Surveillance, M & E
Innovative approaches to SME: Monitoring the durability of LLINs under operational conditions
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by

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Main Points

• Understanding bednet longevity is vital.
  – Planning and budgeting campaigns.
  – Testing manufacturers’ claims.

• Current understanding is incomplete.

• Lack of field data to support procurement and replacement decisions
Definition of Long-lasting Insecticidal Net (LN)

“Long-lasting insecticidal Mosquito Nets (LN) are factory-treated mosquito nets that is expected to retain its biological activity for at least 20 standard WHO washes under laboratory condition and 3 years of recommended use under field condition.”

Currently approval given for 8 LNs:

- Olyset, PermaNet, Interceptor, Netprotect, Duranet, Yorkool, Lifenet, Bestnet, DawaPlus
• Objectives
  – Evaluate condition of 3 brands LNs distributed by GF malaria project thru’ KLM from 2007 to 2010
  – Identify local practices of LN use and maintenance affecting net condition
  – Determine bio-efficacy of different LLIN types and ages

• Sponsor: GF and WHO
• Agencies: RITM-DOH & PSFI
Palawan study

- **Retrospective study** to identify households with GF campaign LNs based on distn records
  - 300 pcs collected, comprising:
    - 180 Olyset Nets – aged 3.3, 2.75 & 2 years
    - 60 PermaNets – aged 1.42 years
    - 60 Dawaplus – aged 5 months
- Household interviews: LNs are widely used, 75-95% reported sleeping every night throughout the year
- Users emphasized LNs are good for sound and restful sleep (79.2%) compared to avoidance of bites from other mosquitoes & other insects (22%).
<table>
<thead>
<tr>
<th>Washing Practices</th>
<th>Napsan</th>
<th>Bacungan</th>
<th>Bahile</th>
<th>Matahimik</th>
<th>San Vicente</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN washed in cold water</td>
<td>55</td>
<td>96.7</td>
<td>75</td>
<td>96.7</td>
<td>76.7</td>
</tr>
<tr>
<td>Detergent bar</td>
<td>70</td>
<td>61.7</td>
<td>68.3</td>
<td>31.7</td>
<td>30</td>
</tr>
<tr>
<td>Detergent powder</td>
<td>28.3</td>
<td>55</td>
<td>28.3</td>
<td>68.3</td>
<td>66.7</td>
</tr>
<tr>
<td>no bleaching products used</td>
<td>63.3</td>
<td>83.3</td>
<td>88.3</td>
<td>80</td>
<td>88.3</td>
</tr>
<tr>
<td>chlorine</td>
<td>33.3</td>
<td>10</td>
<td>8.3</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>no soaking, wash directly</td>
<td>68.3</td>
<td>45</td>
<td>65.0</td>
<td>61.7</td>
<td>45</td>
</tr>
<tr>
<td>hand washed</td>
<td>91.7</td>
<td>95</td>
<td>91.7</td>
<td>98.3</td>
<td>88.3</td>
</tr>
<tr>
<td>LN rinsed after washing</td>
<td>98.3</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>LN dried under the shade</td>
<td>36.7</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>58.3</td>
</tr>
<tr>
<td>LN dried under the sun</td>
<td>61.7</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>40</td>
</tr>
</tbody>
</table>
Measuring holes in field
Computation for Hole Index

Hole Index = (A x no. of size-1 holes) + (B x no. of size-2 holes) + (C x no. of size-3 holes) + (D x no. of size-4 holes)

Where,

A-D corresponds to the weights assigned to each hole category based on the average area of each hole.

Size categories are as follows:
size 1 – (0.5 – 2 cm) or size of thumb
size 2 – (2 - 10 cm) or larger than thumb, but smaller than a fist
size 3 – (10 – 25 cm) or larger than a fist but smaller than a person’s head
size 4 – (>25 cm) or larger than a person’s head
Different LN damages observed

A. Hole at hanging point
B. Horizontal tear
C. Open seam
# Physical damage
(n=60 per brand)

<table>
<thead>
<tr>
<th>Damage sustained by LNs</th>
<th>Olyset (3.33 yrs)</th>
<th>Olyset (2.75 yrs)</th>
<th>Olyset (2 yrs)</th>
<th>Permanet (1.42 yrs)</th>
<th>DawaPlus (0.42 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of LNs repaired</td>
<td>13</td>
<td>19</td>
<td>11</td>
<td>34</td>
<td>16</td>
</tr>
<tr>
<td>ave. # of washes/yr</td>
<td>13.07</td>
<td>14.18</td>
<td>8.85</td>
<td>7.97</td>
<td>12.13</td>
</tr>
<tr>
<td>LN proportion w/ holes, %</td>
<td>90</td>
<td>86.7</td>
<td>83.3</td>
<td>91.7</td>
<td>66.7</td>
</tr>
<tr>
<td>Mean hole index</td>
<td>338.58</td>
<td>406.85</td>
<td>217.13</td>
<td>376.77</td>
<td>369.33</td>
</tr>
</tbody>
</table>
Types of damage observed on LN products

- Burned holes
- Open seams
- Holes at hanging points
- Horizontal tears

LN products & # of years in distribution

- Olyset (3.33 yrs)
- Olyset (2.75 yrs)
- Olyset (2 yrs)
- Permanet (1.42 yrs)
- DawaPlus (0.42 yrs)
LN repairs

- PATCHED
- KNOTTED
- STITCHED
- TAPE
Number of actual repairs made on LN products

<table>
<thead>
<tr>
<th>LN Product</th>
<th># of Years in Distribution</th>
<th># of LN Products Repaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olyset (3.33 yrs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olyset (2.75 yrs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olyset (2 yrs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanet (1.42 yrs)</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>DawaPlus (0.42 yrs)</td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

LEGEND:
- **stitched**
- **knotted**
- **patched**
- **taped**

LN product & # of years in distribution
Between-brand and age variation of physical damage of LNs

LN products & # of years in distribution
Hole size index vs % mortality

LN products & # of years in distribution

% mortality

- <10
- 11 to 90
- 91 to 640
- 641 to 7000
Conclusions

• This study provided us with data on the range of damages LNs from the field.
• Increasing hole indexes show decreasing bioefficacy of LNs with a few exceptions.
• This study will not be able to measure net survival and attrition rates in the field.
• Prospective design – allow comparison of different LNs based on prior census & random allocation; systematically monitor loss of nets in the field
More questions

- Chemical analysis to measure residual a.i.
- Correlation between chemistry, wash fastness, bioassays & hole indexes
- Tunnel tests for LN samples less than 80% mortality
- Design a prospective study comparing different LLIN of different fabrics

How long do LNs really last?

- survivorship/attrition (includes retention)
- Physical integrity (holes)
- Bio-efficacy – interaction between insecticide & holes