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

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

April Monroe1,2,3,*, Sarah Moore2,3,4, Fredros Okumu4,5,6, Samson Kiware4, Neil F. Lobo7, Hannah Koenker1, Ellie Sherrard-Smith8, John Gimnig9 and Gerry F. Killeen4,10,11

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

April Monroe1,2,3,*, Dickson Msaky4, Samson Kiware6, Brian B. Tarimo6, Sarah Moore2,3,4, Khamis Haji5, Hannah Koenker1, Steven Harvey5, Marceline Finda6, Halfan Ngowo4,9, Kimberly Mihayo4, George Greer7, Abdullah Ali7 and Fredros Okumu4,8,9"
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Vector-Human Data Integration

Methods
## Methods: Data Integration

Monroe et al., 2020

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<th>Reported proportion of human population that used an ITN while asleep</th>
<th>Hourly nighttime indoor and outdoor human biting rates</th>
<th>Personal protection by ITN while in-use</th>
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Methods: Data Integration

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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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

A. Behavior-adjusted biting rate for an ITN user

- Vector bites prevented by using an ITN during sleeping hours
- Vector bites occurring indoors while asleep
- Vector bites occurring indoors while awake
- Vector bites occurring outdoors

B. Population-wide mean exposure, given ITN use

- Population-wide mean personal protection provided by reported level of ITN use
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Results & Interpretation

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Results & Interpretation

Suggests gap in protection around ITN access and effectiveness
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

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www.breakthroughactionandresearch.org

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