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# RBM Vector Control Working Group

## Work Stream: Durability of LLIN in the Field

### *Overview of last year's developments*

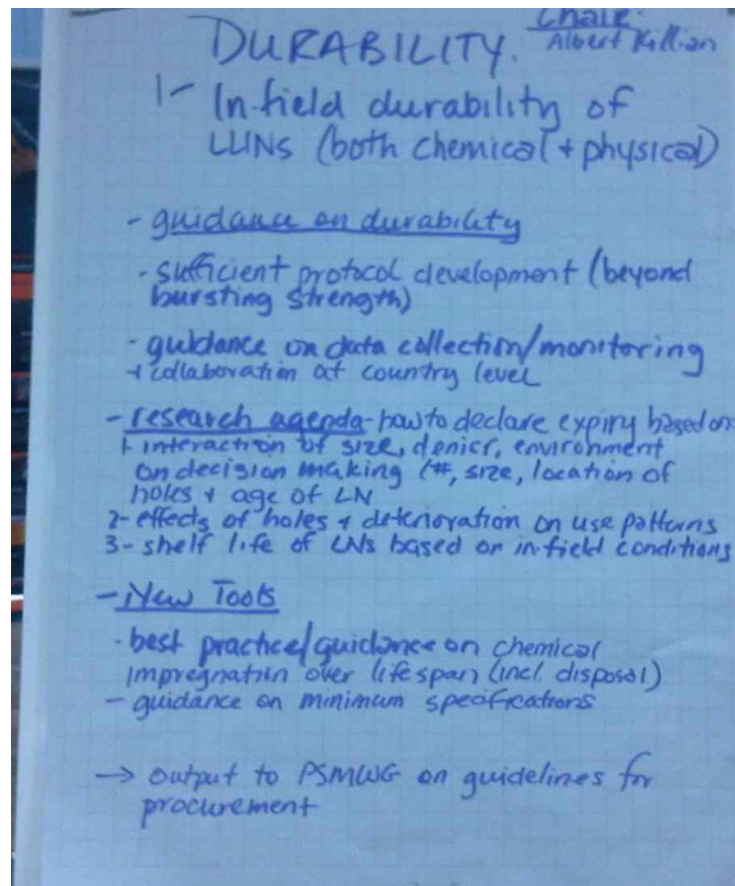
Albert Kilian

6th Work Stream Meeting  
19th February 2014  
Geneva



# LLIN durability WS

- In 5<sup>th</sup> year since start good progress in some areas, less in others



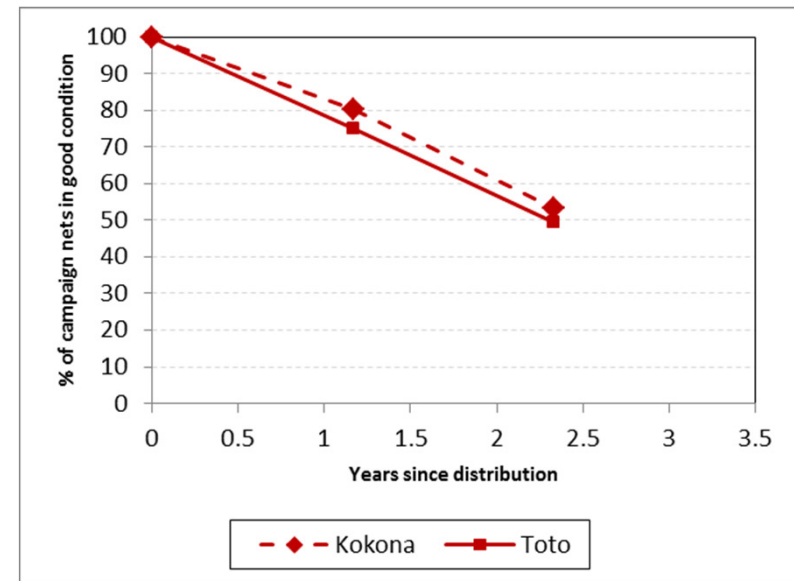
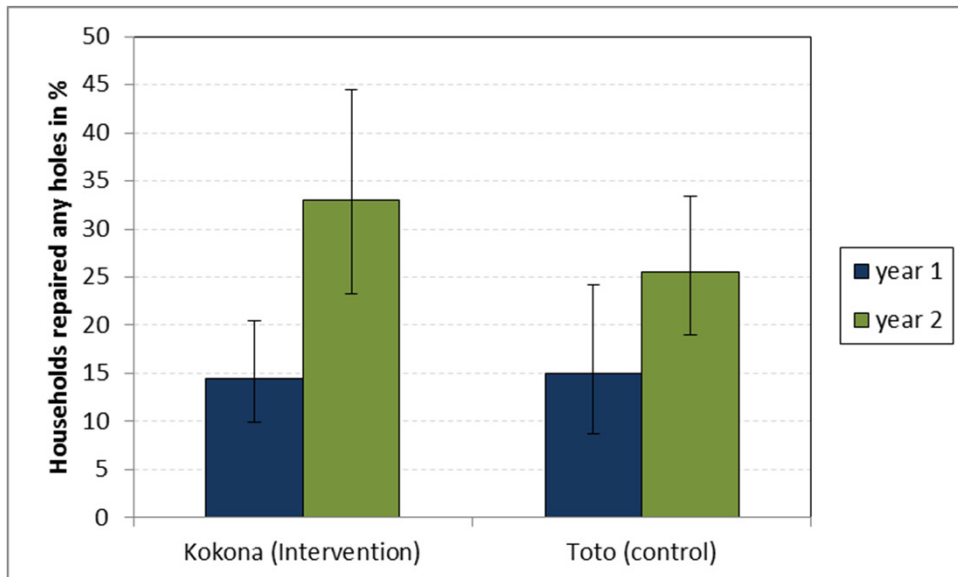
# Areas of Focus

- Methodology to measure LN survival in the field
  - Data from different areas and products
- Textile testing of unused LN in order to predict field performance
  - Input into procurement criteria
- Research
  - Location and size of holes
  - Insecticide levels plus holes >> loss of effectiveness
- Behavioural aspects
  - Care & repair
  - End of life

# Behavioural aspects

## Maintenance, care & repair

- Recent publications (e.g. Wills et al.) confirm very low repair rates
- Ongoing study in Nigeria (Nasarawa) suggests that changing repair behaviour can be challenging
  - Repository of materials on C&R
  - Contact G. Hunter,
    - see: <http://www.k4health.org/toolkits/care-repair-LLIN>



# Behavioural aspects

## End of life, replacement

- Qualitative research shows that people are able to determine need for replacement and express demand for replacement

Loll *et al.* *Malaria Journal* 2013, **12**:337  
<http://www.malariajournal.com/content/12/1/337>



**RESEARCH**

**Open Access**

User-determined end of net life in Senegal: a qualitative assessment of decision-making related to the retirement of expired nets

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# Research

- Work ongoing, no publications yet
  - Location of holes seem to matter for entry but differences between species
  - Size of holes and increase of entry
- Work on hole surface and insecticide level planned in Tanzania (ABC DR-study)

# Textile testing

- WHO (GMP-WHOPES) undertook textile testing of currently recommended LN brands using currently existing textile tests
  - Meeting in August 2013 to discuss preliminary data
  - Decision to add “wounded bursting strength” and update
  - Final results expected early 2014
- Gates funded R4D, NIRI, TH study on damage mechanisms and improved textile testing
  - Phase 1 results are now available

# Field Data Net Survival

- A number of studies from 2013 report on aspects of net survival in the field
  - Usually only some but not all components
- Mutuku et al. (Kenya)
  - Kenyan coast, cross-sectional survey of existing nets routinely used, physical condition and use, considered ineffective when hole surface  $>500 \text{ cm}^2$ , proportion of effective nets decreased until third year and then stabilized at  $\sim 30\%$  (nets discarded), 21% repair
- Mejía et al. (Kenya)
  - Millennium village, Olyset 4.5 years after distribution, uses WHO method for PHI, sampled only hh with nets remaining, 39% of nets not "serviceable", estimate 5.5yrs median survival, but more likely 4.5



# Field Data Net Survival (2)

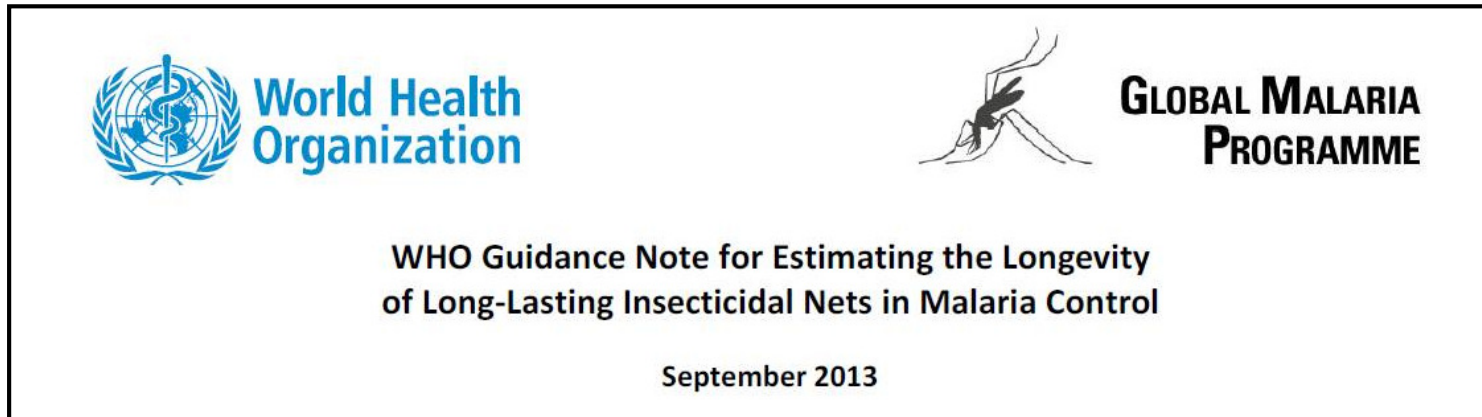
- Haji et al. (Zanzibar)
  - Three year old Olyset, 68% found damaged, but low cut-off (no-WHO), no attrition, but mean permethrin content 84% of new nets
- Wills et al. (Ethiopia)
  - Multiple cross sectional survey on Permanet 2.0 after 3-32 months of use, no attrition reported, 30% after 26-32 months "torn" (WHO criteria)
- Odhiambo et al. (Kenya)
  - Netprotect in two villages, attrition after 3 years 21% (no reason), 90% still effective in cone assay, PHI but no categorization

# Methodology for Survival Estimate

- At last VCWG meeting need for guidance on how to calculate LN survival was emphasized
- Draft document with review of existing evidence was prepared for VCTEG
- Presented and discussed at 1<sup>st</sup> VCTEG meeting, Geneva 3-5<sup>th</sup> July 2013
- After revisions presented to MPAC in September 2013
- Approved and officially published on WHO website

# Methodology for Survival Estimate

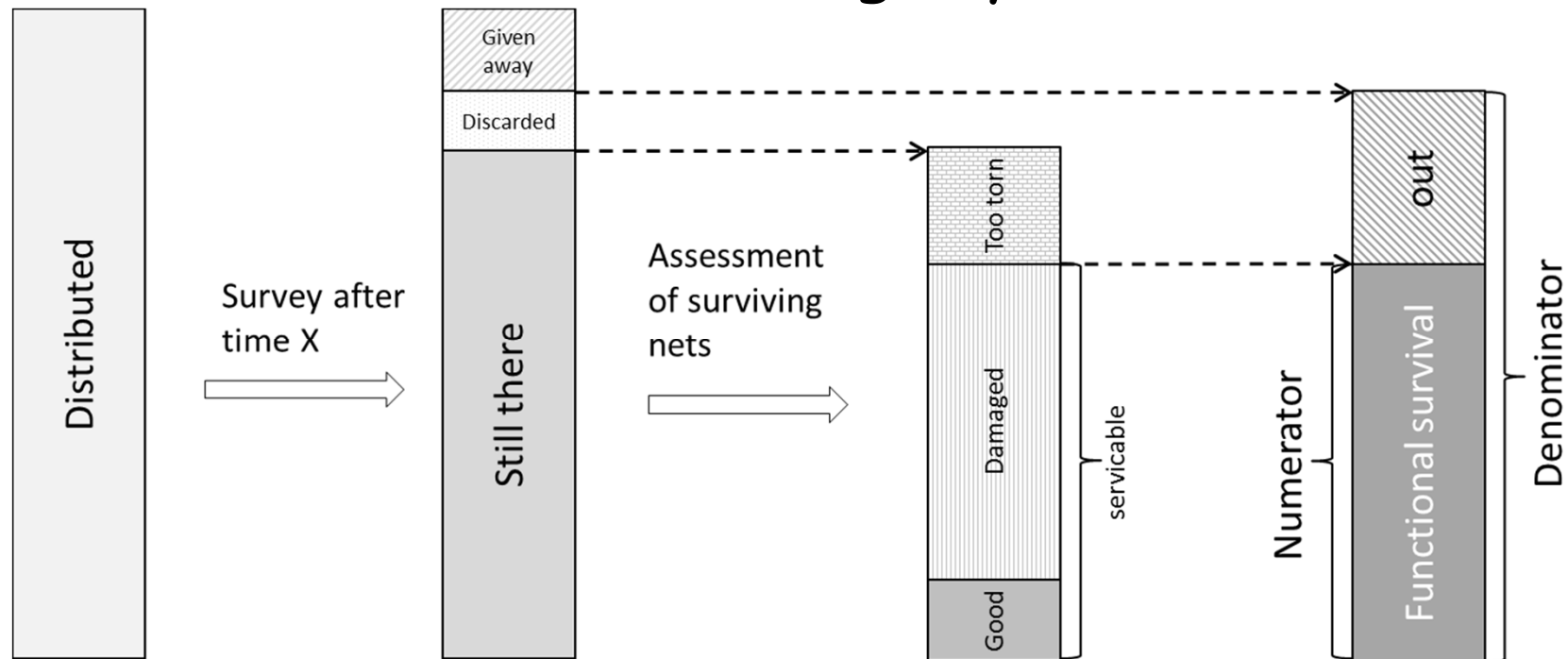
- At MPAC website of WHO



<http://www.who.int/malaria/mpac>

# Survival to time x

- From attrition and integrity data for each net



$$\% \text{ surviving to time } x = \frac{\# \text{ of LN present and "serviceable" at time } x}{\# \text{ of LN originally received and not given away at time } x} \times 100$$

# What about insecticidal effectiveness?

- Following in-depth review of evidence and option VCTEG recommends to not include insecticidal effectiveness in the measure of “median LN survival” until
  - A test is available that can be done in the field on all samples without removing or destroying the net
  - A better understanding of the **minimal effectiveness** is available, i.e. the level of insecticide at which no additional epidemiological protection is achieved

# Estimating median survival

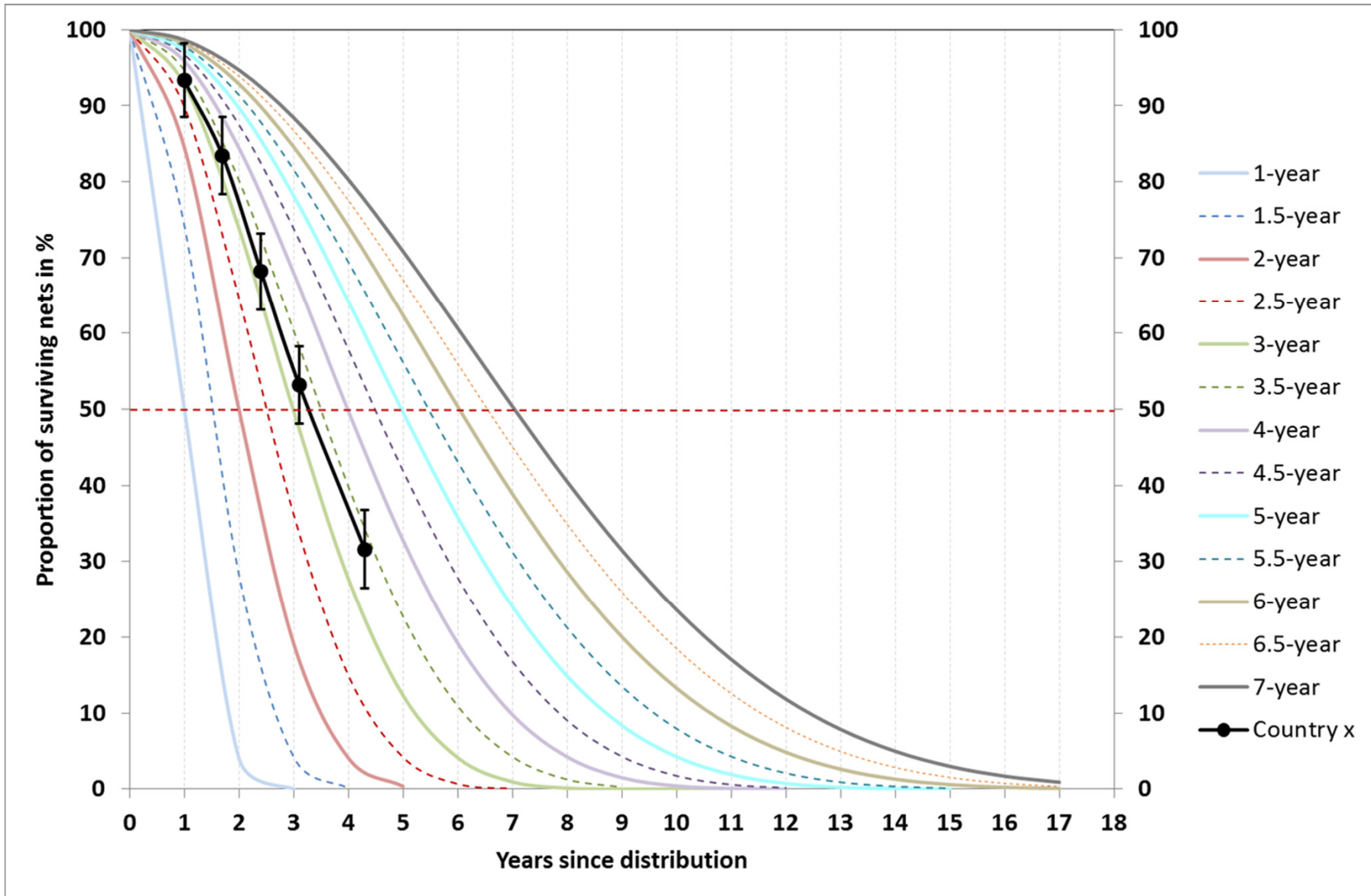
- From at least 2 points of which the lowest should be 85% or lower

$$t_m = t_1 + \frac{(t_2 - t_1) * (p_1 - 50)}{(p_1 - p_2)}$$

- Tool to help plot survival and calculate median survival

Microsoft Excel - median survival tool							
A	B	C	D	E	F	G	H
1							
2							
3	Net survival	year	survival	low	high	minus	plus
4		1	93.3	88.5	98.2	4.80	4.90
5		1.7	83.4	78.4	88.5	5.00	5.10
6		2.4	68.2	63.1	73.2	5.10	5.00
7		3.1	53.2	48.1	58.3	5.10	5.10
8		4.3	31.6	26.5	36.8	5.10	5.20
9							
10		median survival calculator					
11		time (yrs)		estm (%)		low	high
12		t(1)	3.1	p(t1)	53.2	48.1	58.3
13		t(2)	4.3	p(t2)	31.6	26.5	36.8
14							
15			t(m)	low	high		
16			3.28	2.99	3.56		
17							

# Plot survival outcome



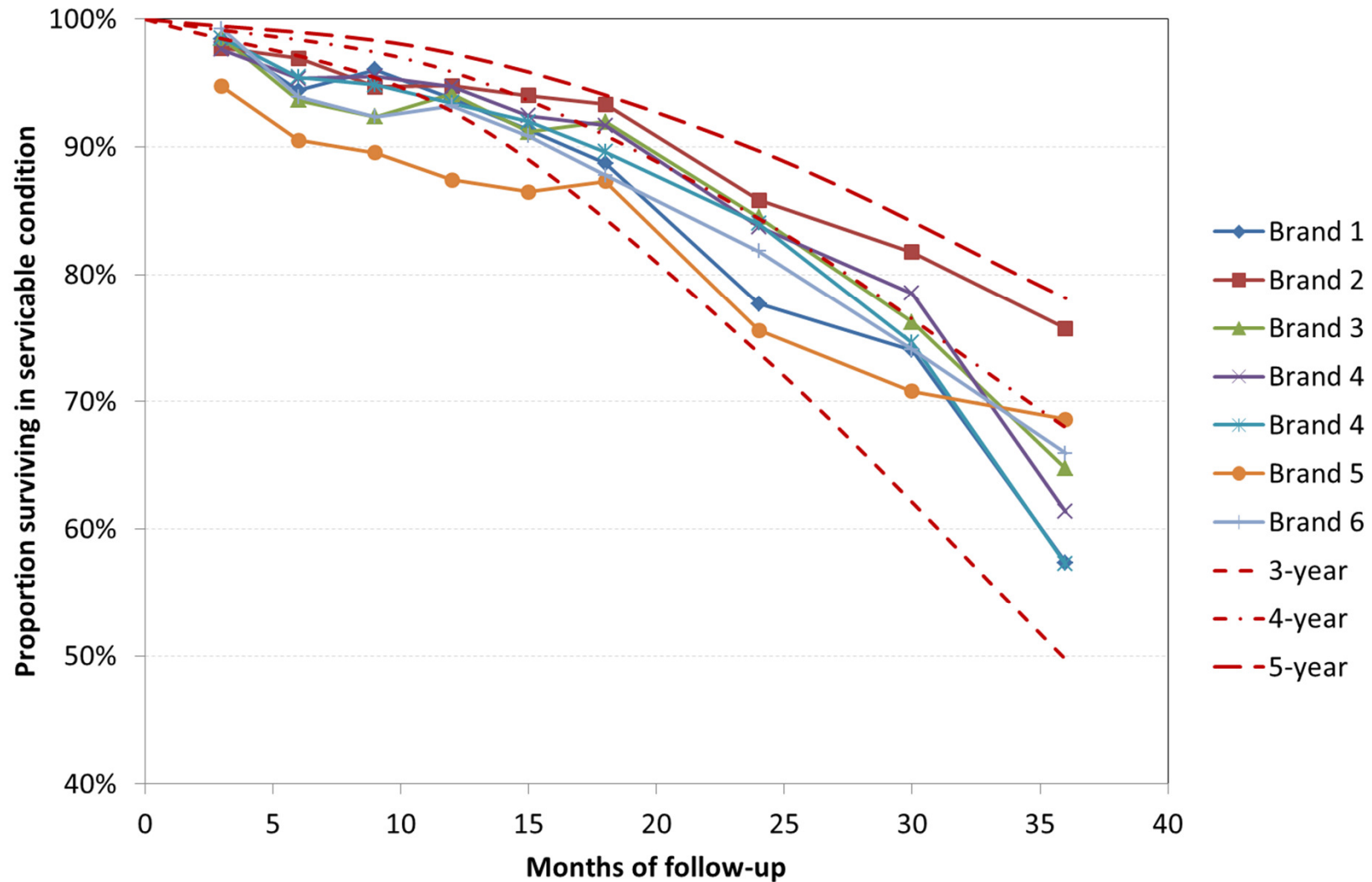






# Uganda prospective LN study

Surviving nets in serviceable condition (holes <math>0.1\text{m}^2</math> prelim. adjustment for attrition)



# Summary (net survival)

- To date few publications have sufficient data to make a judgement on survival
- Yet unpublished data suggests that based on environment and behaviour median net survival in some sites is closer to 4-5 years (or more) than 3 years.
- Need to disseminate new guideline and build capacity for application