Rice and malaria in Africa
Trade-off vs. co-benefits?
Jo Lines & Kallista Chan

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Multi-sectoral malaria control

20% health interventions are delivered by non-health sector businesses

80% Addressing man-made malaria

Addressing insecticide resistance and emerging mosquito-borne disease threats
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What is man-made malaria?

What proportion of malaria is man-made, in any given setting?

- Mainly...vector breeding in man-made landscapes
- What proportion of local vector mosquitoes are from man-made breeding sites? Consider...
  - sites created directly / indirectly by human activity
  - sites much more productive because of human activity
  - (sites inadvertently removed by human activity)
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Man-made malaria

Is it time to revive this concept?

- Big fraction of total malaria burden especially in Africa

- Not a new idea!

- Recently less profile.... but growing importance ...

- ...as landscapes become 100% anthropogenic
Where we are

The state of the evidence

1900-2005: paddies paradox

Nowadays: rice and malaria situation has changed

But... Just 1 paper

1990s: A series of studies in Africa compared malaria in rice vs. non-rice communities

Paddies paradox: rice fields produce VERY MANY EXTRA malaria vectors but the malaria in rice villages was (at the time) similar or a bit less

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Moderate mosquito numbers

Ordinary breeding sites: sunlit, temporary puddles

Humans without nets and poor access to drugs exposed to mosquitoes and parasites

Superabundant mosquito numbers

Prolific breeding in rice fields

Rice brings economic benefits

Humans isolated by nets from mosquitoes, protected / cured of parasites through good access to drugs

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Intervention coverage has changed

Malaria in Africa has changed = pathway to elimination

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# Growing rice w/o growing mosquitoes: feasibility

<table>
<thead>
<tr>
<th>Method</th>
<th>Does it work? (% effectiveness)</th>
<th>No. of studies (no. in SSA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monomolecular surface films</td>
<td>-57.2 (-69.4, -40.3) / -91.6 (-99.9, +486.3)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Biological larvicides</td>
<td>-60.0 (-71.8, -43.1)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Synthetic organic chemicals</td>
<td>-73.1 (-83.8, -55.4) / -72.3 (-89.5, -26.9)</td>
<td>6 (2)</td>
</tr>
<tr>
<td>Fish</td>
<td>-81.5 (-91.4, -60.2) / -87.1 (-92.0, -72.7)</td>
<td>6 (1)</td>
</tr>
<tr>
<td>Copepods</td>
<td></td>
<td>1 (0)</td>
</tr>
<tr>
<td><em>Azolla</em></td>
<td></td>
<td>1 (0)</td>
</tr>
<tr>
<td>Neem</td>
<td></td>
<td>1 (0)</td>
</tr>
<tr>
<td>Intermittent irrigation</td>
<td></td>
<td>7 (2)</td>
</tr>
<tr>
<td>Rice variety</td>
<td>+150.0 (-66.1, +1745.1)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Rice variety &amp; plant spacing</td>
<td>-66.3 (-90.0, +13.4)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Weed control (herbiciding)</td>
<td>+77.4 (+65.7, +89.9)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Agricultural insecticide</td>
<td>-76.4 (-88.8, -50.2)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Land preparation: tillage</td>
<td>-64.7 (-85.5, -14.1)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Land preparation: levelling</td>
<td>-12.8 (-65.2, +118.5)</td>
<td>1 (1)</td>
</tr>
</tbody>
</table>

It is possible! But needs more detailed research.
Growing rice w/o growing mosquitoes: approach

• No point in interventions being developed only by entomologists
• Entomologists have done it – successfully – but no attention (except in China)
• Win-win solutions (with agriculture-health and environmental co-benefits)

Water use: Reduction
Methane emissions: Reduction
Rice yield: Increase
Vector production: Reduction

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Growing rice w/o growing mosquitoes: approach

Asking rice experts to change the way rice is grown in Africa = BIG ASK!

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Agenda

If the big R&D job must be led by the agricultural sector...

Q: What is there for us health people to do?
A: Convince them it is an avoidable problem:
  - problem
  - avoidable
Suggestions?

1. How to strengthen the epidemiological evidence that it is a problem?

1. How to strengthen the evidence that it is avoidable?
1. Strengthen the epidemiological evidence that rice brings malaria:

**HOW?**

- Before-and-after studies -- routine data?
- Risk factor studies - case control?
- Estimate the rice-attributable fraction? We’ve started...
  - what proportion of malaria burden comes from mosquitoes from rice-fields?
- Need geo-referenced prevalence *without the random error of DHS/MIS*

**WHO?**

national cross-sectoral development plans: office of the PM; AU, donors and broad development community, cross-sectoral multi-laterals ... now CIF countries?
The research agenda: next steps for malaria entomologists

2. Show that it is possible to grow rice without mosquitoes

- Lots of promising ideas begging for research

  AWD & Intermittent irrigation

  Levelling/tilling, direct-sowing, weeding methods, rice varieties

  Fish? Even ducks?

  Bti in fertilizer for initial peak of productivity