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Global Infectious
Disease Analysis

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Achieving impact with ITNs: Rethinking the status quo

Andrew Glover^{*1}, Hannah Koenker², Kate Kolaczinski³,
Thomas Churcher¹

¹ *MRC Centre for Global Infectious Disease Analysis, School of Public Health,
Imperial College London, UK*

² *PMI REACH Malaria, PATH, USA*

³ *The Global Fund, Geneva, Switzerland*

^{}a.glover18@imperial.ac.uk*

Presentation Outline



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- Universal coverage to optimal coverage
- Was universal coverage achievable with the status quo?
- How can optimal coverage now be achieved?
- Conclusions and final thoughts



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- **Universal coverage to optimal coverage**
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Universal to optimal coverage



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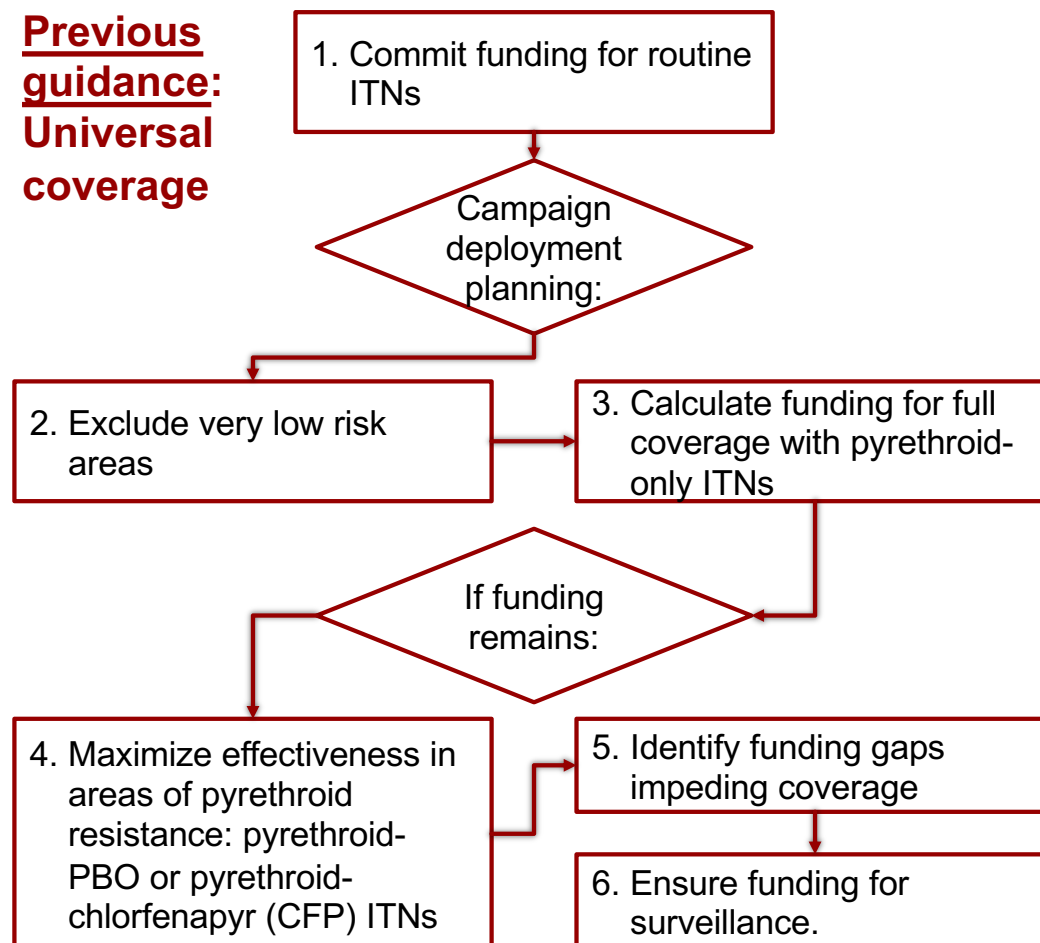
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“Universal coverage is defined as 100%* access to, and use of, ITNs”

World Health Organization. WHO recommendations for achieving universal coverage with long-lasting insecticidal nets in malaria control. World Health Organization. 2013

*80% typically a minimum target

**Previous
guidance:
Universal
coverage**



Universal to optimal coverage



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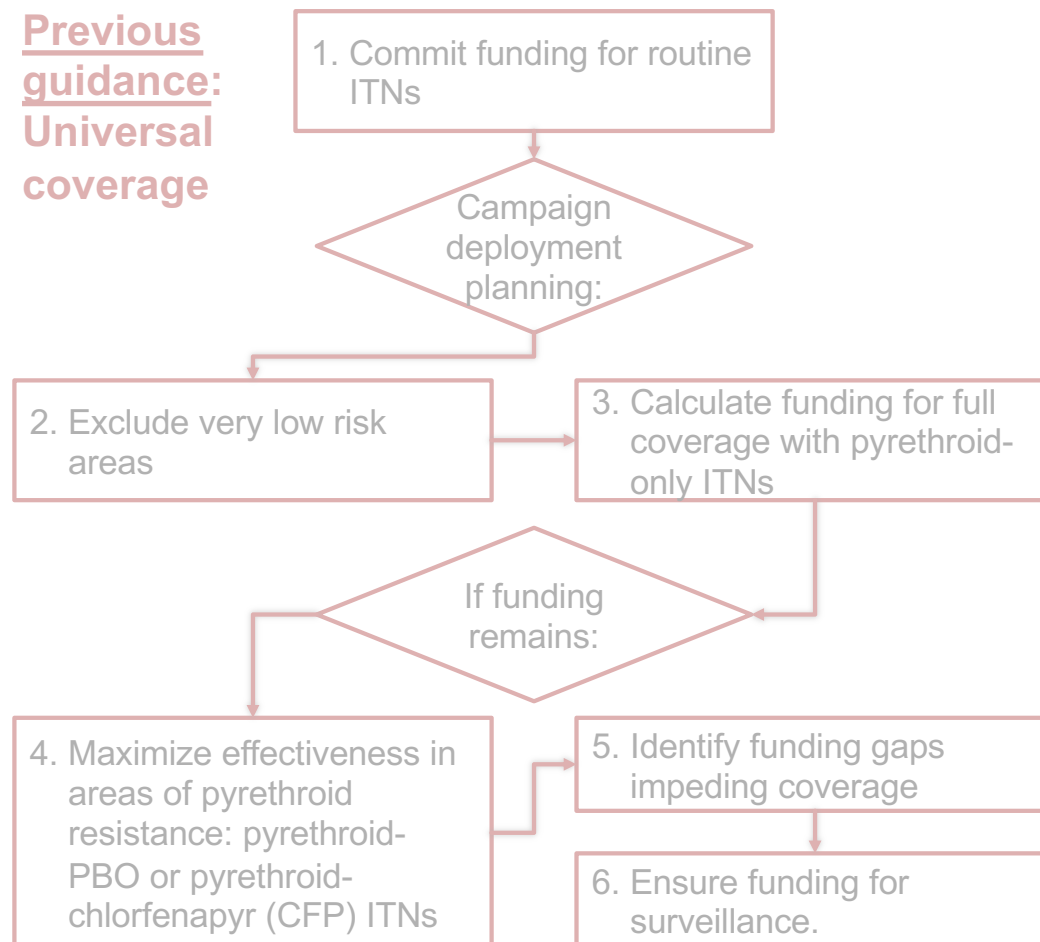
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Current guidance: Optimal coverage

World Health Organization. Guiding principles for prioritizing malaria interventions in resource-constrained country contexts to achieve maximum impact; 2024.

- **Prioritise routine** ITNs for infants and pregnant women.
- Intervention **scale and frequency** for optimal impact.
 - Exclusion of low transmission areas
 - Coverage and effectiveness **trade-offs**
- Areas with **pyrethroid resistance**:
 1. Pyrethroid-chlorfenapyr (-pyrrole)
 2. Pyrethroid-PBO
 3. Pyrethroid-pyriproxyfen
- **Surveillance** of insecticide resistance remains important

Previous guidance: Universal coverage





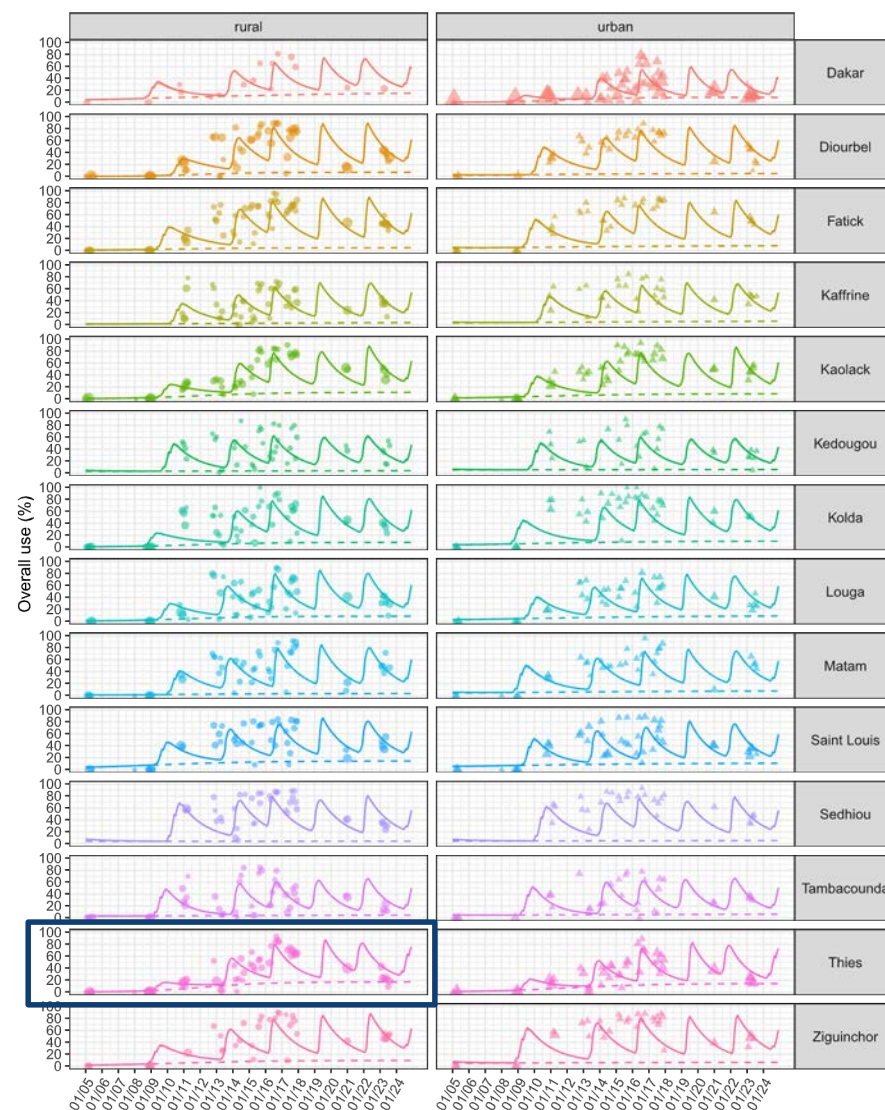
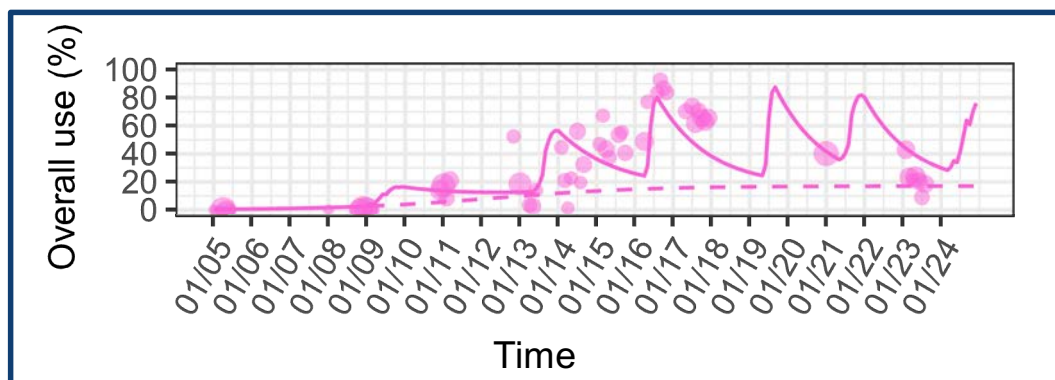
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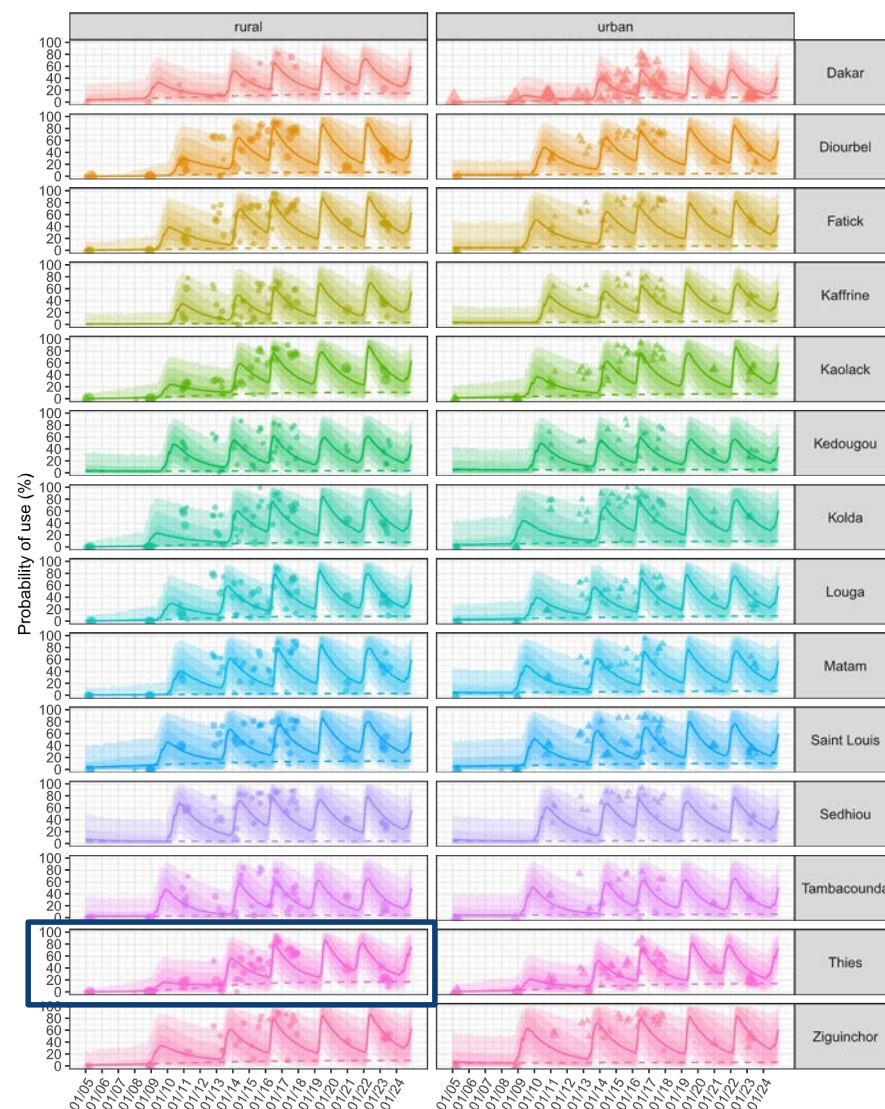
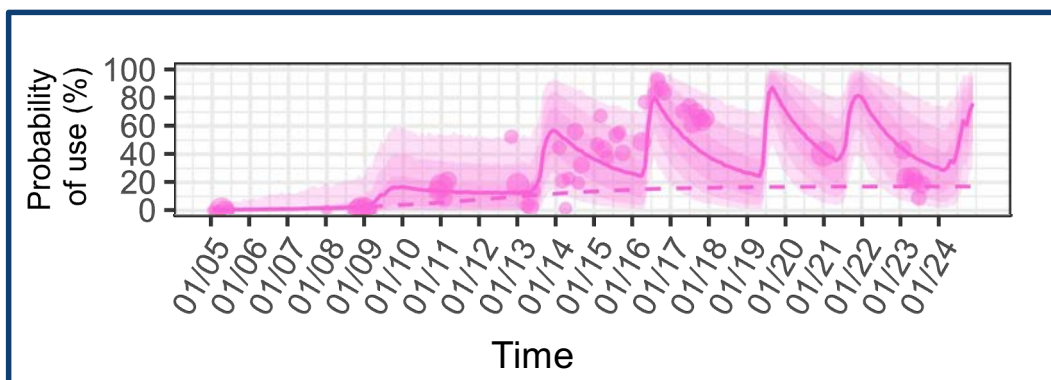
Historical use and access

- We fitted usage and access models to DHS & MIS data for subnational regions in 6 countries (Burkina Faso, Ghana, Malawi, Mali, Mozambique and Senegal)
- Surveys are snapshots that can be misleading
- Overall ITN use (and access) >80% achieved only briefly following mass campaigns



Historical use and access

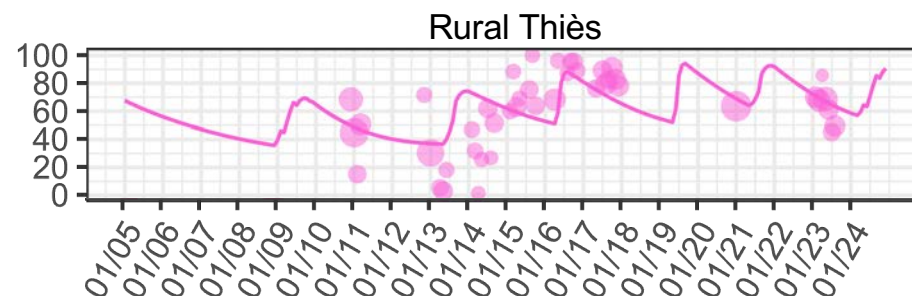
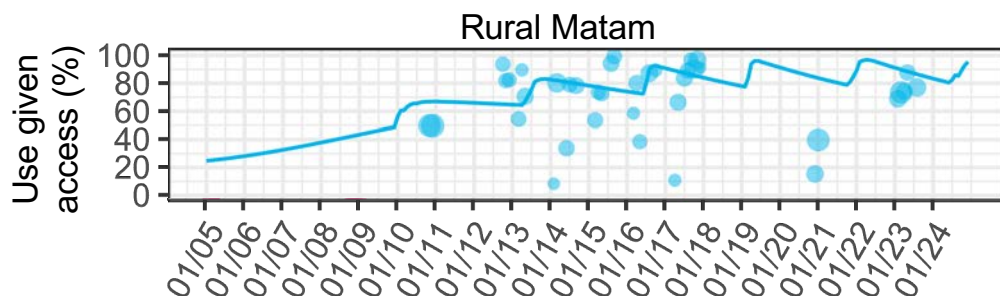
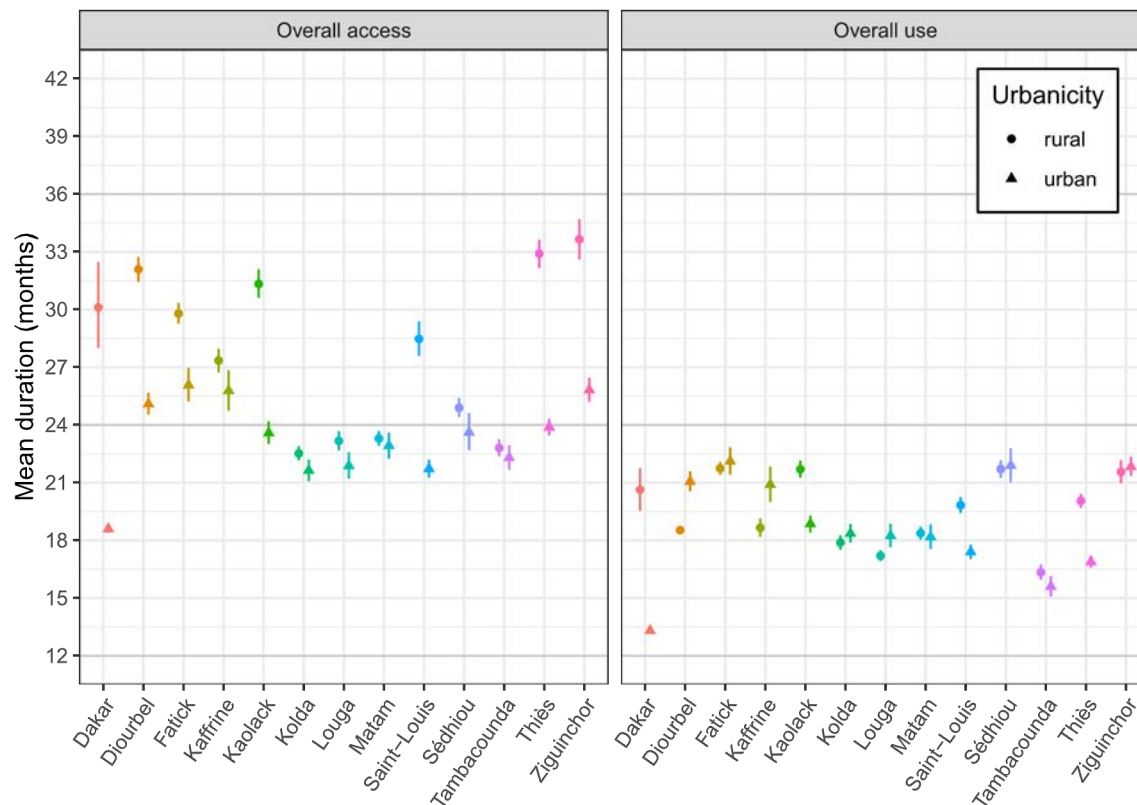
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- Surveys are snapshots that can be misleading
- Overall ITN use (and access) >80% achieved only briefly following mass campaigns
- There is notable variability in use and access

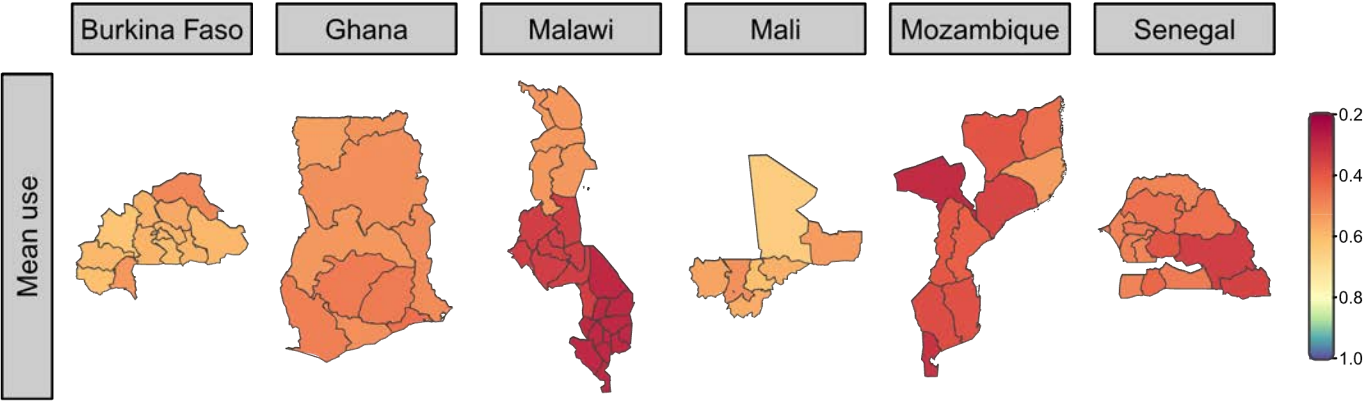


ITN retention

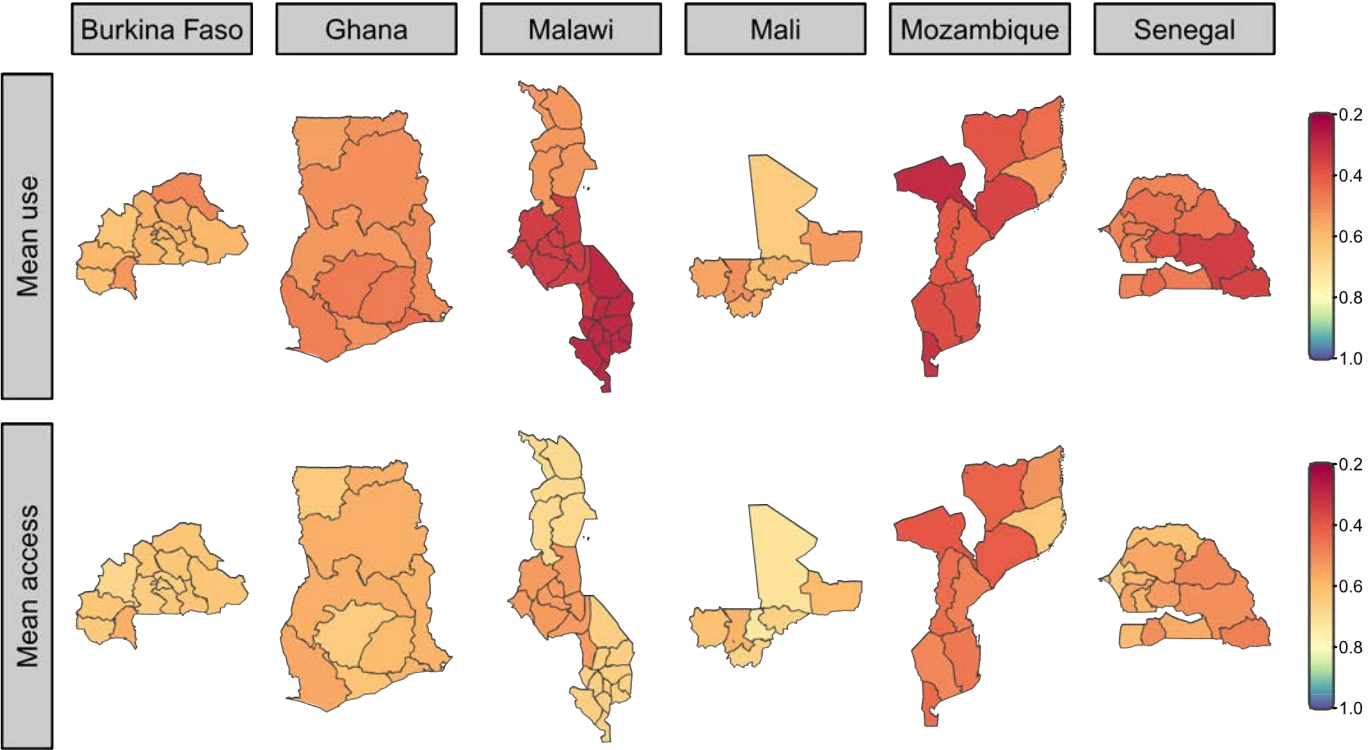
	Access	Use
Regions (n = 146) with mean duration greater than 3 years	12.3%	0.7%

- People **stop using ITNs faster** than they have access to them
- **Use given access declines over time** following a mass campaign

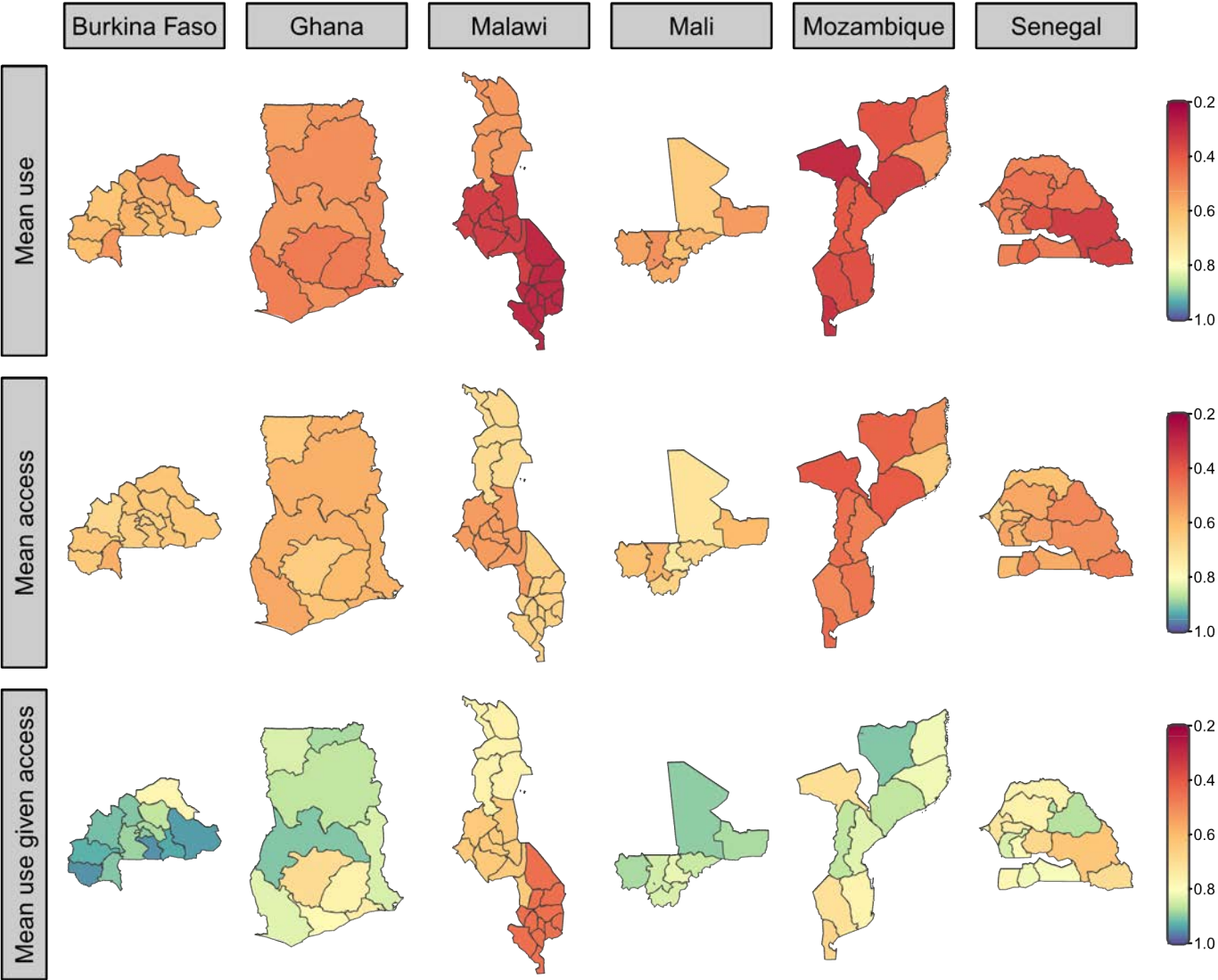




Campaign interval:	3-year	2-year
Overall mean use:	47%	55%



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Overall mean use given access:	77%	89%



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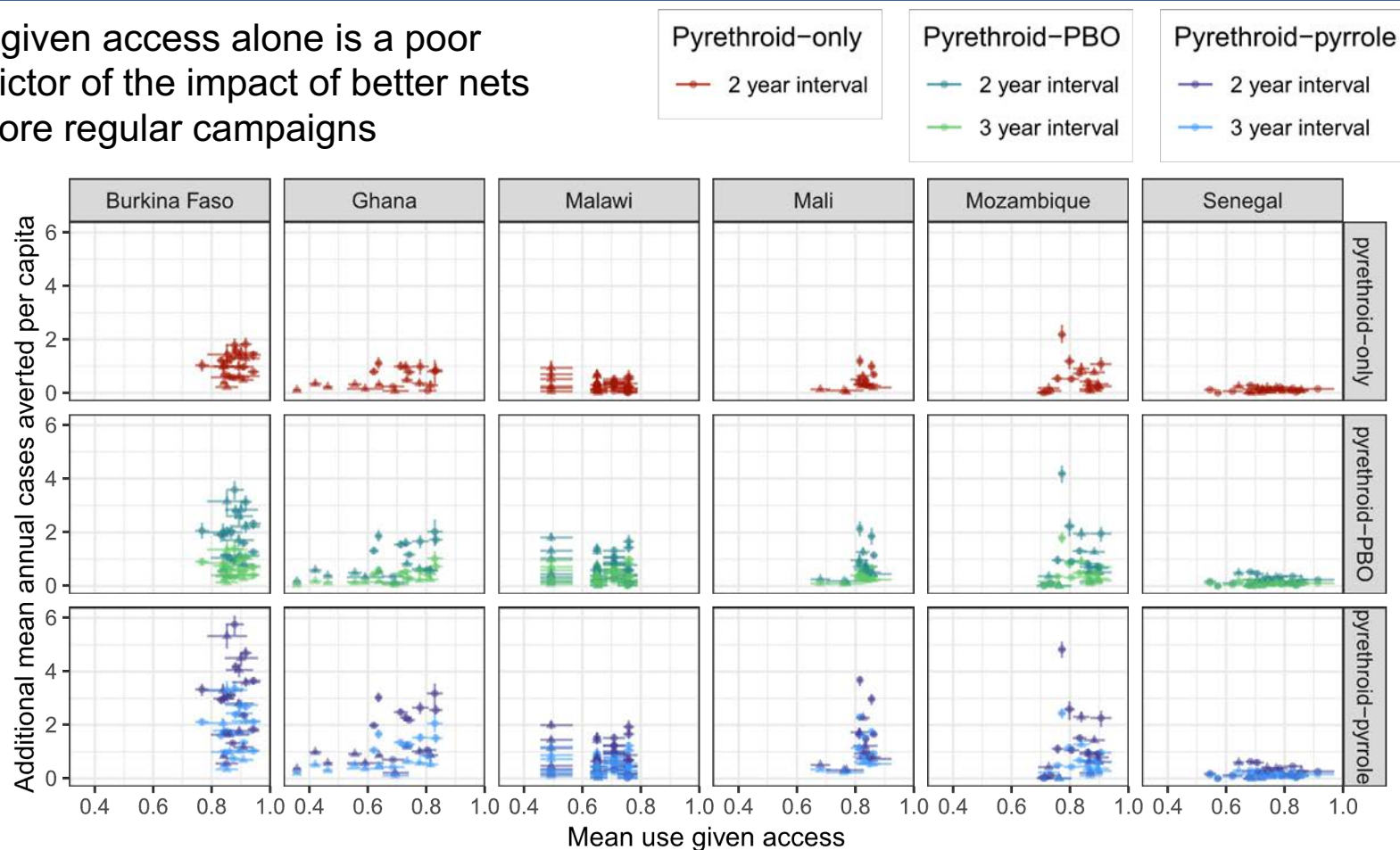
Approaches to maximising impact



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- Use given access alone is a poor predictor of the impact of better nets or more regular campaigns



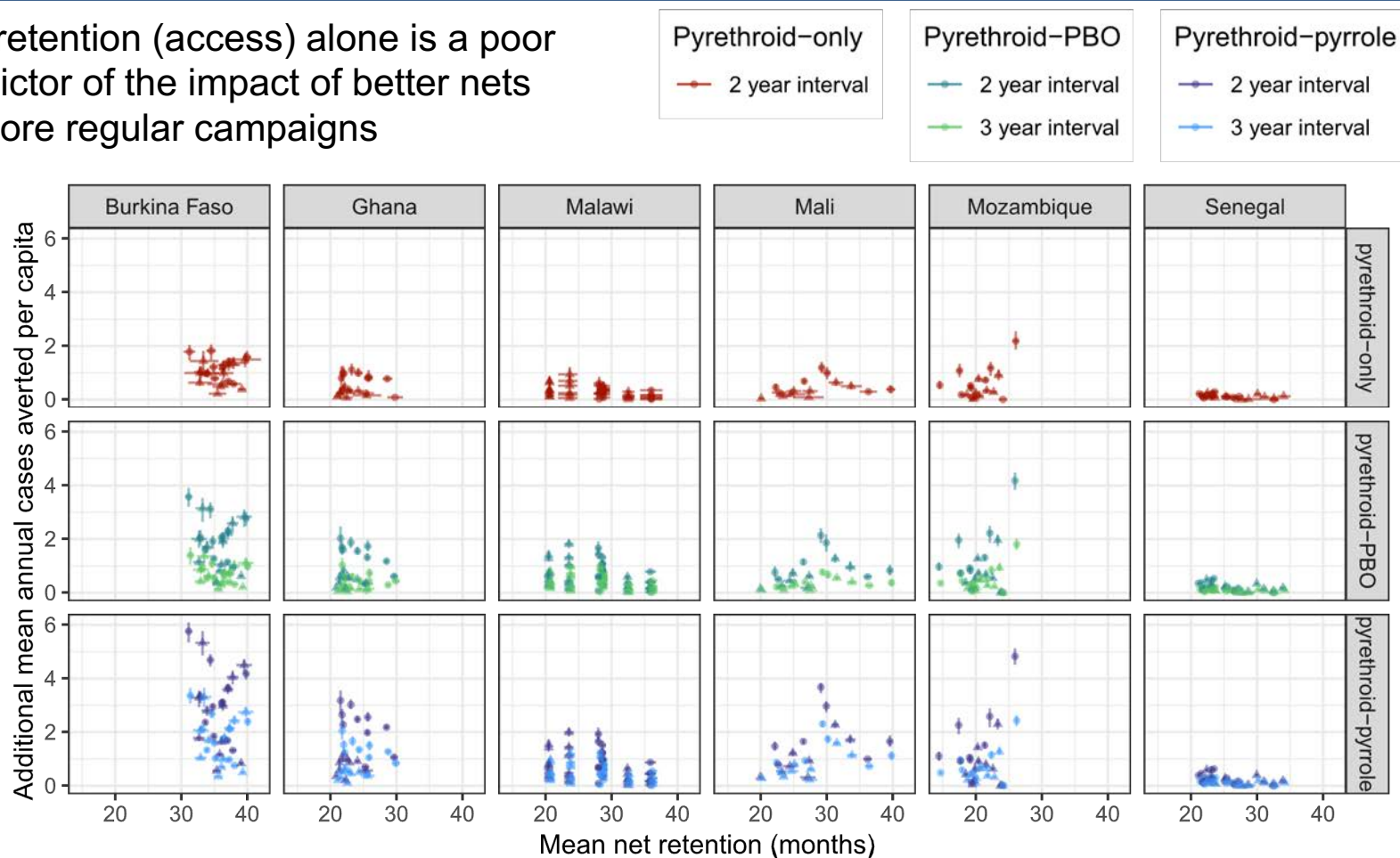
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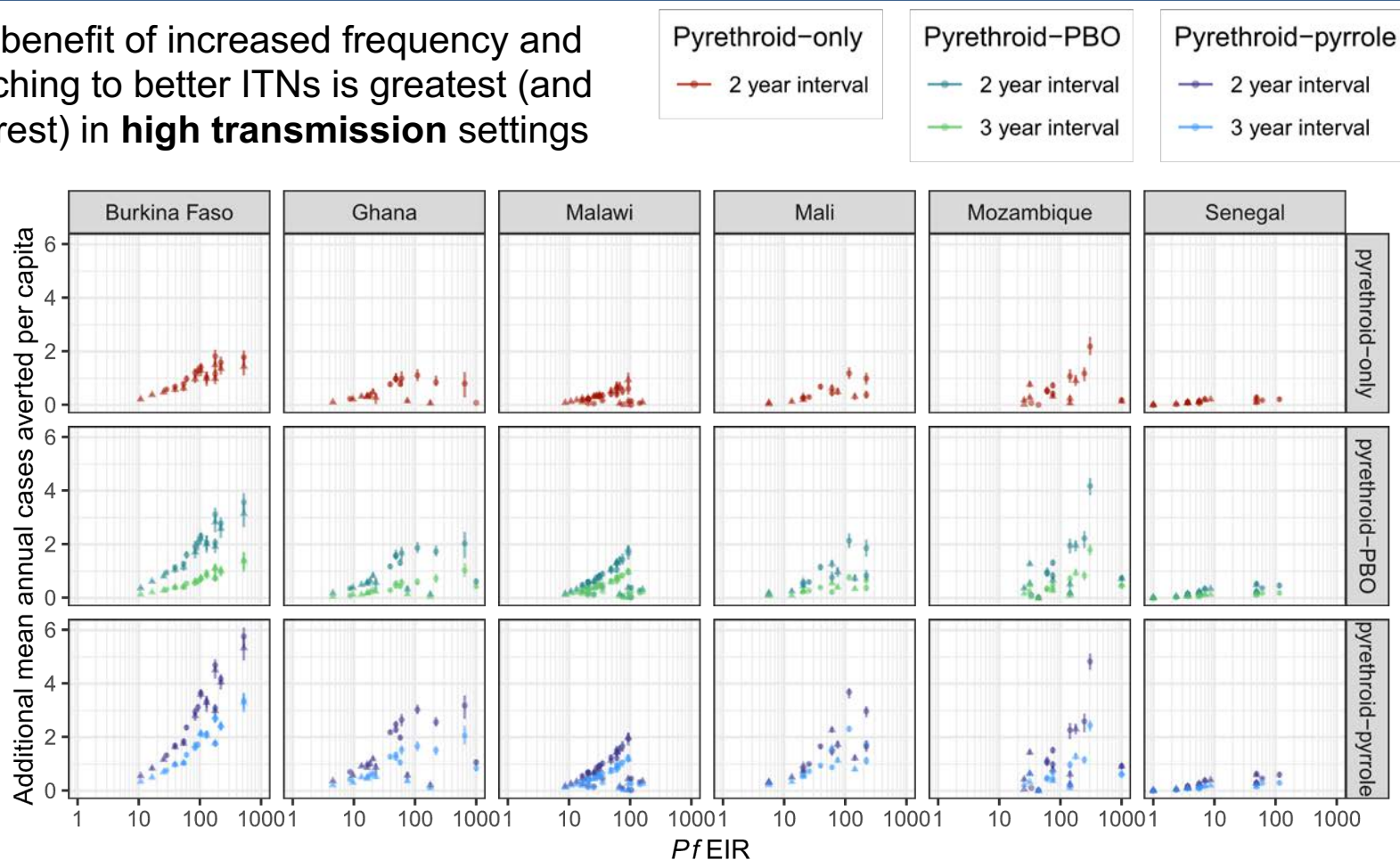
Approaches to maximising impact



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- The benefit of increased frequency and switching to better ITNs is greatest (and clearest) in **high transmission** settings



Approaches to maximising impact



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3-year pyrethroid-only campaigns:

62.9M [36.6, 82.3]
ann. cases averted

Avg. ann. cost **\$37.5M**

8.0M avg. ann. ITNs

Burkina Faso



PfPR₂₋₁₀ (%)



Approaches to maximising impact



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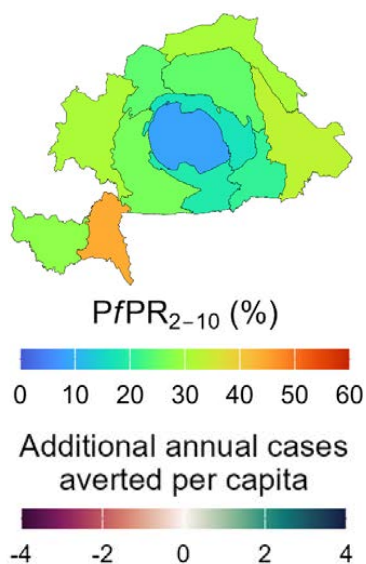
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Approaches to maximising impact



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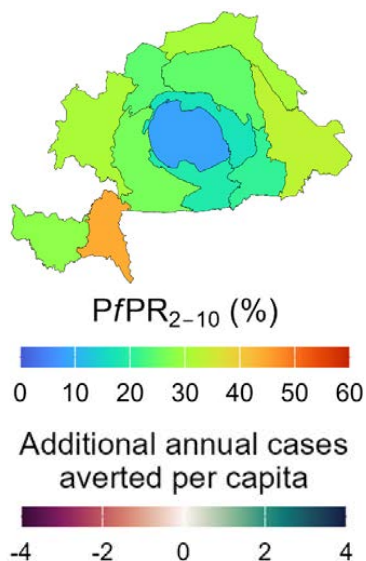
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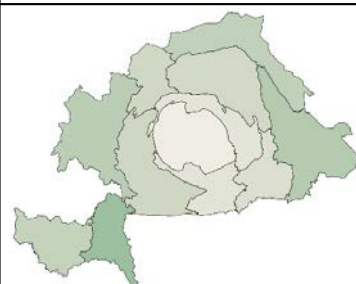


Pyrethroid-pyrrole strategy

3-year campaign intervals

M ann. cases averted
Mean ann. ITNs/cost

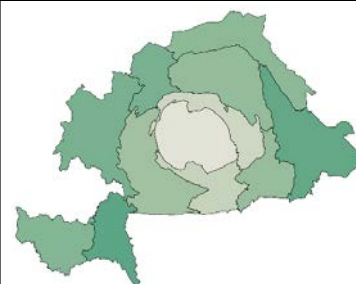
Reduced coverage & equivalent cost



81.0 [52.2, 107]
7.1M / \$37.5M

2-year campaign intervals

M ann. cases averted
Mean ann. ITNs/cost



96.0 [73.7, 124]
6.8M / \$36.1M

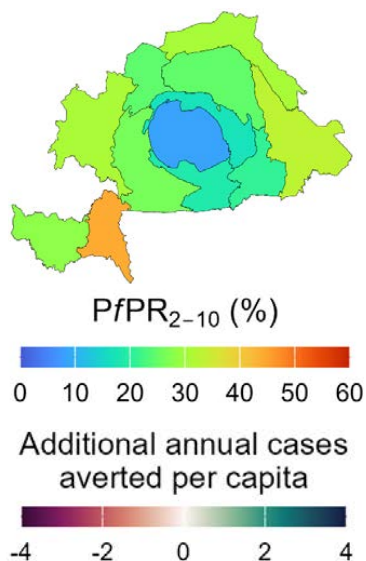
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3-year pyrethroid-only campaigns:
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Pyrethroid-pyrrole strategy	Reduced coverage & equivalent cost	Equivalent coverage & increased cost
3-year campaign intervals M ann. cases averted Mean ann. ITNs/cost	 81.0 [52.2, 107] 7.1M / \$37.5M	 85.2 [55.0, 113] 8.0M / \$42.5M
2-year campaign intervals M ann. cases averted Mean ann. ITNs/cost	 96.0 [73.7, 124] 6.8M / \$36.1M	 122 [96.2, 147] 11.0M / \$58.8M

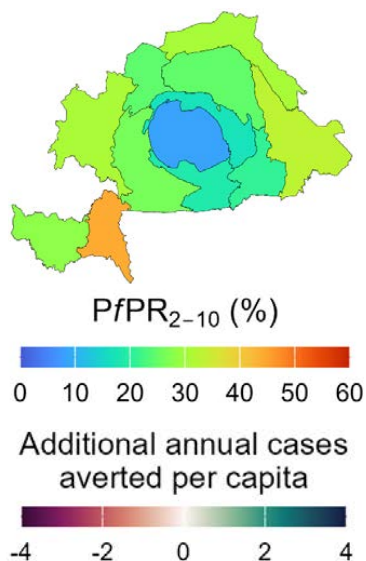
Approaches to maximising impact



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Approaches to maximising impact

Continuous channels only

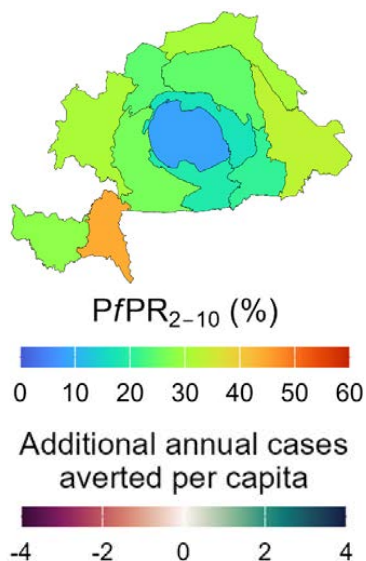
None Urban Rural All

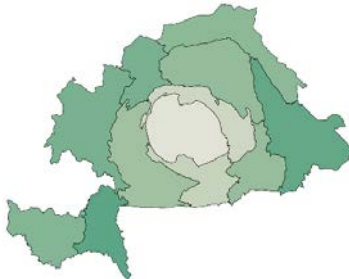
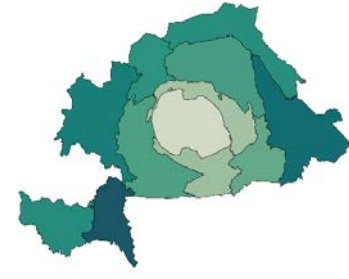


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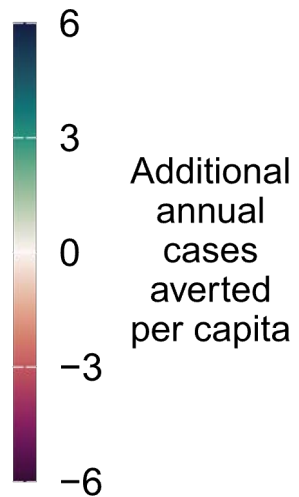
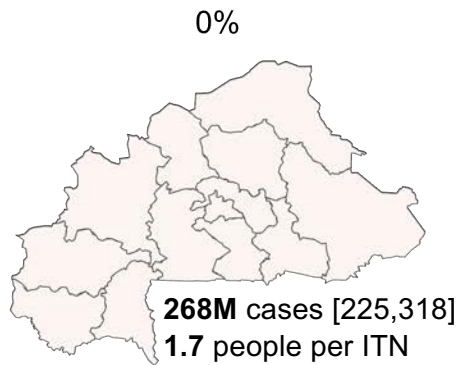
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Pyrethroid-pyrrole strategy	Reduced coverage & equivalent cost	Equivalent coverage & increased cost	Equivalent coverage with deprioritisation
3-year campaign intervals M ann. cases averted Mean ann. ITNs/cost	 81.0 [52.2, 107] 7.1M / \$37.5M	 85.2 [55.0, 113] 8.0M / \$42.5M	 84.3 [71.4, 129] 6.7M / \$35.7M
2-year campaign intervals M ann. cases averted Mean ann. ITNs/cost	 96.0 [73.7, 124] 6.8M / \$36.1M	 122 [96.2, 147] 11.0M / \$58.8M	 107 [87.3, 180] 7.0M / \$37.1M

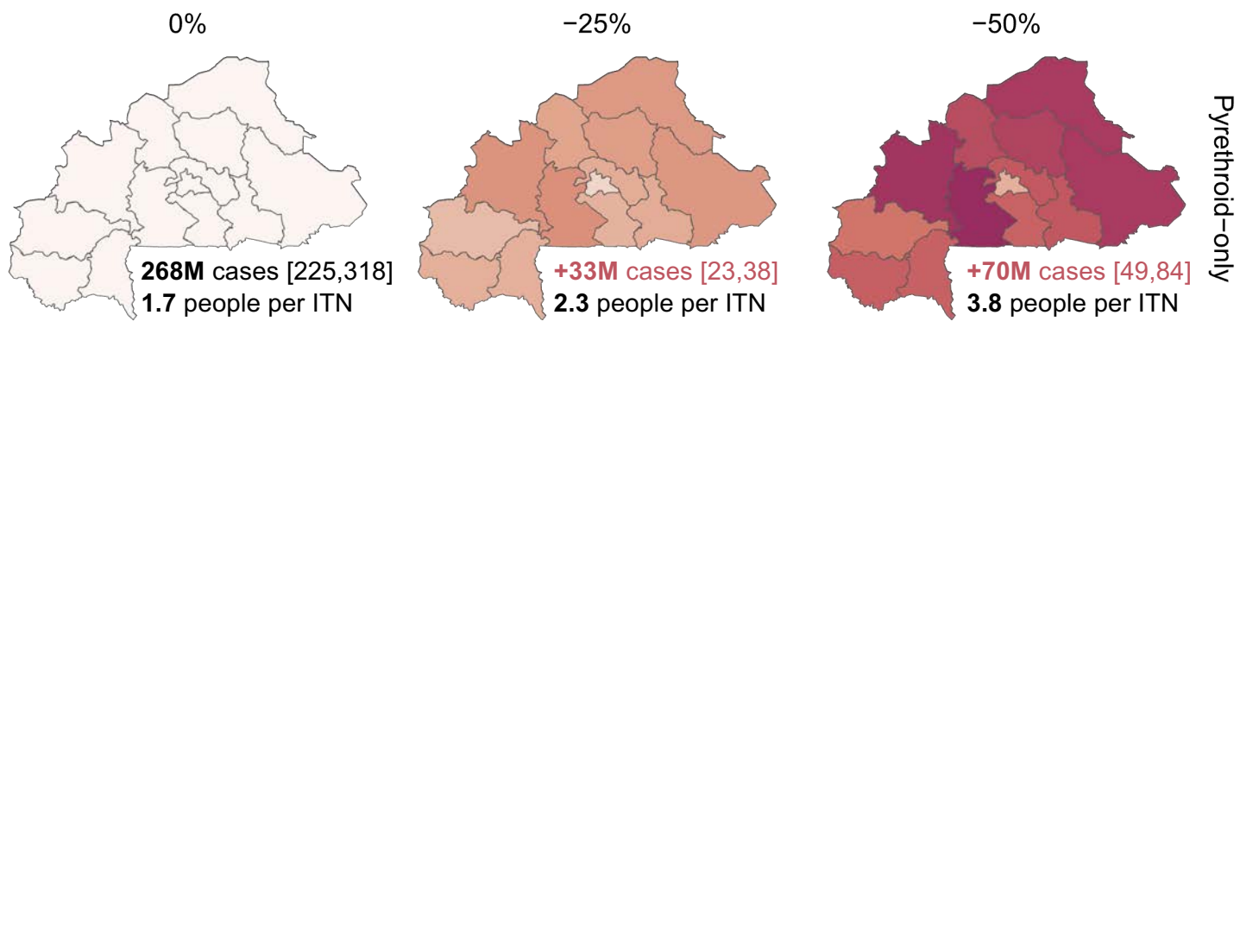
Change to budget: (3-year intervals)

- 630k routine ITNs distributed annually in all scenarios
- Budget achieved by increasing campaign procurement ratios (people per ITN)



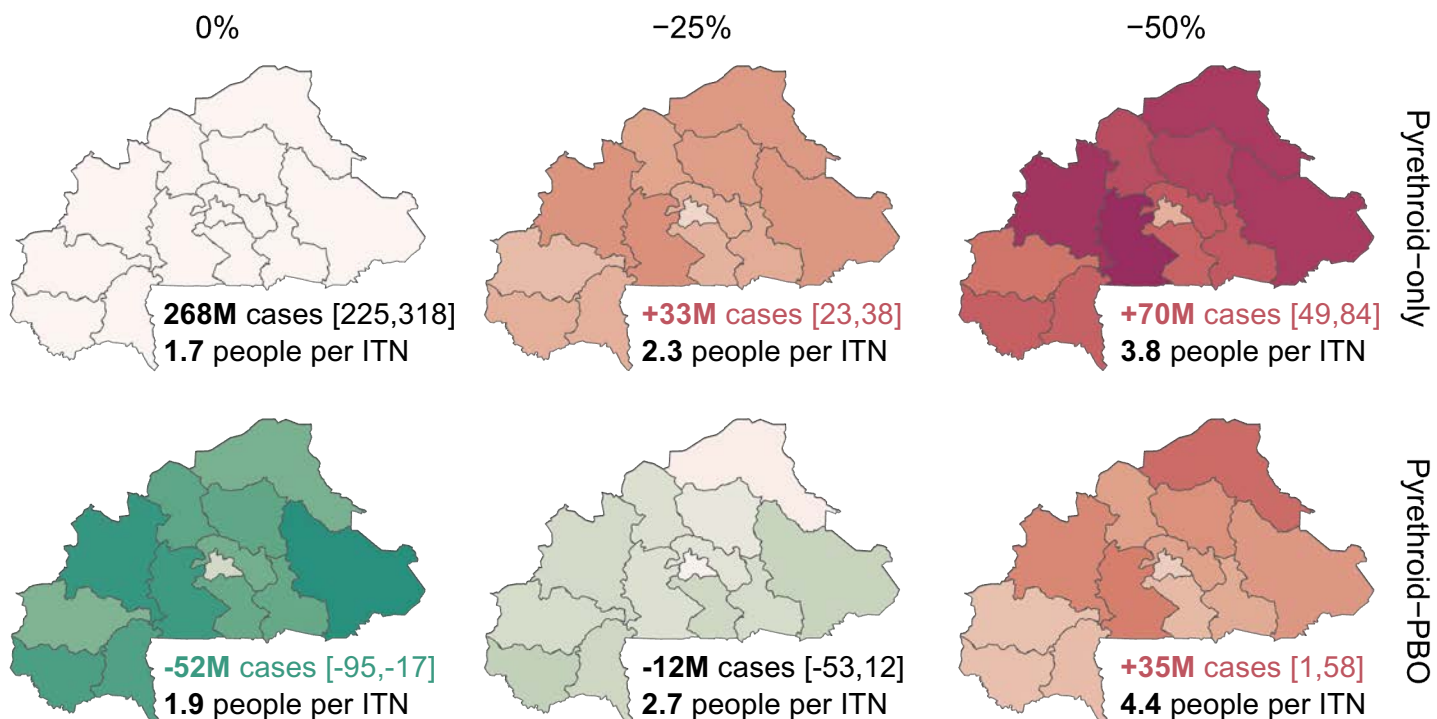
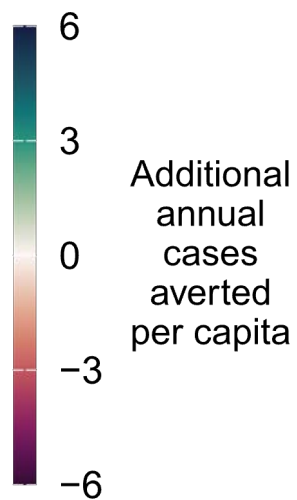
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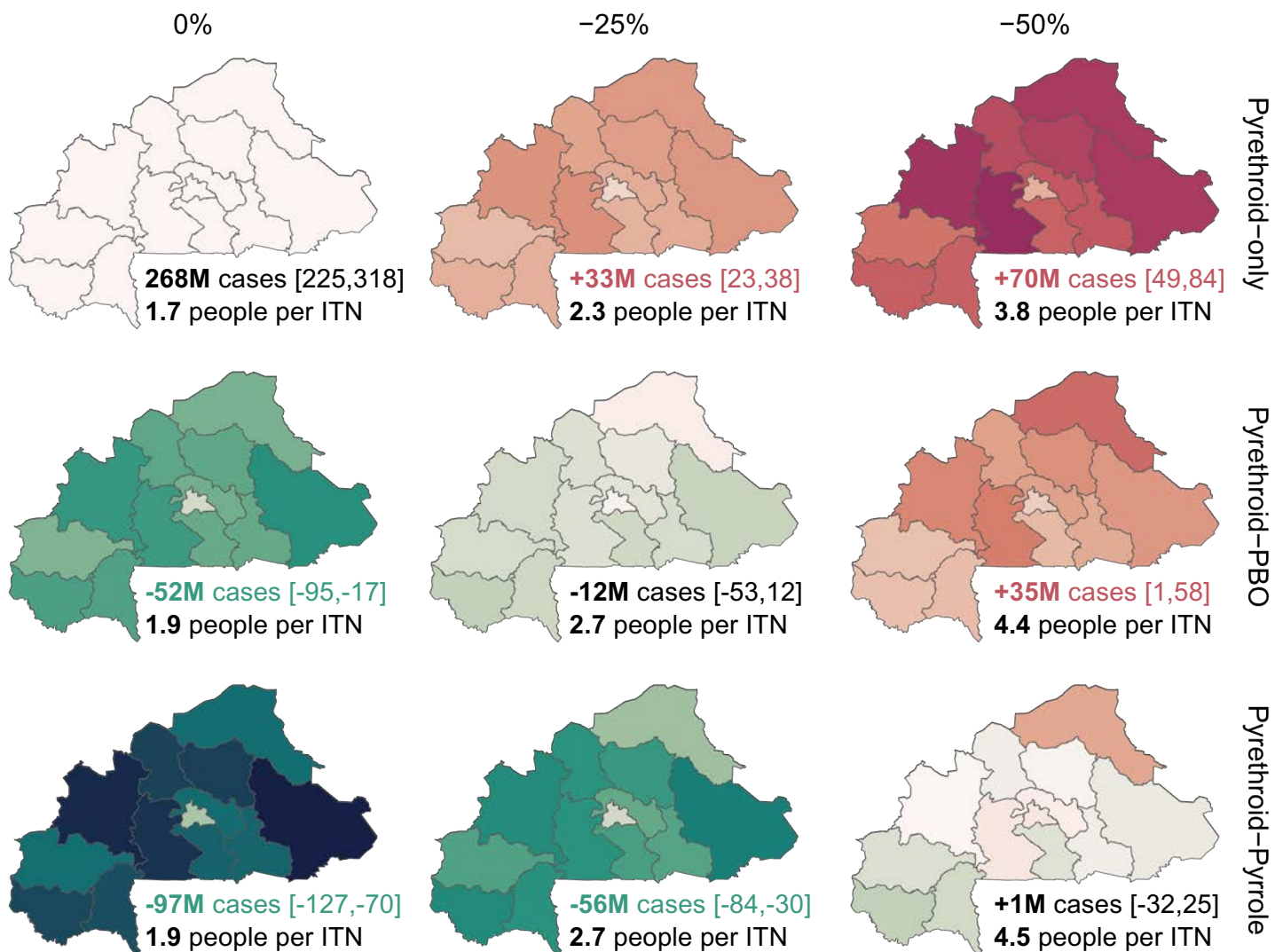
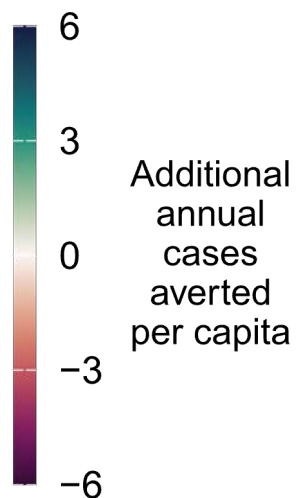
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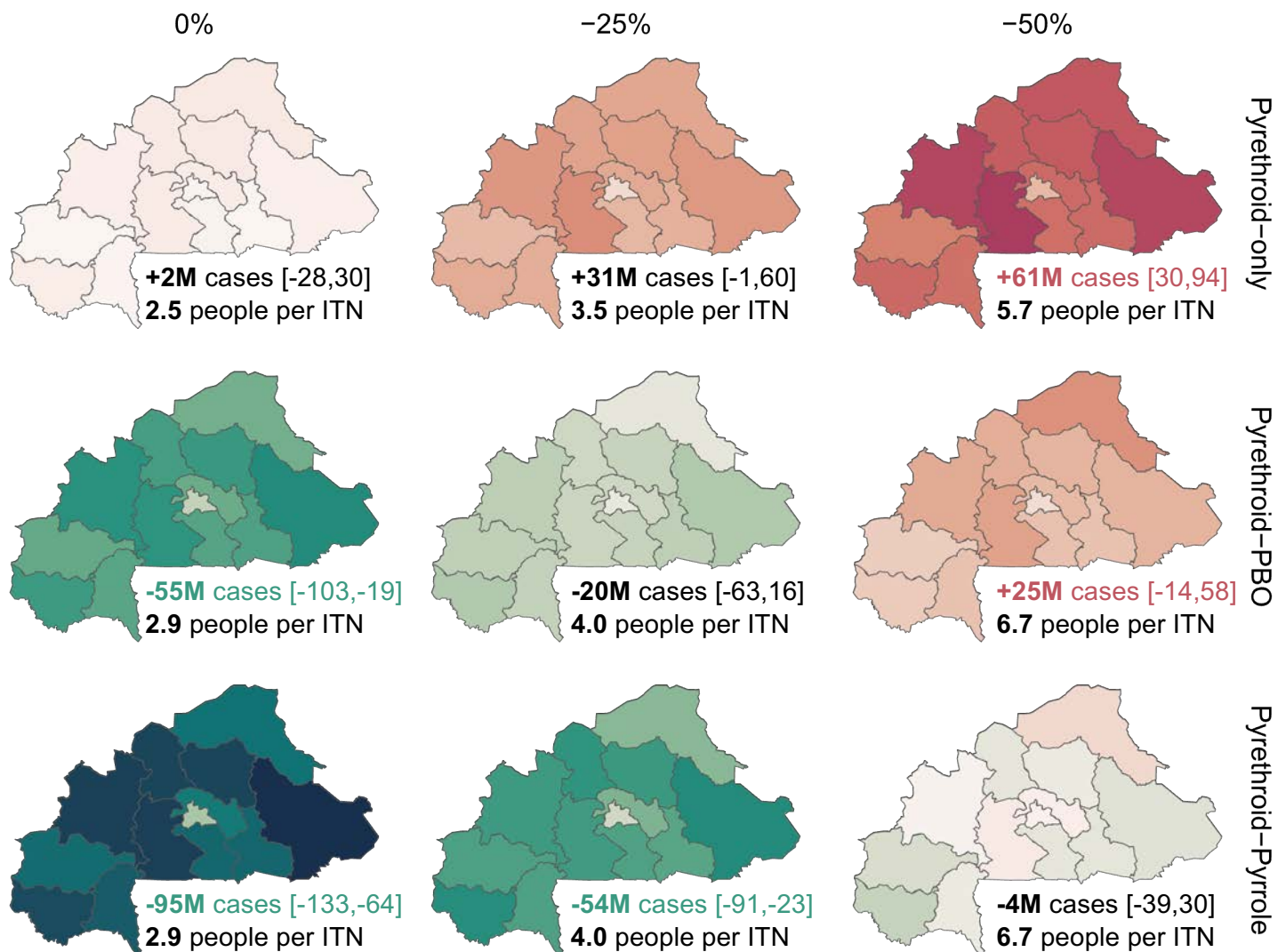
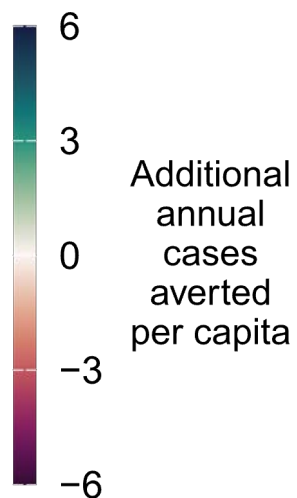
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Summary



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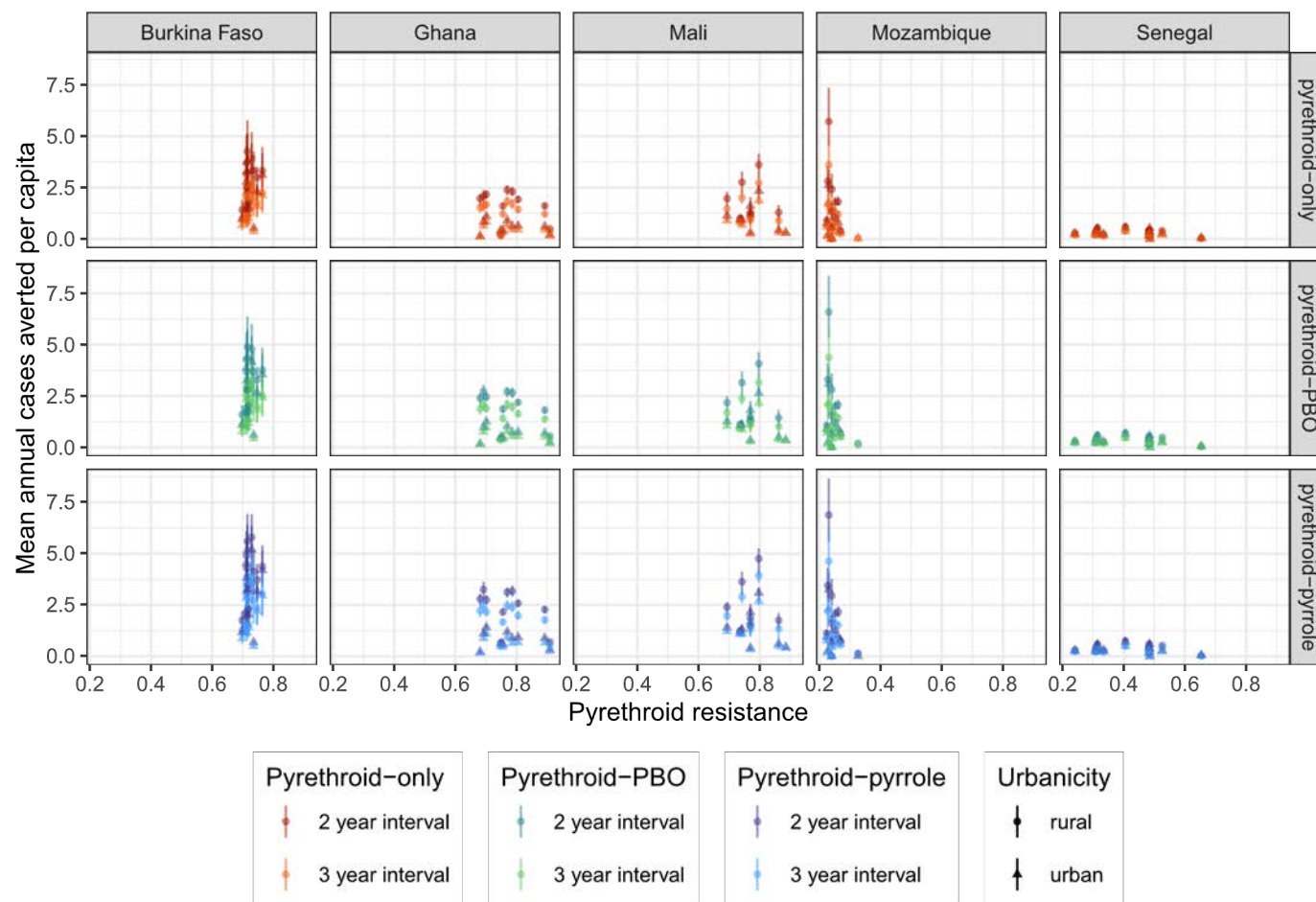
- **Universal coverage was not consistently achieved** anywhere but was (briefly) achieved after mass campaigns in most regions
- **Transmission intensity** best predicts the impact of switching to more regular campaigns and/or better ITNs
- **Prioritising higher-transmission** settings may be optimal under fixed budgets in some settings
- Switching to **fewer, but better nets** could avert:
 - **More cases** for the **same cost**
 - **Similar numbers of cases** under **reduced budgets**

Pyrethroid resistance is also a poor predictor of impact



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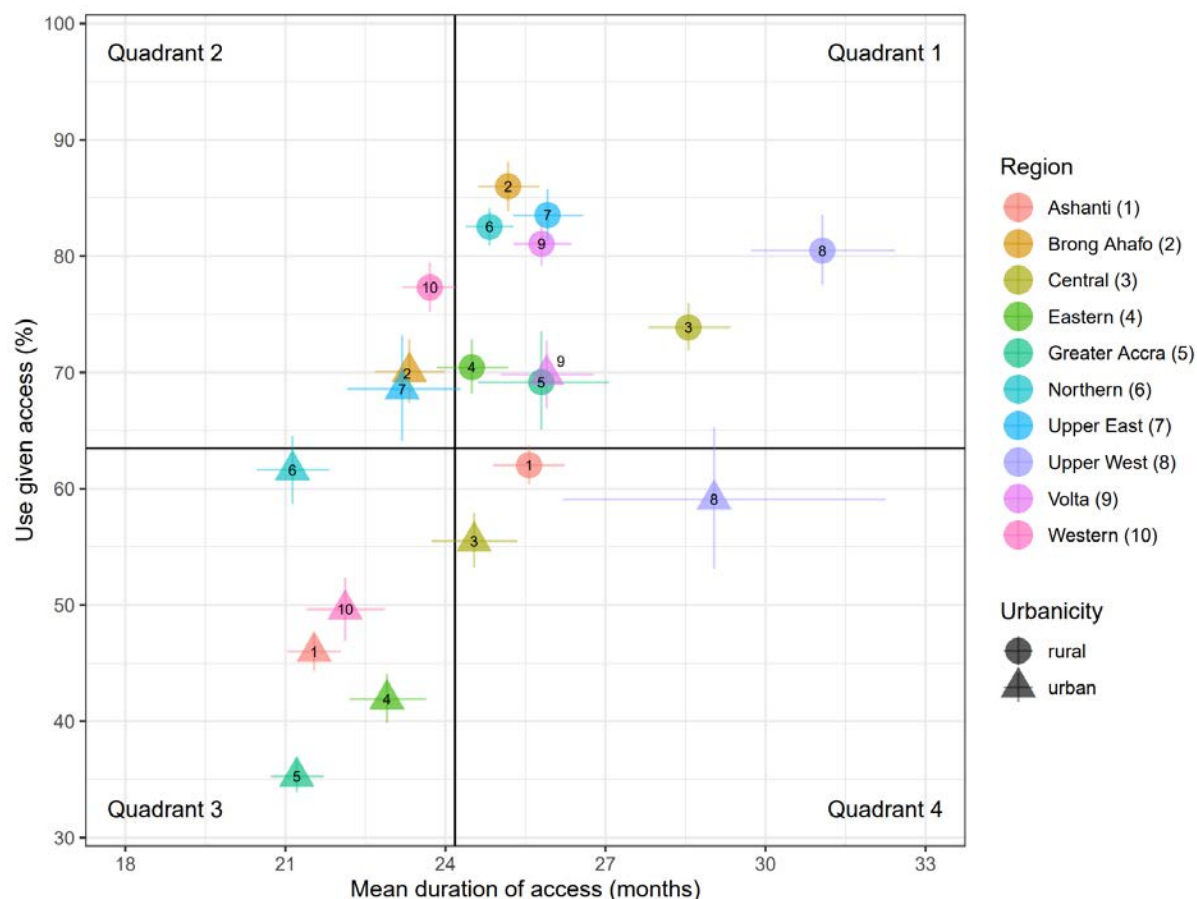
Considerations for subnational tailoring: ITN retention and use given access



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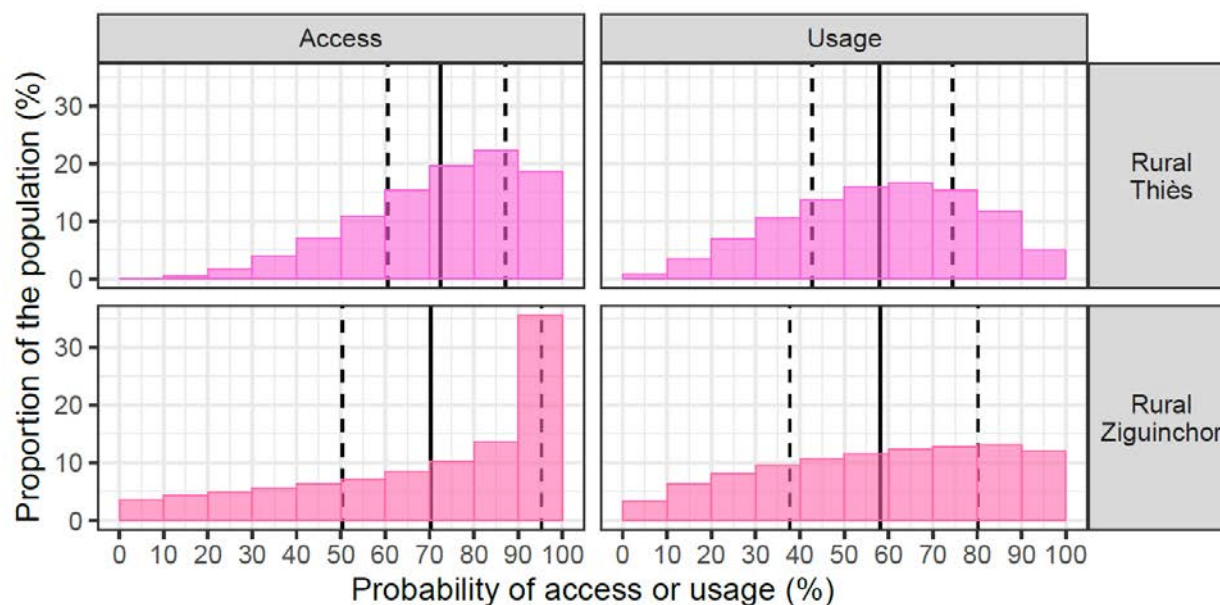
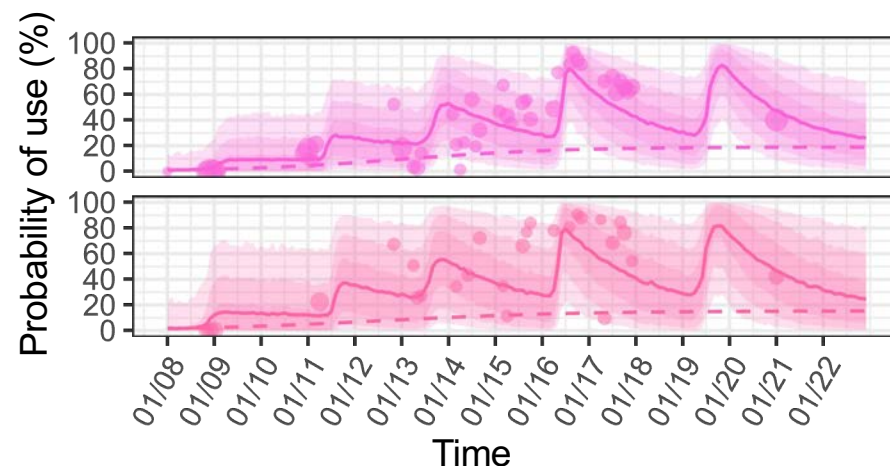
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- In areas of low use given access (quadrants 3 and 4) social behavioural change interventions **may** improve overall use
- Prioritising more regular distribution of ITNs in areas of **high retention** (quadrants 1 and 4) may be more **effective**, but more regular campaigns when **retention is low** (quadrants 2 and 3) may be **more equitable**



Considerations for subnational tailoring: equity of use and access

- Overall use of ITNs is **not evenly distributed** within sub-national regions
- Overall use of ITNs is more unevenly distributed in some regions than others

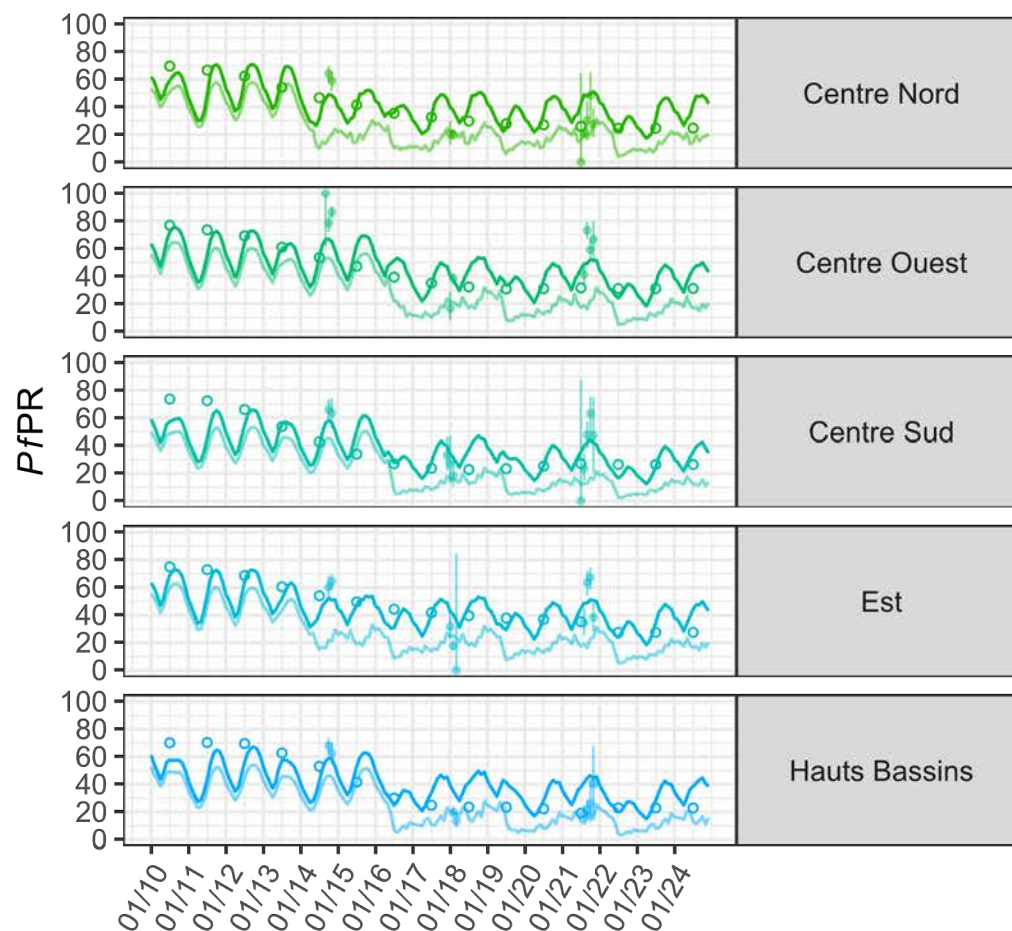
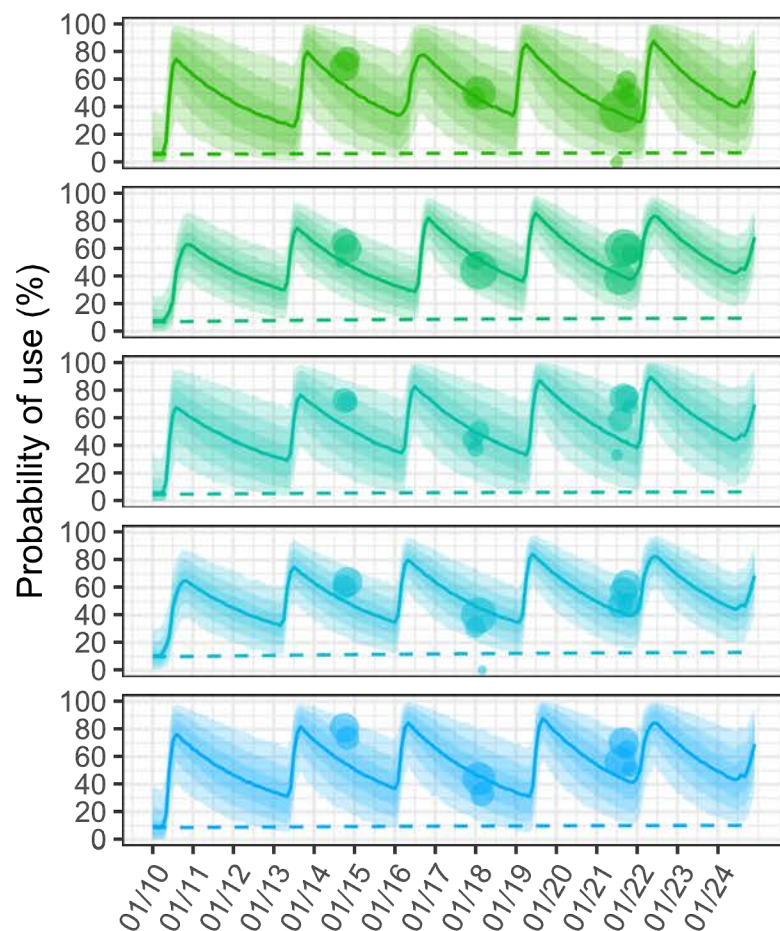


Considerations for campaign intervals: *PfPR* rebounds over time



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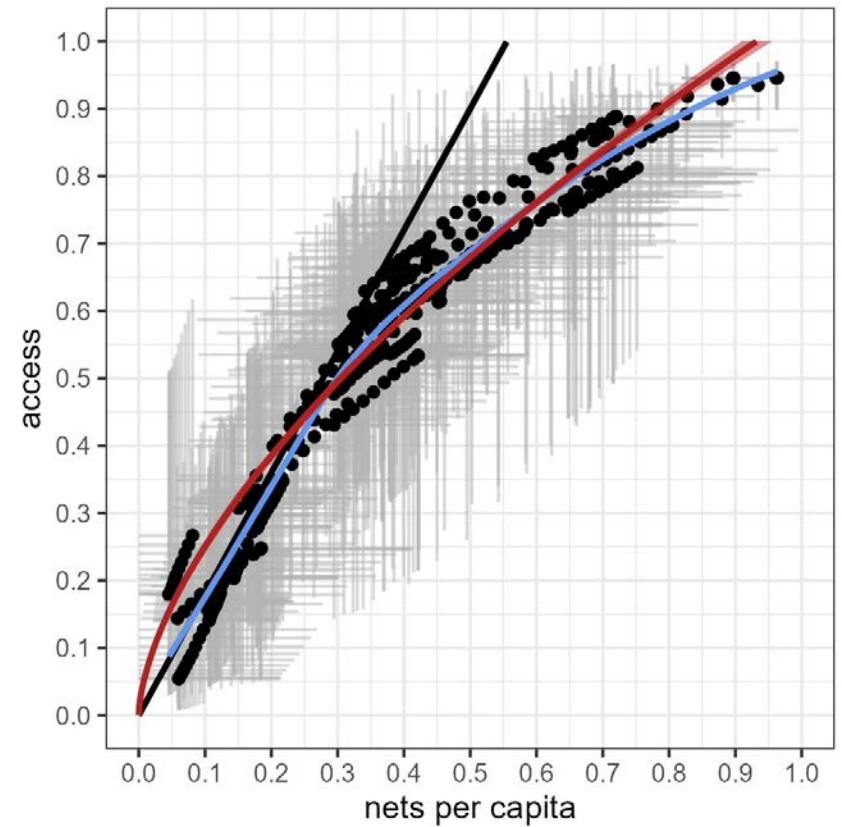
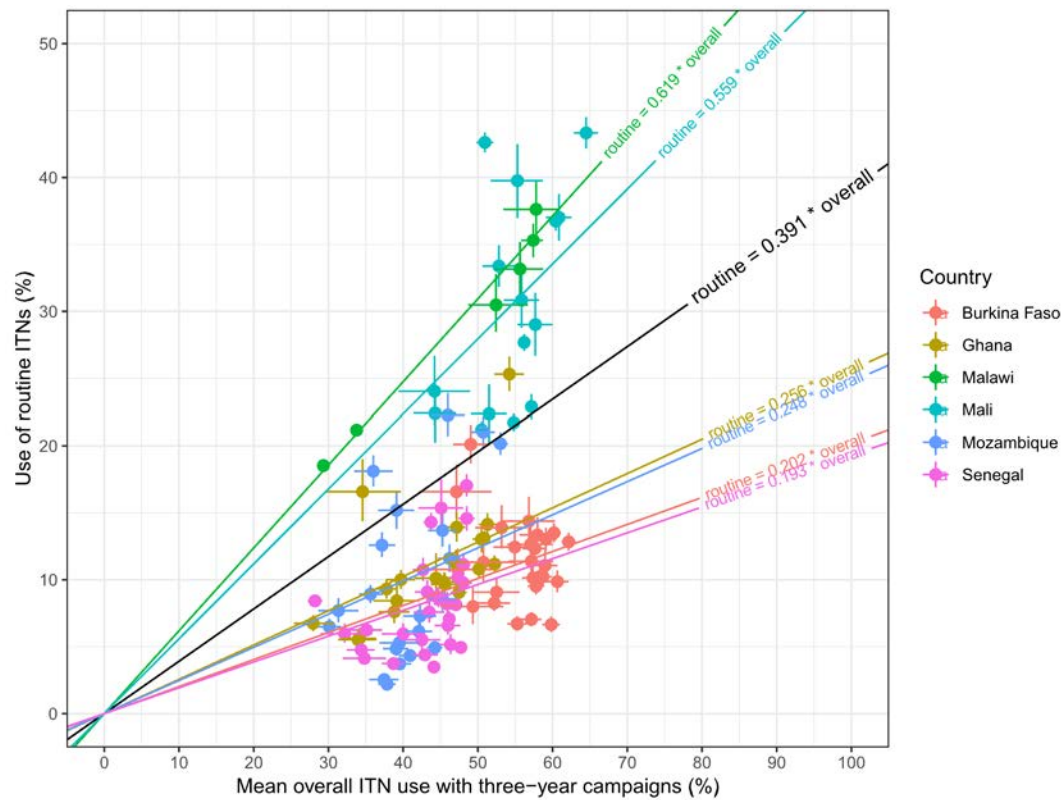


Considerations for distribution channels: 39% of used ITNs from routine channels



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Adapted from: Bertozzi-Villa, A. et al. Nature Communications 12, 1–12 (2021).