Vector control in the Asia Pacific Region: shifting from control to elimination

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Malaria elimination paradigm

• Reduce transmission to the extent that individual human cases can be mapped and treated before onward transmission to mosquitoes.
• The aim is to prevent infection of mosquitoes through prompt diagnosis and treatment.
• But this is possible only if mosquito populations have been sufficiently suppressed.
## Control vs Elimination

<table>
<thead>
<tr>
<th>Activity</th>
<th>Control</th>
<th>Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention target</td>
<td>• Entire or broad areas of country</td>
<td>• Residual and potential transmission foci</td>
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<tr>
<td>Diagnosis</td>
<td>• High reliance on clinical diagnosis;</td>
<td>• All cases confirmed with microscopy and/or RDTs;</td>
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<td></td>
<td>• Limited quality assurance</td>
<td>• Robust quality assurance</td>
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<tr>
<td>Private sector</td>
<td>• Diagnosis and treatment provided in private sector</td>
<td>• No diagnosis or treatment in informal private sector;</td>
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<td></td>
<td></td>
<td>• Fully integrated into surveillance system</td>
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<tr>
<td>Activity</td>
<td>Control</td>
<td>Elimination</td>
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<tr>
<td>Programme management and legislation</td>
<td>• Often limited central capacity, including M&amp;E; • Limited or no cross-sectoral collaboration and enabling legislation</td>
<td>• Strong central capacity with extensive analytical and technical capacity; • Substantial cross-sectoral collaboration and relevant legislation</td>
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<td>Surveillance</td>
<td>• Limited reporting and analysis of cases through passive system</td>
<td>• All new cases rapidly reported and analyzed through both passive and active systems</td>
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<td>Cross-border measures</td>
<td>• Limited or no cross-border initiatives</td>
<td>• Initiatives pursued to dramatically reduce transmission in key neighboring areas; • Prophylaxis for travelers to endemic areas</td>
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</table>
What do we do in control settings?

• Monitor changes in transmission intensity via measurement of EIR
• Systematic longitudinal collections in different ecological zones.
• Monitor insecticide resistance.
• Conduct operational research.
What is the same for us in elimination settings?

• Still need to track insecticide resistance and rationally manage resistance.
• Accurate species identification and characterization
• We will need strategically designed programmatically relevant operational research
Insecticide Resistance
WHO Assays (2009-2010)

Bungoma & Busia are north and west of other sites. A. gambiae was the predominant mosquito in these areas in 2009-2010 while A. arabiensis has been the predominant mosquito along the lakeshore since 2007.
Frequency of the *kdr* allele (1014S) within *An. gambiae* s.s.
What is different for us in elimination settings?

- Detailed epidemiological data informs what we do. (if we don’t have this, we are not in elimination phase!)
- Take advantage of the inherent creativity of decentralized health systems for understanding of transmission risk.
- Specific interventions not suitable for broad scale deployment may be used at local level
- Less emphasis on entomological measures of transmission intensity and longitudinal surveys
Epidemiological data from Cambodia

Thanks to Dr. Heng Somony, Dr. Soy Ty Kheang, Dr. Chy Say, and Dr. Sokomar Nguon
Project Target Information

- Total population: 158,680 (2015)
- 3 Administrative Districts
- 127 villages
- 9 HCs, 1 FDH, 1 RH, 168 VMWs, 32 PPs
- 3 District Special Working Groups for Malaria Elimination

\[\text{Note: } \text{HC: Health Center, FDH: Former District Hospital, RH: Referral Hospital, VMW: Village Malaria Workers, PP: Private Provider, OD: Operational District}\]
Basic essential package of activities for malaria pre-elimination

1-3-7 Surveillance and response
- Case notification on Day-1
- Case investigation through Day-3
- Case response through Day-7

Intensified case management
- 3 days Directly Observed Therapy (DOT) for all cases
- 28 days follow up for Pf/Mix

Treatment regimens
- First line regimen: DHA-PIP till Jan 2016, then ASMQ from Feb 2016
- 1st trimester pregnancy: Quinine
- Second line: Quinine +/- Tetracycline
Key Results (Jul 2015-Sep 2016)

Monthly surveillance and response results

- Notified within 24 hrs
- Investigated within 3 days
- Responded within 7 days

Number of people screened and positive cases

- Index household member: 800, 0 positive
- Co-traveler: 342, 11 positive
- Surrounding index household: 82, 0 positive

# screened # positive
Foci investigation

• “Foci” defined as persistent transmission of P. falciparum

• Components of an entomological investigation
  – Check validity of the data – talk to people about where transmission might be occurring and go there.
  – Assess coverage of interventions (case management, LLINs, IRS)
  – Assess whether larval control at a small scale might be appropriate
Five decentralized elimination programs in Indonesia

Thanks to many colleagues at the MOH, health offices in districts, and UNICEF
District-level achievement of malaria elimination in Indonesia

• Karengasem (east coast of Bali)
  – Major vector sundacicus. Major interventions larviciding with similar larv (pyriproxyfen) and ACD

• Kepulauaan Seribu (islands north of Jakarta)
  – Major vector sundacicus. Much imported malaria in fisherman population. Major interventions migration surveillance and environmental management
District-level achievement of malaria elimination in Indonesia – 4 examples

• Wonosobo – central Java
  – Major vectors maculatus and balabacensis; Major interventions IRS in selected areas; migration surveillance of seasonal workers in Kalimantan, ACD

• Sabang – Aceh
missing info on aceh?  
Hwang, Jimee, 10/01/2016
Malaria elimination in Aceh

• 4.3 million people
• The tsunami arguably brought peace to Aceh, allowing access to remote malaria-endemic areas
• Tsunami funds allowed scale up of diagnosis and treatment with ACT, LLINs, and IRS, leaving many districts in pre-elimination mode
Elimination of malaria transmission

• Model district is Sabang (Weh Island), off the northern coast of Aceh.
• 4.3% point prevalence pre-intervention post tsunami
• 30,000 residents
• Multiple mosquito vectors
• Much emigration and immigration
Is this Sabang data?
Hwang, Jimee, 10/01/2016
Malaria free Sabang – how was it achieved?

- High coverage of standard interventions
- This caused a decrease in cases such that each case could be tracked
- Hospitals began reporting cases to the DHO
- Private clinics report to DHO
- Rapid reporting and follow up such that parasites are killed before a mosquito can transmit
- Political and community support
- Sub-patent parasites apparently don’t matter
- Minor role for larval control
How can Sabang’s malaria free status be maintained?

- Imported cases occur regularly
- 60% of Aceh’s malaria now comes from one district – Aceh Jaya
- Migration surveillance is detecting and treating cases
- However, in Oct 2014, Sabang experienced an outbreak of *Plasmodium knowlesi*
Imported cases in Aceh across district borders

Thanks to Provincial Health Office, Aceh
Plasmodium knowlesi
House of *P. knowlesi* patient in Sabang, Aceh
maybe pull knowlesi and primaquine into the maintaining elimination slide 26 as challenges?

Hwang, Jimee, 10/01/2016
Knowlesi patient, her little brother, and Mom
Community based vector control in eastern Indonesia

Thanks to District Health Office, South Halmahera District
South Halmahera Longitudinal & Cross-Sectional Survey of *Anopheles* Species Distribution

1. *An. sundaicus*
2. *An. aconitus*
3. *An. hyrcarnus group*
4. *An. kochi*
5. *An. subpictus*
6. *An. vagus*
7. *An. annularis*
8. *An. barbirostris*
9. *An. maculatus*
10. *An. minimus*
11. *An. tesselatus*
12. *An. indefinitus*
13. *An. balabacensis*
14. *An. flavirostris*
15. *An. farauti*
16. *An. barbumbrosus*
17. *An. ramsayi*
18. *An. punculatus*
19. *An. leucosphyrus group*
20. *An. umbrosus*
Landscape of South Halmahera
Success of malaria control program in South Halmahera—but why?

- 50% decline in incidence
- Malaria mortality 226 in 2005; 9 in 2009; no more than 2 in subsequent years (through 2015).
- Interventions
  - ACT (and improved diagnosis)
  - LLINs
  - Limited IRS
  - Participatory learning and action and environmental management
Participatory Learning and Action—vector control

• Carried out in 252 of 257 villages in South Halmahera

• Originally designed to seek support for environmental management to reduce malaria vector habit.

• Improved sanitation.

• Leveraged local development funds.
Village mapping by community; Prioritize locations for intervention at Desa Samat and Gane Barat
Drainage works and homemade promotional banners.
sebelumnya

sudah
Conclusions

• There is no standard model, but political and financial support are always needed.
• Capacity building at subnational level is critical.
• Epidemiological thinking must take priority over bureaucratic and legalistic thinking.
• We must be interdisciplinary -- we need epidemiological data to figure out when and where transmission is occurring. We will need to understand human behavior and its interaction with mosquito behavior to understand risk of transmission (operational research).
Thank you!