Textile Testing Methods for Nets
VCWG Work Stream: Durability of LLIN in the Field

Summary of presentations, discussion and consensus

Lyon, February 2-3, 2012
Background

• Increasing interest in including quality (durability) as a criteria in LLIN procurement
• For this to be possible we need
  - Either
  - Precise and accurate data on cost/useful life
  - Or
  - Lab test(s) that reflect performance in the field and have grouped specifications
Impact of durability on Demand and Cost

Savings could be as high as $1 billion in the next 5 years for an LLIN with a 5 year useful life and $1.5 billion for a 7-year LLIN.
Objectives

• To understand current conceptual and methodological issues around “durability”
• To review existing options of textile testing that would better reflect the real life situation
• To recommend next steps on how to arrive at improved standards and/or specifications
• To suggest an action plan to obtain sufficient data to define cut-off levels for potential test methods
Outline of Programme

• Define the problem
  - Methods to measure useful life and durability, available data and specifications
• Review options for textile testing and evidence
  - What tests are already being used for nets, what experience or field data exists
• Develop recommendations for action
Methodology: Two components

Attrition - Integrity

- Retention Rate: Proportion Retained
- Attrition Rate: Proportion Lost
- Surviving nets
- Discarded nets not included

Time
Field methods

• Always need combination of attrition due to damage and proportion of surviving nets still “functional” or “not too torn”

• Cross-sectional surveys can measure attrition and integrity if done well but have problems with recall

• Prospective studies good to measure integrity but seriously underestimate attrition (nets kept)

• We have currently no good methods to distinguish cause of holes through surveys (need qualitative approaches)
Survival of nets as a function of time

Proportion of nets still present in %

Years

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

3-year
5-year
3-year data
5-year data
indirect data

Lindblade et al.
Kilian et al.
Tami et al.
Maxwell et al.
Field data

- There is a high variation of net performance between
  - Geographic areas
  - Between villages (clustering)
  - Within households
- Behavioural and non-product related factors are significant (burn holes - rodents)
Context with textile testing

Lab test on netting

Material, Product

Field use

Behaviour, Environment

Potential Performance

Actual Performance

Significant variation

Sampling crucial

Photo: Sarah Hoibak
Context with textile testing

• Four principal initial causes of holes
  - Tears, burn holes, animal damage, seams
Context with textile testing

- Four principal initial causes of holes
  - Tears, burn holes, animal damage, seams
- Possible pre-damage through other factors (aging)
  - Heat, abrasion, chemical, UV
- Only if textile testing reflects the dominant stress on net (modes of failure) will there be a correlation between lab results and field data
Textile testing methods

• Many methods exist that can mimic certain stresses on the net ... except for animal damage

Bursting test

Source: Ana Paula Fonte, CITEVE
Textile testing methods

- Many methods exist that can mimic certain stresses on the net ... except for animal damage

Shrinkage after washing

Source: Hartmut Haid, ITV
Textile testing methods

- Many methods exist that can mimic certain stresses on the net ... except for animal damage

Tensile test with hook(s)

Source: Ana Paula Fonte, CITEVE
Textile testing methods

- Many methods exist that can mimic certain stresses on the net ... except for animal damage

Dynamic or slow nail test

Source: Marc Dedieu, IFTH
Textile testing methods

- Many methods exist that can mimic certain stresses on the net ... except for animal damage

Source: Marc Dedieu, IFTH
Abrasion

Source: Ana Paula Fonte, CITEVE
Textile testing methods

- Methods to simulate aging in the lab
  - Weather-o-mat (wet-dry-heat-UV)... but relevant?
  - Stone washing... but easy to standardize?
  - Abrasion + tensile test = Abrasion resistance promising to show vulnerability to damage in a “stressed net”

- Microscopic and spectral analysis of representative samples of nets not too old could give a picture of proportionate distribution of initial damage (complement field data)
Conclusions from field and lab data

- While good progress is made to define methodologies there is still a high level of variation and uncertainty
  - Behavior and rodents
  - Variations in testing conditions

- This explains the current absence of correlation between lab and field data (especially bursting strength)
Potential textile tests

- Textile Experts reviewed potential tests at end of meeting and propose the following as most promising
  - i. Bursting strength (strength and integrity of fabric)
  - ii. Modified hook test to simulate tearing vs. cutting effects.
  - iii. Modified ball-burster test. 3D pull for a net hanging at 90 degrees with stress on a branch and intersection of net.
Potential textile tests

- Textile Experts reviewed potential tests at end of meeting and propose the following as most promising:
  - iv. Test for hole-spreading using ball-burster machine. Make a defined cut in net, push through with 1-inch metallic ball, and measure the force it takes to spread a hole.
  - v. If the modified hook test and the ball-bursting tests are used, the traditional tensile test will no longer be necessary.
  - vi. If microscopy shows a degradation of the fibers (size reduced), then conduct a light abrasion test before the above tests.
Way forward—action points

• 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 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