Integrating vector and human behavioral data for malaria prevention: an interdisciplinary approach

VCWG 19th Annual Meeting
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Kaci McCoy, Allison Hendershot, Gabrielle Hunter, Shelby Cash, Sarah Zohdy, Jenny Carlson Donnelly, Joseph Millward, April Monroe

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Introduction

- **Rationale**: Integrating human behavioral data with data on malaria vector behavior can help to identify patterns of human exposure to malaria vectors and identify gaps in protection

- **Research Question:** How can existing Malaria Behavior Survey (MBS) data on human behavior and existing entomological monitoring data be integrated using recognized methods to calculate indicators of vector-human interaction?

- **Output:** Process and lessons learned for using these data sources to inform programmatic decision making on vector control procurement and SBC strategies

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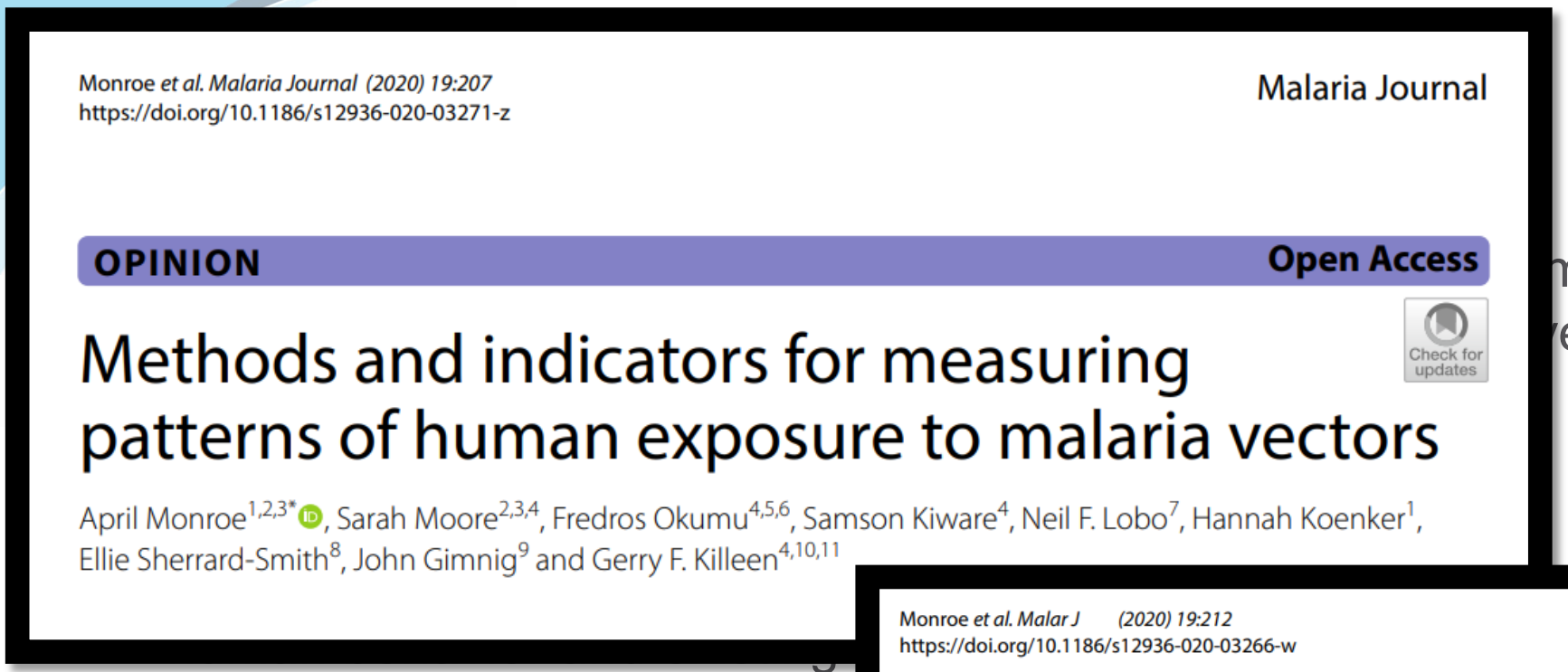

Monroe et al. Malaria Journal (2020) 19:207
https://doi.org/10.1186/s12936-020-03271-z

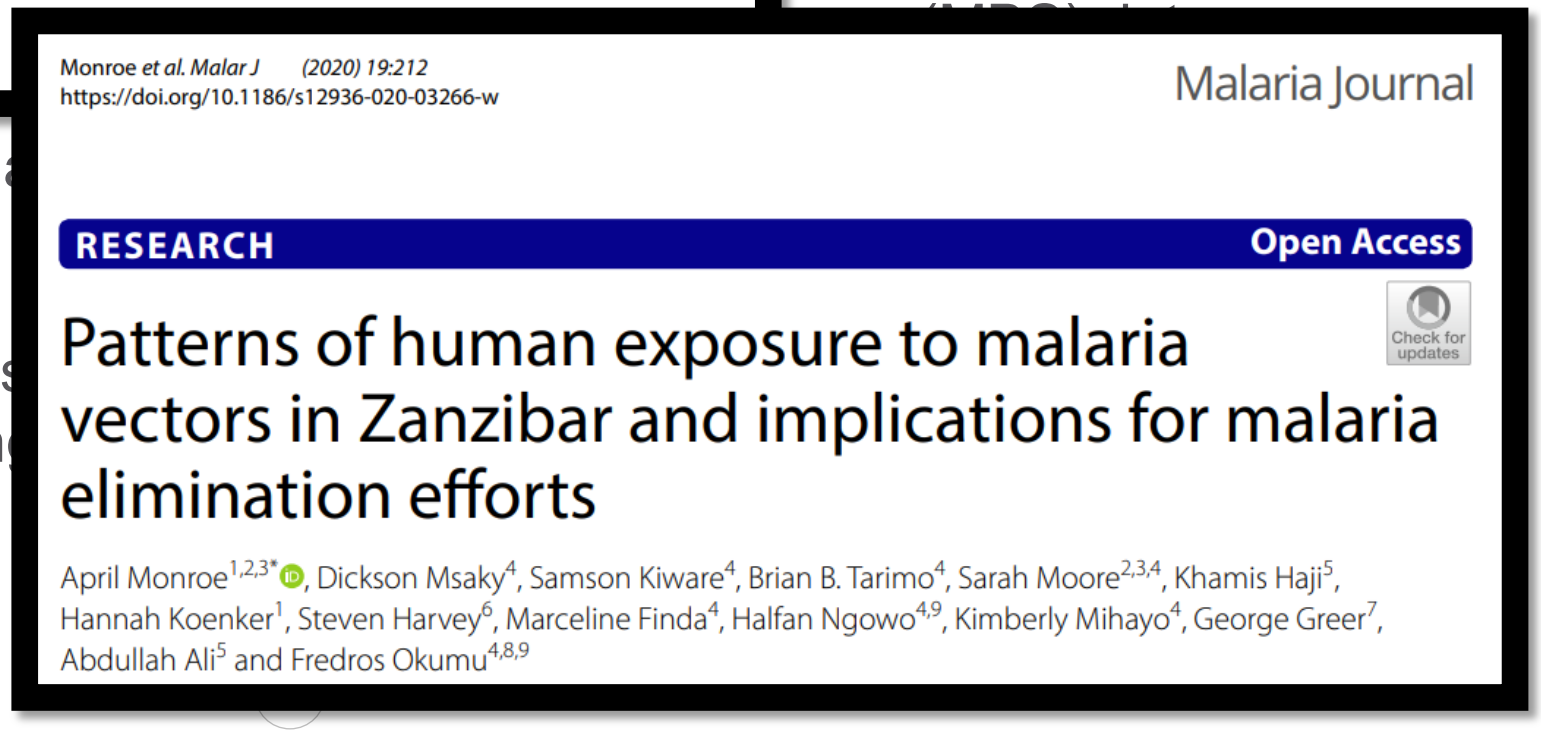
Malaria Journal

OPINION

Open Access

Methods and indicators for measuring patterns of human exposure to malaria vectors

April Monroe[1,2,3*], Sarah Moore[2,3,4], Fredros Okumu[4,5,6], Samson Kiware[4], Neil F. Lobo[7], Hannah Koenker[1], Ellie Sherrard-Smith[8], John Gimnig[9] and Gerry F. Killeen[4,10,11]


Monroe et al. Malar J (2020) 19:212
https://doi.org/10.1186/s12936-020-03266-w

Malaria Journal

RESEARCH

Open Access

Patterns of human exposure to malaria vectors in Zanzibar and implications for malaria elimination efforts

April Monroe[1,2,3*], Dickson Msaky[4], Samson Kiware[4], Brian B. Tarimo[4], Sarah Moore[2,3,4], Khamis Haji[5], Hannah Koenker[1], Steven Harvey[6], Marceline Finda[4], Halfan Ngowo[4,9], Kimberly Mihayo[4], George Greer[7], Abdullah Ali[5] and Fredros Okumu[4,8,9]

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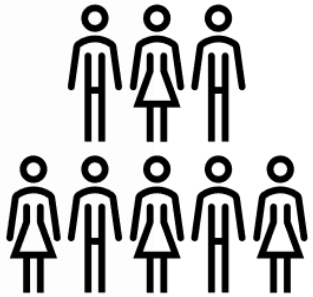
Vector-Human Data Integration

Methods

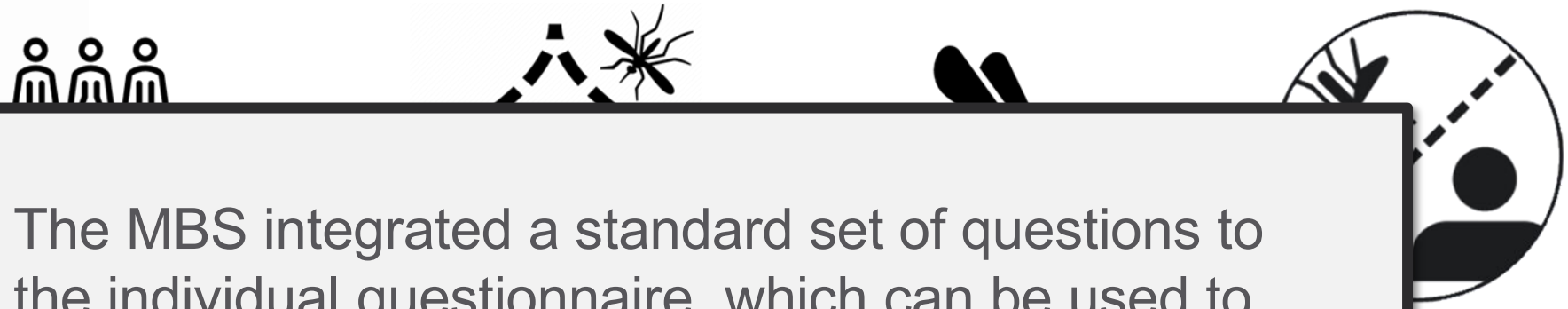
Methods: Data Integration




Monroe et al., 2020

Data Input:	Hourly nighttime indoor and outdoor human location estimates	Reported proportion of human population that used an ITN while asleep	Hourly nighttime indoor and outdoor human biting rates	Personal protection by ITN while in-use
Source:	Malaria Behavior Survey	Malaria Behavior Survey	Entomological Monitoring (HLCs)	Experimental Hut Trials
Population:	Adults (aged 15-49) of participating HHs who stayed in the house the night prior to survey and responded to the individual questionnaire	Adults and children of participating HHs who stayed in house the night prior to survey	HLC data collectors	EHT volunteers
Timing:	May - July 2021	May - July 2021	June 2021	June - September 2017

Methods: Data Integration



Monroe et al., 2020

The MBS integrated a standard set of questions to the individual questionnaire, which can be used to calculate human location estimates:

- Approximately at what time did you go to sleep yesterday?
- Approximately at what time did you wake up today?
- Did you sleep indoors or outdoors?
- What time did you go indoors for the evening?
- What time did you go outdoors for the morning?

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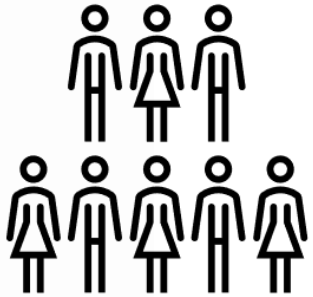

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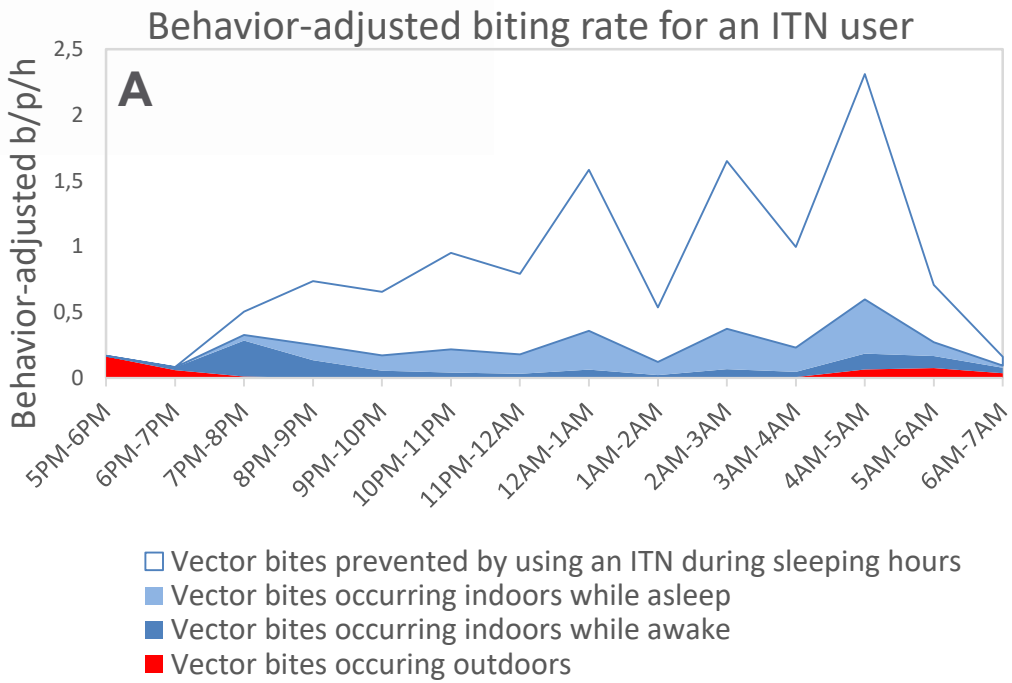
Vector-Human Data Integration

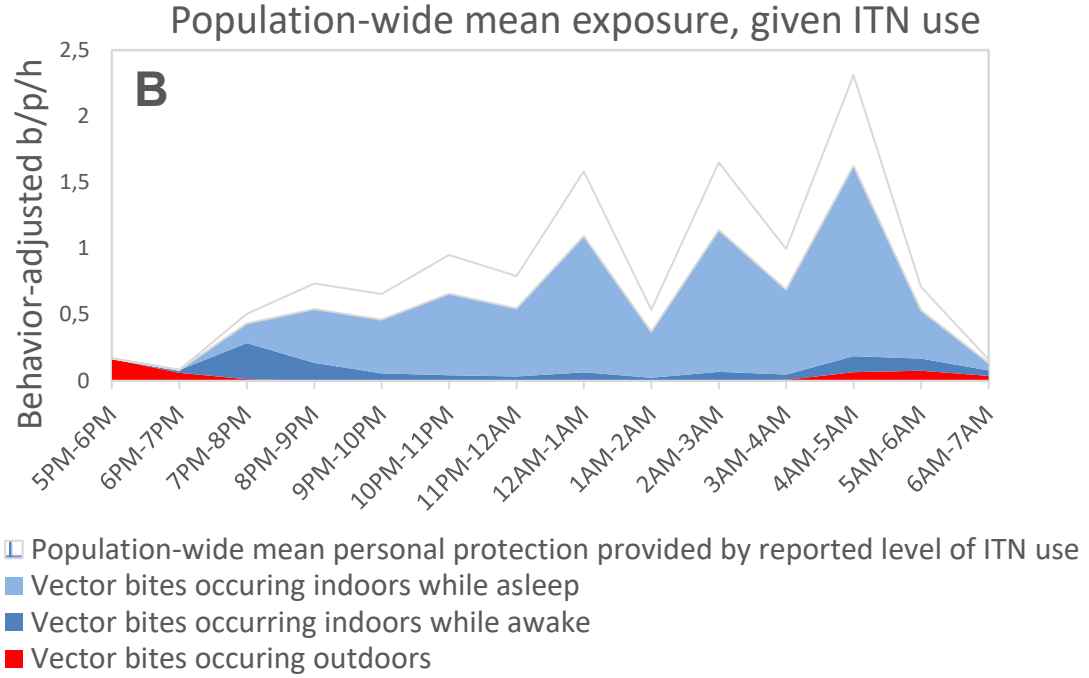
Results and Interpretations

Results & Interpretation

- Data integration produces key indicators:
  - Directly measured biting rate and human location
  - Behavior-adjusted biting rate for an unprotected individual
  - Behavior-adjusted biting rate for an ITN user
  - Population-wide mean exposure to vector bites

Results & Interpretation





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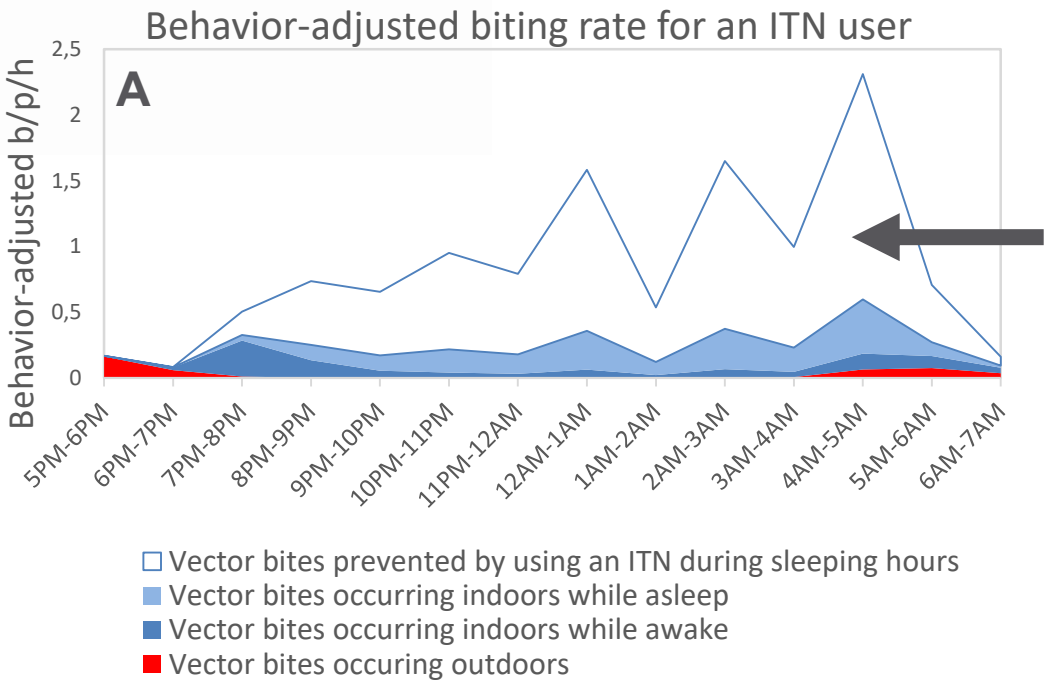
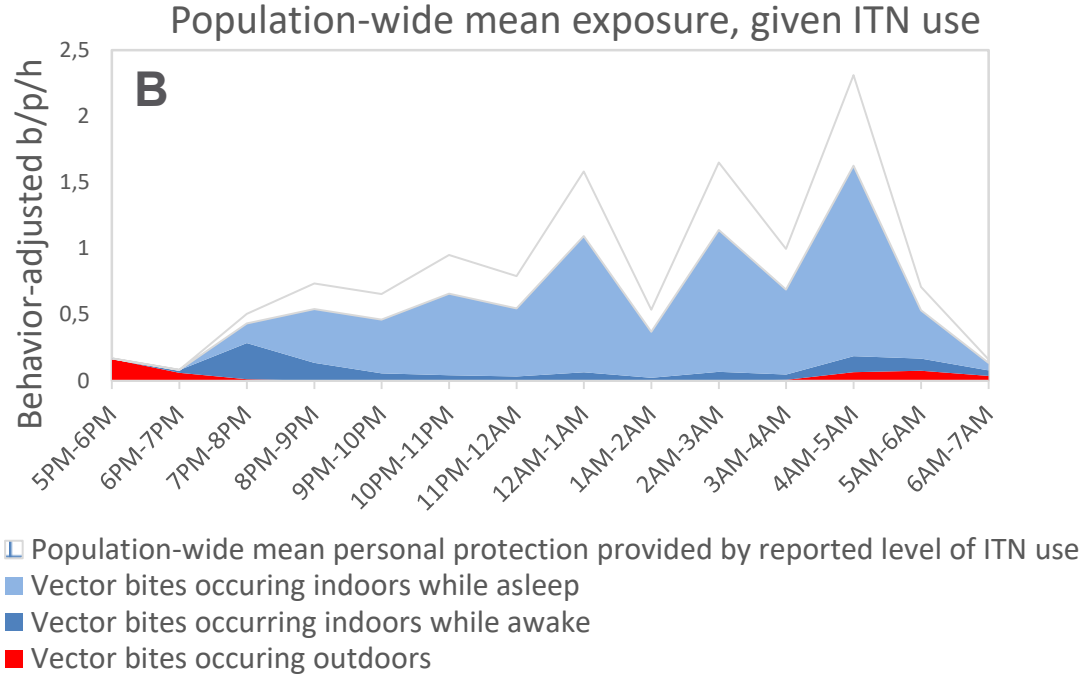
Results & Interpretation





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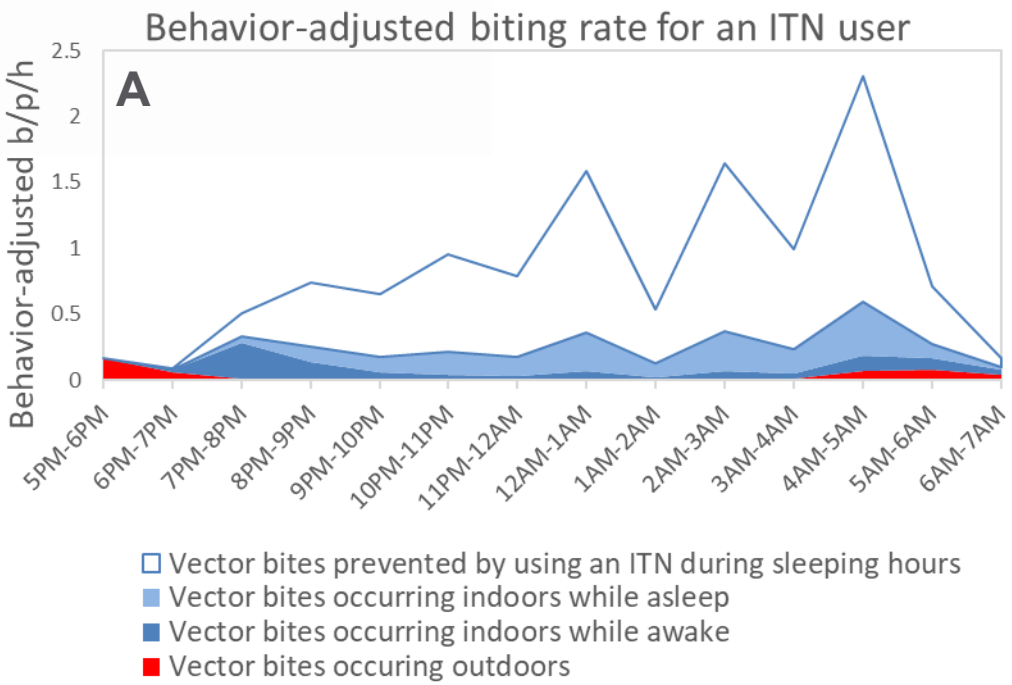
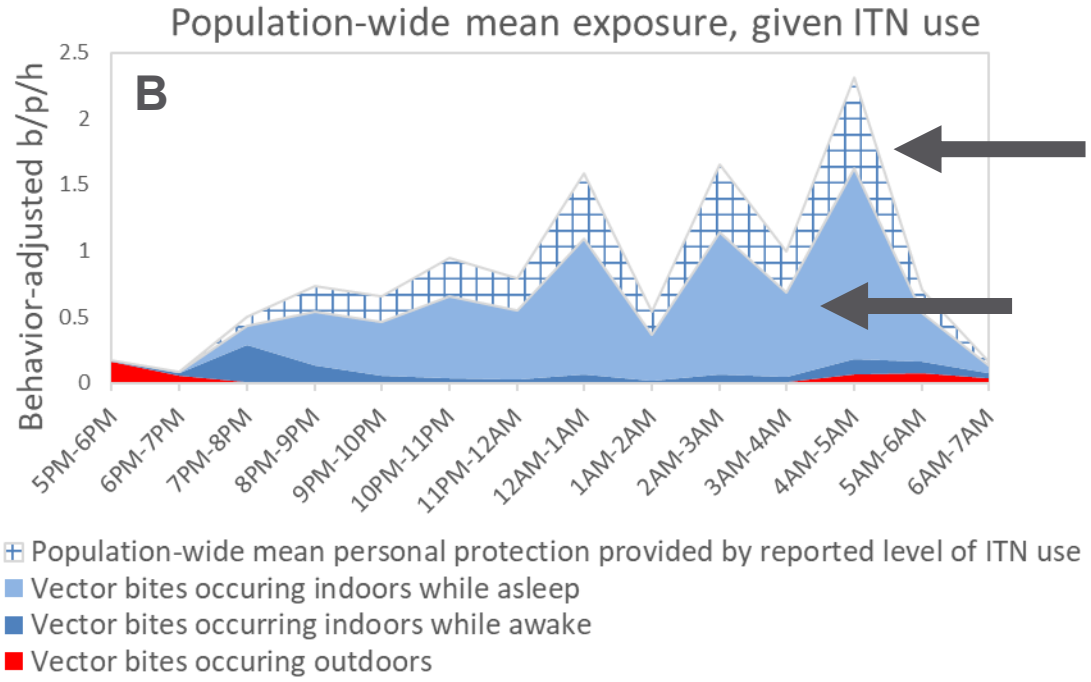
Results & Interpretation





Suggests gap in protection around ITN access and effectiveness

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Results & Interpretation

- Other types of gaps in protection that may be characterized through these methods:
  - Implementation quality/access
  - Behavioral gaps in intervention use
  - Intervention effectiveness
  - Limits to protection current tools can provide

Vector-Human Data Integration

Lessons Learned, Remaining Gaps, and Limitations

Remaining Gaps and Limitations

- Data specific to peri-domestic space and individual behaviors
- Calculations do not directly factor in IRS or community effect on malaria transmission
- Entomological data available did not calculate infection rates or associated risk of malaria transmission (may be available in other contexts)
- Averaged vector behavior across multiple sites

Lessons Learned from Leveraging Routine Data Collection

- Human behavioral data routinely captured through the MBS can be linked to entomological data to identify patterns of vector-human exposure
- Other data sources provide important context to interpret the results
  - Net durability monitoring reports
  - Other ITN use and access estimates (e.g., from MIS) and ITN use:access ratio
  - Other human behavior observations
- Timing of data collection is important, both in determining sufficient overlap in data sources as well as obtaining the most up to date data inputs
- Data collection and integration can be planned concurrently, in advance of decision-making to provide of-the-moment gap identification

Future Applications

- Apply proof-of-concept learnings and process to other countries
  - Large sample sizes from MBS allow patterns to be identified at a large scale
  - At time of planning for MBS is good time to identify where there may be overlapping entomological surveillance for timely integration

- Potential applications of results:
  - Social and behavior change activities to increase ITN use and care
  - Guidance on selection of vector control tools best suited for the context

Thank you!

For more information, please contact

Kaci McCoy

Program Officer

kaci.mccoy@jhu.edu

www.breakthroughactionandresearch.org

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