Durability Monitoring of Long-Lasting Insecticidal Nets in Myanmar

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Overview

- Aspects of LLIN durability
- Durability monitoring survey in Myanmar
  - Objectives & tools
  - Implementation & results from baseline assessment
  - Next steps
Why? The importance of LLIN durability

- Long Lasting Insecticidal Nets, LLINs, is a main and effective malaria prevention measure
- LLIN durability – the ‘average useful life’ of a net is one of the critical factors for malaria programs
What is LLIN durability?

- Net durability (How long does the LLIN remain available to be used for sleeping under)
  - Retention/attrition
  - Physical condition (integrity)

- Insecticidal protection (When does an LLIN lose its ability to protect beyond just the net)
  - given the physical condition
Elements of Net Durability

- Polymer Denier
  - Filament
  - Knitting pattern
- Resistance to damage under reasonable use
- Use pattern under field condition
- Environmental factors
- Preventive behavior
- Repair behavior
- Adaptive behavior
- Discarding and replacement behavior
- Giving away, discarding and replacement
- Giving away, discarding and replacement
- Attrition wear & tear
- R & D
- BCC
- BCC
- LLIN durability
- Net Integrity
Reasons for Attrition

- Given away (including stolen): outcome unknown
- Discarded (thrown away, used otherwise): outcome known
Net integrity

- Categorize nets by calculating composite hole index
  - Good
  - Damaged
  - Torn (no longer useful)
- Serviceable – good + damaged
How to combine attrition and integrity

Distributed

Survey after time X

Still there

From distribution list or recall

Still there

Denominator for durability (survival rate)

Still there

Nets thrown away, destroyed or used otherwise

Physical assessment of surviving nets

Lost

Exclude nets given away or stolen (no outcome)

Fit for use

Durability or survival rate

Too torn

Damaged but servicable

Good
How to combine attrition and integrity

Durability = \frac{\text{# of nets still there and fit for use at time } x}{\text{# of nets originally received and not given away}}
Insecticidal protection

- Given high loading doses in newer LLIN, insecticide effect is expected to last > 3yrs
Research objectives

Aim: to assess the physical durability of the distributed LLINs and people’s attitude and perception on net care and repair

Primary objectives:
1. To assess the physical durability of two brands of 100 denier polyester LLINs treated with deltamethrin (DawaPlus 2.0 and PermaNet 2.0)
2. To compare the durability between the two brands and identify major determinants of field performance.
Research objectives (Cont.)

Secondary objectives:

1. To describe major behavioral aspects of net care and repair and their impact on physical durability
2. To assess the insecticidal effectiveness (residue and bio-assay) after three years of field use
Study site & LLIN brands

- **Site**
  - Tamu Township, Sagaing Region
  - Two brands of LLIN were distributed there during December 2015

- **Brands monitored**
  - DawaPlus 2.0 and PermaNet 2.0
  - 100 denier polyester LLINs treated with deltamethrin
Design Summary

- A prospective cohort study of LLINs over 3-year period in Tamu Township, Myanmar
- Baseline at 6 months after the distribution of LLINs (June, 2016) through a mass campaign, following annual assessment for 3 rounds (2nd round in Dec 2016)
Sampling and sample size

- Multi-stage Cluster Sampling of households
- A cluster: a village or a section of village with a size of 100-200 households.
- Sample
  - 15 clusters for each brand of LLIN
  - 10 households per cluster
- A total sample of 300 households
- All campaign nets from sampled households – become the cohort
Data collection procedures

- **Campaign net cohort**
  - Labelled with a unique identifier
  - Physical condition assessed at baseline
  - Will be done so in three additional annual assessments
  - Related data: household characteristics, and use, care and repair behavior for nets

- **Insecticidal protection**
  - Bio-assays: Separate sub-samples of campaign nets at annual assessments
  - Chemical residue: at end-line assessment (3rd year)
Implementation of baseline assessment

- Five-day data collector training with practice bed nets
- Two weeks of data collection in June 2016
- Four field teams
  - Each with a team leader and two data collectors
  - Supported by local staff from NMCP
The Training
The Tools

i. Tablets for Mobile Data Collection (Open Data Kit – ODK). Integrated GIS data.
ii. Hole Assessment Template
iii. Hole Tally Sheets
iv. Net Labels (Barcodes)
v. Sewing Machine (portable)
Data management & Analysis

- Data collection – Open Data Kit (ODK) software, offline version
- All data cleaning and analyses – STATA version 14.0
Baseline results - overview

- Campaign net cohort: 582 nets identified and tagged
- Campaign net usage: 52%
- Almost all the campaign nets: serviceable condition
- Overall attrition: 20%, mostly due to nets being given away.
## Use of Campaign Nets

<table>
<thead>
<tr>
<th>Type of Campaign Nets</th>
<th>Hanging</th>
<th>In package</th>
<th>Used last night</th>
<th>Used every night (last week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PermaNet 2.0</td>
<td>52.1%</td>
<td>37.5%</td>
<td>56.5%</td>
<td>52.4%</td>
</tr>
<tr>
<td>DawaPlus 2.0</td>
<td>53.6%</td>
<td>34.8%</td>
<td>55.8%</td>
<td>51.7%</td>
</tr>
<tr>
<td>Total</td>
<td>52.8%</td>
<td>36.3%</td>
<td>56.2%</td>
<td>52.1%</td>
</tr>
</tbody>
</table>
# Household ITN ownership and population access

<table>
<thead>
<tr>
<th>Site</th>
<th>HH with at least one ITN for every 2 people</th>
<th>Population access to ITN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PermaNet 2.0 site</td>
<td>57.4%</td>
<td>82.4%</td>
</tr>
<tr>
<td>DawaPlus 2.0 site</td>
<td>62.0%</td>
<td>87.6%</td>
</tr>
<tr>
<td>Total</td>
<td>59.7%</td>
<td>84.7%</td>
</tr>
</tbody>
</table>
# Attrition

<table>
<thead>
<tr>
<th>Site</th>
<th>Time since distribution (months)</th>
<th>Overall attrition</th>
<th>Given away to others</th>
<th>Discarded (Attrition wear &amp; tear)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PermaNet 2.0 Site</td>
<td>6.11</td>
<td>19.8%</td>
<td>17.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>DawaPlus 2.0 Site</td>
<td>6.18</td>
<td>18.1%</td>
<td>17.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total</td>
<td>6.15</td>
<td>19.1%</td>
<td>17.1%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>
## Integrity of surviving nets

<table>
<thead>
<tr>
<th>Type of Campaign Nets</th>
<th>Any holes</th>
<th>Median PHI (if any hole)</th>
<th>Good</th>
<th>Too torn</th>
<th>Serviceable</th>
</tr>
</thead>
<tbody>
<tr>
<td>PermaNet 2.0</td>
<td>14.0%</td>
<td>3.5</td>
<td>99.1%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>DawaPlus 2.0</td>
<td>16.5%</td>
<td>24.5</td>
<td>94.4%</td>
<td>0.37%</td>
<td>99.6%</td>
</tr>
<tr>
<td>Total</td>
<td>15.1%</td>
<td>23</td>
<td>96.9%</td>
<td>0.17%</td>
<td>99.8%</td>
</tr>
</tbody>
</table>
### Nets surviving in serviceable condition

<table>
<thead>
<tr>
<th>Type of Campaign Nets</th>
<th>All cohort nets</th>
<th>Only cohort nets ever-used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>95% CI</td>
</tr>
<tr>
<td>PermaNet 2.0</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>DawaPlus 2.0</td>
<td>99.6%</td>
<td>97.2 – 99.95%</td>
</tr>
<tr>
<td>Total</td>
<td>99.8%</td>
<td>98.7 – 99.98%</td>
</tr>
</tbody>
</table>
Main reported causes of damage

- Damaged in another way
- Pulled and torn on corner
- Torn on edge of nail
- Damaged by rats or mice
- Burned by candle or sparks

**Dawaplus**
- Damaged in another way: 3.6%
- Pulled and torn on corner: 27.7%
- Torn on edge of nail: 20.5%
- Damaged by rats or mice: 33.7%
- Burned by candle or sparks: 30.0%

**Permanet**
- Damaged in another way: 5.0%
- Pulled and torn on corner: 36.3%
- Torn on edge of nail: 26.3%
- Damaged by rats or mice: 30.0%
- Burned by candle or sparks: 16.3%
What’s next?

- Data collection for 12-month assessment will be on December 2016.
- A random sample of 60 campaign nets outside of original cohort nets will be selected for bio-assays.
- Additional cohort of 120 campaign nets will be tagged for 24-month bio-assay assessment.
- Further info: www.durabilitymonitoring.org