

Optimising the deployment of vector control tools against malaria

<https://mint.dide.ic.ac.uk>

Ellie Sherrard-Smith & Tom Churcher

MRC Centre for Global Infectious Disease Analysis

WHO Collaborating Centre for Infectious Disease modelling

*School of Public Health
Imperial College London*

No longer a one size fits all for vector control

Vector control interventions

- Then - Only ITNs and/or IRS
- Now - Pyrethroid resistance means now multiple ITNs classes, different IRS
- Future - Novel LLINs, IRS, ATSBs, LSM, spatial repellents

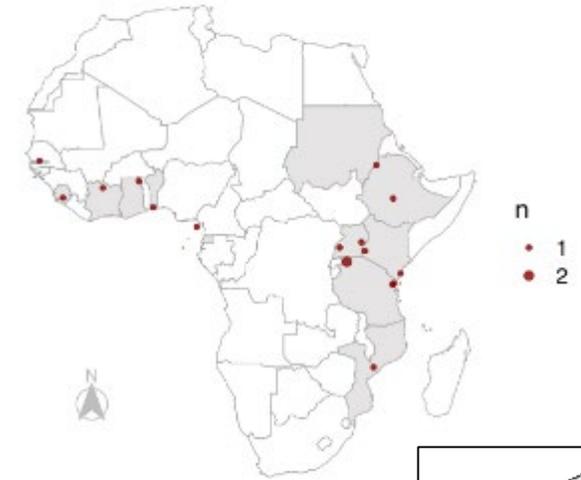
Efficacy and effectiveness varies between sites

- RCTs and pilots are costly and time consuming and cannot be done everywhere
- Experimental hut trials show how entomological impact varies
- More effective products are often more expensive
- Budgets limited

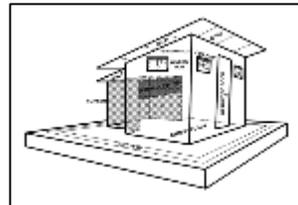
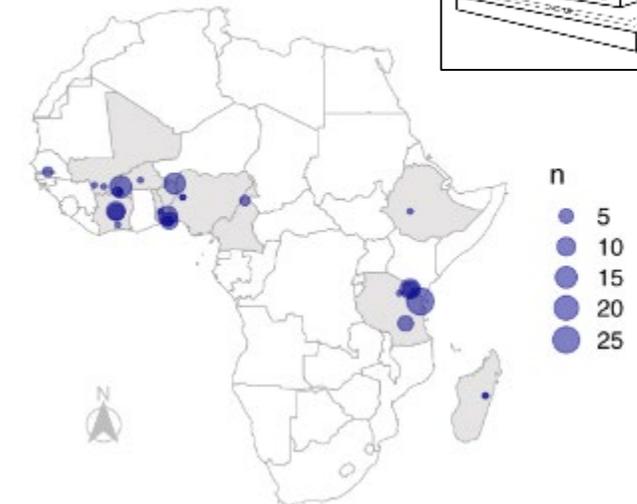
Use of mathematical models

- Models parameterized with hut trial data can recreate RCT results
- Extrapolate results from RCTs to different locations with different entomology, epidemiology and history of malaria control

RCT Sites



Experimental hut trial sites



Move from “do they work” to “how well do they work”

Layering interventions essential to achieve malaria control goals

- Cost must always be considered
- Develop a framework to support evidence-base decision making
- Cost effectiveness analysis could be considered

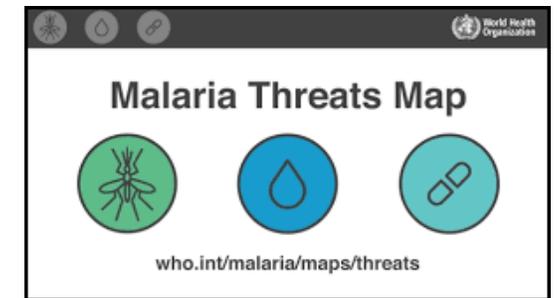


Important to parameterise with quality local data

Local entomology - level of pyrethroid resistance

- % mortality in discriminating dose assay most widely used
- Assay has high measurement error

Local epidemiology, history of vector control, costs

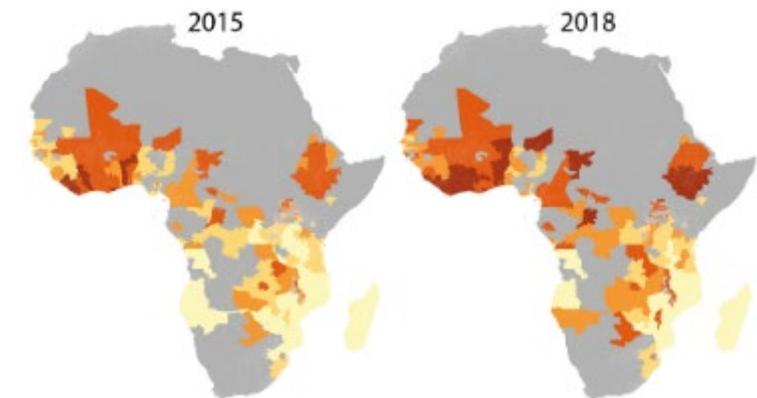


Currently model considers

Pyrethroid only ITNs

Pyrethroid-PBO ITNs

annual IRS (long-lasting)



Demo



This tool is designed to help National Malaria Control Programs explore the most cost effective option of deploying current World Health Organisation (WHO) recommended mosquito net and IRS products for malaria control.

In this tool, a **project** is a collection of regions and a **region** is defined as a management unit - this could be an administration unit, province or village. For each region defined in the tool, there is a set of outputs summarising the impact and cost effectiveness of intervention packages.

IRS is very focal and usually completed in a smaller region of a larger province or district. The model assumes that IRS is applied at random to the population so it is more appropriate to create separate IRS regions and non-IRS regions for this assessment and adjust population size accordingly.

For further guidance please see the [User Guide in English](#) or [en français](#).

Create a project to get started

Name	<input type="text" value="Project name"/>
Regions	<input type="text" value="First region, second region"/>

Add multiple region names separated by commas. You can always add and remove regions later

Setup baseline

Site Inputs

Population Size Seasonality of transmission ⓘ Current malaria prevalence ⓘ [How to use these settings](#) ▾

Mosquito Inputs

Preference for biting indoors ⓘ Preference for biting people ⓘ Level of pyrethroid resistance ⓘ Evidence of PBO synergy ⓘ [How to use these settings](#) ▾

Past Vector Control

ITN population usage in last survey (%) ⓘ What was the estimated coverage of spray campaign (last year) ⓘ [How to use these settings](#) ▾[Next](#)

Setup baseline

Low = less than 10% of children under 5-years have malaria
Medium = approximately 30% of children under 5-years have malaria
High = approximately 65% of children under 5-years have malaria

Seasonality of

Current malaria prevalence

High

[How to use these settings](#)

Mosquito Inputs

Preference for biting indoors

High

Preference for biting people

Low

Level of pyrethroid resistance

60%

Evidence of PBO synergy

Yes

[How to use these settings](#)

Past Vector Control

ITN population usage in last survey (%)

40% usage

What was the estimated coverage of spray campaign (last year)

0% coverage

[How to use these settings](#)

Next

Intervention coverage potential

Expected ITN population use given access

Expected IRS* coverage

[How to use these settings](#)

Procurement and distribution

When planning procurement, what number of people per net is used?

What percentage is your procurement buffer, if used? (%)

[How to use these settings](#)

Price of interventions

Price of pyrethroid LLIN (\$USD)

Price of PBO ITN (\$USD)

ITN mass distribution campaign delivery cost per person (\$USD)

Annual cost of IRS* per person (\$USD)

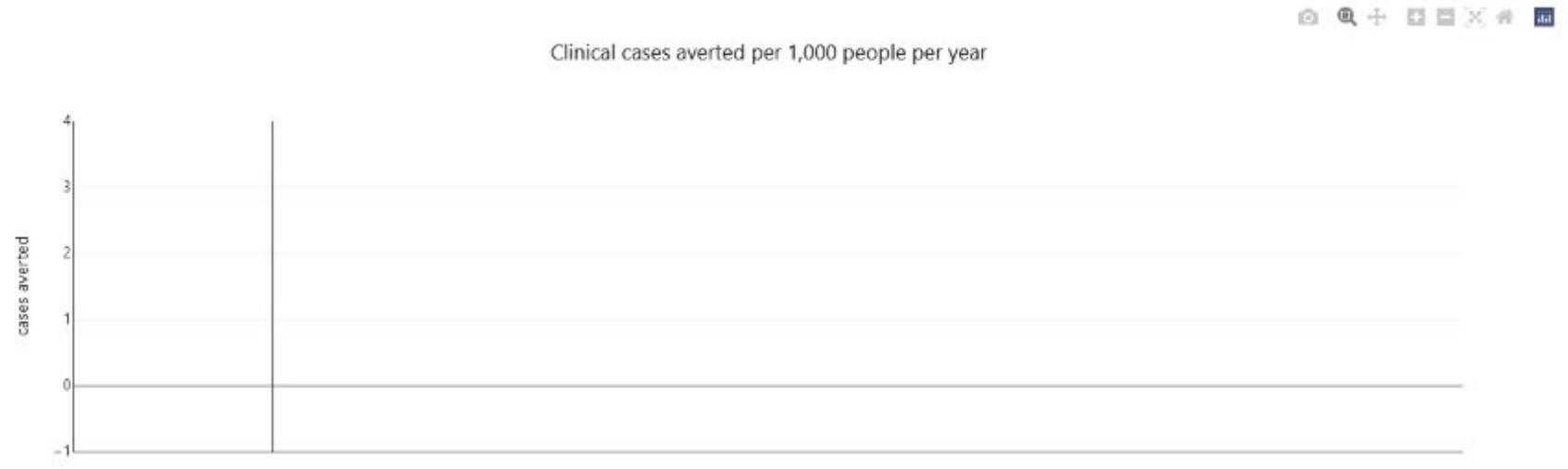
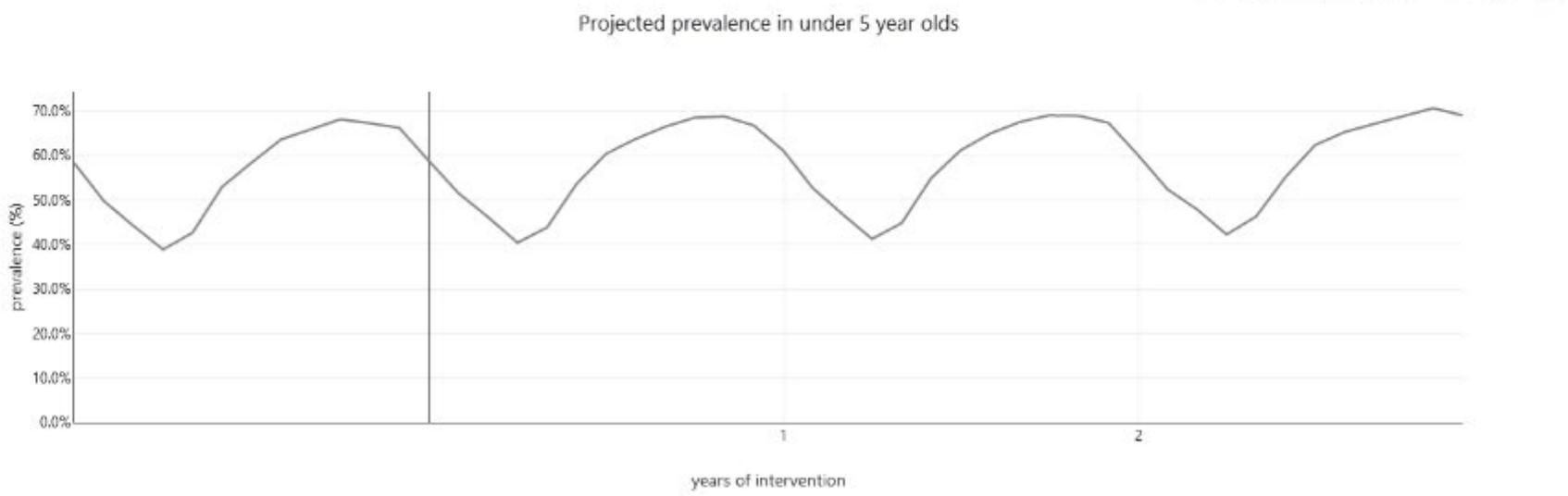
Total available budget (\$USD)

Zonal budget (\$USD)

[How to use these settings](#)

Impact Cost effectiveness

Graphs Table



Intervention coverage potential

Expected ITN population use given access

Expected IRS* coverage

How to use these settings

Procurement and distribution

When planning procurement, what number of people per net is used?

What percentage is your procurement buffer, if used? (%)

How to use these settings

Price of interventions

Price of pyrethroid LLIN (\$USD)

Price of PBO ITN (\$USD)

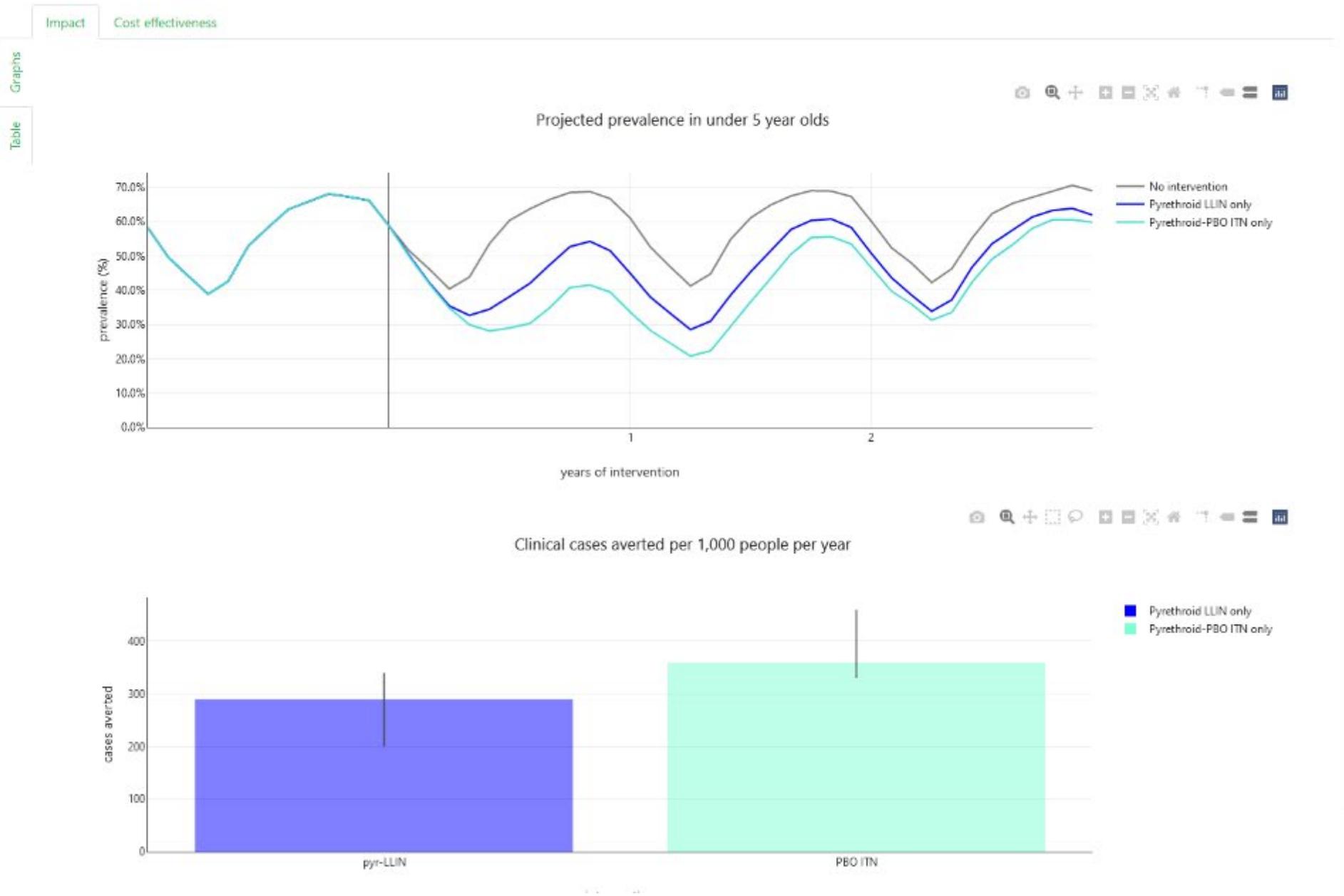
ITN mass distribution campaign delivery cost per person (\$USD)

Annual cost of IRS* per person (\$USD)

Total available budget (\$USD)

Zonal budget (\$USD)

How to use these settings



Intervention coverage potential

Expected ITN population use given access: 80% usage

Expected IRS* coverage: 70% coverage

How to use these settings

Procurement and distribution

When planning procurement, what number of people per net is used? 7

What percentage is your procurement buffer, if used? (%)

How to use these settings

Price of interventions

Price of pyrethroid LLIN (\$USD): 1.99

Price of PBO ITN (\$USD): 2.59

ITN mass distribution campaign delivery cost per person (\$USD): 2.75

Annual cost of IRS* per person (\$USD): 5.73

Total available budget (\$USD): 5000

Zonal budget (\$USD): 5000

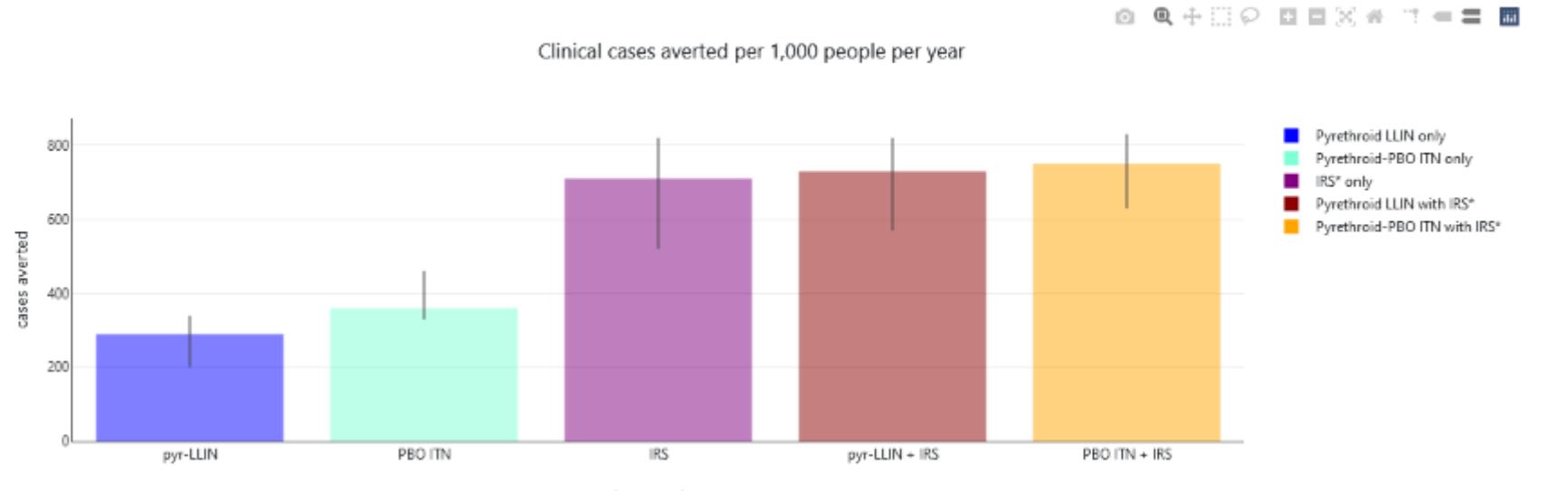
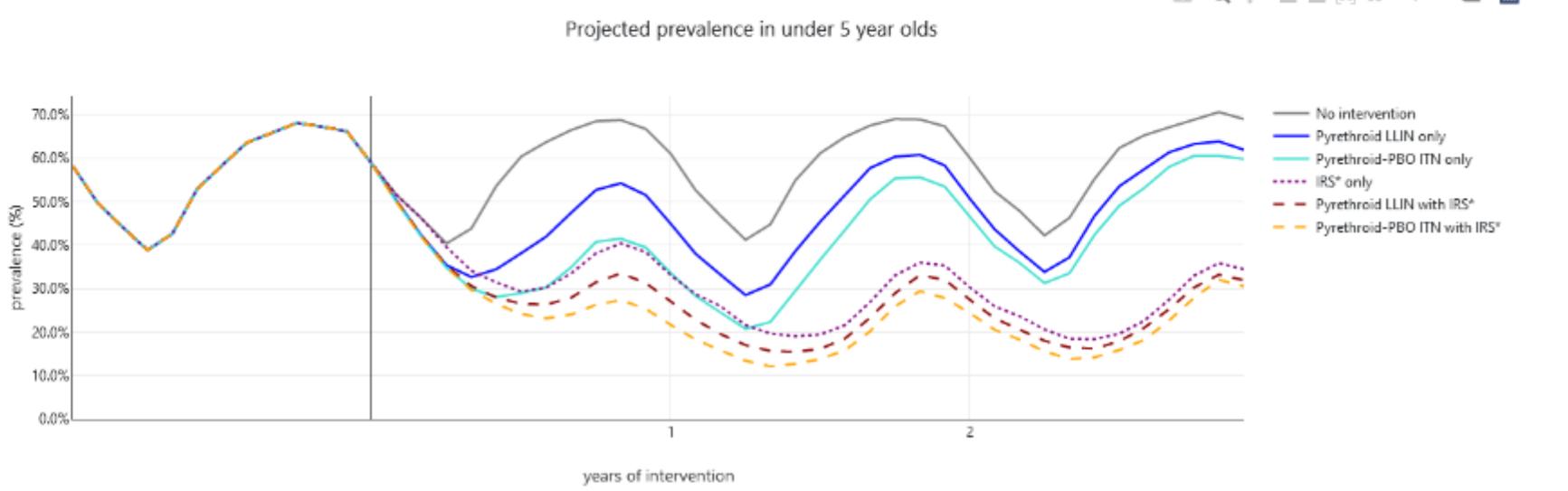
How to use these settings

Impact

Cost effectiveness

Graphs

Table



Intervention coverage potential

Expected ITN population use given access

Expected IRS* coverage

[How to use these settings](#)

Procurement and distribution

When planning procurement, what number of people per net is used?

What percentage is your procurement buffer, if used? (%)

[How to use these settings](#)

Price of interventions

Price of pyrethroid LLIN (\$USD)

Price of PBO ITN (\$USD)

ITN mass distribution campaign delivery cost per person (\$USD)

Annual cost of IRS* per person (\$USD)

Total available budget (\$USD)

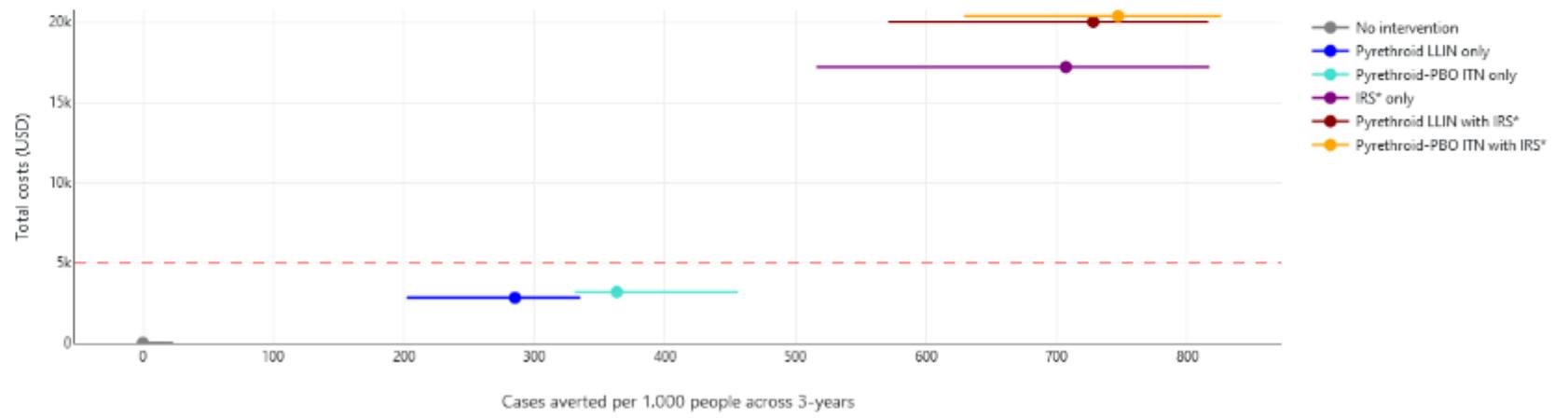
Zonal budget (\$USD)

[How to use these settings](#)

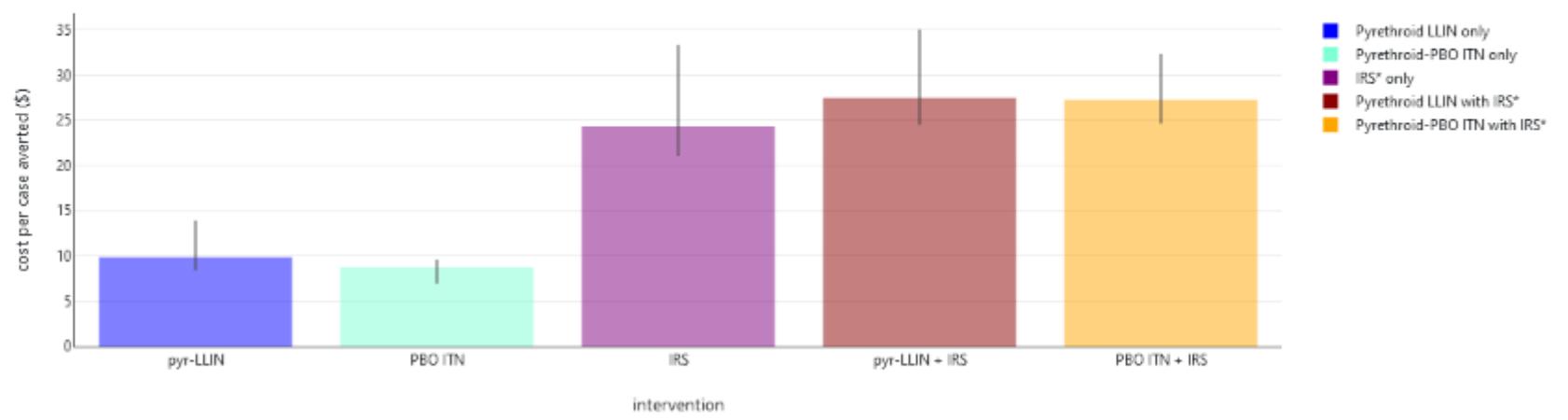
Impact Cost effectiveness

Graphs Table

Strategy costs over 3 years vs Cases averted



Strategy costs per case averted



Site Inputs

Population Size: 1000

Seasonality of transmission: Seasonal

Current malaria prevalence: High

[How to use these settings](#)

Mosquito Inputs

Preference for biting indoors: High

Preference for biting people: Low

Level of pyrethroid resistance: 80%

Evidence of PBO synergy: Yes

[How to use these settings](#)

Past Vector Control

ITN population usage in last survey (%): 40% usage

What was the estimated coverage of spray campaign (last year): 0% coverage

[How to use these settings](#)

Intervention coverage potential

Expected ITN population use given access: 80% usage

Expected IRS* coverage: 70% coverage

[How to use these settings](#)

Procurement and distribution

When planning procurement, what number of people per net is used?: 1.8

What percentage is your procurement buffer, if used? (%): 7

[How to use these settings](#)

Price of interventions

Price of pyrethroid LLIN (\$USD): 1.99

Price of PBO ITN (\$USD): 2.59

ITN mass distribution campaign delivery cost per person (\$USD): 2.75

Annual cost of IRS* per person: 5.73

Impact Cost effectiveness

Table Graphs

Interventions	Net use (%)	IRS* cover (%)	Mean cases averted per 1,000 people per year across 3 years	Total costs	Cost per case averted across 3 years
Pyrethroid-PBO ITN only	80%	n/a	360	\$3.17k	\$8.70
Pyrethroid LLIN only	80%	n/a	290	\$2.82k	\$9.90
IRS* only	n/a	70%	710	\$17.19k	\$24.30
Pyrethroid-PBO ITN with IRS*	80%	70%	750	\$20.36k	\$27.30
Pyrethroid LLIN with IRS*	80%	70%	730	\$20.01k	\$27.50
No intervention	n/a	n/a	0	\$0	reference

[How to interpret these figures](#)

*Work in progress - feedback is very
welcome!!*

<https://mint.dide.ic.ac.uk>

Thank you

Acknowledgements – these and many many more

Imperial College London:

Ellie Sherrard-Smith, Ben Lambert, Rebecca Nash, Mara Kont, Joe Challenger

Centre National de Recherche et de Formation sur le Paludisme:

Sagnon N’Fale, Antoine Sanou, Moussa Guelbeogo et al.

Liverpool School:

Hilary Ranson, Phil McCall, Geraldine Foster, Rosemary Lees

Centre Recherches Entomologiques de Cotonou:

Corine Ngufor

London School :

Mark Rowland, Natasha Protopopoff, Raph N’Guessan,

RAFT team – Jo Lines, Sian Clarke et al.

Uni Abomey-Calavi:

Luc Djogbénou

National Institute for Medical Research:

Alphaxard Manjurano

