

Durability Monitoring of Long-Lasting Insecticide treated Nets in Uganda, distributed during 2020 mass campaign

Background: The Ministry of Health (MOH) of Uganda conducted a Long-Lasting Insecticide treated Net (LLIN) Universal Coverage mass distribution Campaign in 2020. WHO as recommends that durability monitoring studies be done when such campaigns are conducted and in this regard provided guidelines.[1]

Based on this background, MOH through the National Malaria Control Division (NMCD) contracted PACE to conduct a Durability Monitoring study for the LLINs distributed in 2020 campaign. Below are the study objectives:

Primary objective: To assess the physical durability of 5 different brands of nets over a three-year period, estimate median LLIN survival and identify major determinants of field performance.

Secondary objectives:

1. To describe major behavioral aspects of net care and repair and their impact on physical durability.
2. To assess the insecticidal effectiveness (residue and bioassay) over three years of field use

Study design

This is a three-year prospective cohort study. The subject of study are five brands (Interceptor, Permanent 2.0, Permanent 3.0, SafeNet, Royal guard) of the LLINs distributed in the 2020 universal coverage campaign. The study has three main dimensions of net durability being tracked following the WHO guidelines for LLIN durability studies. These are;

- 1) Physical integrity assessed through the Proportionate Hole Index system
- 2) Insecticidal efficacy assessed through Bioassay lab tests and analysis for mosquito knock down and mortality rates
- 3) Insecticidal residue content assessed by extracting and measuring the amount of insecticide left in the nets.

The study assessments and data collection are done in intervals of 12 months after net distribution apart from the baseline which was done between zero to six months after net distribution to the beneficiaries.

Study implementation sites: The study is implemented in Bunyangabu, Hoima, Kakumiro and Kikuube districts.



NMCD oversight PI team observing Net Hole Assessment during the 12th month survey in Kigorobya Town Council, Hoima district.



NMCD oversight team, PACE PI and DHO Bunyangabu observing the net integrity in the bunyangabu district during the baseline survey

Key Achievements for 2021

1. Completed the baseline survey and 12 month survey components of physical integrity aspect.
2. Disseminated the baseline survey results to NMCD and the District Health Teams in the study area.
3. Completed baseline chemical residue analysis for all brands.
4. Completed the baseline (0-6months) Bioassay lab tests and analysis for four brands

SUMMARY OF BASELINE FINDINGS

Physical integrity: Below is a Table 1: summary of the physical integrity results of nets assessed.

Site /Sub county	All cohort ITNs surviving in serviceable condition			Cohort ITNs ever-used, present and surviving in serviceable condition		
	N	Estimate	95% CI	N	Estimate	95% CI
Buheesi	402	93.8%	[90.8%-95.8%]	321	92.8%	[89.2%-95.3%]
Kakindo	412	90.3%	[85.8%-93.5%]	277	87.0%	[81.8%-90.9%]
Kigoroby	403	98.8%	[94.1%-99.7%]	188	97.3%	[89.2%-99.4%]
Kizirafumbi	402	92.5%	[88.0%-95.5%]	254	89.0%	[82.6%-93.2%]
Kyabigambire	384	95.1%	[92.4%-96.8%]	205	91.2%	[86.5%-94.4%]

The percentage survival for nets at baseline varied from 98.8% (Royal Guard) to 90.3% (Permanent 2.0)

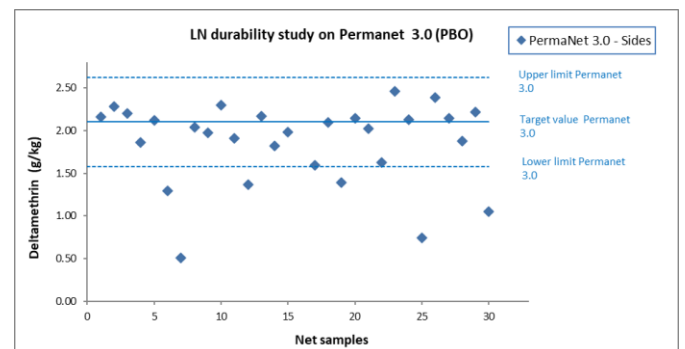
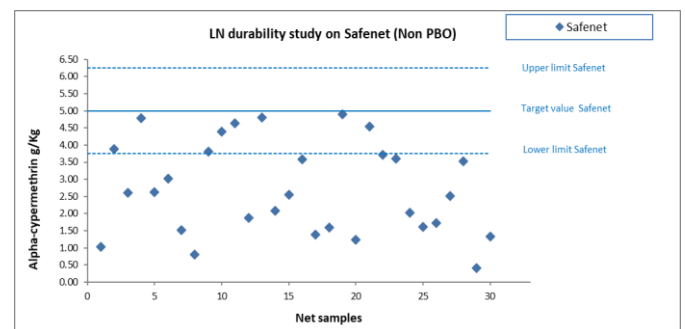
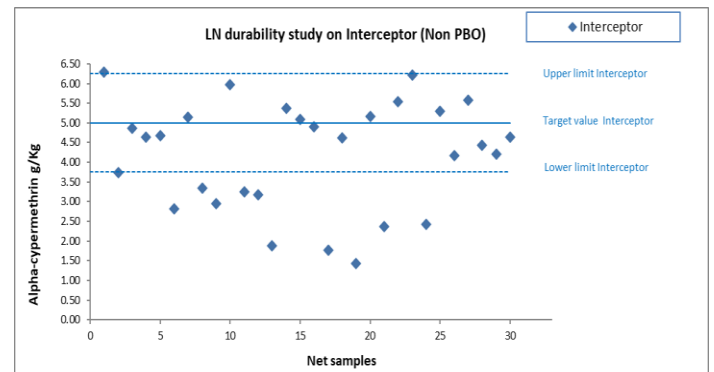
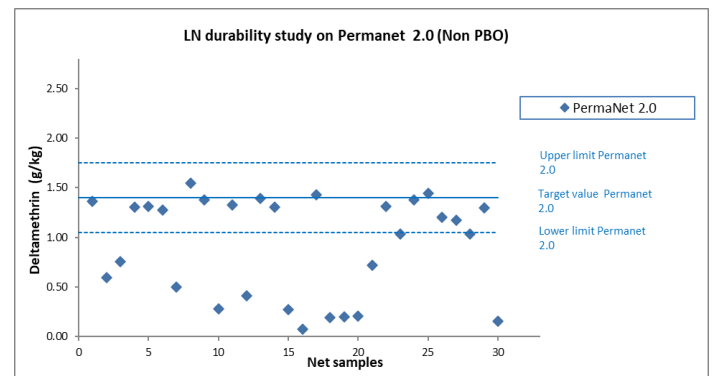
The net repair was at 29.2%, 27.9%, 23.1%, 22% and 21.8% for Royal guard, Permanent 3.0, SafeNet, Permanent 2.0 and Interceptor respectively.

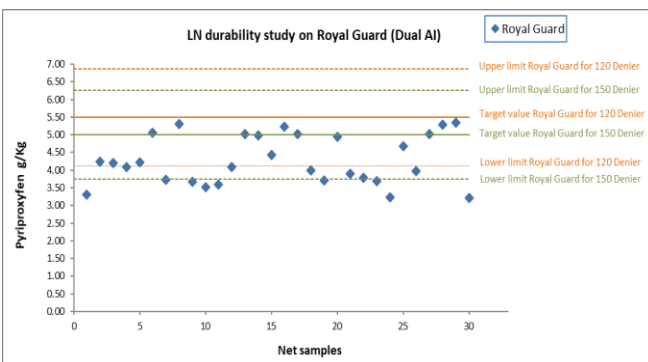
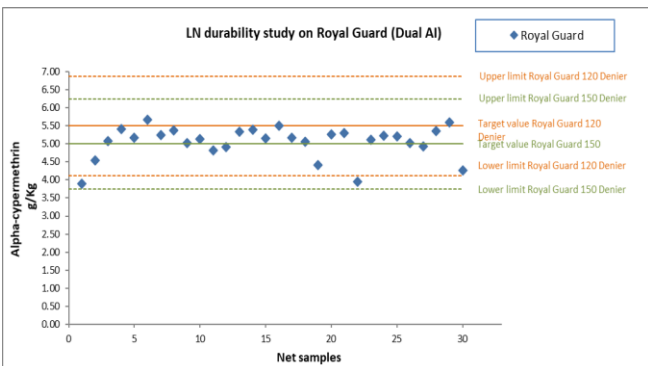
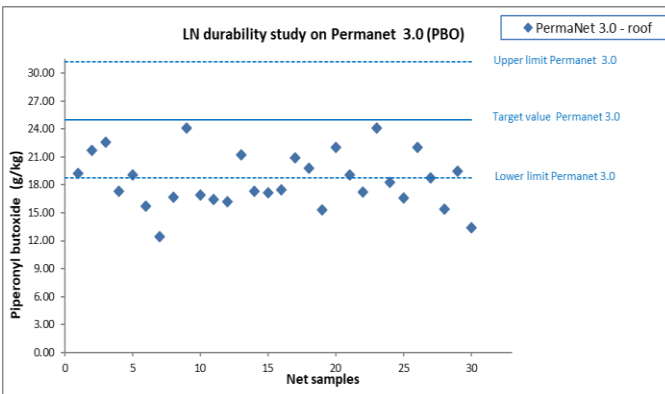
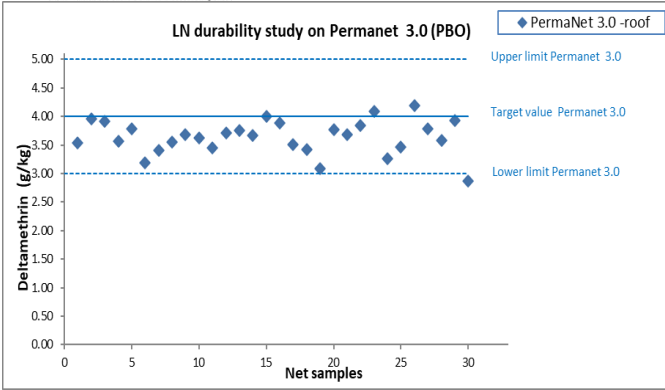
Chemical residue analysis: Thirty nets from each of the five brands were assessed as per protocol. The target amount of insecticide content for each brand depended on the Denier and insecticide being measured. The target dose for each brand and the proportion of nets that met the target are shown in the table below and thereafter the scatter plots for each brand contents.

Table 2 of the Proportion of nets that met or was within the chemical target boundary for each brand at baseline survey (N=30)

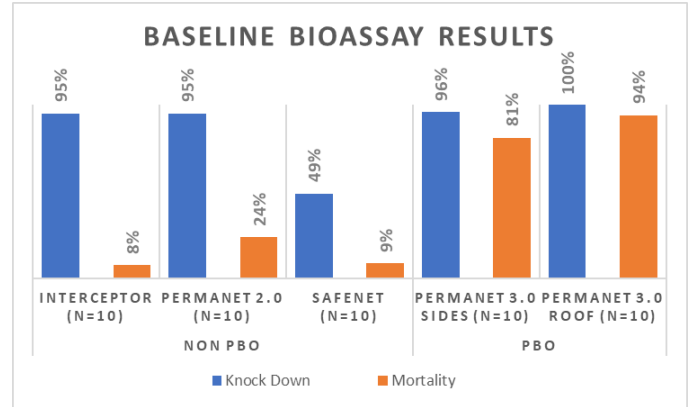
Brand	Insecticide	Percentage within target dose	Target dose for insecticide
Royal guard	Alpha-cypermethrin	100% (30/30)	5.0 g/kg \pm 25 % (3.8 g/kg – 6.3 g/kg)
Royal guard	pyriproxyfen	83% (25/30)	5.0 g/kg \pm 25 % for 150 (3.8 g/kg – 6.3 g/kg)
Permanet3.0 (Roof)	Deltamethrin	97% (29/30)	4.0 g/kg \pm 25 % (3.0 g/kg – 5.0 g/kg)
Permanet3.0 (sides)	Deltamethrin	80% (24/30)	2.1 g/kg \pm 25 % (1.6 g/kg – 2.6 g/kg)
Permanet3.0 (Roof)	Piperonyl Butoxide	50% (15/30)	25.0 g/kg \pm 25 % (18.8 g/kg – 31.3 g/kg)
Interceptor	Alpha-cypermethrin	67% (20/30)	5.0 g/kg \pm 25 % (3.8 g/kg – 6.3 g/kg)
Permanet 2.0	Deltamethrin	60% (18/30)	1.4 g/kg \pm 25 % for 100 (1.1 g/kg – 1.8 g/kg)
SafeNet	Alpha-cypermethrin	30% (9/30)	5.0 g/kg \pm 25 % (3.8 g/kg – 6.3 g/kg)

The scatter plot of the chemical performance of each net brand are given in the figure below.





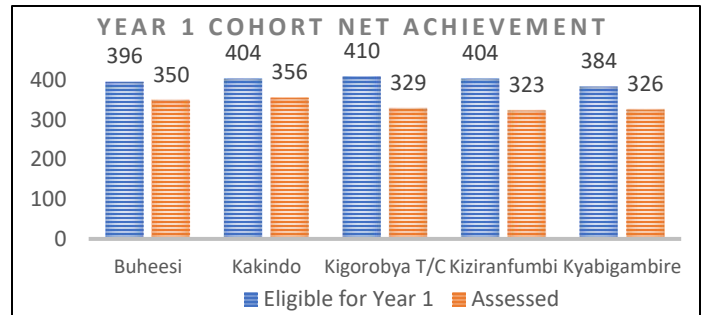
Bioassay analysis: The percentage knock down and mortality of mosquitoes exposed was assessed as protocol and results of non PBO nets of Interceptor, PermaNet 2.0 SafeNet brand and PBO net brand of PermaNet 3.0 are available as per the graph below .



**** The Royal Guard Bioassay results are not out**
The low mosquito mortality of the non PBO nets are strongly correlated with the chemical residue results content presented in table 2.

Summary of the 12 Month survey

Below is a summary of cohort nets assessed at 12 Month survey.



Plans for 2022

Data analysis for 12onth survey physical integrity, Bioassay and chemical residue analysis for 12 months survey. Conduct data collection for the 24 months survey. The 24 months / Year 2 survey is scheduled to happen between August to December 2022.

Overall, among the non PBO nets assessed, 44% couldn't reach the target value of the chemical content expected at baseline (0-6 months)