

Cost and cost-effectiveness of IRS in a high malaria transmission district of Mozambique with access to pyrethroid-treated LLINs



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Find our study protocol here

Scan me



- Cluster-randomized, open label, parallel arms, superiority trial
- Mopeia district in Zambezia, Mozambique from 2016 to 2018
- Alphacypermethrin long-lasting insecticidal net (LLIN) use among households with at least one LLIN was 89% in province (2018 Malaria Indicator Survey)

Methods

86 clusters stratified and randomized to receive/not receive indoor residual spray (IRS) with the organophosphate, pirimiphos-methyl (Actellic®300 CS)

16,500 structures (83%) sprayed in 2016
16,936 structures (85%) sprayed in 2017

Malaria care-seeking and morbidity costs were routinely collected among 1,373 households with at least one child enrolled in an active case detection (ACD) cohort in Mopeia, and through cross-sectional surveys with 824 families in 2017 and 805 families in 2018. Household costs included direct medical expenses, transportation and opportunity costs of the time lost due to illness. Structured questionnaires were used to estimate the health system costs associated with malaria care in all 13 district health facilities.

A decision analysis approach was followed to evaluate the cost-effectiveness of the combined effect of IRS and LLINs as compared to pyrethroid-treated LLINs alone on (1) a theoretical cohort of 10000 children U5 and (2) a theoretical cohort of 10000 individuals of all ages, followed over their lifetime. For each cohort we compared lifetime costs and health effects (based on trial data) associated to each study arm.

Resources and costs incurred for IRS activities in Mopeia were prospectively collected for the two spray campaigns conducted during the study period (October-November 2016 and 2017).

In an area with high malaria endemicity and high access to pyrethroid-treated insecticidal nets, is indoor residual spraying with an organophosphate cost-effective?

Results

Table 1 shows the averaged cost of the 2016 and 2017 IRS campaigns and details cost components.

Using data from passive case surveillance at the health facility level and considering households' direct and indirect costs, a deterministic cost-effectiveness analysis demonstrated that the combination of IRS and LLINs was highly cost-effective compared to LLINs alone in the children U5 cohort (incremental cost per DALY averted: ICER=US\$404) but not for the cohort of individuals of all ages (ICER=US\$1822).

The tornado diagram (**Figure 1**) confirmed that the malaria infection incidence and the IRS cost per person protected had the highest impact on ICERs. For the all-ages cohort, the mentioned decrease in the IRS cost per person protected (US\$5-73) or a 15% reduction in the IRS-arm incidence rate would make the intervention cost-effective, compared to the use of LLINs alone.

	Economic cost of IRS campaigns (US\$)	% of total
Insecticide	312,006	51%
Project management	100,453	17%
Vehicles	60,230	10%
Equipment	39,048	6%
Personnel	35,020	6%
Monitoring and evaluation	18,793	3%
Training	16,595	3%
Commodities	15,160	3%
Buildings	9,746	2%
TOTAL	607,122	
Cost per structure sprayed	36-28	
Cost per person protected	8-26	

Table 1. Economic costs of IRS campaigns

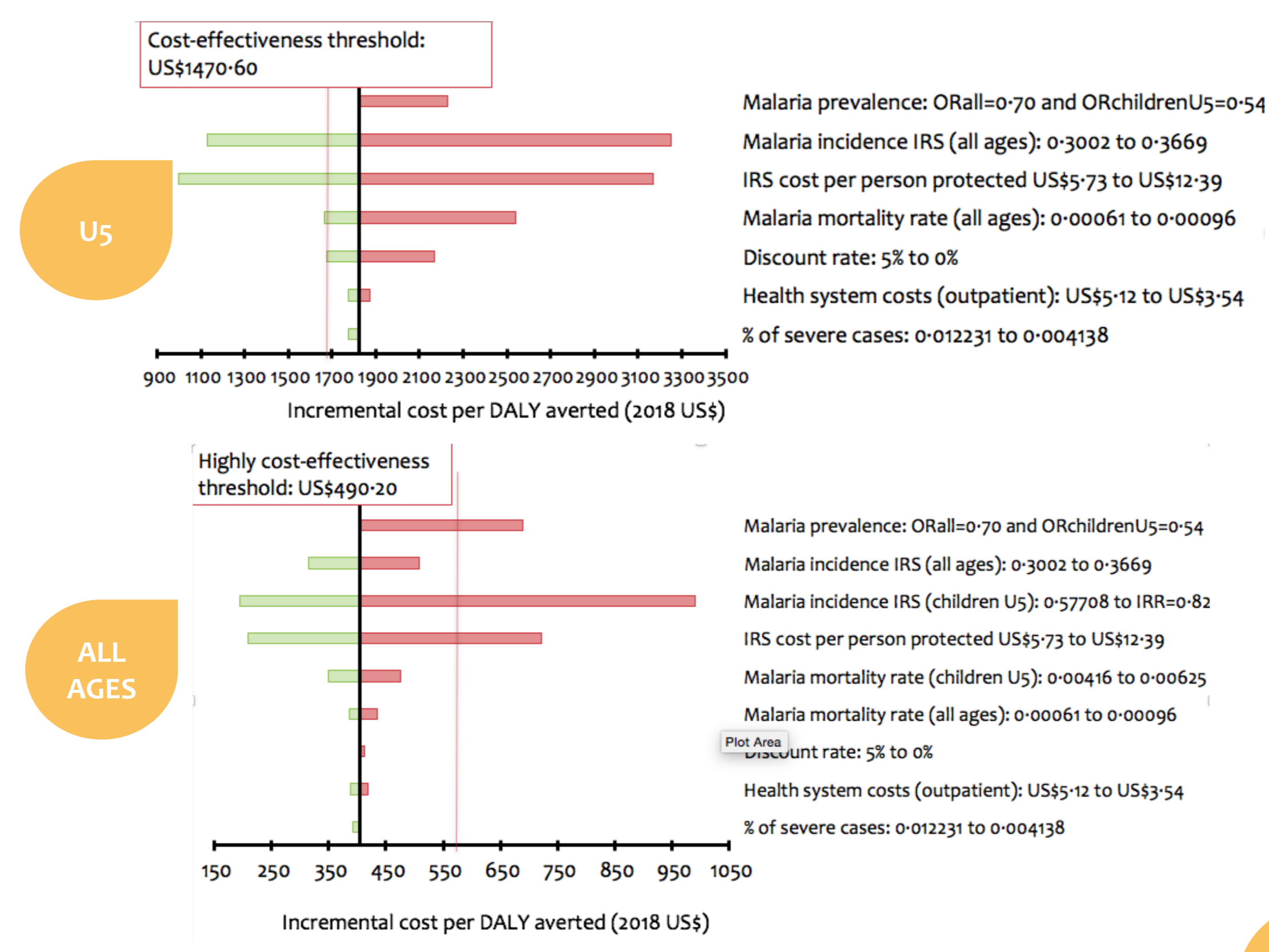


Fig 1. Tornado diagram showing results from univariate sensitivity analysis. Changes on the deterministic value of the incremental cost-effectiveness ratio (ICER) by changing the value of selected parameters (US\$). Mean deterministic ICER (U5)=US\$404 and ICER(all)=US\$1822.

Read the FULL PAPER in the *Malaria Journal*:

The economic burden of malaria on households and the health system in a high transmission district of Mozambique

Median household costs (uncomplicated malaria) among individuals of all ages: **US\$3.46** for an uncomplicated case (IQR US\$0.07–22.41) and **US\$81.08** for a severe case (IQR US\$39.34–88.38).

Median household costs for children under five **US\$1.63** for an uncomplicated case (IQR US\$0.00–7.79) and **US\$64.90** for a severe case (IQR US\$49.76–80.96).

Median health system costs among patients of all ages were **US\$4.34** for an uncomplicated case (IQR US\$4.32–4.35) and **US\$26.56** for a severe case (IQR US\$18.03–44.09).

The resulting economic burden of malaria reaches **US\$332,286.24** per year in Mopeia District alone.

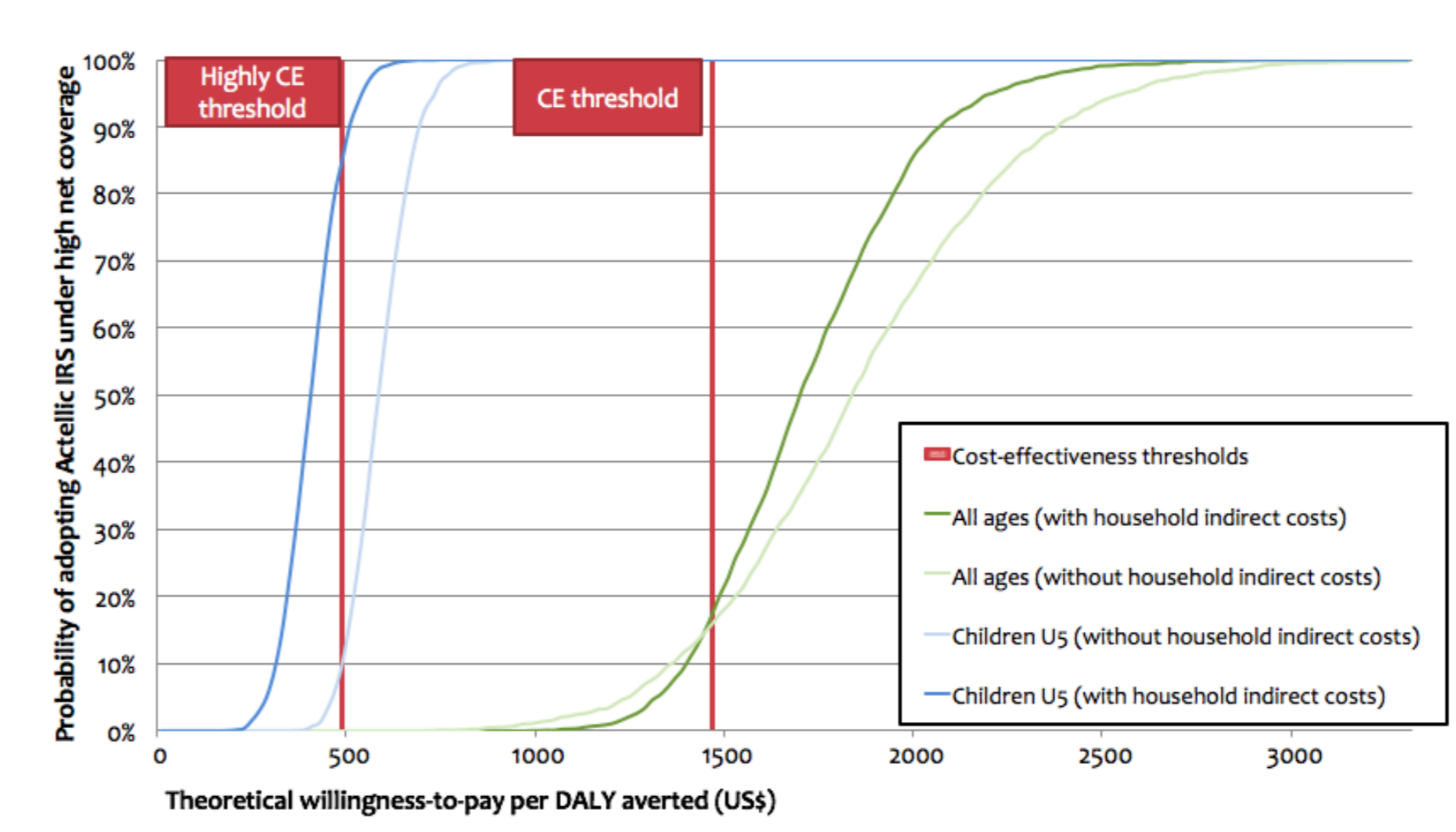


Fig 2. Cost-effectiveness acceptability curves for the cohort of children under five (U5) and individuals of all ages: results from the probabilistic sensitivity analysis (PSA) expressed as Incremental cost per DALY averted. Model parameters and distributions extracted from the RCT.

Cost-effectiveness acceptability curves (**Figure 2**) show the probability that IRS with an organophosphate alongside high LLIN coverage is cost-effective at specific willingness-to-pay, compared to not implementing IRS. Considering households' indirect costs, using a theoretical willingness-to-pay of US\$1470-60, the combination of IRS and LLINs was cost-effective compared to LLINs alone for 100% of the simulations in children U5, and 18% of simulations for individuals of all ages.

In children U5 the intervention was highly cost-effective in 85% of the simulations using a theoretical willingness-to-pay of US\$490-20.

Probabilistic and deterministic results were consistent.

While expensive to implement, IRS with an organophosphate can be cost-effective in high-transmission regions with high LLIN coverage. As insecticide cost is the main IRS cost, its price is an important driver of the cost-effectiveness of IRS.