The status of malaria in Tanzania: Changing challenges in malaria control

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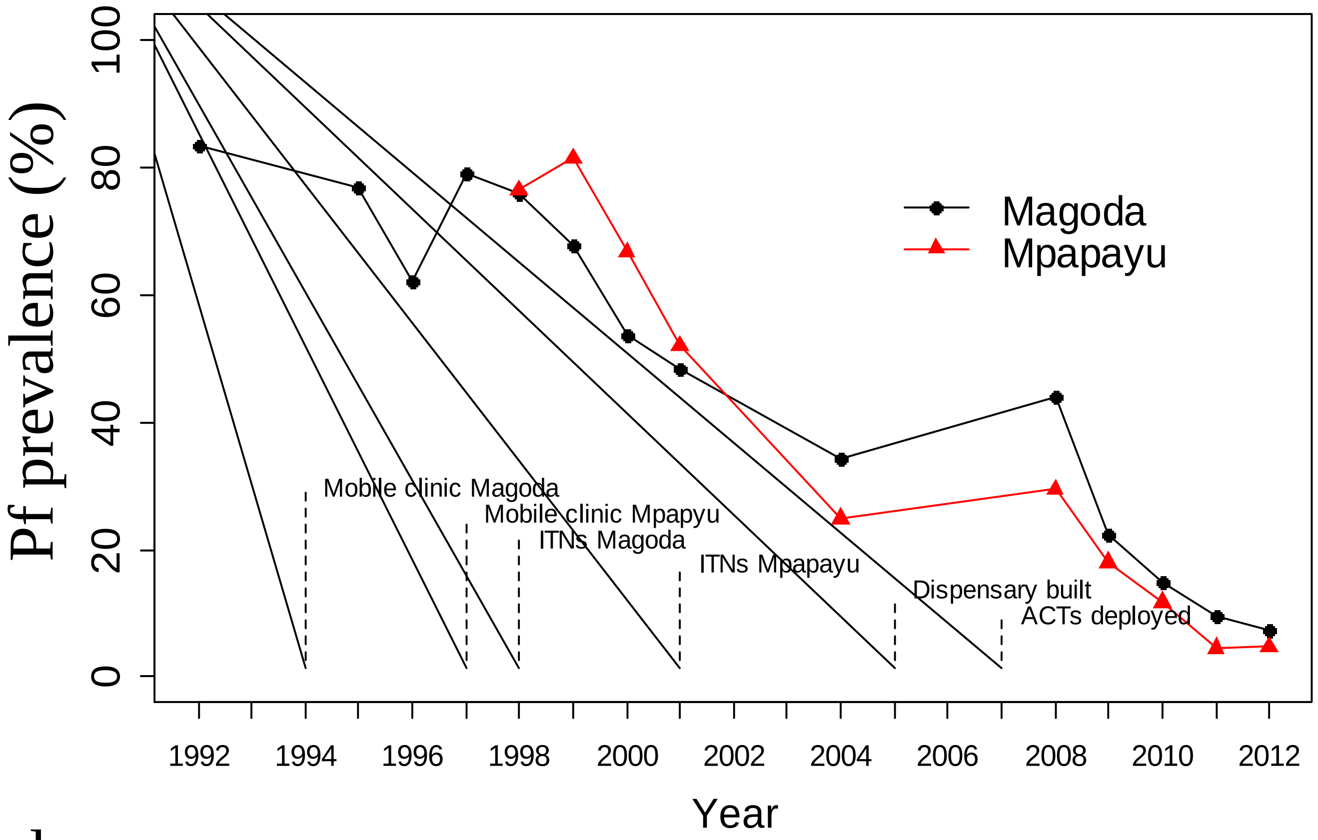
Background

- Malaria has been and remains the most important infectious disease
    - High morbidity and mortality
    - Permanent disability
    - Lost labour and school attendance
    - Economic loss and socio-economic development
- In the mid 2000s, reports of declining malaria burden started to emerge

Was the declining malaria burden real?

When did it actually start?

Malaria in NE Tanzania….1



- Magoda:
  - **Risk of infection decreased by 75% (1999 to 2004) and by 97% (2008-2012)**
- Mpapayu:
  - **Risk of infection decreased by 89% (1999 to 2004) and by 99% (2008-2012)**

Ishengoma *et al* .. *Malar J* 2013, 12: 338

Malaria in NE Tanzania….2

(Korogwe study…1)

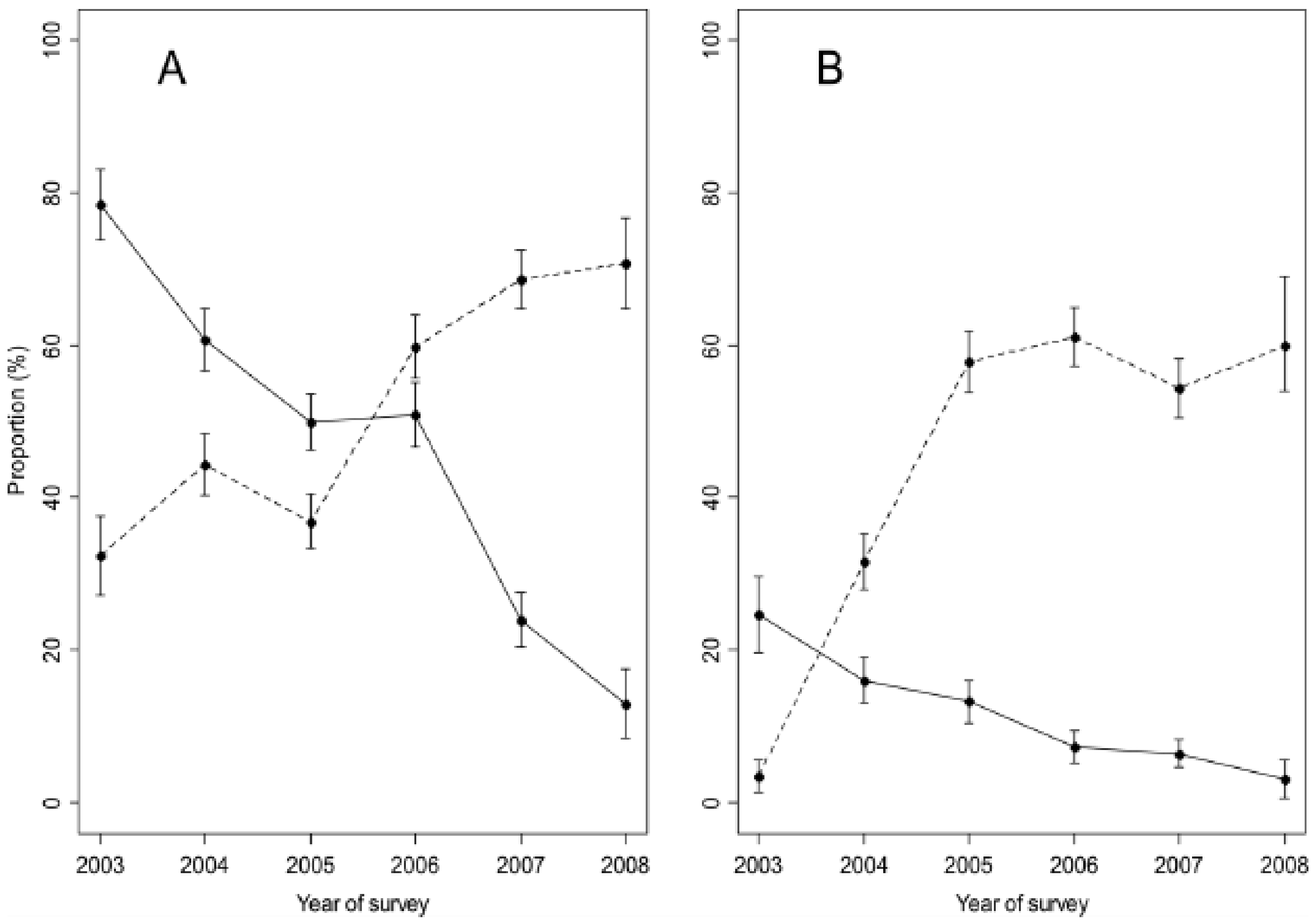


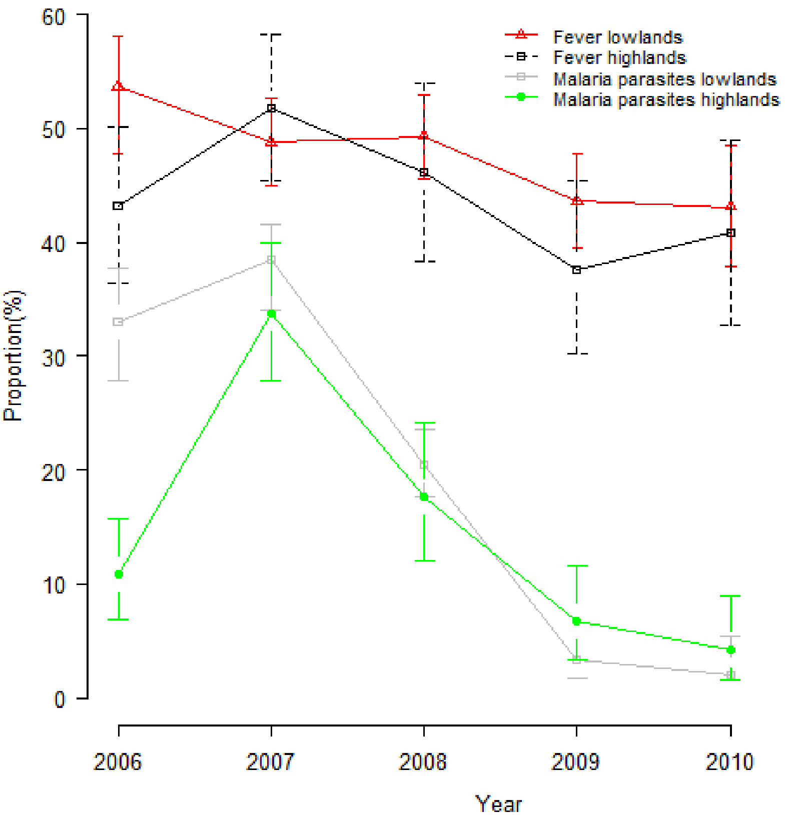
Figure 1 Proportion of *Plasmodium falciparum* parasitaemia and reported use of insecticide treated or non-treated nets obtained during cross-sectional surveys. Filled circles connected with solid lines for the proportion of *Plasmodium falciparum* and filled circles with dotted lines for proportion of reported use of insecticide treated or non-treated nets. Panel A for lowland village and Panel B for highland village.

Mmbando et al. Malaria Journal 2010, 9:216

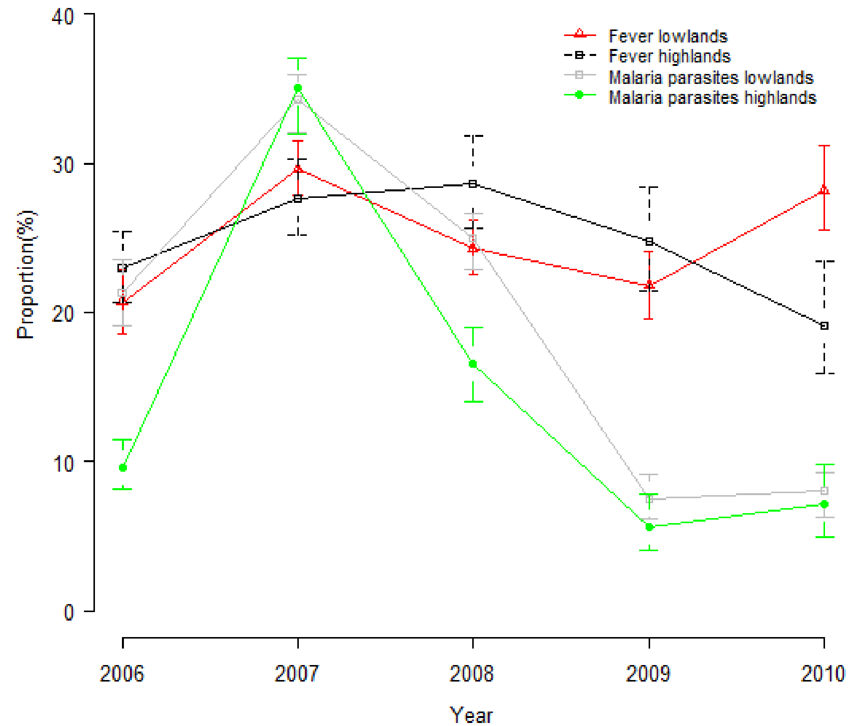
Malaria in NE Tanzania….3

(Korogwe study…2)

<5 yrs old



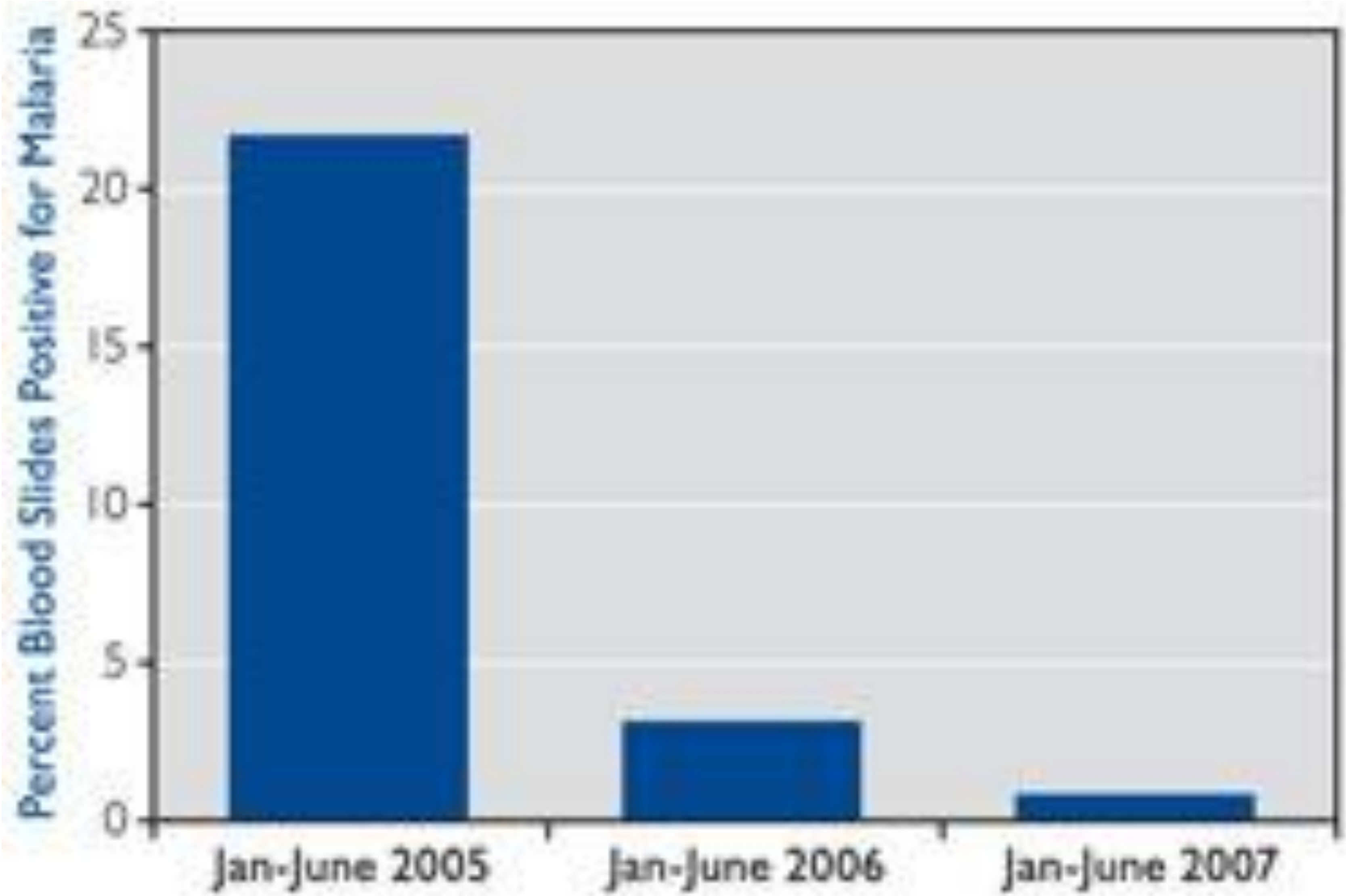
≥ 5 yrs old



Parasite positivity rates declined significantly but fevers remained high in all age groups and altitude strata

Rutta et al. Malaria Journal 2012, 11:152

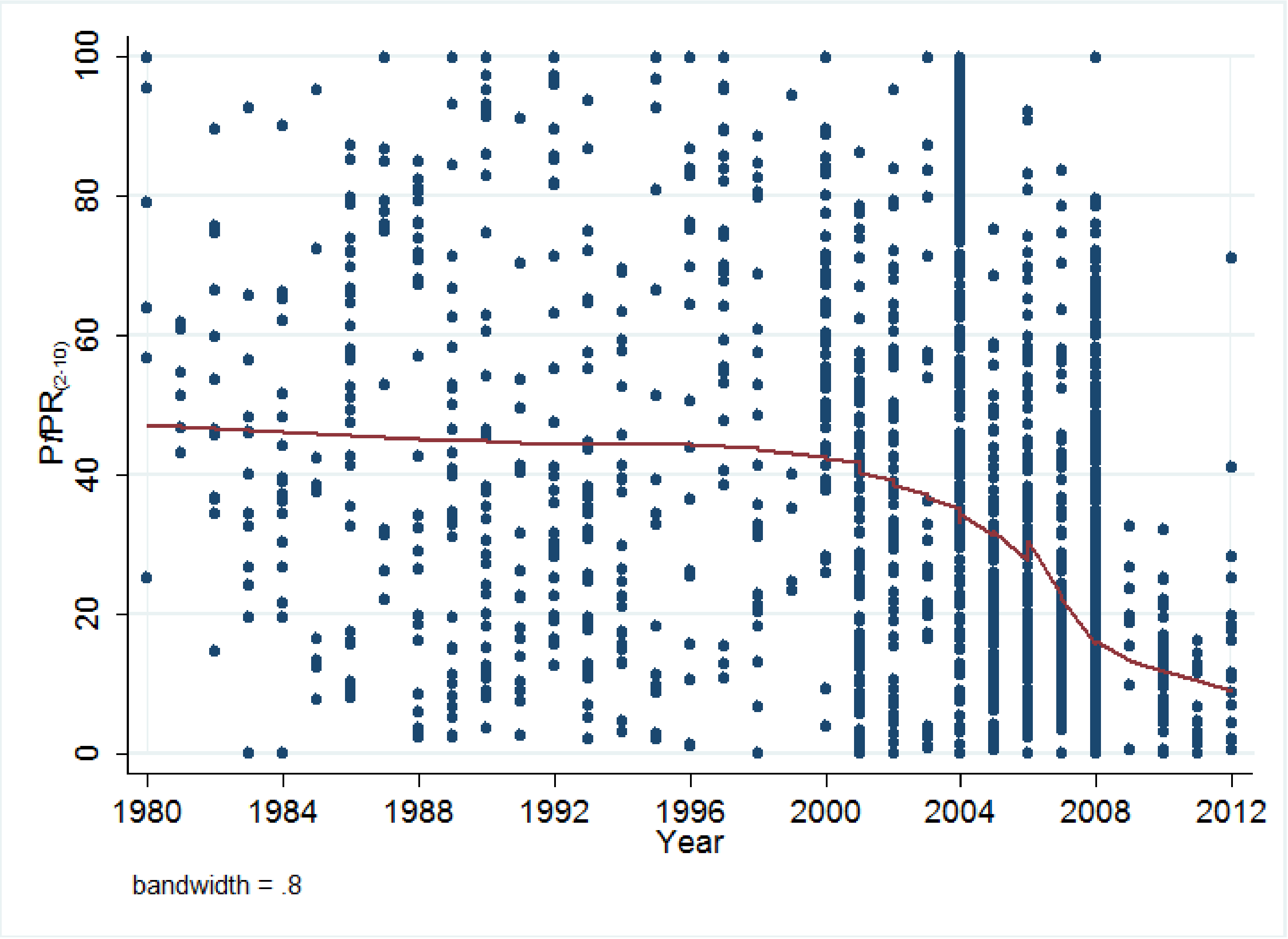
Zanzibar



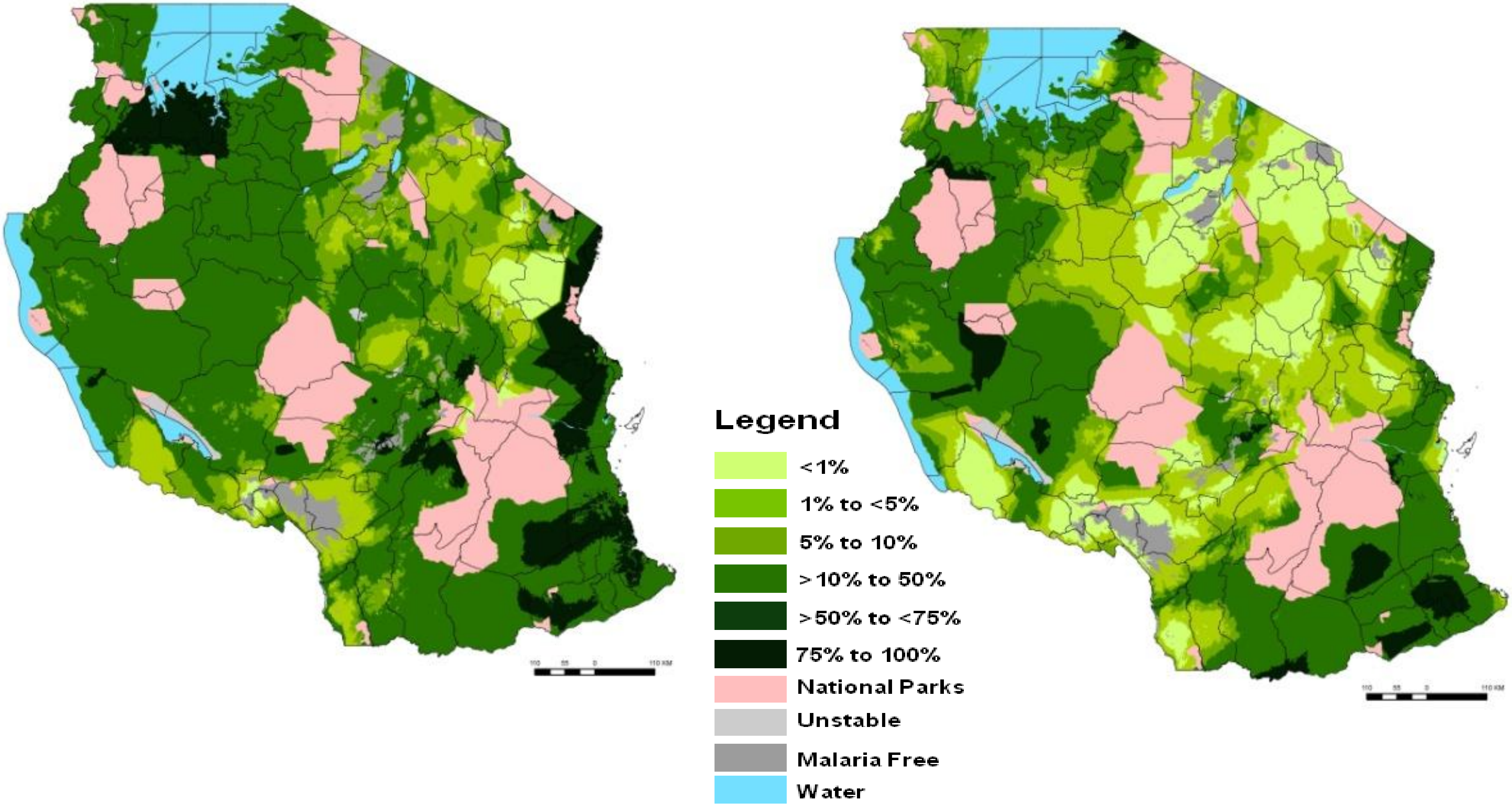
Bhattarai et al. PLoS Med 2007, 4: e309
Aregawi et al. Mal J

The broader picture

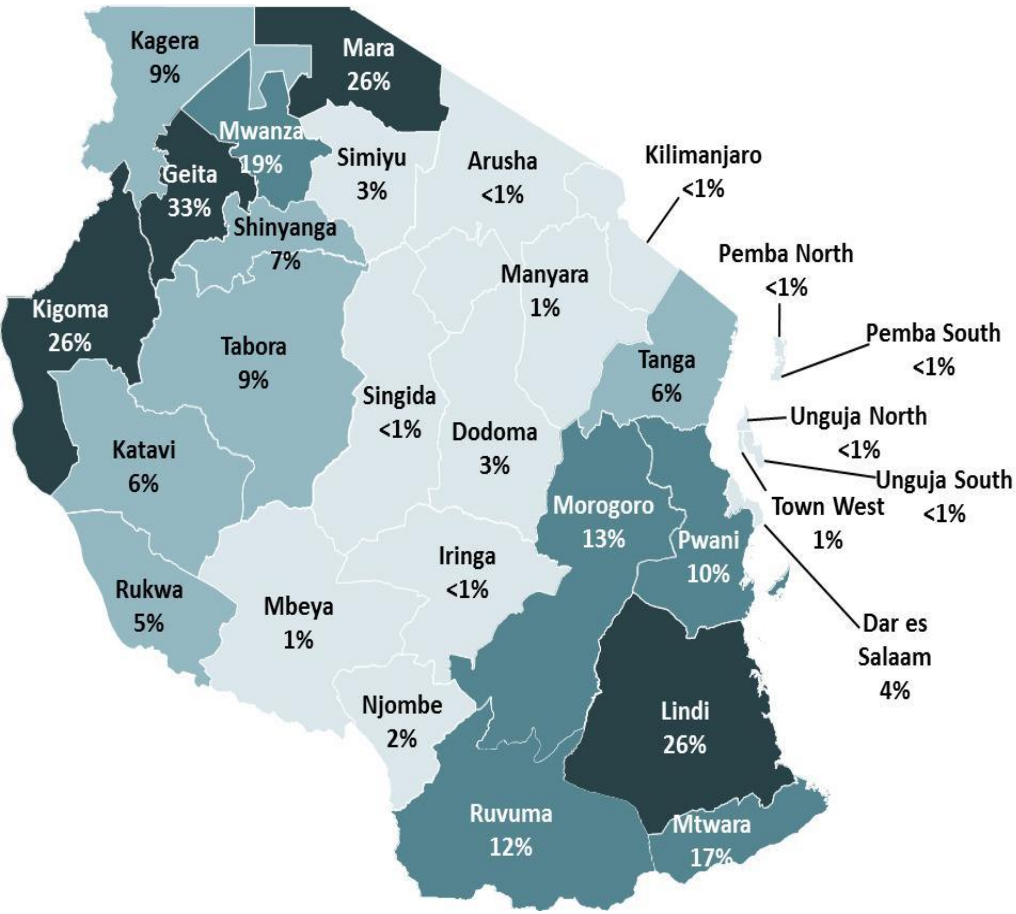
Parasite prevalence 1980 – 2012
LOESS Regression



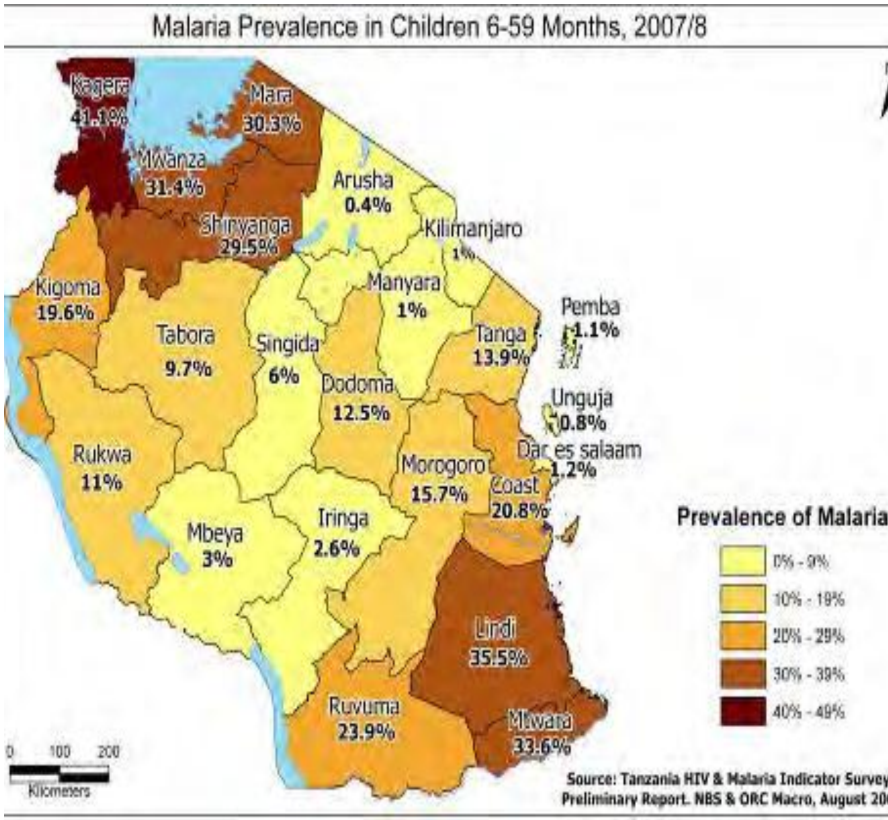
The malaria epidemiological transition: endemicity classes for year 2000 and 2010



Parasite Prevalence in children 6-59 Months,



THIMS 2011/12



THIMS 2007/08

- Prevalence declined by 50% between 2007/08 and 2011/12 (from 18% to 9%)

•Large variations throughout the country

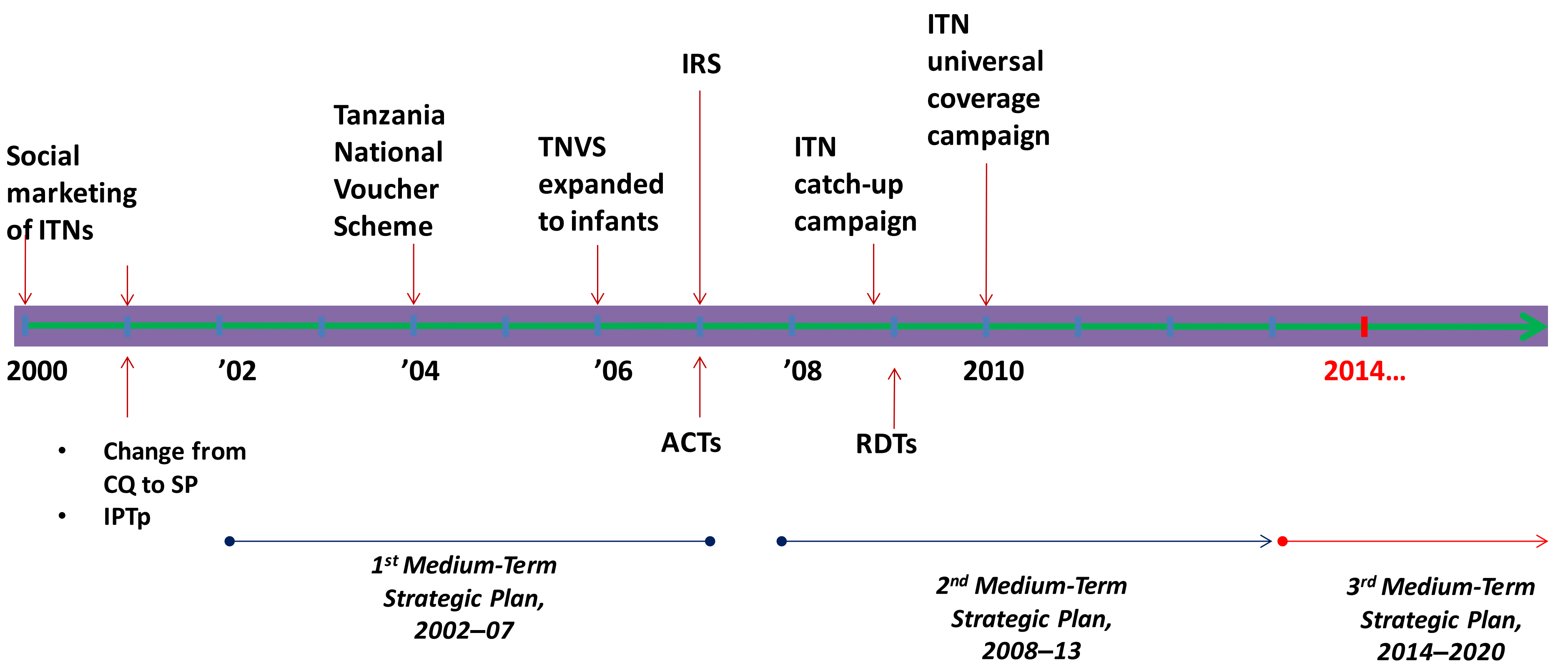
Why the decline?

Causes of declining malaria transmission

- Scaled up interventions
  - Mosquito control with ITN/LLIN + IRS
  - Improved case management with ACTs
- Socio-economic development
- Changes in vector populations
- Climate change?
- Unrelated interventions (use of SP for malaria and ivermectin for LF)?

Malaria control strategies and Challenges

Tanzania's Malaria Control Policy Milestones, 2000–10 & beyond

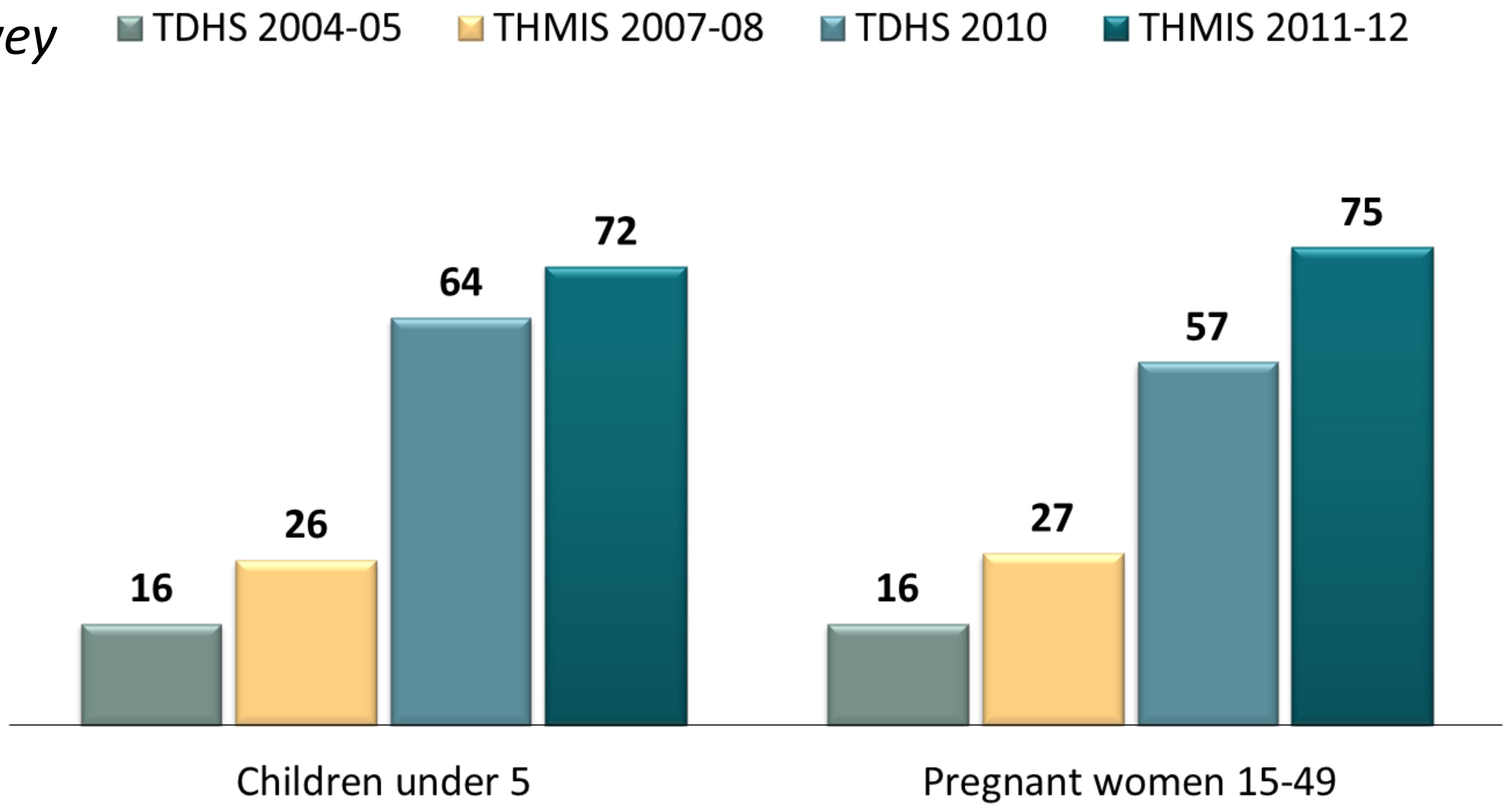


From control to scaling up for impact in Tanzania

	2002 - 2007	2008 - 2013
POLICY FOCUS	VULNERABLE GROUPS: PREGNANT WOMEN AND CHILDREN <5	UNIVERSAL COVERAGE
TARGETS	ABUJA TARGETS: 60% COVERAGE	80% COVERAGE

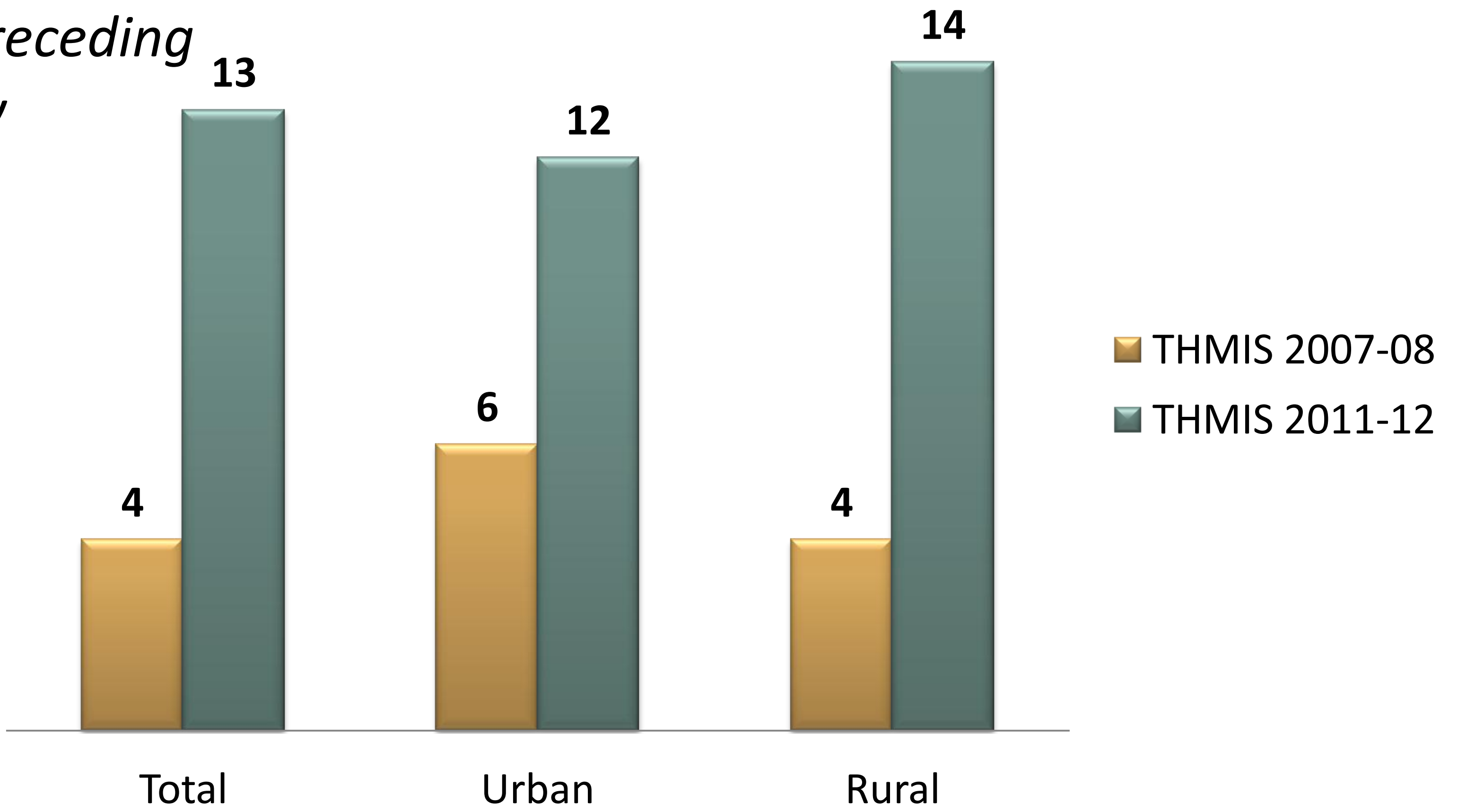
Sustaining Ownership and use of ITNs

Percent who slept under an ITN the night before the survey

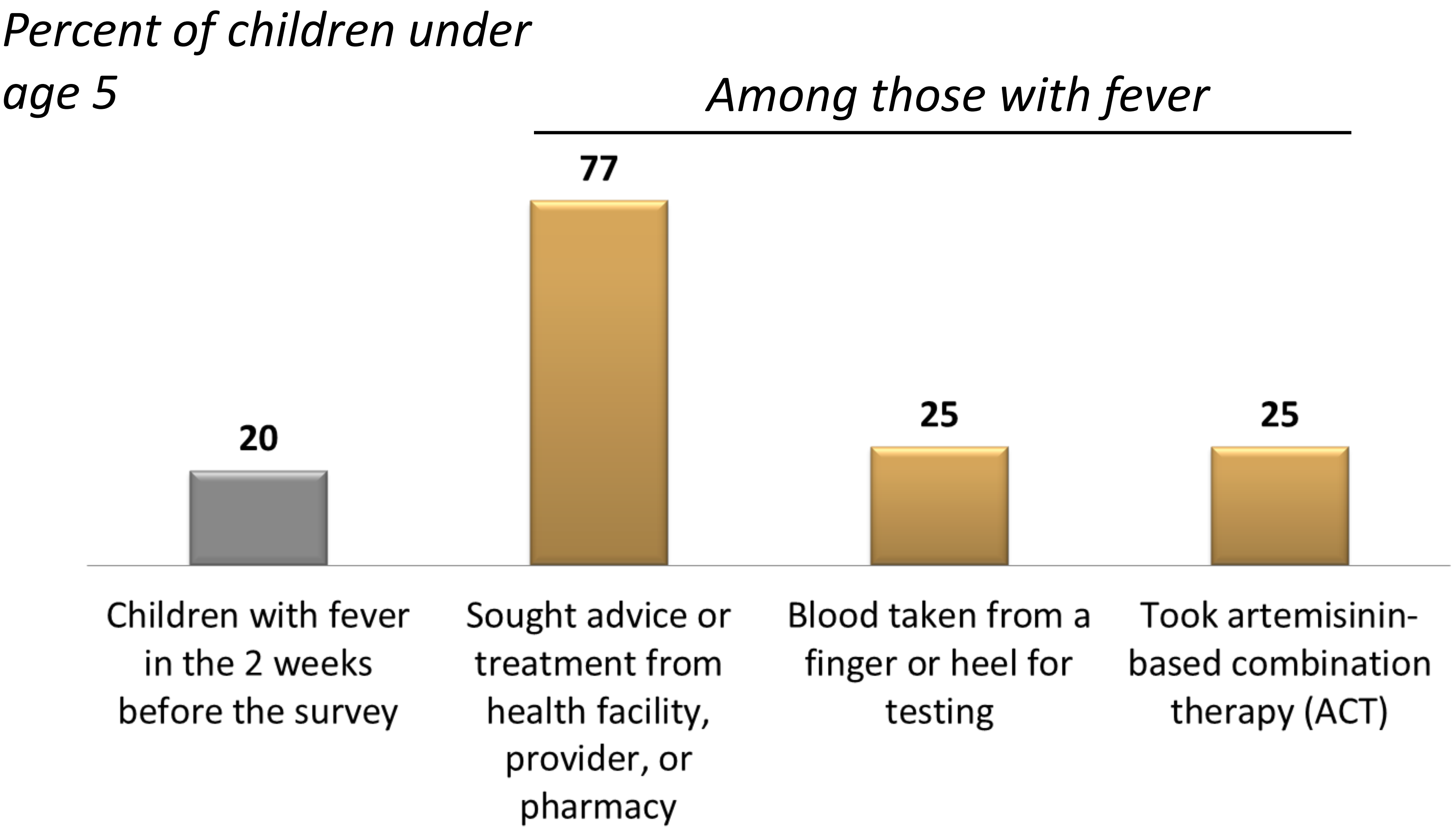


Sustaining and expanding IRS coverage

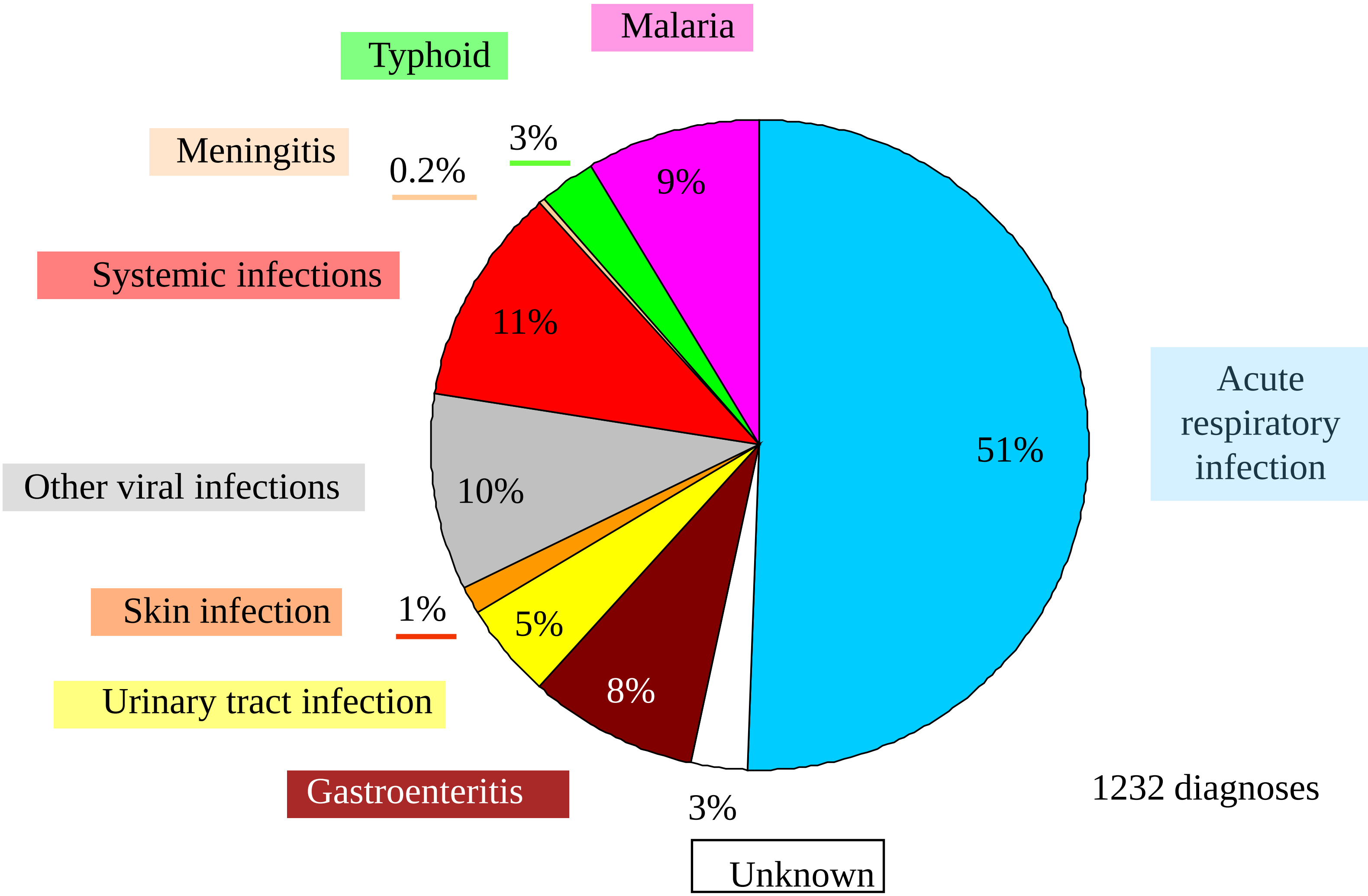
Percent of households with IRS in the 12 months preceding the survey



Treatment of Fever in Children

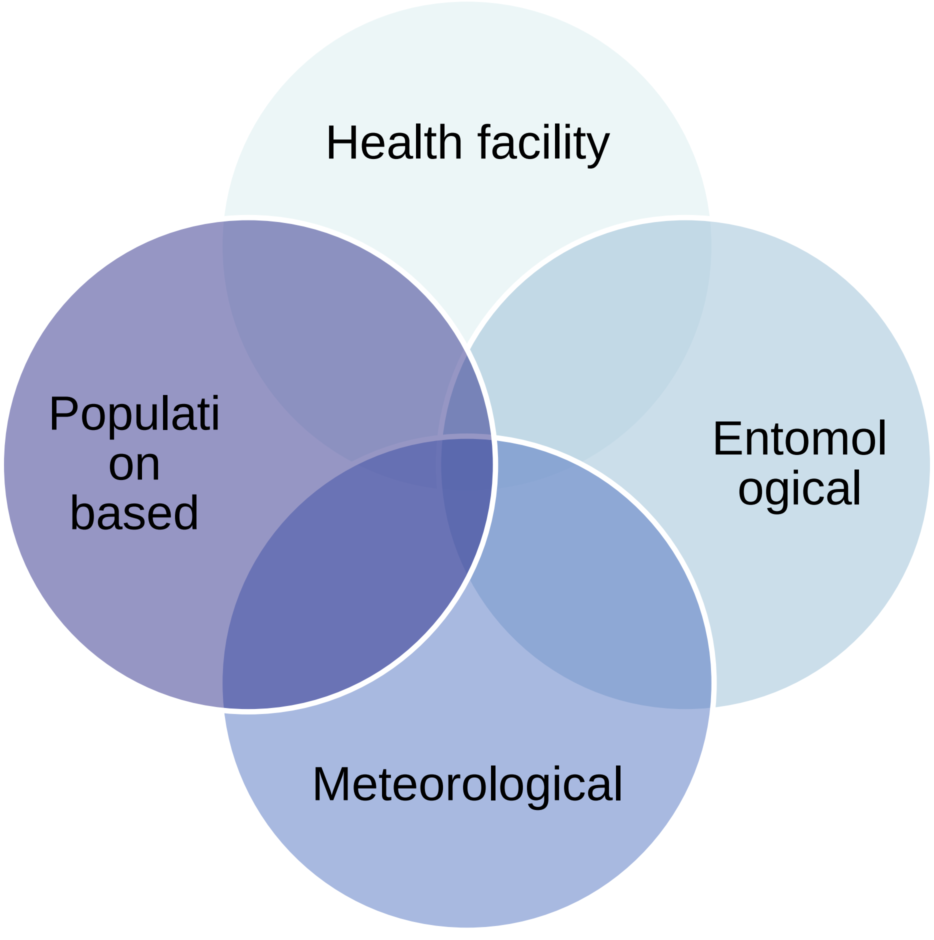


Case management: targeting all causes of fevers



D'Acremont *et al*, ASTMH 2010

Improve Surveillance and Integrate National Platforms



Insecticide resistance

Protopopoff *et al. Malaria Journal* 2013, **12**:149
http://www.malariajournal.com/content/12/1/149

MALARIA JOURNAL

RESEARCH **Open Access**

High level of resistance in the mosquito *Anopheles gambiae* to pyrethroid insecticides and reduced susceptibility to bendiocarb in north-western Tanzania

Natacha Protopopoff[1*], Johnson Matowo[2], Robert Malima[3], Reginald Kavishe[2], Robert Kaaya[2], Alexandra Wright[1], Philippa A West[4], Immo Kleinschmidt[5], William Kisinza[3], Franklin W Mosha[2] and Mark Rowland[1]

Abstract

Background: To control malaria in Tanzania, two primary vector control interventions are being scaled up: long-lasting insecticide-treated nets (LLINs) and indoor residual spraying (IRS). The main threat to effective malaria control is the selection of insecticide resistance. While resistance to pyrethroids, the primary insecticide used for LLINs and IRS, has been reported among mosquito vectors in only a few sites in Tanzania, neighbouring East African countries are recording increasing levels of resistance. To monitor the rapidly evolving situation, the resistance status of the malaria vector *Anopheles gambiae* s.l to different insecticides and the prevalence of the *kdr* resistance allele involved in pyrethroid resistance were investigated in north-western Tanzania, an area that has been subject to several rounds of pyrethroid IRS since 2006.

Methods: Household collections of anopheline mosquitoes were exposed to diagnostic dosages of pyrethroid, DDT, and bendiocarb using WHO resistance test kits. The relative proportions of *An. gambiae* s.s and *Anopheles arabiensis* were also investigated among mosquitoes sampled using indoor CDC light traps. Anophelines were identified to species and the *kdr* mutation was detected using real time PCR TaqMan assays.

Results: From the light trap collections 80% of *An. gambiae* s.l were identified as *An. gambiae* s.s and 20% as *An. arabiensis*. There was cross-resistance between pyrethroids and DDT with mortality no higher than 40% reported in

WHO GLOBAL MALARIA PROGRAMME

GLOBAL PLAN FOR INSECTICIDE RESISTANCE MANAGEMENT

IN MALARIA VECTORS

Artemisinin resistance

Artemisinin resistance has been confirmed in South-East Asia and surveillance is urgently required to track and detect the emergence and potential spread of resistance in SSA

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Artemisinin Resistance in *Plasmodium falciparum* Malaria

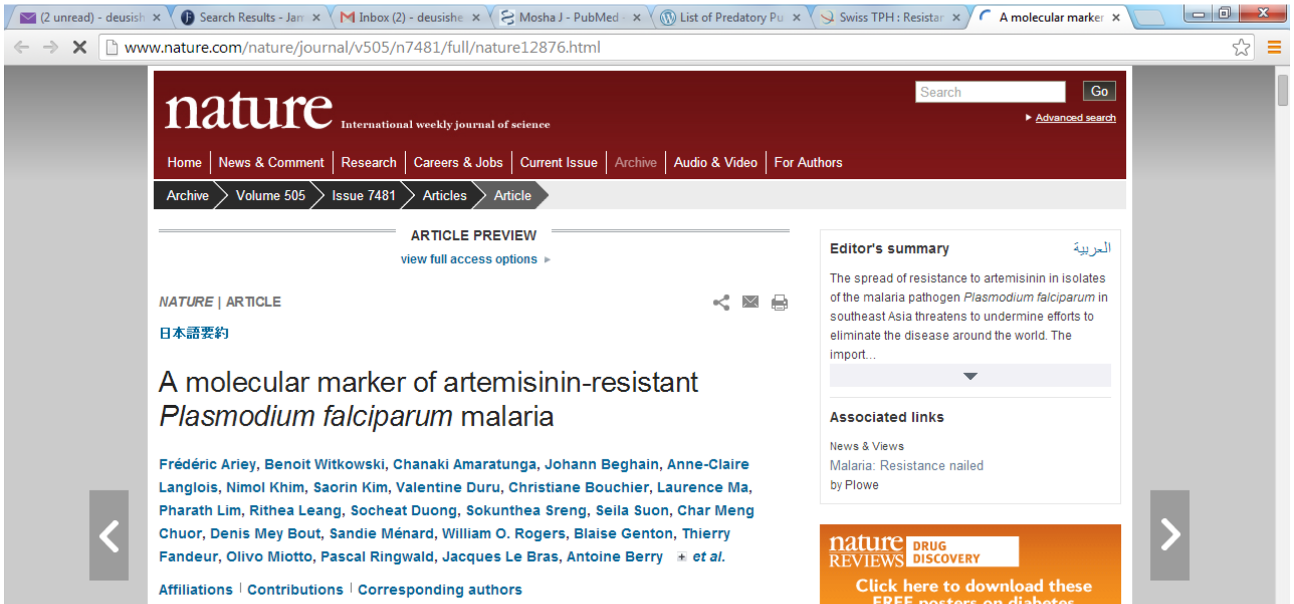
Arjen M. Dondorp, M.D., François Nosten, M.D., Poravuth Yi, M.D., Debashish Das, M.D., Aung Phae Phyo, M.D., Joel Tarning, Ph.D., Khin Maung Lwin, M.D., Frederic Ariey, M.D., Warunee Hanpithakpong, Ph.D., Sue J. Lee, Ph.D., Pascal Ringwald, M.D., Kamolrat Silamut, Ph.D., Mallika Imwong, Ph.D., Kesinee Chotivanich, Ph.D., Pharath Lim, M.D., Trent Herdman, Ph.D., Sen Sam An, Shunmay Yeung, Ph.D., Pratap Singhasivanon, M.D., Nicholas P.J. Day, D.M., Niklas Lindegardh, Ph.D., Duong Socheat, M.D., and Nicholas J. White, F.R.S.

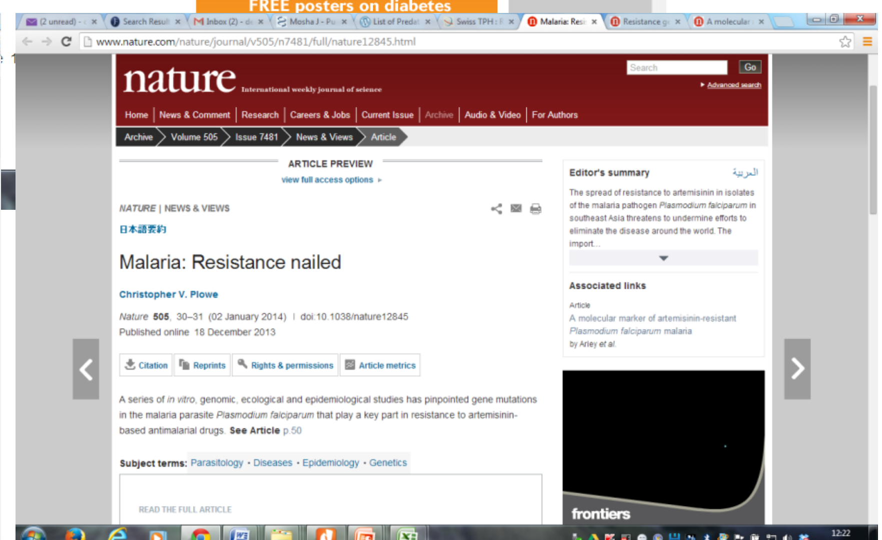
nature genetics

Multiple populations of artemisinin-resistant *Plasmodium falciparum* in Cambodia

Olivo Miotto[1–3], Jacob Almagro-Garcia[1,3,4], Magnus Manske[3], Bronwyn MacInnis[3], Susana Campino[3], Kirk A Rockett[1,3,4], Chanaki Amaratunga[5], Pharath Lim[5,6], Seila Suon[6], Sokunthea Sreng[6], Jennifer M Anderson[5], Socheat Duong[6], Chea Nguon[6], Char Meng Chuor[6], David Saunders[7], Youry Se[8,25], Chantap Lon[8], Mark M Fukuda[7,9], Lucas Amenga-Etego[1,10], Abraham V O Hodgson[10], Victor Asoala[10], Mallika Imwong[2,11], Shannon Takala-Harrison[12], François Nosten[2,13,14], Xin-zhuan Su[5], Pascal Ringwald[15], Frédéric Ariey[16], Christiane Dolecek[14,17], Tran Tinh Hien[14,17], Maciej F Boni[14,17], Cao Quang Thai[17], Alfred Amambua-Ngwa[18], David J Conway[18,19], Abdoulaye A Djimdé[20], Ogobara K Doumbo[20], Issaka Zongo[21], Jean-Bosco Ouedraogo[21], Daniel Alcock[3], Eleanor Drury[3], Sarah Auburn[22], Oliver Koch[1], Mandy Sanders[3], Christina Hubbart[4], Gareth Maslen[3], Valentin Ruano-Rubio[3,4], Dushyanth Jyothi[3], Alistair Miles[1,4], John O'Brien[4], Chris Gamble[23], Samuel O Oyola[3], Julian C Rayner[3], Chris I Newbold[1,3,24], Matthew Berriman[3], Chris C A Spencer[1,4], Gilean McVean[4], Nicholas P Day[2,14], Nicholas J White[2,14], Delia Bethell[7], Arjen M Dondorp[2,14], Christopher V Plowe[12], Rick M Fairhurst[5] & Dominic P Kwiatkowski[1,3,4]

Marker of Artemisinin resistance





Malaria control….the major hurdles

- Suitability for malaria transmission unchanged
- Malaria heterogeneity and resilience to weather changes
- Different human population settings
- Socio economic variation
- Equitable health service delivery needs
- Difficulties to reach and maintain universal coverage for effective intervention
- Cost implication and sustainability of approved interventions

Sustaining the gains: Challenges for the future

- Long term funding for maintaining universal coverage
- Plans, tools and messages to sustain BCC campaigns to promote use and uptake of interventions
- Diagnosis of malaria and *Mis-classification of cases*, Lack of compliance to mRDT results
- Commodity procurement and supply chain logistics (particularly for RDTs and ACTs) require substantial work- frequent stock out
- Pyrethroid resistance (absent in 2009) was detected at 4 of 14 monitoring sites on Mainland in mid-2011
- Threat of artemisinin resistance – so far reported in SEA
- Weak Routine data collection, use and measuring our success stories and accounting for investments

Conclusions and recommendations

- The burden of malaria has significantly declined in most parts of Tanzania
  - Heterogeneity exists among regions/districts
  - The new pattern is highly unstable and resilient to weather changes
- Current control strategies need to be reoriented to handle the changes in malaria epidemiology
- Strengthening of the health system is urgently needed
- Surveillance needs to be strengthened to monitor the trends of malaria, insecticide and artemisinin resistance to support timely and appropriate response

Thank you...
Ahsanteni sana….
Mange Tak