Using a spatial decision support system for adaptive malaria control on Bioko Island
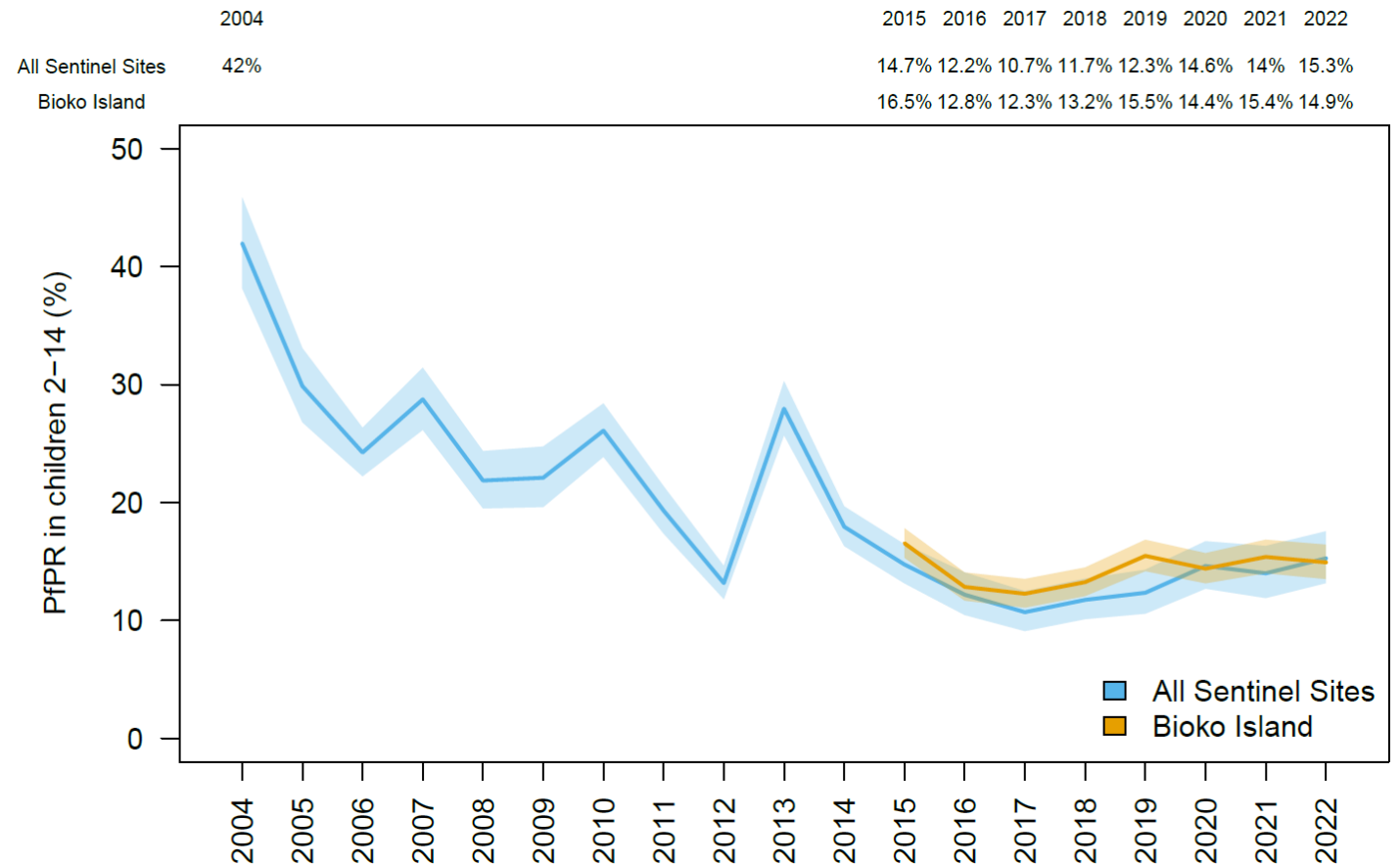
David Galick

AMP Annual Meeting, Nairobi, May 2023

MCD Global Health

mcd.org

Impact of the BIMEP since inception: 2004-2022

	2004		2015	2016	2017	2018	2019	2020	2021	2022
All Sentinel Sites	42%		14.7%	12.2%	10.7%	11.7%	12.3%	14.6%	14%	15.3%
Bioko Island			16.5%	12.8%	12.3%	13.2%	15.5%	14.4%	15.4%	14.9%

Overview

I. Adaptive management for malaria control in Equatorial Guinea

II. Use of data for decision-making: Spatial Decision-Support System

III. Situational Analysis: Strategy of LLINs on Bioko Island

IV. Adapting malaria control strategies

mcd.org

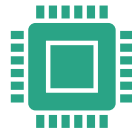# I. Adaptive Management for malaria control in Equatorial Guinea
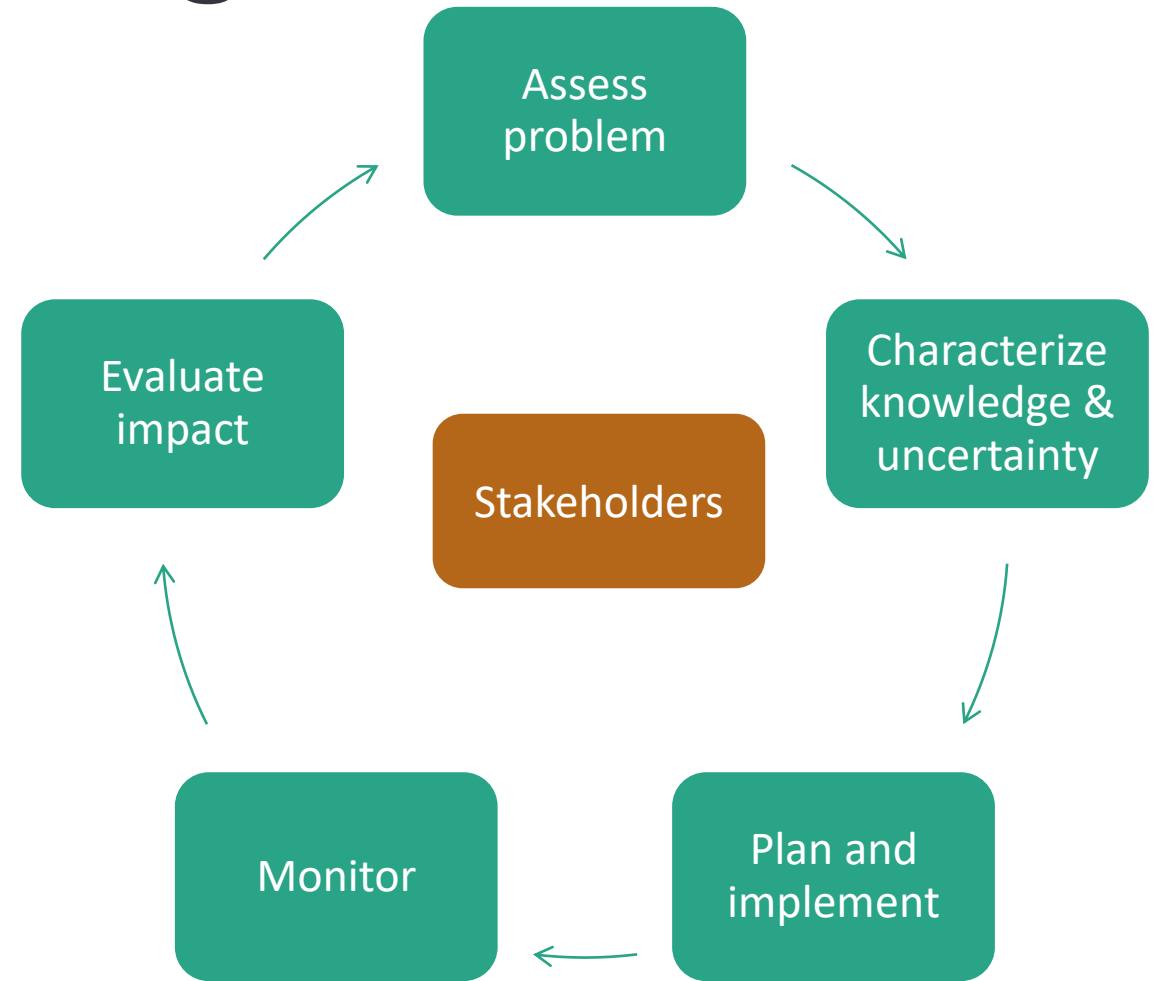
What is adaptive management?

Use of data to iteratively improve implementation, both in terms of operational efficiency and impact

M&E identifies weaknesses and opportunities for improvement

New approaches iteratively tested and improved until ready for programmatic scale-up

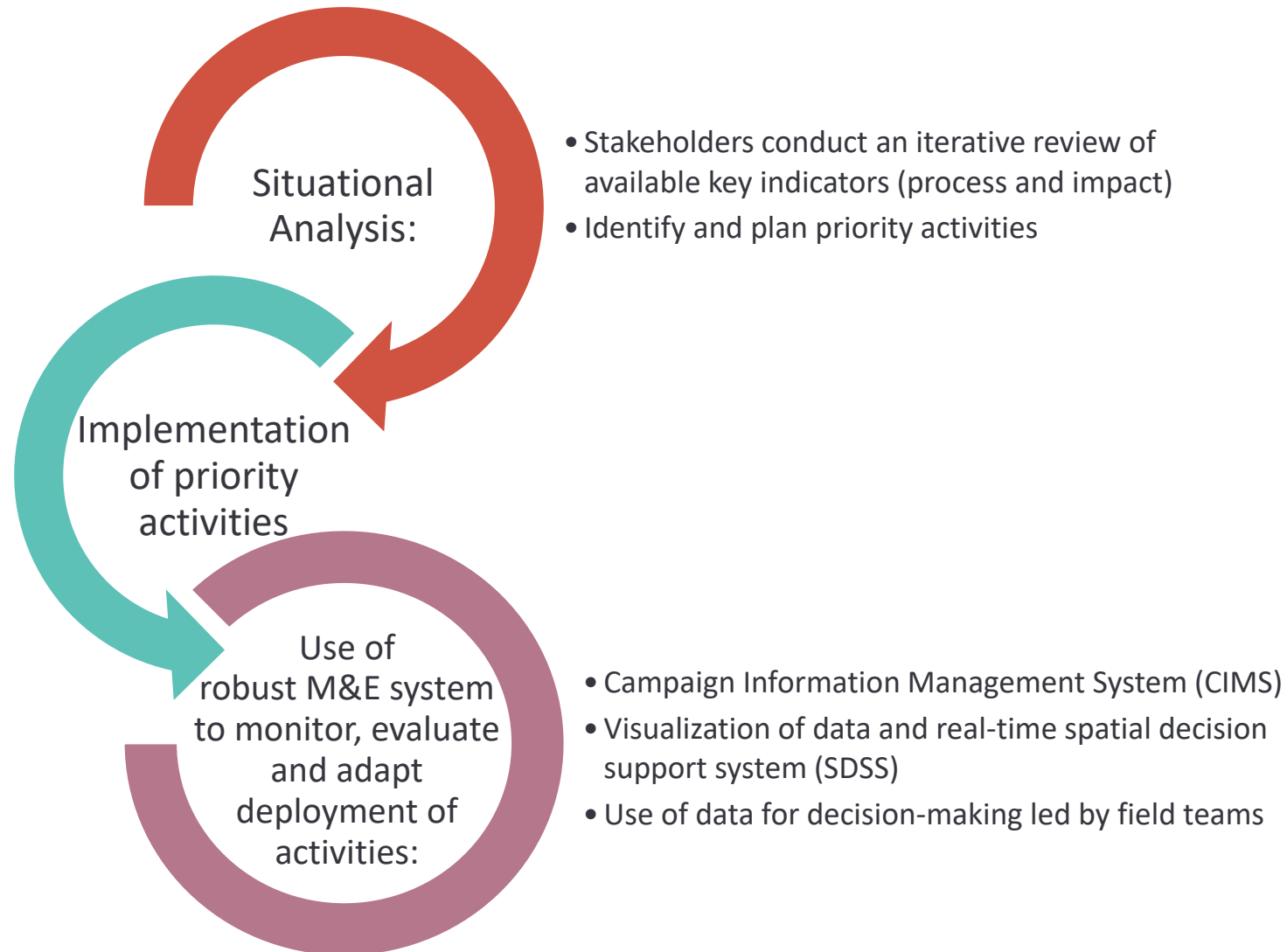**Key to making this work is closing the loop between implementation & M&E**

Assess problem

Characterize knowledge & uncertainty

Stakeholders

Plan and implement

Monitor

Evaluate impact

Adapted from Rist, L., Felton, A., Samuelsson, L., Sandström, C., & Rosvall, O. (2013). A New Paradigm for Adaptive Management. *Ecology and Society*, *18*(4)

mcd.org

Approaches for adaptive management adopted for Bioko

Situational Analysis:

- Stakeholders conduct an iterative review of available key indicators (process and impact)
- Identify and plan priority activities

Implementation of priority activities

Use of robust M&E system to monitor, evaluate and adapt deployment of activities:

- Campaign Information Management System (CIMS)
- Visualization of data and real-time spatial decision support system (SDSS)
- Use of data for decision-making led by field teams

mcd.org

II. Use of data for decision-making: Spatial Decision-Support System

CIMS Motivation: Accurate denominators

- Household-based interventions on Bioko Island largely in densely populated urban areas
  - Unclear and possibly changing deployment zones
  - No unique household identifiers makes counting denominators difficult
- Planning deployment of household-level interventions difficult without unique identifiers and reliable denominators
- Coverage estimates unreliable without accurate denominators
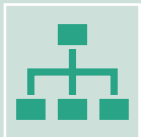
CIMS Motivation:
Digitizing data collection and standardizing data systems

All data collected in digital format

Increases data quality

Speeds up analysis

Different data systems for different activities presents difficulties:

Multiple systems for field teams to learn

Difficult or impossible to link data from other activities

Centralized, standardized data collection, management and analysis system can streamline planning, implementation and analysis

mcd.org

CIMS outline: A grid-based

- A grid-based mapping system underpins the CIMS:
  - **map-areas** of 1km2
  - **map-sectors** inside map areas of 100m2
- All houses have unique identifiers for tracking activities over time
- Household denominators updated dynamically during field activities
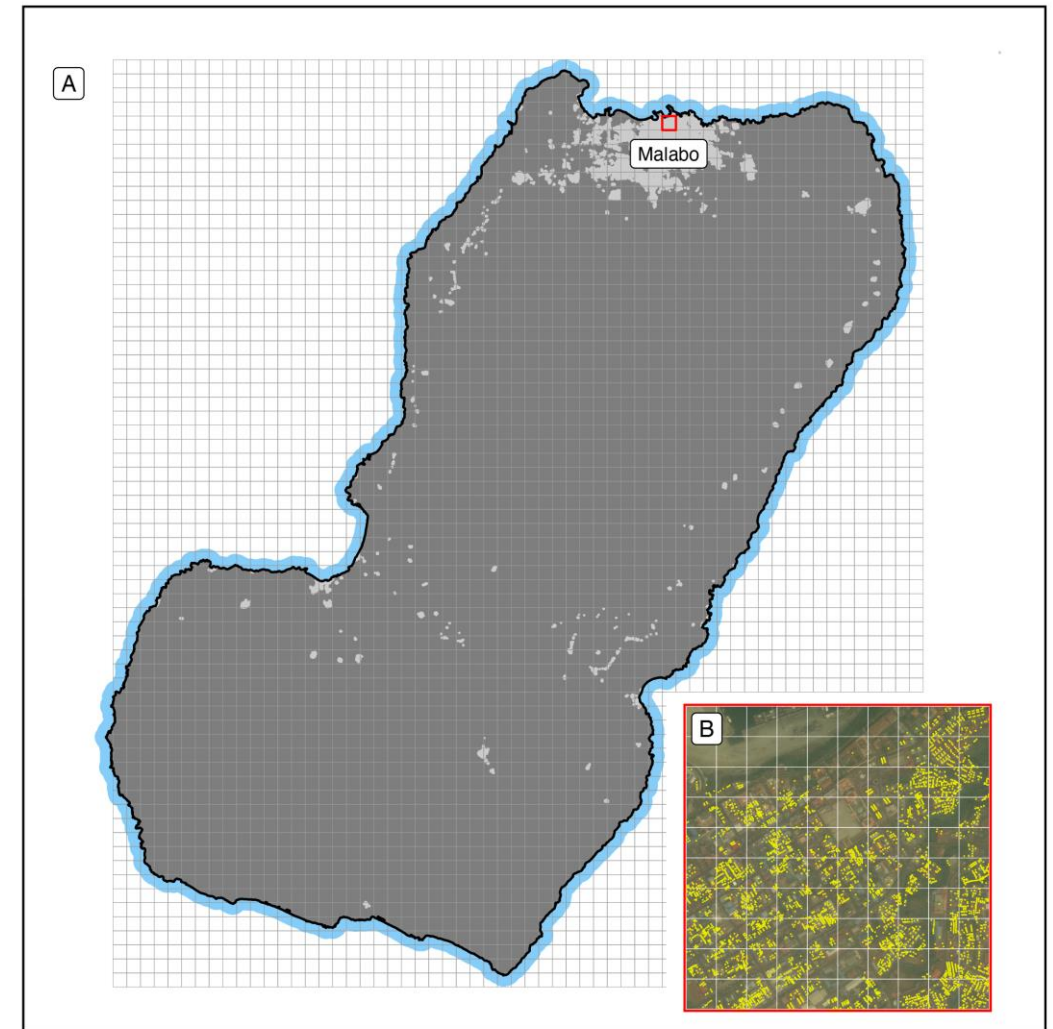
García GA, Hergott DEB, Phiri WP, Perry M, Smith J, Osa Nfumu JO, et al. Mapping and enumerating houses and households to support malaria control interventions on Bioko Island. Malaria Journal. 2019;18(1):283.

mcd.org

CIMS outline:
Data collection, management and analysis

1. Create data collection forms

2. Download forms and relevant data to tablets for offline use

3. Send completed forms to server

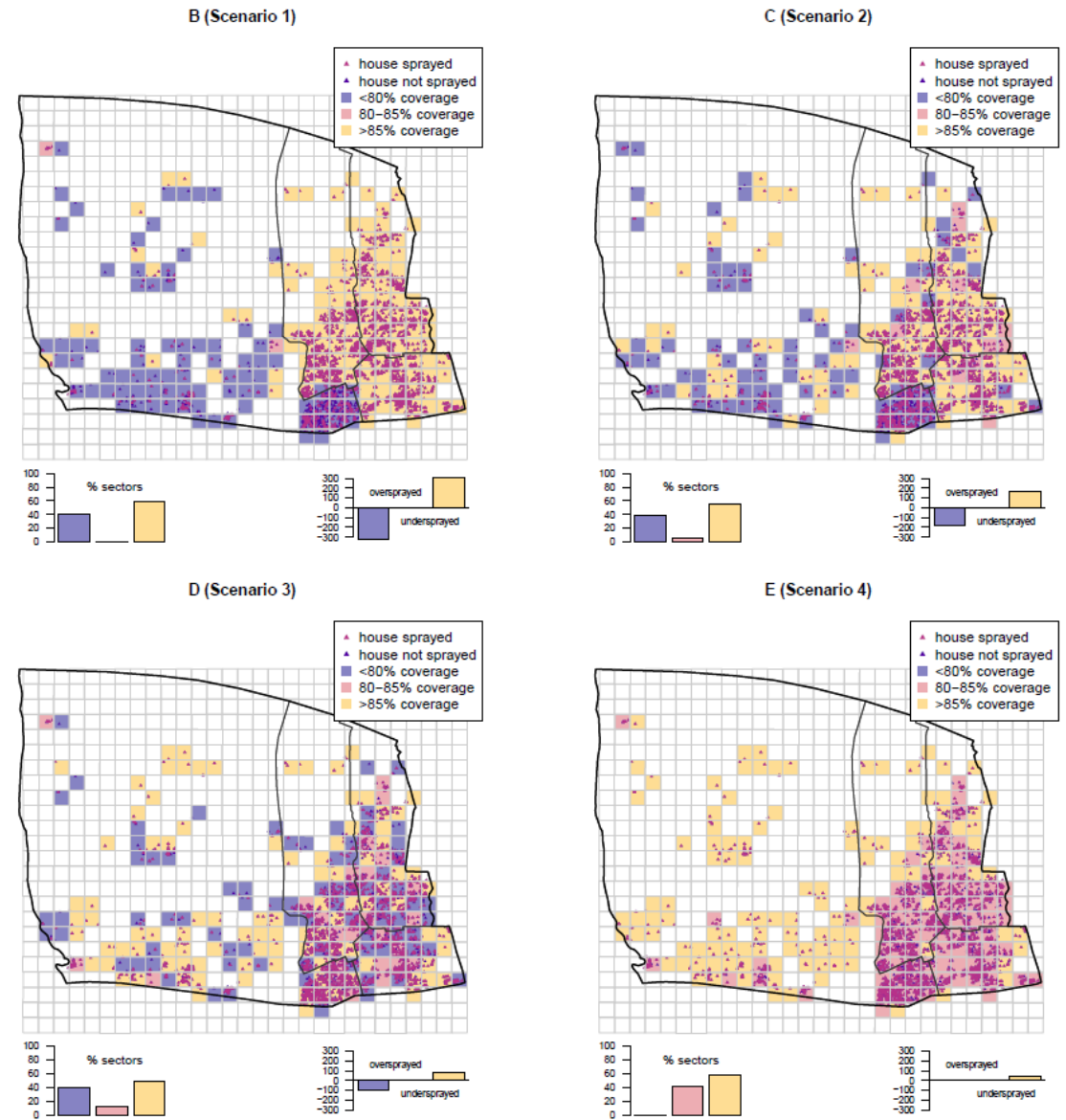4. Analyze data in real-time using dashboards
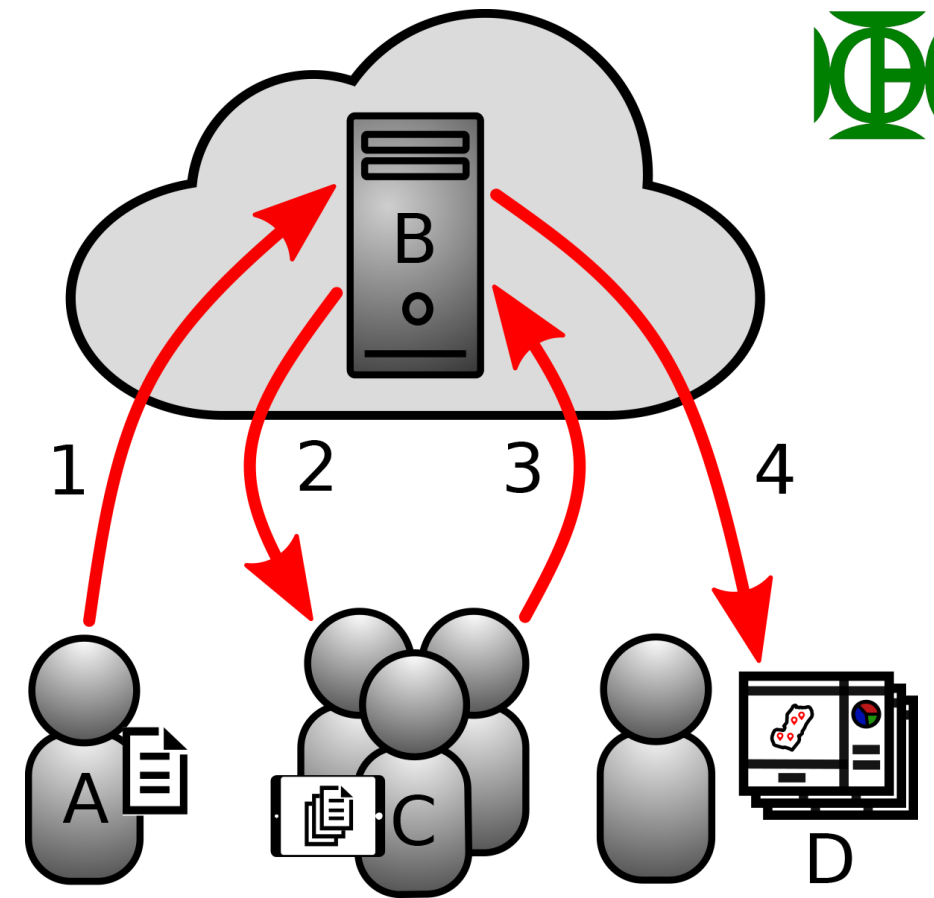
García GA, Atkinson B, Donfack OT, Hilton ER, Smith JM, et al. (2022) Real-time, spatial decision support to optimize malaria vector control: The case of indoor residual spraying on Bioko Island, Equatorial Guinea. PLOS Digital Health 1(5): e0000025.

mcd.org

Planning deployment and defining spatial coverage of activities: use of map-sector

- Use of map-sector (100m2) granularity:
  - Allows more equitable distribution of coverage
  - maximizes community protection while optimizing productivity
  - Provides flexibility for targeting interventions (spatially and temporally)
 - Facilitates precise risk distribution and optimization of activities

García GA, Atkinson B, Donfack OT, Hilton ER, Smith JM, et al. (2022) Real-time, spatial decision support to optimize malaria vector control: The case of indoor residual spraying on Bioko Island, Equatorial Guinea. PLOS Digital Health 1(5): e0000025.

mcd.org

Measuring impact: use of grid-based sampling system

Since 2015: standardize sampling implemented grid-based stratified sampling system based on:

- Population density
- Local residual transmission

Stratum

1: Low pop. density, high LRT

2: High pop. density, low LRT
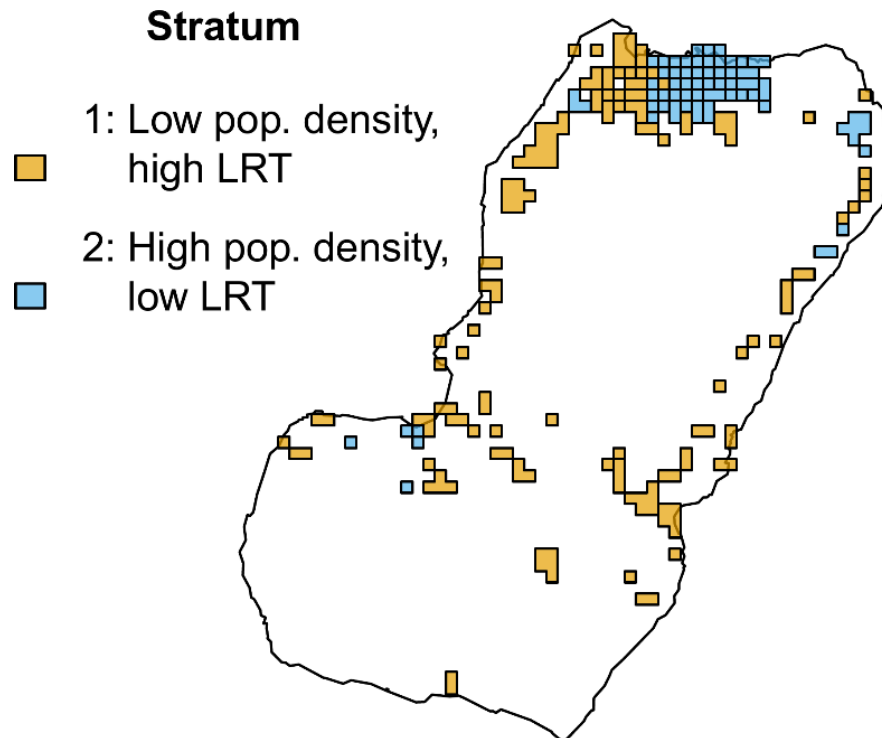
	2015	2016	2017	2018	2019	2020	2021	2022
Bioko Island	12.7%	8.9%	10.2%	10.6%	13.4%	11.9%	13.7%	14%
Rural/high transmission	19.2%	11%	18.4%	12.5%	18.7%	23.1%	23.7%	24.2%
Urban/low transmission	12.1%	8.7%	9.4%	10.4%	12.9%	10.8%	12.7%	13%
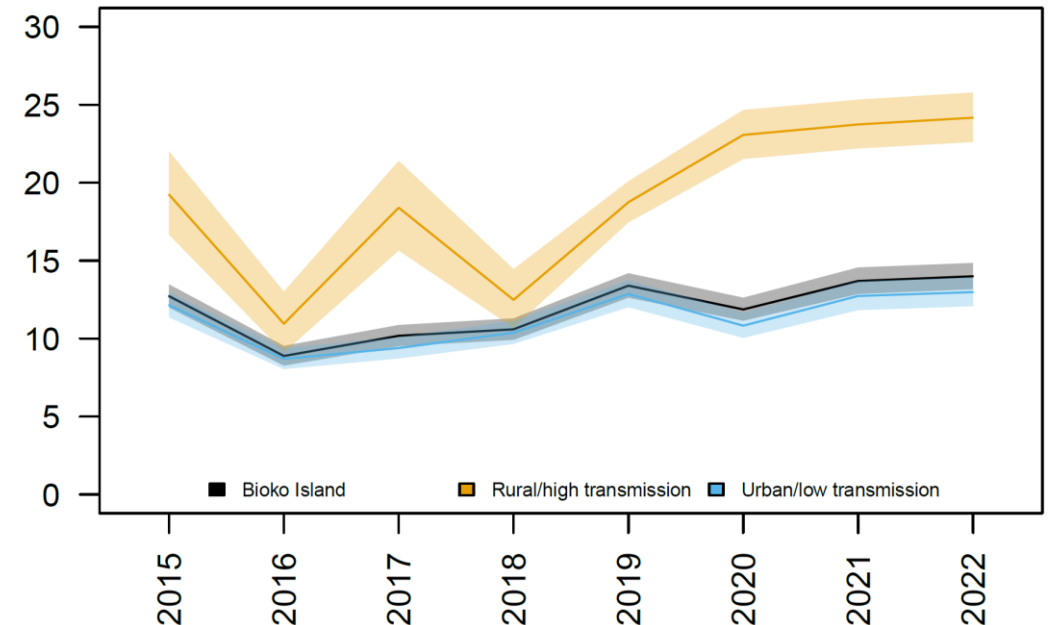
# III. Situational Analysis: Strategy of LLINs on Bioko Island

LLIN distributions on Bioko

- Mass distributions: 2007, 2015, and 2018

- Top-up campaigns: 2017, 2020 for areas not receiving IRS

- Recurring distributions: all years through ANC

- Adaptation of LLIN Strategy in 2021:
  - Mass distribution outside urban Malabo (historically higher use)
 - Open fixed distribution points in Malabo

LLIN Indicators on Bioko

|	2015	2016	2017	2018	2019	2020	2021	2022
ITN use	49.7%	35.8%	33.4%	54.4%	37.1%	37.6%	34%	34.8%
Population ITN access	50%	66.2%	61.2%	66.3%	46.9%	51.8%	45.8%	41.7%
ITN use:access	99.4	54	54.5	82.1	79	72.5	74.2	83.5

mcd.org
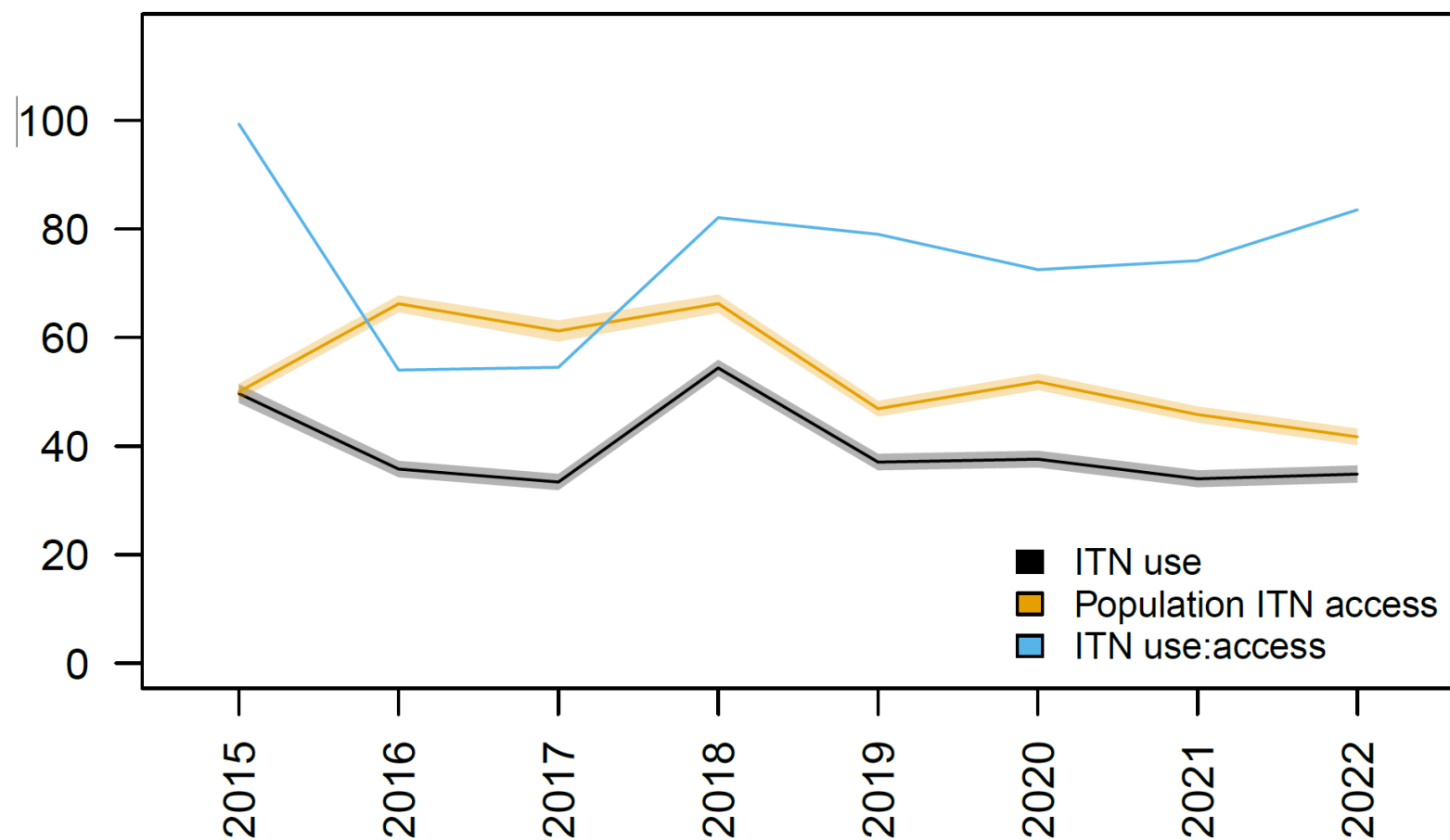
High loss of LLINs after distribution

- Use unique household ID to link distribution data and MIS data to calculate household-level net loss

- From 2018 distribution to MIS, there was an **overall loss of 37%** of LLINs

- Likely caused by:
    - Transferring nets to other areas of the country
    - Other uses of nets
    - Throwing away

LLINs lost

> 50%

40%

30%

20%

10%

No loss
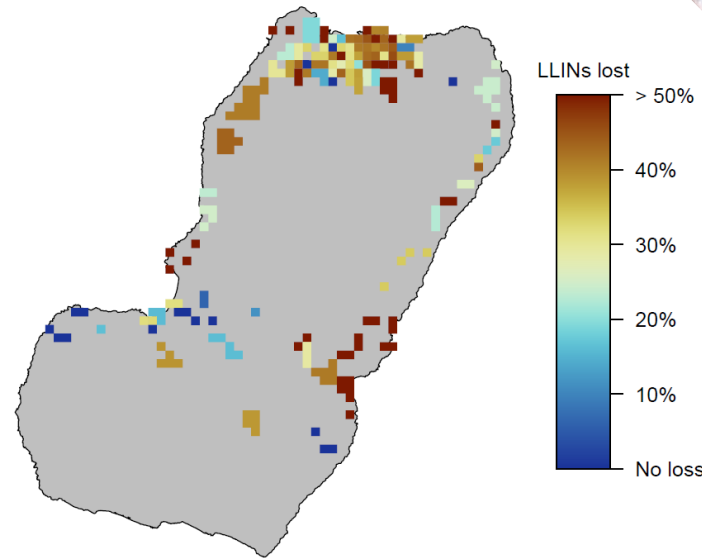
Further net loss in 1st year after distribution

- Significant decline in net access (and use) in 2019 compared to 2018

2018

2019

2020

Population access

100%

75%

50%

25%

0%
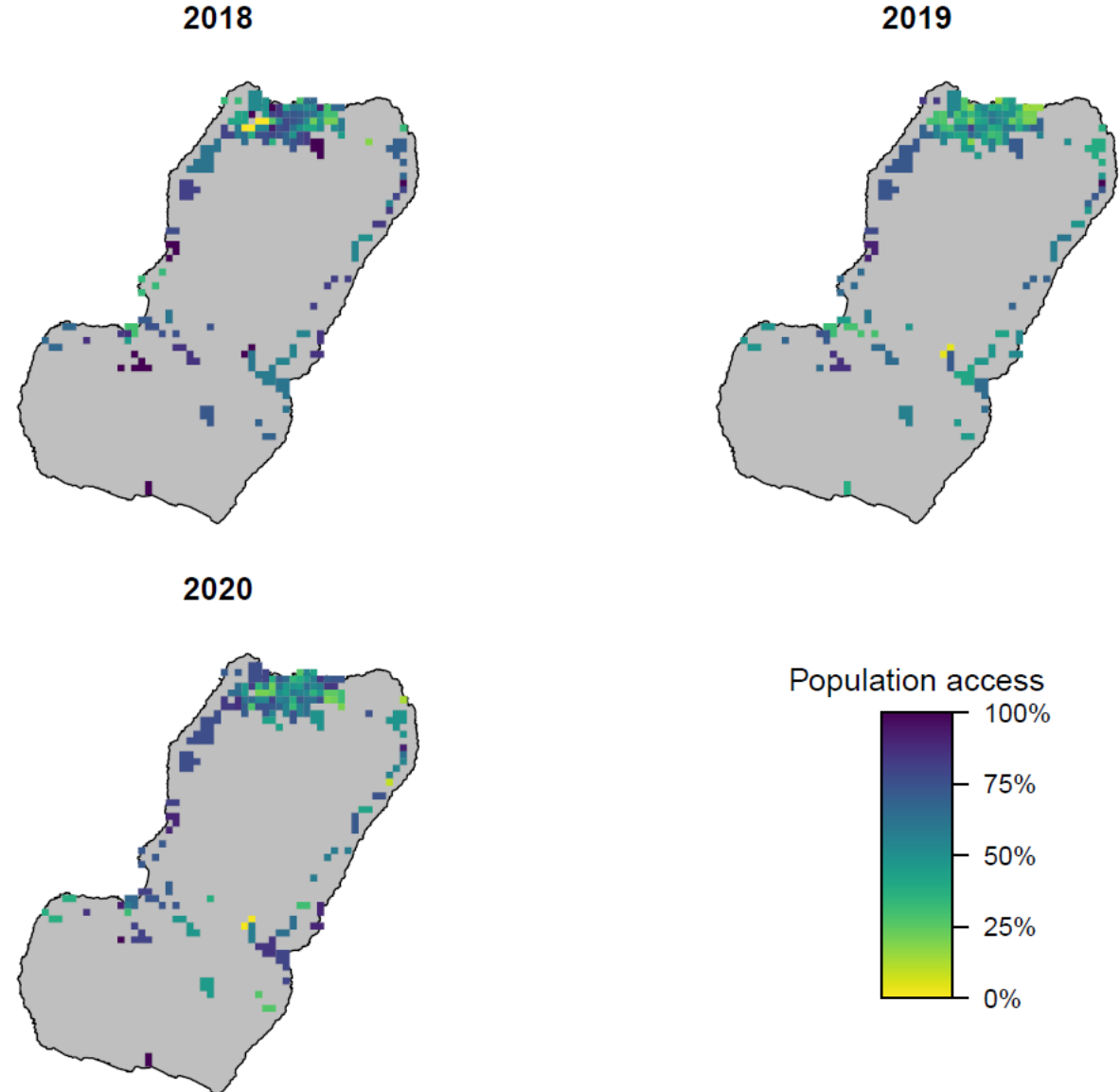
Adapting LLIN strategy in Malabo: situational analysis

80% of the population lives in Malabo and most work for distribution is there

LLIN indicators show many nets distributed in Malabo unlikely to be used

Even though nets are effective, there may be better allocation of resources than an urban mass distribution

Can we effectively distribute nets to those who use them in Malabo *without* a mass distribution?

mcd.org

# IV. Adapting malaria control strategies

Re-fined LLIN Strategy: Scaling fixed distribution points in Malabo

- Increase access at fixed distribution points to all ages and to those who want them

- Adapt communication strategy to increase awareness of the availability of nets at fixed distribution points providing similar access to people who are likely to use nets from a mass distribution

- Strengthen SBCC messaging during the collection of nets

- 6 distribution points opened in 2021

Use of data for decision-making: Process indicators at fixed distribution points
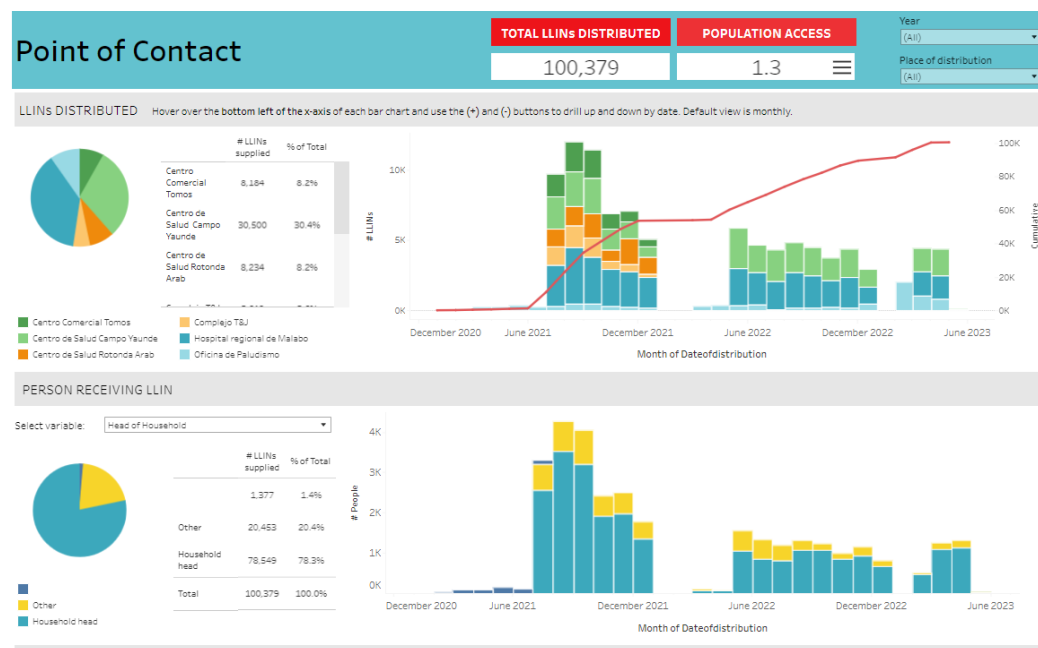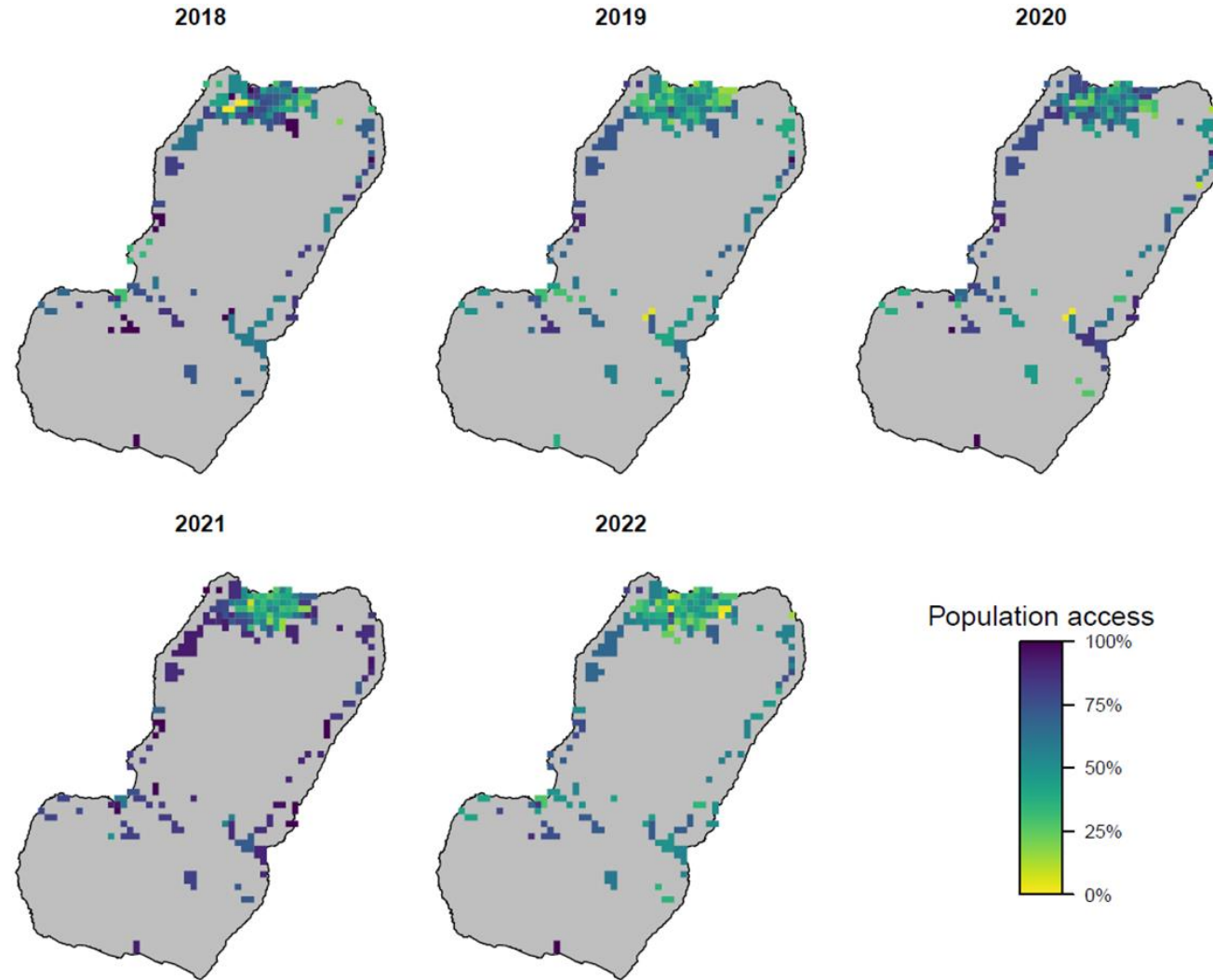

Evaluating site effectiveness:
- Majority of nets distributed at 2 points
- Other sites closed in 2022

Continuous need to consider opening other sites

Use of data for decision-making: Impact of fixed distributions on LLIN indicators

Spatially, not much change compared to 2018-2020 in Malabo

Use of data for decision-making: Impact of fixed distributions on LLIN indicators

- Among areas with no community distribution since 2018:
  - All indicators sharply declined in the 1st year after the distribution (2019)
  - Since 2019, population access has continued to decline but use has plateaued (so use:access increased)
- In 2021-2022, households with a net from a distribution point had significantly higher net use than households with nets only from other sources

mcd.org
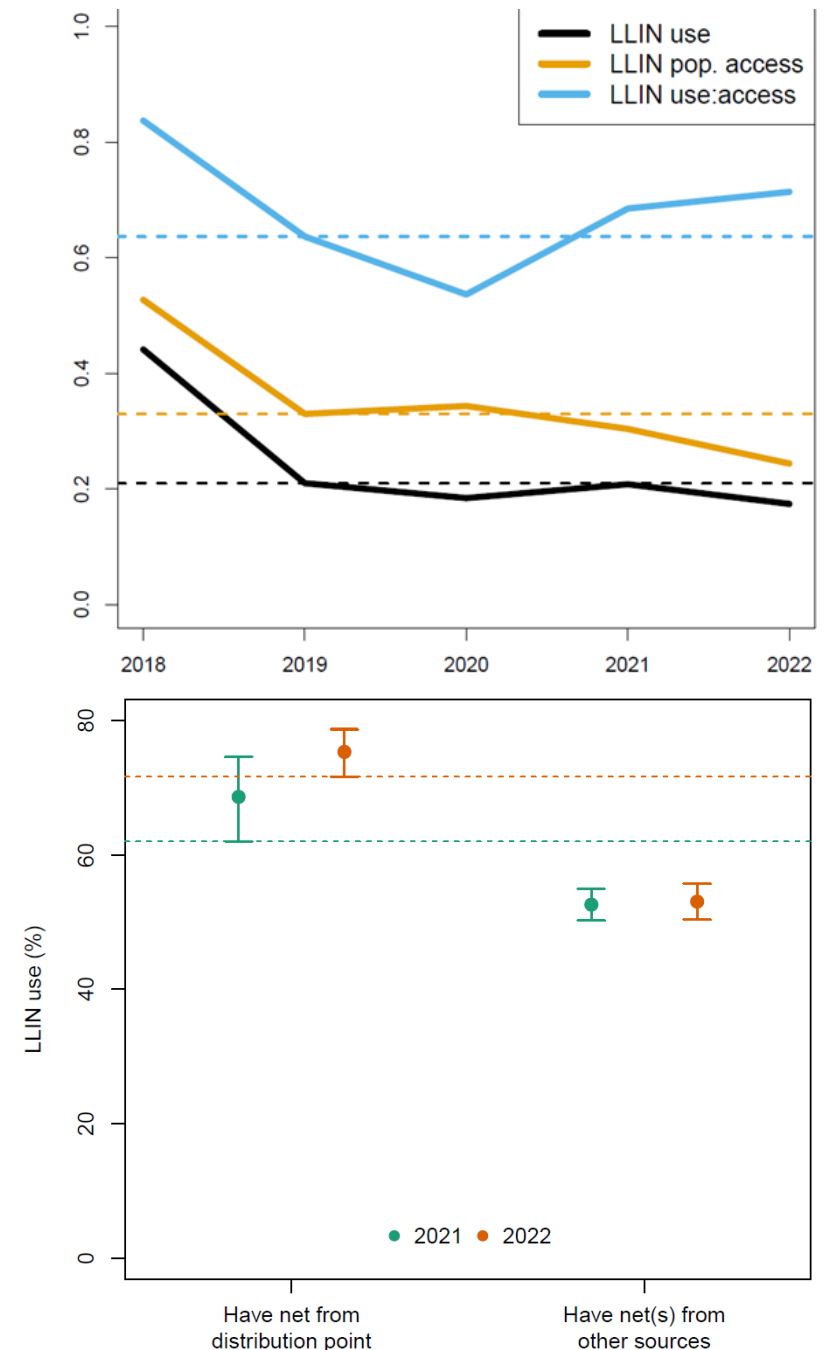
Use of data for decision-making: tailoring interventions and optimization of resources

Reduced level of effort from mass to fixed point distribution

- Mass distribution would have been 20k+ additional person-days of effort in 2021
- Instead, a small number of staff run fixed distribution points, freeing up resources

Reallocation of resources allowed for tailoring activities on Bioko:

- Expanding IRS deployment to all of Malabo in 2021 and 2022
- Piloting other activities:
  - larger-scale LSM implementation in Malabo
  - Outreach to pregnant women at the household level to improve protection during pregnancy
- Expand entomological surveillance

mcd.org

Conclusions

- The use of an adaptive management framework with a robust M&E system to collect, process, and analyze data has allowed for increased efficiencies in tailoring activities and optimizing the use of resources for malaria control on Bioko Island.

- Decisions are not based on the direct benefit of intervention (i.e. nets work but don't get used), but rather the best use of resources.

- Continuous need to re-evaluate and adapt strategies of implementation and communication.

Acknowledgements

BIMEP team

Donors

Partners

Thank you