# Project BITE:

## Evaluating and advancing bite prevention tools for malaria elimination

October 4, 2023

IVCC Stakeholder Forum

# Themes of Project BITE

Partnerships

Targeting gaps in protection

Accelerated research to impact

Staged approach to evidence generation

The critical role of semi-field evaluations

Malaria Elimination Initiative

UCSF

Institute for Global Health Sciences

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IVCC Building Partnerships Creating Solutions Saving Lives

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(Formerly PIRK by Widder Bros)

Warmkraft

Sumitomo Chemical

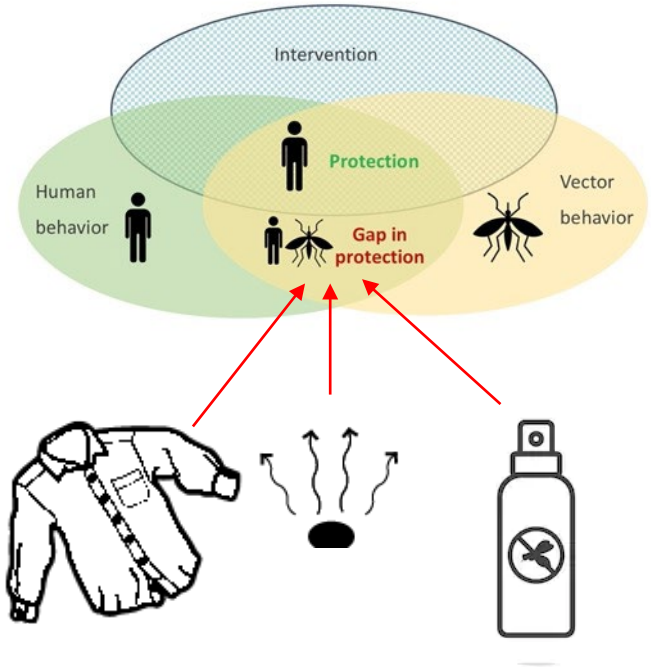
SC Johnson

# *P. falciparum* elimination - a decade of success in the GMS


World Malaria Report, WHO, 2022

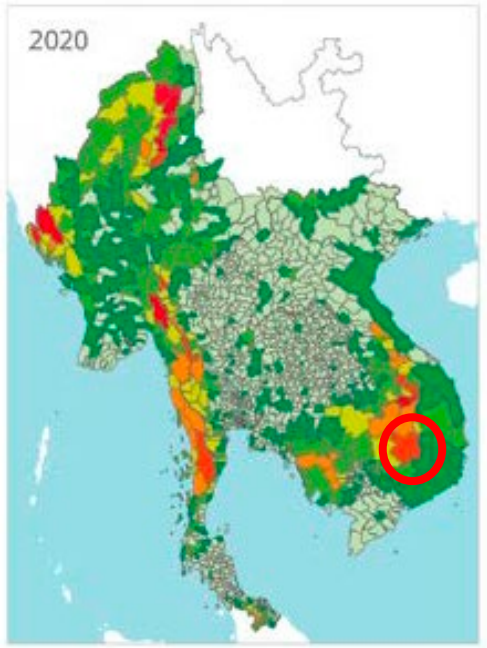
# Need for targeted and tailored approaches

Appropriate, acceptable, and effective tools…




…delivered to the right people…


…in the right places



# Gaps in protection based on vector and human behavior

# Forest packs in demand by NMCPs and funded by the Global Fund

**2019**

US$25

- Backpack
- Insecticide treated hammock net
- Boots
- Health education leaflet

**2020**

US$20-US$37

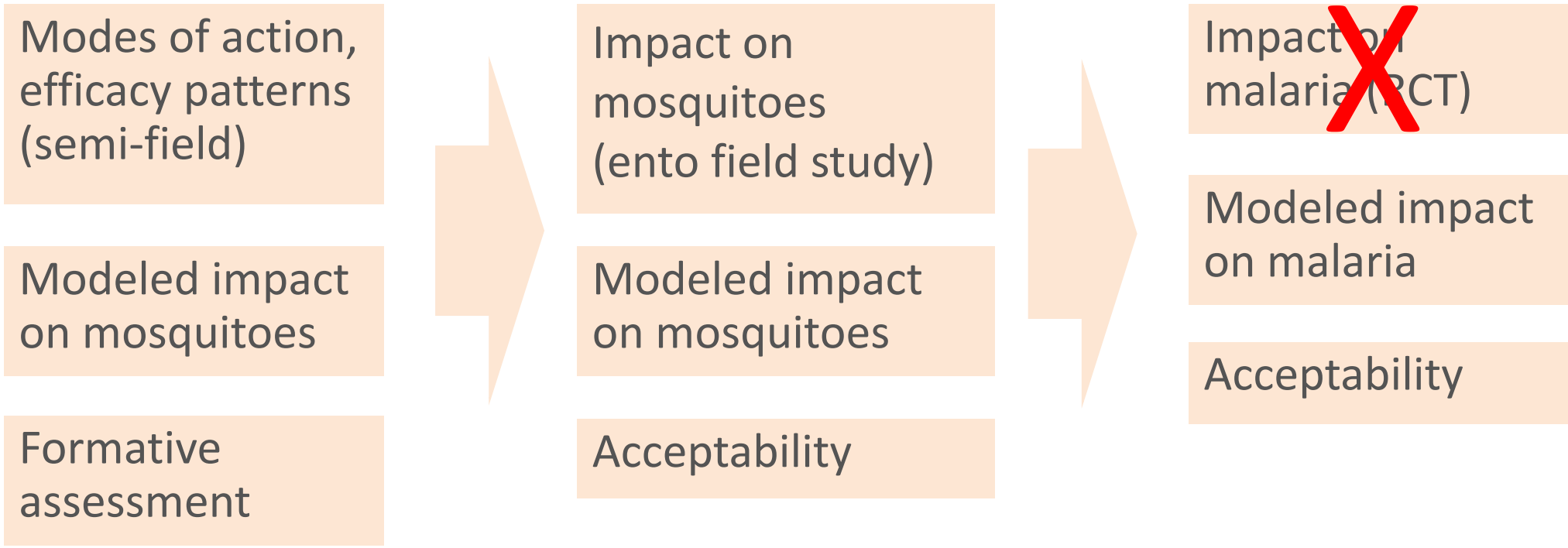
- Backpack
- Untreated/ treated hammock net
- LLIN
- Topical repellent (20% picaridin, donated by SCJ)

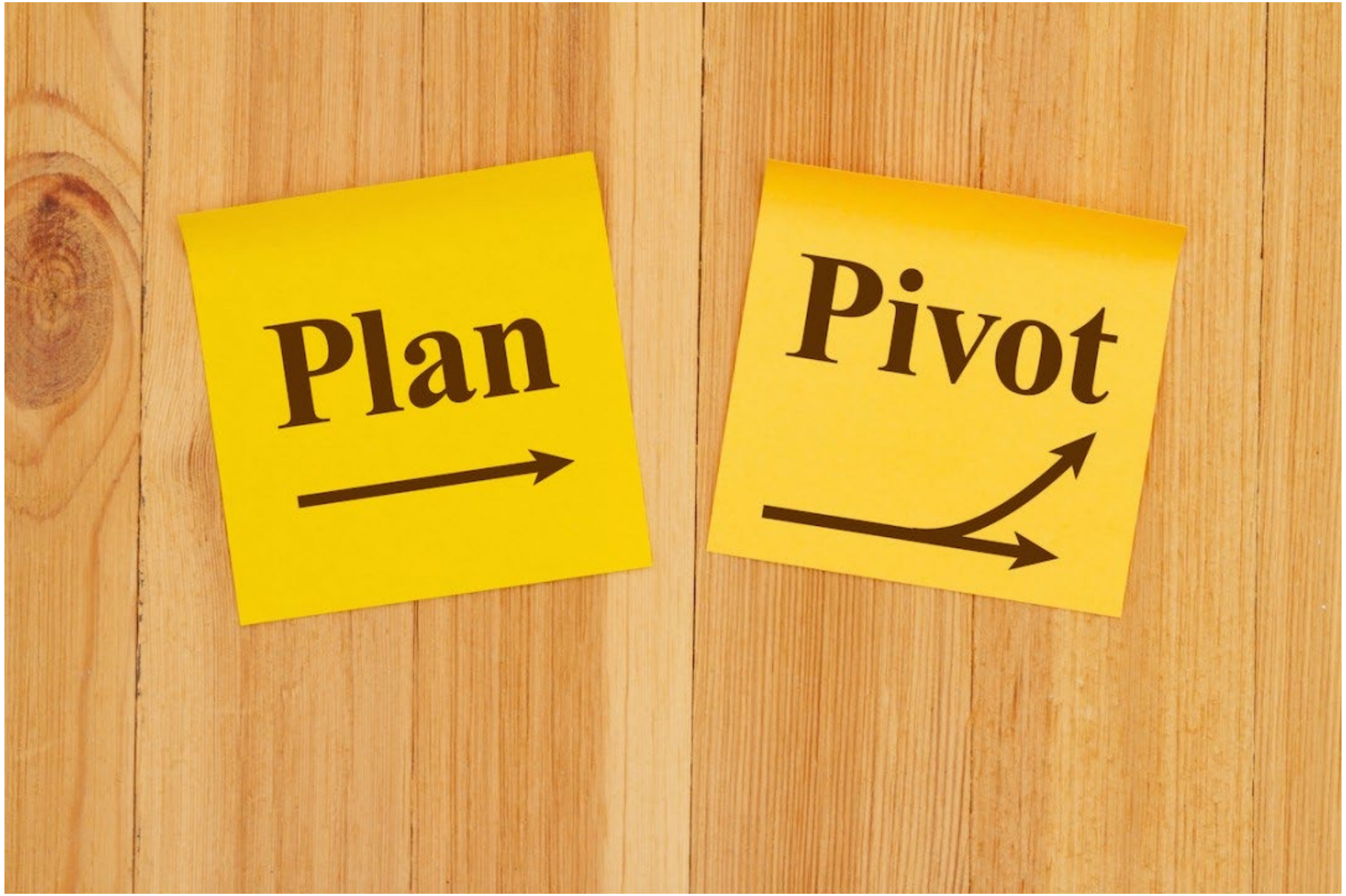
Photo courtesy of Feliciano Monti,. USAID Myanmar

Cambodia NMCP interested in other high quality, efficacious, and suitable tools for these packs as part of its intensification effort

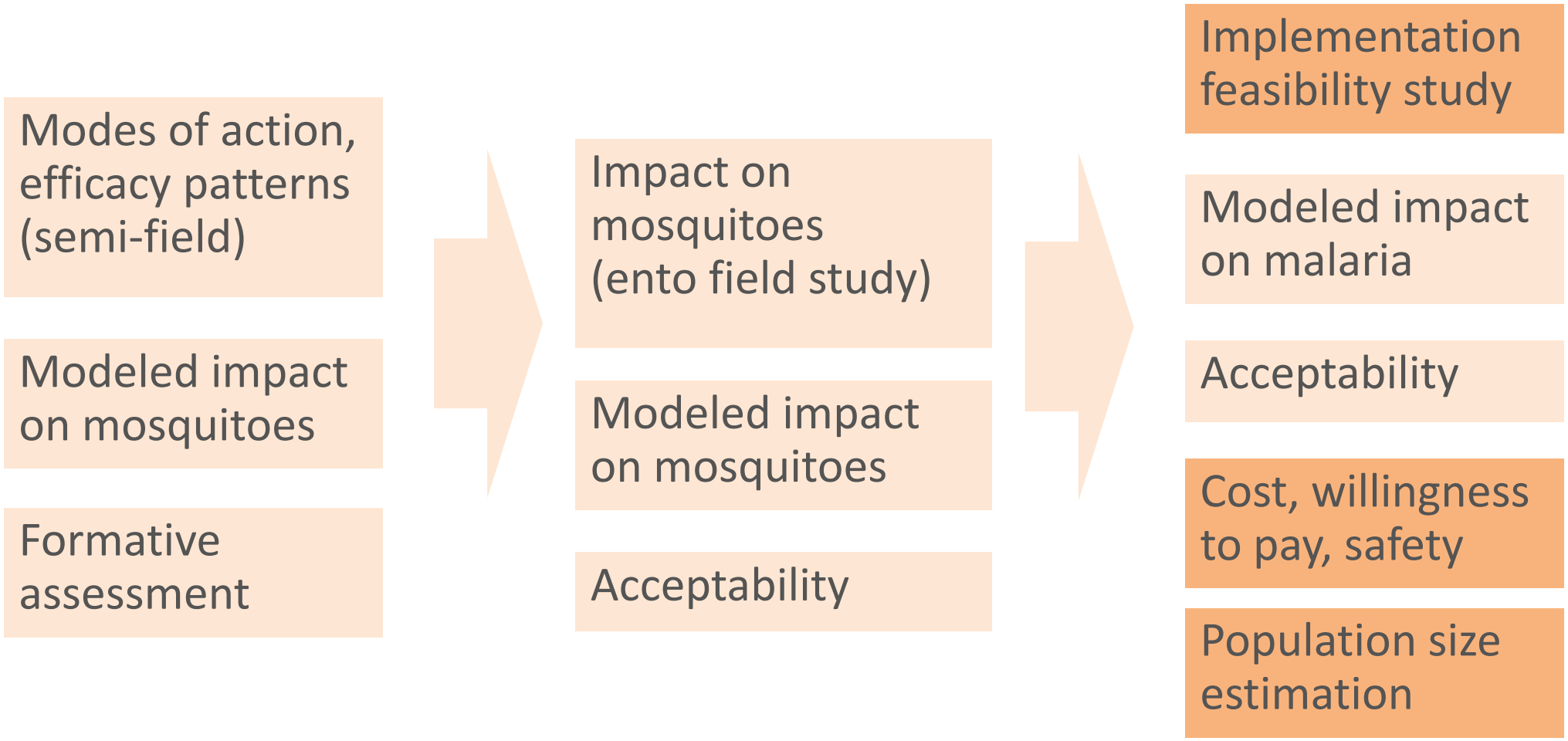
And broader interest across the region in tools for outdoor protection

# Initial 3-year plan to get new tools to the people who need them, Jan 2020-Dec 2023




Plan
Pivot

# 4-year plan to get new tools to the people who need them, Jan 2020-Dec 2023



# Paradigms and products for evaluation

- VPSRs (active and passive)
- Insecticide treated clothing
- Topical repellent

Semi-field only

Espresso (active VPSR*)

SumiOne (passive VPSR*)

All research stages


Bite Barrier, formerly known as "PIRK" (Passive VPSR*)

20% Picaridin topical repellent

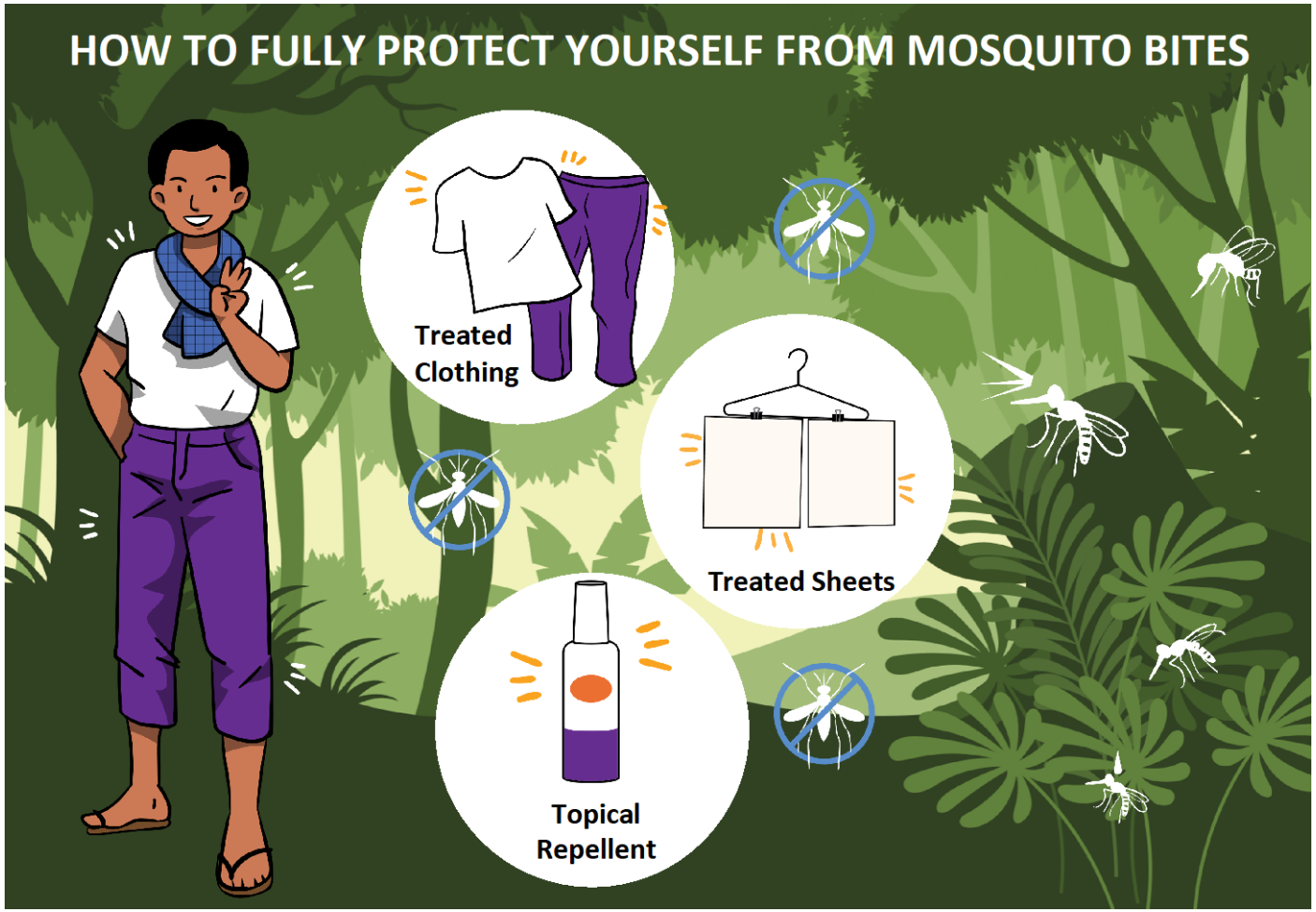

Etofenprox – civilian clothing


Etofenprox spray


Etofenprox – ranger clothing

*VPSR = volatile pyrethroid spatial repellent

# Social and behavioral change communication




## របៀបប្រើឧបករណ៍ការពារមូសខាំទាំងបីមុខ

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Malaria Elimination Initiative

UCSF Institute for Global Health Sciences

Australian Government Department of Foreign Affairs and Trade

IVCC Building Partnerships Creating Solutions Saving Lives

- SBCC provided at each delivery point
- Instruction pamphlets, dos and don’ts, safety considerations
- Promotion of “full time protection”
- Khmer language

- YouTube animation

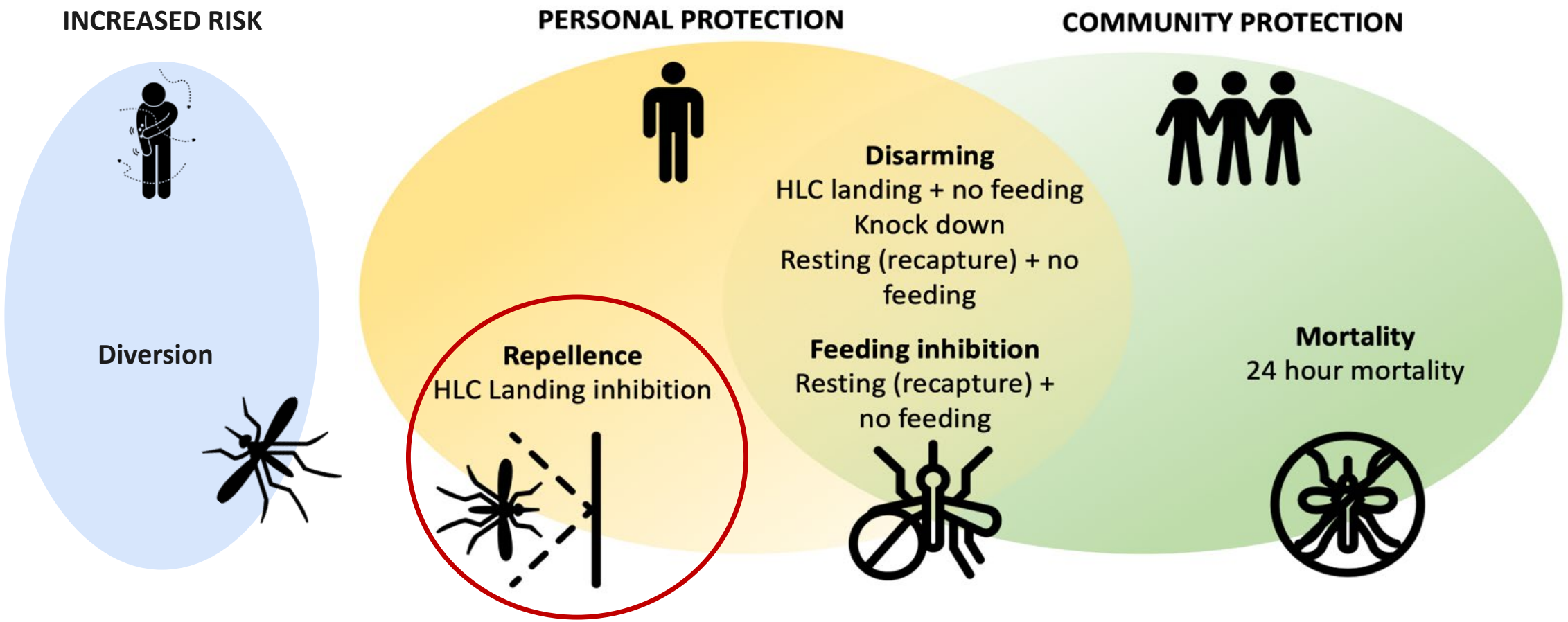
# Forest pack that addresses all spatial and temporal exposures – 24-hour protection

Treated clothing
Topical repellent

Passive VPSR
Treated clothing
Topical repellent

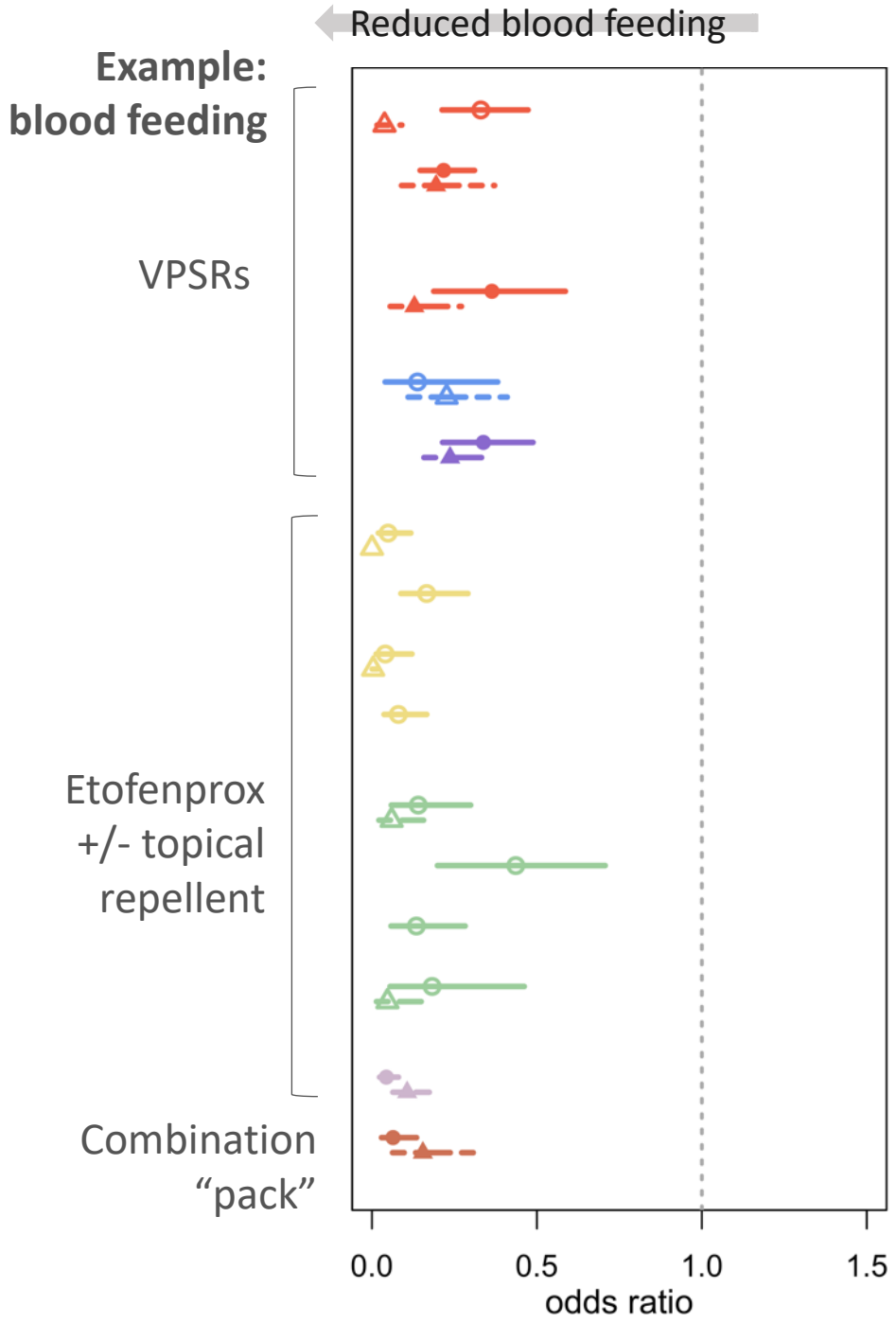
Passive VPSR
Treated clothing
Topical repellent

# Outcome measures and intervention modes of action (MoAs)



# SFS results by mode of action and patterns of protective efficacy

- All interventions effectively reduced mosquito landing
- All interventions have the potential to provide community protection in addition to personal protection through:
  - Disarming mosquitoes for a night through rapid knockdown and killing of mosquitoes, preventing diversion to nearby non-users
  - Reducing blood feeding

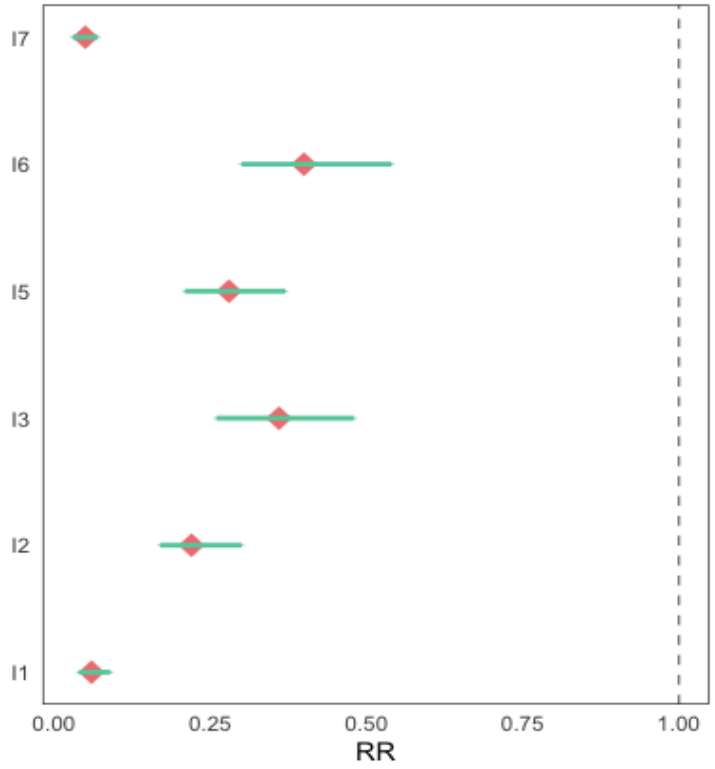


# Implications of SFS findings

- Evaluating only the impact of interventions on landing is insufficient for understanding how VPSRs and insecticide treated clothing (ITCs) function
- VPSRs and ITCs likely go beyond personal bite prevention by providing community protection
- SFS trials are a critical step for evaluating new classes of products because they allow us to evaluate endpoints beyond mosquito landing, providing informative baseline data to help explain field-based outcomes
- SFS data allow model parameterization of modes of action for predicting epidemiological impact of interventions

# Results from the entomological field study

Risk of mosquito landing for each intervention compared to control




I1 – Bite Barrier new
I2 – ETO x0wash CIVILIAN (short sleeves, long trousers) + PICARIDIN20%
I3 – ETO x20wash RANGER + PICARIDIN20%
I4 – Control
I5 – ETO x0wash RANGER + PICARIDIN20%
I6 – ETO x20wash CIVILIAN (short sleeves, long trousers) + PICARIDIN20%
I7 – Combined interventions: Bite Barrier (new) + ETO x0wash CIVILIAN + PICARIDIN20%

- All six interventions significantly reduced risk of landing by at least 50%
- The Bite Barrier (formerly “PIRK”) alone and the combination of three products reduced mosquito landings by nearly 95%

# Implementation feasibility study in Cambodia

- CNM and NGO (Malaria Consortium)-led implementation of Bite Barrier, etofenprox clothing treatment, topical repellent, and SBCC
- Distributed “packs” to 5,744 individuals in active *P. falciparum* hotspots across two provinces
- Evaluation by Project BITE team, led on the ground by Health Forefront Organization
  - 3 cross-sectional studies, including questionnaires and DBS and mosquito collection
  - 2,047 individuals enrolled, complete cohort of 1,080 for serology study

# Early results* from cross-sectional survey questionnaires and end-user interviews

| | Bite Barrier | Eto treated clothing | Topical repellent |
|---|---|---|---|
| Acceptability | 94% | 95% | 93% |
| Appropriateness | 97% | 98% | 95% |
| Coverage | 98% | 22% | 98% |
| Use (last night) | 91% | 60% | 70% |
| Use (in the last week) | 96% | 87% | 91% |

*Province average, T2 time point

*"Generally speaking, we use the [Bite Barrier] when resting from work and sleeping. The spray-on-the-skin [topical repellent] works better when working, but with the [Bite Barrier], we have to hang it in one place."* KII_09_KS_Male_Age 37

*"I will continue to use the products because I have used them and I know the quality. It is like when you know that the fertilizer is good for your rice field, why wouldn't you use it?"*
KII_02_KS_Male_Age 44

*"**The [Bite Barrier] is pretty straightforward**. You only need to hang it in the corner or inside the room, and it is done. …."* IDI_07_Mondulkiri_Male_Age 32

*"When the rain comes, the wind also comes. So, the **combination of wind and rain can easily destroy the [Bite Barrier], so we cannot take it to the forest**."*
*KII_03_KS_Male_Age 43*

*"There is nothing difficult with the treated clothing. After treatment, we can wear it and don't have to carry it in a bag. **We wear it like our regular clothes to the forest. This is relatively easy. We can even sleep with the clothes** on in the forest."*
KII_07_MDK_Male_Age 32

*"The treated clothing is not suited for forest goers because **most have only one or two sets for forest activities. So, it is difficult for them to wash**."* Kg Speu_VMW_IDI_02 (implementer)

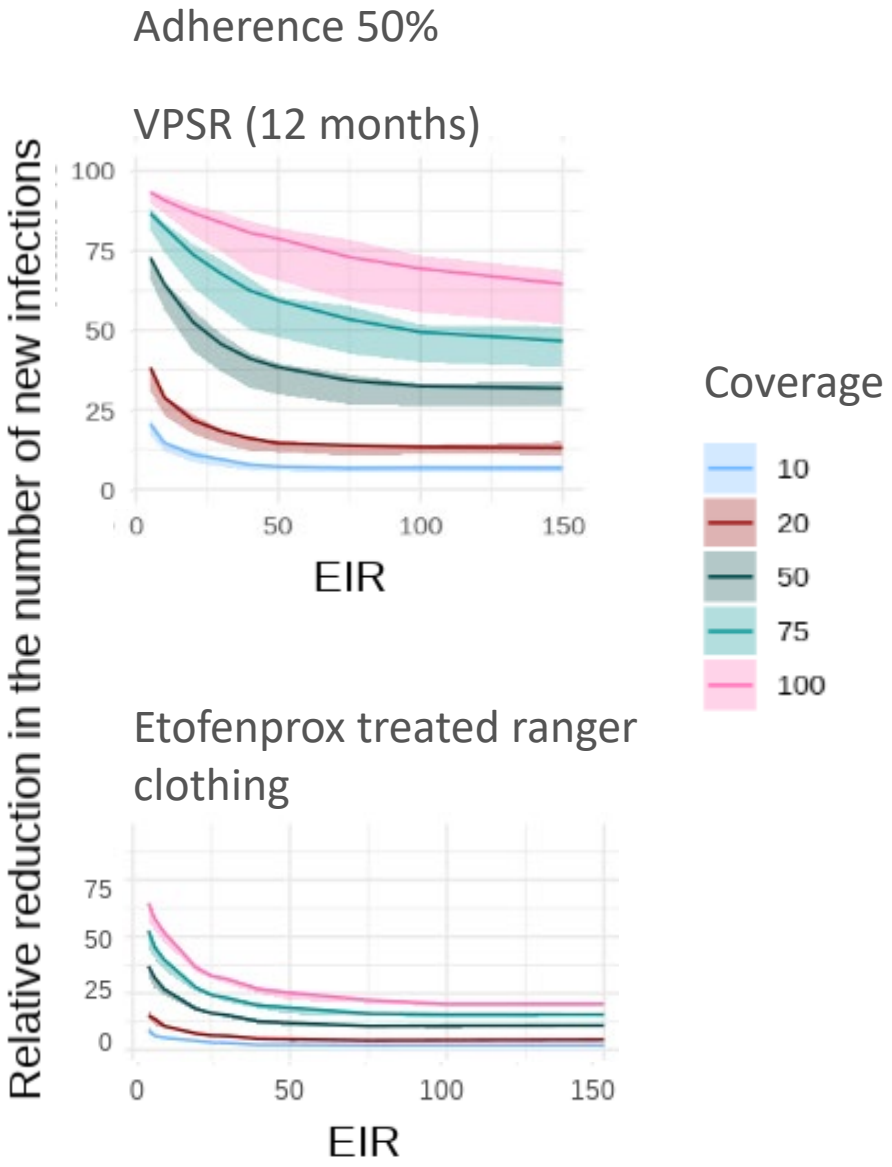
*We can use [the topical repellent] **anytime and anywhere**. Sometimes, when I go to the toilet at night, I take it with me to spray [themselves]. So I can take it with me everywhere I go.*
IDI_01_Mondulkiri_Female_Age 26

*"I sprayed [the topical repellent] **in the closet and underneath the bed** and I hang the [Bite Barrier] near the bed and **I sprayed topical repellent on the sheet**..."*
FGD_03_KS

# Modeling insights

Based on SFS and entomological field data, OpenMalaria simulations suggest

- Estimates of impact are higher in settings of lower EIR
- Longer-lasting tools with higher coverage and adherence are impactful in higher EIR settings
- Estimates of impact strongly associated with the level of adherence and coverage
- Targeting those who receive the most bites and increasing adherence can reduce malaria transmission more with the same amount of product



# Implications of BITE results to date

- Based on semi-field and entomological field trials and modeling insights to date, these tools
  - Prevent mosquito bites in outdoor settings
  - Impact on mosquito life traits and thus vectorial capacity
    - Indicating protection at the community level if used correctly with sufficient coverage
  - Are generally accepted by end users, with room for improvement around delivery
  - Require early and sustained SBCC and community engagement
- The Cambodia NMCP is interested in integrating VPSRs in its program alongside topical repellents
- Other GMS NMCPs interested in new bite prevention tools to address remaining challenges to elimination, including outdoor transmission
- Potential application to humanitarian settings (e.g. IDP camps) and hard-to-reach and mobile populations in residual transmission settings in Africa

# BITE symposium @ ASTMH

Symposium 43

October 19

3:00 – 4:45 PM, Chicago time

# Thank you

The University of California San Francisco
Malaria Elimination Initiative