SOPs for the evaluation of insecticide-treated clothing in rubber plantations

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The Mekong Outdoor Malaria Transmission Network Regional Workshop,
9 November 2016
Rubber tapping takes place during the night, coinciding with low and peak biting times of *Anopheles dirus* and *An. minimus*

Risk groups: Mobile and migrant populations, forest-goers, rubber tappers, etc

Protection gap when only indoor insecticide-based vector control methods applied*

*Adapted from Durnez, L. & Coosemans, M. (2013).*
Background

• Permethrin insecticide-treated clothing (ITC) reduce *Aedes* biting rates by >90% and impact malaria transmission. However, application is so far limited to military and recreational markets.*

• More information is needed to **ensure the success of ITC as a strategy**, specifically on wearing practices, durability, adverse effects, bio-efficacy and supply-demand aspects.

• This will help **inform policymakers on targeted distribution** to mobile and migrant populations.

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Operational research objectives

• Determine wearing practices and durability of ITC

• Assess supply and demand perspectives from the community and civil society to inform future social marketing or ITC distribution programmes

• To assess bio-efficacy of ITC [versus non-treated clothing (NTC) control]. Variables: effects of UV radiation, washing and no. of launderings on cotton, polyester and cotton-polyester mix [note: study is on-going]

• Ethical clearance for the ‘Preference and Acceptability of ITC’ study was obtained from Ethics Review Committee on Medical Research Involving Human Subjects, Department of Medical Research (Lower Myanmar) and Ministry of Health, Government of the Republic of the Union of Myanmar (Letter No. 54/Ethics 2014)
Study area

- large number of migrant rubber workers; 33% of population in high risk work environments for malaria*
- API: 13.68 per 1000 population
SOPs and Results
Protocol: A cluster-randomized equivalence, crossover trial to determine population preference and acceptability of permethrin-treated clothing in Myanmar

Proposal version 0.2; 06.03.2014

Participants instructed not to use bleach or dry clothing in direct sunlight as can reduce potency of insecticide

First follow-up (FU1)
Feb-Mar 2015

ICT arm 1
(8 clusters, n=116)

14 days

Supervisory visit

Acceptability and use survey; FGDs
CROSSOVER: collect used clothing (ITC/NTC) and distribute other type (NTC/ITC)

Arm 1: Received NTC
(n=112)

Arm 2: Received ITC
(n=115)

14 days*

Supervisory visit

Second follow-up (FU2)
Mar 2015

ITC arm 1
(8 clusters, n=116)

14 days

Supervisory visit

Acceptability, preference and use survey; FGDs
Participants told to continue using same set of clothing for next 6 weeks

Arm 1: NTC
(n=101)

Arm 2: ITC
(n=100)

6 weeks

Supervisory visit

Third follow-up (FU3)
May 2015

Acceptability, preference and use survey
FGDs; IDIs

Arm 1 participants remaining (n=79)

Arm 2 participants remaining (n=78)
## Intervention: ITC and NTC

<table>
<thead>
<tr>
<th>Type</th>
<th>Material and size</th>
<th>Insecticide treatment</th>
</tr>
</thead>
</table>
| **ITC** | • Long sleeve cotton shirt (dark blue)  
• Cotton trousers (black)  
• Myanmar-made  
• 3-4 sizes for males and females | • Treated in Insect Shield factory, 0.52% w/w ± 10% permethrin and a polymer (EPA-registered and WHO-approved) |
| **NTC** | • Long sleeve cotton shirt (dark blue)  
• Cotton trousers (black)  
• Myanmar-made  
• 3-4 sizes for males and females | • Untreated regular garment |

A proportion of ITC and NTC sets had stitched-on patches that were systematically removed at each follow-up round and sent for protective efficacy bioassays in Mahidol and arctec labs.
Guidelines and SOP

Baseline census in rubber plantations
Pre-distribution survey guide
Acceptability survey guide
ITC & NTC questionnaire
FGD guide
Supervisory checklist
Adverse events reporting
Guidelines for care and use of ITC
SOP for KII interviews
Clothing durability questionnaire
**Baseline demographics of households by trial arm**

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Arm 1 (n=84 households)</th>
<th>Arm 2 (n=84 households)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (n ± SD)</td>
<td>33 ± 11</td>
<td>33 ± 11</td>
</tr>
<tr>
<td>Gender (n, %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>52 (62%)</td>
<td>56 (67%)</td>
</tr>
<tr>
<td>Education (n, %)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary or lower</td>
<td>55 (65%)</td>
<td>51 (61%)</td>
</tr>
<tr>
<td>Distance (miles) to the nearest health center (n ± SD)</td>
<td>3.0 ±10.7</td>
<td>1.9 ±2.2</td>
</tr>
<tr>
<td>Geographic origin (n, %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-state (Mon)</td>
<td>49 (58%)</td>
<td>57 (68%)</td>
</tr>
<tr>
<td>Out of state (Bago, Irrawaddy, Other)</td>
<td>35 (42%)</td>
<td>27 (32%)</td>
</tr>
<tr>
<td>Malaria prevention methods used**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITN/LLIN*</td>
<td>40 (48%)</td>
<td>53 (63%)</td>
</tr>
<tr>
<td>Mosquito coil</td>
<td>38 (45%)</td>
<td>36 (43%)</td>
</tr>
<tr>
<td>Wood smoke*</td>
<td>13 (15%)</td>
<td>4 (5%)</td>
</tr>
<tr>
<td>Repellent</td>
<td>5 (6%)</td>
<td>4 (5%)</td>
</tr>
</tbody>
</table>

*Chi-square test indicate significant difference of p<0.05 between arms

**multiple responses indicated, only top answers presented
### SOP – conducting focus group discussions (FGDs) in the two study arms (ITC1 and ITC2)

Table 1. Number of FGDs conducted with male and female participants at each field visit in Phase 1 and Phase 2.

<table>
<thead>
<tr>
<th>FGDs</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 1</td>
<td>FU1</td>
<td>FU2</td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDIs</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>
Recommendations from FGD

1. Conduct formative assessments prior to targeted distribution, to tailor ITC to local preferences
2. For this target population, provide multiple sets of clothing and seasonal attire
3. Utilize local networks for advocacy and distribution, and distribute according to seasonal and occupational patterns
4. Generate demand for ITC through mass media channels and health promotion
5. Develop SBCC messages on ITC and deliver these through local channels, such as CHWs, midwives, rubber plantation owners/manager
6. Use advocacy strategies to engage rubber plantation owners and managers
Protocol for assessing the durability of ITC

Figure 4. Left: Stains of rubber latex on the distributed trousers. Right: Tears in the crotch and seams of the distributed trousers.

<table>
<thead>
<tr>
<th>Hole index (pH)</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current WHO-approved method of bed net evaluation bins holes into three sizes using &quot;finger-fist-head-larger than head&quot; size criterion:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Less than 0.5 cm dia - ignore
- 0.5 cm dia
- 2 cm dia
- 2.5 cm dia
- 5 cm dia
- 10 cm dia

Holes in net are size-classed irrespective of location and counted to yield a single number ‘hole index’ value.

Front shirt (including long sleeves):
- Size 1 (less than a finger)
- Size 2 (finger)
- Size 3 (fist)
- Size 4 (head)

Back shirt (including long sleeves):
- Size 1 (less than a finger)
- Size 2 (finger)
- Size 3 (fist)
- Size 4 (head)

Front pants:
- Size 1 (less than a finger)
- Size 2 (finger)
- Size 3 (fist)
- Size 4 (head)

Back pants:
- Size 1 (less than a finger)
- Size 2 (finger)
- Size 3 (fist)
- Size 4 (head)

Total:
- Size 1 (less than a finger)
- Size 2 (finger)
- Size 3 (fist)
- Size 4 (head)
SOP for cone bioassays

SOP for arm-in-cage assays

SOP for washing of ITC (CIPAC method)
SOP for moving-landing collections: 18:00-23:00 h, 8 nights
*Schreck et al. 1984; Bank et al. 2014; Skintex: http://www.skintexmrlii.com; Insect Shield: http://www.insectshield.com*
1. Research and development

Tailoring the product for rural populations:

- **Washing technique**
  - Insect Shield clothing registered to last up to 70 washes, however:
  - Permethrin concentration wanes more *rapidly* with *hand-washing* compared to machine washing; similar trend seen for protective efficacy as measured by knockdown (KD) and mortality [*data not shown*]

- **Optimal treatment method and testing method**
  - Three main treatment methods: factory dipping, home dipping, microencapsulation – our study used factory dipping
  - Finding appropriate balance between lifetime of clothing and lifetime of insecticide
  - Binding strength vs. insecticide concentration and release rate
2. Promotion and uptake

- Formative assessments:
  - Needed to understand knowledge, attitudes, existing behaviours, preferences, barriers, potential tools and channels of communication, in order to tailor ITC according to individual target groups and purpose
  - One-size-fits-all approach will not work

- Behaviour change communication (BCC) and advocacy:
  - Less BCC-intensive than other interventions, but need specific messages on proper care and use of ITC – washing gently and drying out of direct sunlight – and to address misconceptions about side-effects
  - Emphasise health benefits, but ensure perceived value does not stop participants from wearing it
  - Creating ritual or habit may be effective: wearing ITC as a symbol of pride
Zika-proof Olympic uniforms (CNN)
South Korea unveiled new uniforms infused with mosquito-repellant as fear grows of the Zika virus in Brazil
WHO National scaling up of ITN usage: Conceptual framework (Source: WHO)
Conclusion at PPM workshop on 3.3.2016

• ITC offer short term protection in outdoor settings
• **Short-term**: import treated fabrics and work with garment industry for local distribution
• **Medium-long term**: explore options for
  • ITC local production based on technology transfer, capital investment, technical assistance etc.
  • Establishment of a social enterprise for ITC
• Private-public partnership
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