10 March 2022

Break-out room instructions

- A message «Join break out room» will appear on the bottom of your screen.
- Choose the session you would like to join, by clicking on «join».
- You can change between rooms.
- Leave break out room, NOT LEAVE MEETING!!!
Workstream 1: Enhancing the Impact of Core Interventions

We will start momentarily.

Instructions (EN): We will use the chat function to share ideas as well as for questions and answers. For questions, please write “Question” and indicate @to whom the question is addressed.

Instructions (FR): Nous utiliserons la fonction de chat pour partager des idées ainsi que pour les questions et réponses. Pour toute question, voudriez-vous écrire "Question" et indiquer @à qui la question est adressée.
Objectives

1. Gather VCWG member inputs to develop a common vision of success for optimal selection, deployment, quality, and use of ITNs and IRS

2. Identify key action items to achieve the vision of success for core interventions

3. Gather inputs for the updated Workstream one (WS1) workplan matrix, and four task forces as well as the WS1 meetings in May
# Agenda: Breakout Group, Workstream One

**Enhancing the Impact of Core Interventions**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Facilitator</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:40-15:45</td>
<td>Welcome participants, Session Overview</td>
<td>Allan</td>
<td></td>
</tr>
<tr>
<td>15:45-16:00</td>
<td>Vision for Workstream one: Enhancing the Impact of Core Interventions</td>
<td>Mary</td>
<td></td>
</tr>
<tr>
<td>16:00-16:25</td>
<td>Workstream one workplan and task team planning: Identifying and prioritizing action items to achieve the vision</td>
<td>Mary and Allan</td>
<td>Ellie Sherrard-Smith, Thomas Churcher, Imperial College London Edward Thomsen, I2I</td>
</tr>
</tbody>
</table>
| 16:25-17:00| Team 2: Special focus session : *Addressing biological threats: new insecticides for vector control*  
- Results of the Tanzania cluster-randomized trial evaluating new generation ITNs  
- Related evidence from the New Nets Project field pilots. | Christen Fornadel | Dr Jacklin F. Mosha, National Institute for Medical Research, Mwanza Dr Nancy Matowo, LSHTM Dr Joseph Wagman, PATH |
A critical juncture

Source: World Malaria Report 2021
Global vision

The vision of WHO and the global malaria community is a world free of malaria.

Milestones (compared to 2015):

- Reduce malaria mortality by at least 75% by 2025 and 90% by 2030
- Reduce malaria case incidence by at least 75% by 2025 and 90% by 2030
- Eliminate malaria from countries in which it was transmitted: at least 20 countries by 2025 and 35 countries by 2030
- Prevent the re-establishment of malaria in all countries that are malaria-free
Vision
Vision Exercise

- What does success look, sound, feel like?

- What will have happened to “shift the needle” driving vector control gains to support the achievement of the 2025 and 2030 milestones?
Workstream one
Enhancing the Impact of Core Interventions

Workplan and task team planning
Identifying and prioritizing action items to achieve the vision
**WORKSTREAM ONE: Enhancing the Impact of Core Interventions**

**Themes:** ITNs and IRS

**Co-Leads:**
Allan Were: Allan_Were@abtassoc.com
Mary Kante: mkante@eauclaireconsulting.co

<table>
<thead>
<tr>
<th>Focus Output 1</th>
<th>Task Teams next steps</th>
<th>Focus Output 2</th>
<th>Task Teams next steps</th>
<th>Focus Output 3</th>
<th>Task Teams next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify tool gaps or capacity needs &amp; steer research priorities</td>
<td></td>
<td>Policy clarification &amp; evaluation pathways</td>
<td></td>
<td>Implementation/Operational scale-up support/Training and capacity building initiatives</td>
<td></td>
</tr>
<tr>
<td>Using data to inform optimal selection and deployment of Core Interventions (ITNs, IRS) – <strong>Task Team 1</strong></td>
<td></td>
<td>Using data to inform optimal selection and deployment of Core Interventions – <strong>Task Team 1</strong></td>
<td></td>
<td>Capacity building, localization, and private sector involvement for sustainable vector control – <strong>Task Team 3</strong></td>
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<tr>
<td>Team lead: TBD</td>
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<td></td>
<td>Addressing biological threats: new insecticides for vector control (for IRS and ITNs) – <strong>Task Team 2</strong></td>
<td></td>
<td>Addressing non-biological threats – <strong>Task Team 4</strong></td>
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<tr>
<td></td>
<td></td>
<td>Team lead: Christen Fornadel</td>
<td></td>
<td>- ITN quality</td>
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<td></td>
<td></td>
<td>- ITN access and use</td>
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<td></td>
<td></td>
<td>- ITN durability/replacement</td>
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<td></td>
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<td></td>
<td>Team lead: TBD</td>
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</tr>
</tbody>
</table>
WS1 Task Team One: Using data to inform optimal selection and deployment of core interventions (ITNs, IRS)

Objective: Support members in their efforts to

- Identify and support use of key tools and resources for country-led decision-making for ITN and IRS selection and deployment
- Anticipate policy shifts for the selection and deployment of ITNs and IRS, supporting the adaptation and use of new tools and resources
Malaria INtervention Tool MINT v1:
A tool to explore the potential of nets and spray interventions in different ecological settings.

Weblink: https://mint.dide.ic.ac.uk/
Paper link: https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196%2821%2900296-5/fulltext

Enter info on the location that you would like to explore

Try out different characteristics for mosquitoes (how indoor / outdoor biting are they? What was the local susceptibility bioassay result (an approx. for resistance))

Set up the simulation to reflect the situation – what interventions are currently in use?
Try out what level of use future interventions (given mass campaigns) is expected. We assume enough nets are procured for the population, but this can be altered to reflect the local situation.

The price of interventions and their delivery can be explored and specific to the region under investigation.
The tool presents results for prevalence and estimated cases averted, and costs per cases averted for different net types with or without long-lasting indoor residual spraying.

Different figures or tables can be explored.

(e.g. showing the prevalence estimates over time since intervention deployed. Nets each 3-years, sprays every year)
Malaria INtervention Tool MINT v2:
A tool to explore the potential of nets and spray interventions in different ecological settings and strategise the interventions across settings depending on the most cost effective options.

Enter info on multiple regions (e.g. a, b, c)

Explore different total budgets available

<table>
<thead>
<tr>
<th>Maximum Cost Vs Budget</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total Cases Averted</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy 1 100%</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>198,807</td>
<td>$940,584</td>
</tr>
<tr>
<td>Strategy 2 95%</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>198,807</td>
<td>$940,584</td>
</tr>
<tr>
<td>Strategy 3 90%</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid LLIN only</td>
<td>187,851</td>
<td>$860,928</td>
</tr>
<tr>
<td>Strategy 4 85%</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid LLIN only</td>
<td>Pyrethroid LLIN only</td>
<td>183,525</td>
<td>$846,741</td>
</tr>
<tr>
<td>Strategy 5 80%</td>
<td>Pyrethroid LLIN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid LLIN only</td>
<td>175,368</td>
<td>$794,066</td>
</tr>
</tbody>
</table>
## Strategize across regions

Explore different total budgets available

### All strategies

<table>
<thead>
<tr>
<th>Maximum Cost Vs Budget</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total Cases Averted</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy 1</td>
<td>IRS* only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>261,696</td>
<td>$2,796,204</td>
</tr>
<tr>
<td>Strategy 2</td>
<td>IRS* only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN only</td>
<td>261,696</td>
<td>$2,796,204</td>
</tr>
<tr>
<td>Strategy 3</td>
<td>IRS* only</td>
<td>No intervention</td>
<td>Pyrethroid-PBO ITN only</td>
<td>217,971</td>
<td>$2,695,879</td>
</tr>
<tr>
<td>Strategy 4</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN with IRS*</td>
<td>Pyrethroid-PBO ITN only</td>
<td>211,752</td>
<td>$1,526,677</td>
</tr>
<tr>
<td>Strategy 5</td>
<td>Pyrethroid-PBO ITN only</td>
<td>Pyrethroid-PBO ITN with IRS*</td>
<td>Pyrethroid-PBO ITN only</td>
<td>211,752</td>
<td>$1,526,677</td>
</tr>
</tbody>
</table>
Test running for countries

- Develop national-, provincial-, and district-level scenarios
- Would anyone be interested to trial the tool and work together in April to see what is and is not useful?

Please reach out! esherrar@ic.ac.uk

Thank you
Explore how different regions may benefit from this strategy.
WS1 Task Team Two

*Addressing biological threats - new insecticides for vector control*

Special Session – Coming up next
**WS1 Task Team Three:** *Capacity building, localization, and private sector involvement for sustainable vector control*

**Objective:** Support members in their efforts to foster sustainable ITN and IRS interventions through the capacity strengthening of NMCPs, local partners, and the private sector.
Objective: Support members in their efforts to evaluate and reinforce effective

- ITN quality
- ITN access and use
- ITN durability/replacement
Raising the Floor on Nets

VCWG update

10 March 2022
Overview of the December 2021 convening

- Problem statement: Nets are not consistently performing as expected for the full three years in the field
- Aim: To identify challenges to improving net quality and solutions to resolve these challenges
Major themes

• Communicate
  • Definitions
  • Roles
  • Trust
  • Transparency

• Align specifications with performance

• Incentivize quality as well as price

Are we talking about the same thing?

**technical definition**
the degree to which nets meet the chemical and physical properties defined by their specifications

**common definition**
whether nets do what we expect under normal usage conditions (remain physically and chemically active for 3 years)

Meeting the technical definition does not always lead to meeting the performance expected in the common definition

More extensive list of meeting outputs can be found at innovationtoimpact.org/raising-the-floor-on-nets/
Next Steps

- Define the roadmap for Raising the Floor of ITNs
  - Theory of change, logical framework, communication plan
  - Case studies to identify areas of focus
  - Harmonize quality testing guidelines for pre-shipment sampling and testing
  - Investigate links between product specifications and eventual performance
  - Review product testing and evaluation methods for potential updating
  - Develop a case for Return on Investment for improved performance of ITNs and identify potential procurement incentives
  - Identify potential additions to ISO 9001 to improve inspection protocols and manufacturing sites

- Second convening in May 2022 focused on post-shipment quality issues
  - Stewardship
    - Data
    - Power

What themes would you like to see covered?
Thank You

Any comments/suggestions welcome:

Eddie Thomsen - edward.thomsen@lstmed.ac.uk
Angus Spiers - angus.spiers@innovation2impact.org
Draft theory of change

**SAVE MORE LIVES**

**BETTER ACCESS TO SAFE, HIGH QUALITY, EFFICACIOUS VECTOR CONTROL TOOLS**

- **OUTCOMES**
  - Quality management system drives continual improvement in ITN quality
  - Improved communication and trust among stakeholders
  - Procurers use data to make value-based decisions
  - Quality and innovation are incentivized
  - Product specifications represent attributes that correlate with performance
  - Methods are standardized and results more consistent

- **OUTPUTS**
  - ISO 9001+ specific for ITN manufacturing
  - Data landscaping report
  - Database / data sharing platform
  - Context-relevant procurement model
  - ITN market analysis
  - Manufacturer quality management system risk-stratification
  - Blueprint for external quality assurance scheme for ITN testing facilities
  - ITN testing facility capacity assessments and action plans
  - Revised physical and chemical specification requirements
  - Reports on wash resistance, AI/bioefficacy relationship
  - Revised product change guidance
  - ITN quality guidance for regulators and NMCPs
  - Post distribution data toolkit
  - New editions of product testing guidelines

- **ACTIVITIES**
  - Develop quality management system standards specific to ITN manufacturing
  - Improve transparency of data and process
  - Enhance procurement model and shape market to reward quality and innovation
  - Improve consistency of ITN lab testing results
  - Link product specifications with performance
  - Harmonize in-country approach to quality & performance management
  - Revise product testing guidelines
WS1 Task Team Two – Special Session

Addressing biological threats - new insecticides for vector control
WS1 Task Team 2: *Addressing biological threats - new insecticides for vector control*

**Objectives:**

1) Keep the membership apprised of new IRS or ITNs that are currently under evaluation and any related evidence

2) To share SOPs for monitoring of both resistance to any new insecticides (in preparation of deployment when approved), as well as monitoring of the products themselves

3) To seek inputs from members on key topics or emerging issues to consider for discussion, sharing with members, other actions
Effectiveness of three types of dual active ingredient treated nets compared to pyrethroid long lasting insecticidal nets against malaria in an area with pyrethroid-resistant mosquitoes in Tanzania: a four-arm, cluster-randomised trial

Jacklin F. Mosha¹ & Nancy S. Matowo²

¹National Institute for Medical Research, Mwanza Medical Research Center, Tanzania
²London School of Hygiene and Tropical Medicine, Department of Disease Control, UK

VCWG: 10th March 2022
**Study design/ outcomes**

- Four-arm, cluster-randomised trial: 21 clusters / arm

**Main outcomes:**
- Malaria infection prevalence by RDT in children aged 6 months to 14 years (measured at 12, 18, 24, 30 and 36 months)
- Malaria case incidence (RDT) in children aged 6 months to 10 years (over 24 months follow up)
- EIR and Anopheles density (over 24 months & 36 months follow up) &

**Other outcomes**
- Cost per disability-adjusted life-year (DALY)
- Strength and resistance mechanism (yearly)
- Net attrition and hole index in nets collected yearly
- Mortality & blood feeding & sterility every 6 months (cone, tunnel and hut)

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### Description of product

<table>
<thead>
<tr>
<th>LN brand</th>
<th>LN specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interceptor® (reference)</td>
<td>Alpha-cypermethrin 200 mg Polyester BASF</td>
</tr>
<tr>
<td>Interceptor® G2</td>
<td>Alpha-cypermethrin 100 mg + Chlorfenapyr 200 mg Polyester BASF</td>
</tr>
<tr>
<td>Olyset™ Plus</td>
<td>Permethrin 800 mg + PBO 400 mg Polyethylene Sumitomo Chemicals</td>
</tr>
<tr>
<td>Royal guard®</td>
<td>Alpha-cypermethrin 216 mg + Pyriproxyfen 225 mg Polyethylene Disease Control Technologies LLC</td>
</tr>
</tbody>
</table>

**LN specificity**

- **Pyrethroid**: Neurotoxicity, Fast Knock down and killing
- **Chlorfenapyr**: Disrupts the insect’s ability to produce energy, slow killing effect.
- **Pyriproxyfen**: Disrupt female reproduction and fertility of eggs
- **Piperonyl butoxide**: Enhance the potency of the PY insecticide
Study Area
- 72 villages (84 clusters)
- 42,314 Households (study census 2018)
- 251,155 population size

Malaria:
- 2017 prevalence in primary school children = 46.3% (NMCP)
- Two transmission seasons following start rainy seasons: Oct-Dec and February-May

Vector information:
- *An. funestus* predominant in South part
- *An. gambiae* s.s. Northern part between (February-May)
- *An. arabiensis* s.s. All study area
- Pyrethroid resistance Mortality < 60%
**Epidemiological data collection**

**Cross-sectional survey: prevalence**

- 45 HH selected per cluster
  - Up to 2 children (6 months-14 years) are tested per HH
  - Approximately 5000 children are tested at each time point

  - Measured:
    - Malaria by RDT
    - Anaemia
    - Temperature

**Cohort follow-up: case incidence**

- 35 HH (year 1) and 40HH (year 2) are selected per cluster
  - One child (6 months-10 years) per HH
  - 2940 (cohort year 1) and 3360 (cohort year 2) children are selected and followed every 2 weeks for 1 year

  - Measured:
    - Malaria by RDT
    - Temperature
### Study cluster characteristics

<table>
<thead>
<tr>
<th></th>
<th>Std LLIN arm (Interceptor)</th>
<th>Chlorfenapyr arm (Interceptor G2)</th>
<th>PBO arm (Olyset plus)</th>
<th>Pyriproxyfen arm (Royal Guard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (all study area)</td>
<td>61183</td>
<td>60115</td>
<td>57631</td>
<td>57567</td>
</tr>
<tr>
<td>Population (core area)</td>
<td>43877</td>
<td>41748</td>
<td>45020</td>
<td>43266</td>
</tr>
</tbody>
</table>

### Households and children characteristics baseline cross sectional survey (sept 2018)

- **SES (poorest households)**
  - Std LLIN arm: 28.9%
  - Chlorfenapyr arm: 30.7%
  - PBO arm: 36.6%
  - Pyriproxyfen arm: 36.1%

- **LLIN use in selected children**
  - Std LLIN arm: 63.6%
  - Chlorfenapyr arm: 62.5%
  - PBO arm: 63.4%
  - Pyriproxyfen arm: 64.9%

- **Malaria infection prevalence**
  - Std LLIN arm: 46.6%
  - Chlorfenapyr arm: 42.7%
  - PBO arm: 42.0%
  - Pyriproxyfen arm: 46.2%

### Entomological characteristics (Sept-Dec 2018)

- **Mean indoor vector per house per night**
  - Std LLIN arm: 5.9 (0.8-11.1)
  - Chlorfenapyr arm: 2.8 (0-6.0)
  - PBO arm: 1.9 (0.8-7.6)
  - Pyriproxyfen arm: 4.2 (0.8-7.6)

- **Sporozoite rate**
  - Std LLIN arm: 4.4%
  - Chlorfenapyr arm: 2.2%
  - PBO arm: 3.0%
  - Pyriproxyfen arm: 3.3%

- **EIR per HH per night**
  - Std LLIN arm: 0.35 (0.01-0.68)
  - Chlorfenapyr arm: 0.04 (0-0.08)
  - PBO arm: 0.07 (0.01-0.13)
  - Pyriproxyfen arm: 0.11 (0.01-0.21)

- **% An. funestus**
  - Std LLIN arm: 94.3%
  - Chlorfenapyr arm: 95.4%
  - PBO arm: 92.8%
  - Pyriproxyfen arm: 95.0%

- **% An. arabiensis /An.gambiae s.l.**
  - Std LLIN arm: 85%
  - Chlorfenapyr arm: 81%
  - PBO arm: 71%
  - Pyriproxyfen arm: 84%

- Malaria infection prevalence, SES, LLIN use, population density and species composition similar in all 4 arms.
- Vector density and EIR higher in Std LLIN and Pyriproxyfen arm (95%CI overlap and collection covered only 4 months, long dry season and short rainy season)
Study net usage and all net usage in all age groups

- Overall net usage increase from 60% to 80% after the net distribution and remain constant.
- 3 months after distribution study net usage was between 69% and 77% but rapidly decrease to 30% to 50% at 24 months.
- PBO net usage decrease the most drastically followed by Pyriproxyfen net.
## Infection prevalence (Intention to treat)

*adjusted for the baseline prevalence well as the other covariates used in the randomisation procedure

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Malaria prevalence</th>
<th>OR*</th>
<th>95%CI</th>
<th>p value**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std LLIN arm (Ref)</td>
<td>31%</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorfenapyr arm</td>
<td>16%</td>
<td>0.47</td>
<td>0.31-0.71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PBO arm</td>
<td>19%</td>
<td>0.65</td>
<td>0.44-0.99</td>
<td>0.042</td>
</tr>
<tr>
<td>Pyriproxyfen arm</td>
<td>22%</td>
<td>0.69</td>
<td>0.48-1.04</td>
<td>0.075</td>
</tr>
<tr>
<td><strong>18 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std LLIN arm (Ref)</td>
<td>52%</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorfenapyr arm</td>
<td>41%</td>
<td>0.66</td>
<td>0.45-0.97</td>
<td>0.037</td>
</tr>
<tr>
<td>PBO arm</td>
<td>43%</td>
<td>0.76</td>
<td>0.52-1.12</td>
<td>0.170</td>
</tr>
<tr>
<td>Pyriproxyfen arm</td>
<td>51%</td>
<td>0.98</td>
<td>0.67-1.44</td>
<td>0.918</td>
</tr>
<tr>
<td><strong>24 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std LLIN arm (Ref)</td>
<td>46%</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorfenapyr arm</td>
<td>26%</td>
<td>0.45</td>
<td>0.30-0.67</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PBO arm</td>
<td>41%</td>
<td>0.99</td>
<td>0.67-1.45</td>
<td>0.961</td>
</tr>
<tr>
<td>Pyriproxyfen arm</td>
<td>38%</td>
<td>0.79</td>
<td>0.54-1.17</td>
<td>0.235</td>
</tr>
</tbody>
</table>

• Significant reduction in prevalence at 24 months (main end point) was only observed for Chlorfenapyr arm.

• Reduction in prevalence observed in all the intervention arms at 12 months compared to std LLIN arm but borderline for PBO and Pyriproxyfen.

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* *adjusted for the baseline prevalence well as the other covariates used in the randomisation procedure

** P-value <0.017 is considered statistically significant after Bonferroni correction
### Case incidence

<table>
<thead>
<tr>
<th>Year</th>
<th>Incidence per child per year</th>
<th>rate ratio*</th>
<th>95%CI</th>
<th>p value**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std LLIN arm (ref)</td>
<td>0.32</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>Chlorfenapyr arm</td>
<td>0.13</td>
<td>0.46</td>
<td>0.28-0.74</td>
<td>0.002</td>
</tr>
<tr>
<td>PBO arm</td>
<td>0.13</td>
<td>0.53</td>
<td>0.33-0.85</td>
<td>0.009</td>
</tr>
<tr>
<td>Pyriproxyfen arm</td>
<td>0.27</td>
<td>0.94</td>
<td>0.60-1.48</td>
<td>0.803</td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std LLIN arm (ref)</td>
<td>0.57</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorfenapyr arm</td>
<td>0.31</td>
<td>0.61</td>
<td>0.40-0.94</td>
<td>0.025</td>
</tr>
<tr>
<td>PBO arm</td>
<td>0.48</td>
<td>1.11</td>
<td>0.73-1.67</td>
<td>0.631</td>
</tr>
<tr>
<td>Pyriproxyfen arm</td>
<td>0.53</td>
<td>1.02</td>
<td>0.67-1.55</td>
<td>0.924</td>
</tr>
</tbody>
</table>

*adjusted for the baseline prevalence well as the other covariates used in the randomisation procedure

**P-value <0.017 is considered statistically significant after Bonferroni correction

- Overall 44% reduction in malaria incidence in children 6 months to 10 years residing in Chlorfenapyr arm compared to those in standard LLIN arm (not in table)
- 47% reduction in Malaria case incidence in year 1 in children residing in PBO arm compared to those in standard LLIN and no reduction in year 2.
- No significant reduction in malaria incidence in the Pyriproxyfen arm compared to standard LLIN.
Entomological cross sectional survey

**CDC light traps**

- Randomly selected houses per cluster in 84 clusters (21 clusters per arm)
- Each cluster visited every quarter (32 house-CDC nights collection per cluster per year)
- 36% relative reduction in EIR (relative risk 0.64) between the intervention relative to reference arms
- Questionnaire (ODK) and direct observations
- SES, house design, LLINs coverage

**Mosquito processing and molecular analysis**

- Morphological IDs on Anopheles species, physiological status
- Sporozoite rate: CSP ELISA on a sub-sample (10 Anopheles per species per HH) from CDC light traps
- PCR for species ID on samples confirmed positive with Plasmodium falciparum and three extra from each surveyed cluster
## Anopheles density & Entomological inoculation rate

### Compared to standard LLIN:
- Chlorfenapyr Net, 57% (density) and 85% (EIR) overall (year 1 and 2) reduction
- PBO net, 46% (density) and 44% (EIR) reduction
- Pyriproxyfen net, 23% (density) and 27% (EIR) reduction.

Reduction in EIR mainly driven by density except for Chlorfenapyr net (Sporozoite rate 0.8% vs 1.8% (std LLIN) OR: 0.48 (95%CI: 0.24–0.95), p value: 0.035)

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Density / night/ HH</td>
<td>DR*</td>
</tr>
<tr>
<td>Std LLIN arm (ref)</td>
<td>2.5</td>
<td>0.04</td>
</tr>
<tr>
<td>Chlorfenapyr arm</td>
<td>0.7</td>
<td>0.33</td>
</tr>
<tr>
<td>PBO arm</td>
<td>0.7</td>
<td>0.42</td>
</tr>
<tr>
<td>Pyriproxyfen arm</td>
<td>1.2</td>
<td>0.62</td>
</tr>
</tbody>
</table>

*adjusted for the baseline prevalence well as the other covariates used in the randomisation procedure

**P-value <0.017 is considered statistically significant after Bonferroni correction
Conclusions

**Chlorfenapyr Net (Interceptor G2)**
- More effective than standard LLIN over the two years
- Effect on incidence and entomological outcome lower in year 2
  - Decrease net usage (textile durability)
  - 80% reduction of chlorfenapyr content

**PBO Net (Olyset Plus)**
- This RCT further indicates superior effectiveness of Olyset plus over standard pyrethroid LLINs for one year but did not confirm the sustained effectiveness found in previous trials.
- Rapid drop in Olyset plus usage could partly explain the lack of effectiveness in year 2.
- Poor textile durability of the nets is likely to be the main factor of usage reduction.

**Pyriproxyfen net (Royal Guard)**
- There was some indication that Royal guard reduced malaria prevalence and entomological outcomes compared to standard LLIN in year 1, however the effect was not large enough to be significant.
- There was no indication of an effect of Royal guard on malaria case incidence in any year despite high usage of study net in cohort children.
- Low bio-efficacy of PPF could explain the results as well as decrease net usage over time and/or PPF resistance in the main malaria vector An. funestus.
Acknowledgements

This presentation includes data from:

- Eliud Lukole (epi and textile durability)
- Jacklyn Martin (Textile durability and bio-efficacy)
- Manisha Kulkarni (Ecological niche model)
- Charles Thickstun (Map and cluster delineation)

Collaborators

- Tanzania National Malaria control Programme
- RMO Mwanza, DMO Misungwi, Malaria Focal Person, DC Misungwi, DED and CHMT representatives
- Community in Misungwi
- Field technicians

Funding

- DFID/MRC UK/NIHR/Wellcome: Joint Global Health trial (Main RCT: 2 years)
- B&MGF (Entomo Bio-efficacy and hut trial) through IVCC
- PMI/USAID (SBCC for net distribution)
New Nets Project interim results

Evidence from pilots in Burkina Faso, Rwanda, and Mozambique

Dr. Joe Wagman, Project Director, PATH
New Nets Project partners

- **IVCC**
  - Lead and coordinator
  - Liaison with industry partners
  - Link to vector control product development pipeline

- **psi**
  - Compilation of cross-country lessons learned from pilot studies, funding for process evaluations

- **The Alliance for Malaria Prevention**
  - Technical assistance

- **Imperial College London**
  - Modelling of trials design and implementation impact

- **PATH**
  - Cost-effectiveness determination from pilot implementations

- **RBC**
  - Entomological correlates of epidemiological impact

- **Tropical Health**
  - Cost effectiveness study design and data collection

- **LSTM**
  - Cluster-randomized trials of dual active-ingredient ITNs and entomological correlates in trials

- **Tulane University**

**Interim results – interpret with caution**
NNP partners are using enhanced surveillance activities to evaluate the impact of piloting different ITN types (2020 – 2022)

- **Epidemiology**
  - Malaria infection prevalence
  - Malaria case incidence

- **Entomology**
  - Vector population density, behavior, infection, and resistance status

- **Anthropology**
  - ITN uptake and usage, transmission risk, social determinants of impact

- **Cost-effectiveness**
  - Product price, delivery and deployment costs, and effectiveness based on incidence rates

- **Durability monitoring**
  - Survivorship, attrition, physical integrity, and insecticidal content
New Nets Project Pilot Evaluations

- Burkina Faso
- Nigeria
- Rwanda
- Mozambique

- Standard ITNs
- IG2 ITNs
- PBO ITNs
- RG ITNs
- Standard ITNs + IRS

Interim results – interpret with caution
Burkina Faso
NPN Pilot Surveys
Burkina Faso

- **Mix of species:** *Anopheles gambiae* s.s., *An. coluzzii*, *An. funestus*.
- **High levels of pyrethroid resistance** by multiple mechanisms.
- **Roughly equal rates of indoor and outdoor biting.**

### Population that slept under a net last night (95% CI)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gaoua (Standard ITNs)</th>
<th>Banfora (IG2 ITNs)</th>
<th>Orodara (PBO ITNs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>20.8% (18.6%–23.1%)</td>
<td>67.7% (64.9%–70.3%)</td>
<td>78.8% (76.1%–81.2%)</td>
</tr>
<tr>
<td>2020</td>
<td>44.2% (40.9%–47.5%)</td>
<td>90.4% (88.5%–92.1%)</td>
<td>84.8% (82.3%–87.0%)</td>
</tr>
<tr>
<td>2021</td>
<td>37.0% (30.5%–42.5%)</td>
<td>82.8% (79.0%–86.6%)</td>
<td>83.5% (79.9%–87.1%)</td>
</tr>
</tbody>
</table>

### Population ITN access (95% CI)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gaoua (Standard ITNs)</th>
<th>Banfora (IG2 ITNs)</th>
<th>Orodara (PBO ITNs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>44.4% (42.4%–46.2%)</td>
<td>58.9% (57.1%–60.7%)</td>
<td>94.0% (93.1%–94.9%)</td>
</tr>
<tr>
<td>2020</td>
<td>53.8% (51.4%–56.2%)</td>
<td>84.2% (83.1%–85.3%)</td>
<td>87.4% (86.3%–88.5%)</td>
</tr>
<tr>
<td>2021</td>
<td>40.5% (37.9%–43.1%)</td>
<td>74.9% (73.5%–76.2%)</td>
<td>82.0% (80.7%–83.3%)</td>
</tr>
</tbody>
</table>

### Malaria prevalence in children from CSS (RDT+) (95% CI)

<table>
<thead>
<tr>
<th>Year</th>
<th>Gaoua (Standard ITNs)</th>
<th>Banfora (IG2 ITNs)</th>
<th>Orodara (PBO ITNs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>81.0% (74.9%–86.0%)</td>
<td>39.6% (33.0%–46.6%)</td>
<td>28.4% (22.4%–35.3%)</td>
</tr>
<tr>
<td>2020</td>
<td>48.9% (41.9%–56.1%)</td>
<td>18.4% (13.5%–24.6%)</td>
<td>3.7% (1.8%–7.5%)</td>
</tr>
<tr>
<td>2021</td>
<td>21.1% (15.5%–27.5%)</td>
<td>11.6% (7.4%–17.0%)</td>
<td>2.1% (0.6%–5.3%)</td>
</tr>
</tbody>
</table>

*The ITN distribution campaign was complete at the time of the cross-sectional survey.

*Use given access is calculated by dividing use (population that slept under a net last night) by access. Values over 1 are possible given that the calculation is a ratio.
NNP Pilot: Passive case detection to date

Burkina Faso

**Average monthly incidence rate (per 10,000 person-months) by district, 2018–2021**

**Difference-in-difference (DiD) comparison of malaria incidence with next-generation ITNs and standard ITNs.**

<table>
<thead>
<tr>
<th>District</th>
<th>Year 1 (November–May) change from baseline</th>
<th>Year 1 DiD relative to standard ITNs</th>
<th>Year 2 (June–May) change from baseline</th>
<th>Year 2 DiD relative to standard ITNs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaoua and Nouna</td>
<td>−18.4% (&lt;24.8% to −14.8%)</td>
<td>−20.6% (&lt;24.9% to −17.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banfora and Tougan</td>
<td>−0.76% (&lt;−6.1% to 1.8%)</td>
<td>−18%</td>
<td>−35.3% (&lt;−36.7% to −34.6%)</td>
<td>14.7%</td>
</tr>
<tr>
<td>Orodara</td>
<td>−22.9% (&lt;−28.8% to −2.7%)</td>
<td>4.5%</td>
<td>−26.4% (&lt;−29.2% to −24.8%)</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

Interim results – interpret with caution
Rwanda
NPP Pilot Surveys

Rwanda

- **Mix of species:** *An. gambiae* s.s., *An. funestus*, *An. arabiensis*.
- **Low to moderate levels of pyrethroid resistance**—mitigated by PBO.
- **Roughly equal rates of indoor and outdoor biting.**
- **Overall, relatively low rates of biting**

<table>
<thead>
<tr>
<th>Population that slept under a net last night (95% CI)</th>
<th>Nyamagabe (Standard ITNs)</th>
<th>Karongi (IG2 ITNs)</th>
<th>Ruhango (Standard ITNs + IRS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 2020</td>
<td>Dec 2020</td>
<td>Feb 2020</td>
<td>Dec 2020</td>
</tr>
<tr>
<td>70.5% (66.8%–74.0%)</td>
<td>68.7% (65.0%–72.2%)</td>
<td>68.2% (64.5%–71.8%)</td>
<td>70.9% (67.3%–74.3%)</td>
</tr>
<tr>
<td>81.8% (79.5%–84.1%)</td>
<td>80.7% (78.6%–82.7%)</td>
<td>82.2% (79.8%–84.7%)</td>
<td>86.1% (84.3%–87.9%)</td>
</tr>
<tr>
<td>0.86</td>
<td>0.85</td>
<td>0.83</td>
<td>0.82</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Population ITN access (95% CI)</th>
<th>Nyamagabe (Standard ITNs)</th>
<th>Karongi (IG2 ITNs)</th>
<th>Ruhango (Standard ITNs + IRS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 2020</td>
<td>Dec 2020</td>
<td>Feb 2020</td>
<td>Dec 2020</td>
</tr>
<tr>
<td>2.36% (1.14%–4.30%)</td>
<td>2.70% (1.36%–4.78%)</td>
<td>2.47% (1.24%–4.38%)</td>
<td>2.69% (1.40%–4.65%)</td>
</tr>
</tbody>
</table>

*Use given access is calculated by dividing use (population that slept under a net last night) by access. Values over 1 are possible given that the calculation is a ratio.

*The ITN distribution campaign was ongoing at the time of the cross-sectional survey.
Interim results – interpret with caution

NPN Pilot: Passive case detection to date

Rwanda

Average monthly incidence rate (per 10,000 person-months) by district, 2018–2020

Difference-in-difference (DiD) comparison of malaria incidence with next-generation ITNs, standard pyrethroid ITNs, and standard pyrethroid ITNs + IRS

Year 1 (April–March) change from baseline

<table>
<thead>
<tr>
<th>District</th>
<th>Year 1 Change</th>
<th>DiD relative to standard ITNs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nyamagabe (Standard ITNs)</td>
<td>−48%</td>
<td>−53% to −45%</td>
</tr>
<tr>
<td>Karongi (IG2 ITNs)</td>
<td>−62%</td>
<td>13%</td>
</tr>
<tr>
<td>Ruhango (Standard ITNs + IRS)</td>
<td>−77%</td>
<td>−78% to −75%</td>
</tr>
</tbody>
</table>

Average monthly incidence rate (per 10,000 person-months) by district, 2018–2020
First steps toward understanding the intersection of human and mosquito behaviors in driving malaria transmission risk: mapping the proportion of time (observations made) not under an ITN to indoor and outdoor biting rates.
Northern Mozambique
### NNP Pilot Surveys

**Northern Mozambique**

- **Mix of species**: *An. gambiae* s.s. and *An. funestus*.
- **Moderate to high levels of pyrethroid resistance**—mitigated by PBO.
- **Roughly equal rates of indoor and outdoor biting**.
- **No obvious peaks** hours for biting – consistent throughout the night.

#### Population that slept under a net last night (95% CI)

<table>
<thead>
<tr>
<th>Location</th>
<th>2020</th>
<th>2021</th>
<th>2020</th>
<th>2021</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gurue (standard ITNs)</td>
<td>23.0% (21.3%–24.7%)</td>
<td>87.4% (82.8%–90.8%)</td>
<td>19.4% (17.9%–21.0%)</td>
<td>67.9% (57.0%–77.1%)</td>
<td>17.0% (15.5%–18.6%)</td>
<td>81.6% (74.7%–87.0%)</td>
</tr>
<tr>
<td>Cuamba (IG2 ITNs)</td>
<td>21.0% (19.7%–22.3%)</td>
<td>64.8% (54.8%–74.8%)</td>
<td>16.4% (15.3%–17.6%)</td>
<td>75.5% (69.0%–82.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandimba (RG ITNs)</td>
<td>16.4% (15.3%–17.6%)</td>
<td>75.5% (69.0%–82.3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Population ITN access (95% CI)

<table>
<thead>
<tr>
<th>Location</th>
<th>2020</th>
<th>2021</th>
<th>2020</th>
<th>2021</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gurue (standard ITNs)</td>
<td>23.1% (21.8%–24.4%)</td>
<td>85.7% (82.5%–88.8%)</td>
<td>0.99</td>
<td>1.02</td>
<td>0.92</td>
<td>1.05</td>
</tr>
<tr>
<td>Cuamba (IG2 ITNs)</td>
<td>21.0% (19.7%–22.3%)</td>
<td>64.8% (54.8%–74.8%)</td>
<td>1.03</td>
<td>1.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandimba (RG ITNs)</td>
<td>16.4% (15.3%–17.6%)</td>
<td>75.5% (69.0%–82.3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Use given access*

- 0.99
- 1.02
- 0.92
- 1.05
- 1.03
- 1.08

#### Malaria prevalence for children under 5 years old (RDT+) (95% CI)

<table>
<thead>
<tr>
<th>Location</th>
<th>2020</th>
<th>2021</th>
<th>2020</th>
<th>2021</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gurue (Standard ITNs)</td>
<td>64.9% (54.8%–75.0%)</td>
<td>52.5% (42.9%–61.9%)</td>
<td>47.5% (38.1%–57.0%)</td>
<td>29.4% (20.9%–39.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cuamba (IG2 ITNs)</td>
<td>66.0% (57.5%–74.4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandimba (RG ITNs)</td>
<td>46.2% (38.2%–54.4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Interim results – interpret with caution*
NNP Pilot: Passive case detection to date
Northern Mozambique

Interim results – interpret with caution

Average monthly incidence rate (per 10,000 person-months) by district, 2019–2020

Difference-in-difference (DiD) comparison of malaria incidence with next-generation ITNs and standard pyrethroid ITNs

<table>
<thead>
<tr>
<th>District</th>
<th>DiD relative to standard ITNs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gurue (Standard ITNs)</td>
<td>8% (-3% to 24%)</td>
</tr>
<tr>
<td>Cuamba (IG2 ITNs)</td>
<td>-48% (-52% to -40%)</td>
</tr>
<tr>
<td>Mandimba (RG ITNs)</td>
<td>-28% (-31% to -23%)</td>
</tr>
</tbody>
</table>

RDT- and microscopy-confirmed cases per 10,000 person-months

Gurue (Standard) | Cuamba (IG2) | Mandimba (RG) | High transmission
Western Mozambique
**ITN landscape**

**Western Mozambique**

- **Mix of species**: *An. gambiae* s.s. and *An. funestus*.
- **Moderate to high levels of pyrethroid resistance**—mitigated by PBO.
- **Roughly equal rates of indoor and outdoor biting**.
- **No obvious peaks** hours for biting – consistent throughout the night

<table>
<thead>
<tr>
<th></th>
<th>Chemba  (Standard ITNs)</th>
<th>Guro (IG2 ITNs)</th>
<th>Changara (PBO ITNs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
<td>2021</td>
<td>2020</td>
</tr>
<tr>
<td>Population that slept under a net last night (95% CI)</td>
<td>33.3% (32.1%–34.7%)</td>
<td>90.1% (87.1%–92.4%)</td>
<td>18.5% (17.2%–19.8%)</td>
</tr>
<tr>
<td>Population ITN access (95% CI)</td>
<td>30.4% (29.3%–31.6%)</td>
<td>86% (82.0%–90.1%)</td>
<td>18.8% (17.5%–20.1%)</td>
</tr>
<tr>
<td>Use given access*</td>
<td>1.10</td>
<td>1.05</td>
<td>0.98</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Chemba  (Standard ITNs)</th>
<th>Guro (IG2 ITNs)</th>
<th>Changara (PBO ITNs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
<td>2021</td>
<td>2020</td>
</tr>
<tr>
<td>Malaria prevalence for children under 5 years old (RDT+) (95% CI)</td>
<td>44.3% (36.5%–52.1%)</td>
<td>39.0% (31.3%–47.2%)</td>
<td>17.1% (11.6%–22.7%)</td>
</tr>
</tbody>
</table>

*Use given access is calculated by dividing use (population that slept under a net last night) by access. Values over 1 are possible given that the calculation is a ratio.*
Key takeaways – interim results

• Mass ITN distributions (universal coverage campaigns) are strongly associated with increased ITN use and decreases in malaria transmission regardless of ITN type.

• In areas of moderate to high transmission with pyrethroid-resistant vectors:
  • Distribution of any of the new net types (IG2, PBO, and RG ITNs) seem more effective at controlling malaria than campaigns distributing standard, pyrethroid-only ITNs.
  • May be less pronounced in West African settings with complex resistance profiles.

• More complete and nuanced analyses will consider access, impact, and durability of ITNs after more than one year, as well as ITN use patterns and climate patterns.
Thank you – Obrigado – Merci

Questions, comments & discussion
PATH
Thank you! We look forward to speaking with you.

Allan: Allan_Were@abtassoc.com
Mary: mkante@eauclaireconsulting.co
Christen: Christen.Fornadel@ivcc.com
A message «Join break out room» will appear on the bottom of your screen.

Choose the session you would like to join, by clicking on «join».

You can change between rooms.

Leave break out room, NOT LEAVE MEETING!!!