Swiss TPH

Modeling to support decisions about the geographic and demographic extensions of SMC in Benin

IDM Symposium, May 24th 2023

Jeanne Lemant

Outline

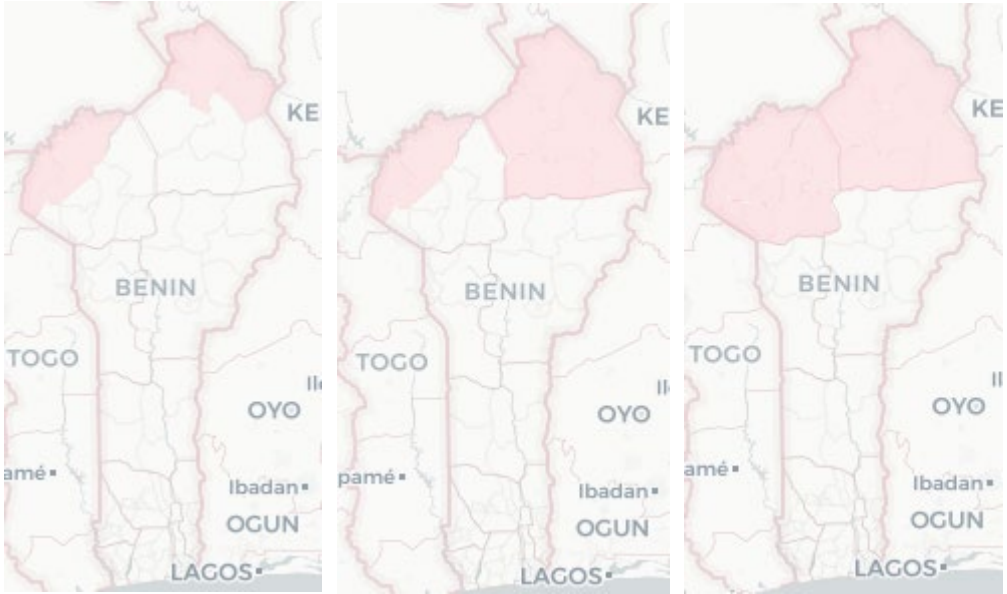
- Context
  - Seasonal Malaria Chemoprevention (SMC) in Benin
  - Questions of the National Malaria Control Program (NMCP)
- Methods
  - Calibration of the model OpenMalaria
  - Simulation of the two extensions
- Results
  - Demographic versus geographic extension
  - New zones to target in priority
- Discussion
  - Key points
  - Limitations
  - Interactions with the NMCP

Context

SMC in Benin: geographical extension since 2019

- SMC started in two zones of northern Benin in the region of the Sahel in 2019.
- Children aged 3 to 59 months
- Severe cases in children under 5 were reduced by 50% compared to 2018.
- Progressive extension until the two northern departments of Alibori and Atacora were targeted in 2021 (almost 600 000 children)

2019 2020 2021-2022



Questions of the NMCP

Demographic extension of SMC in the same departments to children under 10

OR

Geographic extension to southern departements, only children under 5

→ Which departments should be targeted first?

Why use modeling?

- Neither extension had been tested in Benin before.

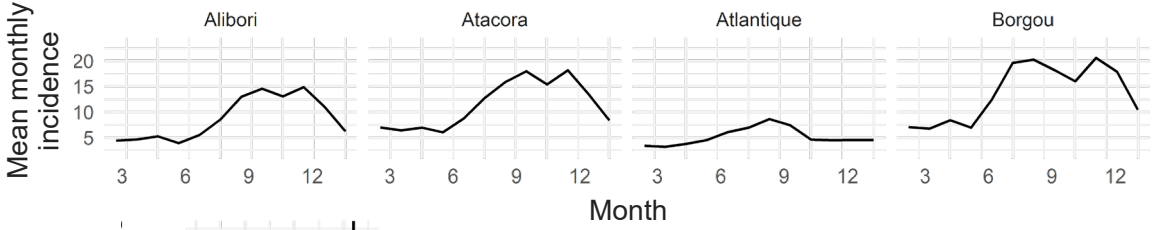
- Complex issue, need to simultaneously take into account:
  - Burden
  - Seasonality
  - Population
  - Cost
  - History of interventions (bednets and IRS)
  - Future interventions (PBO and IG2 bednets started to be distributed in 2020 and then 2023)

- Both extensions would be beneficial, but in a context of limited resources, **which extension would have more impact, and by how much**?

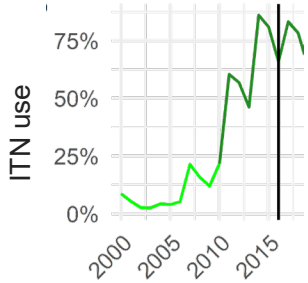
Methods

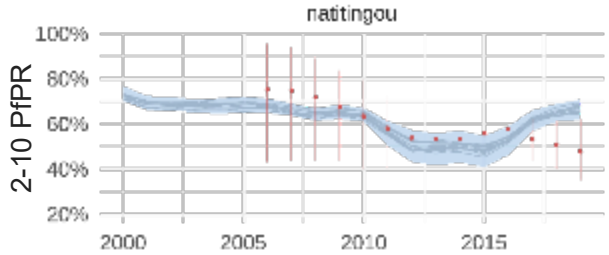
Calibration of the model OpenMalaria

- Geographical factors
  - Seasonality of transmission
  - *Anopheles* species

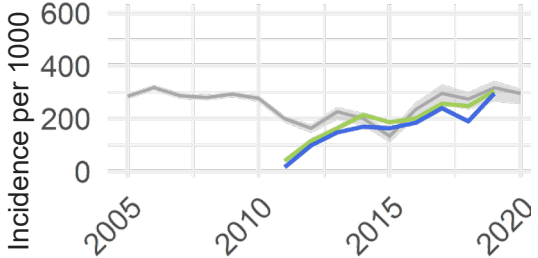


- History of interventions in Benin
  - Bednet use, IRS, SMC, case management improvements





- Calibration to prevalence for each commune
  - Malaria Atlas Project estimates



- Validation
  - Reported and adjusted cases

Swiss TPH

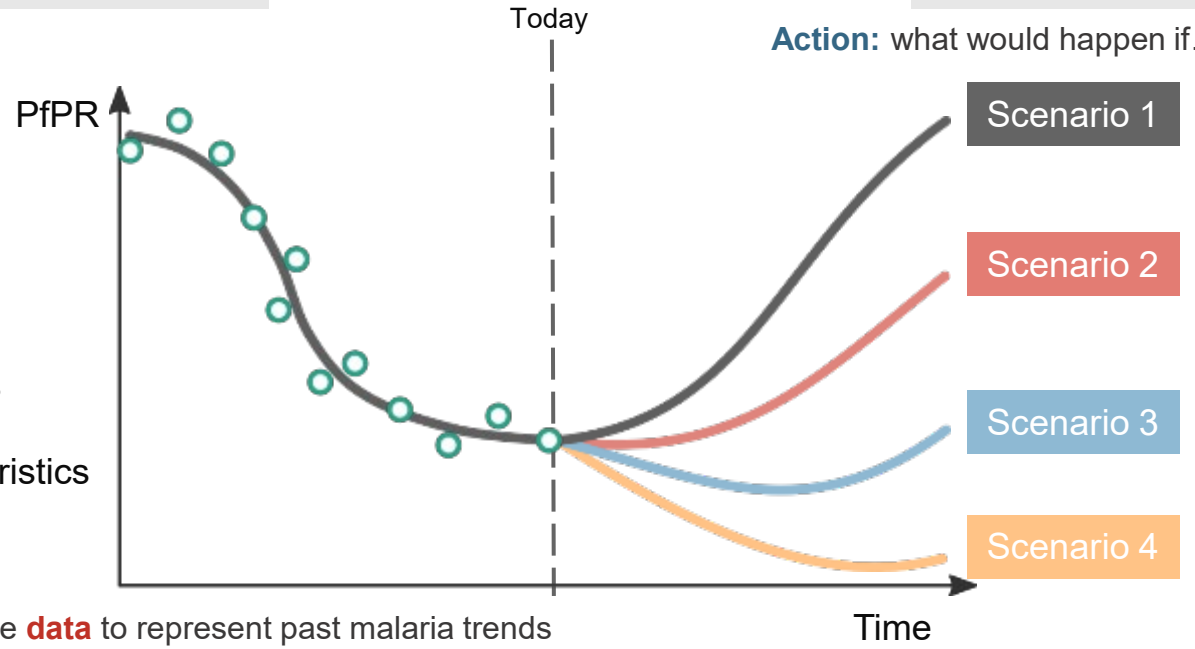
Calibration and future simulations

What is known

Past trends

What is unknown

Future scenarios



Action: what would happen if…

Intervention efficacy

History of interventions

Geographical characteristics

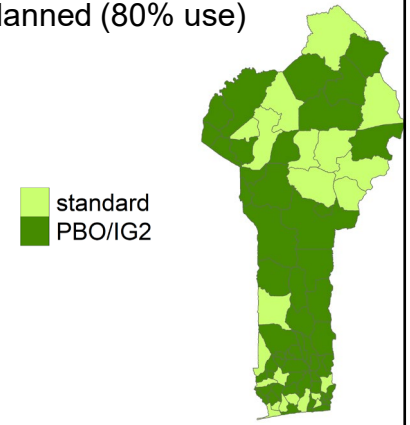
Use **data** to represent past malaria trends

Illustrative figure only – courtesy of Tatiana Alonso Amor

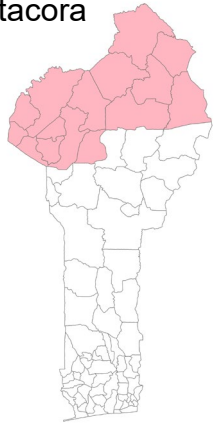
Planned interventions and SMC extensions

Plan

Bednets as planned (80% use)



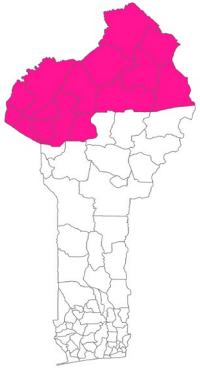
SMC until 5 in Alibori and Atacora



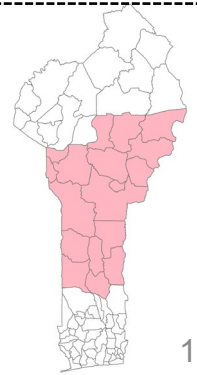
Pilot PMC

Exten-sions

\+ Demographic extension of SMC in the same departments to children from 5 to 10



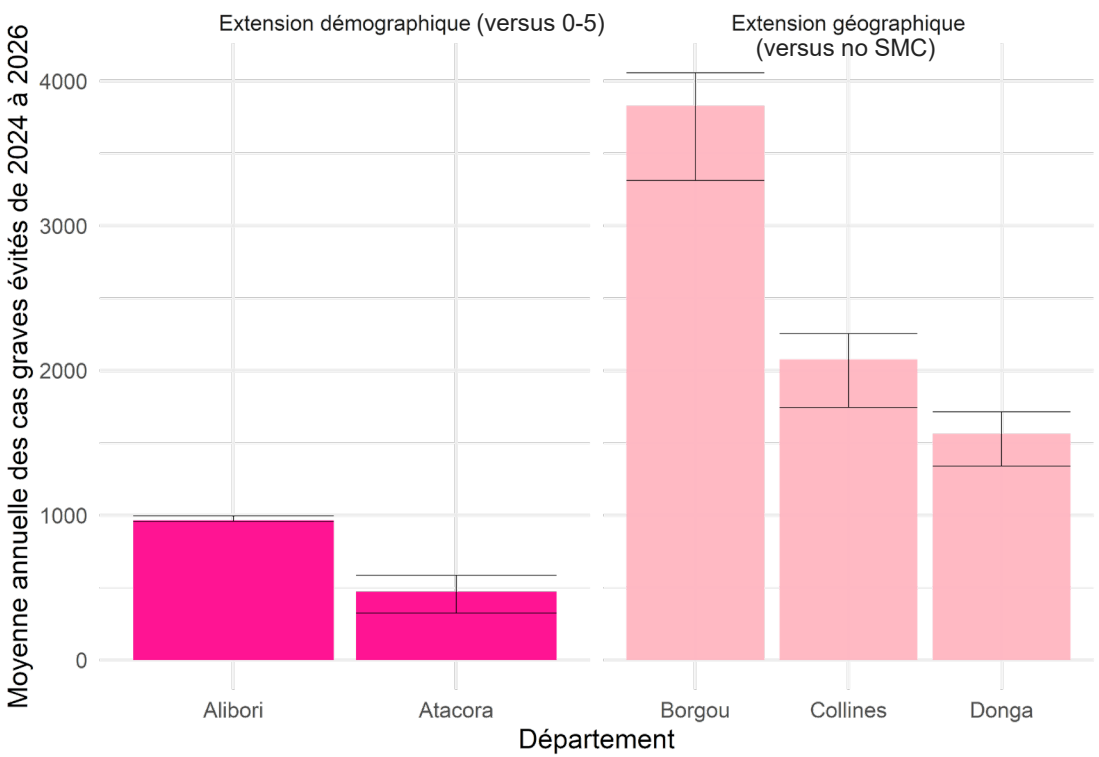
\+ Geographic extension of SMC to children under 5 of Donga, Borgou and Collines

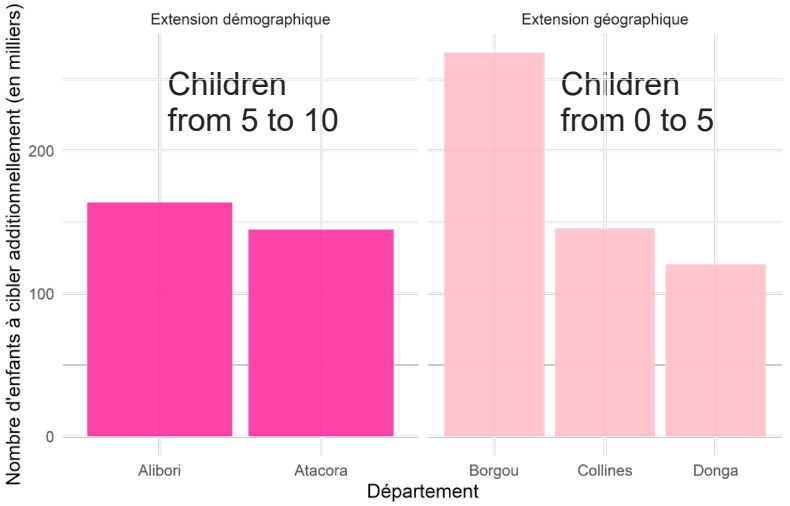


Results

Demographic versus geographic extension

Severe cases averted by the SMC extensions

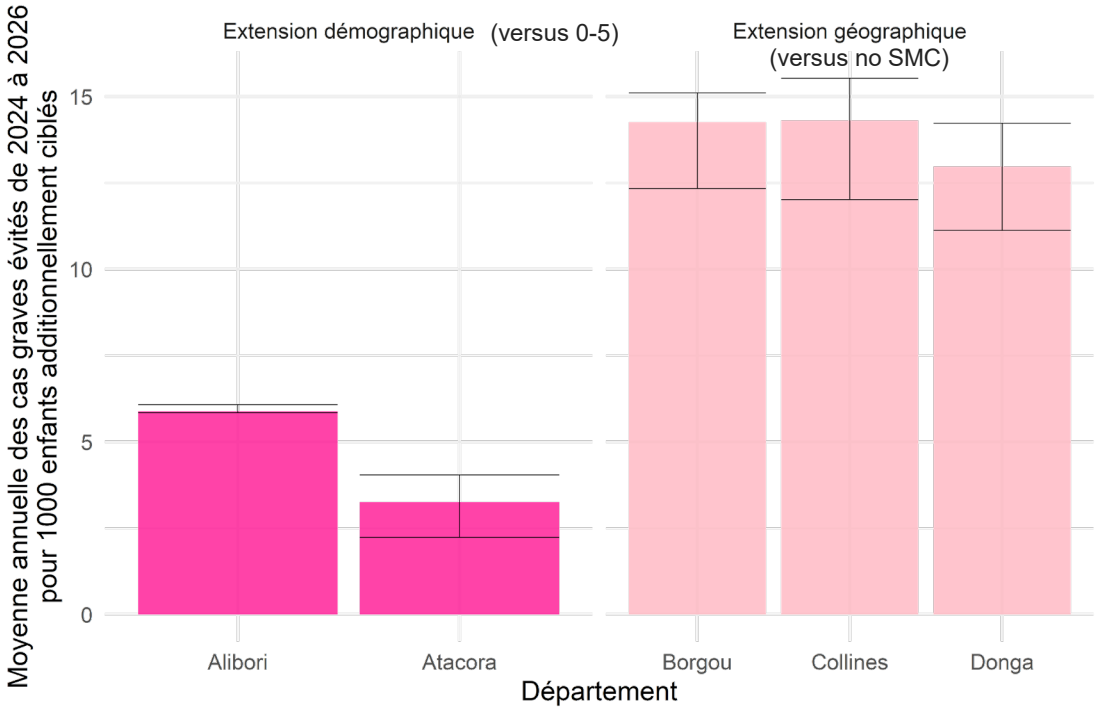




More severe cases could be averted by the geographic extension, but this could be driven by the size of the targeted population.

Swiss TPH

Severe cases averted per targeted child



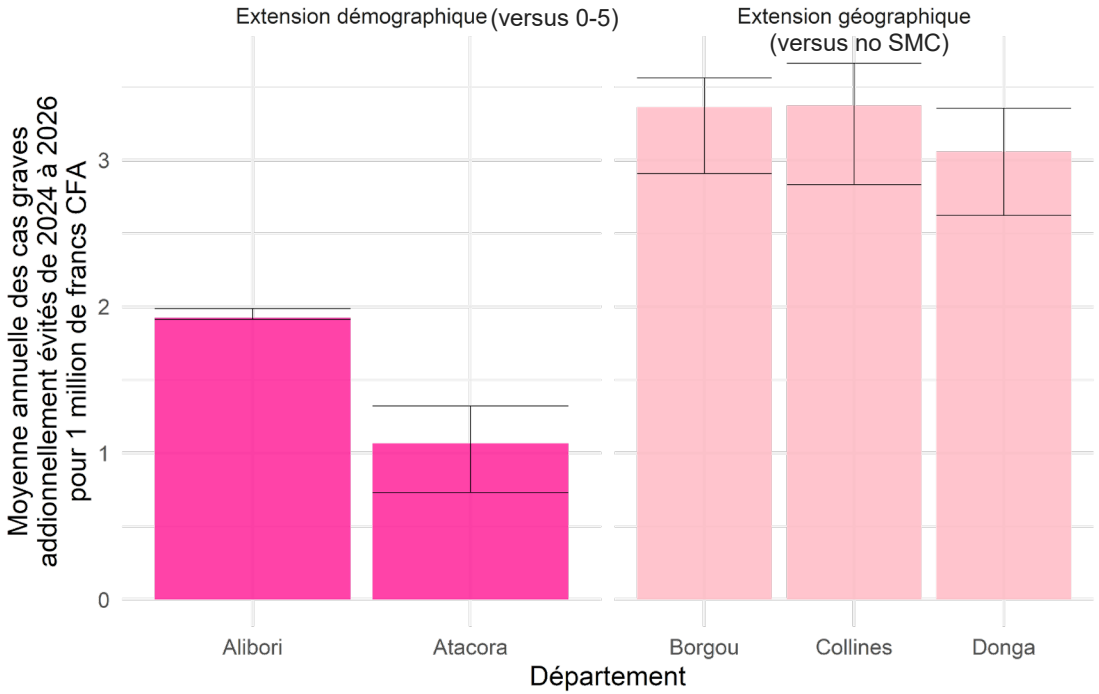
When dividing by the additional targeted population (children from 5 to 10 or children under 5), the ratio of severe cases averted per additionnally targeted child still favors the geographic extension.

Young children are more at risk of severe cases and deaths than school-aged children.

To invert the ratio, the geographic extension should be 3 times more expensive.

Swiss TPH

Severe cases averted per CFA spent



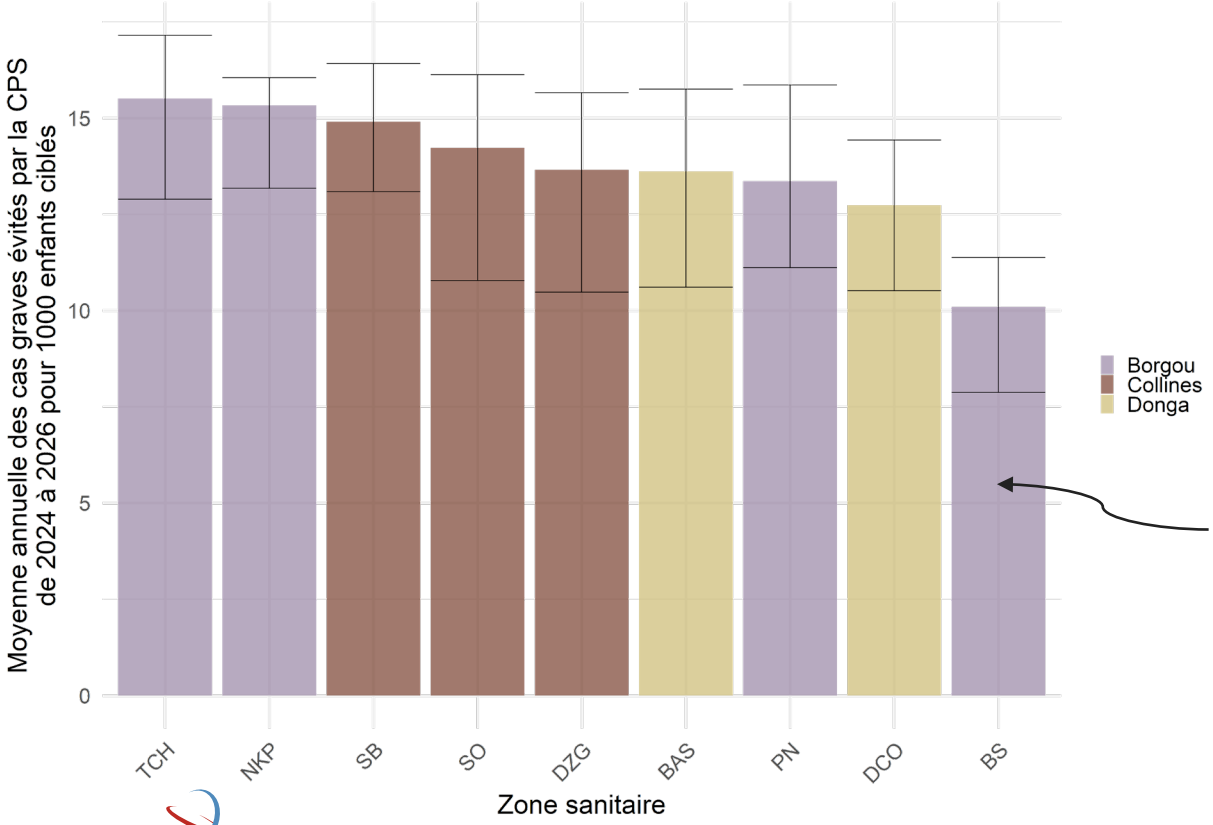
We could extract the cost of extending SMC to new geographies from the 2019-2021 extensions:

- Demographic extension is assumed to cost the same as staying in the current zones: 3059 CFA/child
- Geographic extension costs 4242 CFA/child (+39%)

Probably already an overestimation, and costs would go down after the first year of implementation.

New zones to target in priority

Severe cases averted per targeted child



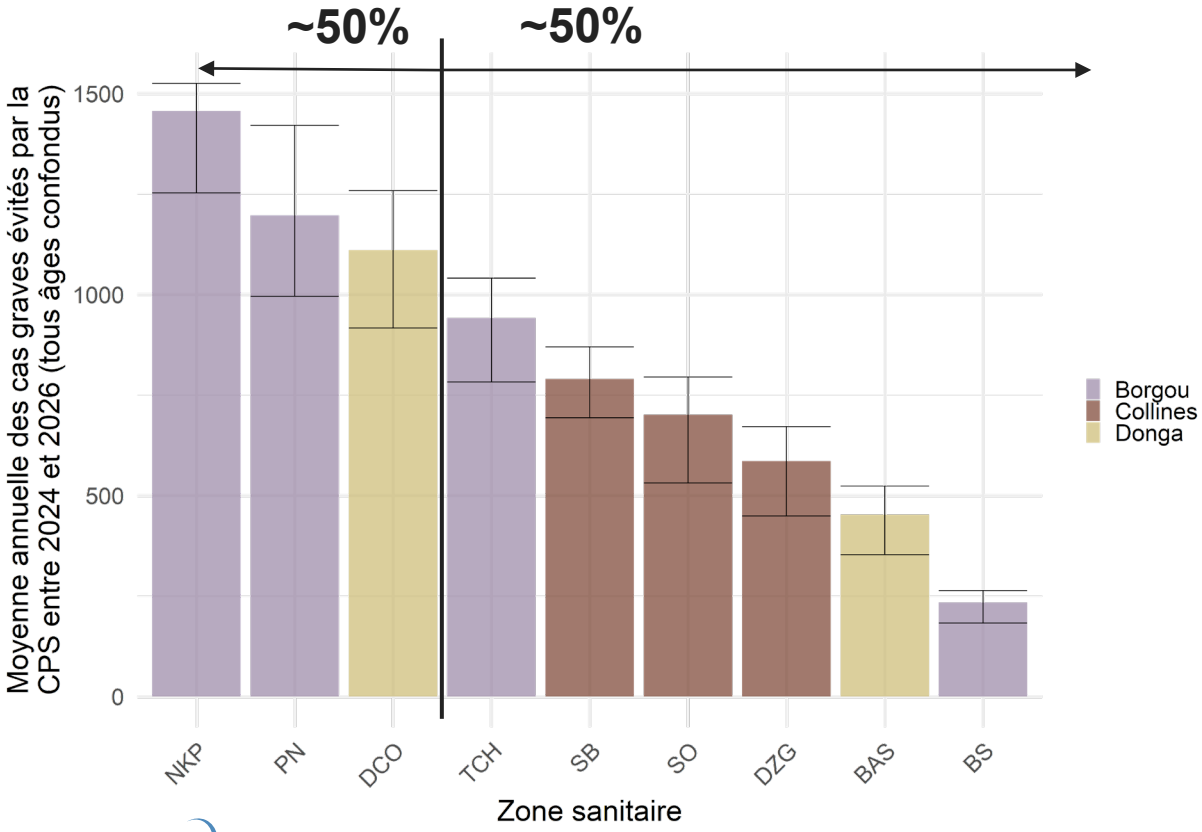
Zones ordered by decreasing order of severe cases averted by SMC per 1000 under 5 children

No strong differences between the three departments as malaria risks are quite similar

PMC pilot project in Bembereke-Sinende zone

Swiss TPH

Absolute number of severe cases averted



Zones ordered by decreasing order of severe cases averted by SMC

Implementing SMC in the three most populated zones would avert as many severe cases as implementing it in the other six zones

Discussion

Key points

- The geographic extension of SMC would **avert 3 times more severe cases** than the demographic extension.
- The geographic extension would cost at most 40% more than the demographic extension.
- The most populated zones should be targeted in priority if the risks are similar.

Limitations

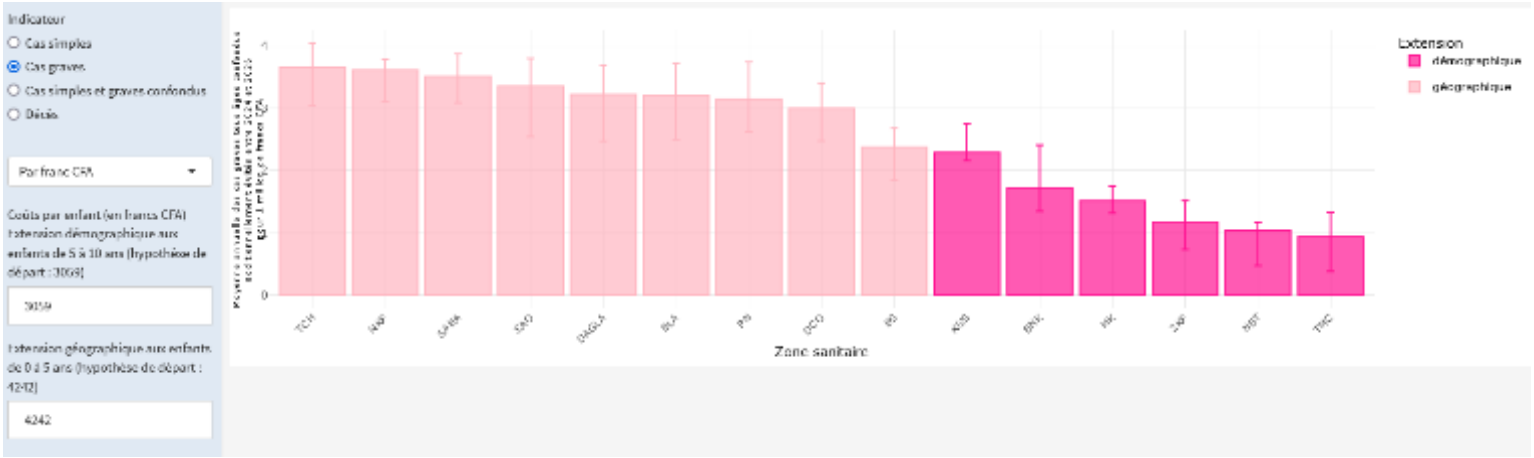
- Hypotheses can always be refined
  - SMC coverage (assumed to be 80% and uniform)
  - Constant cost through time and departments
  - Coverage of other interventions (bednet use)

- Efficacy based on clinical trials: assumes perfect implementation

- Constant population as commune-level population estimates were not available

Interactions with the NMCP

- Starting point: question from the programme
- Check that the zones and interventions are correct
- Choice of indicators: online dashboard to explore them



Acknowledgments

Swiss TPH
Swiss Tropical and Public Health Institute

Emilie Pothin
Clara Champagne

Cyriaque Affoukou
Julien Aïssan
Rock Aïkpon
William Houndjo
Saka Kpanou

CLINTON HEALTH ACCESS INITIATIVE

Didier Adjakidje

BILL & MELINDA GATES foundation

map

University of Basel
sdCORE | Center for Scientific Computing

Thank you for your attention!