



**Partnership**  
To End Malaria

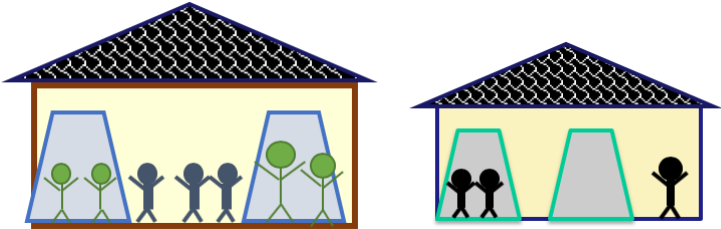
# Non-inferiority testing of long-lasting insecticidal nets through ambient chamber tests I-ACT

Sarah J Moore

Ifakara Health Institute and Swiss Tropical and Public Health Institute

# What matters when calculating the functional life of a net?

1. Attrition (access) and use

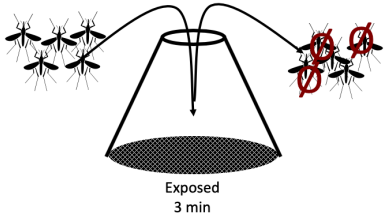


Koenker  
2019

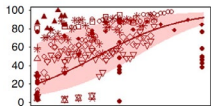
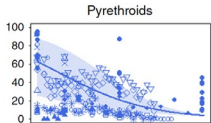
2. Damage



3. Bio-efficacy

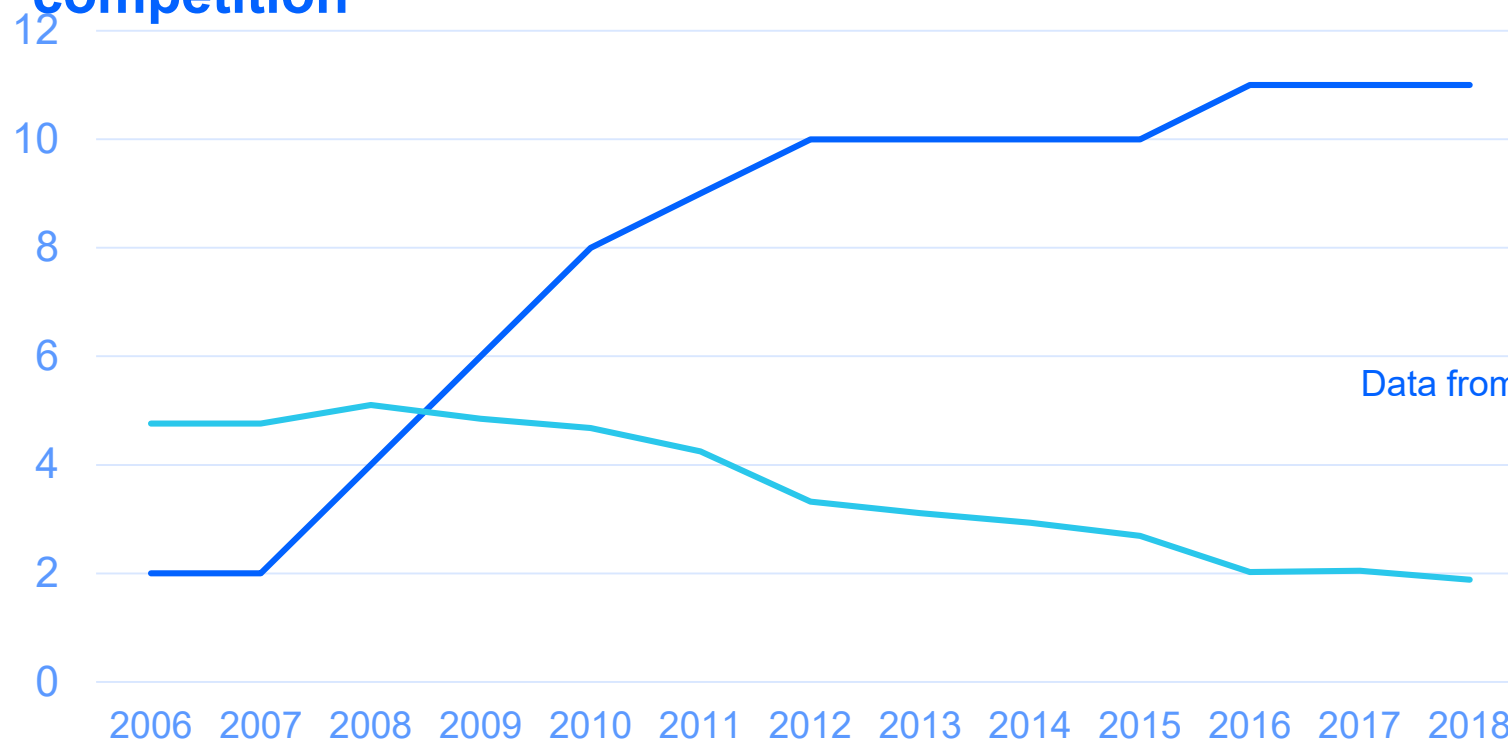


4. Chemical content



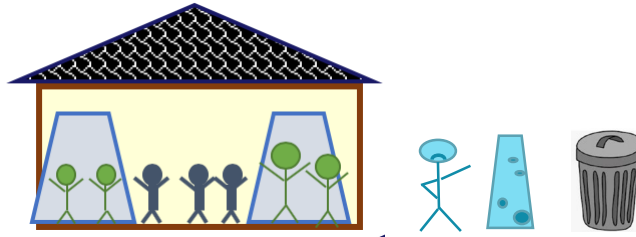
Sherrard-Smith 2018

## Procurement cost of LLINs is related to competition

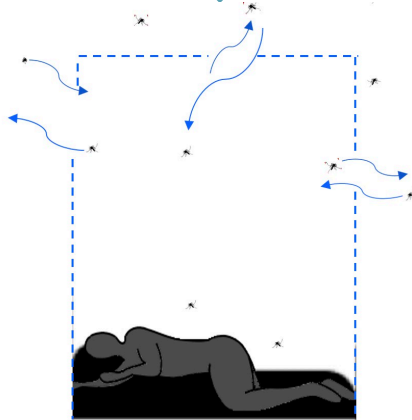


Data from UNICEF 2018

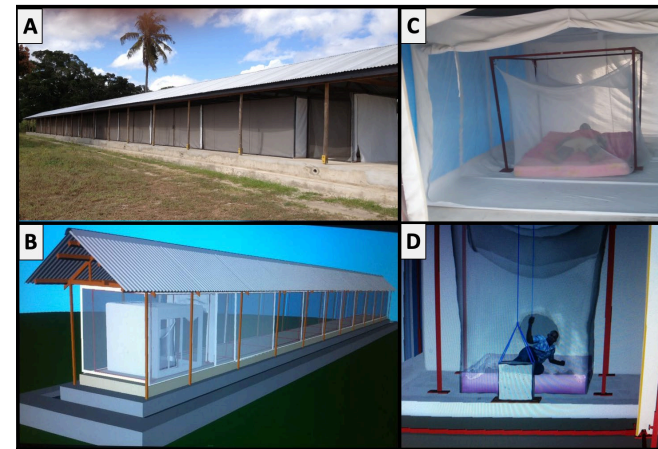
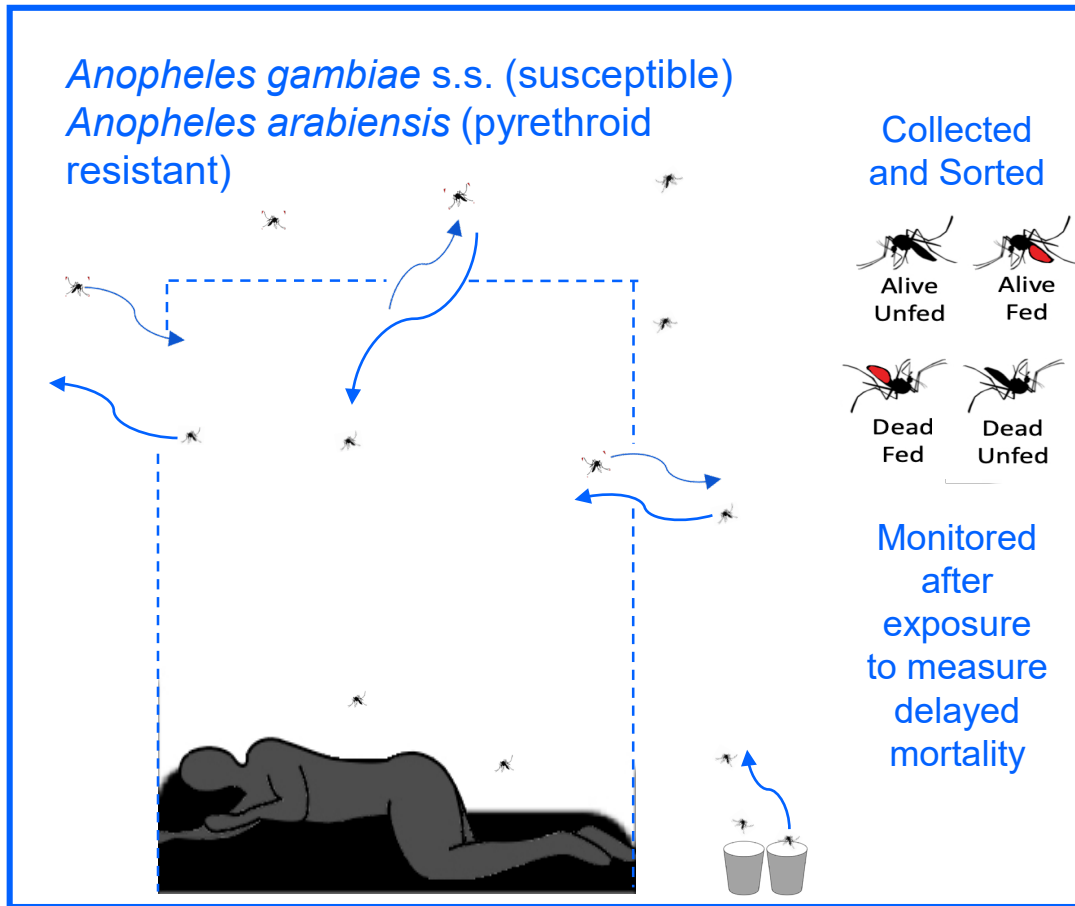
- Net brands on market
- median cost per net (USD)



Damage

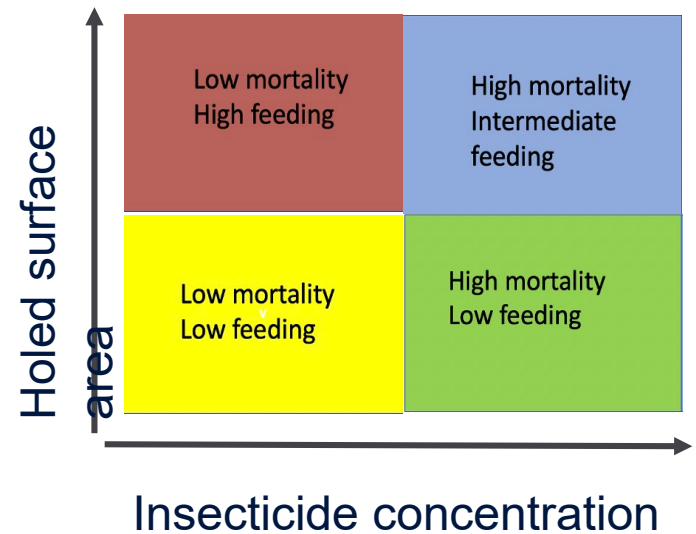
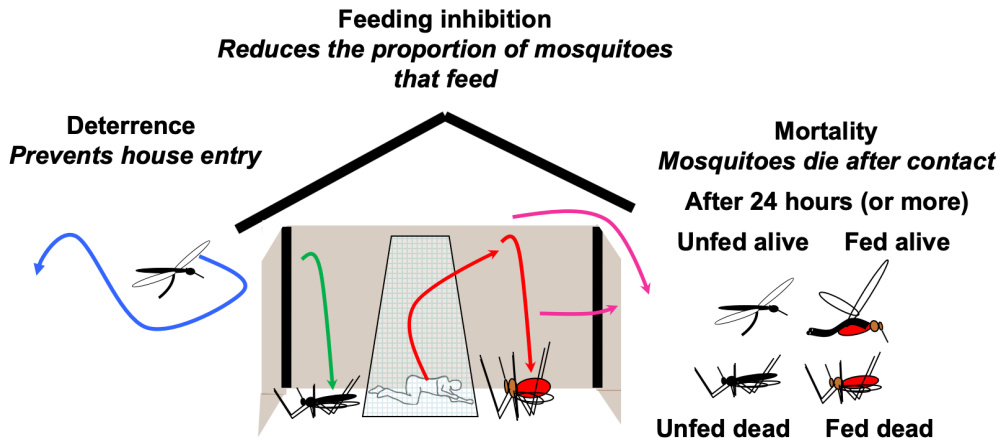


# Hole net tests

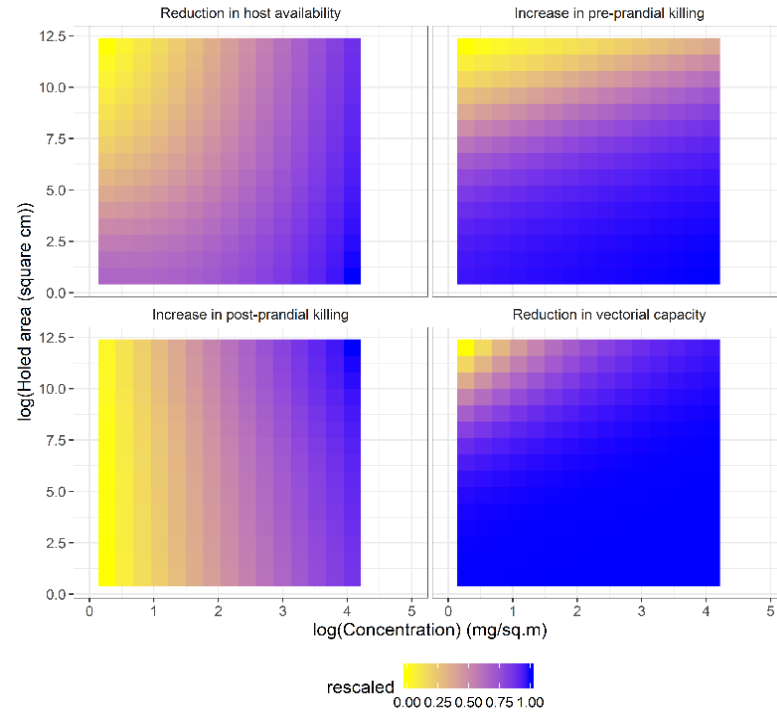
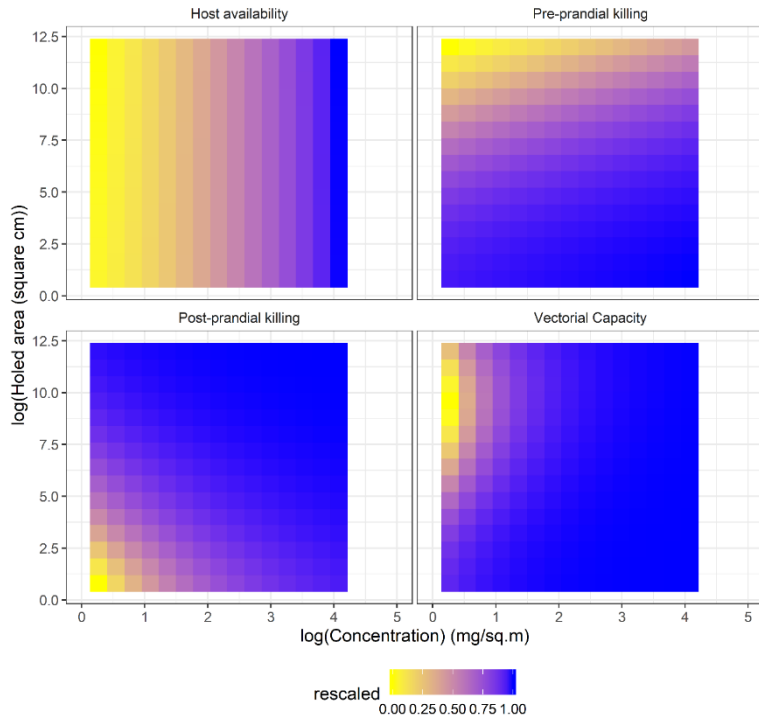


Okumu 2012 PLoS One  
Massue 2019 Mal J

# What do nets do to reduce malaria?



# Results summary

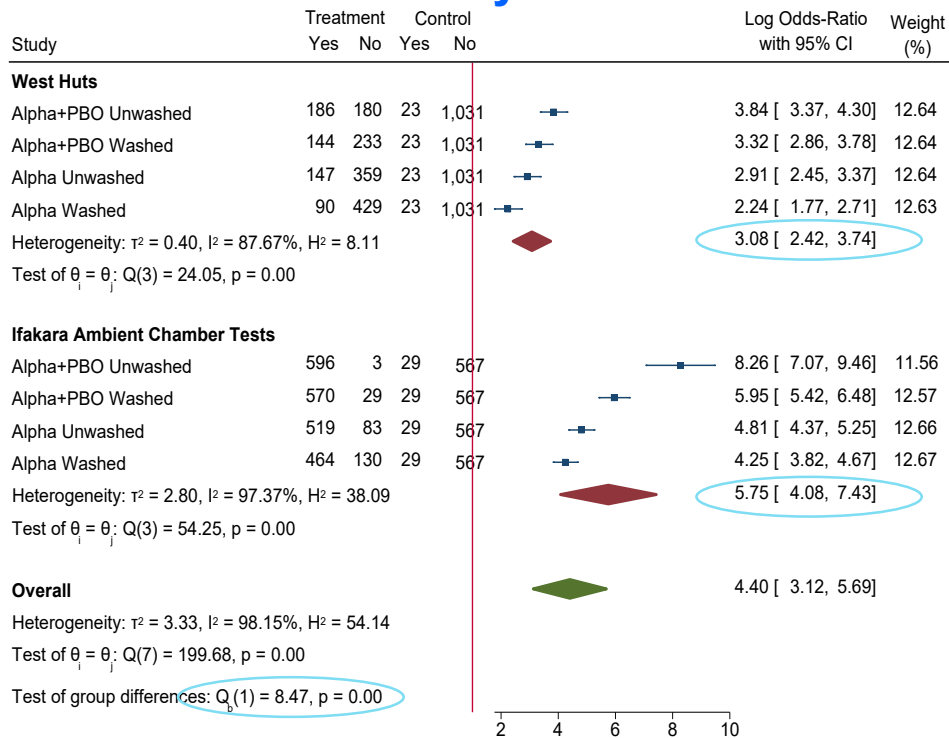


Estimates for humans using mosquito nets at complete coverage, with mosquitoes behaving like the susceptible colony (left) and resistant colony (right).

Blue corresponds to the highest value for each effect, and yellow to the lowest

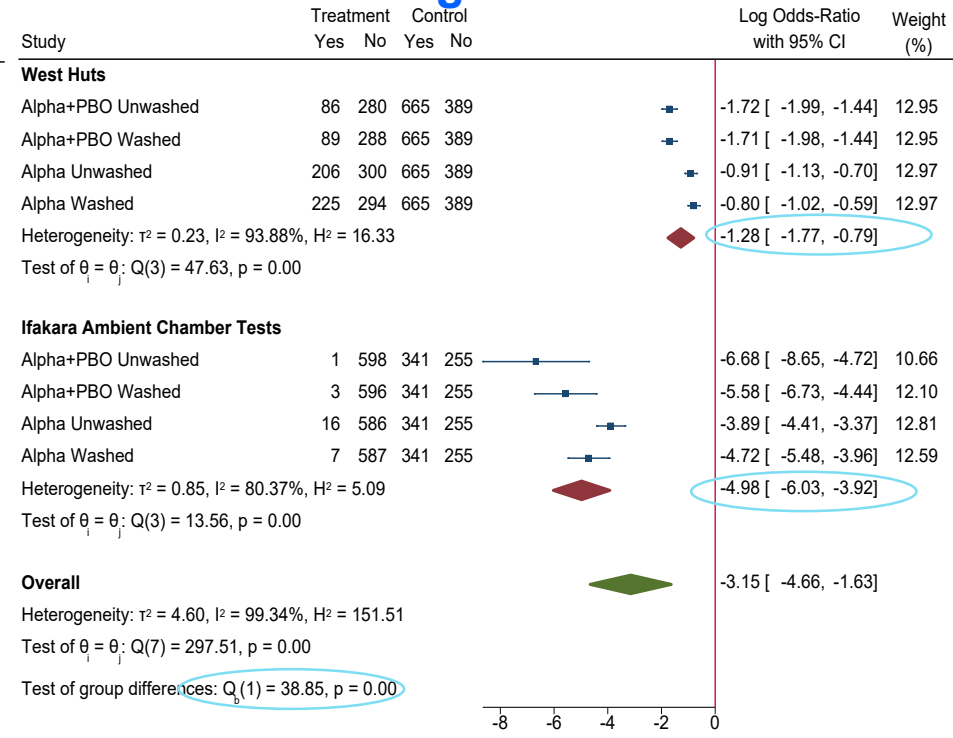
# IACT vs West African Huts PBO Nets

## Mortality



Random-effects REML model

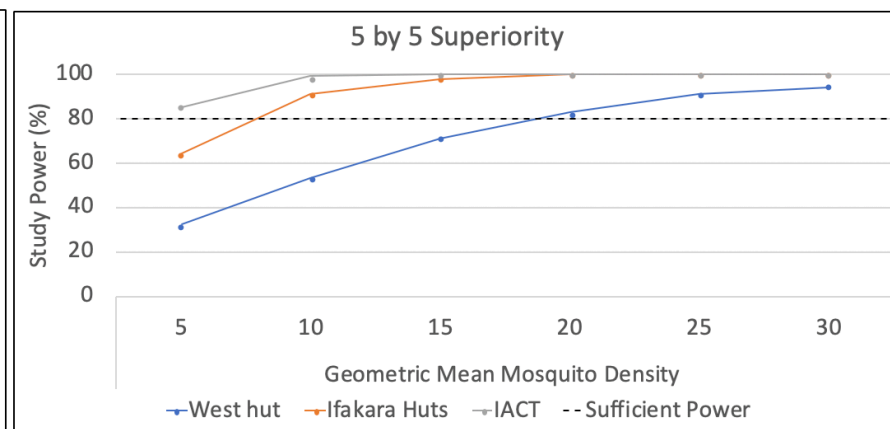
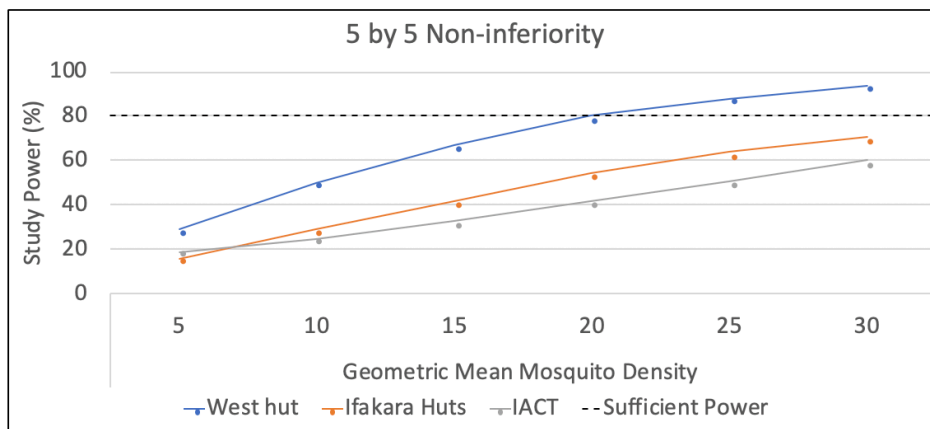
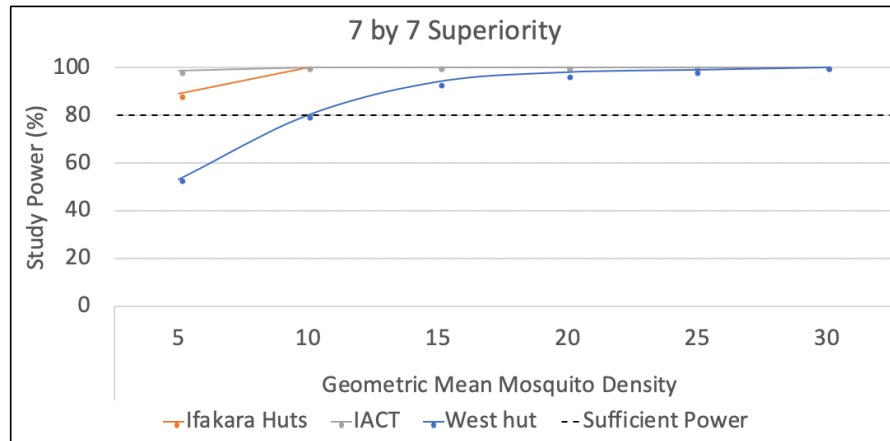
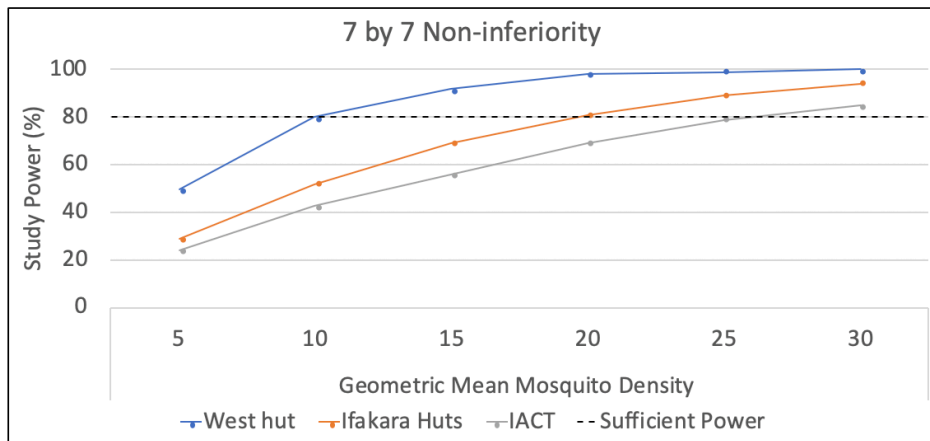
## Feeding Success



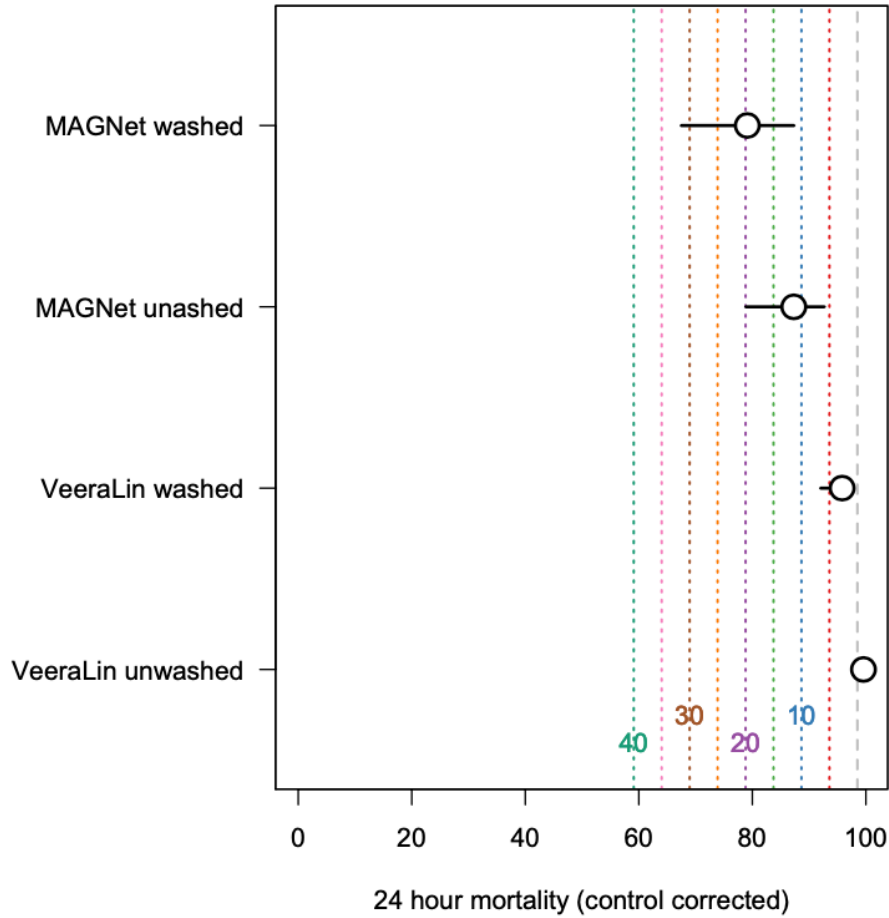
Random-effects REML model



To be sure that new candidate nets are truly no worse than those with demonstrated public health benefit, it is important to have adequate replication (sample size) because the less rigorously conducted the trial, the easier it can be to show non-inferiority due to large confidence intervals.

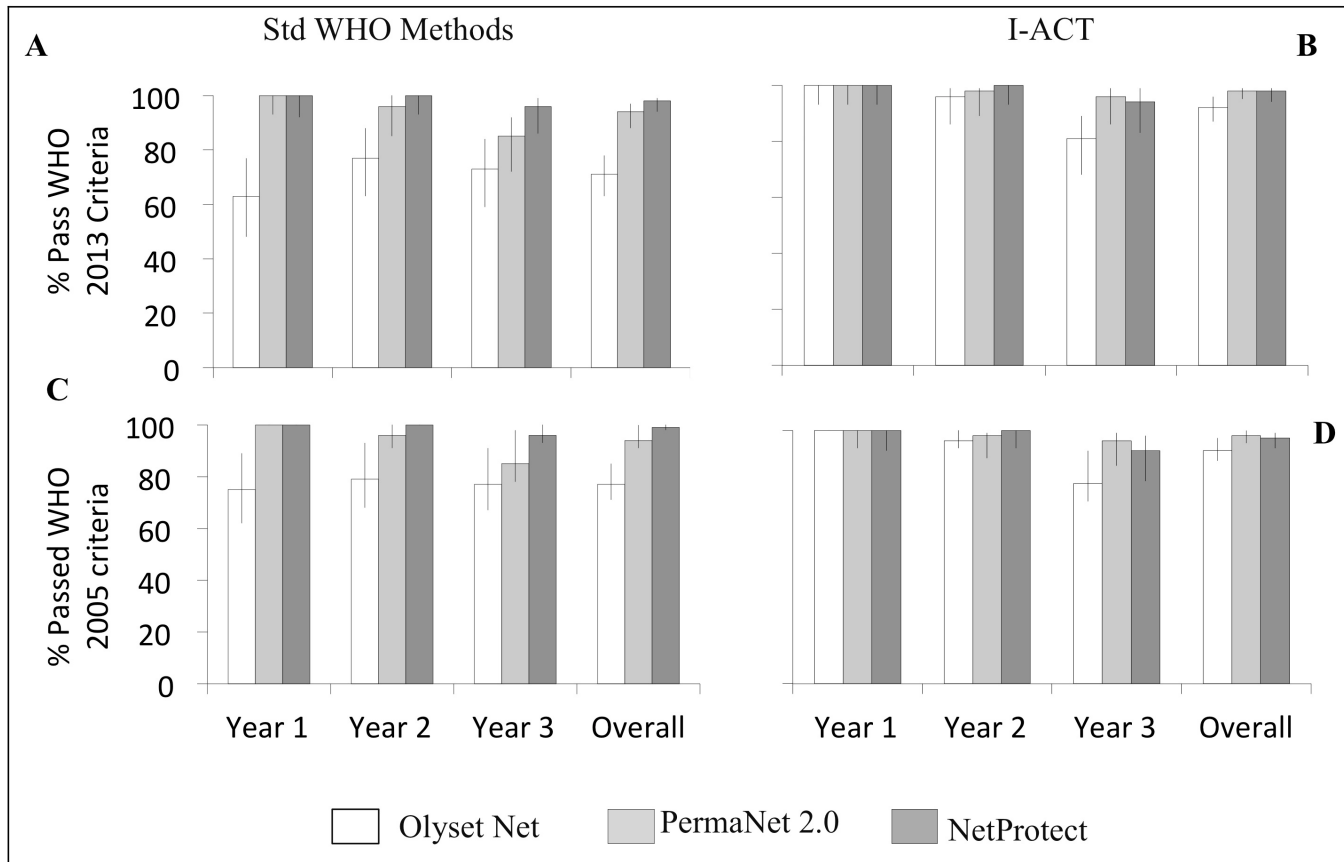


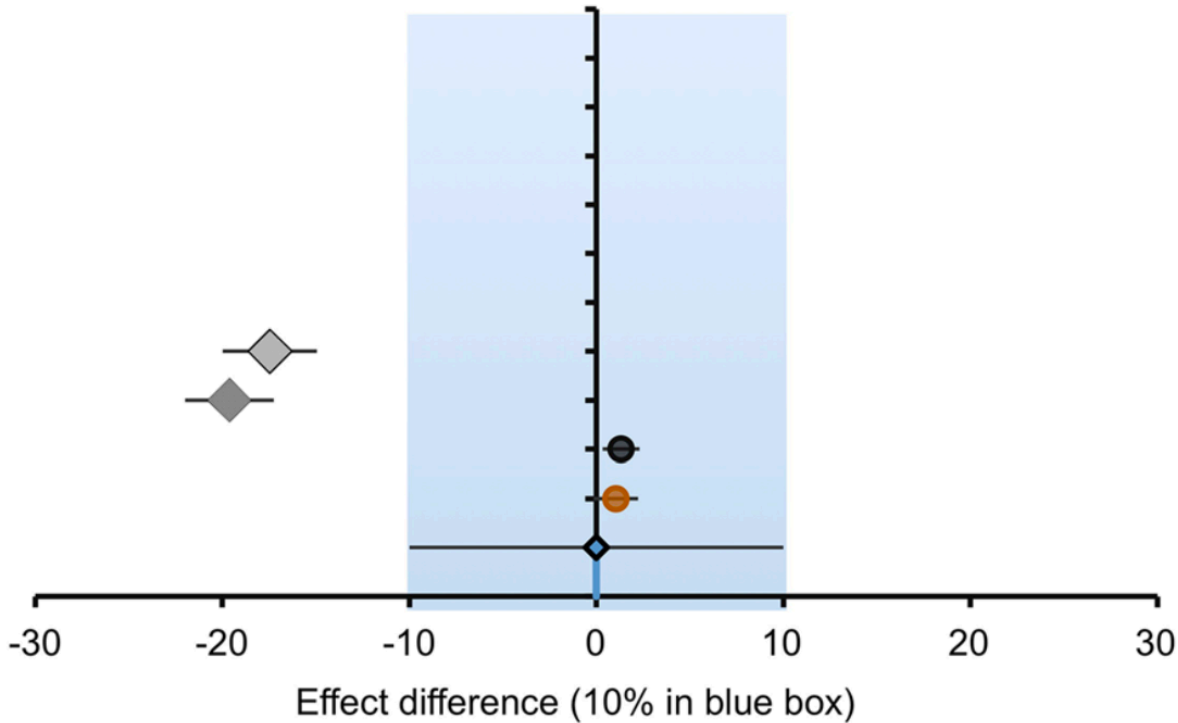
# IACT Superiority of PBO Nets for resistant strain (P450)



Data presented courtesy of VKA Polymers

# I-ACT compared to standard WHO methods





- ◆ PermaNet 2.0 Mortality
- ◆ NetProtect Mortality
- PermaNet 2.0 Feeding Inhibition
- NetProtect Feeding Inhibition

**Fig. 5** Non-inferiority of PermaNet 2.0 net and NetProtect combined 24 h mortality and feeding inhibition for 3 years of data with Olyset<sup>®</sup> as the reference performed in the I-ACT using a 10% margin of non-inferiority



Particular	WHO cone test	WHO Tunnel test	Ifakara Ambient Chamber test (IACT)
Endpoints measured	Knock down mortality (KD 60) 24 hour mortality	24 hour mortality Feeding inhibition	24 hour mortality Feeding inhibition Reproductive inhibition
Bait Used	No	Rabbit, guinea pig	Human
Circadian rhythm	Day	Night	Night
Mosquito flight	No	Yes	Yes
Mosquitoes per net	80	100	30
Exposure time	3 minutes	12-15 hours	12 hours
Holding time	24 hours	None	24 hours
Time to conduct including preparation	25 hours	16 hours	26 hours
Surface area exposed to mosquitoes	78cm <sup>2</sup>	625cm <sup>2</sup>	Whole net
Useful for durability monitoring	Measures presence of insecticide	Measures mortality and feeding inhibition on section of net	Measures the functional efficacy of nets under user conditions

## Results summary the impact of Pyriproxyfen

	Net Type	No. of washes	No. BF	No. BF alive at 24 hrs	No. BF alive at 72 hrs	No. (%) laid eggs	Total eggs	Mean eggs per female	Total larvae	Mean larvae per female	Mean (%) Eggs hatched	% redn in fecundity
Susceptible	Control	0	667	633	559	559 (100)	12,067	35.3	11,739	21.0	97.3	
	PPF net	0	91	24	20	14 (70)	95	19.0	65	4.6	68.4	99.39
		20	115	30	29	4 (14)	337	112.3	252	63.0	74.8	97.65
Resistant	Control	0	696	660	598	598 (100)	13,063	31.18	11,913	20	91.2	
	PPF net	0	276	233	212	101	462	21.39	357	3.5	77.3	97
		20	340	275	239	195	1,598	12.67	1,141	5.6	71.4	90.4

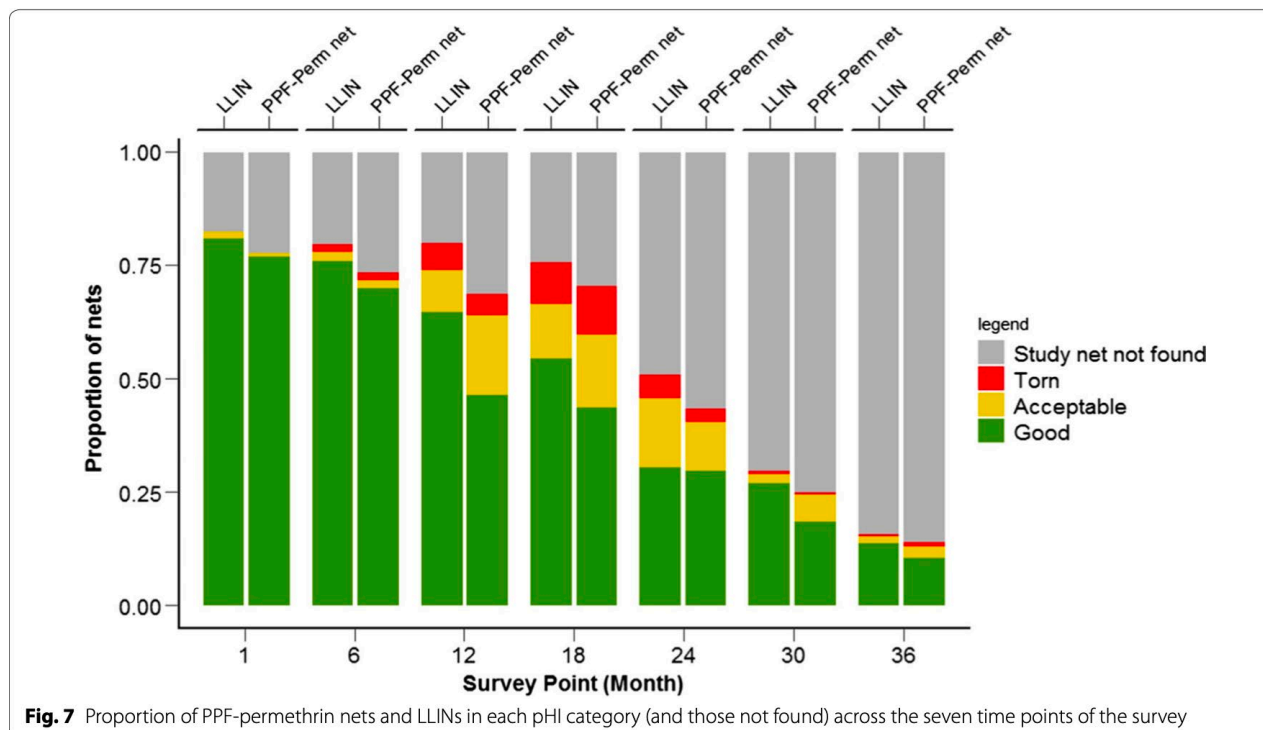
RESEARCH

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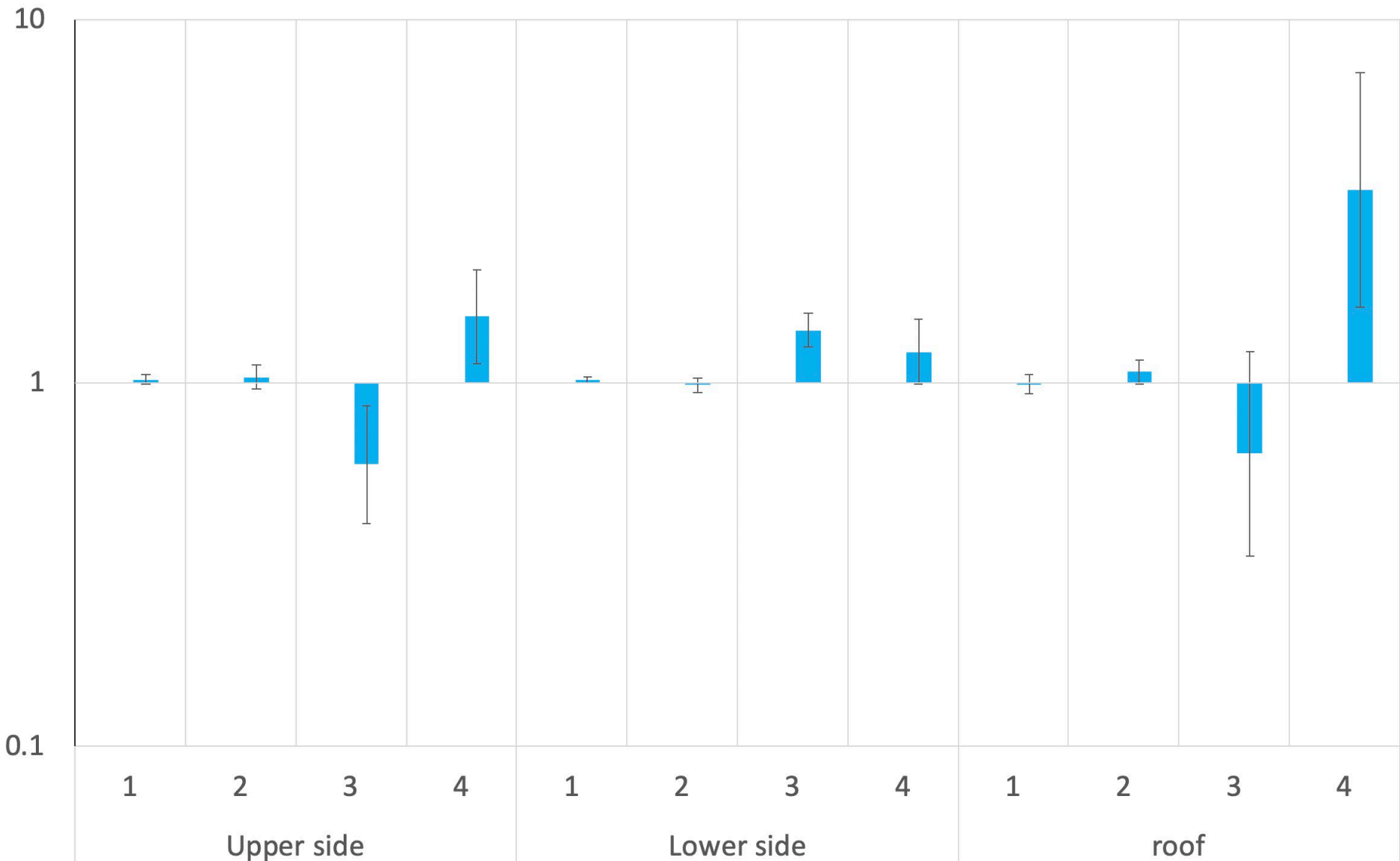
# Assessing the impact of the addition of pyriproxyfen on the durability of permethrin-treated bed nets in Burkina Faso: a compound-randomized controlled trial

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**Fig. 7** Proportion of PPF-permethrin nets and LLINs in each pHI category (and those not found) across the seven time points of the survey

# Survival of feeding adjusted for hole size and location *An. gambiae* s.s. susceptible



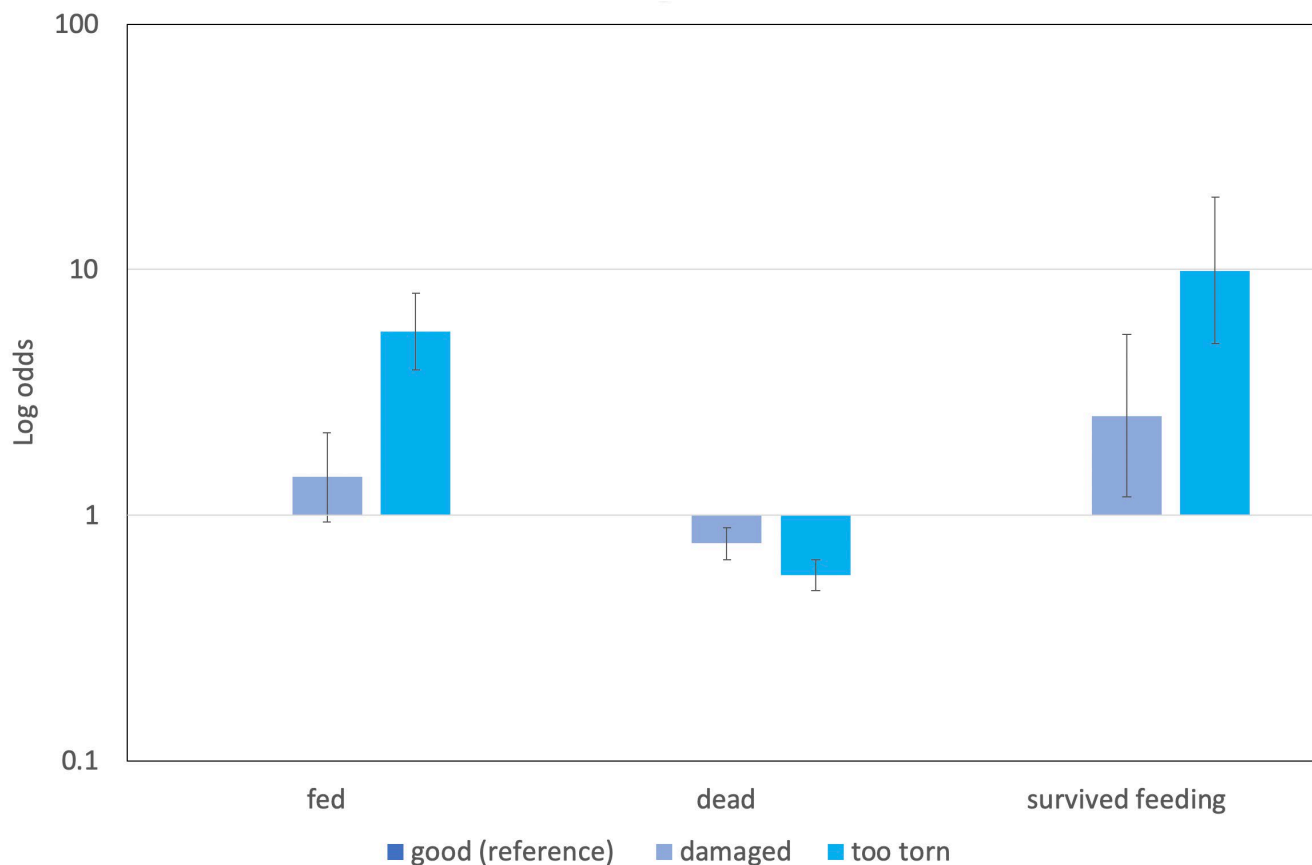


# Estimating functional survival of long-lasting insecticidal nets from field aged nets

**Table 1:** Suggested categorization of proportionate Hole Index data

Category	pHI value range	Approximate total hole surface area in cm <sup>2</sup>	
		If circle*	If rectangular*
Good	0-64	<79	<100
Damaged	65-642	80-789	100-1,000
Too torn	643+	>790	>1,000

\*refers to the assumed functional shape of the hole



Swiss TPH 

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- Tom Smith

# The team



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- Dennis Massue



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- Jo Lines
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MERCI, ASANTE SANA,  
 THANK YOU