Trends of Malaria Morbidity Following IRS: Indicators From a Sentinel Site Surveillance System in Two Epidemiologic Settings

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Background

- Malaria control in Africa has been largely dependent on effective case management and the prevention of malaria through the use of ITNs.
- Indoor residual spraying (IRS) has recently received increased attention and funding as a control intervention in Africa.
The impact of IRS is dependent on reducing vectorial capacity which is influenced by the following factors:
- Resting behavior of vector
- Timing and coverage
- Baseline level of transmission

IRS primarily used in the following settings:
- Low transmission areas
- Discrete communities (islands, refugee camps)
- Epidemic response

WHO now recommending an extended role of IRS in higher transmission areas of Africa
Objectives

- To measure the impact of district wide IRS campaigns in two distinct epidemiologic settings using the USMP sentinel site surveillance system
- To assess the relationship between our measures of impact and the duration following IRS
Methods

Study site 1: Kanungu district
- Population of ~ 190,000 persons living in 45,000 households
- Moderate malaria transmission intensity (EIR=6)

Intervention:
- District wide IRS campaign targeting all household from late Feb 2007 – mid March 2007
- Synthetic pyrethroid (Lambda-cyhalothrin) in 10% WP (wetable powder)
Methods

- **Study site 2: Apac district**
  - Population of ~ 354,505 persons living in 111,534 households
  - Very high malaria transmission intensity (EIR>1500)

- **Intervention:**
  - District wide IRS campaign targeting all household from late April 2008 – late May 2009
  - Lambda-cyhalothrin CS (ICON CS)
Methods, cont

- Outcome measures using UMSP sentinel site surveillance system at Kiihi Health Center IV (Kanungu District) and Aduku Health Center IV (Apac District)

- Following data collected on all patients

- Kihihi August 06 – May 08

- Aduku August 07- February 09
  - Age
  - Parish of residence
  - Blood smear result
  - Whether the patient was diagnosed with malaria
  - Treatment for malaria
Outcomes of interest

- Data available on several measures
- Two outcomes of interest presented here:
  - Proportion of patients treated for malaria
  - Proportion of blood smear read as positive
## Results - Kihiihi

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pre-IRS</th>
<th>Post-IRS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aug 06 – Mar 07</td>
<td>Apr 07 – Aug 07</td>
</tr>
<tr>
<td>Total number of patients seen</td>
<td>16337</td>
<td>6388</td>
</tr>
<tr>
<td>Average number of patients seen per month</td>
<td>2042</td>
<td>1278</td>
</tr>
<tr>
<td>Proportion of total with age less than 5 years</td>
<td>35%</td>
<td>25%</td>
</tr>
<tr>
<td>Proportion of total with malaria suspected</td>
<td>69%</td>
<td>51%</td>
</tr>
<tr>
<td>Proportion of malaria suspected with microscopy done</td>
<td>75%</td>
<td>69%</td>
</tr>
<tr>
<td>Proportion with positive blood smear treated for malaria</td>
<td>88%</td>
<td>95%</td>
</tr>
<tr>
<td>Proportion with negative blood smear treated for malaria</td>
<td>23%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Proportion of patients prescribed antimalarial therapy

Absolute decrease in the probability of a patient being prescribed antimalarial therapy following IRS

<table>
<thead>
<tr>
<th>Age group</th>
<th>Apr 07-Aug 07</th>
<th>Sep 07-Jan 08</th>
<th>Feb 08-May 08</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RD (95% CI)</td>
<td>P</td>
<td>RD (95% CI)</td>
</tr>
<tr>
<td>&lt; 5 years</td>
<td>23.1% (15.7-30.5%)</td>
<td>&lt;0.001</td>
<td>25.4% (17.2-33.6%)</td>
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<tr>
<td>≥ 5 years</td>
<td>12.2% (6.9-17.5%)</td>
<td>0.001</td>
<td>10.8% (4.1-17.5%)</td>
</tr>
</tbody>
</table>
Proportion of blood smear read as positive

- Aug 06 - Mar 07 (pre-IRS) 47%
- Apr 07 - Aug 07 12%
- Sep 07 - Jan 08 16%
- Feb 08 - May 08 8%

Age group: < 5 years vs. >= 5 years

<table>
<thead>
<tr>
<th>Age group</th>
<th>Apr 07 - Aug 07</th>
<th>Pre IRS vs. Sep 07-Jan 08</th>
<th>Pre IRS vs. Feb 08-May 08</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 years</td>
<td>32.2% (26.1-38.3%)</td>
<td>&lt;0.001</td>
<td>21.1% (19.1-37.1%)</td>
</tr>
<tr>
<td>&gt;= 5 years</td>
<td>16.5% (8.5-24.5%)</td>
<td>&lt;0.001</td>
<td>7.9% (2.8-13.0%)</td>
</tr>
</tbody>
</table>

Absolute decrease in the probability of a blood smear being positive following IRS.
Results-Apac

Number of patients seen
Number of cases of suspected malaria
Number of cases of laboratory confirmed malaria
Number of patients prescribed antimalarial therapy
Conclusions

- IRS was associated with a significant reduction in the proportion of patients treated for malaria and the proportion of blood smears read as positive in Kanungu District but not in Apac District.

- IRS resulted in significant and sustained benefit in Kanungu but no noticeable change in Apac District.
Recommendations

- Significant antimalarial savings are possible if IRS is coupled with accurate diagnosis in areas of low and moderate transmission.
- More data is needed to determine the benefit of IRS in high malaria transmission settings.
- Further research is needed to evaluate the cost-effectiveness and impact of IRS at the population level in Africa.