

Developing New Anti-Transmission Measures in the Asia Pacific Region

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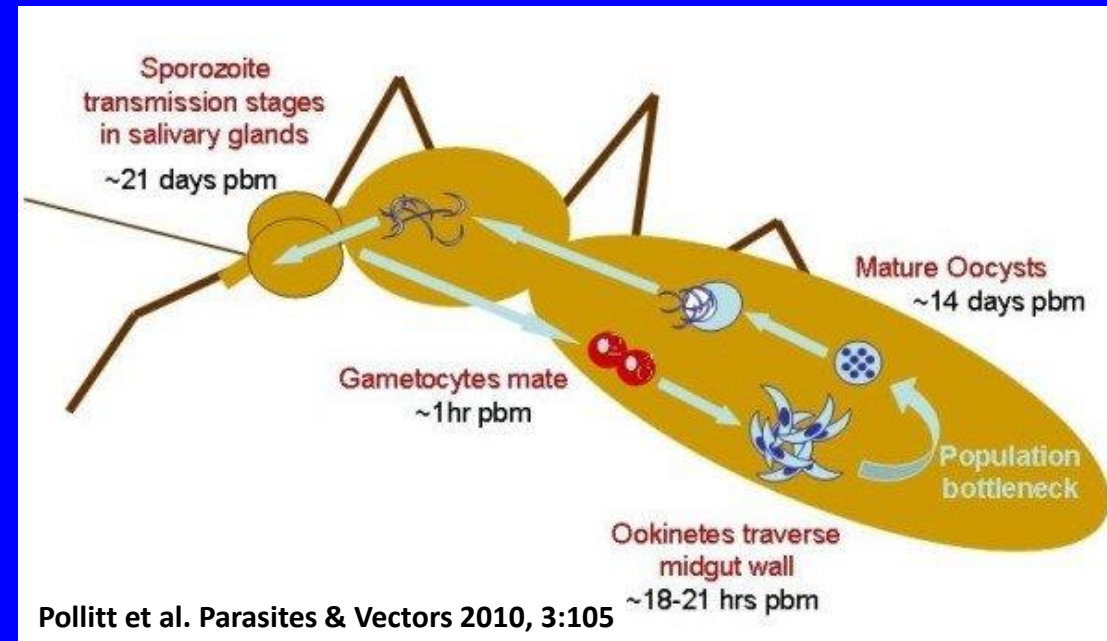
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Blocking Transmission Key to Ending Malaria

- Transmission by mosquitoes implies a vulnerable existence
- Break the chain of transmission and you stop malaria infection
- This has already happened in half the world and is progressing in most other countries



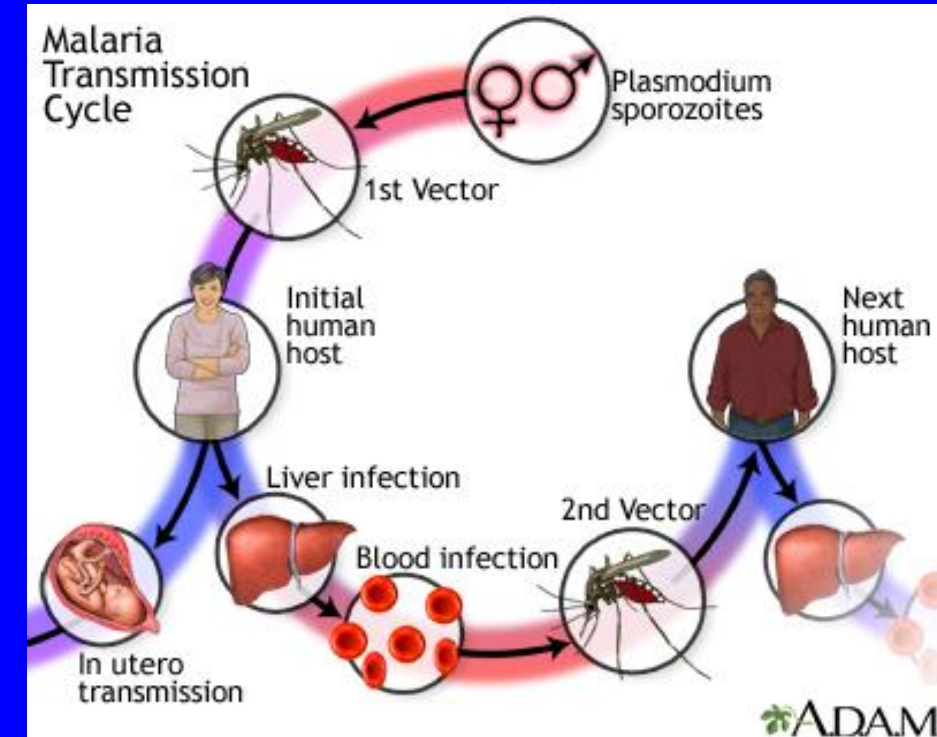
Malaria Transmission Blocking

- Anti vector measures are key to malaria control but are usually insufficient to eliminate parasites from a region
- Not all malaria transmission occurs indoors at night; no clear means to tackle transmission that occurs outdoors
- We need better bednets but also adjunctive measures to enhance / prolong their effect



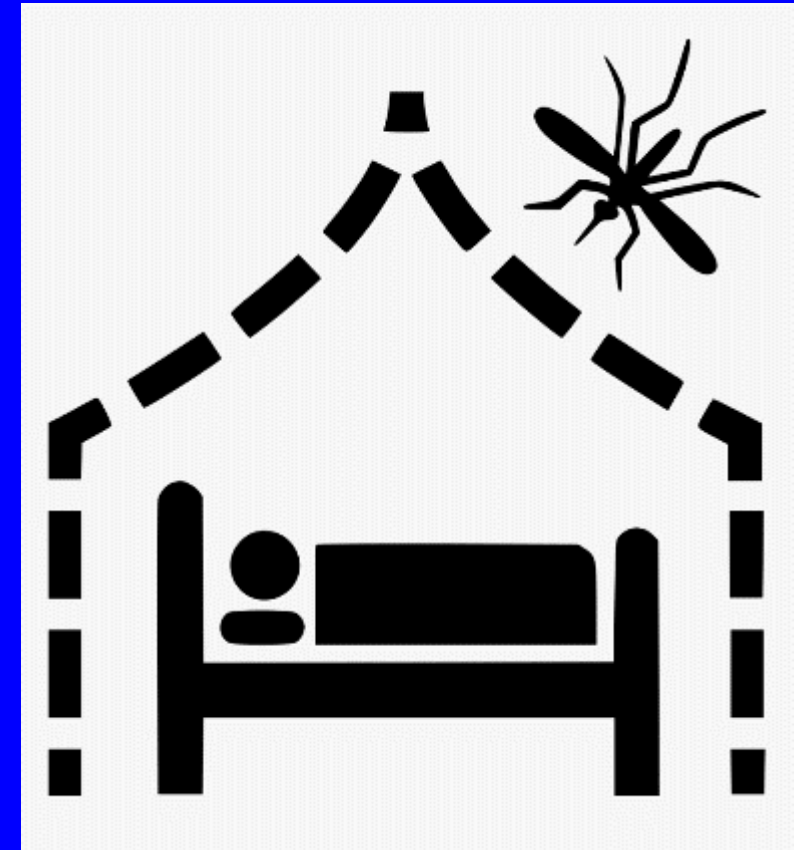
Stopping Parasites Getting to the Next Person

- **Bednets:** blocking human / mosquito contact at night
- **Drugs:** to destroy gametocyte
- **Mosquito traps:** kill or block
- **Environmental changes / management**



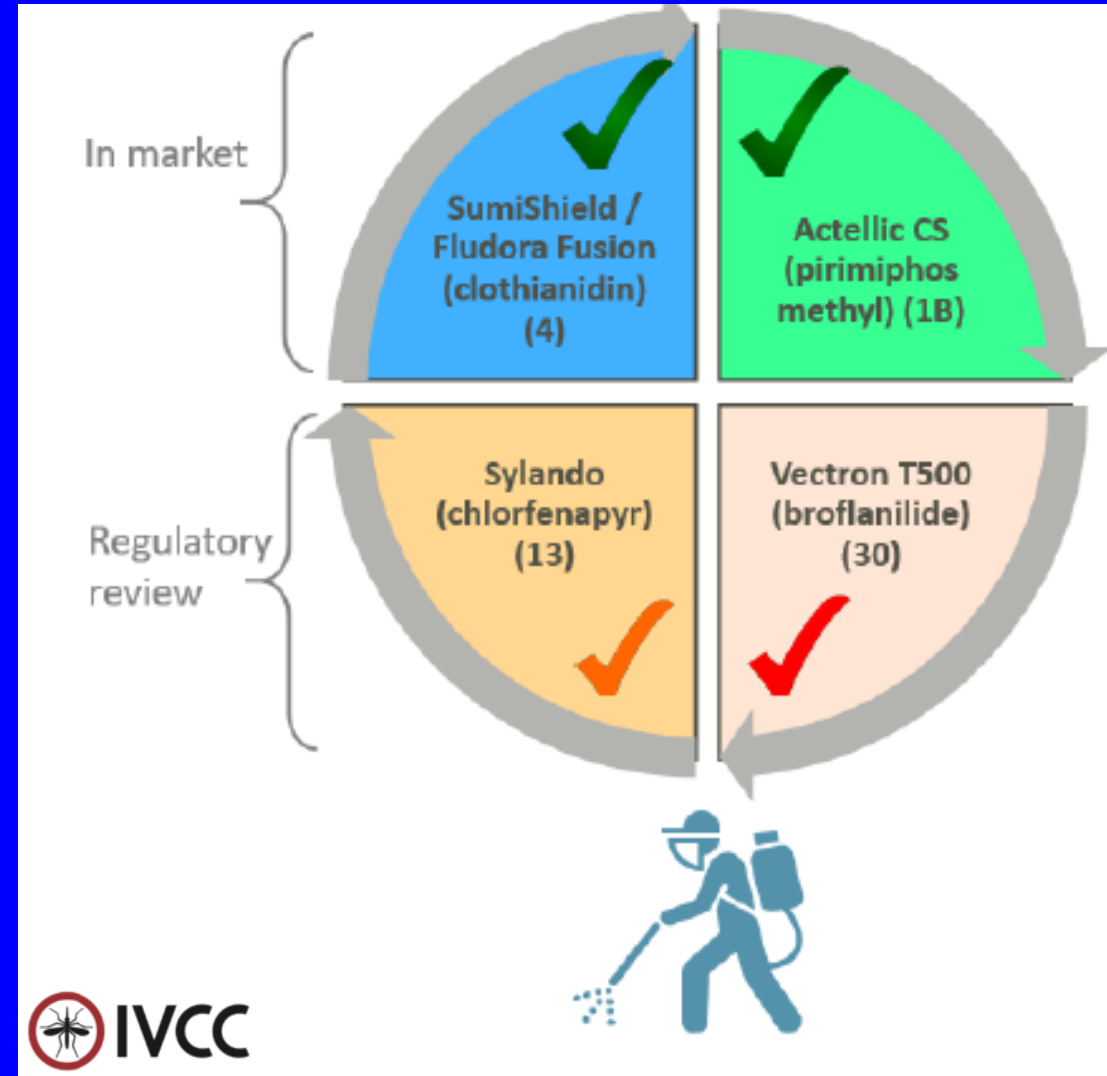
Bednets as Human-Baited Traps for Mosquitoes

- Female mosquitoes attracted to humans at night: baited trap
- Insecticide in the net can kill, repel or shorten the life of the mosquito contacting net
- Blocking human contact is only part of what a bednet does to block transmission



Better Bednets Are Being Developed

- Just as one needs new drugs, we also need new insecticides for replacement
- IVCC is working on 4 new chemicals / combinations to put into bednets
- Unsure how soon they will be commercially available



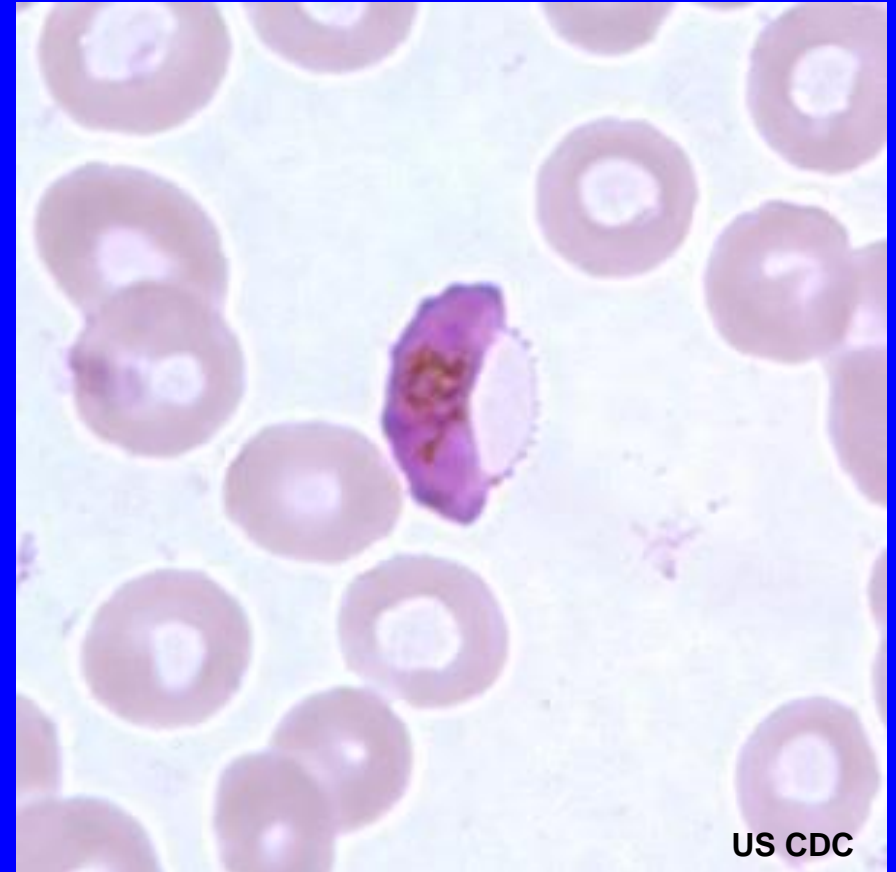
Spatial Repellents Beginning to Develop Traction

- Takes mosquito coils to the next level of complexity
- Aerosols to fill spaces and repel mosquitoes
- Promising results coming from Indonesia and Kenya



Anti-Transmission Drugs: Primaquine +

- Gametocytes are the sexual forms that infect mosquitoes
- Stop gametocytes and you will then malaria block transmission
- Some redox active drugs (primaquine, methylene blue) kill gametocytes, stop transmission



US CDC

Tafenoquine: Long Anti-Transmission Drug

- Small doses of tafenoquine blocks infection of mosquitoes by inactivating gametocytes
- Although same redox action as older drug primaquine, tafenoquine lasts much longer than primaquine
- Long-acting anti-transmission measure may be possible



Krintafel GSK

Pulse Tafenoquine Through a Population?

- Likely a single dose sufficient for a month of transmission blocking
- Less than perfect participation rates may not be essential
- Infected mosquitoes die out while drug blocks formation of any sporozoites in newly infected *Anopheles* mosquitoes



Possible Tafenoquine Scenario for Elimination?

- Pulse of drug into a defined area to stop transmission
- Mass drug administration in order to eliminate relapses
- Stopping an on-going epidemic with tafenoquine



Attractive Sugar Baited Traps for Mosquitoes

- All mosquitoes (both sexes) need sugar as feed / fuel
- Using toxins in sugar feeders can kill mosquitoes
- Problem is technology to only poison the insects you want to and not others such as bees and other pollinators



Toxic vs. Anti-Transmission Traps in Future?

- Toxins to kill may not be necessary and will inevitably force Darwinian selection
- Drugs to block transmission (methylene blue) would be great if you could get mosquitoes to feed with it
- Uncertain if sugar baited traps can block transmission



Promoting Mosquito Unfriendly Environments

- Malaria favors certain environments: rural forests, brackish coastal areas
- Suitability depends on the vector Anopheline and its adaptability to changes
- Agriculture can both promote (rice) or stop (cassava) malaria



Stopping Malaria Without Environmental Costs?

- Malaria transmission in Thailand largely stopped by deforestation
- Once the trees were gone, so was the malaria risk
- Landmines became promoters of malaria by maintaining forests; replanting fruit trees allowed return of vectors



Population Movements and Occupations

- International borders and refugee movements (Papua, Burma) often associated with malaria risk
- Forest goers are at risk of malaria in parts of SE Asia whereas in PNG the traders that go from the highlands to coast carry malaria
- Conjunction of people, places and mosquito vectors



Conclusions for Blocking Malaria Transmission

- Blocking malaria transmission is the route to malaria elimination
- Malaria is an ecological construct that needs to be addressed on multiple levels / interventions
- No single countermeasure will eliminate malaria and need to be better at integrating interventions



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