



Meta-analysis on the effects of differentially treated ITNs in a multi-site experimental hut study

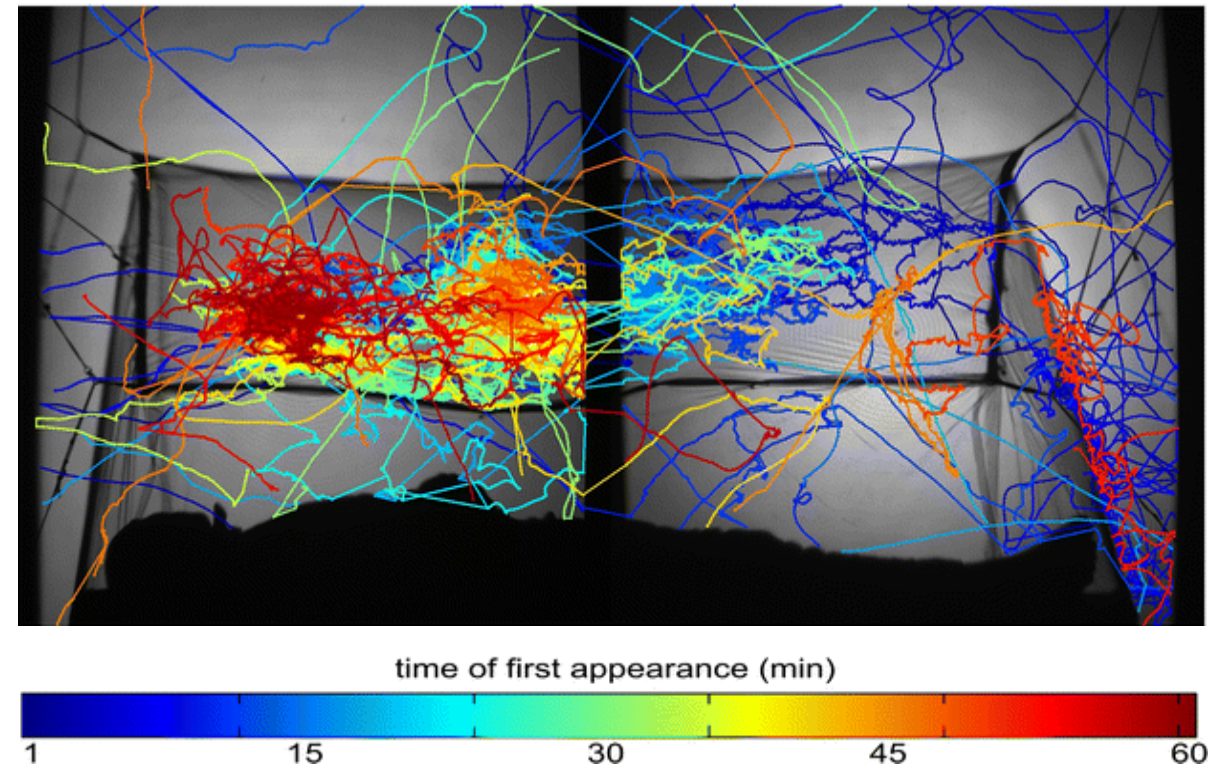
VCWG - Kigali

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Hybrid ITN concept

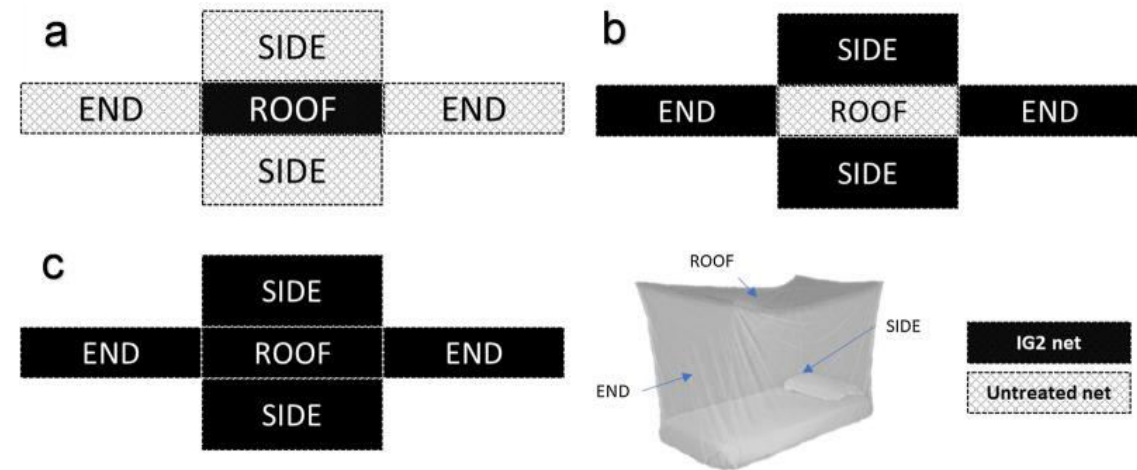
- Anopheles mosquitoes concentrate flight activity around key areas of a bednet, such as the roof panel
- This is likely due to CO₂, odour and heat convection plumes radiating from the host
- Little activity is observed at the sides of the net, where nets are more likely to be damaged
- Options to exploit this mosquito behaviour
 - “Smart patch”
 - Barrier nets (Murray et al 2020)
 - Differing roof panels (PermaNet 3.0, Tsara-boost)
 - Hybrid nets (differentially treated ITNs)



Examples of the flight tracks of *Anopheles arabiensis* in response to a human volunteer inside an untreated net – figure adapted from Parker *et al.* (2017)

Hybrid ITN concept – potential advantages

- Partially treated ITNs, focussing specifically on the roof, have the potential to:
 - Save on the cost of the insecticide component of the ITN and, hence, reduce the overall cost of the ITN
 - Minimise insecticide human exposure leading to more favourable risk assessments
 - It may also enable different materials to be used for the side panels of an ITN
 - The material texture of polyethylene ITNs can be perceived as rougher and hotter than polyester material (Kim et al., 2019)
 - Side panels of nets could be made from materials less susceptible to damage



Net configurations in Hybrid net study – figure adapted from Mbewe et al (2022)

Overview of hut studies conducted

- 10 experimental hut studies were conducted at 6 different Research Institutes
- Trial facilities in different parts of SSA were targeted to capture a range of vector species and hut styles

East-African style huts

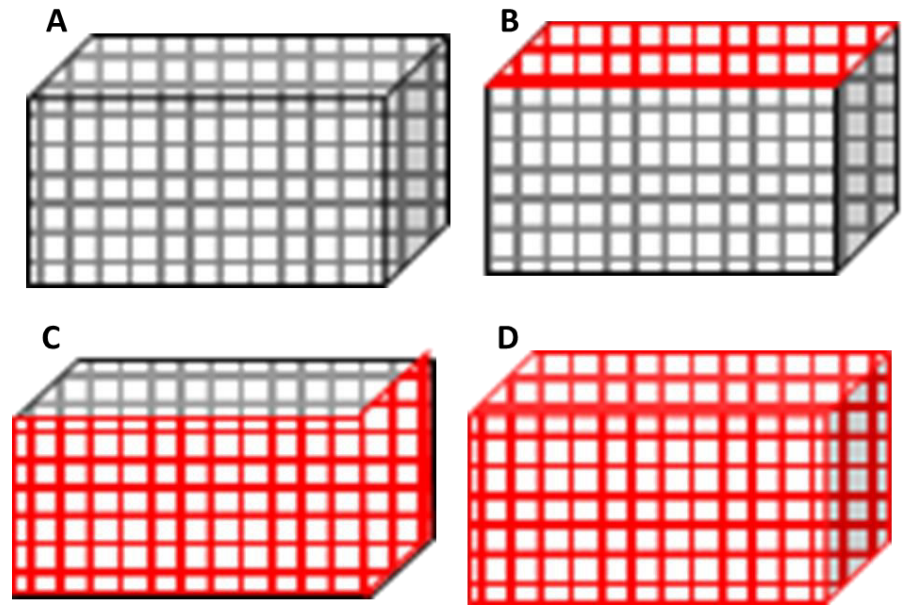


West-African style huts



Treatment arms – Hybrid net study

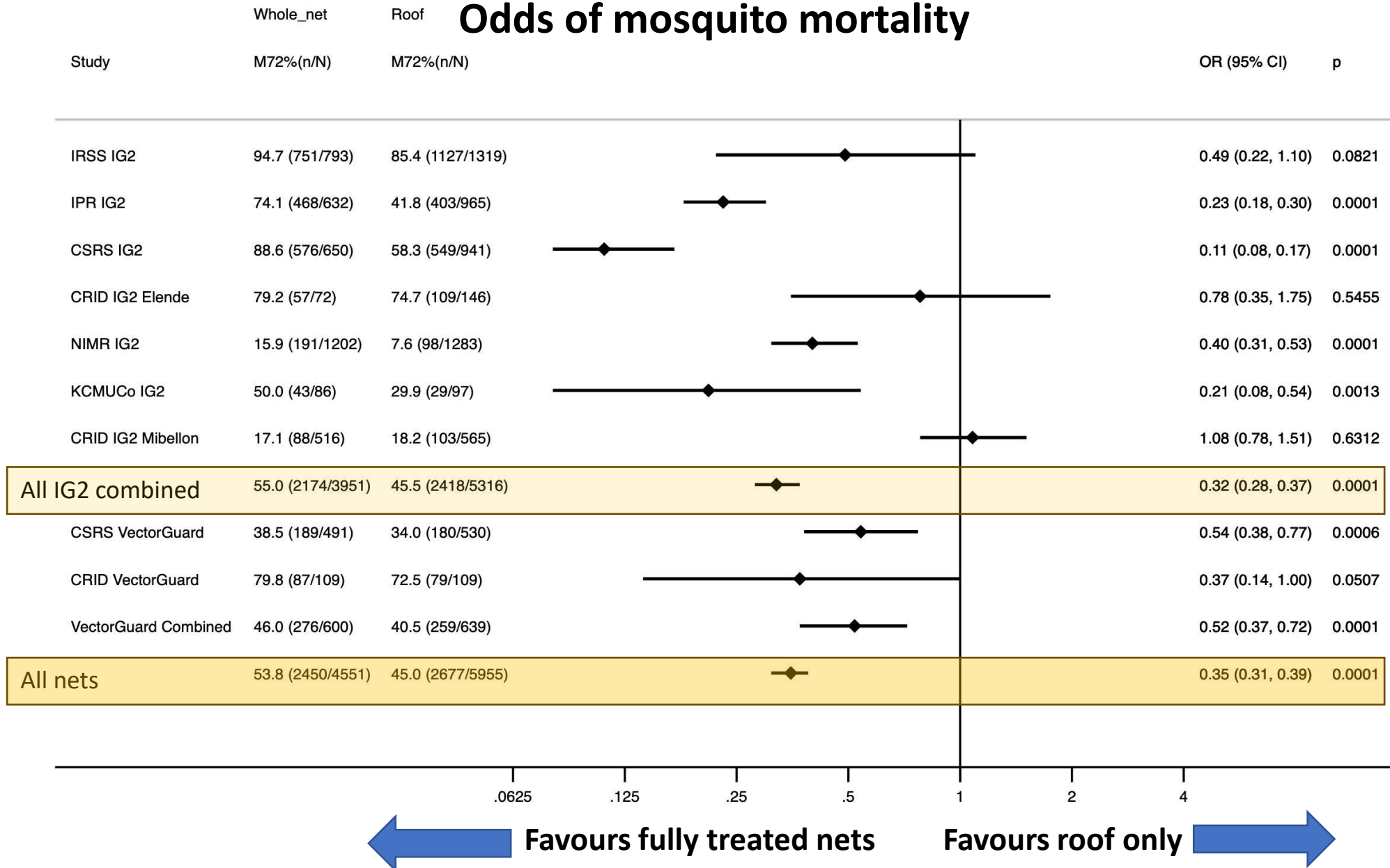
- The experimental hut trials had treatment arms with different treated panels
 - untreated (A)
 - roof-only (B)
 - sides only (C)
 - fully treated (D)
- IG2 (CFP+ACM) or VectorGuard (PBO+ACM) netting was sewn to untreated netting to create partially-treated nets
- Mosquito mortality was the primary outcome, bloodfeeding inhibition was secondary
- Meta-analysis was conducted on the combined studies



Country	Trial facility	Location	ITN	Start	End	Collections nights
Burkina Faso	IRSS	Vallée du Kou	IG2	Sep-20	Nov-20	72
Cameroon	CRID	Mibellon	IG2	Sep-21	Nov-21	48
		Elende	IG2	Feb-22	April-22	42
			Vector Guard	Feb-22	May-22	60
Cote d'Ivoire	CSRS	Tiassalé	IG2	Sep-21	Mar-22	144
			Vector Guard	May-22	Oct-22	128
	IPR	M'be	IG2	Sept-21	Dec-21	72
Tanzania	KCMUCo	Pasua	IG2	Jun-21	Sep-21	64
	NIMR Mwanza	Misungwi	IG2	Oct-21	Mar-22	108

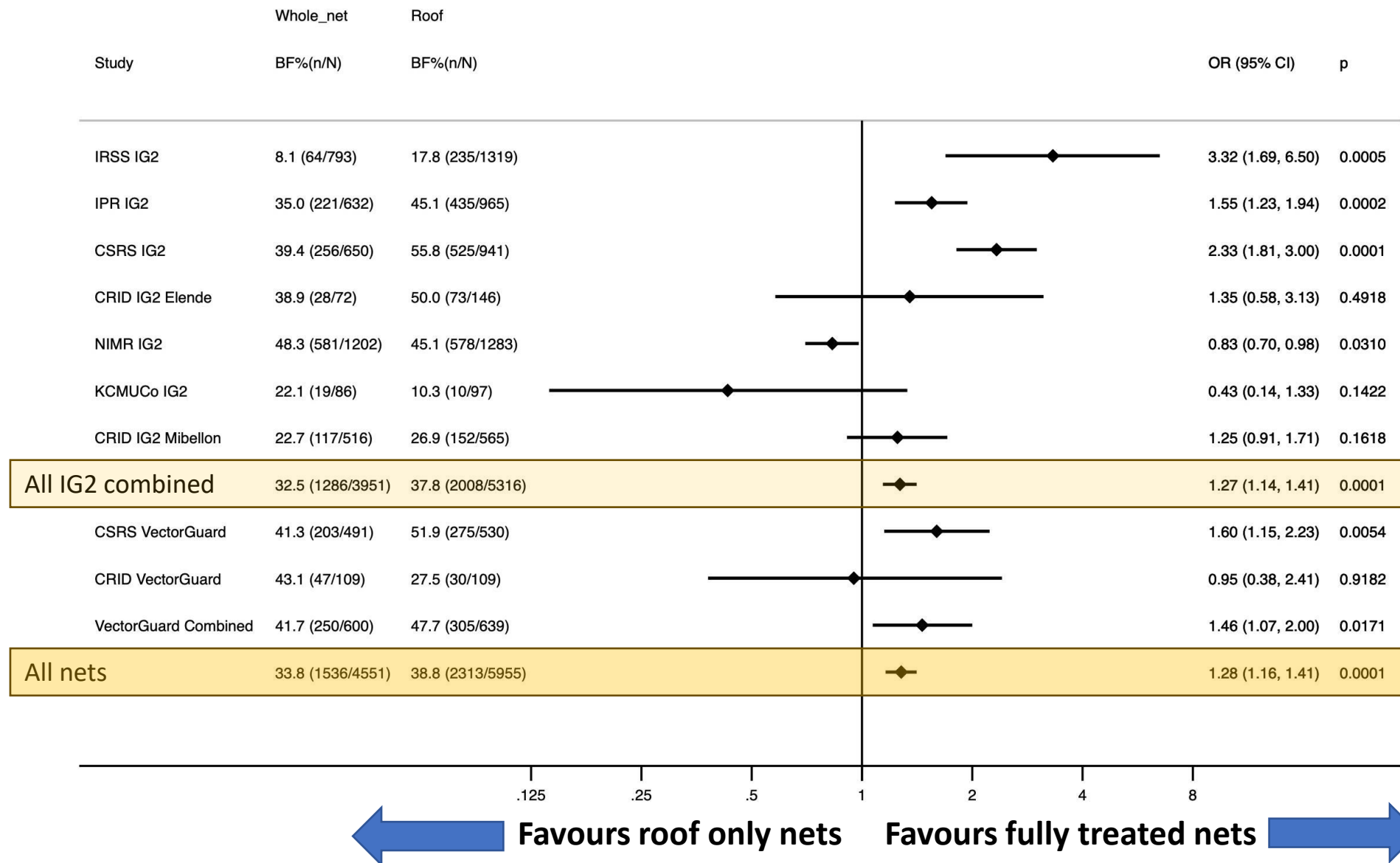
Whole net Treatment vs Roof only

Odds of mosquito mortality



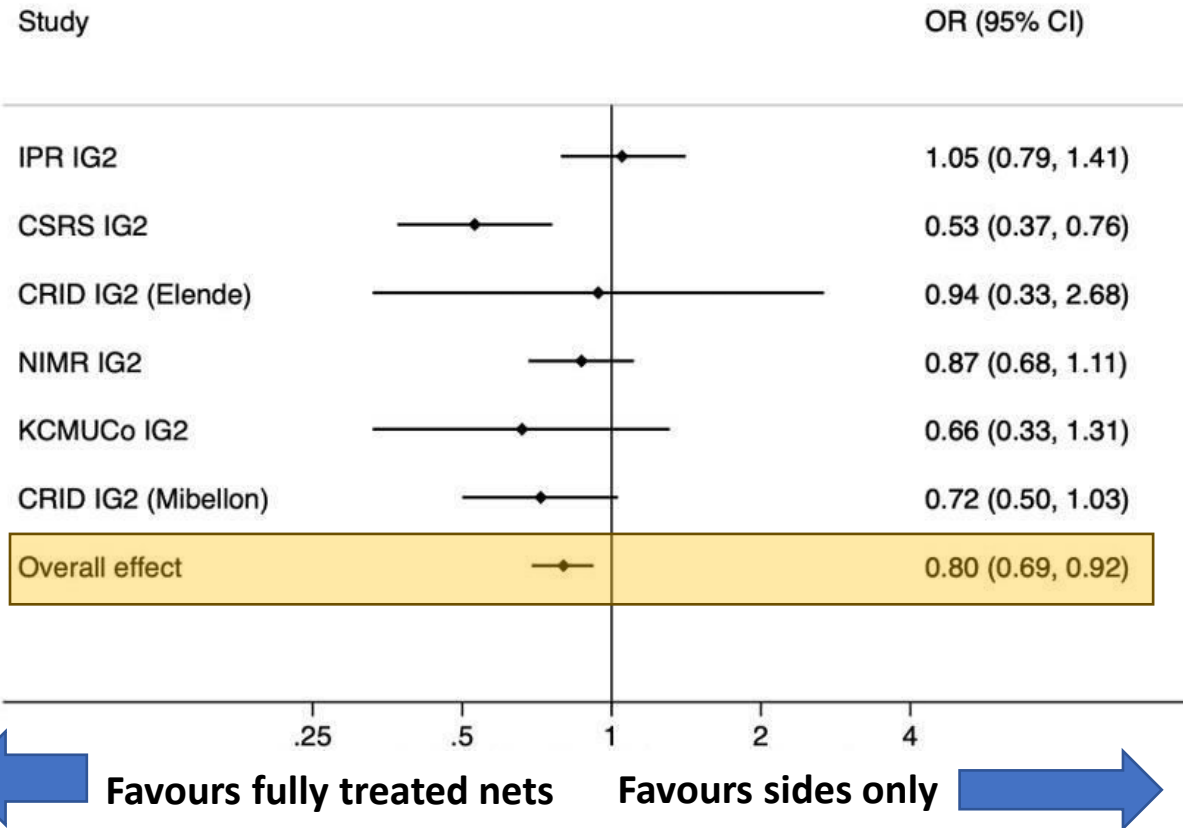
Whole net Treatment vs Roof only

Odds of blood feeding

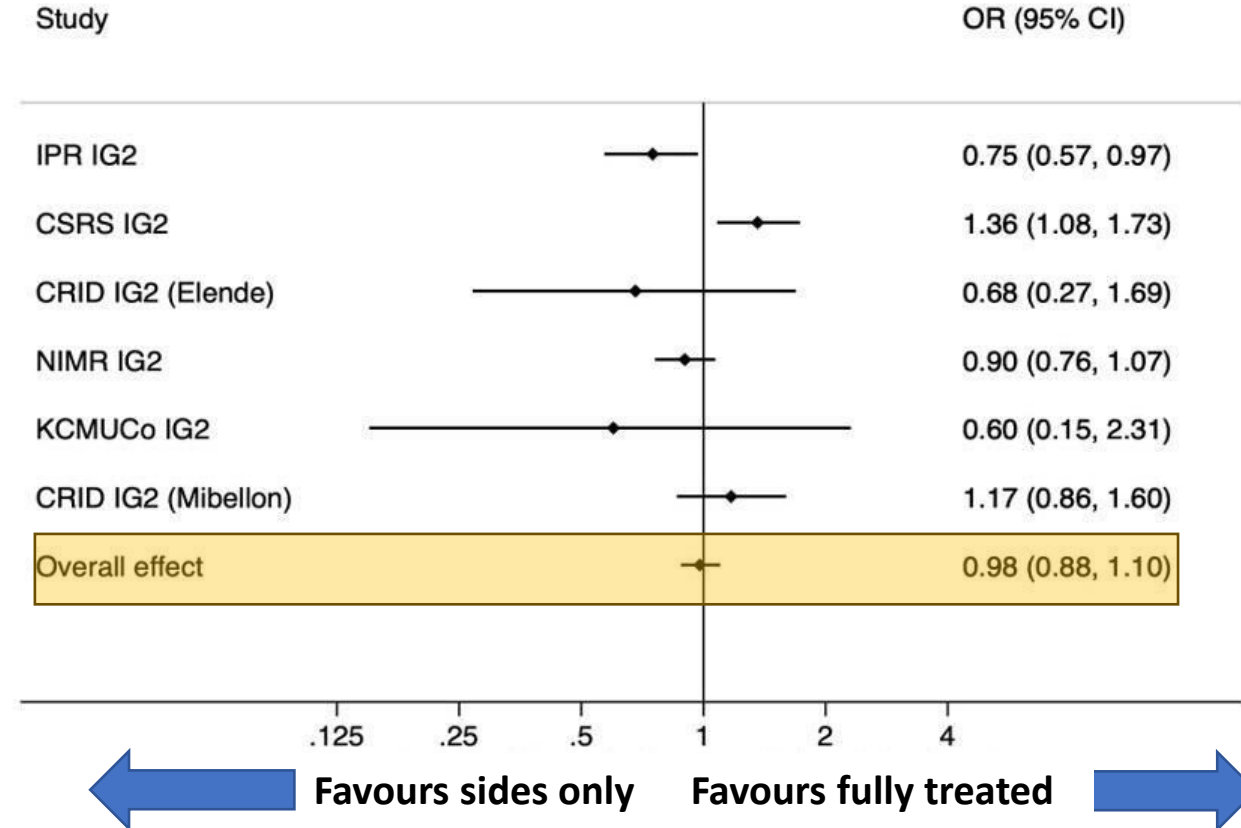


Whole net Treatment vs Sides only

Odds of mortality



Odds of blood feeding



Conclusions

- The meta-analysis showed **significantly greater mortality in fully treated nets** compared to roof- and side-only treatments
- In roof-only comparisons, 6 out of 11 studies showed a significant difference in mortality
- In side-only comparisons, only 1 out of 6 studies showed a significant difference in mortality
 - This suggests that the mosquito mortality increases when a greater area of the comparator net was treated with AI. This underlines the hypothesis made by Mbewe *et al.* (2022) that the total surface area of treatment, rather than specific placement, may have a greater impact on efficacy
- The meta-analysis showed **significantly greater blood-feeding in roof-only nets** compared to fully treated nets
 - This suggests fully treated nets offer greater personal protection by reducing the chances of blood-feeding
- The individual trials conducted in this study covered a range of geographies, vector species (*An. gambiae*, *An. coluzzii*, *An. arabiensis*, and *An. funestus*), hut designs (east and west style) and hosts (cows and humans). However, the trials were not designed and powered to determine if these factors affected mosquito mortality.
- **This meta-analysis showed that hybrid net strategies that restrict the insecticide treatment to specific panels of an ITN do not give equivalency or superiority in either mortality or blood feeding inhibition to fully treated nets.**
- Manuscript in preparation: Lissenden et al.

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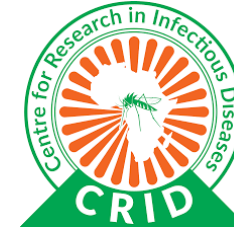
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OUR VALUES

PARTNERSHIP

We believe in the power of partnership, collaboration and teamwork.

INNOVATION

We embrace ideas that drive vector control innovation, deliver impact and save lives.

RESPECT

We value diversity and treat each other with respect.

Funding Partners

BILL & MELINDA
GATES *foundation*



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