RBM Vector Control Working Group

Durability of LLIN in the Field Work Stream

Progress on 2011 Work Plan – Dr. Albert Kilian

Progress against the five objectives of the 2011 work plan for this work stream was reviewed; significant progress had been achieved in relation to developing consensus on a methodology for assessment of net condition in the field and reaching agreement on improved textile testing for all netting materials. For the planned activity to assess net conditions in the field, consensus was reached on hole measurement, tools and training materials were produced; recommended hole assessment protocols were published in WHOPES Guidelines. With regard to textile laboratory testing, a meeting was held in Lyon February 2nd and 3rd, attended by twenty-six participants, including five textile testing experts / institutes. Progress was also made in evaluating current knowledge on LLIN durability (review expected to be completed in the second quarter of 2012) and in maintaining communication and disseminating work stream products.

Discussion

The key factors influencing durability of LLINs in the field have been identified as initial damage caused by burning with candles, kerosene lamps, etc and also rodents in some rural areas. Unfortunately, very little data are available on these two key aspects beyond what is obtained through owner recall. There is a clear need to link these factors with lab-testable criteria.

The issue of defining and measuring the epidemiological point at which a net should be replaced was discussed. Participants were informed that a trial is being planned, but due to the high number of confounding variables that need to be taken into account, the process is complex. CDC is also looking at the interaction of physical durability and insecticide persistence on epidemiological performance of the net and reports that physical durability again appears to be the most important factor. Washing may also have an impact in some cases, especially where the pH of the washing water and detergents is high.
WHOPES testing is also looking at long-scale durability. The first set of data has been published on Interceptor nets, with others to follow over the next 30 months.

Currently, there is no formal mechanism for countries using the guidelines and protocol to feed data on durability back to WHOPES, the VCWG, or other partners. Better communication is needed with end-users of the guidelines.

Information on the interplay between net cost and durability, and the impact on the overall cost of achieving and maintaining universal coverage (e.g. unit cost per life-year of protection) was requested. Preliminary data suggest that more durable nets could cost up to between 1.5 and 2.5 times the current unit costs, but because of their improved durability would not increase the overall cost of maintaining universal coverage.

The issue of waste, both in relation to disposal of old nets and also net packaging was raised. It was reported that there is little evidence that old nets are dumped in the environment. More usually, they are 'recycled' and used for alternative purposes. The AMP will further discuss the waste and packaging issue at its February 2012 meeting.

3rd Durability of LLINs in the Field Work Stream Meeting
Tuesday 7th February 2012
IFRC Auditorium, Geneva, 13:00-15:00

Leader: Dr. Albert Kilian
Rapporteur: Dr. John Silver

Summary of Lyon Meeting – Dr. Albert Kilian

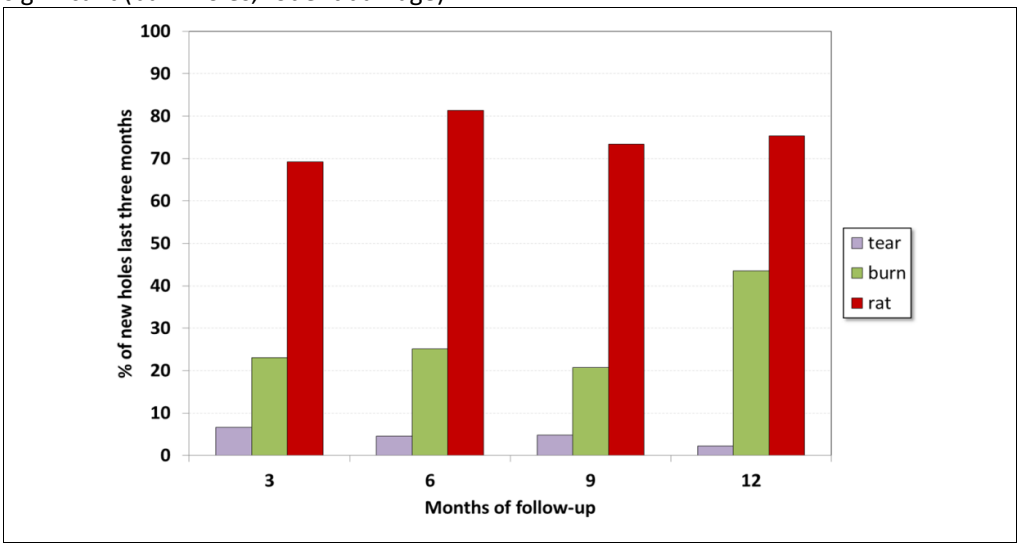
The Durability of LLINs in the Field work stream session commenced with an update on the outcomes of the recent meeting in Lyon with textile experts and manufacturers.

The meeting was convened in response to the increasing interest in including quality (durability) as criteria in LLIN procurement decisions and the need to therefore have available precise and accurate data on cost/useful life, or alternatively laboratory test(s) that reflect performance in the field and support minimum standards and grouped specifications. Two key objectives of the meeting were:

- To understand current conceptual and methodological issues around "durability"
- To review existing options of textile testing that would better reflect the real life situation

Determination of durability in the field requires knowledge of the combination of attrition due to damage and the proportion of surviving nets that are still "functional" or "not too torn". Cross-sectional surveys can measure attrition and integrity if done well but have problems associated with reliance on owner recall. Prospective studies are good at measuring integrity but seriously underestimate attrition as nets are kept longer than normal. We have currently no good methods to distinguish cause of holes through surveys (need qualitative approaches).

Available field data show that there is high variation in net performance between geographic areas, between villages (clustering), and within households. Behavioural and non-product related factors are significant (burn holes, rodent damage).



Field studies reveal that there are four principal initial causes of holes: tears, burn holes, animal damage, opening seams. It is possible that pre-damage through other factors related to ageing (Heat, abrasion, chemical, UV) could be important. Only if textile testing reflects the dominant stress on net (modes of failure) will there be a correlation between lab results and field data.

A range of currently available textile testing methods were described, including: burst testing, shrinkage, tensile testing with hooks, dynamic or slow nail testing, fire tests, and abrasion testing. A combination of several of these tests may lead to a test that better mimics durability in the field.

The Lyon textile meeting concluded that the way forward is to:

- Collect well-defined field data from representative locations ASAP in accordance with WHO-GMP guidelines to be analyzed for attrition, physical condition and tested in lab
- Develop methods (validated field tools) to distinguish cause of holes in the field in early phase of destruction
- Evaluate the actual proportional contribution of each “mode of failure”. Then determine suite of (weighted) tests reflecting cause pattern
- Target is to have minimal standards (cut-off) for different aspects of net performance set by WHOPES
- Find better ways to define the magnitude of rodent problem and options for interventions

Discussion

The issue of the importance of rodent damage in rural locations was discussed extensively. Rodents appear to damage the net from all sides, top and bottom. They do not appear to eat the net, but do appear to take the material away, possibly for nest-building. Anecdotal evidence suggests that rodent damage is not an issue in Kenya and therefore more data is required and mechanisms developed to identify the extent of rat infestation in a specific area.

A question was raised regarding whether there was any evidence that net owners repaired damaged nets. In response, it was noted that there are few published data, but the rate of repair appears to be very low, and efforts are ongoing to better understand the reasons for lack of maintenance. There is no apparent difference in the incidence of maintenance of nets depending on whether nets were obtained free of charge or purchased by the owner. A study in Nigeria will look at the potential for increasing lifespan of nets through maintenance and repair.

The ease with which the cause of damage to nets can be accurately identified in the field was discussed and it was concluded that this can be done if inspectors are well trained, but ideally it would be better to develop some form of independent microscopic identification of causes. Asking owners why there is a hole in their net may not provide accurate information.

WHOPES is currently reviewing the guidelines for pesticide procurement and it was suggested that this would be a good opportunity to reflect some of the recent findings on net durability in the document.

Effective Lifetime of LLIN Mass Distributions – Dr. Olivier Briët

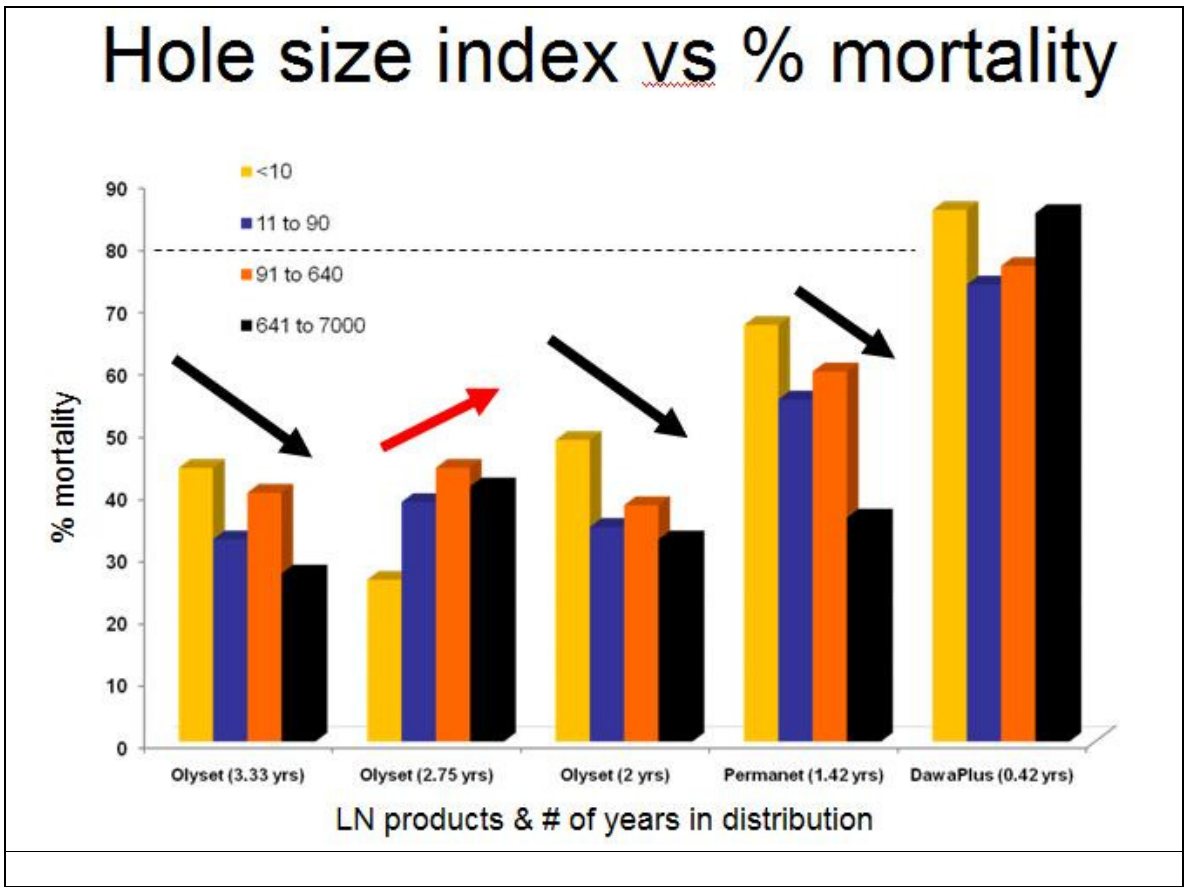
This presentation described the results of a modeling study to determine some of the factors that affect the effective lifetime of a mass net distribution. Model parameters included intensity of transmission, attrition of nets, net coverage and utilization, various aspects of mosquito behaviour, rate of hole formation, among others. The annual Entomological Inoculation Rate at the commencement of the distribution was found to be the most important factor in determining the

effective lifetime of the distribution. In conclusion, the required frequency at which mass LLIN distributions need to be undertaken varies more with the local entomological situation than with LLIN quality.

Monitoring LLIN Durability in Palawan – Dr. Jeffrey Hii

Data on retrospective field studies of durability of three LLIN products in the Palawan islands were presented. Household interviews revealed that LLINs are widely used, with 75-95% of respondents reporting sleeping under the net every night throughout the year. Burn holes and holes formed at the hanging point were the commonest forms of net damage observed across all net products.

A comparison of hole index with mortality in bioassay tests revealed that increasing hole indexes correlate with decreasing bioefficacy of LLINs, albeit with a few exceptions.



Discussion

Participants noted that the number of holes was similar in younger and older nets and this suggests that most damage appears to occur at the beginning of use, perhaps due to nets being novel to the users.

The dirtiness of nets does not appear to affect bioefficacy and this was also observed in studies in Uganda.

Assessing the Durability of LLINs – Dr. John Gimnig

Data were presented on LLIN durability studies in several PMI-supported countries. The studies on several net products revealed no correlation between the number of holes or the hole index with fabric type (polyester vs. polyethylene); denier; or burst strength.

The presentation also described a collaboration between CDC and North Carolina State University College of Textiles (Raleigh, NC) to design laboratory test methods that predict LLIN deterioration rates, with: Minimal changes to ISO methods and instruments; and rapid and reproducible results. Results should be available by September 2012.

Field Data from Uganda and Chad – Dr. Albert Kilian

Data were presented on hole index and attrition rates for 75 and 150 denier nets used by refugee communities in Chad. Some data from a cross-sectional study in Uganda looking at the effect of physical condition of nets on parasitaemia in children under five were also presented. Preliminary results suggest that there is no clear association between physical condition of nets and childhood parasitaemia.

Discussion

Participants raised the question as to what could the work stream feasibly contribute in the next 12 months, given the lack of funding from RBM. The following activities were proposed:

- Follow-up results of the Lyon textile meeting
- Ensuring that available information, publications and studies are shared
- Networking and coordinating studies and sharing information

It was suggested that the Global Fund should be a key audience for this type of information, in order that it can be factored into procurement decisions, instead of relying solely on price, as is currently the case. It was noted that high level discussions are now taking place and there is increasing recognition that the cheapest price should not be the only factor in procurement decisions.

Establishing standards for net durability and developing categories of performance (minimum / good / excellent) is critical as this would allow for standards to be applied to new products in the pipeline, not just existing products. Establishment of standards is likely to take a minimum of 12 months.

Albert Kilian expressed his willingness to continue as Chair of the work stream, but invited members to submit an interest in the position of co-chair.

Final Conclusions and Summary – Dr. Albert Kilian

Discussions

- Update on the Lyon textiles meeting
- Update on field results on LLIN durability

Key Issues

- Current absence of correlation between lab and field data (especially bursting strength) linked to high variability and uncertainty in relation to behavioural and ecological factors, including incidence of burn holes and rodent damage to nets
- A wide variety of potential tests exist or can be created that can simulate any potential mechanism of damage
- Only if textile testing reflects the dominant stress on net (modes of failure) will there be a correlation between lab results and field data
- Need to analyze damaged nets in the lab to verify the exact modes of failure and their respective contribution
- Physical durability is more important than insecticidal deterioration in determining durability of nets in the field

Actions and 2012 Work Plan

1. Follow-up textile meeting and support collecting or making available of nets for testing and development towards improved textile standards
2. Improve field methods to specify cause of holes
3. Explore potential of BCC interventions
4. Encourage and support studies on epidemiological effects
    - At which level of holes + insecticide does protection cease
    - What determines entry of vector into torn nets
5. Networking, advocacy and dissemination
6. Establish work stream co-chair

Agenda	
13:00-13:15	Introductions
13:15-13:30	Objectives of meeting, summary of past activities and issues at hand by chair
13:30-14:00	Summary of textile meeting in Lyon (A. Kilian) and discussion
14:00-14:20	Update on durability issues from the floor and discussion
14:20-14:50	Future role and work plan of work stream in view of absence of funds from RBM - discussion
14:50-15:00	Election of chair and co-chair (if applicable)
15:00-15:30	Afternoon break/coffee and tea

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