Validation of Ifakara Ambient Chamber Test

PAMCA Annual Meeting 2023 Symposium 14 ID488

Dr Sarah J Moore

Outline

- What is the Ifakara Ambient Chamber Test (I-ACT)?
- Example from the Global Fund sponsored studies of PBO Insecticide treated nets (ITN)
  - Comparison against experimental hut data
  - Repeatability
- Conclusions & next steps

Why validate?

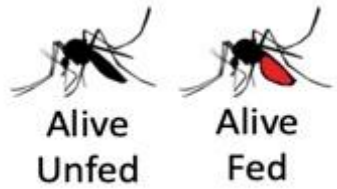A laboratory is required to carry out validation when:

i. it has designed or developed a new method ✓

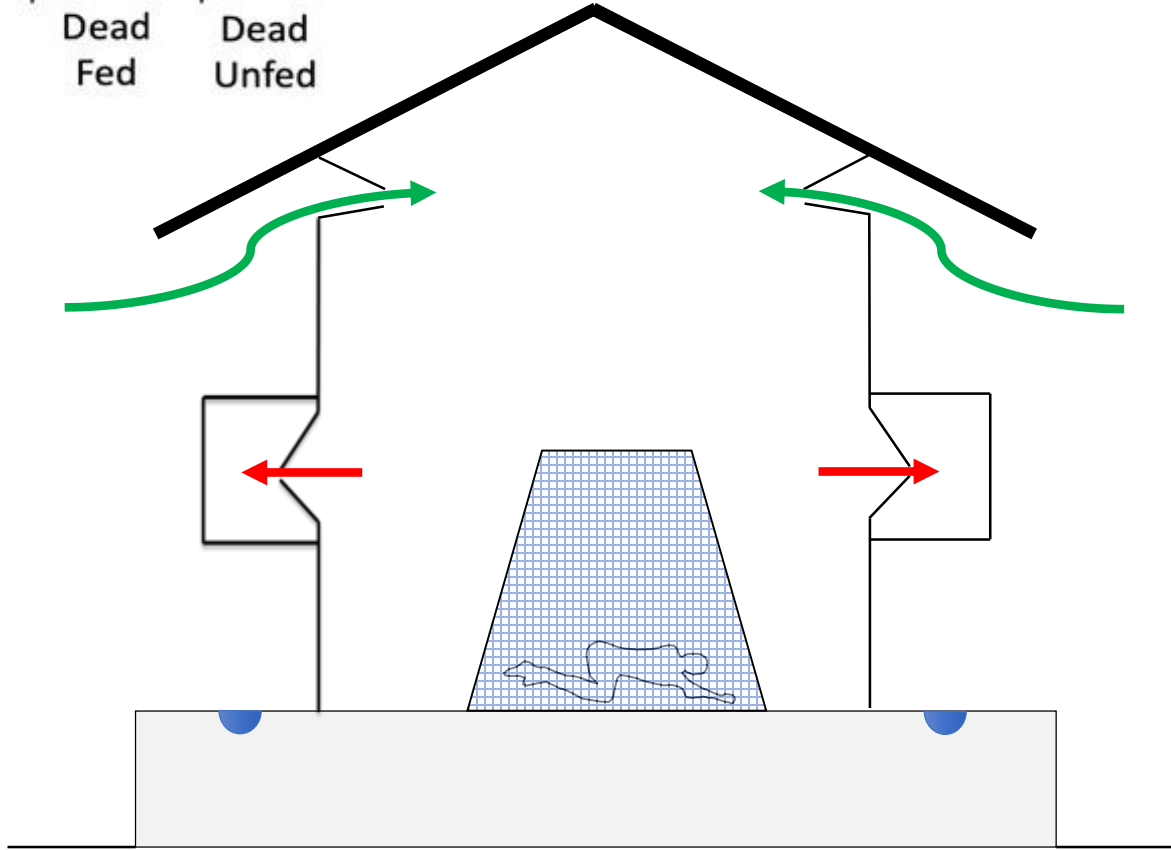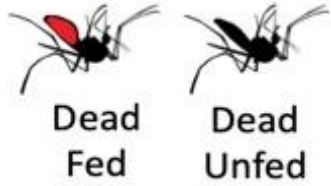ii. needs to demonstrate comparability between a new vs standard method ✓

iii. A standard method has been modified
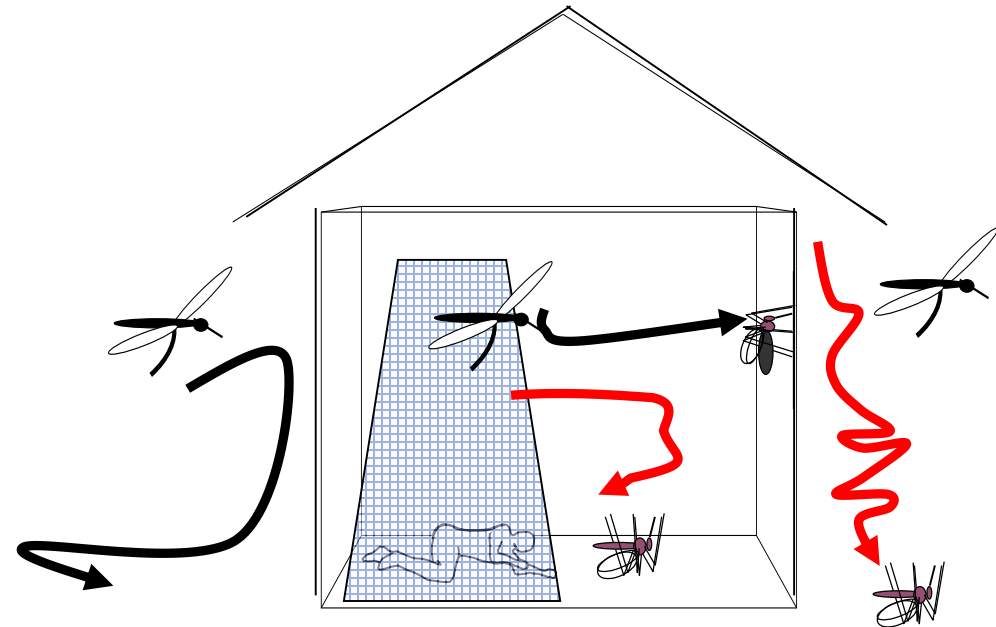
Matope et al Mal J *in press*

PRIMARY ENDPOINTS
1. Proportion of mosquitoes dead after 24 (+) hours
2. Proportion of mosquitoes blood-fed

SECONDARY ENDPOINTS
1. Deterrence
2. Induced exophily
3. Personal protection

Alive Unfed
Alive Fed
Dead Fed
Dead Unfed

4

ITN evaluation in I-ACT
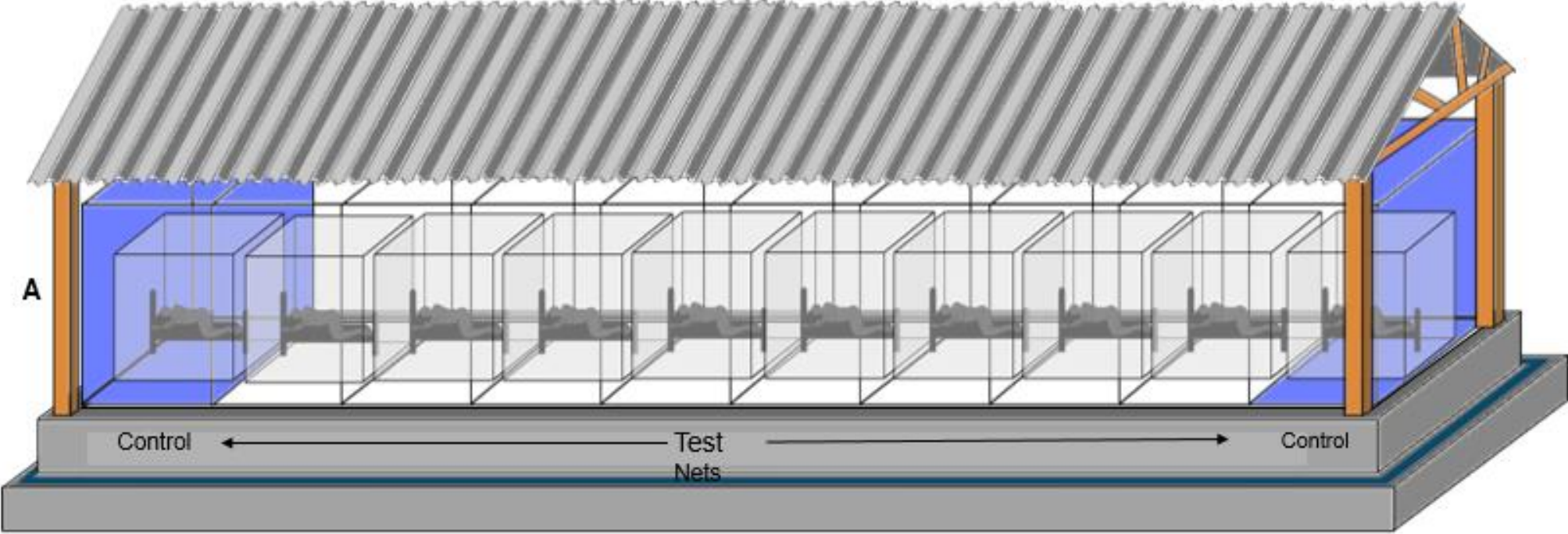
Non inferiority trials were conducted of all PBO ITNs in Mbe and Ifakara

The study arms were as follows:

1. Untreated net (control)
2. Olyset Plus unwashed (reference LN)
3. Olyset Plus washed 20x (reference washed LN)
4. PermaNet 3.0 unwashed
5. PermaNet 3.0 washed 20x
6. VEERALIN LN unwashed
7. VEERALIN LN washed 20x
8. Tsara Boost unwashed
9. Tsara Boost washed 20x
10. Olyset Net LN (standard pyrethroid, positive control) unwashed
11. Olyset Net LN washed 20x

Courtesy of Dr Raphael N'Guessan

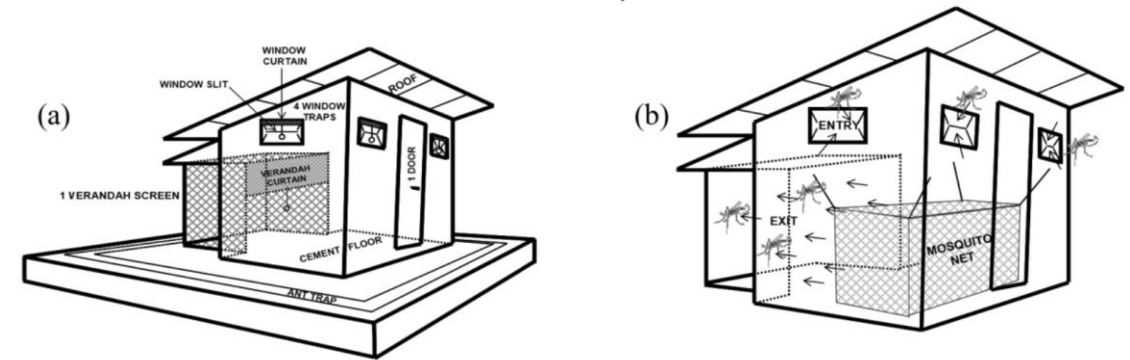R. N'Guessan et al.   July 2021

Figure 2. (a) Design of experimental hut; (b) Schematic of mosquito movement in hut

The same nets were evaluated in IACT

	I-ACT	Ifakara	Mbe
Arms*	12	12	11
Nights	54	36	132
Observations / arm	106	72	132
Power	>90%	90%	89%
Mosquitoes entering	15	21	10
Variation between huts	0.00	0.15	0.01
Variation between sleepers	0.03	0.01	0.04
Variation between observations	0.45	1.0	0.43

* 2 control arms were run

Data on variability courtesy of: 1) huts Joe Challenger 2) IACT Olukayode Odufuwa

Mortality point estimates vary by location and assay – patterns the same in Mbe, Ifakara and I-ACT

Comparing data from the two trials - Mortality
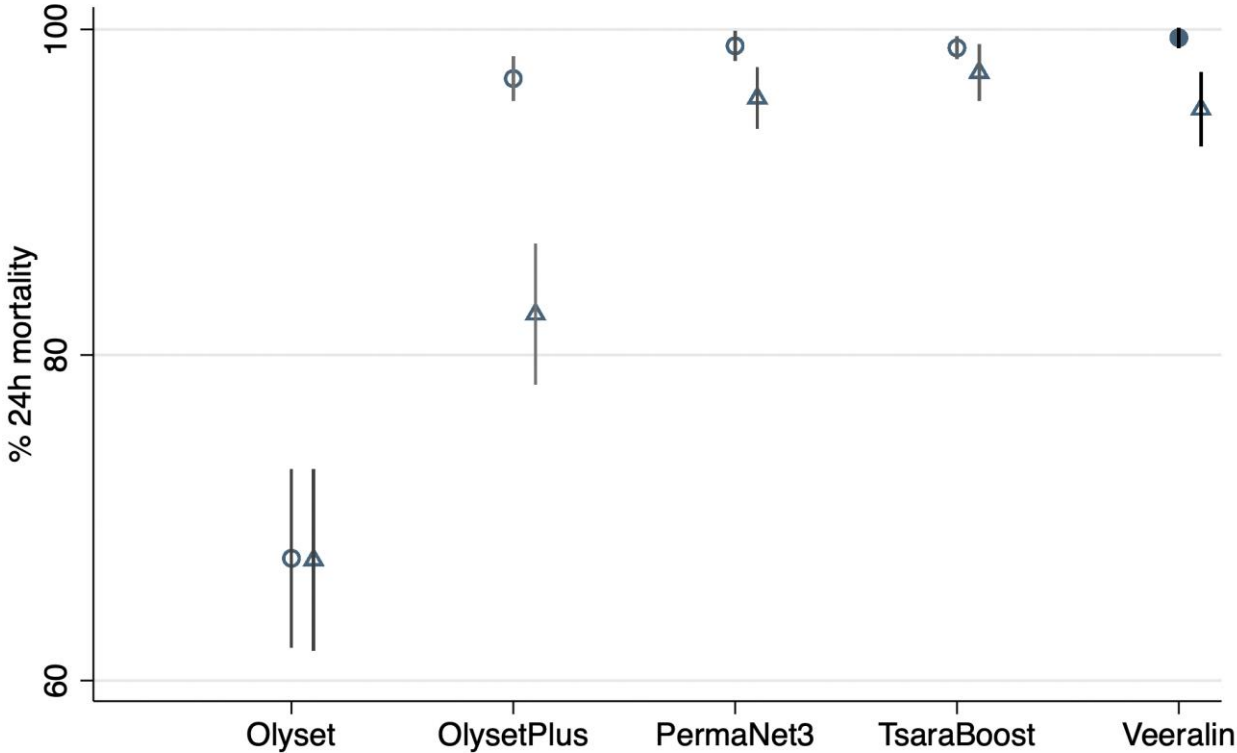
Trial: MBe, Ifakara; Unwashed, 20 Washes
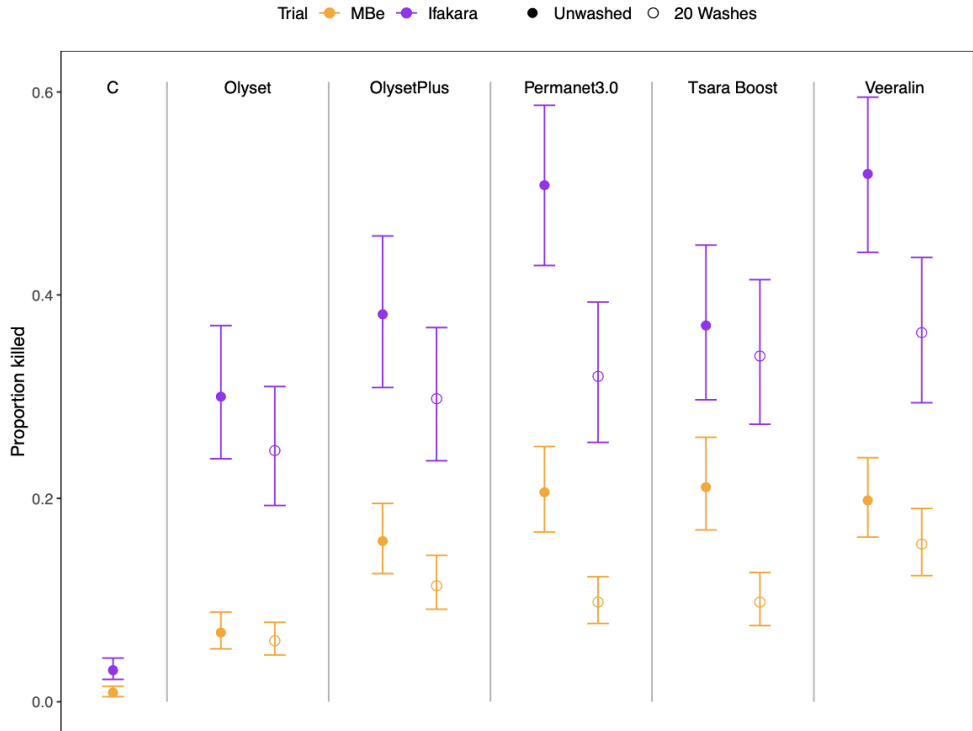
IACT - Mortality

Courtesy of Dr Joe Challenger

Blood feeding estimates vary by location and assay – patterns the same in Mbe, Ifakara and I-ACT
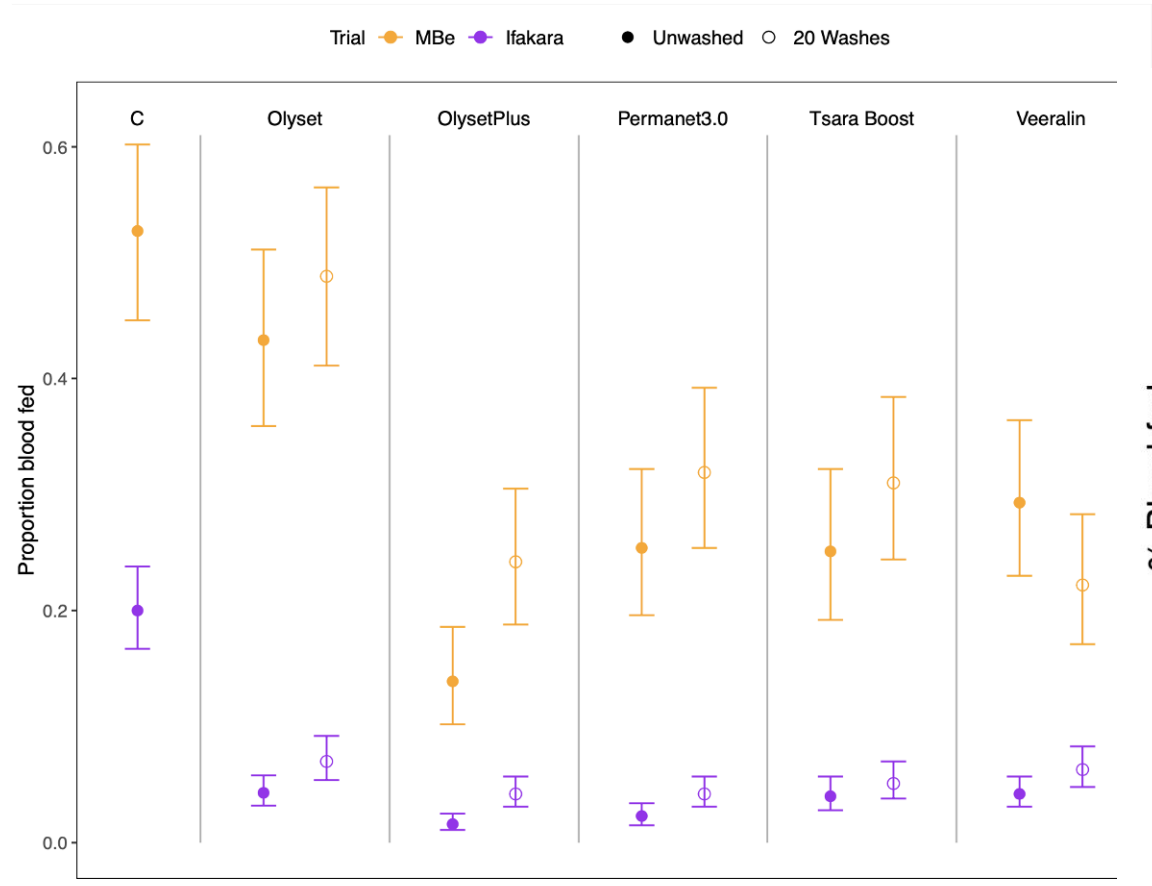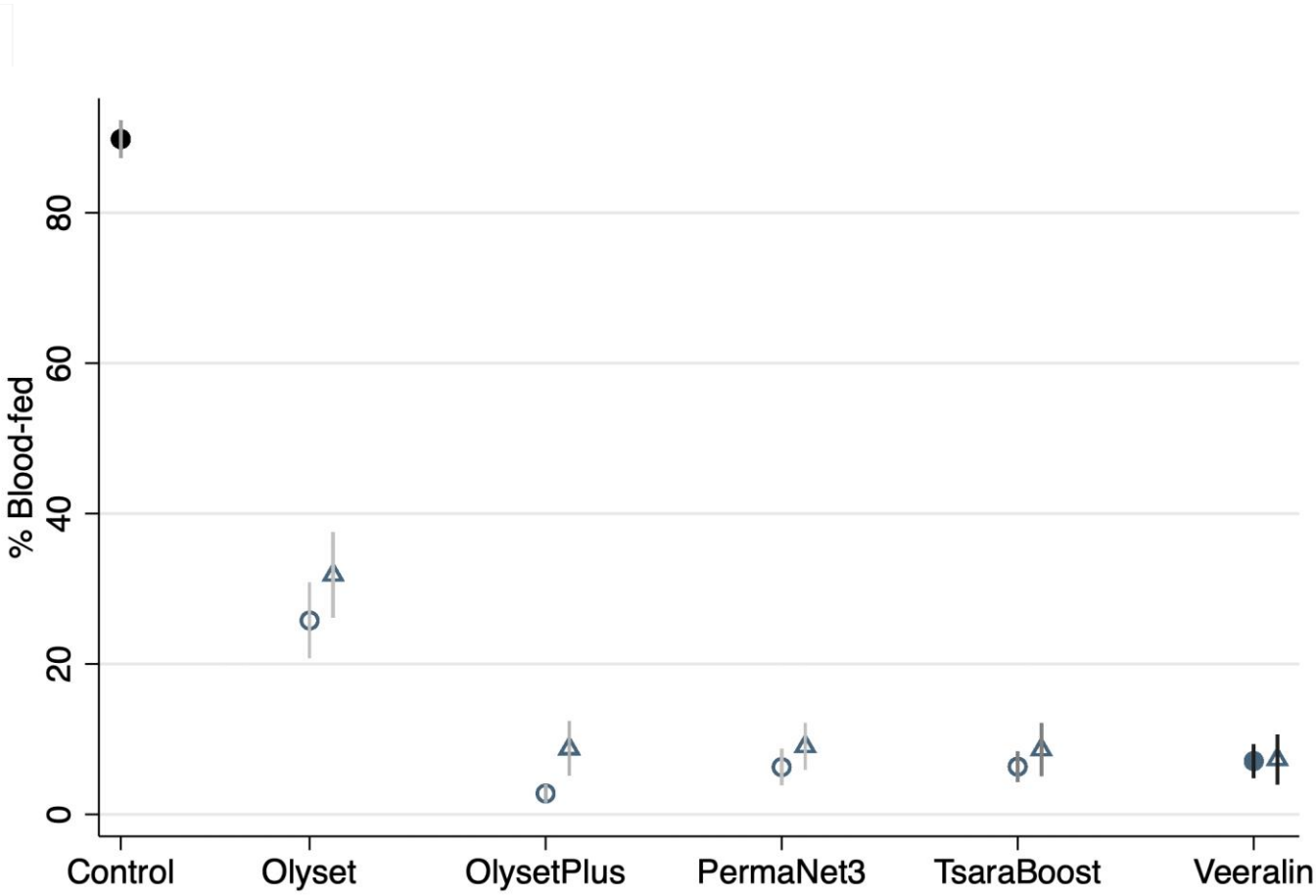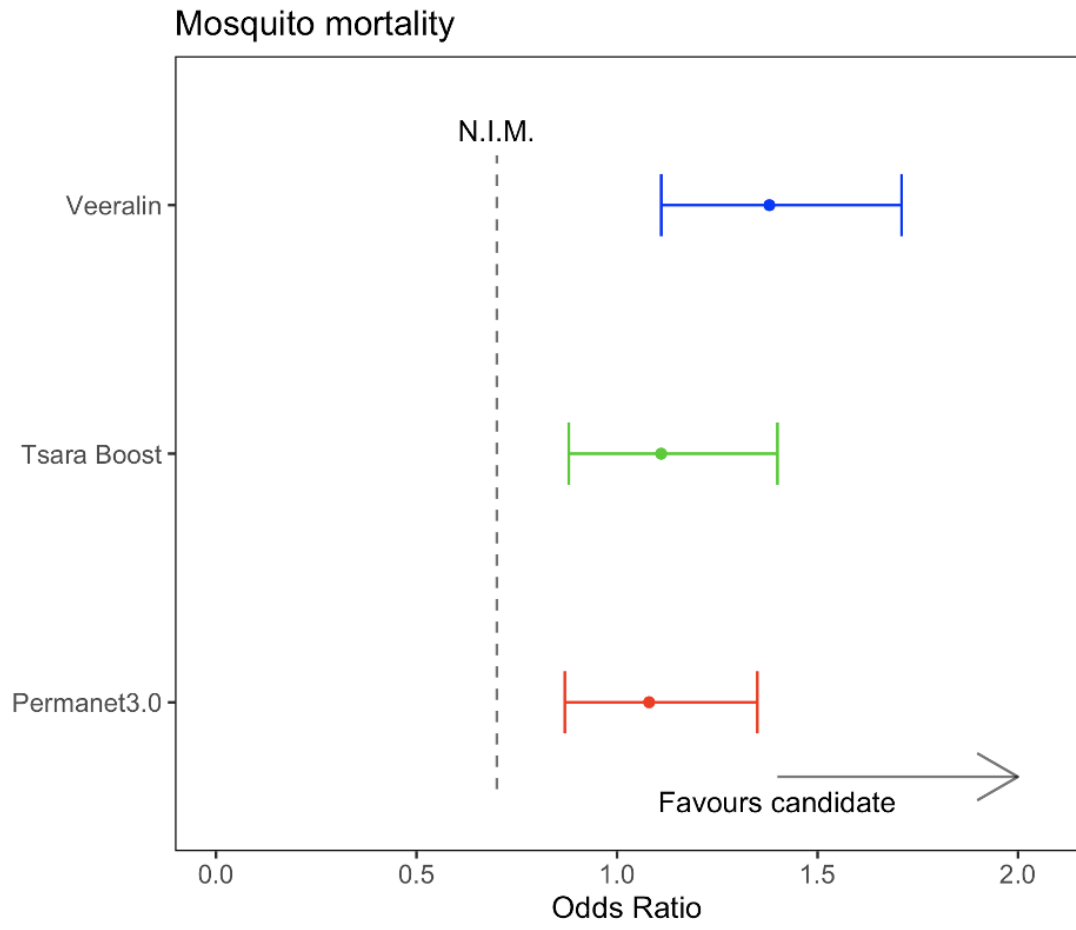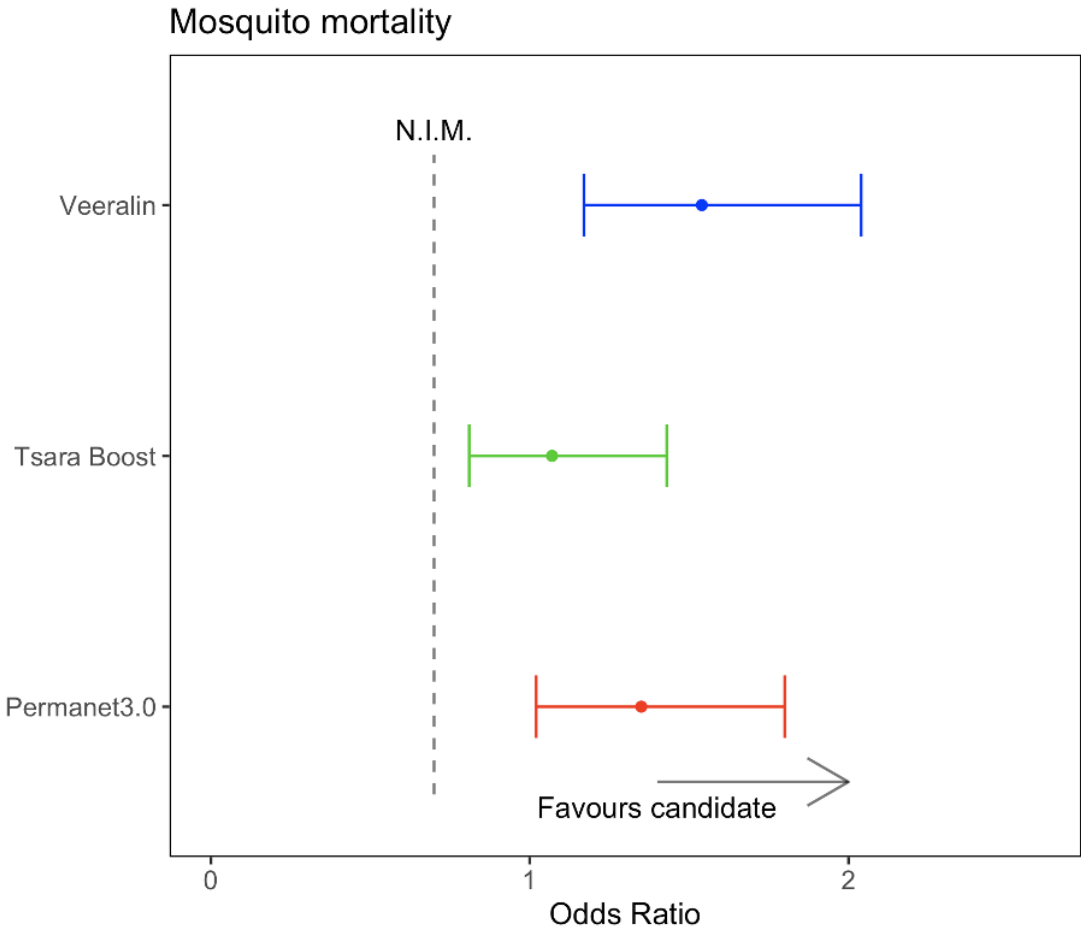

Courtesy of Dr Joe Challenger

Relative Mortality – similar at hut sites

Ifakara Non-Inferiority Assessment (Mortality - Combined)

MBe Non-Inferiority Assessment (Mortality - Combined)

Courtesy of Dr Joe Challenger

Relative mortality patterns from West African, Ifakara huts and I-ACT – same decision reached

Reference Olyset Plus
24 hour mortality

AI	Type	Treatment %M24	Reference %M24		OR (95% CI)	difference point estimate
PermaNet 3.0	HUT TZ	45.5	37.5		1.41 (1.11, 1.79)	8
PermaNet 3.0	HUT IC	15.2	13.6		1.10 (0.90, 1.35)	1.6
PermaNet 3.0	IACT TZ	97.3	89.75		1.99 (1.60, 2.47)	7.55
TsaraBoost	HUT TZ	40.5	37.5		1.17 (0.92, 1.49)	3
TsaraBoost	HUT IC	15.45	13.6		1.10 (0.90, 1.41)	1.85
TsaraBoost	IACT TZ	98.15	89.75		2.21 (1.77, 2.76)	8.4
Veeralin	HUT TZ	48.5	37.5		1.56 (1.23, 1.97)	11
Veeralin	HUT IC	17.65	13.6		1.30 (1.10, 1.60)	4.05
Veeralin	IACT TZ	97.4	89.75		2.03 (1.63, 2.52)	7.65

.5 .7 1.5 3

Favours candidate

Repeatability: mortality point estimates vary slightly by year – patterns the same in Ifakara huts and I-ACT – same decision reached

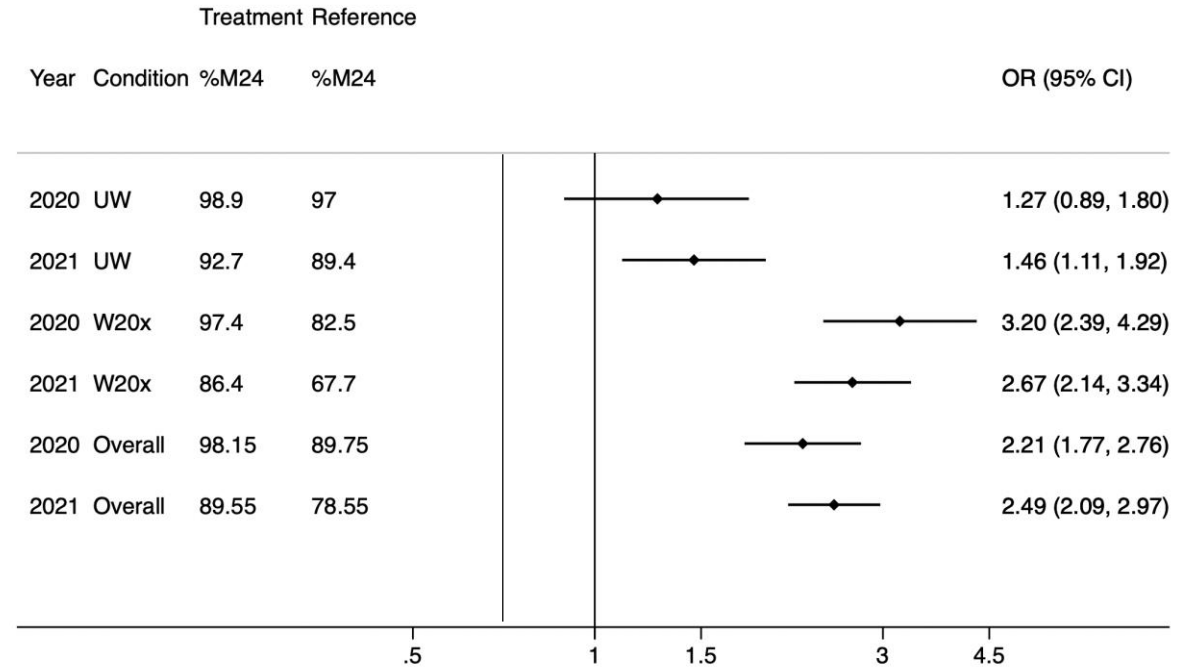## Tsara Boost vs Olyset® Plus
24 hour mortality HUT

		Treatment	Reference	
Year	Condition	%M24	%M24	OR (95% CI)
2020	UW	43	42	1.05 (0.74, 1.49)
2021	UW	50.7	44	1.59 (1.45, 1.75)
2020	W20x	38	33	1.29 (0.93, 1.80)
2021	W20x	34.5	32.8	1.13 (1.05, 1.23)
2020	Overall	40.5	37.5	1.17 (0.92, 1.49)
2021	Overall	42.6	38.4	1.21 (1.14, 1.28)

Tsara Boost vs Olyset® Plus
24 hour mortality IACT

		Treatment	Reference	
Year	Condition	%M24	%M24	OR (95% CI)
2020	UW	98.9	97	1.27 (0.89, 1.80)
2021	UW	92.7	89.4	1.46 (1.11, 1.92)
2020	W20x	97.4	82.5	3.20 (2.39, 4.29)
2021	W20x	86.4	67.7	2.67 (2.14, 3.34)
2020	Overall	98.15	89.75	2.21 (1.77, 2.76)
2021	Overall	89.55	78.55	2.49 (2.09, 2.97)

Published IACT validations

- Agreement between WHO tunnel, experimental hut and I-ACT for Interceptor and Interceptor G2

- Agreement between WHO bioassay methods and I-ACT for field aged pyrethroid nets

Parasites & Vectors

Malaria Journal

RESEARCH   **Open Access**

Influence of testing modality on bioefficacy for the evaluation of Interceptor® G2 mosquito nets to combat malaria mosquitoes in Tanzania

Ummi Abdul Kibondo[1*], Olukayode G. Odufuwa[1,2,3], Saphina H. Ngonyani[1], Ahmadi B. Mpelepele[1], Issaya Matanilla[1], Hassan Ngonyani[1], Noel O. Makungwa[1], Antony P. Mseka[1], Kyeba Swai[1,2], Watson Ntabaliba[1], Susanne Stutz[4], James W. Austin[5] and Sarah Jane Moore[1,2,6,7]

METHODOLOGY   **Open Access**

Comparing the new Ifakara Ambient Chamber Test with WHO cone and tunnel tests for bioefficacy and non-inferiority testing of insecticide-treated nets

Dennis J. Massue[1,2,3,4*], Lena M. Lorenz[5], Jason D. Moore[1,2,4], Watson S. Ntabaliba[4], Samuel Ackerman[4], Zawadi M. Mboma[4,5], William N. Kisinza[3], Emmanuel Mbuba[4], Selemani Mmbaga[4], John Bradley[6], Hans J. Overgaard[7] and Sarah J. Moore[1,2,4]

Conclusion

I-ACT shows reproducibility from internal validation

I-ACT conclusions matched those from hut trials in two locations

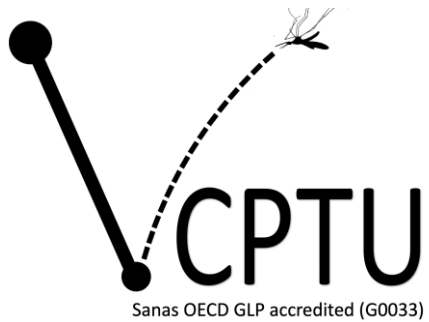Measures precisely

Lower heterogeneity than hut trials

Needs validation in other locations

Next validation will be in Papua New Guinea

SOP: Ifakara Ambient Chamber Test (I-ACT)

August 2023

Study team

- Sarah Moore (Study director) smoore@ihi.or.tz
- Amanda Ross (Statistician on ITN study)
- **Olukayode Odufuwa** (Study Investigator)
- **Ummi Kibondo** (Study Investigator)
- **Emma Mbuba** (GLP Coordinator/Study Investigator)
- **Kyeba Swai** (Study Investigator)
- Jason Moore (Test facility manager)
- Rose Philipo (Project manager)
- Alwisa Urassa (Quality assurance)
- Hassan Ngonyani (Field testing)
- Safina Ngonyani (Laboratory testing)

Thanks to those providing data, figures and statistical advice

John Bradley (LSHTM)
Raphael N'guessan (LSHTM)
Joe Challenger (Imperial College)
Tom Churcher (Imperial College)

Swiss TPH
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CPTU
Sanas OECD GLP accredited (G0033)