Monitoring of Insecticide-Treated Nets in the Americas

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Preliminary Thoughts

- **Entomology as a challenge**

- **Excellent expertise and experiences in countries**

- **Need for standardization**

  - **My personal fault….**

- **Need to accept limitations and think programatically and medium scale**

Good News

- **AMI strategic document in entomology approved and in printing**

  – **Agreement among AMI partners reached**

- **Different reference guidelines in discussion**

- **I have learned some entomology**

- **I like the coffee in Belize**

Agenda

- **Discuss reasons for evaluating insecticide-treated nets (ITNs)**

- **Comment possible approaches within AMI context**

- **Think medium and large scale**

- **Show how CDC can help**

CDC

- **Not a research institution**

- **Assistance to countries collect information needed for programatic decisions**

- **Pool of public health professionals eager to assist**

- **Consider involving CDC and other partners in your plans**

- **AMI's main goal is to make your program a success**

Potential Pitfalls

- **Not only about having expertise in using different tools**

- **Important to have tools used as part of sound strategies for monitoring and response plans**

- **An easy quick method may not be the best answer**

- **A scientifically sound approach may not be much more complicated**

Background

- **ITNs protect individuals and community**

- **Long-lasting ITNs (LLINs)**

  - **Adequate insecticidal activity after 20 standard washes and 3 years of routine use**

- **WHO Pesticide Evaluation Scheme (WHOPES) interim recommendation to 6 net products**

Classic ITN Efficacy Study

- **Impact of ITN in malaria cases**

- **Expensive and multi-year study required to capture mortality data**

- **Need for a comparison group (no net), ethics concerns**

- **Need to account for other control measures (ACT use) in place in the area**

- **Beyond scope of AMI**

Context

- Large investment worldwide
  - Countries in the Americas investing in ITNs
    - Focus on monitoring vector control operations
  - Coverage
  - Durability
- ITNs not lasting as long as expected
  - Programmatic implications

Frequency

- **Coverage evaluations**
  - **Performed periodically**
    - **Possibly every 2 to 4 years**
    - **Sometimes performed to evaluate distribution campaigns**

- **Durability evaluations**
  - **Not needed as often**
  - **Findings valid as long as cultural behavior and practices remain the same**

Why Evaluate Coverage?

- **Information can assist in planning of ITN distribution campaigns**

- **Objectives**

  - **Measure household ownership of ITNs**

  - **Measure ITN use by different target groups (children <5 years old, pregnant women, all persons)**

Coverage Evaluations

- **Done by independent partners**
  - **Not the same responsible for distributions**

- **Selection of a statistically representative sample of the population of interest**

- **Different sampling schemes possible**

- **No need to visit every household (large-scale programs now….)**

Indicators

- **Household ownership of ITNs**
  - **Proportion of households ≥1 ITN**
  - **Proportion of households with ≥1 ITN per sleeping space (AMI exclusive indicator…)**
  - **Proportion of ITNs distributed in a campaign still present**
- **Use**
  - **Persons who slept under an ITN the previous night**

# Sample Size Calculation and Sampling Scheme

- **Decision on sampling scheme and domain of interest on a country-by-country basis**

  – **Sampling scheme**
    - **Normally, multi-stage cluster**

  – **Domain of interest (impact sample size)**
    - **Regional, provincial, country, other**

CDC Experience

- **Often a 3-stage selection process**
  - **2 stages by probability proportional to size**
    - **Selection of municipalities and localities (using census data, in your office....)**
  - **1 stage by random sample**
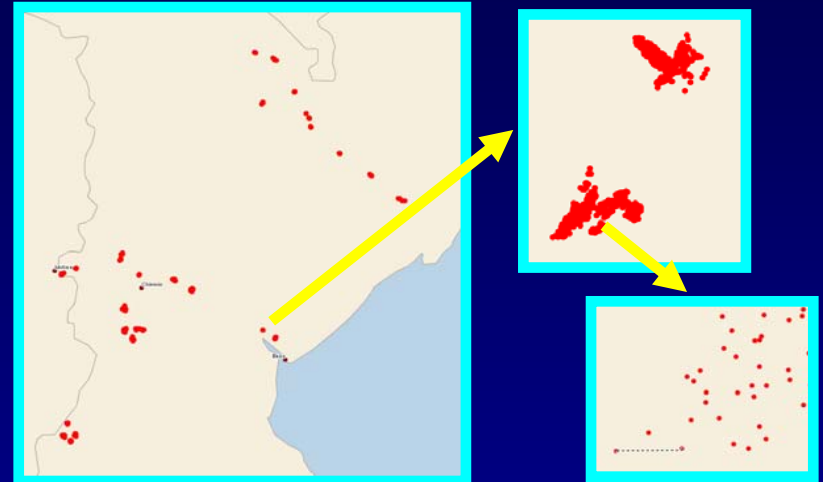   - **Selection of households in localities**

Random Household Selection

- **All households in a locality mapped using global positioning system (GPS) and personal digital assistants (PDA)**

- **Mapped households randomly selected**

- **GPS speeds up process**
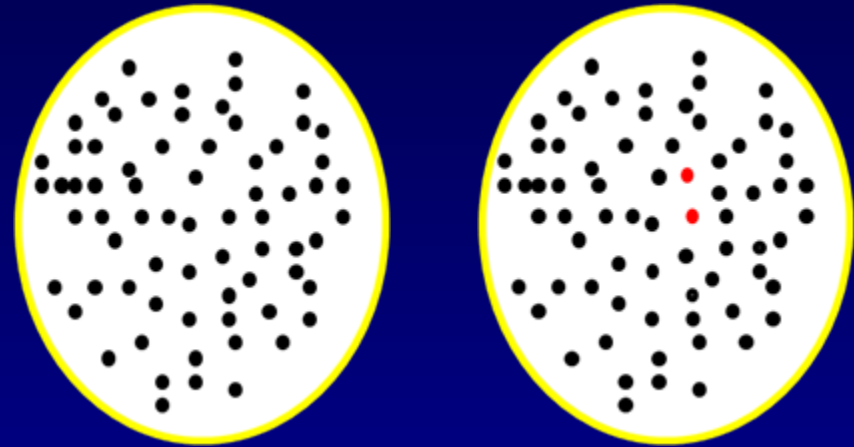
Utility of GPS/PDA

- **Navigate back to selected households**

- **Interview persons with digitally programmed questionnaire**

Timeline of Coverage Evaluations

- Pre-survey: Development of protocol (4 months)

- Training of interviewers: 4-6 days for survey strategy and practice

- Data collection: 1 week per province

Why Evaluate Longevity?

- **Information can assist with planning purposes**

    - **Planning the replacement of worn-out nets in ongoing LLIN program**

    - **Making procurement decisions to select most suitable LLINs for given setting**

Durability Evaluations

- **Guidelines in development**
- **Mainly "qualitative"**
- **Sample size**
  - **30-50 nets randomly selected in domain of interest**
- **Need for some infrastructure**
  - **Hole counting is detail-oriented**
  - **Need of colony mosquitoes for cone testing**

Types of Durability Evaluations

- **Cross-sectional**
  - **Collect nets with expected time in use**
  - **Look at holes and insecticide content**

- **Longitudinal (prospective)**
  - **Mark and distribute nets and identify houses where nets received**
  - **Visit random sample of houses and collect data at regular intervals (e.g. 1x year)**

Parameters of Durability Evaluations

- Document the physical durability using standard methodology

- Cone bioassay to determine effectiveness against pyrethroid-susceptible mosquitoes

- Residual insecticide measurement by standard and colorimetric method (only for LLINs with deltamethrin)
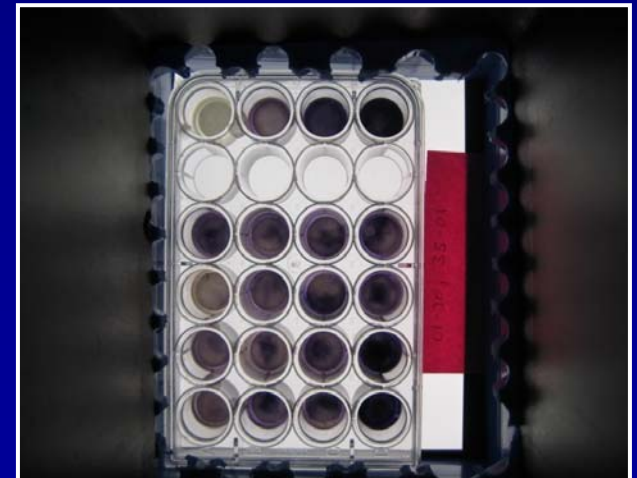
Hole Counting

- **All holes counted, measured, and located**

  - **Takes time and attention to detail**

- **Need for "reference" lab for hole counting**

Bioassay and Chemical Analysis

- **Nets used for residual insecticide testing**

- **Current methods**

  - **Gold standard methods with HPLC and GC**

  - **WHO residual insecticide cone assay**

  - **Colorimetric method for LLINs with deltamethrin**

Issues from Yesterday

- **Difference in insecticide resistance and cone bioassay on ITN**

  - **Evaluation of different things**

- **Know what you need to know for programmatic reasons**

- **At this moment, cone bioassays are to use 'susceptible' mosquitoes only**

Key Messages

- **Pilot phase has passed**

- **Following protocols and using sound epidemiology are essential to obtain valid results**

- **Additional effort to do things right is not that much**

- **AMI partners can help you**

Acknowledgements

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- Many others

AMI countries

- Too many to name here

PAHO

- Mari Paz Ade
- Keith Carter

USAID

- Jaime Chang

Muito Obrigado

Plans in Acre, Brazil

- **Cross-sectional evaluation**
- **Previously numbered nets to be collected**
- **Holes will be counted**
- **Insecticide content measured**
- **Nets were closely monitored and time period of distribution known**

Vector Control Operations Evaluation

- **Component of AMI Strategic Document on Entomology**
  - **Standard internationally accepted indicators**
  - **Coverage**
- **Household ownership**
- **Use**
  - **Durability**
- **Physical durability and insecticide content of ITNs at regular intervals**

Background

- ITNs protect individuals and community Divert host-seeking vectors to feed elsewhere
  - Kill vectors that attempt to feed on persons protected by a net
  - Unprotected individuals may benefit by reduction in mosquito density, reducing risk of transmission

- Long-lasting ITNs (LLINs): adequate insecticidal activity after 20 standard washes and 3 years of routine use

- WHO Pesticide Evaluation Scheme (WHOPES) interim recommendation to 6 net products

Sample Size Calculation and Sampling Scheme for Coverage Evaluations

- **Determine the sample size of households**
  - Depends on sampling design (clustering or random or both)
  - Expected ownership in a population
- **CDC often relies on 3-stage clustering**
  - Select number of districts and number of enumeration areas (EAs) by probability proportional to size (using census data) (2 stages)
  - Select households in EA by random sample (3rd stage)