

# Methods

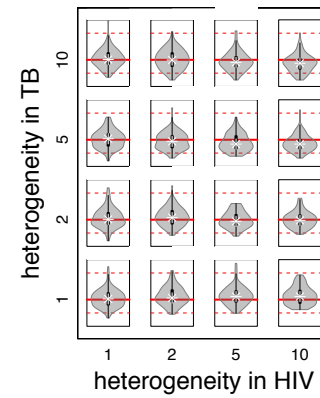
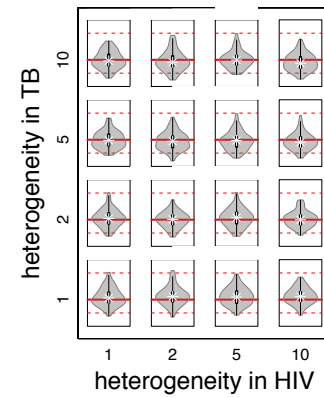
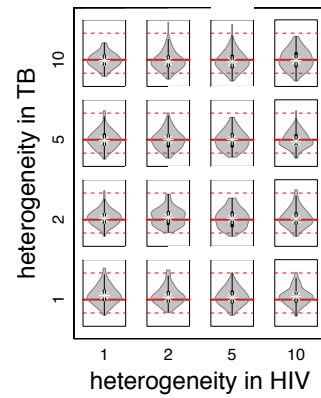
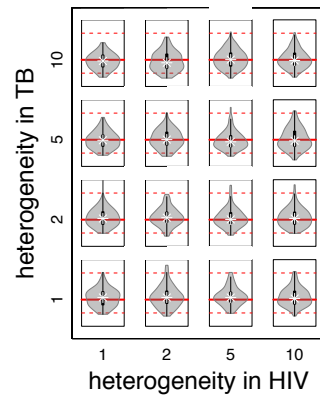
Risk Overlap:  $\phi = 0\%$

Risk Overlap:  $\phi = 10\%$

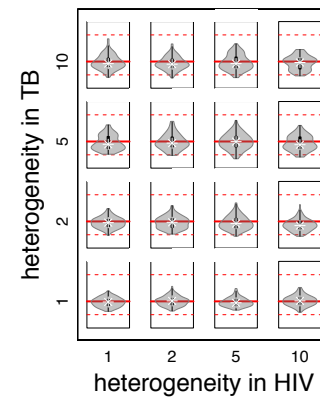
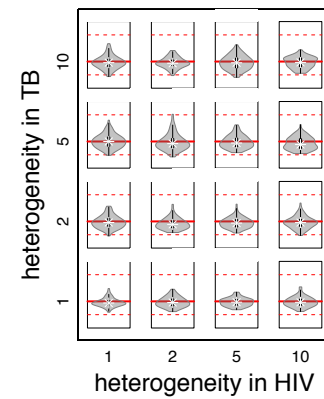
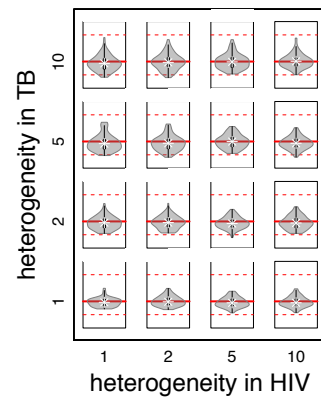
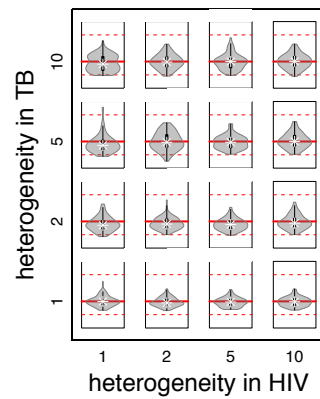
Risk Overlap:  $\rho = 50\%$

Risk Overlap:  $\rho = 100\%$

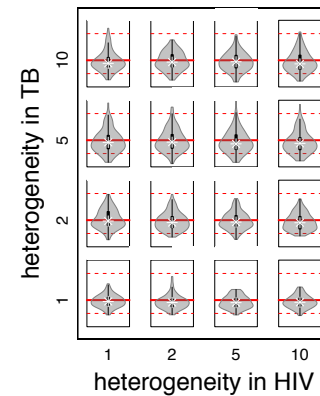
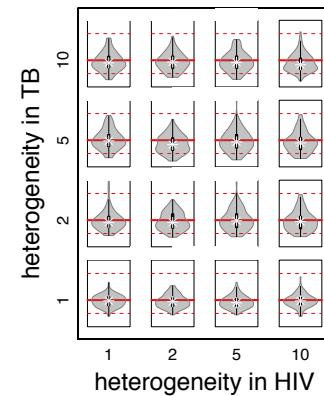
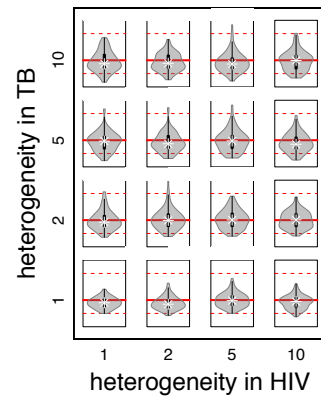
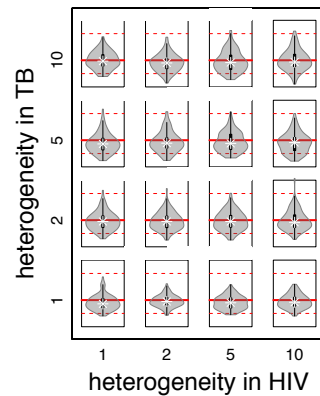
CANADA



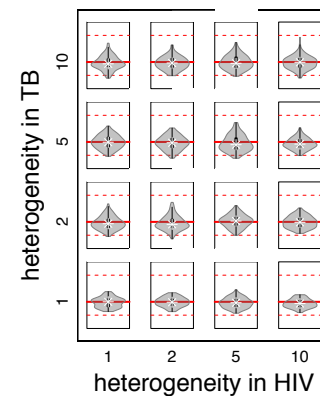
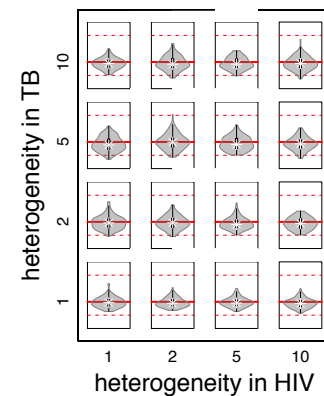
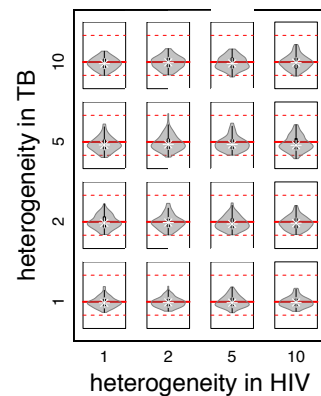
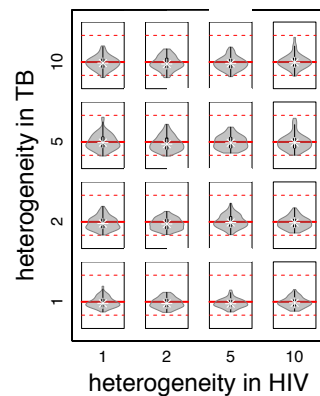
INDIA



KENYA



## SOUTH AFRICA



.. across different settings.

# Methods

CANADA

INDIA

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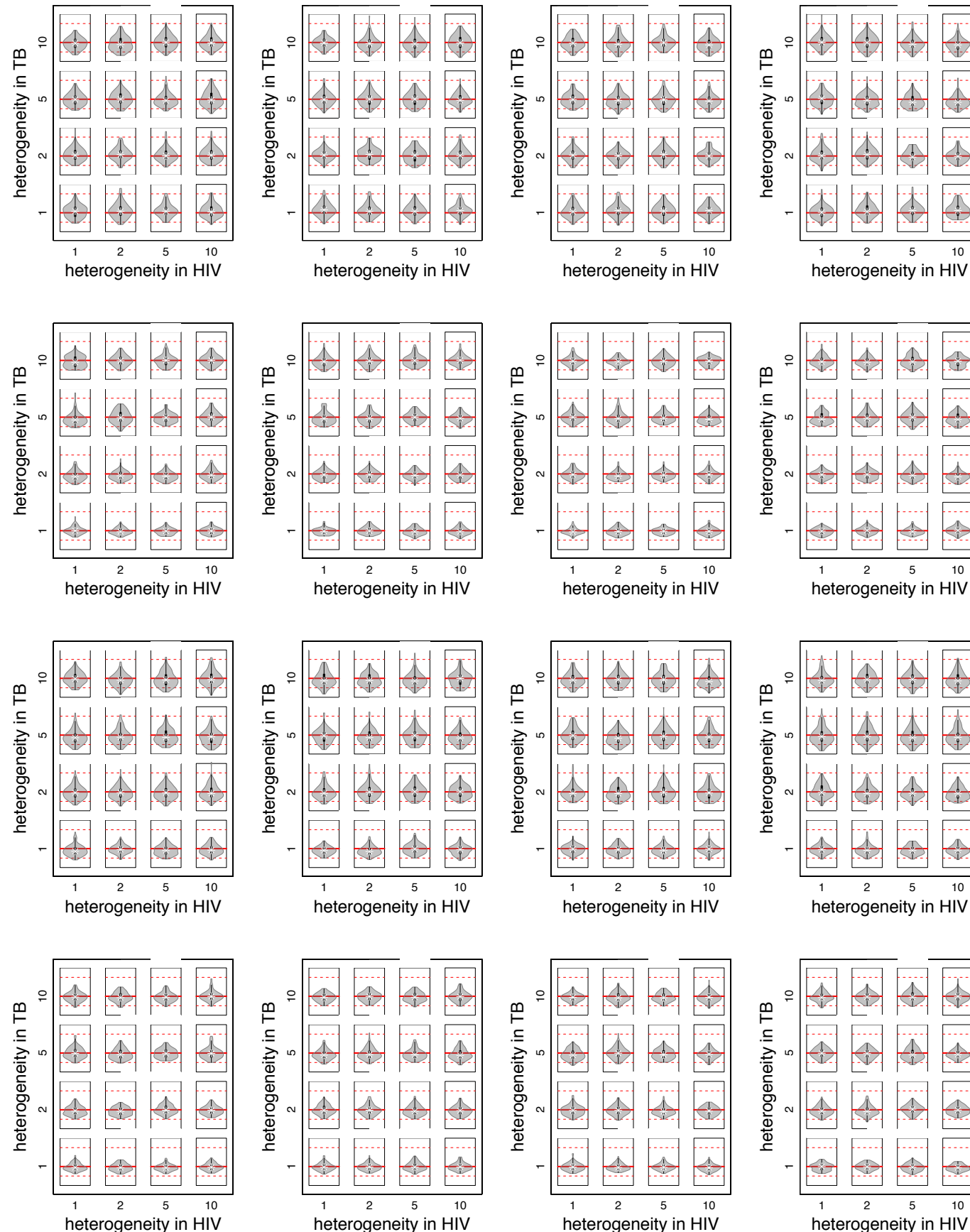
SOUTH AFRICA

Risk Overlap:  $\phi = 0\%$

Risk Overlap:  $\phi = 10\%$

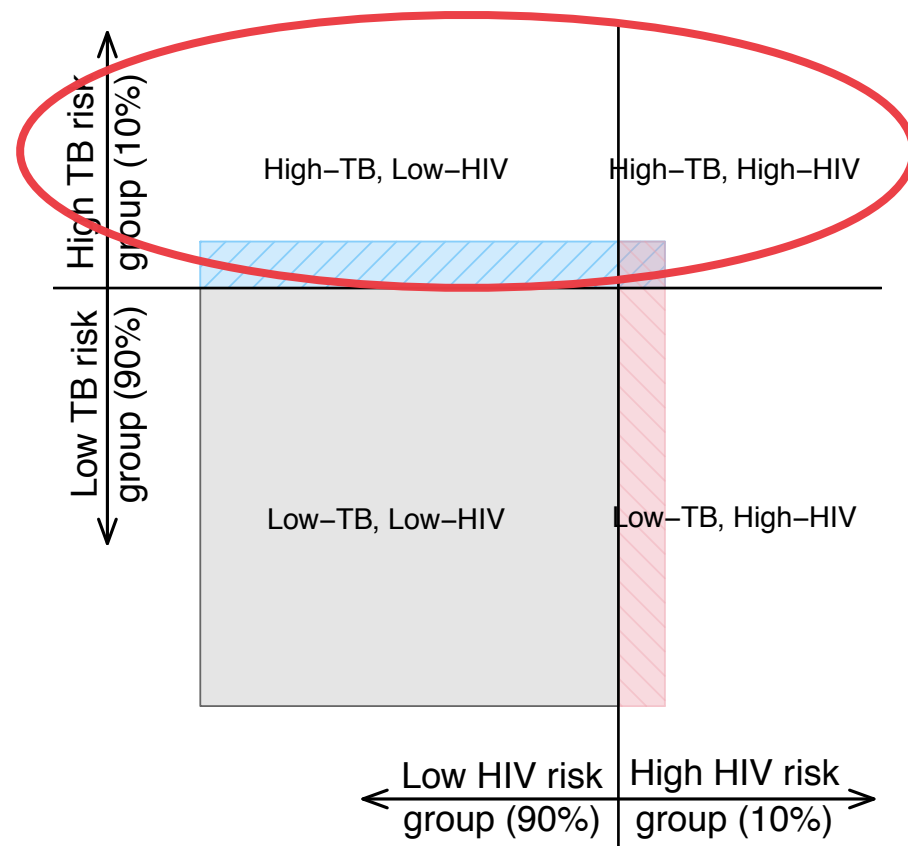
Risk Overlap:  $\phi = 50\%$

Risk Overlap:  $\phi = 100\%$



Models showed flexibility to fit to the calibration targets across spectrum of heterogeneity in different settings.

# Intervention



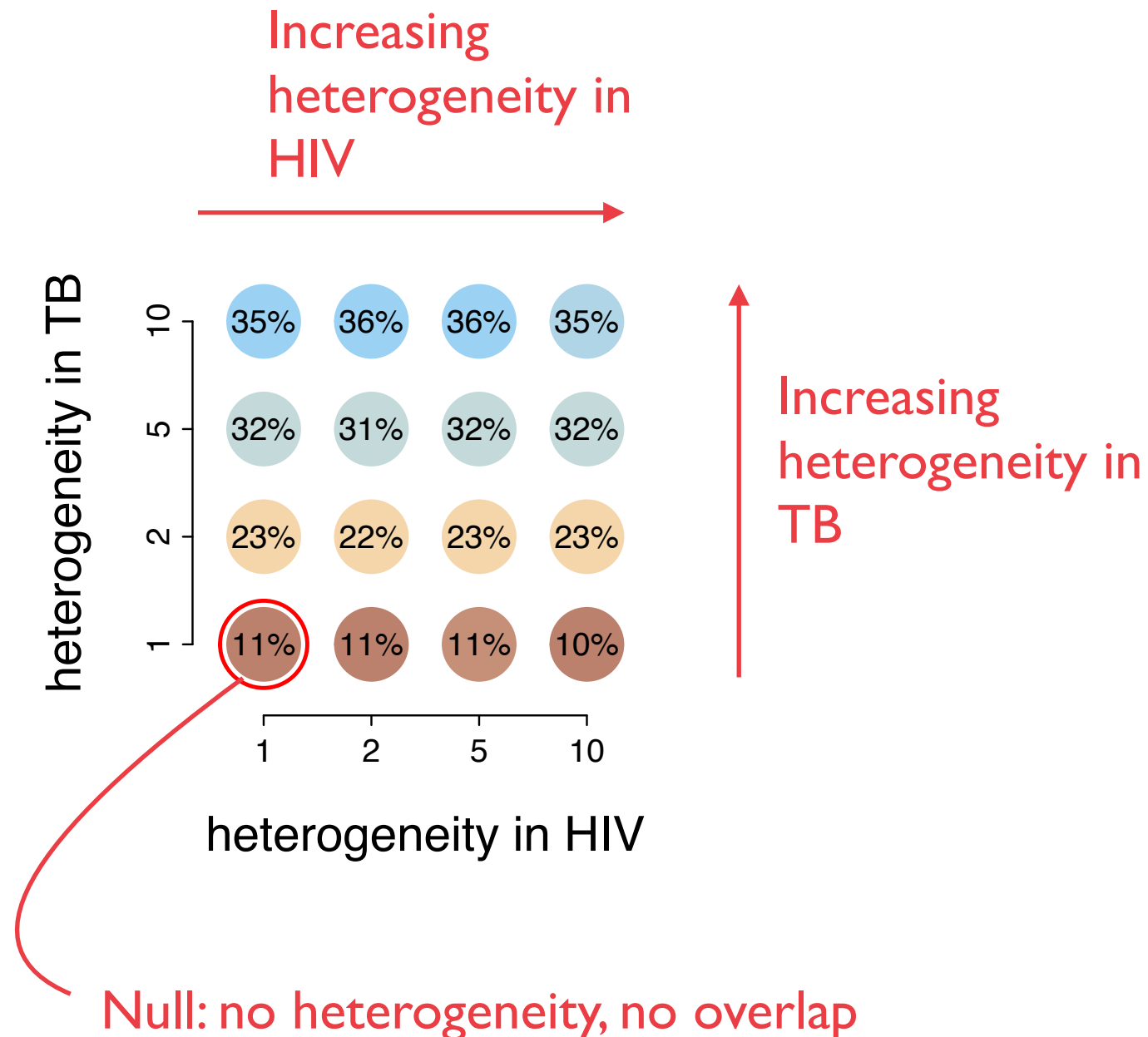
## Targeted Intervention:

One Time Mass Screening  
(5% of the Population)

ART initiation + TB  
treatment + Preventative  
Therapy

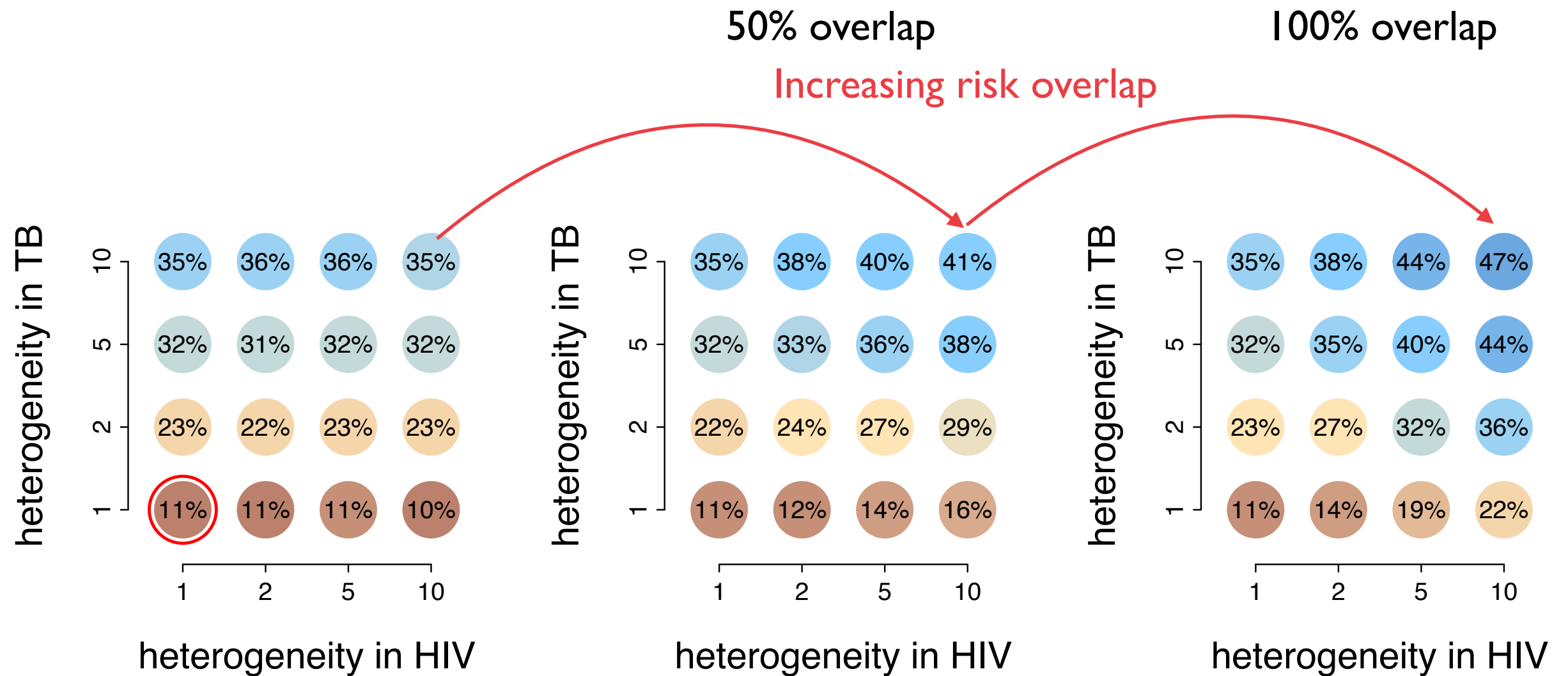
Outcome: % Reduction in TB  
incidence after 10 years.

# Results



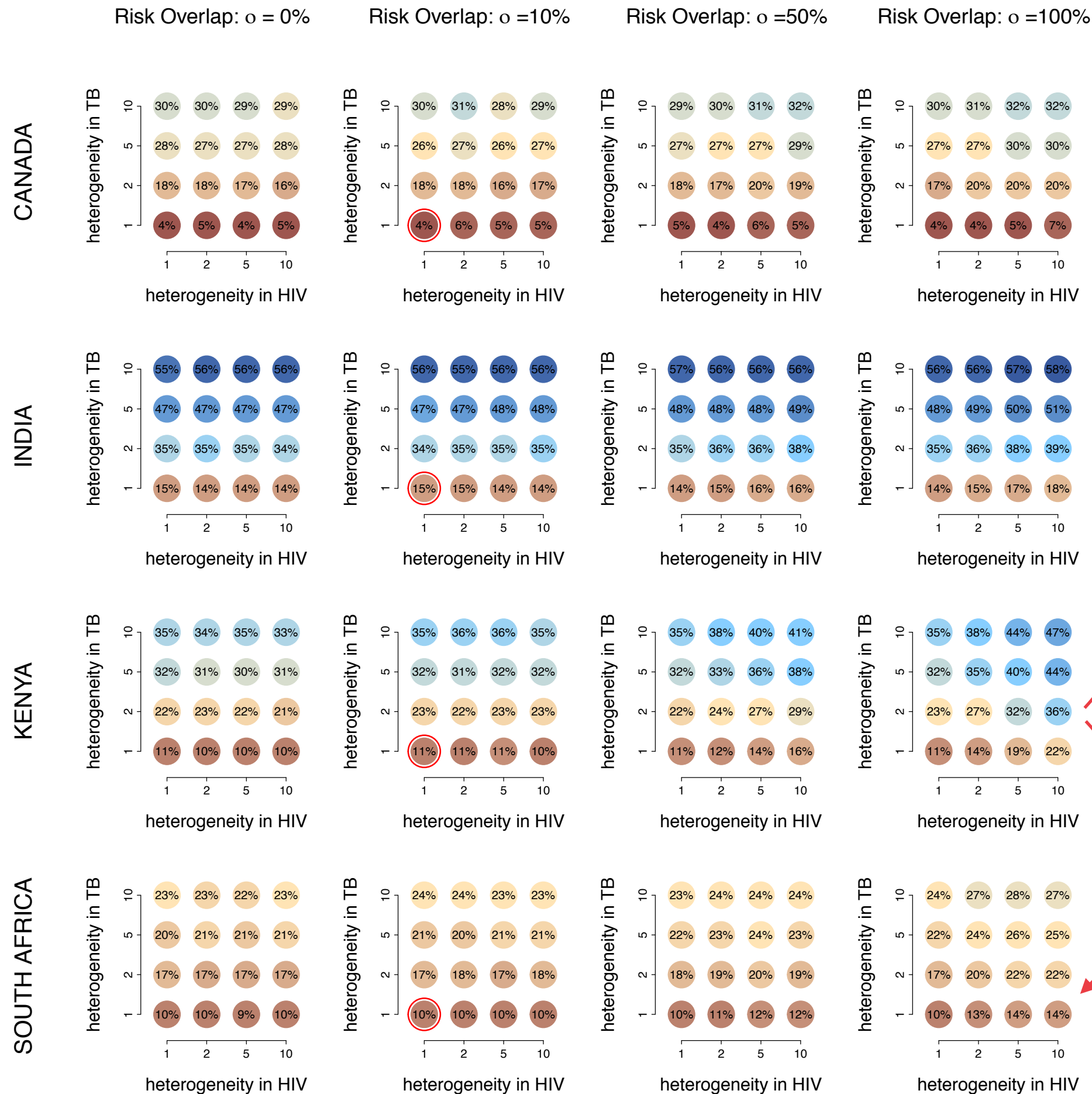
Impact of TB intervention could be substantially increased when in the presence of heterogeneity in TB transmission.

# Results



Heterogeneity in HIV can further accentuate the impact of targeting high-risk group.

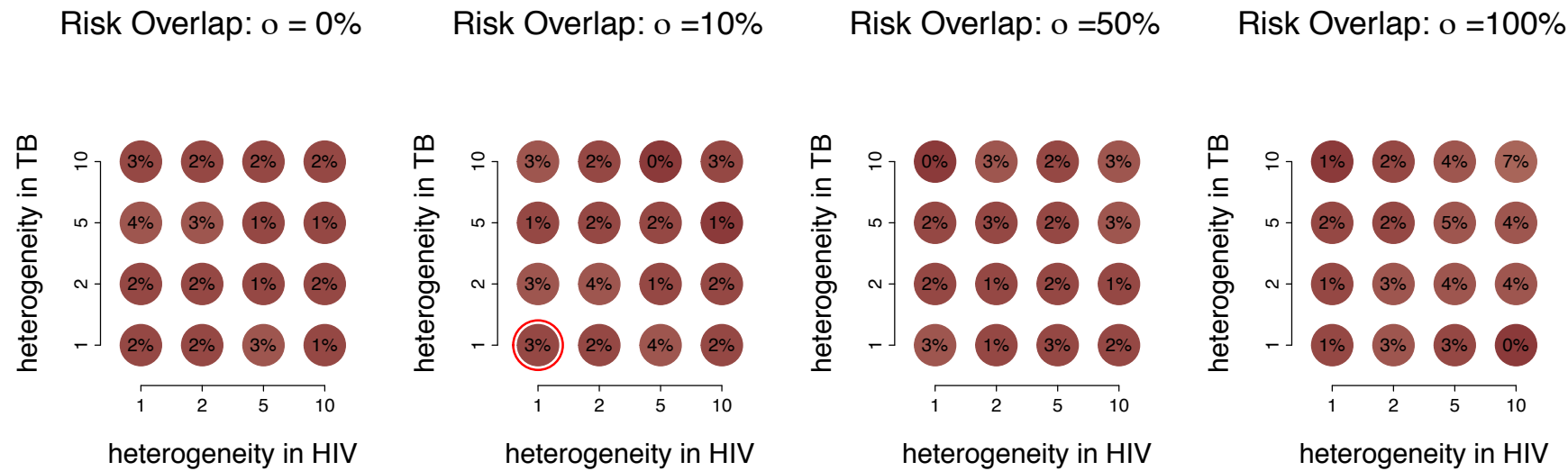
# Results



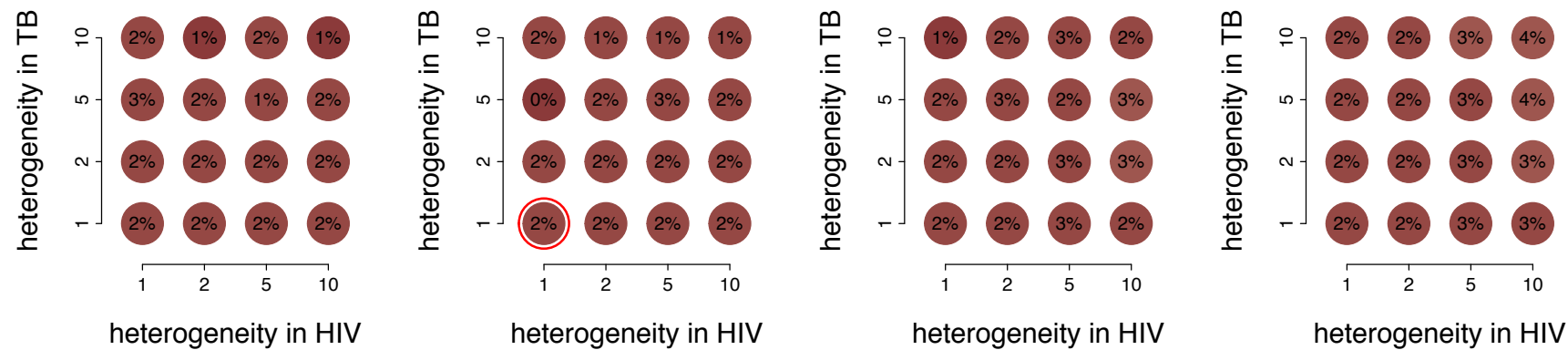
While general patterns translate across setting, the relative impact can be setting specific.

# Results

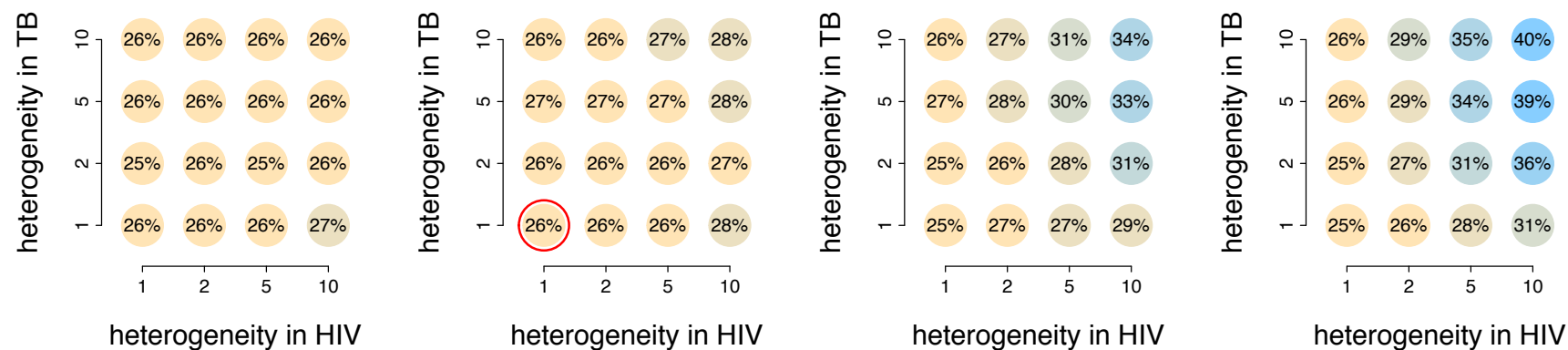
CANADA



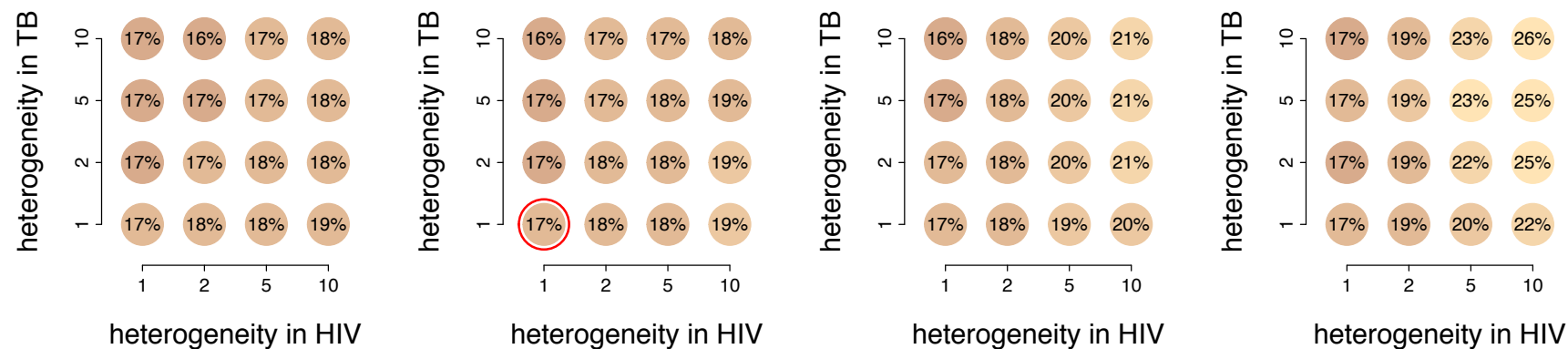
INDIA



KENYA



SOUTH AFRICA



Targeting  
individuals  
receiving ART with  
TB intervention.



# Summary

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- Models can incorporate a range of heterogeneity.
  - Population level data generally used to calibrate models do not have the information to discriminate the level of heterogeneity.
- For targeted TB interventions, heterogeneity in both TB transmission and HIV can be an important determinant of their overall effectiveness.
- Ability to identify and target high-risk population can significantly improve the effectiveness of TB interventions.
  - Relative effectiveness can be setting specific.



## Part II

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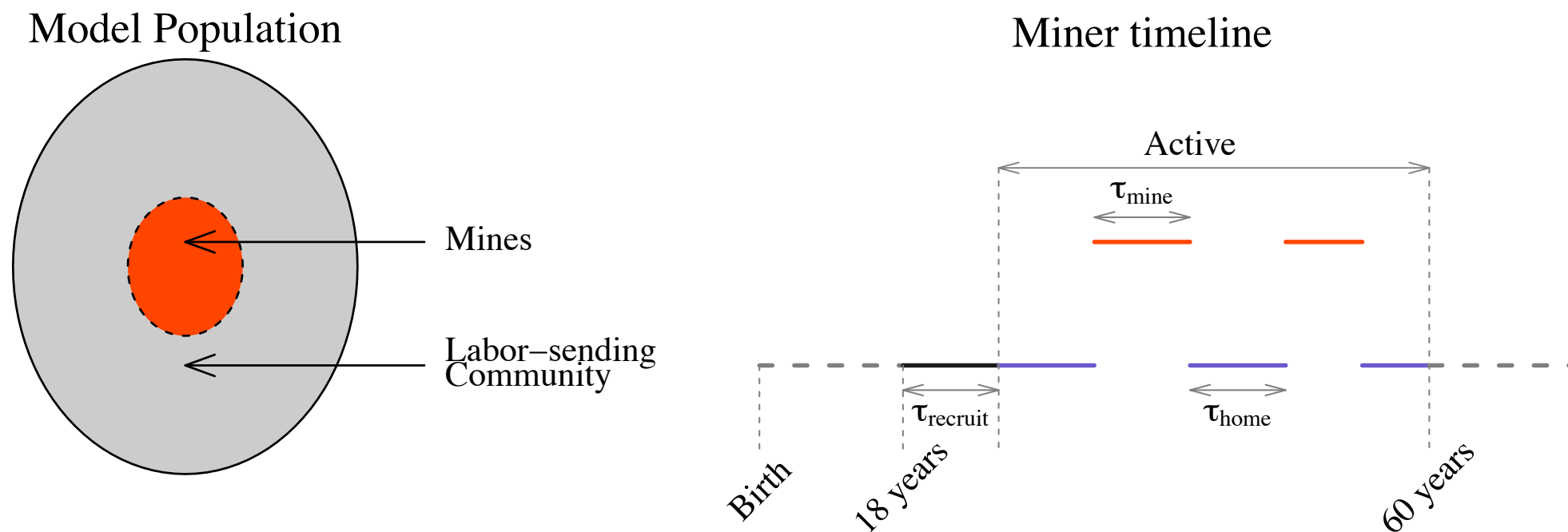
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Targeted TB vaccination in South African mining communities.

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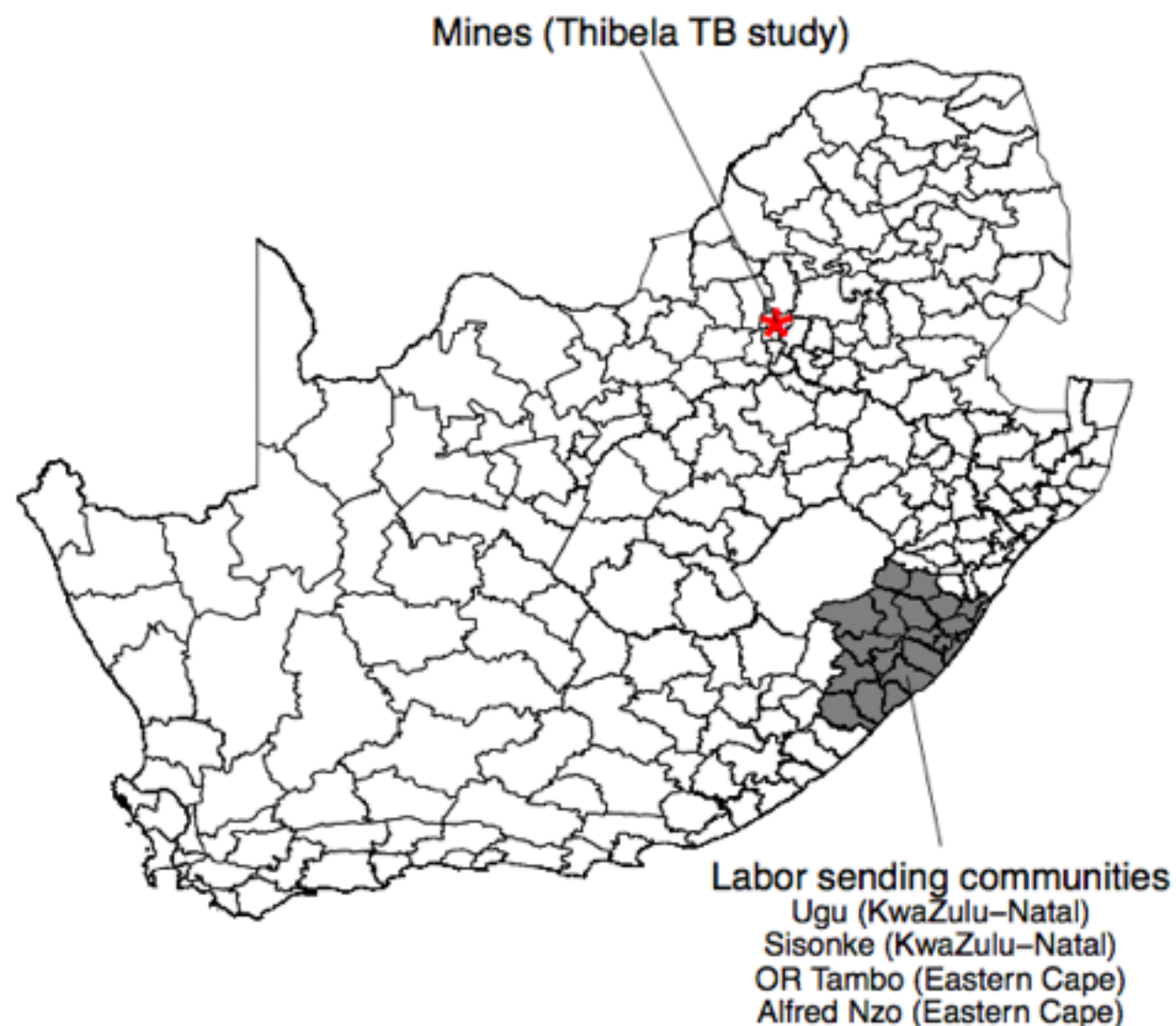
# Model

- Conceptualized the model population to comprise of mines and the associated labor sending community.
- Explicitly modeled life trajectory of miners, with recruitment and travels back and forth between the mines and their home community.



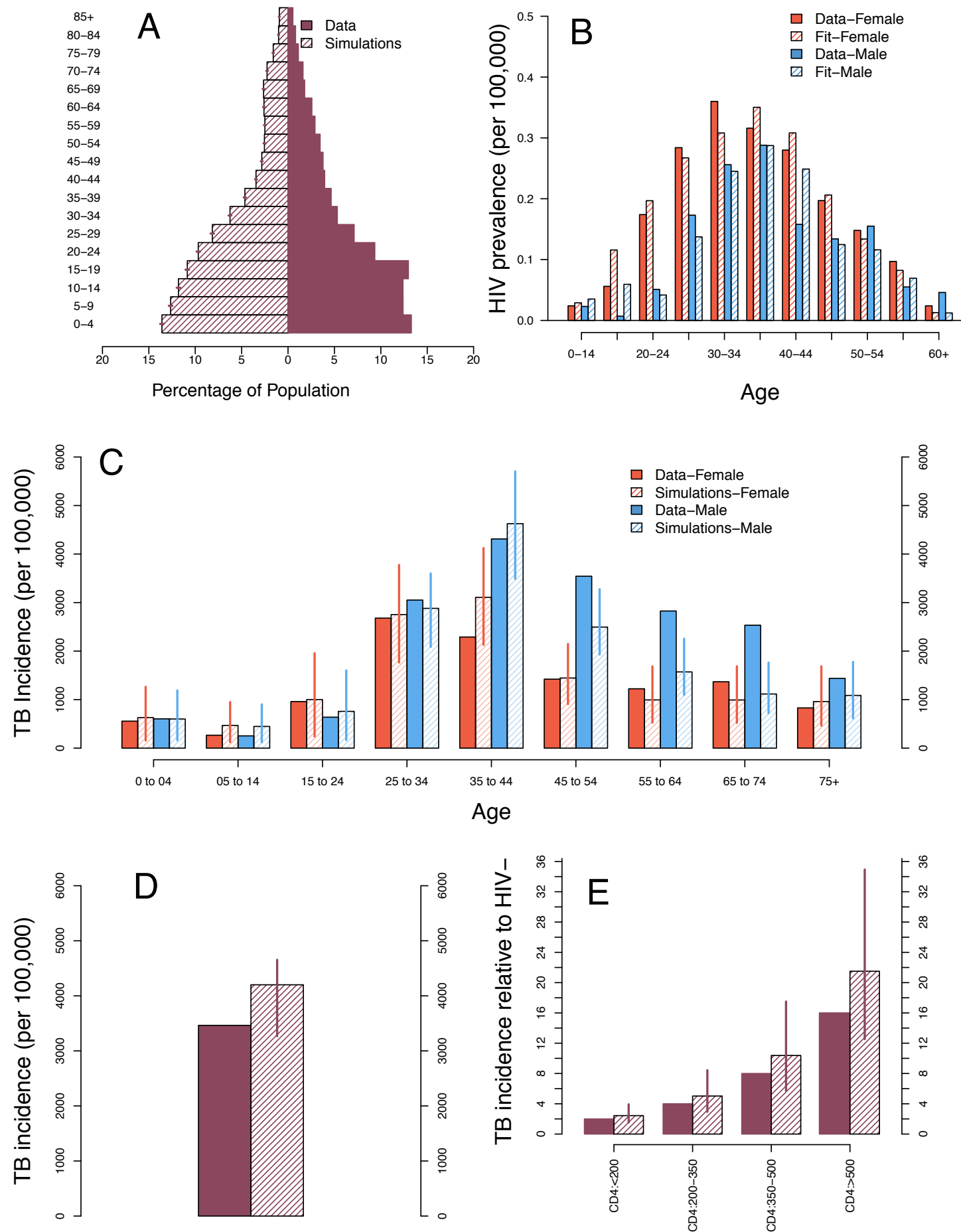
- Natural history of TB and HIV (as described previously).

# Setting



- Anchored our model to data on miners are collected from the Thibela TB study (Churchyard et al, 2014).
- We identified 4 districts from KZN and Eastern Cape as communities representative of labor sending communities.

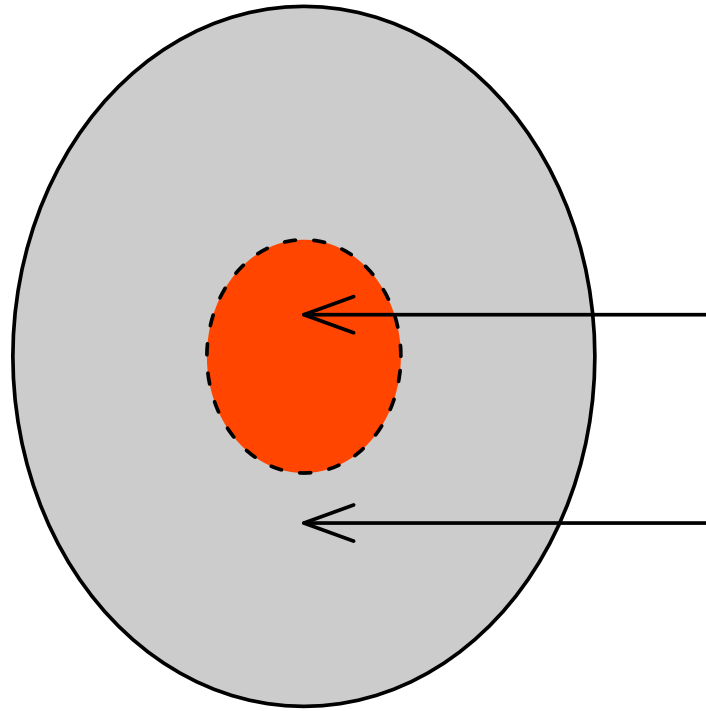
# Results



Model calibrated to data on demography, TB and HIV.

# TB vaccination

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## 20 year adult TB vaccination campaigns:

### Mine-targeted vaccination:

All miners are vaccinated (as they enter the mining workforce).

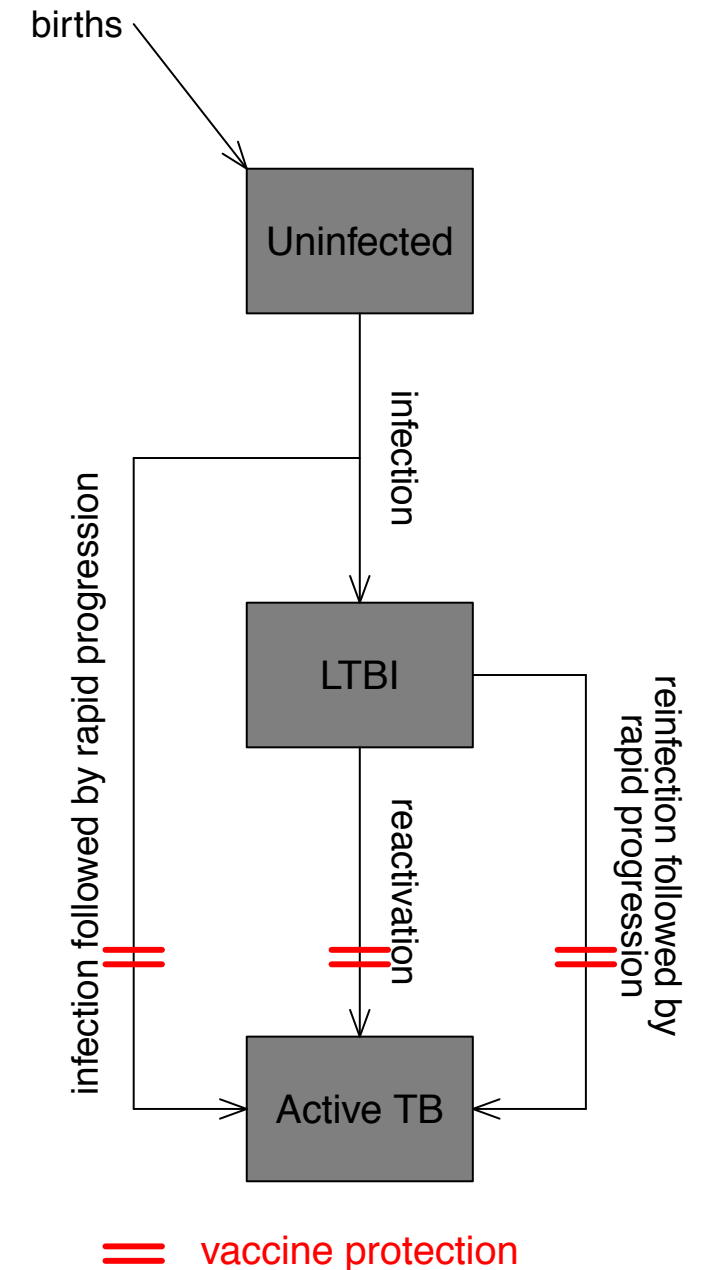
### Community-targeted vaccination:

Random adults in the community are vaccinated.

- Vaccination rates are matched (for comparison).

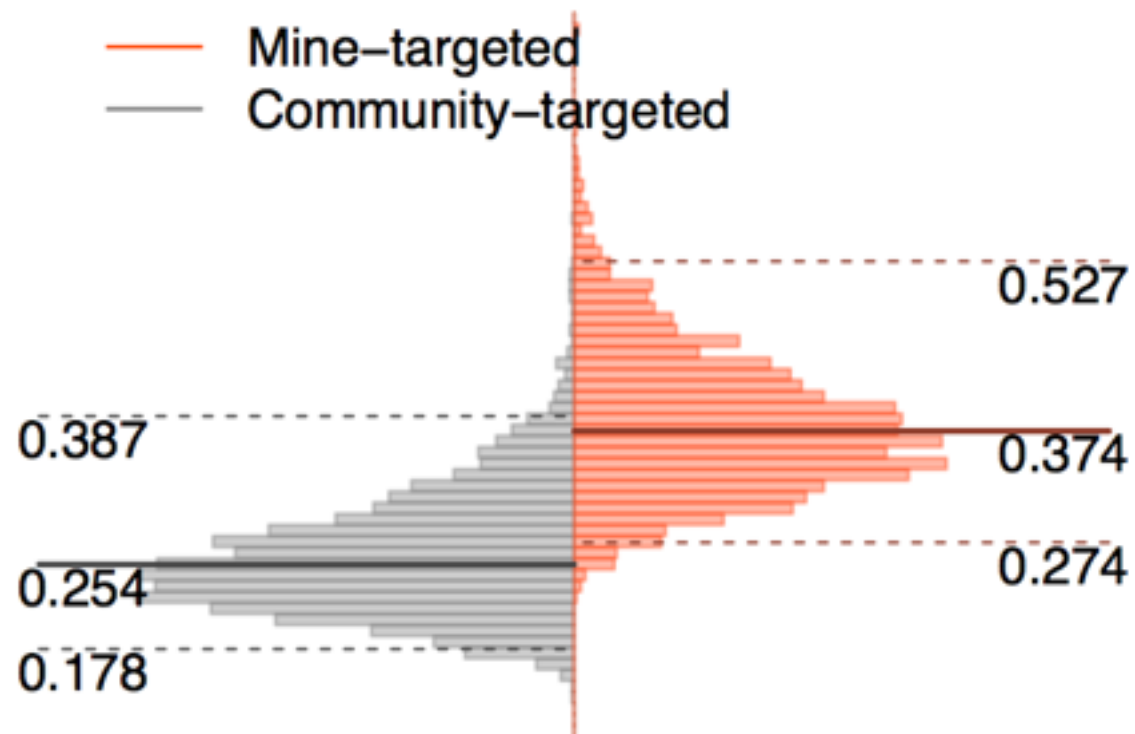
## Vaccine characteristics:

- Post-infection vaccine that protects against disease (not infection).
- 10 years of protection with 60% efficacy.

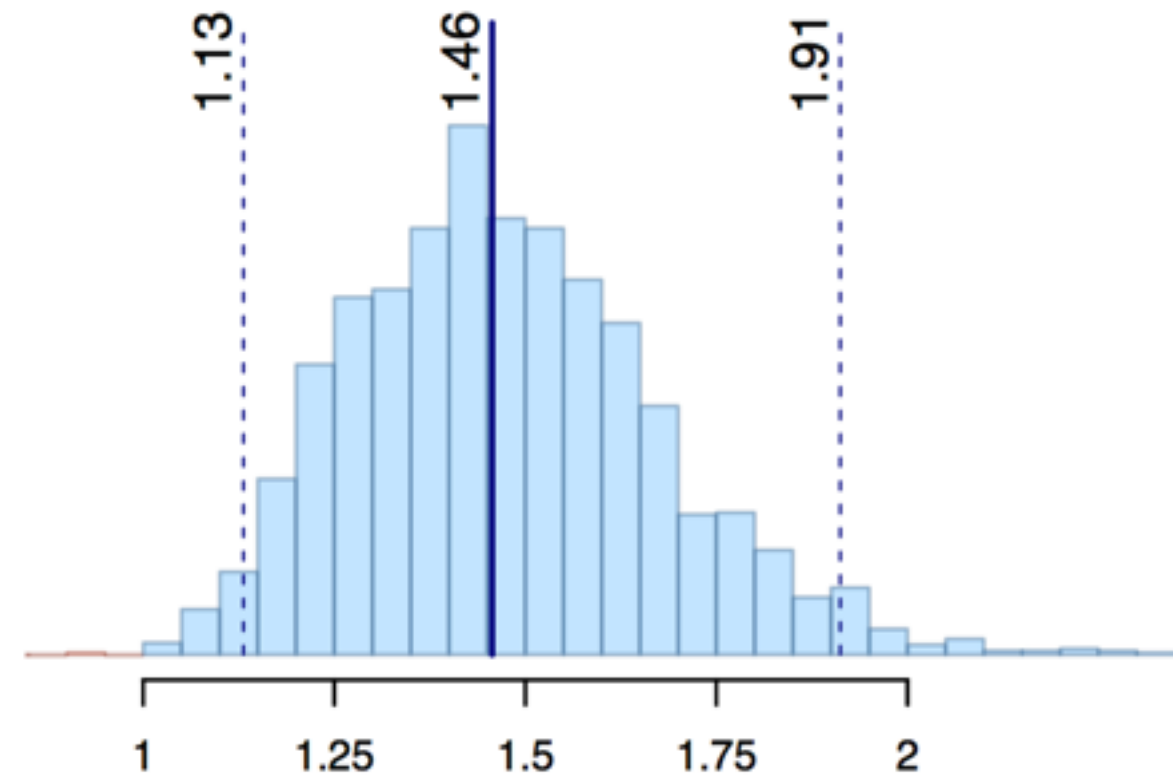


# Results

Over 20 year period of vaccination:



TB cases averted per vaccine



Relative impact of mine-targeted vaccine  
(Mine-targeted:Community-targeted)



# Results

Factors

Proportion of TB Disease Occurring in Adult Males

Proportion of Population That Become Miners

Rate At Which Perspective Miners Are Recruited

Rate of TB Diagnosis and Treatment

HIV Associated Increase in TB Reactivation Rates  
Among Individuals with CD4 <200

Level of Immunity Achieved From Previous Infection

PRCC

0.756

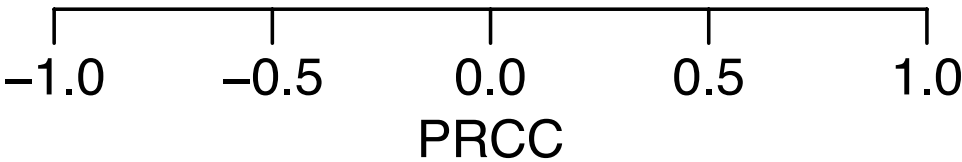
-0.430

-0.135

-0.085

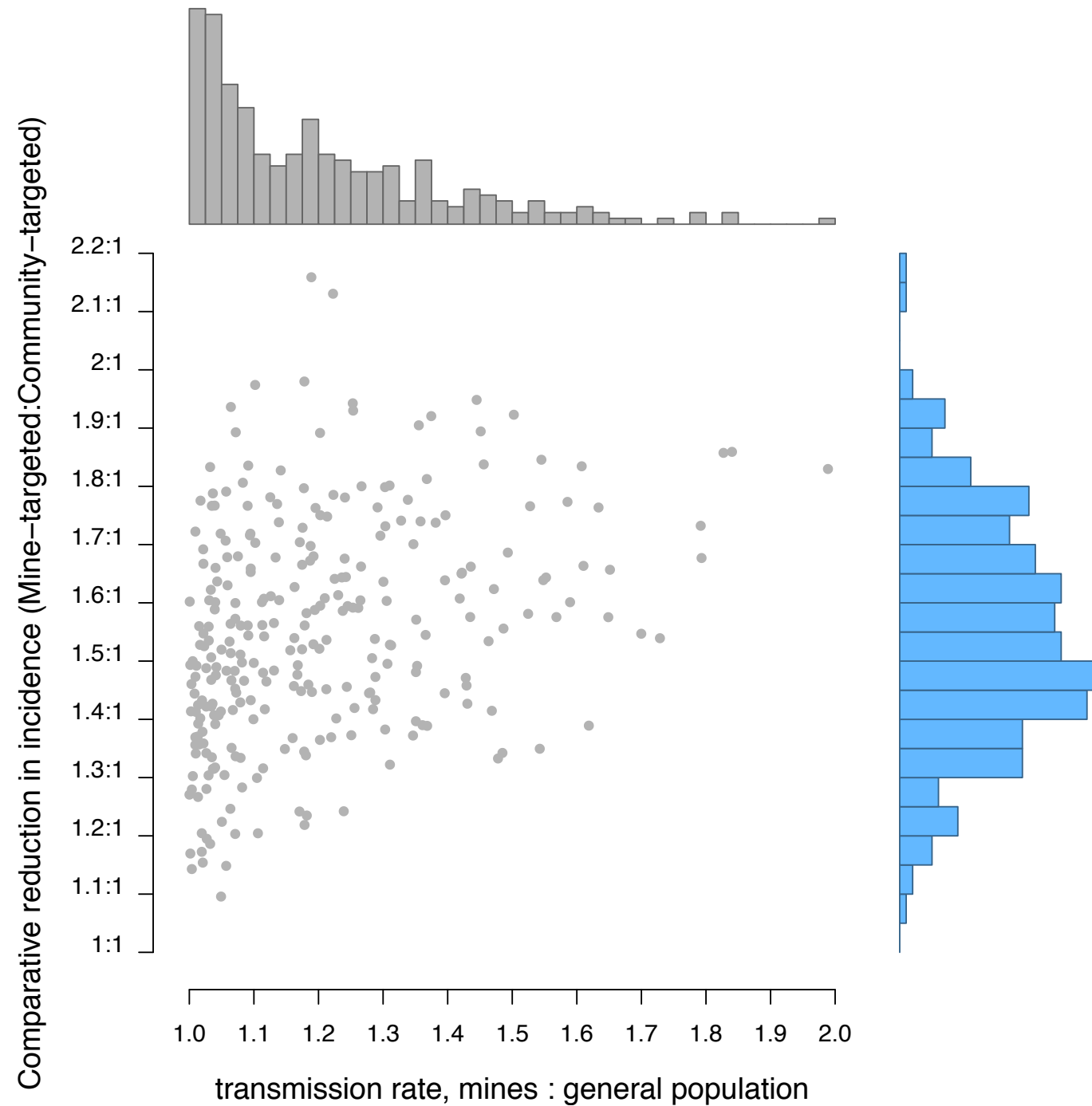
0.055

-0.050



% TB occurring in adult males correlated strongly with relative impact of targeting mines.

# Results



Data did not support differential transmission rates between the mines vs. the general population.

# Summary

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- The absolute impact of adult TB vaccination was substantial, reflecting the tremendous incidence of TB in the population as a whole.
- Mine-targeted vaccination strategy provided modest but sizeable relative improvement over community-targeted strategy.
- The relative benefit achieved by targeting the mines largely reflected the fact that mine-focused strategies target a demographic group with higher TB incidence: adult males.
- Mines, in this context, even when they are not “transmission hotspots”, may nonetheless serve as a mechanism via which demographic groups with higher risk of TB can be identified, and they may also be logistically more accessible than general adult populations.

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**THANK YOU!**