MINUTES OF THE MEETING OF
THE LLIN DURABILITY WORK STREAM
6TH RBM VCWG MEETING
Wednesday 9th February, 2010
IFRC, Geneva, Switzerland

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Participants: 38

SUMMARY:
Discussions

1. Use of a proportionate Hole Index to standardize categorization of LLIN physical condition
2. Improved methods to test textile performance in lab
3. Testing field LLINs in hut trials to observe protection as function of insecticide and holes
4. Incorporate hole measure in large surveys to establish epidemiological effects
5. Potential of care & repair BCC to prolong durability
6. Perceptions of Durability

Work ahead

1. Review of existing literature (published & grey)
2. Make current tools available on RBM website
3. Consensus statement on hole index
4. Organize meeting on new methods of textile testing
5. Propose durability questions to MERG for MIS/DHS

PRESENTATION 1: LLIN Durability – Construction and application of a proportionate Hole Index. (Kilian)

Suggest that there is a proportionate Hole Index (pHI) calculation to determine preliminary cut-off for good and torn nets to measure "net integrity". Something that we can use to contribute to assessment of "useful life" of LLINs. This can be done two ways:

1. Cross-sectional retrospective surveys: limited by attrition of nets in a certain state, and what remains are only surviving nets. Unable to evaluate those discarded.
2. Longitudinal: preferred to show attrition and condition of surviving nets, and to follow those that leave their intended purpose as an LLIN.

Surveys could be done at the lab level, however taking nets into a lab a draping them over a frame (like work of Stephen Smith – CDC) is labour intensive, and not feasible at field level, so we move to the possible use of ranking holes by size that can be easily measured. Taking three sizes of holes we are able to calculate an index that is proportionate to the approximate surface area on the net based on:
Size 1: 0.5-2cm
Size 2: 2-10 cm
Size 3: >10 cm
And then weighting the summary of holes to approximate measure of total hole surface:
= (1 x # size 1) + (9 x #size 2) + (56 x # size 3)

From there we are able to create categories of nets (these categories can change based on available information on epidemiology etc. that comes in the future, and data can be reanalyzed retrospectively), but at the least now a standard comparable way of collecting data across surveys. Several options are available for setting thresholds and different nomenclature: serviceable to very torn (unusable).

DISCUSSION:

- How do we consider the repairs of holes when counting the holes in the nets? Does this matter?
- Weight given to bigger holes. Some papers recommend measuring the linear length of the hole.
- In terms of the weighting are there other categories?
- Does is matter where the holes are on the nets and how that related to the bionomics of mosquitos. – lack of data on just how a mosquito gets into a net.
- Will we need to factor in the "shape" of the net?
- Do we need to factor in "where the holes are on the net"
- What about insecticide resistance issues
- Behaviour component here – how to properly maintain their nets to maximize their life span. (could manufacturers put additional scrap fabric with nets to use as a patch kit?)

PRESENTATION 2: Determination of Strength of Mosquito Nets – influence of knitting pattern, square meter weight and denier (Skovmand)

Current laboratory tests on strength of nets do not reflect how nets have performed in the field. Tests were done to look at additional measures on several model nets with different yarn patterns, square meter weight and denier. – Tests performed at CITEVE

1. Bursting strength – push object through a net
2. Tension strength: - nail in net and pull down(One grab / One hook)

Results show:

- PET are much stronger in tension strength grab and Hook
- Tighter knitting with 75 denier yarn. – density of holes does not improve the tension strength grab and hook.

DISCUSSION:

- Important to consider the length and width of material - yarns currently are woven such that come down in parallel fashion which makes the net more elastic, yet weaker. Can just make stronger nets by turning them.

PRESENTATION 3: Type of alternate tests (Hesse).

There are two textile institutes in France and Germany that Bayer has been working with for alternative net durability testing from a "textile" point of view – real life measurements on all three current fabrics (Polyethylene, Polyester, Polypropylene)

- Abrasion tests – marindale test – movements (random) on the surface fabric – fraying until there is a hole (automobile and textile industry)

- Attrition – filaments getting thinner and lighter. (All three materials are the same).
- The slow nail test – pull it to the point of rupture. Resistance of fabric to ripping breaking after foreign object enters. (Length and width – polyethylene and polypropylene – same in length but different in width
- Rapid movement – dynamic nail test – really close to ripping. Typical movement (like you pull your bednet aside).
- Ball bursting / punching test. Physical test during all its lifetime. Stress the net and then relax. Metal ball punching the same side of the bednet. Fatigue effect. Accelerated aging – fatigue effect after daily use of the net. Cyclic bursting test. In cycles to show fatigue.
- Tensile cycling – pulling at a point until fatigue.
- Polypropylene and PET quite similar in pure physical testing, and stronger than – PES.
- These are all ISO tests and results will be published.

DISCUSSION:

- If we succeed in persuading, that at a matter of routine with large procurements a competitive durability test between brands, we will have data sets which combine different lab measures (holes and insecticide availability) for different environments.
- CDC study – 7 brands – 3 locations (Malawi, Kenya, Senegal) and Malaria Consortium (Western Kenya) randomly distributed 7 brands. So there is data being captured on durability and attrition rates.
- Is it easy to determine how the holes are created – burn holes, tears, seem holes, rat holes? Seems easy to identify – the burns and animal chewing.

PRESENTATION 4: Testing in Huts of field used LLINs (Rowland)

Effectiveness is related to the number of holes and amount of insecticide on the net. Over course of use insecticide concentration will fall away and over that same period number of holes will accumulate. But not just a function of holes and insecticide

- WHOPES – bioassay – 80% kill
- actual chemical content
- Proportion of holes
- What does it mean in practice to functional efficacy of a net?
- Personal protection – from these nets
- Experimental hut – mortality and blood feeding able to achieve through feeding through the holes.

Use standard WHO technique. Certain insecticide level is killing or protecting at 1,2,3 years of field use, and assess by taking samples from the field. This going forward will help to make an accurate assessment.

DISCUSSION:

- What does this mean in terms of resistance – Are these nets protective against resistance.
- Should we be asking MIS to record hole size, shape and type of net in their surveys – as an opt in / opt out module?
- Are there ethical implications. When you put someone in a net like that. – Should not be these are WHO standards, with subjects on prophylaxis and access to treatment.
- Comment that where risk of arboviruses circulating – then that would make a difference.

PRESENTATION 5: Survey Data on Holes and Protection (Kleinschmidt)

- Net use, net condition and infection with malarial parasites (Bioko, Equitorial Guinea, Malawi)
- MIS surveys. P falciparum in children.
- Not a sophisticated hole index. MERG – LLIN, ITN, untreated. Simple classification – any holes, A size battery, and larger than D size . Crude categories. Presence or absence of holes.
- Those who slept under nets with no holes or small holes OR 0.65
- Overall coverage at the site – coverage <60% no protection gained if you were not under a net. No protective community effect seen.
- Need to generalize a standardized way to look at the condition of net used and infection status. Multiple countries with susceptible mosquitoes

DISCUSSION:

- Adjust for SES
- Do the experimental hut studies fit these outcomes.
- Could the MIS/DHS opt in for an extended bednet component.
- Western Uganda, a large survey midterm evaluation of ICCM – parasitaemia and aneamia. Detailed subset – to look at the hole count etc.
- Community protection – needs to play back into the model – we do need to – want to keep the population level control. Modeling options with Tom Smith's group could vary by the level of transmission.
- BCC issues – take forward in countries – net use. Net repair – net conversion – measuring how to track how they are changing their habits.
- Care and Repair kits will be used in Eq. Guinea (Immo can share with work stream)
- Modeling Larger data sets critically needed at higher coverage, and also with heterogeneity of coverage.
- Density of the population. Can be done with GPs coordinates.

2011 WORK STREAM PRODUCTS

Expect continued data collection – on durability in the field, hut trials (with resistance), epidemiological impact in field studies (holed nets), behavior change activities to improve net maintenance.

What potentially can be done:

1. A review of the literature on durability. (NETWORKS project)
2. Consensus statement from work stream
3. A collection of tools for measuring durability housed on the RBM website
4. Durability module –suggested questions that can be added into MIS/DHS proposed to MERG
5. SOP / Guidelines for how to measure durability (WHOPES/WHO for part of work)
6. Advise on BCC strategies. Net maintenance
7. Measuring the different decay / attrition rates in different contexts, with different products.
8. net manufacturers and textile testing institutes – have a workshop with WHO in an official frame (crop life – IIC , CITEVE) WHOPES and GMP for testing methods to discuss new methods for testing physical strength.

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