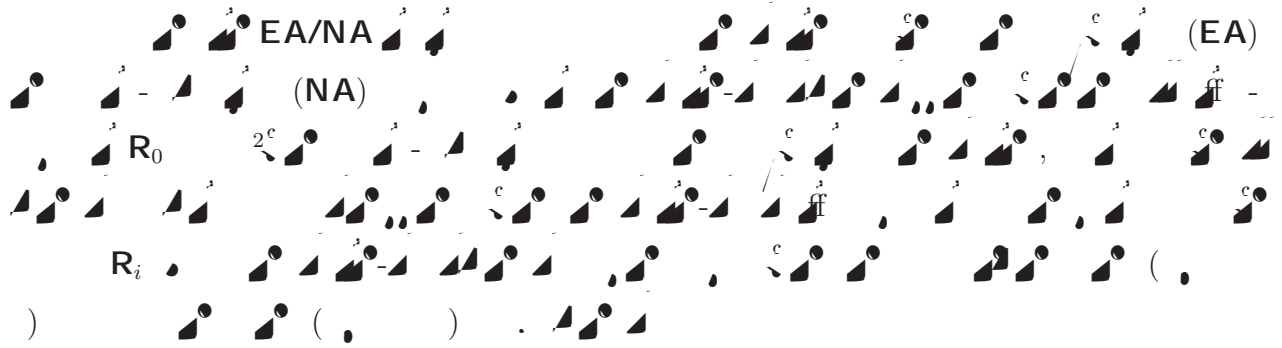


$$\begin{aligned}
 P(R_{0,EA/NA}, R_i, \sigma_{R_i,EA/NA}^2, \alpha, \gamma, \mu_{EA/NA}, a_{EA/NA}, b_{EA/NA}, \sigma_{EA/NA}^2) &\propto \pi(R_{0,EA/NA}) \pi(R_i) \times \\
 \pi(\sigma_{R_i,EA/NA}^2) \pi(\alpha) \pi(\gamma) \pi(\mu_{EA/NA} | a_{EA/NA}, b_{EA/NA}) \pi(a_{EA/NA}, b_{EA/NA}, \sigma_{EA/NA}^2) &\times \\
 \mathcal{L}(R_{0,EA/NA}, R_i, \sigma_{R_i,EA/NA}^2, \alpha, \gamma, \mu_{EA/NA}, a_{EA/NA}, b_{EA/NA}, \sigma_{EA/NA}^2) &.
 \end{aligned}$$



$$\frac{a_{EA}}{a_{EA} + b_{EA}} \sim B(\alpha, \beta), \quad \frac{a_{NA}}{a_{NA} + b_{NA}} \sim B(\alpha, \beta),$$

$$a_{EA} \sim \Gamma(\text{mean}, \text{var}), \quad a_{NA} \sim \Gamma(\text{mean}, \text{var}).$$



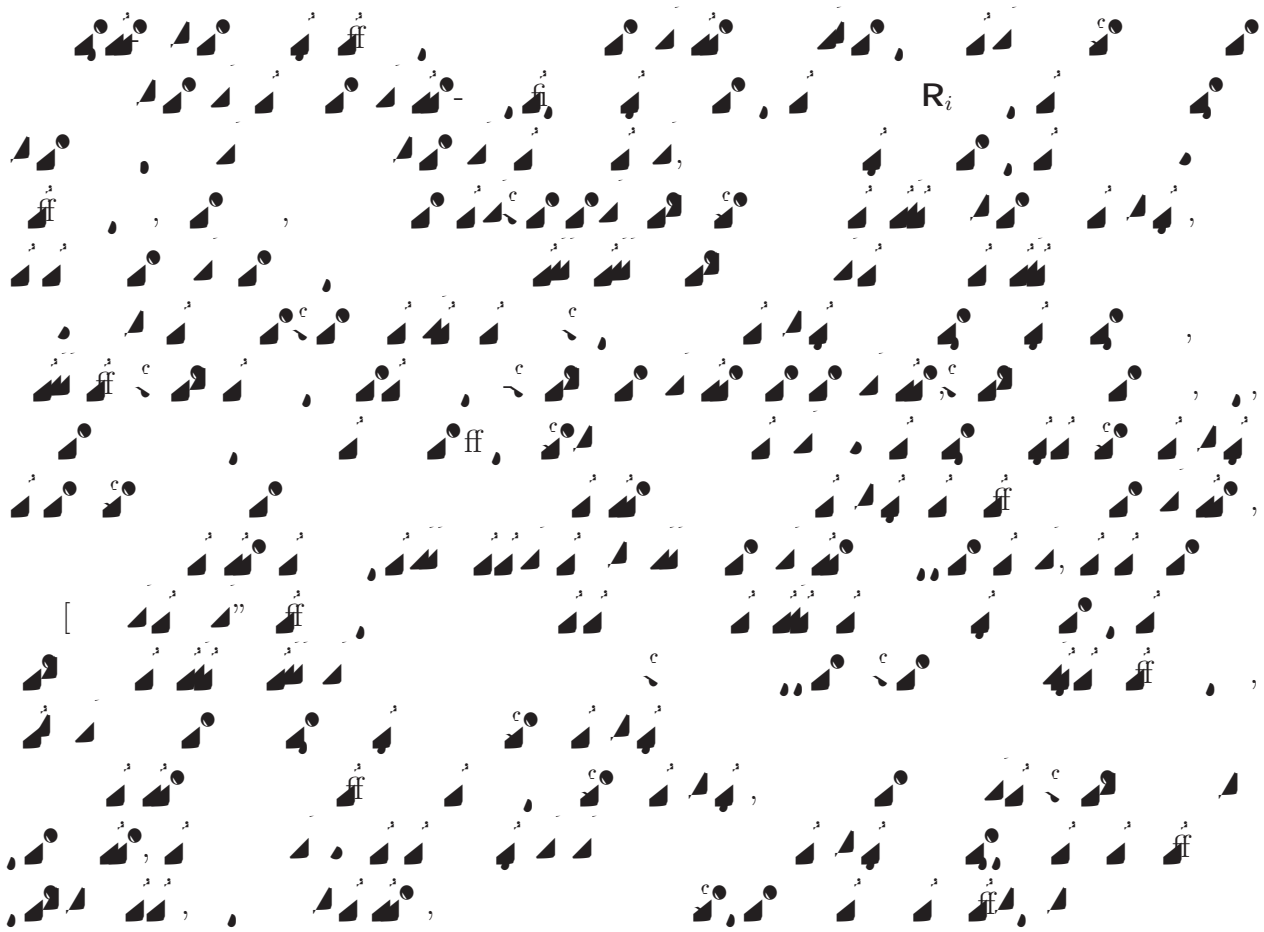
$$\begin{aligned}
 R_{i,NA} &\sim \mathcal{N}(R_{0,NA}, \frac{2}{R_{i,NA}} \Psi), \\
 \Psi &\sim \text{Gamma}(-d, \mathcal{D}), \\
 d &\sim \text{Gamma}(\dots),
 \end{aligned}
 \tag{ }$$

$$\Psi \propto \prod_{i=1}^N \left( \frac{R_i}{R_{i,NA}} \right)^2 \mathcal{N}(R_i | R_{i,NA}, \frac{2}{R_{i,NA}} \Psi) \text{Gamma}(\mathcal{D} | \dots)$$

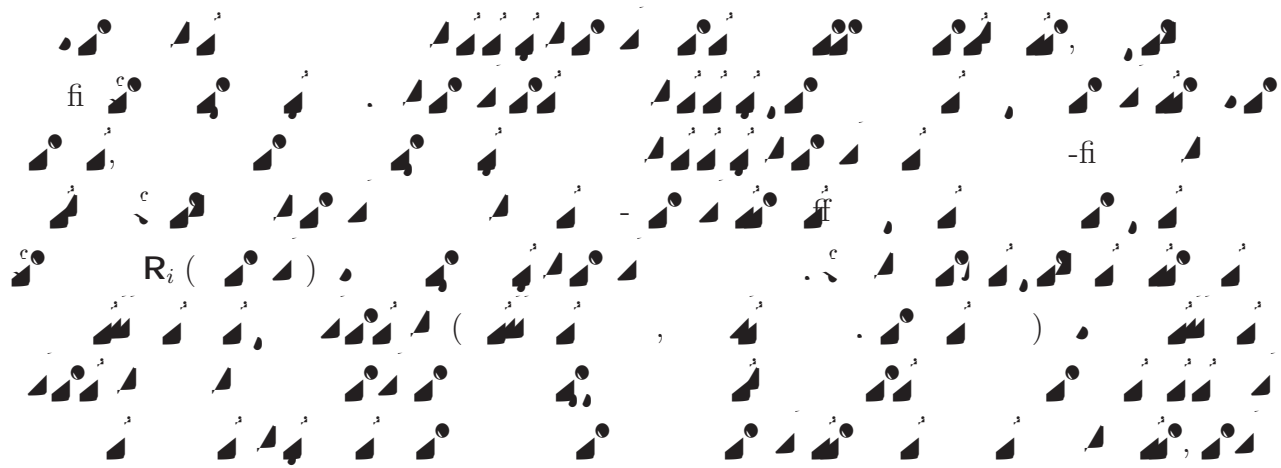
**Markov chain Monte Carlo (MCMC) sampler**

The MCMC sampler iterates over the parameters  $R_{i,NA}$ ,  $\Psi$ , and  $d$ . For each iteration, it proposes a new value for  $R_{i,NA}$  based on the current value and the likelihood function. The proposed value is then accepted or rejected based on the Metropolis-Hastings acceptance ratio. The process is repeated for all  $i$  and for a fixed number of iterations. The final values of  $R_{i,NA}$ ,  $\Psi$ , and  $d$  are then used to estimate the posterior distribution.

# Unexplained Variation



## Epidemics in Small Populations












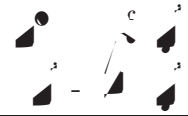

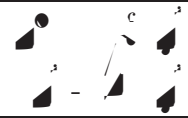




f.

$R_0$

$R_0$

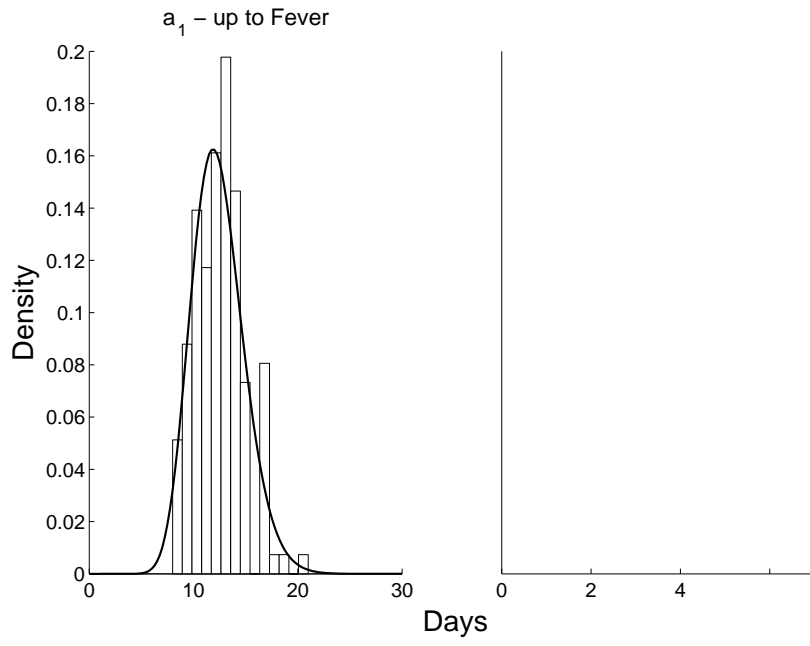
$R_0$

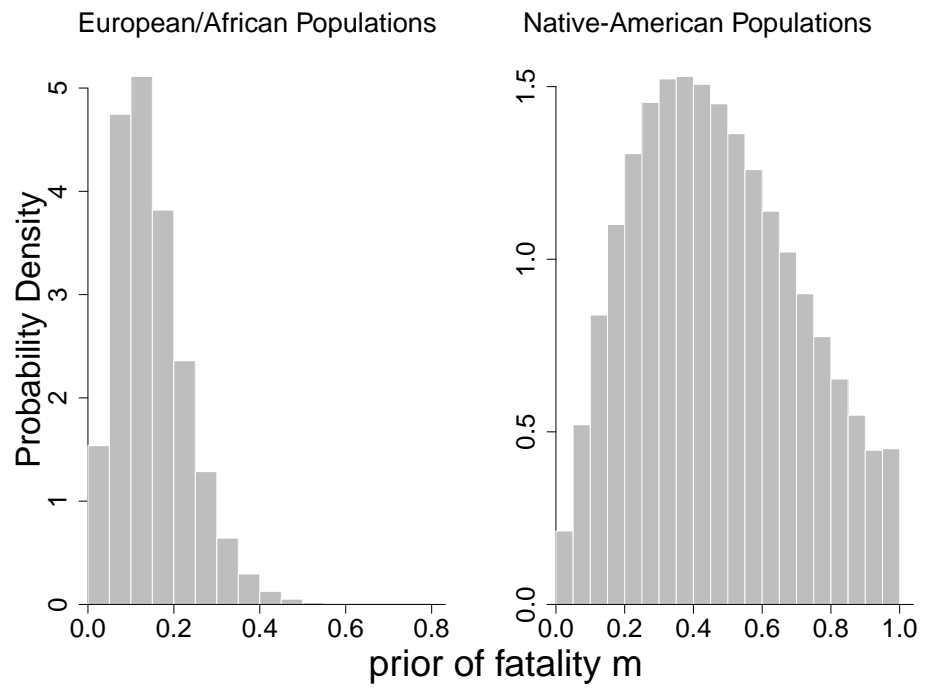
			
	( , )		( , )
	( , )		( , )
	( , )		( , )





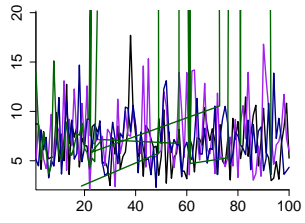








4





5

