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ABCDR - A retrospective evaluation of LLIN durability after 2-4 years in Tanzania

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Introduction

Long-Lasting Insecticidal Nets (LLINs) are the mainstay of malaria control. However, despite many National Malaria Control Programs adopting universal LLIN coverage, the effective life of nets under user conditions – LLIN durability – is largely unknown. Olyset® nets were provided for free to children under 5 in 2009/2010 and to the general population in 2010/2011 in Tanzania.

Methods

Four aspects of LLIN durability were investigated in nets from 3,420 households in 8 districts in Tanzania.

- **A**ttrition: net loss through discarding or re-using
- **B**ioefficacy: knock-down or mortality of *Anopheles* mosquitoes
- **C**hemical content: g/kg pyrethroid in net fibres
- **D**egradation: number, size and location of holes

All nets were collected from households, and a questionnaire was administered. BCD components were measured in a sub-sample of 200 identified campaign nets.

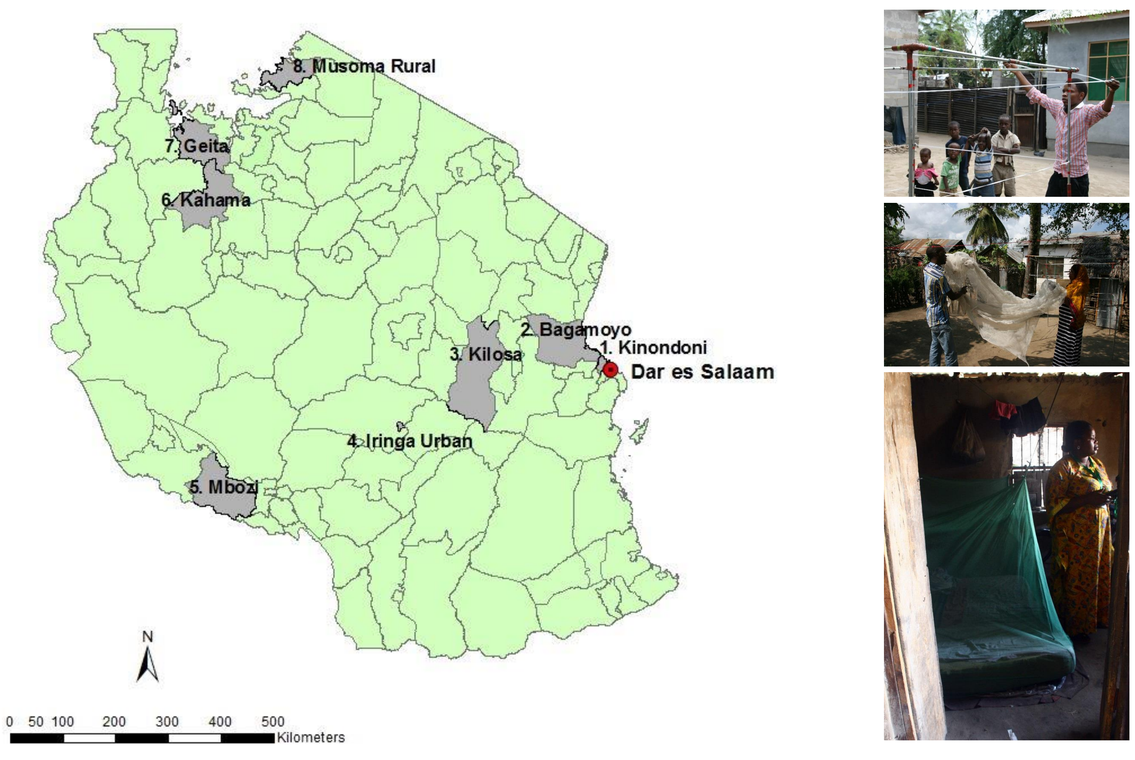
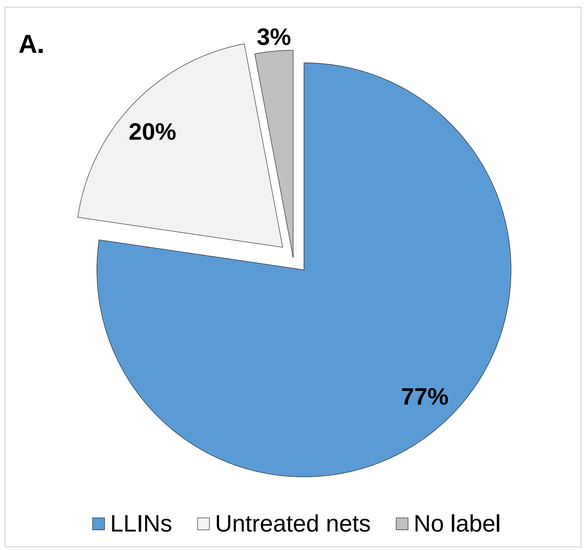


Fig. 1 Map of Tanzania, highlighting the 8 ABCDR districts. Ten villages, and 45 households within a village, were selected per district for household questionnaires and retrospective net sampling.

Results

Retrospective net characteristics (6,537 nets collected)



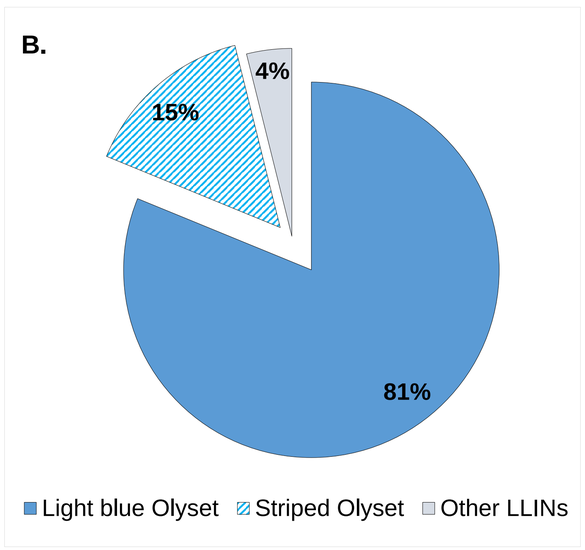


Fig. 2 A. Proportion of LLINs and untreated nets collected from 3,420 households.
B. Proportion of light blue (campaign) and blue-white striped (TNVS) Olyset® nets found. Other LLIN brands included PermaNet® and BASF.
Average number of nets / household: 1.9. Average number of LLINs / household: 1.5.

Results

A Component - Attrition

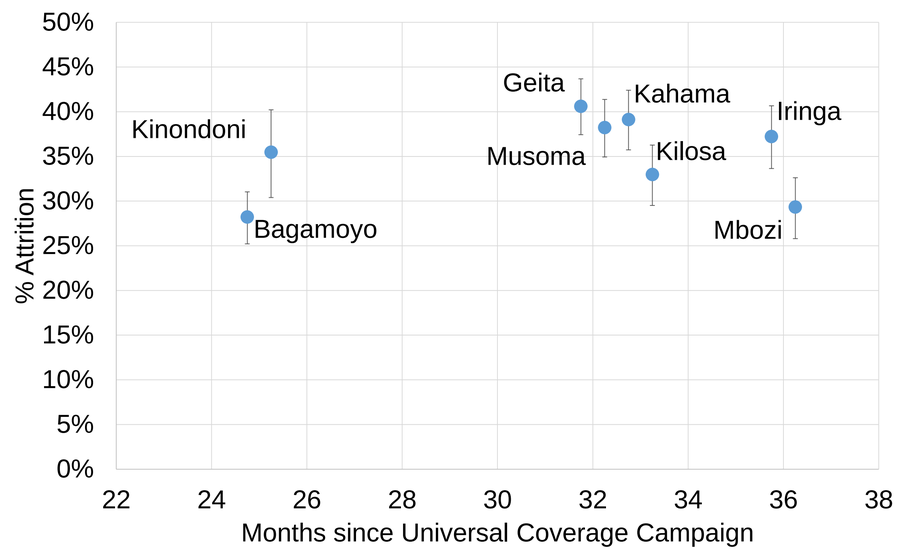
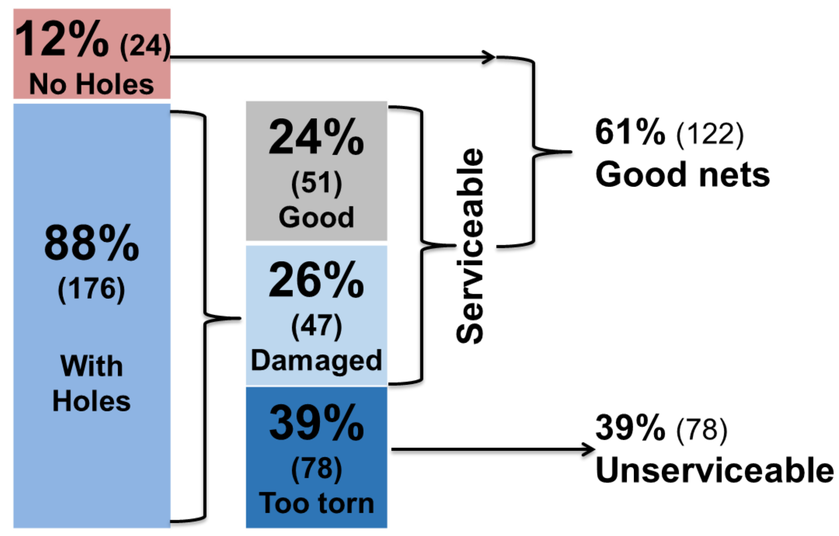


Fig. 3 Percentage net loss (± 95% CI) of Olyset® campaign nets by month since distribution and district.
Attrition was calculated from: $\frac{number\ of\ light-blue\ Olyset\ nets\ collected}{reported\ number\ of\ campaign\ nets\ received}$

D Component – physical Degradation (200 nets sampled)



B + C Components – Bioefficacy

Table 1 Number and percentage of 2, 3 and 4 year old Olyset® nets failing a sub-set of WHO durability criteria. Mosquito mortality is only shown for WHO cone bioassays, a less accurate bioefficacy indicator for permethrin-based LLINs than WHO tunnel tests.

	4 years (n=24)	3 years (n=122)	2 years (n=48)	TOTAL
<80% *Anopheles* 24hr mortality (WHO cone tests)	20 (83.3%)	98 (80.3%)	31 (64.6%)	**149 (75.3%)**
<15.0 g/kg permethrin content (HPLC)	9 (37.5%)	28 (23.3%)	5 (10.4%)	**42 (21.9%)**
… 'Too torn' [1]	13 (54.2%)	42 (34.4%)	21 (43.8%)	**76 (39.2%)**

[1]using hole counts, pHI >643 & hole surface area >790cm^2

Preliminary Findings

- Age range of Olyset® nets tested: 2 – 4 years
- Most nets in houses in Tanzania are still Olyset® campaign nets
- Loss of Olyset® campaign nets ranges from 29 – 41% depending on time since distribution
- 39% of nets still present "too torn" to be useful against malaria
- 75% of nets did not pass the WHO cone 24 hour mortality test – WHO tunnel test results pending
- 22% of nets contained less permethrin within fibres than recommended by WHO for new nets

References

WHO (2011) Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions. WHO/HTM/NTD/WHOPES/2011.5
WHO (2013) Guidelines for laboratory and field testing of long-lasting insecticidal nets. WHO/HTM/NTD/WHOPES/2013.1
Lorenz *et al* (2014) Study Protocol: Investigating the useful life of bednets for malaria control in Tanzania - Attrition, Bioefficacy, Chemistry, Degradation and insecticide Resistance (ABCDR). *Submitted to* BMC Public Health