Multicentre Studies of Durable Lining in Africa & Asia: Entomological Efficacy and User Acceptance During One Year of Field Use

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Study Design

- Multi-centre field trials for one year
- DL installed in traditional rural houses
- IRS with pyrethroid applied as control

Study objectives:

1. Entomological efficacy – WHO cone bioassays (30 min)
2. User acceptability – Questionnaires
3. Durability in the field – Questionnaires & Observations
4. Insecticide residuality - HPLC (Vietnam only)
Investigators

1. Equatorial Guinea
   Richard Allan (Mentor)
   Abrahan Arnez (MCDI)
   Simon Ecuaga (MoH)
   S Ondo, I Ncogo, M Nguema, B Abeso, A Manana (MCDI)
2. Ghana:
   JB Stiles-Ocran (Malaria Control Centre, AngloGold)
3. Mali:
   M Coulibaly, M Larsen, B Diallo, A Traoré, M Konaté, A Guindo
   (Malaria Research & Training Centre; Technical Institute of Denmark)
4. Nigeria:
   Dr Adedapo Awolola
5. South Africa:
   C Mulder, G Stander, P Olivier (Agricultural Research Station, Friedenhiem)
6. Vietnam
   Chi Phan (NIMPE; Vestergaard)
DL Features (1)

• DL applied to house interior as long-lasting IRS substitute
  – Provides uniform insecticide coverage independent of wall substrate
DL Features (2)

- VestergaardFrandsen (ZeroVector®)
- HDPE impregnated with deltamethrin (170mg/m²)
- Produced in rolls of 2.3 x 100m
South Africa

Ghana
Equatorial Guinea
Installation (1)

• DL installed by 3 person team:
  (1) Outside DL rolled out & cut to fit house dimensions
  (2) Team work around room fixing DL with nails at 60-intervals (1 person fixes top, 1 fixes bottom)
Installation (2)

• DL installed by 3 person team:
  (3) Cut holes for door & windows
  (4) Option to leave eaves screened
Results: Installation

• 148 households participated in DL installation

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Average Installation Time (Mins)</th>
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</thead>
<tbody>
<tr>
<td>Sitting Room</td>
<td>82 ± 30 (SD)</td>
</tr>
<tr>
<td>Bedroom</td>
<td>76 ± 24 (SD)</td>
</tr>
<tr>
<td>1 Room House</td>
<td>59 ± 19 (SD)</td>
</tr>
</tbody>
</table>
Results: Entomological Efficacy (1)

- Equatorial Guinea
  - DL: no loss of bioassay efficacy over 1 year
  - IRS: significant loss of activity over 1 year ($P=0.001$)
Results: Entomological Efficacy (2)

- Ghana (DL overlaid concrete or mud walls)
  - DL: no loss of bioassay efficacy on concrete or mud surfaces over 1 year
  - IRS: Significant loss of activity on concrete and mud (both $P=0.001$) over 1 year
Results: Chemical Analysis

• Vietnam
  – After 15 months, DL retained 78% of original deltamethrin content
Results: User Acceptability (1)

- Adverse events
  - 14 individuals out of 148 households reported minor side effects mostly within 1st month
Results: User Acceptability (2)

- **Entomology**
  - 93% (313/333) reported fewer mosquitoes
  - 82% (250/304) reported fewer mosquito bites

- **Indoor Environment**
  - 83% (286/345) reported no change in indoor temperature
  - 69% (238/347) reported no change in indoor light levels
Results: User Acceptability (3)

• DL aesthetics
  – 97% (262/271) were satisfied with the DL colour given
  – Disliked black, white & red
Results: User Acceptability (4)

• Choice of Intervention in Eq. Guinea
  – All intervention groups preferred DL
  – 85% of DL group preferred DL (67/80)
  – 5% of IRS group preferred IRS (1/22) but 68% preferred DL (15/22)
Results: Durability

- 35 out of 148 households experienced failure of nail fixings
- 33 out of 148 households experienced DL tearing
  - Tearing around doors, windows, room corners, furniture contact, usually blamed on children
- 32 households reported cleaning DL throughout year
  - Cleaning increased over time
  - Cleaning with wet cloths or dry brushes
• Nail failure
  – Eq. Guinea at 12 months

• DL tearing
  – Eq. Guinea at 12 months
Study Limitations

• No untreated control: i.e. DL without deltamethrin
• Residual insecticide activity only
  – No measure of effect against free flying vectors
Conclusions

• After 12 months DL remains efficacious in bioassays, with a small loss of insecticide content
• Household acceptability was high, positive responses to entomological and aesthetic questions
• Less than 30% of households experienced problems with nails or torn lining after one year
Insecticide treated polyethylene sheeting (ITPS) for prevention of malaria in emergencies: an observational cohort study in refugee camps in Sierra Leone


Mentor, WHO, UNHCR, LSHTM, JHU, Wageningen, IRD
Study area

- Liberian refugees settled in Sierra Leone
- Study camps:
  - Largo
  - Tobanda
- Populations: 8000
- Issued with ITPS or untreated PS on registration
Camp maps and ITPS distribution

Tobanda

Largo

Kenema District
Nongowa Chiefdom
Surface: 48 ha
Capacity: Approx 7'000 persons

Kenema District
Small Bo Chiefdom
Surface: 73 ha
Capacity: Approx 8,000 persons

Non-Evaluation Schemes:
6 Communities with 47 functioning shelters (4/75/27L)

Section 01 Cohort Monitoring:
34 Communities with 482 functioning shelters (7/15/24L)

Section 02 Buffer Area:
17 Communities with 222 functioning shelters (6/17/18L)

Section 03 Buffer Area:
11 Communities with 122 functioning shelters (8/10/78L)

Section 04 Cohort Monitoring:
33 Communities with 224 functioning shelters (5/45/29L)

Section 05 Buffer Area:
6 Communities with 97 functioning shelters (3/17/14L)

Section 07 Buffer Area:
5 Communities with 81 functioning shelters (6/10/21L)

Section 08 Buffer Area:
5 Communities with 61 functioning shelters (4/10/33L)

Non-Evaluation Schemes:
25 Communities with 197 functioning shelters (8/75/20L)
ITPS deployment

- Differences in ITPS usage
- Largo: all inner walls and ceilings lined with ITPS
- Tobanda: Roof only lined with ITPS
- Monitoring was done over 8 months in 8 sectors of Largo and 12 of Tobanda, randomly selected from untreated and ITPS arms
Outcomes

Tobanda camp:
Study arm A: ITPS roof only
Study arm B: UPS roof only

Largo camp:
Study arm A: ITPS inner walls and ceiling only
Study arm B: UPS inner walls and ceiling

Primary outcome
• Malaria incidence rate in children under 3 years from ITPS and UPS arms

Secondary outcome
• Haemoglobin (g/dL) in children under 3 years
## Incidence outcome

<table>
<thead>
<tr>
<th></th>
<th>Incidence rate(^a) (95% CI)</th>
<th>IR Ratio (95% CI)</th>
<th>Adjusted IRR* (95% CI)</th>
<th>% Protective efficacy* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Largo (walls &amp; ceiling)</strong></td>
<td></td>
<td></td>
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<tr>
<td>UPS</td>
<td>163 (157-169)</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>ITPS</td>
<td>63 (52-76)</td>
<td>0.39 (0.36-0.41)</td>
<td>0.40 (0.33-0.47)</td>
<td>60 (53-67)</td>
</tr>
<tr>
<td><strong>Tobanda (roof only)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPS</td>
<td>157 (147-167)</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>ITPS</td>
<td>133 (120-148)</td>
<td>0.85 (0.81-0.89)</td>
<td>0.85 (0.75-0.95)</td>
<td>15 (5-25)</td>
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</table>

\(^a\)Incidence rate per 100 child-years;

* Adjusted for age and sex using a random effects poisson regression model
Limitations

• Intervention of ITPS and UPS not truly cluster randomised
• Camp divided into one UPS and one ITPS section
• Within each section 4-6 clusters were allocated but these were all ITPS or all UPS and cannot be assumed to be independent
• With the possibility of selection bias, the protective efficacy of ITPS may have been overestimated
• Difficult to conduct cluster randomised trial in emergencies
• Need to conduct cluster randomised trial of DL in stable settings