

Is the cone bioassay mosquito mortality rate more accurate than the mosquito knock-down rate (kdr) to estimate the insecticide concentration in used Long-Lasting Insecticidal Nets (LLINs)? Results from a multi-methods study in Afghanistan

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Introduction

- Long-Lasting Insecticidal Nets (LLINs) are effective malaria prevention tools.
- WHO recommends regular field monitoring of LLIN durability
Goal: Ensure that distributed LLINs demonstrate adequate bioefficacy, in accordance with product specifications
- Most widely-used method: **WHO cone bioassay test** with susceptible mosquitoes exposed for 3 minutes to netting material
Outcome measures:
 1. Mosquito knock-down rate (kdr) after 1 hour
 2. Mosquito mortality rate after 24 hours
- Study rationale:** Information lacking which outcome measure is most accurate in estimating deltamethrin concentration in used LLINs

Methods

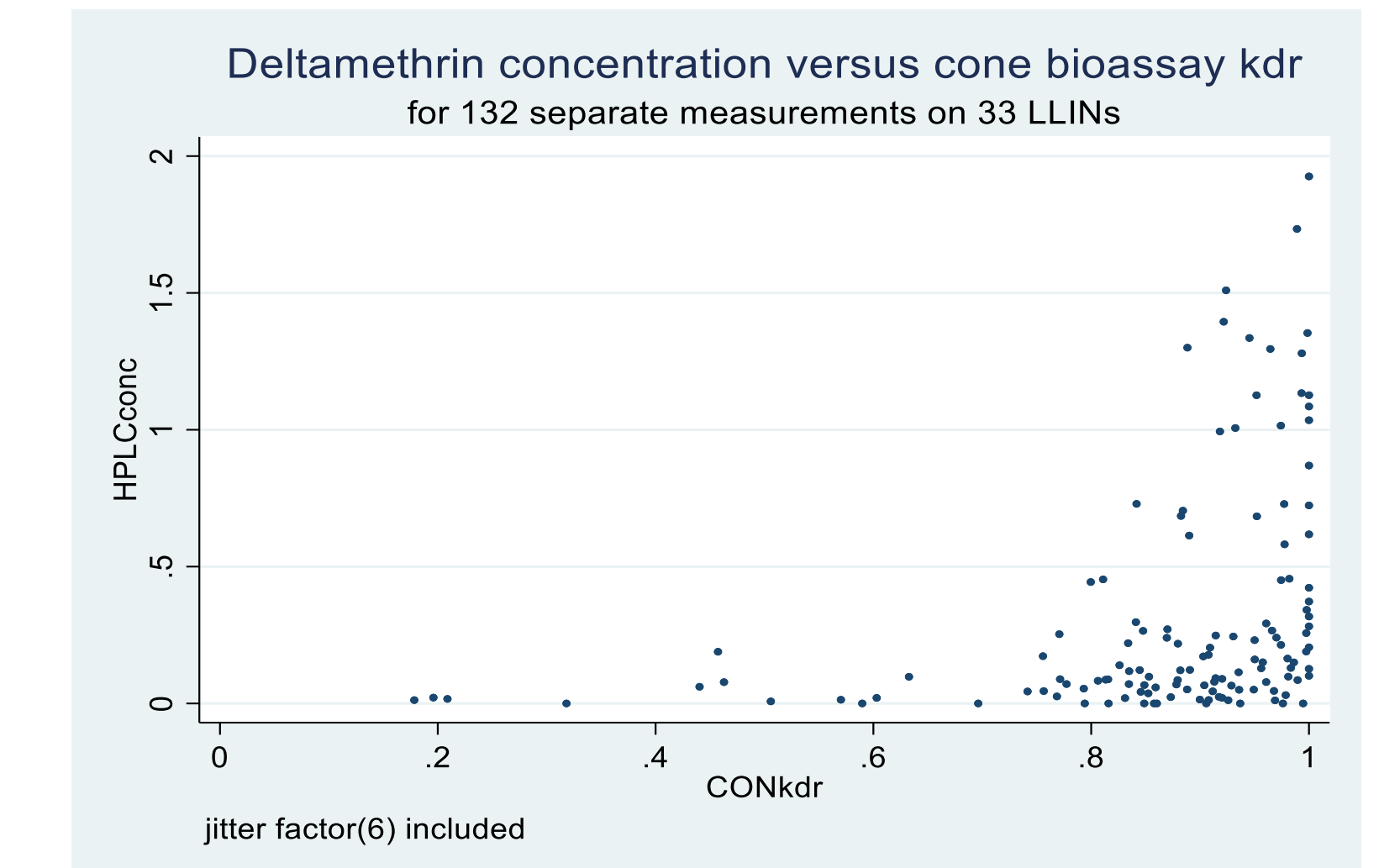
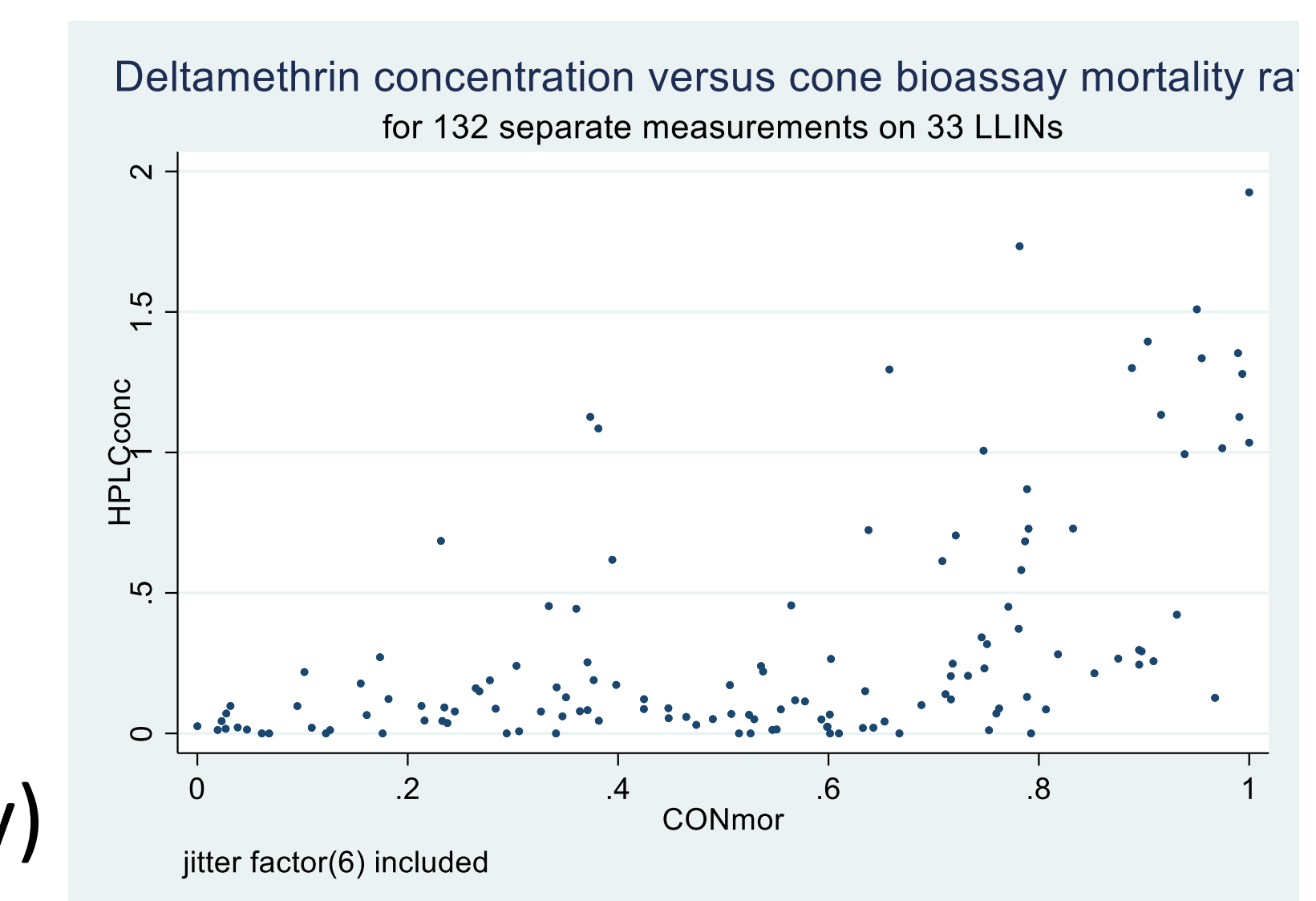
The following analyses were done on a sub-sample of LLINs (*PermaNet 2.0*), being used for three years in five malaria-endemic provinces in Afghanistan:

1. Cone bioassay mosquito knock-down rate (kdr)
2. Cone bioassay mosquito mortality
3. Deltamethrin concentration
(through *High-Performance Liquid Chromatography* (HPLC))



Results

- Analyses were done on 132 position-specific netting pieces from 33 LLINs
- Median mosquito kdr: 0.91
(Interquartile range (IQR): 0.84-0.98)
Median mosquito mortality: 0.56 (IQR: 0.31-0.77)
Median deltamethrin concentration: 0.12 g/kg netting material (IQR: 0.03-0.27) (7% of original concentration)
- Pearson correlation coefficient (r)**
 r (deltamethrin concentration on mosquito kdr) = 0.34 ($P < 0.0001$)
 r (deltamethrin concentration on mosquito mortality) = 0.55 ($P < 0.0001$)



Conclusions

Mosquito mortality provides a more accurate measure of the remaining deltamethrin concentration in the LLIN fiber. It may thus be better to use this as the primary outcome measure in cone bioassay tests.

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