CA CODE Child and Adolescent Causes of Death Estimation

INCORPORATING CALIBRATED CAUSE-SPECIFIC MORTALITY FROM VERBAL AUTOPSIES IN CAUSE OF DEATH ESTIMATION

Jamie Perin on behalf of CA-CODE

CA-CODE Objectives : Estimate causes of mortality for children and adolescents

Age-specific mortality

a. Neonates
b. Under five years
c. 5-9 both sexes
d. 10-14 both sexes
e. 15-19 females
f. 15-19 males

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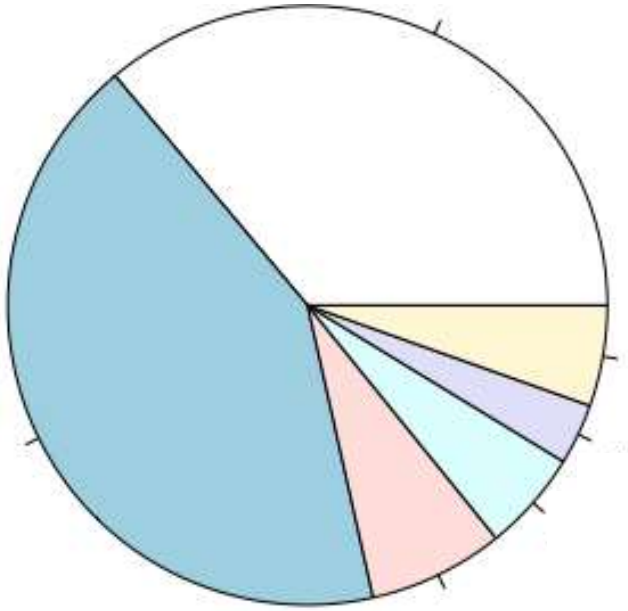
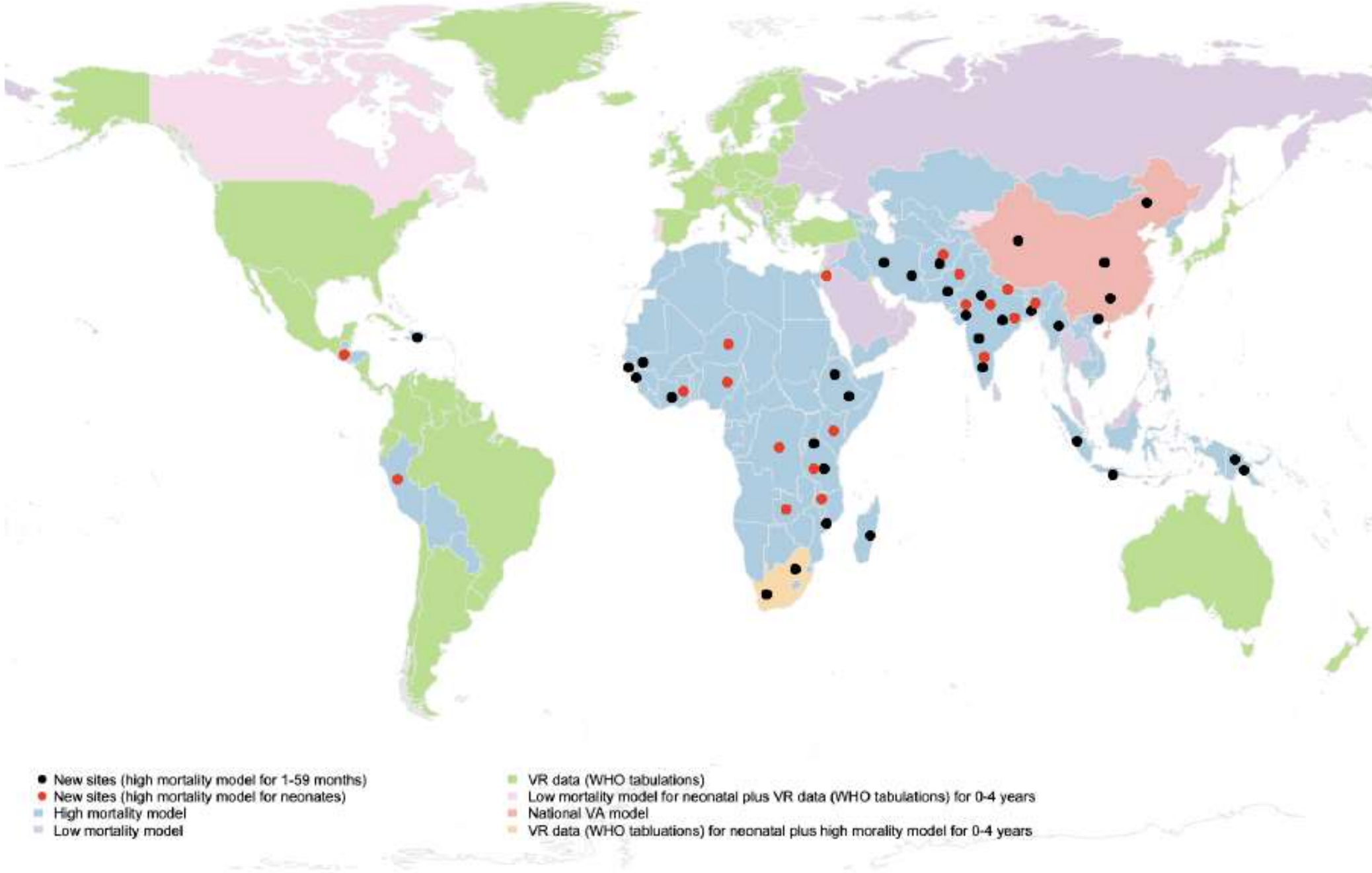
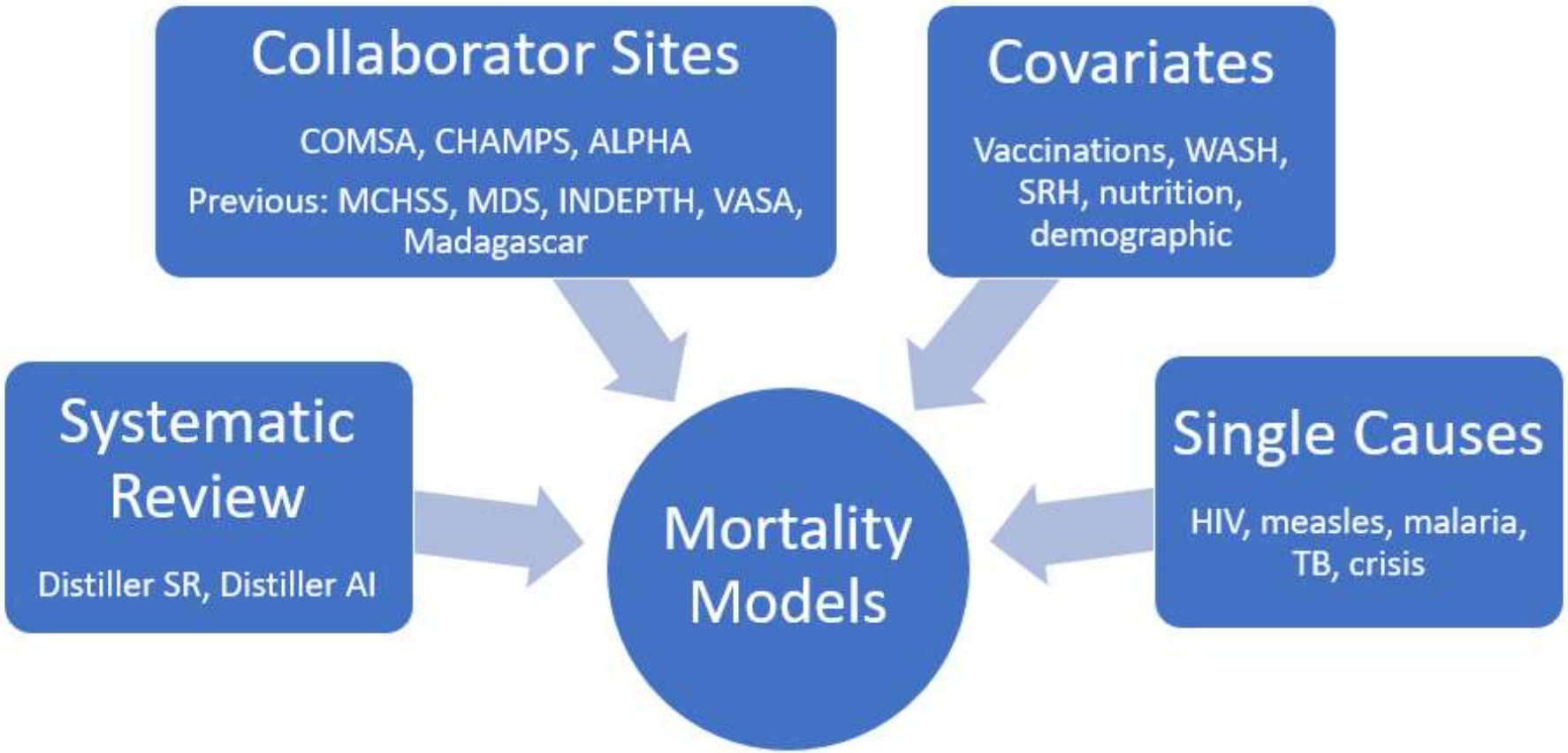
CA-CODE Objectives

Cause specific mortality = ????




New sites (high mortality model for 1-59 months)
New sites (high mortality model for neonates)
High mortality model
Low mortality model
VR data (WHO tabulations)
Low mortality model for neonatal plus VR data (WHO tabulations) for 0-4 years
National VA model
VR data (WHO tabluations) for neonatal plus high morality model for 0-4 years

Sources of causes of death and covariates



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Methods for high mortality areas

- Systematic review of cause-specific mortality in high mortality settings
- Multinomial regression in Bayesian framework: Covariates systematically prioritized (selected) in using the LASSO (Least Absolute Shrinkage and Selection Operator)
- Cross-validation
- Areas with nationally representative studies have more influence in their estimates (random effects)

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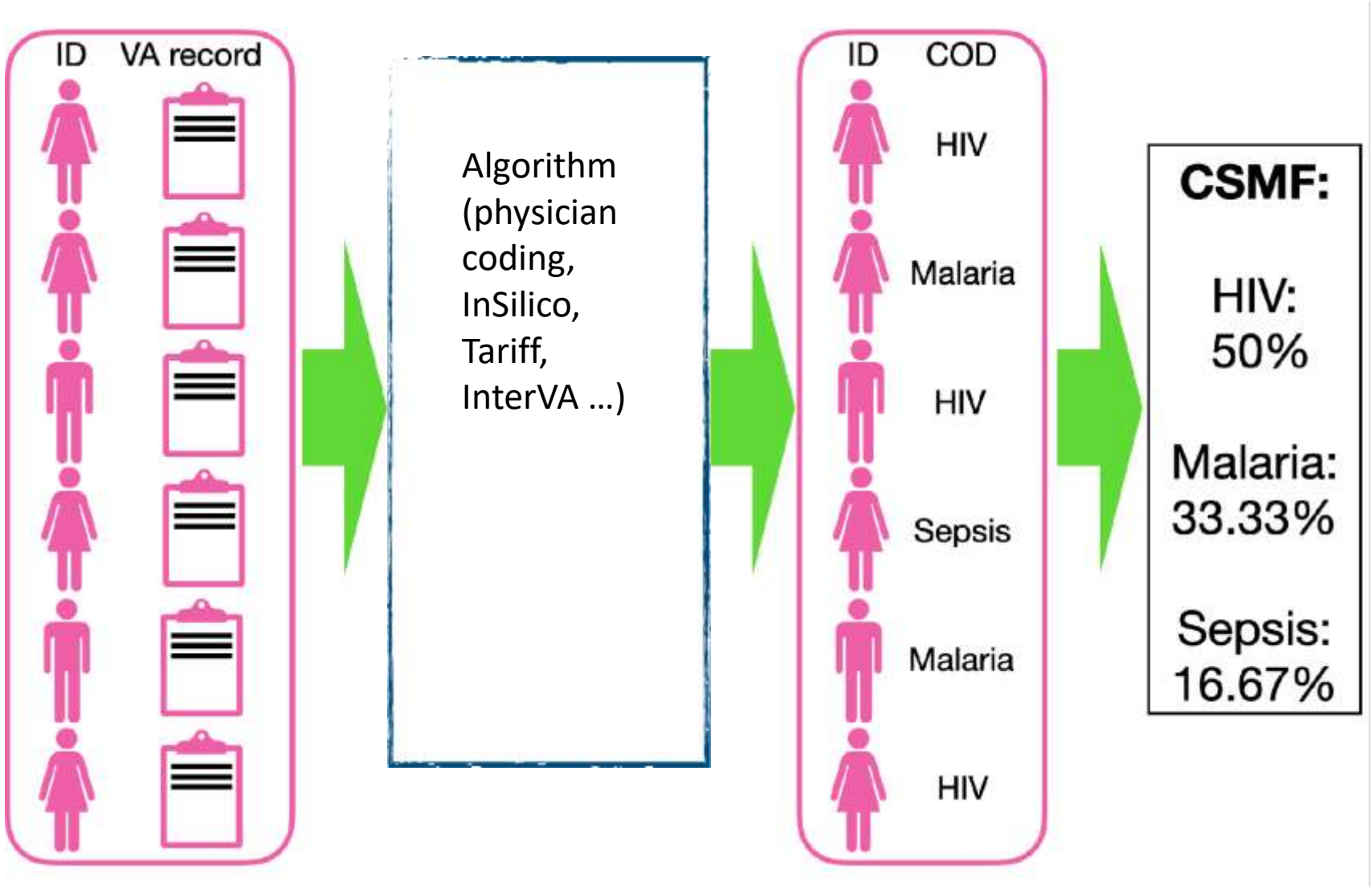
Weakness in methods for high mortality areas

- Verbal autopsy
  - Known limitations

Verbal Autopsy to Cause of death to cause specific mortality fraction



Can we trust these estimates?

Collaborators And Funding

JHU, Biostatistics

Jacob Fiksel

Brian Gilbert

(former PhD students of Ahbi Datta)

Sandipan Pramanik (Postdoctoral fellow)

Scott Zeger

Abhi Datta

Agbessi Amouzou

Emily Wilson

Henry Kalter

Bob Black

Li Liu (JHU, PFRH)

Dianna Blau (CHAMPS)

Ivalda Macicame (INS Mozambique)

(JHU, International Health)

Funding (Bill and Melinda Gates Foundation):

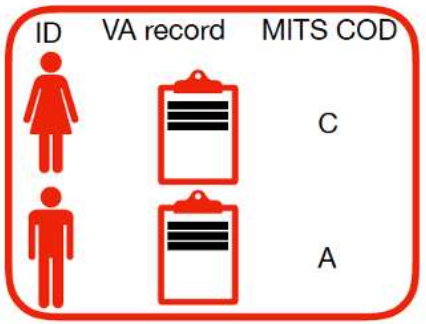
- COMSA-Mz: Countrywide Mortality Surveillance for Action in Mozambique
- MITS-VA: Broadening minimally-invasive-tissue-sampling (MITS)-based verbal autopsy (VA) calibration to improve global mortality estimates (PI: Datta)

Minimally Invasive Tissue Sampling (MITS)

Data from CHAMPS project with both VA-COD and a minimally invasive tissue sampling (MITS)-COD

MITS-COD assignments been shown to be reasonably accurate when compared to the full diagnostic autopsies (Bassat et al. 2017)

CHAMPS data can be used to create a paired VA-MITS dataset to understand the accuracy of VA

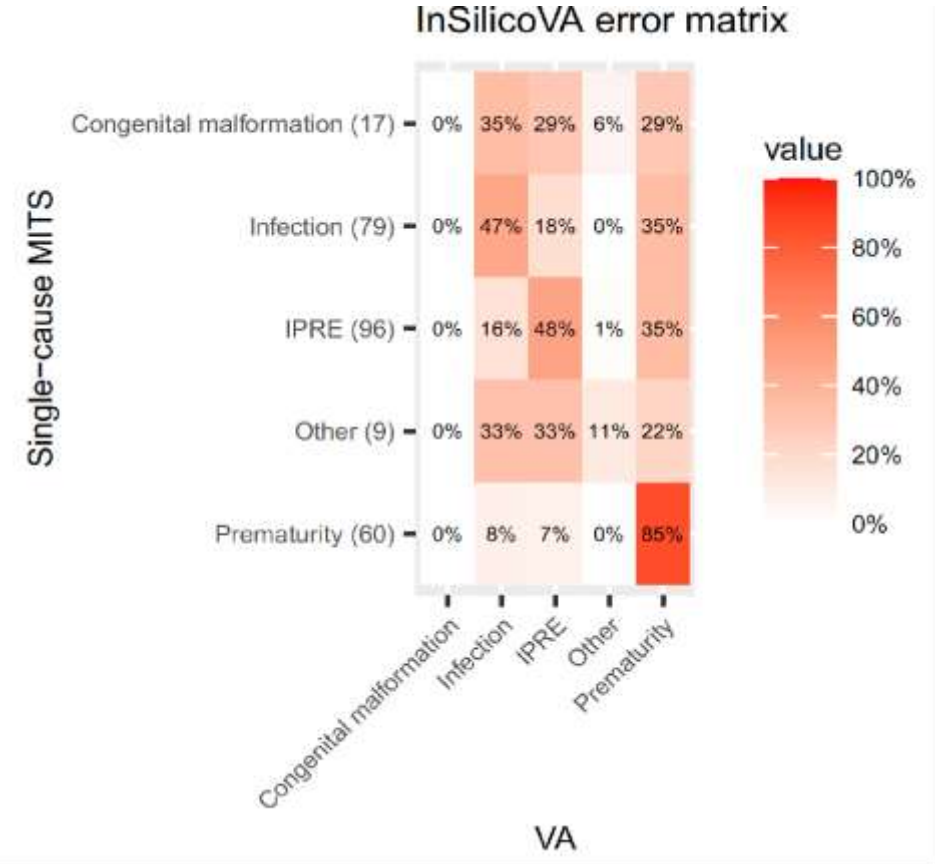


CHAMPS paired MITS-VA data

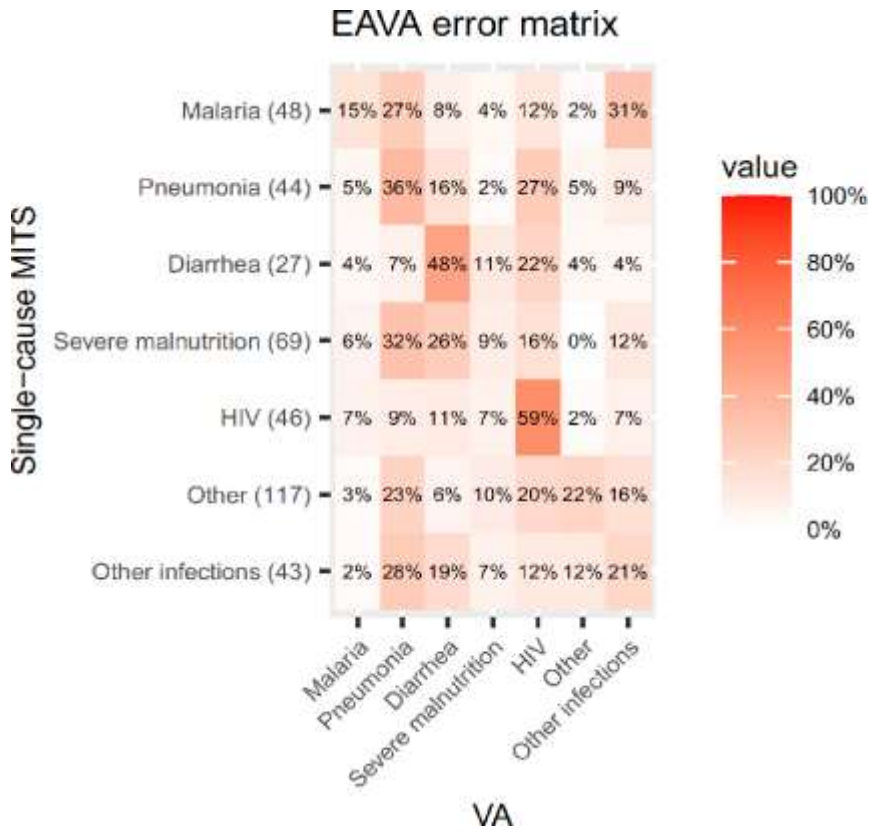
MITS \ VA	A	B	C
A	100%	0%	0%
B	0%	100%	0%
C	50%	0%	50%

MITS-VA Misclassification rates matrix

Cause of death misclassification by VA compared to MITS



Misclassification rates of VA
for neonates in COMSA-Mozambique



Misclassification rates of VA
for under-5 children in COMSA-Mozambique

This paired data reveals that VA misclassifies COD in a large % of deaths

This occurs for all age groups and choice of CCVA algorithm

Estimating model parameters, incorporating measurement error of verbal autopsy

$$\begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{bmatrix}_s = \begin{bmatrix} M_{1,1} & M_{1,2} & M_{1,3} & M_{1,4} \\ M_{2,1} & M_{2,2} & M_{2,3} & M_{2,4} \\ M_{3,1} & M_{3,2} & M_{3,3} & M_{3,4} \\ M_{4,1} & M_{4,2} & M_{4,3} & M_{4,4} \end{bmatrix} * \begin{bmatrix} P_1 \\ P_2 \\ P_3 \\ P_4 \end{bmatrix}_s$$

$$\begin{bmatrix} log(P_1/P_1) \\ log(P_2/P_1) \\ log(P_3/P_1) \\ log(P_4/P_1) \end{bmatrix}_s = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ \beta_{2,1} & \beta_{2,2} & \beta_{2,3} & \beta_{2,4} & \beta_{2,5} \\ \beta_{3,1} & \beta_{3,2} & \beta_{3,3} & \beta_{3,4} & \beta_{2,5} \\ \beta_{4,1} & \beta_{4,2} & \beta_{4,3} & \beta_{4,4} & \beta_{2,5} \end{bmatrix} * \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \end{bmatrix}_s$$

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Estimating model parameters, incorporating measurement error of verbal autopsy

- Misclassification matrix integrated with Bayesian model
  - Advantages: uncertainty, elegance
  - Disadvantages: transparency, incorporating separate algorithms

- Alternative to model integration of verbal autopsy error/misclassification: pre-processing
  - Advantages: transparency
  - Disadvantages: uncertainty

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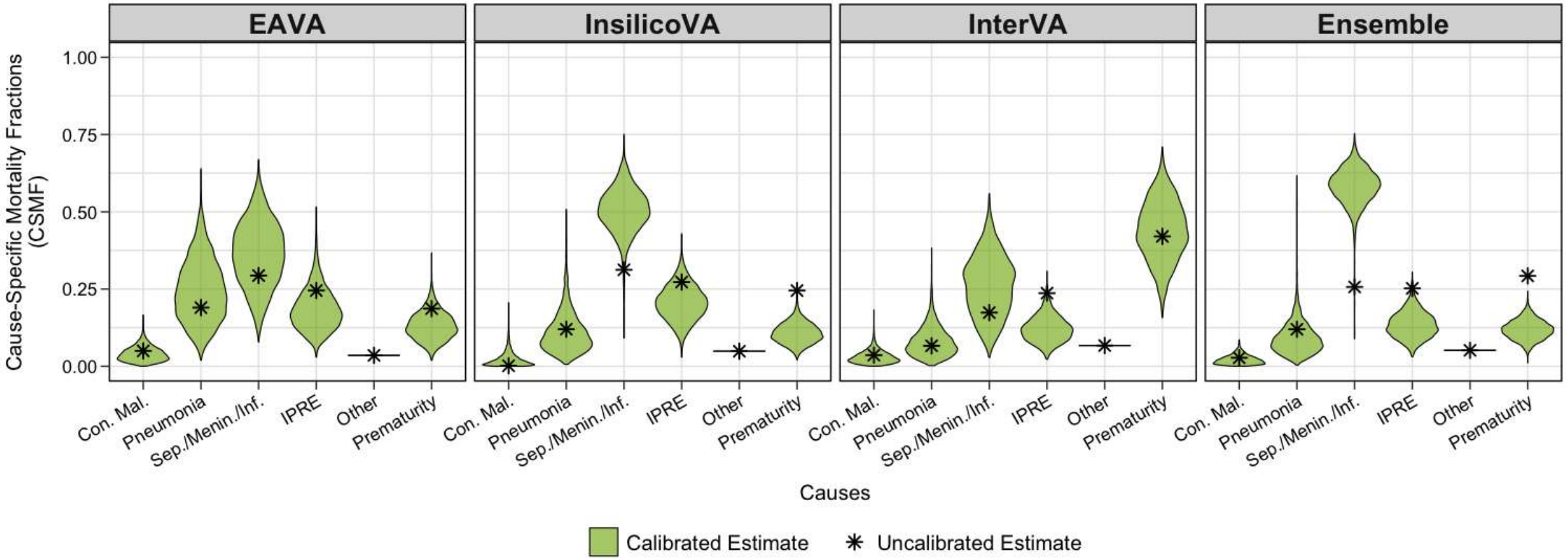
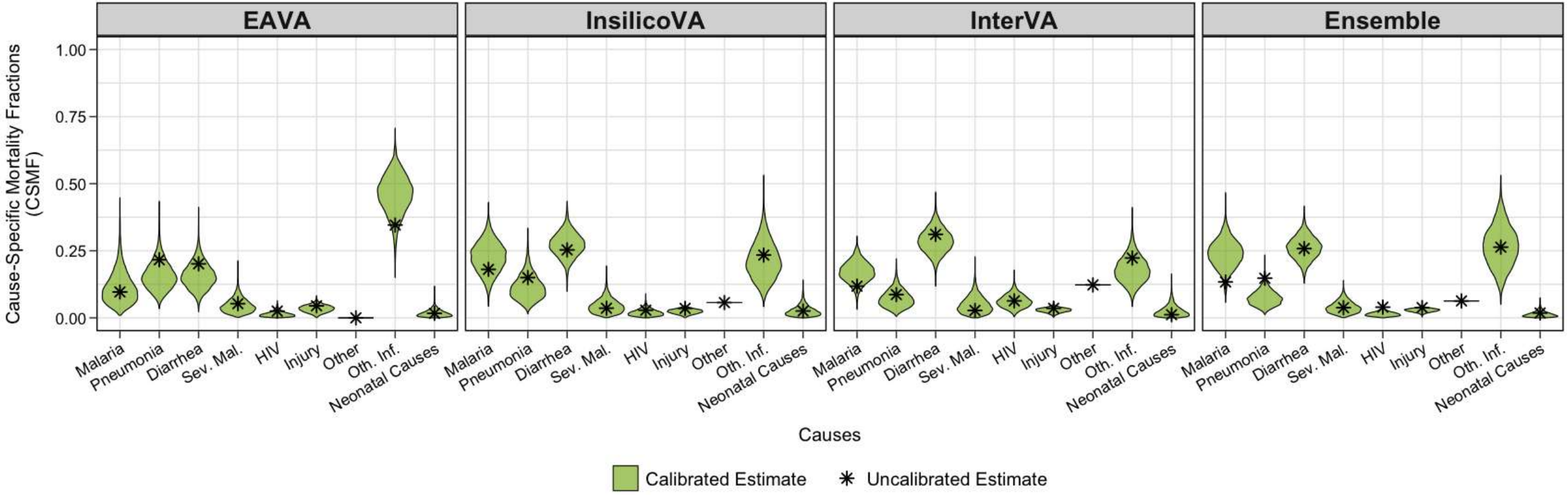
Uncalibrated vs. Calibrated CSMF Estimates in Moz (<1 Month)



Uncalibrated vs. Calibrated CSMF Estimates in Moz (1–5 Yrs.)



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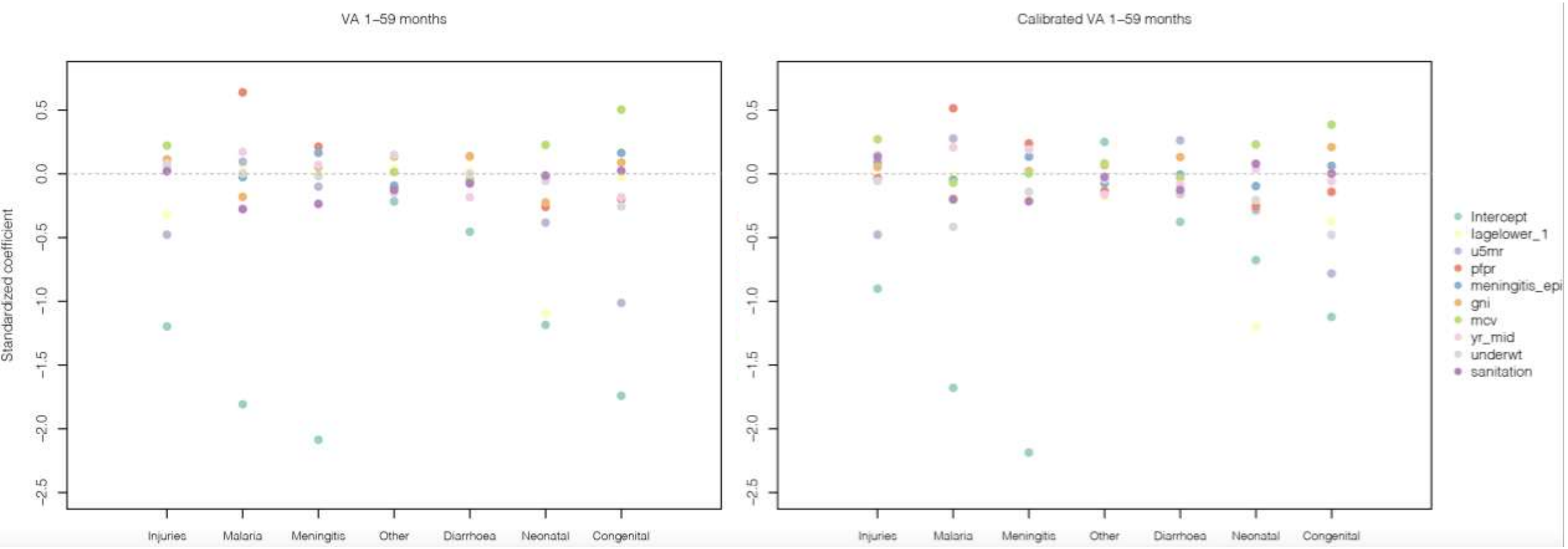
Results

Impact of correcting verbal autopsy error on model parameter estimates



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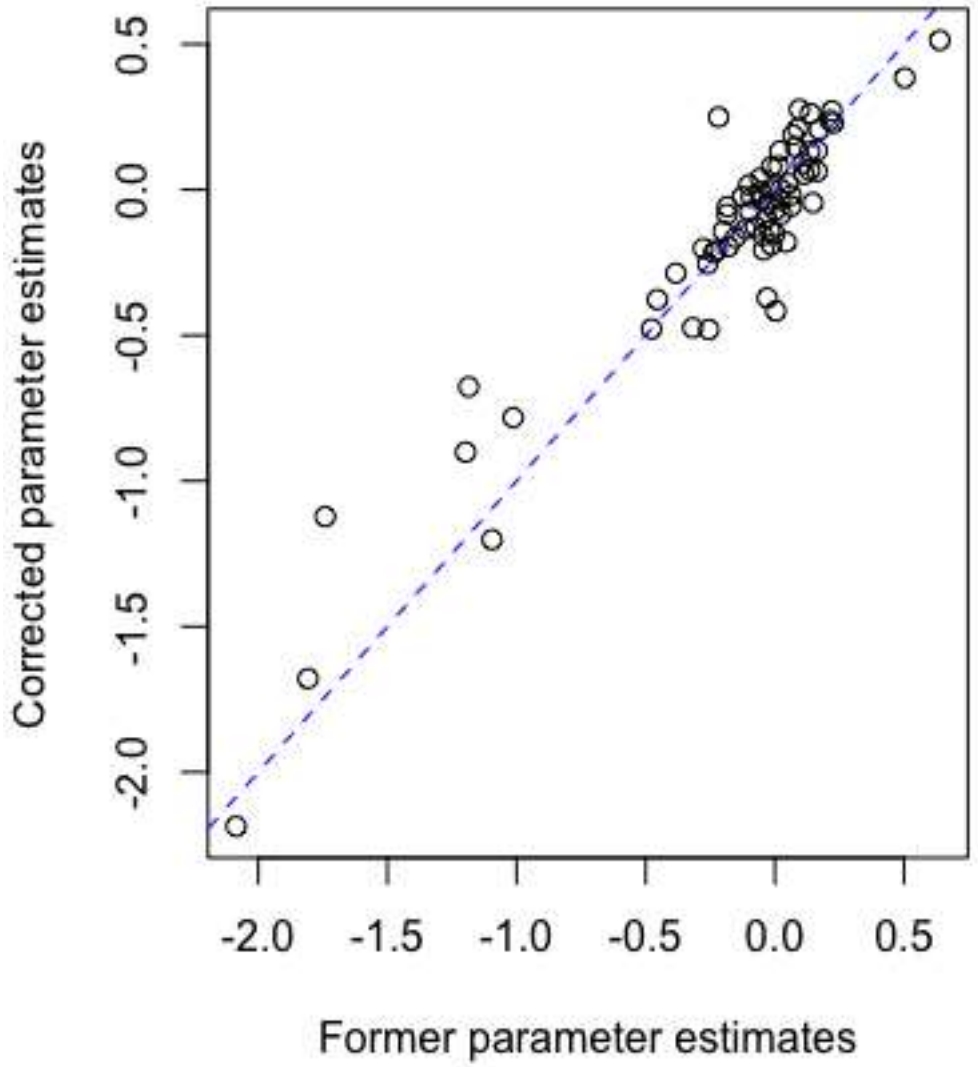
Impact of correcting verbal autopsy error on model parameter estimates



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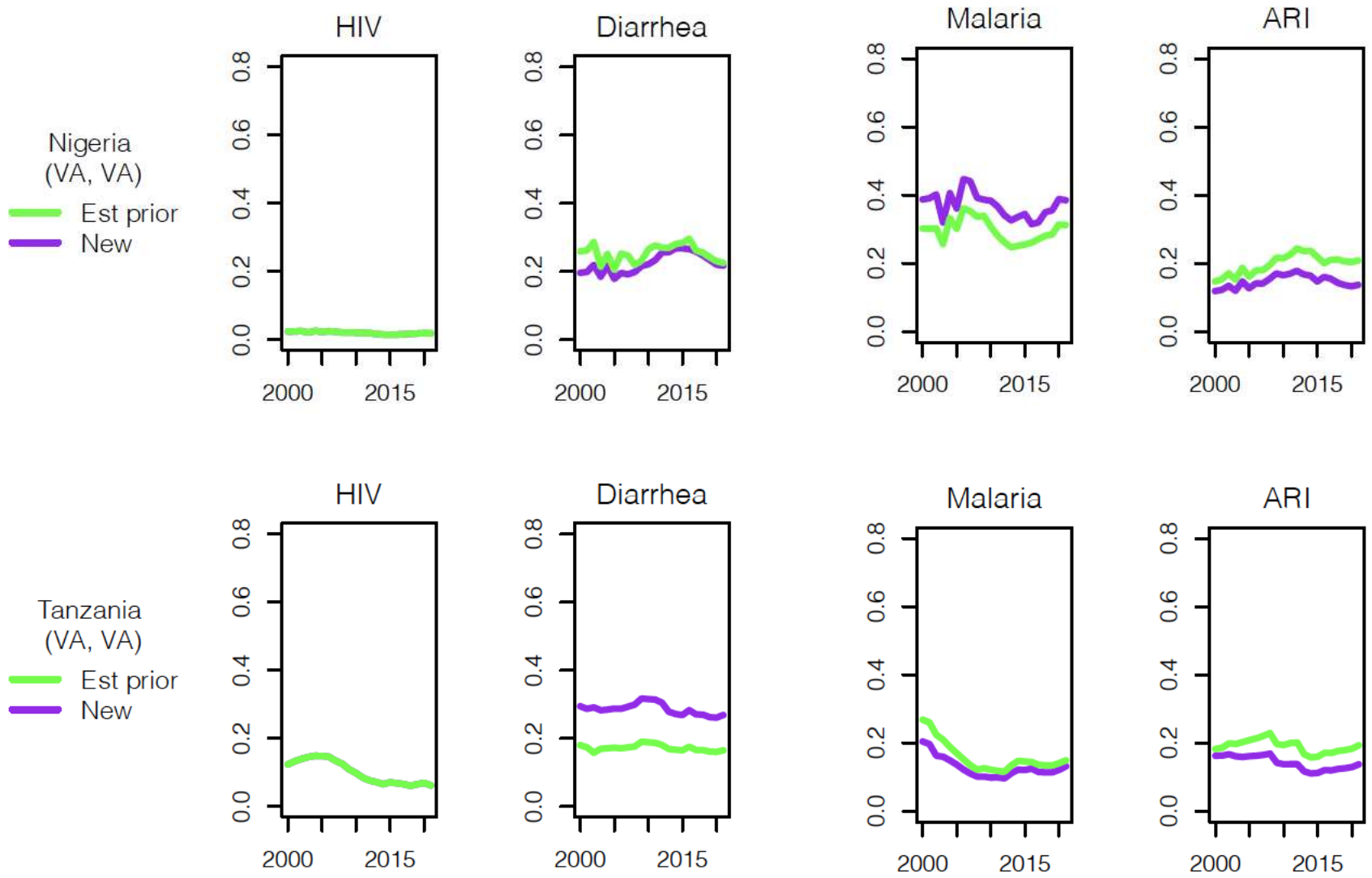
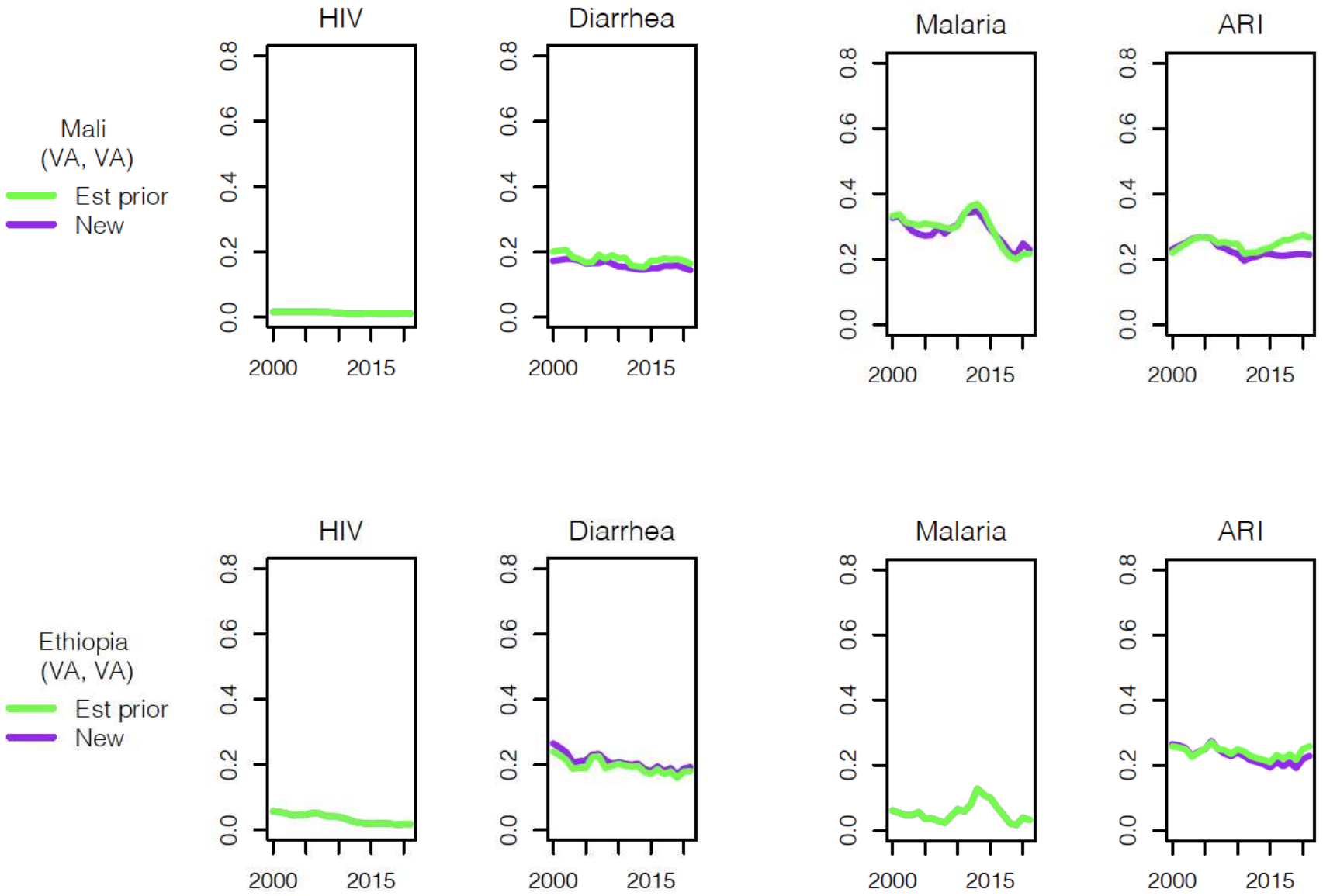
Impact of correcting verbal autopsy error on estimates of cause specific mortality



Impact of correcting verbal autopsy error on estimates of cause specific mortality



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In Summary

- Some country estimates are impacted by correcting the biases from verbal autopsies, especially those with large national surveys
- Cause specific estimates improve when correcting for VA biases and increase confidence
- Uncertainty has still to be worked out

THANK YOU FOR YOUR ATTENTION!

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