, Kenya), Shiva Murugasampillay (WHO), Evan Mathenge (KEMRI, Kenya)) that there is much to learn from those countries

already implementing LSM. There is a lack of clear policy, evidence and dialogue on LSM. The aim of an RBM working group should be to build a network, mobilise and share information.

2. A DECISION-MAKING FRAMEWORK TO IDENTIFY WHETHER A COUNTRY SHOULD USE LSM

- Countries should take stock of their **vector species** before endorsing the power of LSM; information could be stratified by vector species and ecologies (Steve Lindsay and Peter DeChant). One partner described how the relative density of *Anopheles arabiensis* and *Anopheles funestus* is determined by the stage of growth that a rice field has reached, as this affects the availability of sunlight, and he suggested that such information should be tabulated in order that NMCPs can check the habitats in question.
- Roberto Sanchez Prieto (Labiofam, Cuba) described how **mapping** has proved useful in Angola for planning the LSM strategy.
- There was a debate over the need for LSM in locations where other interventions are working well. Chioma Amajo (National Malaria Control Programme, Nigeria) highlighted that LLINs and IRS are given priority in malaria control programmes and that substantial funding is not currently allocated to LSM. Thus it should be emphasised that **LSM can complement other interventions**. However another partner suggested that resources might not stretch to LSM where LLINs and IRS are effective and that LSM is not appropriate where current programmes are proving effective. Jacob Williams of the RTI countered this, highlighting the dangers of making such a statement given that there exist areas where it is not known how effective adult measures are. It was agreed by all that the work stream must not give a false sense of the effectiveness of LSM.
- The potential role of LSM at different stages of **elimination** should be emphasised (Kalifa Bojang, MRC, The Gambia).

3. GUIDELINES & FIRST DRAFT OF A WHO TRAINING MANUAL FOR LSM

- Shiva Murugasampillay stated that the work stream should produce a **clear set of guideline for countries**. Steve Lindsay mentioned that Ulrike Fillinger has already written a toolkit for LSM and suggested that this could be simplified and made available.
- Guidelines for **training** are required, as capacity building is often the limiting factor in LSM implementation (Charles Mbogo).
- Guidelines should set out how to **integrate** LSM with other interventions (Kalifa Bojang).
- LSM could be **categorised** along the following lines: chemical, biological, environmental engineering, education/mobilisation of communities (Karl Malamud-Roam). Guidelines could then be tailored to the actors responsible for implementing LSM (i.e. communities, national malaria control programmes etc).
- Guidance is needed to inform malaria control programmes of the most effective **products**. While new larvicide products are now available, WHOPES is already at its testing capacity and therefore there will be a delay in updating the WHOPES LSM product list. Shiva Murugasampillay stated that RBM should provide more support for WHOPES testing. Chioma Amajo also emphasised the need for guidance on which firms in the private sector should be approached for LSM products and suggested that this information should be available online. There is a choice between biological and chemical control; countries need guidance. It was suggested that a country should test for insecticide resistance before implementing LSM, as this would determine which products are most appropriate.

- Chioma Amajo suggested that guidelines should also be **aimed at decision makers**, since it must be made clear that LSM might be required even where adult control is effective.
- Karl Malamud-Roam suggested that tools are needed to **evaluate the efficacy of LSM**.

5. Research agenda

- There is a need for further research and development, pilot projects and monitoring and evaluation (Michael MacDonald, USAID, USA). Graham White highlighted that **good reviews already exist**: (1) Takken, W., Snellen, W. B. & Verhave, J. P. Environmental measures for malaria control in Indonesia: an historical review on species sanitation, Wageningen Agricultural University, 1990 (this review can be utilised by countries with extensive breeding sites); (2) Walker, K. & Lynch, M. Contributions of Anopheles larval control to malaria suppression in tropical Africa: review of achievements and potential. *Med Vet Entomol*, 2007. 21(1), pp 2-21; (3) the Cochrane Review on LSM which is soon to be published. Graham therefore suggested that all that therefore needs to be done is to 'pass on the message', emphasising the importance of the vector.
- Kate Aultman suggested that in order for LSM to be considered a robust intervention, the research agenda should be thought of in terms of a **checklist** or critical path. Larvicides constitute a significant 'unknown'; which niche, which species, what effect (i.e. additive or synergistic with other interventions), how much will it cost? Such a list should be assembled in order to produce a set of recommendations and guidelines.
- The following priority areas of research were discussed:

1. ROLE OF LSM ALONGSIDE LLINS AND IRS

- Shiva Murugasampillay questioned whether LSM can add value where LLINs and IRS are used extensively, and if so, where? Steve Lindsay reiterated this, questioning how effective LSM will be where LLINs and IRS are less effective.
- The group agreed that existing data is not sufficient to quantify the added benefit of LSM.

2. RESISTANCE MANAGEMENT

- LSM will become more important as resistance to insecticides spreads. Steve Lindsay highlighted that *Anopheles funestus* has clearly defined habitats and therefore is an obvious choice for targeting when resistance becomes a problem.
- The question of how to combine interventions was raised by Steve Lindsay. It is not pragmatic to wait for resistance to be a significant problem before introducing LSM as it takes time to build up infrastructure. Therefore research is needed to determine how quickly resistance is likely to build up, and also to determine how effective LSM will be where LLINs and IRS are less effective.

3. RESIDUAL FOCI OF INFECTION

- Peter McIlroy described the role of LSM in Zanzibar in controlling surges in incidence. Even where there is a high coverage of LLINs and IRS, there is a place for LSM in 'hot spot' control.

4. ENVIRONMENTAL IMPACT OF LSM

- The environmental impact of LSM requires further investigation.

5. COST-EFFECTIVENESS OF LSM

6. CONTROL vs ELIMINATION

- Does the marginal benefit of LSM changes between control and elimination mode (Karl Malamud-Roam)?

7. OUTDOOR BITING

- IRS and LLINS select for outdoor biting, therefore LSM can play a role where this reduces their effectiveness.

In short, it was agreed that the following areas of research should be given most priority:

- a) Determining the effectiveness of LSM as a tool for **insecticide- resistance** management
- b) Demonstrating the effectiveness of LSM for controlling **outdoor** biting vectors
- c) Showing the effectiveness of LSM for mopping-up residual foci of malaria transmission during **elimination** programmes
- d) Determining the effectiveness of LSM in the African savannah & forest biomes
- e) Assessing how LSM strategies would differ when used for malaria control and for malaria elimination
- f) Producing tools for measuring the efficacy of LSM control programmes at the country level
- g) Providing cost-benefit analyses of different LSM strategies
- h) Monitoring the environmental impact of large-scale LSM programs.

6. LSM work stream: planning, funding, future meetings

FUNDING

- RBM could help support the work stream financially and funds should be made available to support further research.
- Shiva Murugasampillay suggested that support from countries considering or using LSM might be given.
- Konstantina Boutsika described how the USAID networks programme is a source of funding for other working groups.

STAFF

- All those present (bar one) agreed to participate in the work stream.
- Both Bill Jany and Karl Malamud-Roam volunteered to play a major role in developing the work stream.
- It was agreed that a secretariat would be required.

FUTURE MEETINGS

- Steve Lindsay suggested a meeting of interested parties at ASTMH, Philadelphia, December 2011. Konstantina Boutsika agreed that it was pragmatic to meet again this year, with products drafted which could be discussed.
- Around 10 of 35 partners plan to go to Philadelphia.
- It was agreed that an open meeting would be held in Philadelphia to discuss progress and discuss the research agenda in more detail. In particular, the outline of a decision-making framework could be presented at this meeting for discussion. Presentations on where LSM has been used successfully could be given, to open debate.
- Peter McIlroy asked for a timescale for this meeting and suggested that a LSM symposium could be organised at this conference.

7. Conclusions and points of actions

1. Partners recognised that LSM is a highly effective method of malaria control in specific situations.
2. LSM consists of environmental management and manipulation, biological control and the use of chemical and microbial larvicides.
3. LSM should be combined with other vector control tools, like LLINs and IRS.
4. LSM would be particularly beneficial to reduce the spread of vectors resistant to insecticides used indoors.
5. LSM would be useful in many situations where there were outdoor biting malaria vectors.
6. The evidence base needed to support LSM should be improved.
7. It was a priority to document well where LSM should and should not be used.
8. RBM should facilitate producing documents to provide information on the evidence for the effectiveness of LSM for malaria control.
9. A research agenda should be made to highlight the areas where further information was required. A provisional list includes:
 - a) Determining the effectiveness of LSM as a tool for **insecticide- resistance** management
 - b) Demonstrating the effectiveness of LSM for controlling **outdoor** biting vectors
 - c) Showing the effectiveness of LSM for mopping-up residual foci of malaria transmission during **elimination** programmes
 - d) Determining the effectiveness of LSM in the African savannah & forest biomes
 - e) Assessing how LSM strategies would differ when used for malaria control and for malaria elimination
 - f) Producing tools for measuring the efficacy of LSM control programmes at the country level
 - g) Providing cost-benefit analyses of different LSM strategies
 - h) Monitoring the environmental impact of large-scale LSM programs.

8. List of participants

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9. Agenda

1. Who is who in LSM
2. Consensus statement on LSM
3. Facilitate reviews of LSM effectiveness
4. Case studies: narrative of successes and failures
5. Decision making framework to identify whether a country should start LSM
6. Future meeting of interested parties at ASTMH Philadelphia 2011
7. Funds to do what?
8. Partnership of working group