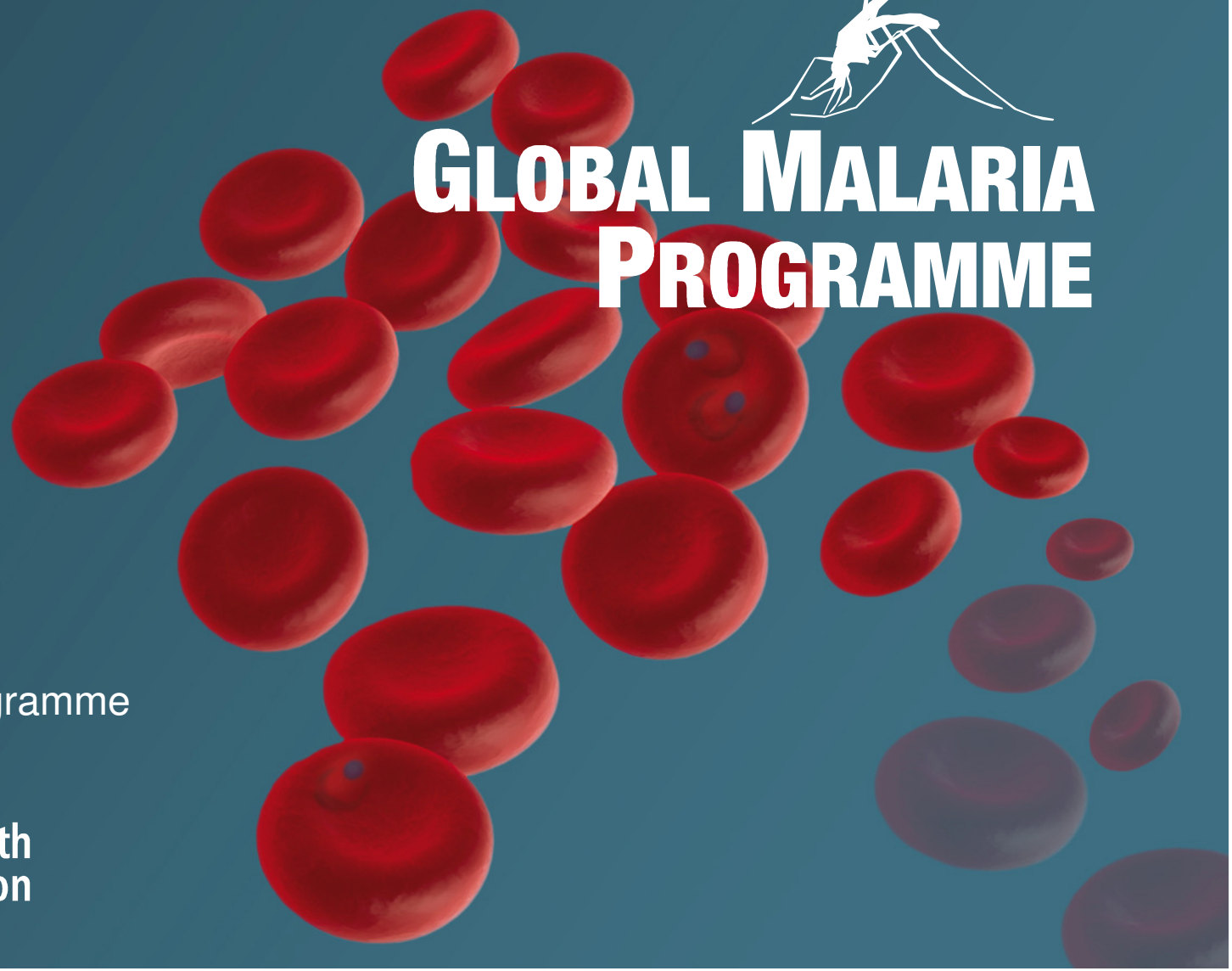
Vector Control Progress and Issues
VCWG feb ’11



GLOBAL MALARIA PROGRAMME

Jo Lines
Global Malaria Programme

World Health Organization

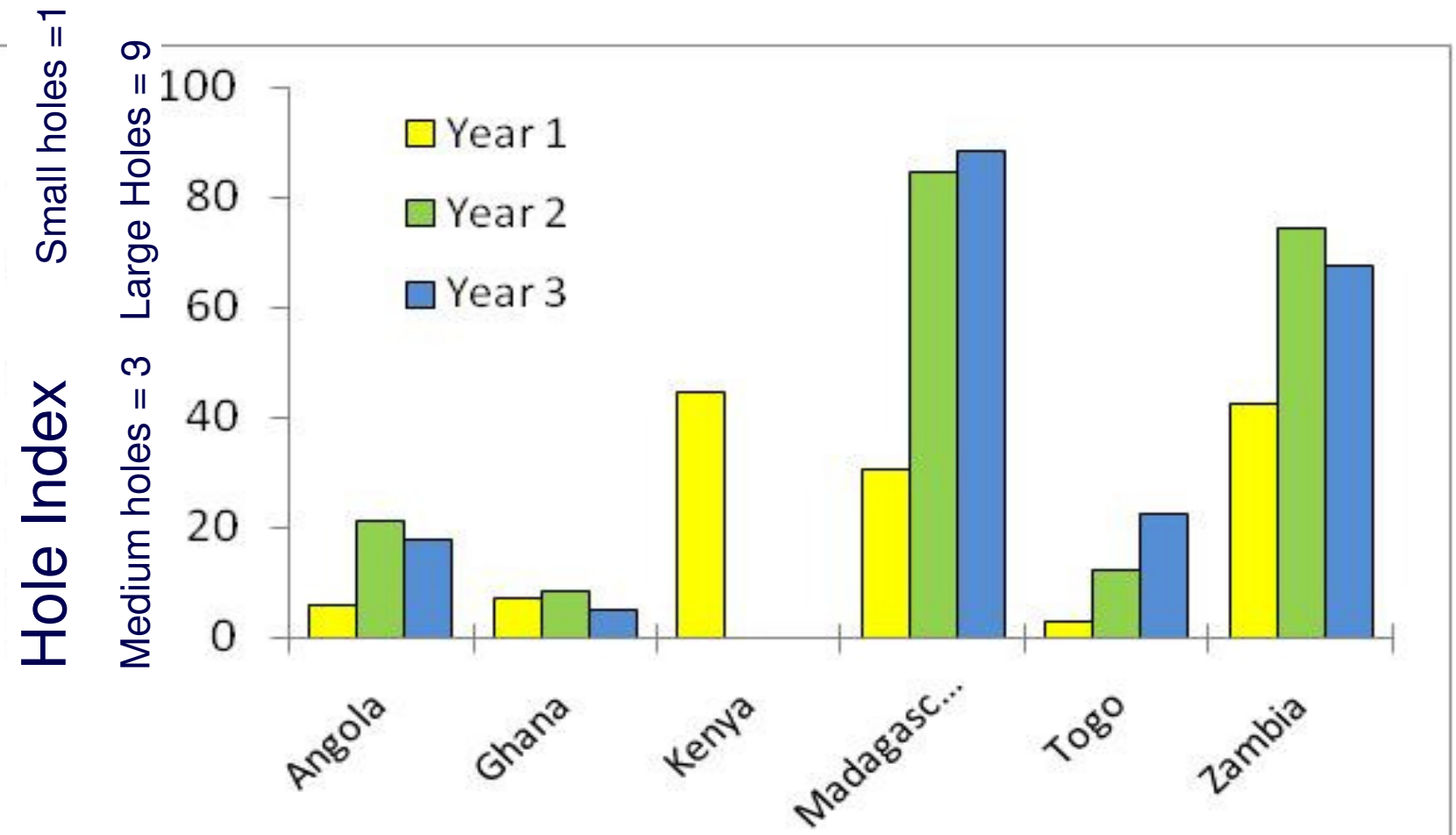
Current GMP issues in LLIN procurement & distribution

- How long do LLINs really last?
- Which LLIN product to buy?
- Procurement Guidelines
- Resistance issues – new policies coming
- ++++++++++++++++++++++++++++++++++++
- What is Universal Coverage?
- How many to buy?
- How to keep-up LLIN coverage ?
- Need to remove old LLINs

Two 75 denier polyester nets, both 3 years old, in a durability study.

(a) rate of physical deterioration is variable, and
(b) in such a study, some nets are kept which otherwise would have been discarded.
(Photos - Albert Kilian)

Between-site variation in rate of physical wear



- Redrawn from 12th WHOPES report

Monitoring LLIN Durability (draft) -3

- **Elements of durability:**
  - **Survivorship / Attrition**
    - **includes retention**
  - **Physical Integrity (holes)**
  - **Bio-efficacy (residual insecticidal activity – (interaction between insecticide + holes)**

Monitoring LLIN Durability (draft) -1

- **Multi-country studies show unexpectedly large variation in effective life between locations – even more variation between locations than between brands**
  - Evidence that the relative lifespan of different brands is not constant but varies in different contexts
  - So a global "top five" ranking is not realistic (and would not be good for market)
- **Draft standard durability monitoring methods (by CDC and MC experts) now being finalised.**
  - Retrospective monitoring limited by
    - Unreliable recall / records to estimate net-age
    - Attrition cannot be estimated
    - Ceiling effect on holes

Monitoring LLIN Durability (draft) -2

- **Method Involves**
  - **A Mixture of Brands / Products used together**
    - ***(why this is new and important)***
  - **Exactly equal and recorded numbers of each brand**
    - ***(why this is new and important)***
  - **Emphasis on attrition and holes – insecticide optional**
  - **A Hole Index - quantification of physical wear**
    - ***(not just % with holes) (but need to calibrate this)***
  - **Procedures can be openly & critically scrutinised**
    - ***– so demonstrably free of external influence*** / bias
  - **Should user preference also be included? Is it possible to get user preference data that is guaranteed free from manufacturers' influence? (feedback from the meeting please).**

Monitoring LLIN Durability (draft) -4

- **Need constant flow of location-specific data, not some large set-piece trials from WHO. This monitoring will be recommended as "good practice" in all large-scale procurements/deployments, for all implementation agencies, and all donors, especially GFATM.**
- **Estimated Cost: depends on scale and outcomes measured. Typical ballpark might be (excluding nets): $100k - $300k**
- **So – how often?**
  - ? should normally be part of every procurement over $2m ?
  - ? Where each procurement is smaller, then after every cumulative $2m.
  - So then cost of monitoring would be an extra 1%.
  - Expected to save >>10% !

Monitoring LLIN Durability (draft) -5

- A system will be specified for how to feed this data back to inform product choice in GF procurement -
- Suggestion:
  - Define physical definition of "worn out".
  - Standard method to estimate half-life (median time to worn-out).
  - Divide bid price by this half-life.
  - Gives estimate of "dollars per year of effective life".
- WHO will set standards and criteria for its independence and quality
  - this is the key condition for procurement agencies
  - suggestions please
- Need for RBM technical support to roll-out these monitoring methods

Other local data for procurement

- Preference?
  - Solomons data – qual vs quant
  - As part of durability competitive trial ?
  - Ask users to choose between products ?
  - Monitor usage of different products ?
- Size?
  - As part of durability competitive trial ?
  - In coverage surveys? (usage by size?)

Guidelines for procurement

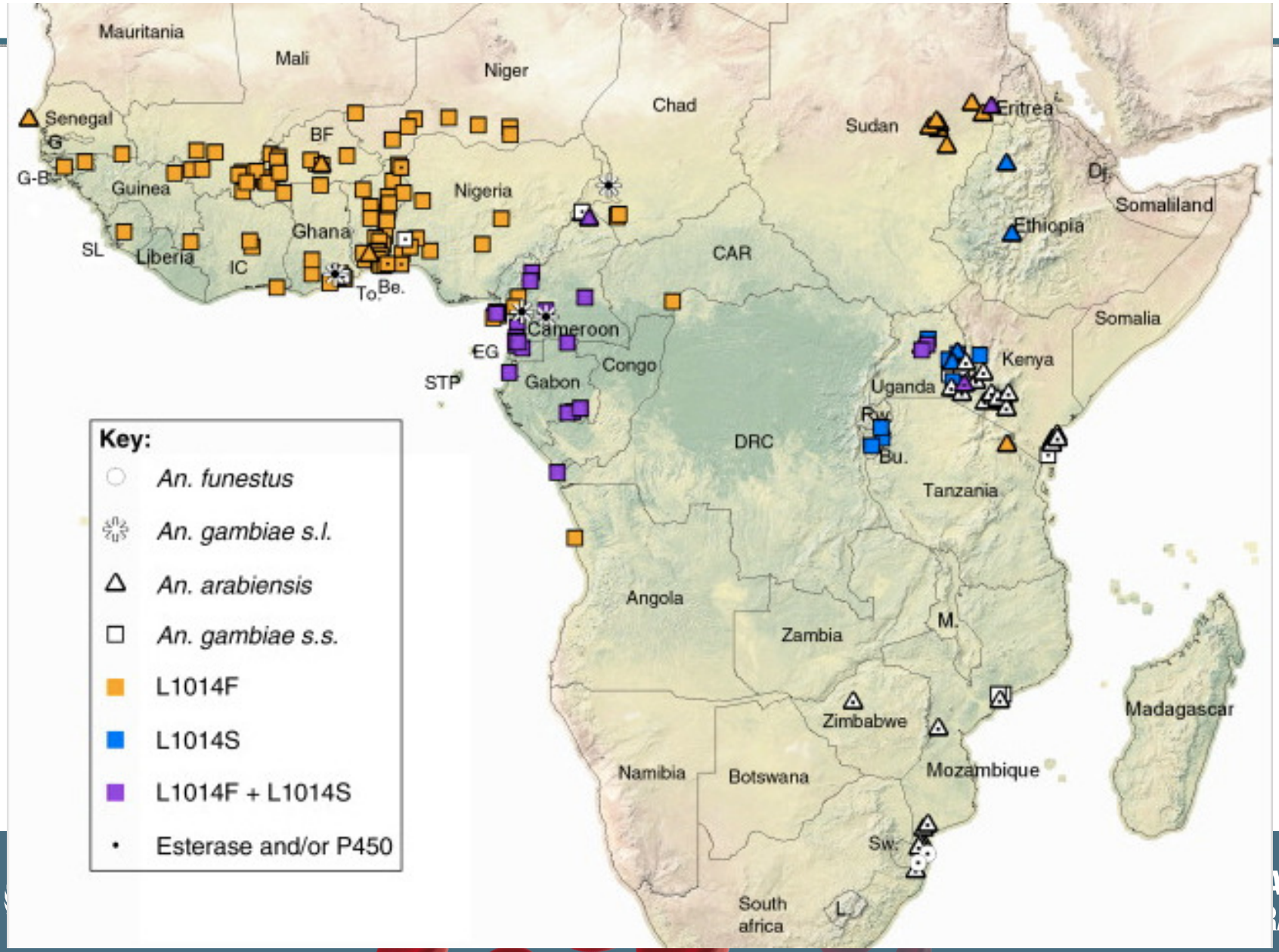
- Guidelines for LLIN procurement: ToRs for production process proposed and informally agreed with GF
- WHOPES proposes joint guidelines – all pesticide products, to include quantification and QC.
- Suggestions requested
  - what issues / questions / processes should be covered ??

From IRAC 2010

Biochemical mechanism of resistance

	Metabolic			Target-site	
	Esterases	Monooxygenases	GSH S-Transferases	kdr	MACE
Pyrethroids	●	●		●	
DDT		●	●	●	
Carbamates	●				●
Organophosphates	●	●			●

Mechanisms of resistance in African malaria vectors



ALARIA
RAMME

Strategies to delay resistance – 1

- **Action must be Immediate and Pre-emptive**
- **DO implement resistance management measures,**
- **from the outset,**
- **in every vector control programme.**
- **DON'T wait for detectable resistance, or proof of control failure.**
- **BECAUSE methods for delaying resistance (rotations, combinations, mixtures) become less effective as resistance becomes common.**

Strategies to delay resistance – 2

- **Judicious use & good pesticide management**
  - Spray with care and discrimination
  - Reduce both waste and unnecessary selection pressure
    - by targeting to avoid non-transmission areas
  - Ensure correct delivery of insecticide to target insect: dose, timing and technique.
  - Diversify methods of vector control – IVM

Strategies to delay resistance – 3

- **Rotations**
  - **DO alternate between different insecticides for IRS, in rotation**
  - **DON'T spray the same class of insecticide repeatedly year after year.**
    - Rotations are a common form of 'best practice' in agriculture, and are thought to have a good record at slowing down the evolution of resistance
    - The insecticides in a rotation system will vary in cost, so planning should consider the average annual cost over the whole cycle.
  - **Rotations assume that resistance has a fitness cost – which may be lost when resistance becomes common**
    - hence "prevention is better than cure".

Diagram illustrating how resistance management using rotations is expected to be cost-saving in the long run

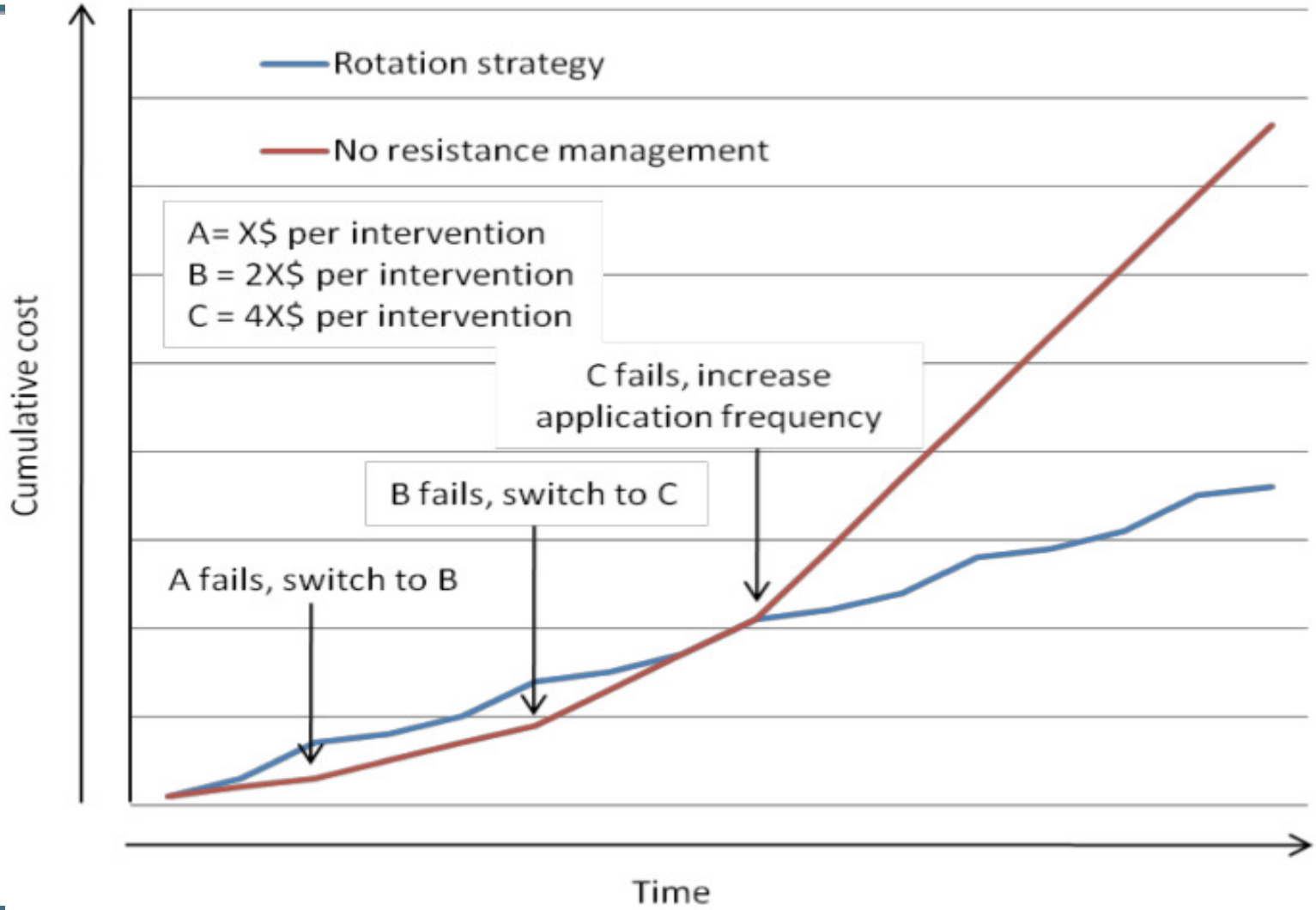


Diagram from IRAC 2010

Strategies to delay resistance – 4

- **Combination interventions**
  - **Combinations = different insecticide classes applied in different forms within a house (e.g. a carbamate sprayed on the wall and a pyrethroid on an LLIN).**
  - **Combinations use principle of "redundant killing"**
    - **Insects not killed by A will be killed by B, and vice versa**
    - **This is different from the principle of rotations; it does not depend on fitness cost of resistance, but it does assume no exposure to one and not the other.**
    - **Preliminary studies of combinations have given very promising results, and further investigation, both in small-scale studies and in evaluation of operational-scale trial interventions, is urgently needed.**
  - **DON'T combine pyrethroid IRS with high-coverage LLINs**
    - **(but carbamate on the wall + LLIN is good!)**

Strategies to delay resistance – 5

- **Mixtures = co-formulations of two insecticides of different classes with a similar rate of decay.**

  - **May be the best way to ensure that insects surviving exposure to one insecticide are killed by the other, and thus one of the most effective resistance management approaches.**

  - **Currently, there are only a few mixture products in agricultural use, and none in public health, but manufacturers should be encouraged to develop such products. Barriers to product development include some critical formulation and regulatory issues.**

Monitoring 1

- **A major intensification of resistance monitoring** is urgently needed.
  - **Decisions on targeting and insecticide selection must become contingent on local data.**
- **A common cross-border reporting system is needed at regional level**
  - **with defined responsibilities and adequate funding support.**
  - **Creation of a new Insecticide Resistance Expert Group – to make recommendations at sub-regional level**
- **The NMCP should coordinate national-level monitoring**, and all data should be reported to them **as they are collected and without delay** (e.g. they should not be held back for prior publication or institutional approval).

Monitoring 2

- **Monitoring is a shared responsibility** of all agencies participating in the implementation of vector control – including NGOs & contractors - to make sure that adequate resistance testing (and data reporting) is done in their target areas.
- Donors funding insecticide procurement should check that product choice has been informed by adequate resistance monitoring data.
- The **WHO guidelines** on monitoring insecticide resistance need to be updated urgently.

New Products 1

- New classes of insecticides are needed both now and in the future.
- We also require new formulations of the currently available insecticides, designed for resistance management.
- We need methods to identify and measure “effectiveness at delaying resistance evolution” without waiting for the evolution to happen!
- How to turn this into country procurement choices?
- Manufacturers need to know that products that are effective in this way will be favoured.

New Products 2

- One public-private partnership to support market development of new products already exists, but other institutional interventions may also be needed.

- Some products are under development for IRS, but prospects for new insecticides for LLINs are less promising. Special efforts may be needed, because the insecticide represents only a very small fraction of the value of an LLIN, but a much larger proportion with other vector control products.

Cost Implications 1

- Compared to current practice, all alternatives involve an increase in short-term costs.
- In order to maintain long-term effectiveness of vector control, short-term costs will go up.
- In the end, these investments will almost certainly be cost-saving, if the effectiveness of pyrethroids on LLINs is preserved.

Cost Implications 2

- **Developing a new class of insecticides takes ten years, and manufacturers will do it only if there clear prospects of a market that will last for more than one decade.**
  - The major chemical manufacturers (who alone have the resources to search for new molecules) are already concerned and inhibited by the apparent instability of the public health market. We need to re-assure them, by producing realistic estimates of future costs, and showing that donors remain committed. -
  - We should project market size in medium / long term (>=15y).

Universal Coverage – net replacement

- **The rate at which nets wear out is highly variable….**
- **…… Between nets in a cohort**
- **…... Between settings**
- **…… Between LN products (ranking depends on setting)**
- **So…**

Routine to fill the gap

- A net for every pregnancy and every child
- Practical methods – VCWG
- Resources (effect on ANC / EPI coverage ?)

http://www.rollbackmalaria.org/docs/round10/WHOpolicyBriefMay2010.pdf

Malaria Global Fund Proposal Development

WHO POLICY BRIEF
May 2010

Global Malaria Programme

World Health Organization

Universal Access Coverage (provisional) **=**
% of people living in HH with at least 1 ITN for every 2 HH members

- **Differs from "% HH with at least 1 ITN for 2 people" because larger HH less likely to have enough nets.**
- **Access = availability to user, it does NOT include usage**
- **Target = 100%, Success (from HH survey) = 80%**
- **Possible 2º indicators / variants:**
  - U5s+PW = vulnerable groups
  - Any net = including untreated
  - Adjust "2" to "observed mean no. people under each occupied net"
- **HH ownership = "% of HH with at least 1 ITN"**
  - useful for initial scaling-up, low coverage situations
  - not so good for moderate to high coverage, as a measure of progress to universal coverage

Campaign Planning Ratio : why 1.8?

- **At population level, procure 550 nets for every 1000 population (1 net for 1.8 people).**
- **Formal WHO target is 1 net for 2 people**
  - some data (more needed) confirming approx. 2 occupants per occupied net
- **But this must work at HH level, in campaign distribution**
- **Giving fixed number of nets per HH is not v good:**
  - if mean HH size is 5, then
  - 45% of HH have <4 and >6 members

Campaign Planning Ratio : why 1.8?

- **So give 1 LLIN for 2 people in HH**
- **But what about odd-numbered HHs?**
  - must round up or round down
- **If rounding up:**
  - half of all HH are odd-sized
  - give 2 nets for HH with 3 people, 3 nets for 5 people, etc
  - each odd-sized HH gets an extra 0.5 LLIN
- **Overall this is an extra 0.25 nets per HH**
  - so an extra 10% if mean HH size = 5
    - = 550 nets for 1000 people, 1 net for 1.8 people

Variants on 1.8?

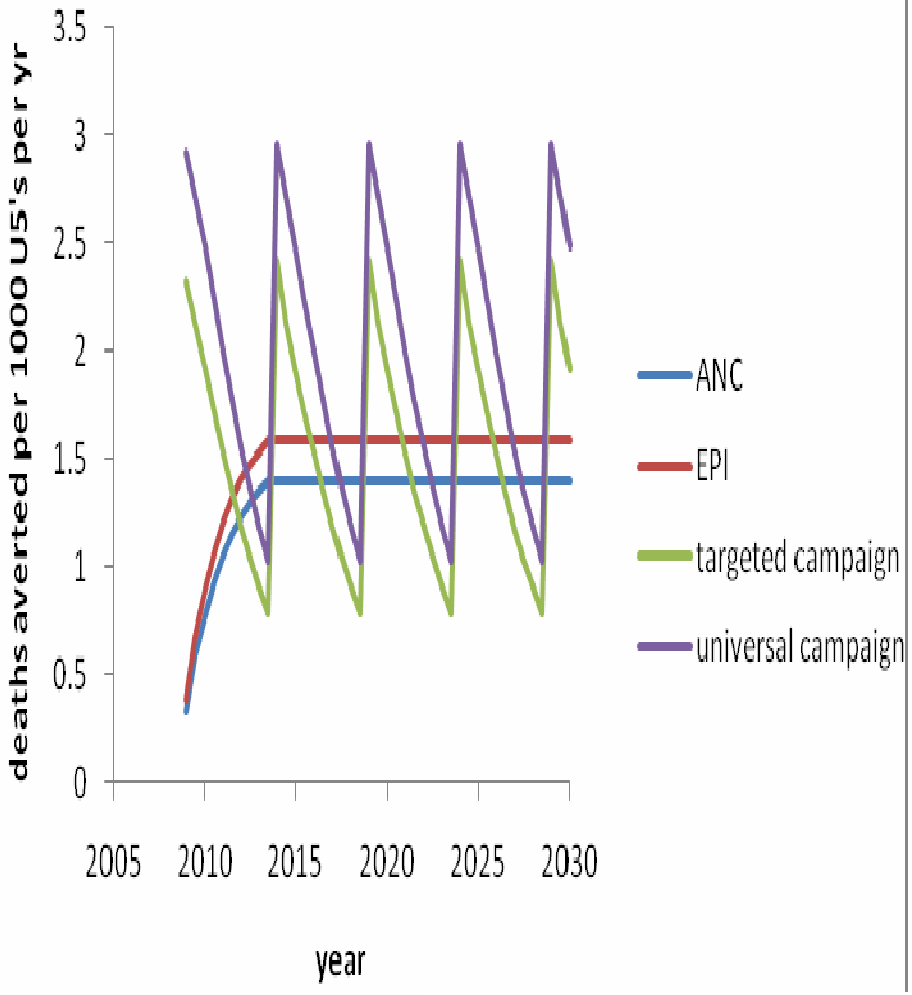
- Further rounding error from bales/village ?
- Routine losses ?
- Insert observed number of people per occupied net?

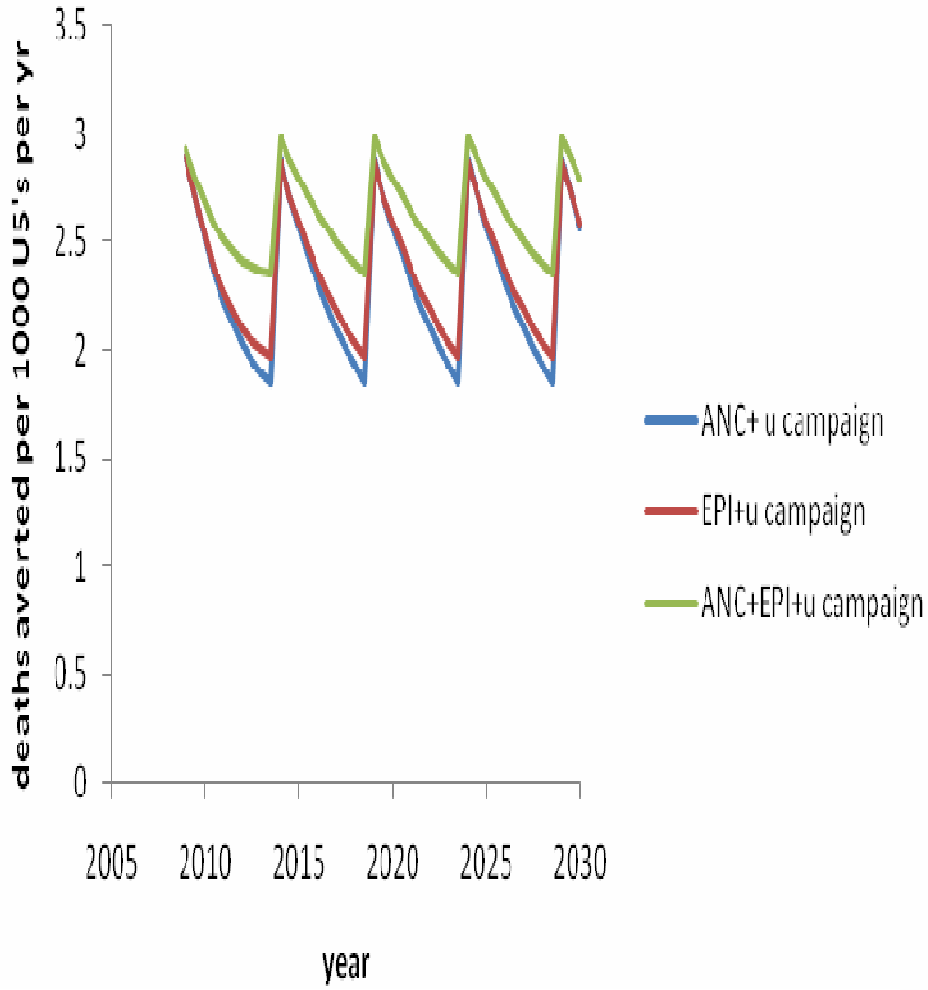
LLIN strategies for Universal Coverage

- All age-groups - targeting to vulnerable groups only if necessary
- Socio-economic equity AND Geographic equity

- **Campaigns every 3 years – Yes but not alone!**
  - Current LLIN strategies assume that all LLINs exactly 3 years - So periodic campaigns alone give full and full-time coverage of the target population – but the data says this assumption is false!
- **Must have Keep-Up too –**
- **Give equal priority to routine systems – ANC + EPI**
- **Re-treatment of local nets during campaigns ?**

Modelling shows how continuous routine distribution through EPI can complement fixed-interval campaigns





Modelling by Lucy Smith, Lucy Okell & Jayne Webster, LSHTM

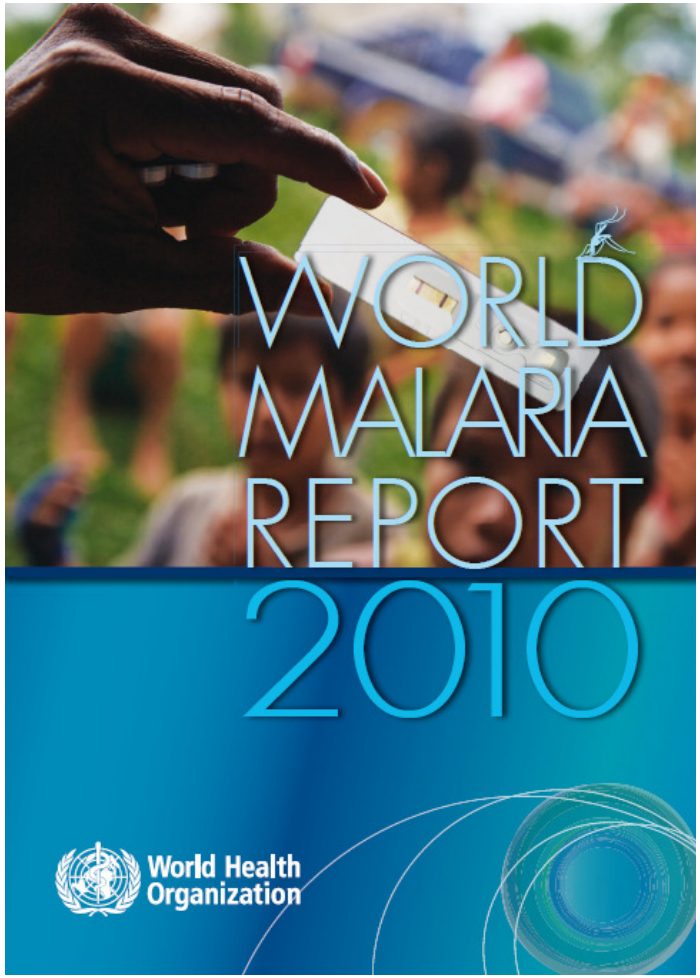
Sustaining Universal Coverage

- Responding to a mixture of nets – range of conditions, incl untreated - operational research needed!! Procurement SOPs, Logistics SOPs, Village- and Household-level SOPs
- Give equal (or more) priority to Routine, compared to Campaign
- How to estimate procurement quantities for populations with partial coverage from previous campaigns (which may have been targeted, incomplete, long ago etc)?
  - Answer: Ignore all LLIN >3y old;

Do we need to remove old nets?

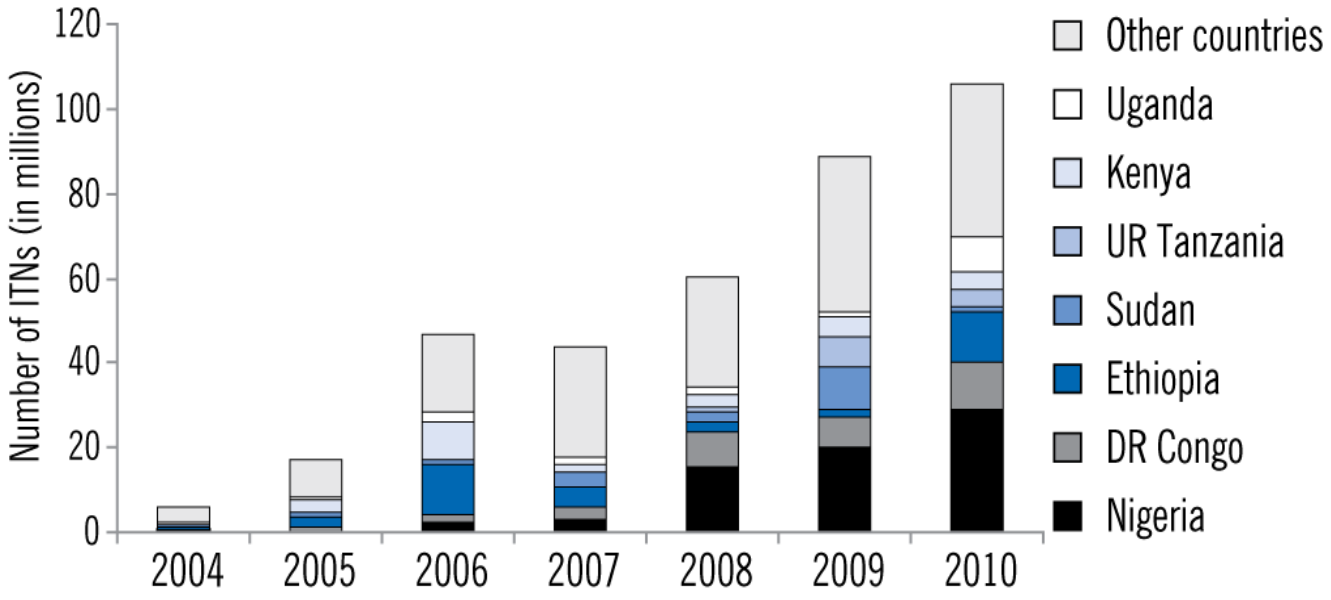
- **2 reasons suggested .. Blocking new nets and environmental pollution. But Evidence?**
  - Research project - assess need to dispose and methods (meanwhile DON”T burn)
  - Interim advice: NO DEMONSTRATED NEED to recover old nets
  - Re-use > Recycle > Energy recovery > Disposal:
  - Old nets are perhaps best re-used within the community – e.g.
    - under the mattress of sleeping mat against crawling insects,
    - as eave-curtains, or to

World Malaria Report 2010



- 2010 Report released on 14 December
- Annual reference on the status of global malaria control & elimination
- Principal data source is national programs in 106 endemic countries with support from: WHO Regional offices, ACT Watch, CDC, DHS/ Measure, Global Fund, IHME, IRI, JHU, PATH, RBM, Tulane University
- Summarizes key malaria targets & goals
- Documents trends in financing, intervention coverage and malaria cases and deaths
- Updates malaria burden estimates for decade: 2000-2009
- Provides country-by-country summaries

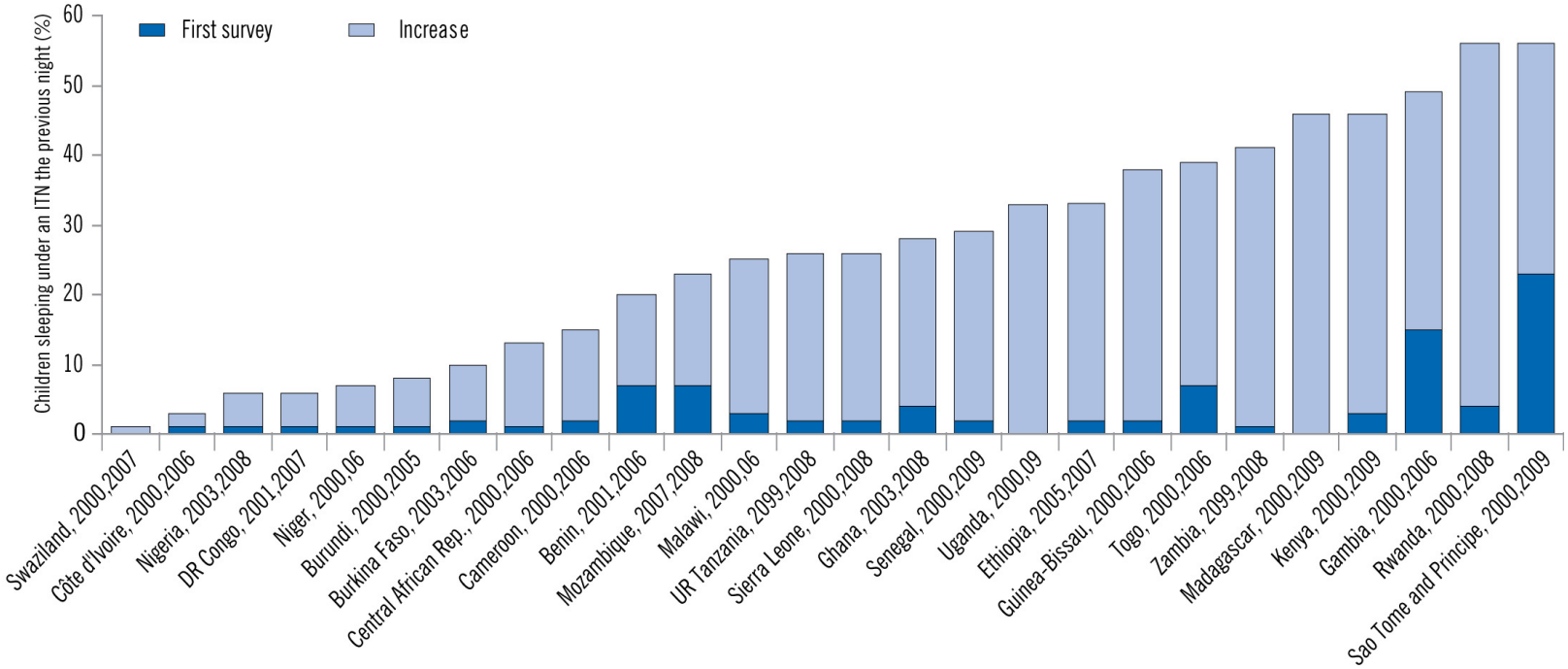
Number of ITNs delivered by manufacturers to countries in sub-Saharan Africa



Seven countries account for >50% ITN deliveries

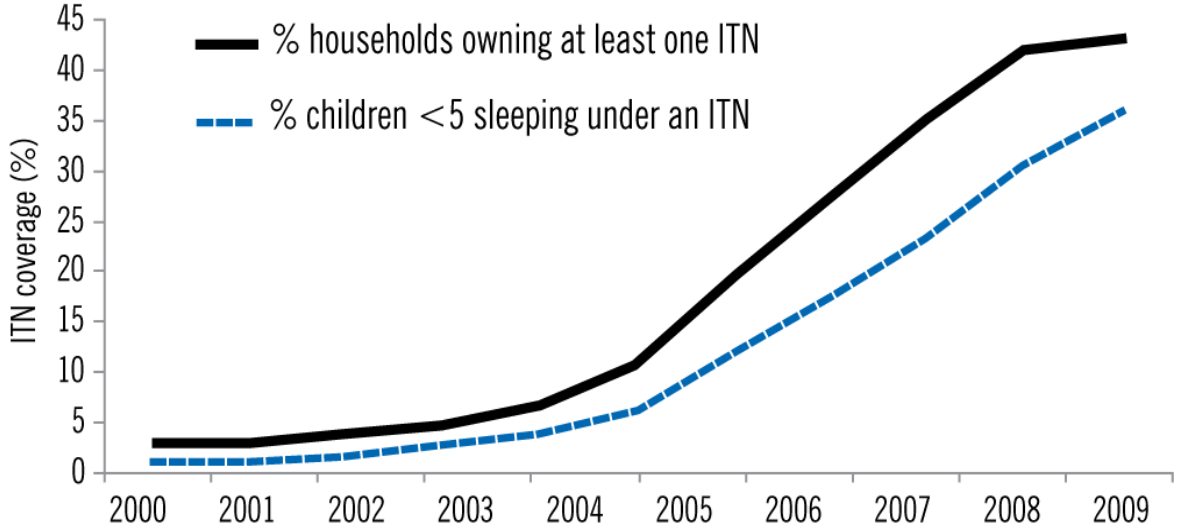
Source: AMP records of nets procured

Trends in % of children sleeping under an ITN for countries with more than one survey, 2000–2009



Source: Household surveys (DHS, MICS, MIS)

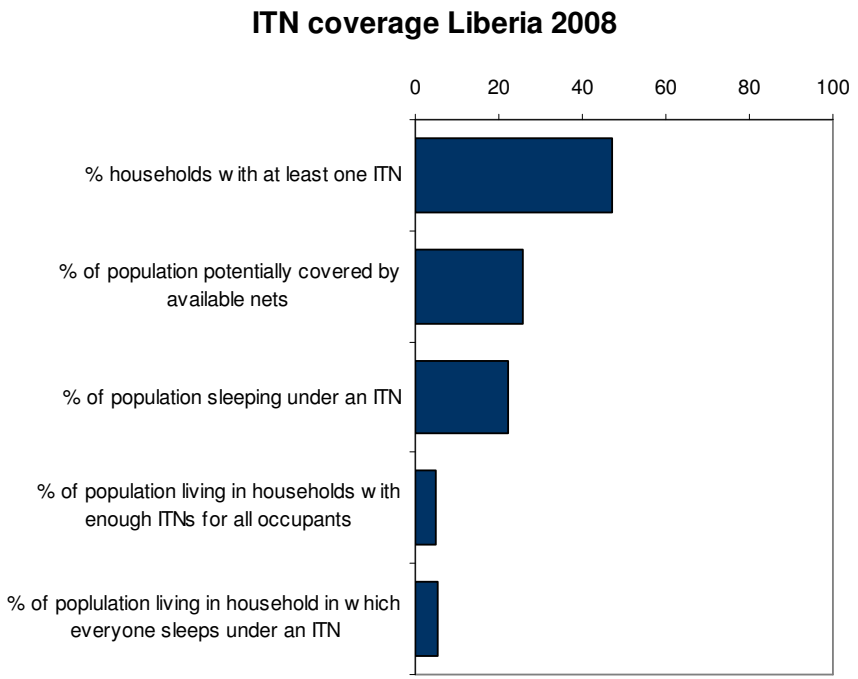
Model based estimate of ITN coverage in sub-Saharan Africa

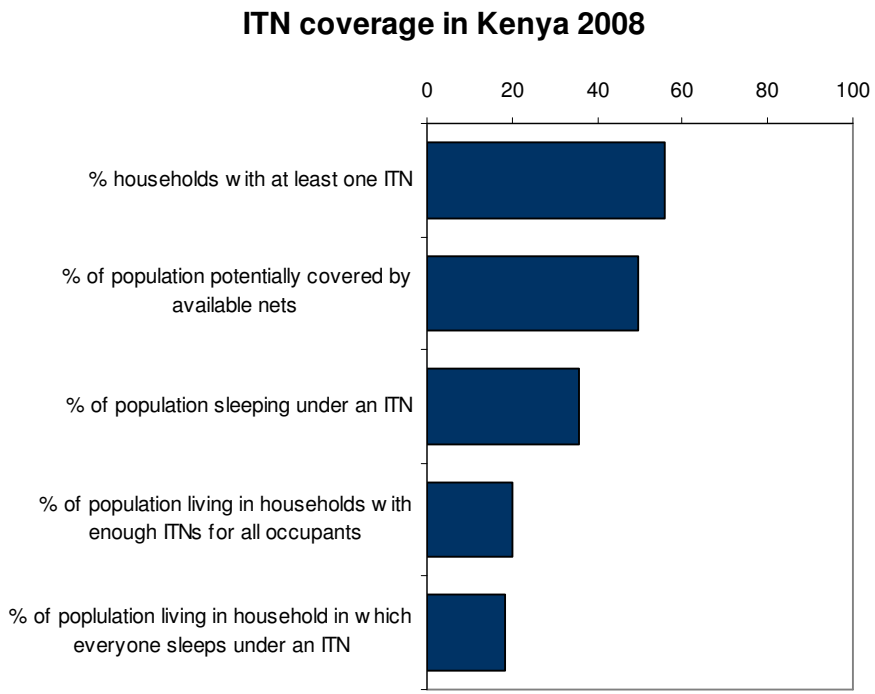


- 42% of households owned at least one ITN by mid 2010
- Household ITN ownership reached more than 50% in 19 African countries
- 35% of children <5 years old slept under an ITN

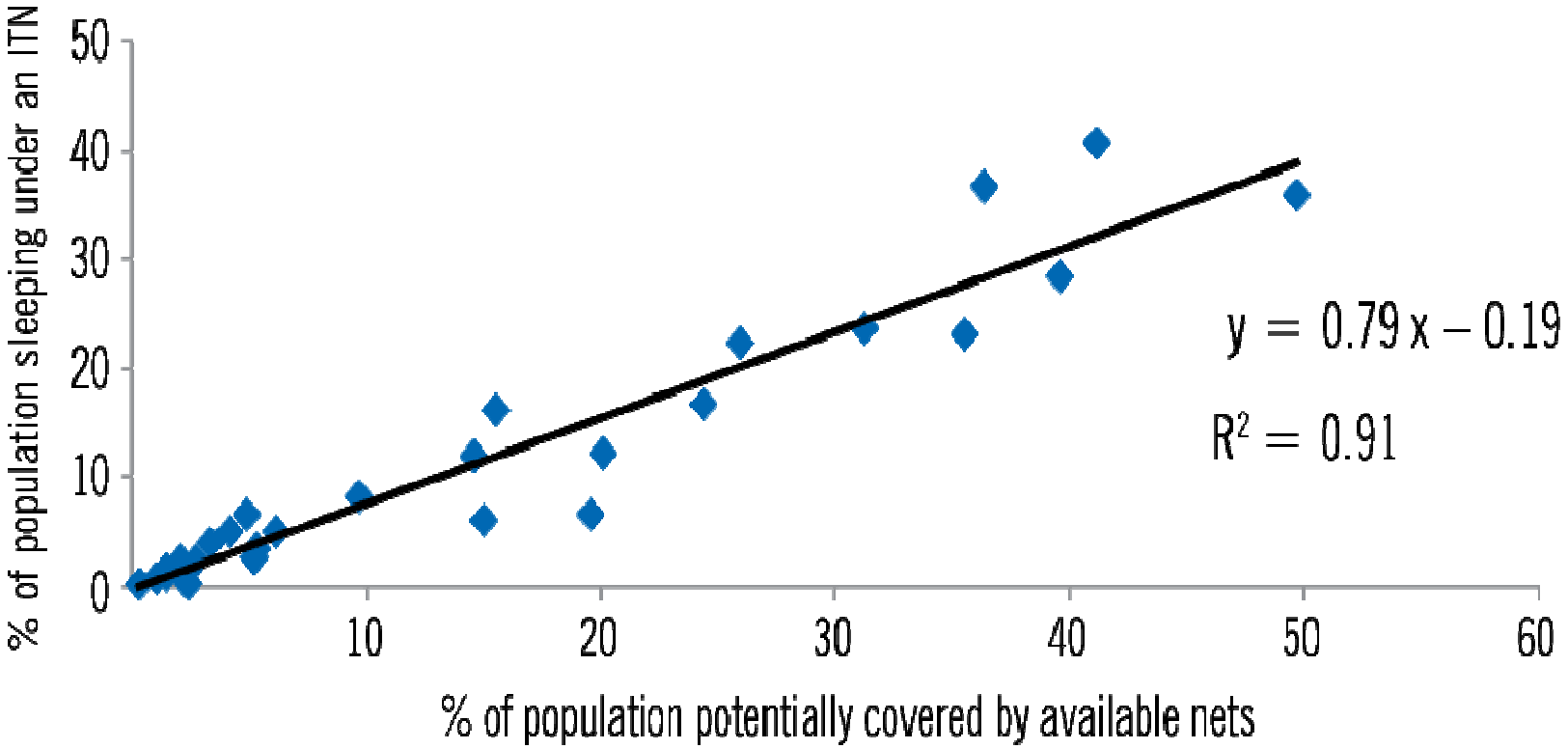
Source: Model developed by IHME using information from household surveys, nets procured from manufacturers and nets distributed by malaria programs.

Bottlenecks in Achieving Universal Coverage



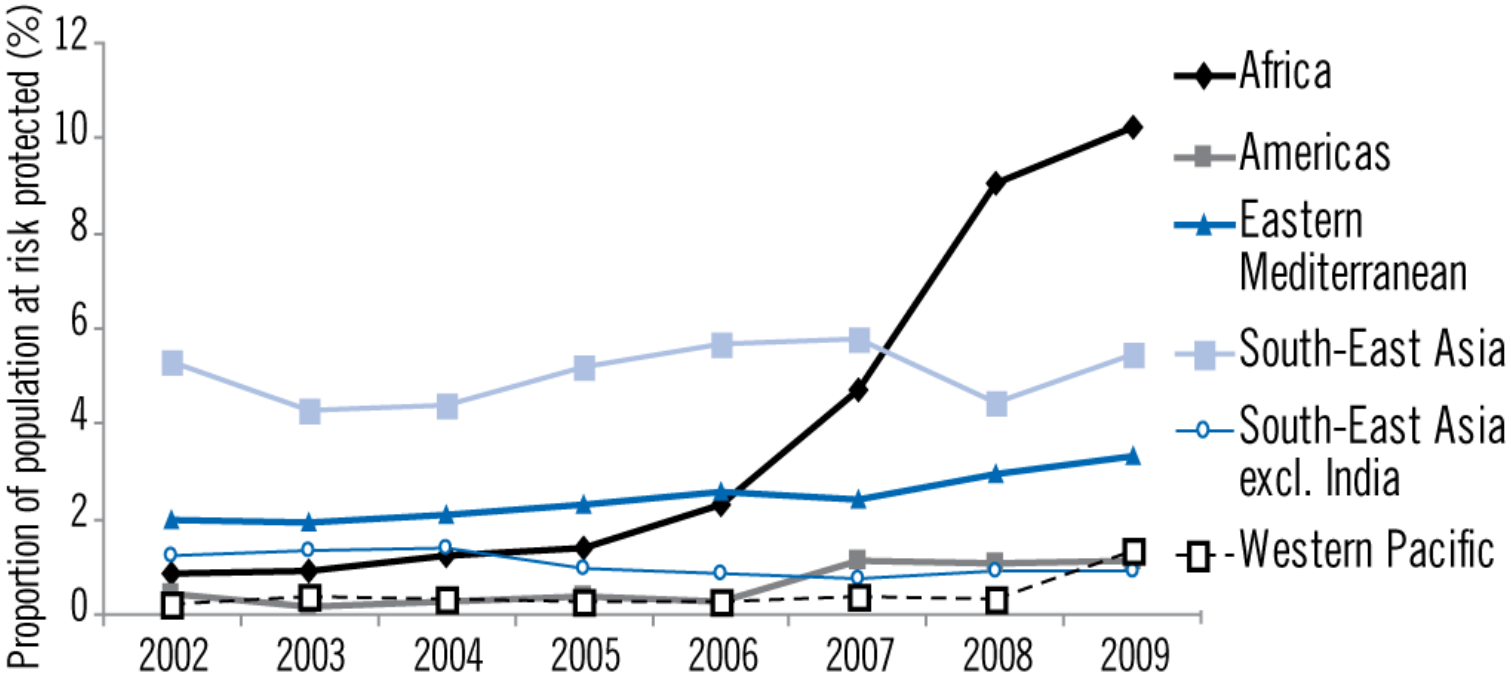


Relationship between % of population sleeping under an ITN and % with access to an ITN



Take home message: ITNs are used to 80% of capacity

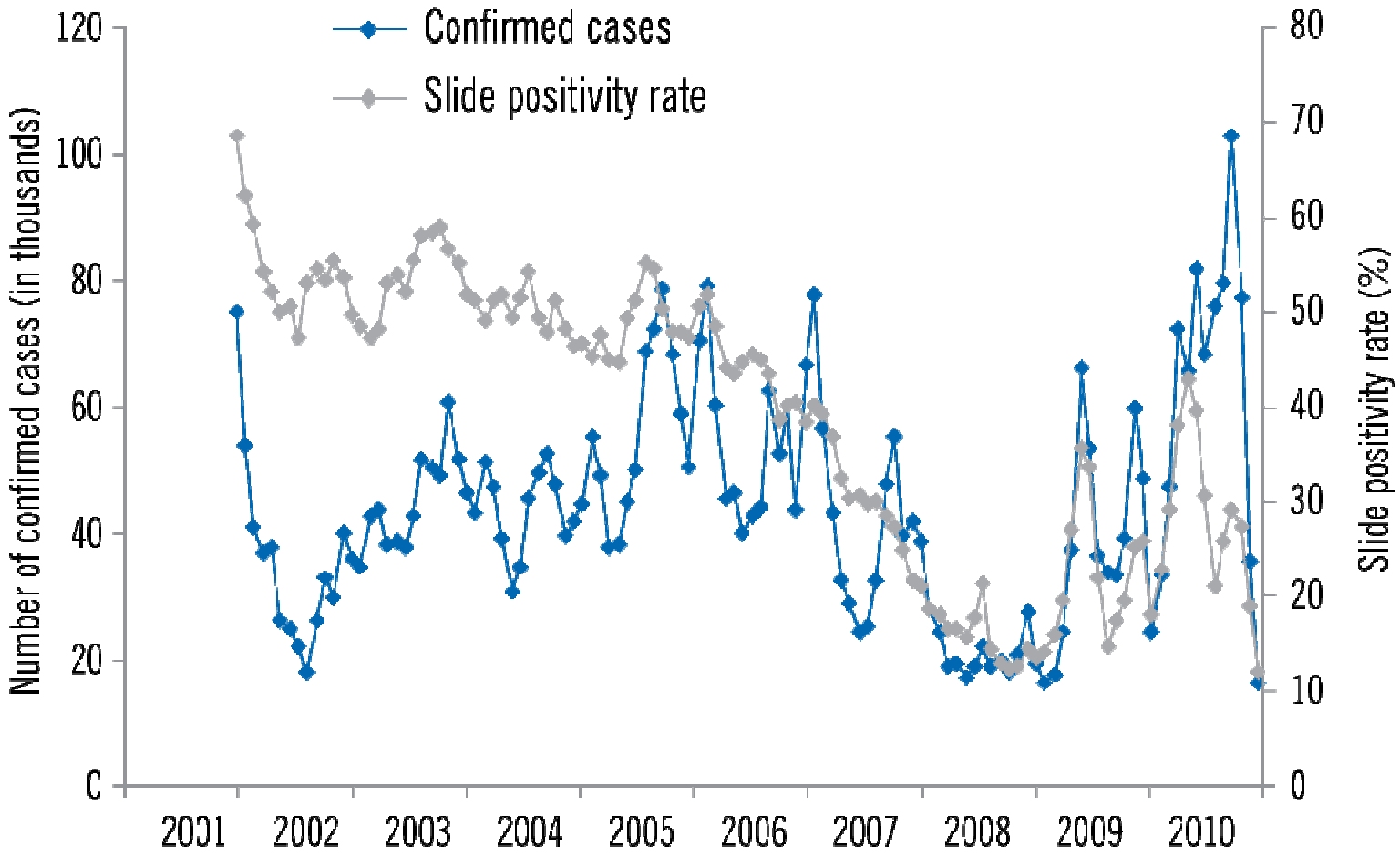
Proportion of population at risk protected by IRS



The number of people protected by IRS increased from 13 million (2005) to 75 million (2009) in sub-Saharan Africa

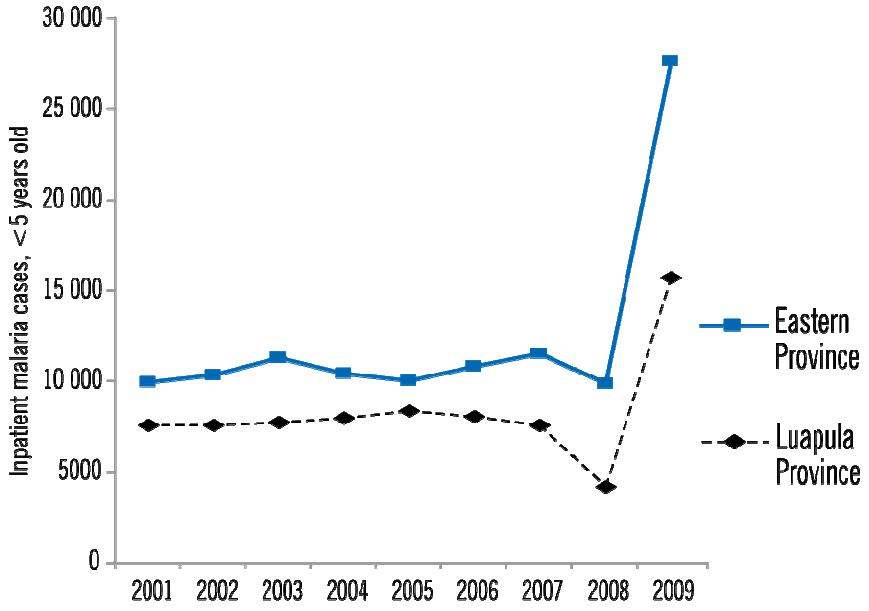
Source: malaria endemic countries

Recent increases in malaria cases: Rwanda



Recent increases in malaria admissions: Zambia

In Eastern and Luapula provinces



Other provinces