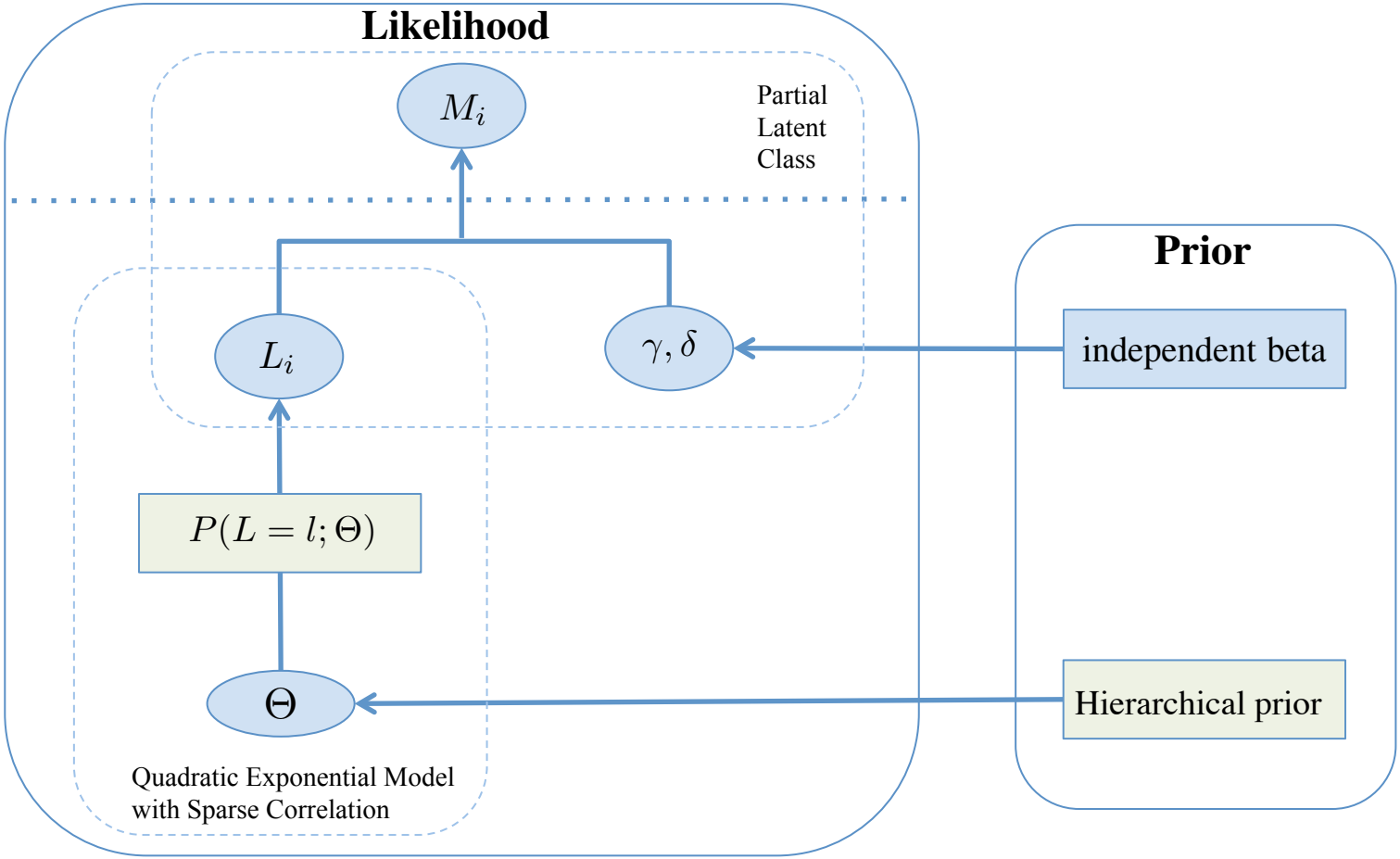
Model Hierarchy



Latent Variable

Regular Quadratic Exponential Model:

$$P(L = l; \Theta) = \exp\{\Theta_1^T l + \Theta_2^T u_2\}/A(\Theta)$$

$$\text{with } A(\Theta) = \sum_{l^* \in \{0,1\}^K} \exp\{\Theta^T l^*\}$$

$\theta_{ik}^{(1)} = X_i^T \beta_k$, where X_i is the vector of covariates.

Sparse Correlation:

$$\Theta_2 = \theta_2 \cdot (I_1, \ldots, I_{\binom{K}{2}})$$

Hierarchical Prior:

$$I_j \sim \text{Bernoulli}(p)$$

$$p \sim \text{Beta}(a, b)$$

Simulation Study

5 candidate etiological pathogens.
BS and SS measurements are available for each of them.
500 cases and 1000 controls in each data set.
200 independent data sets simulated.
Two binary covariates: age and severity.

SS TPR ≈ 0.1
BS TPR ≈ 0.6
BS FPR ≈ 0.45

β_0	0.210	-0.282	-0.835	-0.205	1.068
β_{age}	-0.1	-0.5	0.5	0.2	0.1
β_{sev}	-0.3	0.2	-0.2	-0.1	0.3
$\beta_{a:s}$	0.4	0.3	-0.4	0.2	-0.2

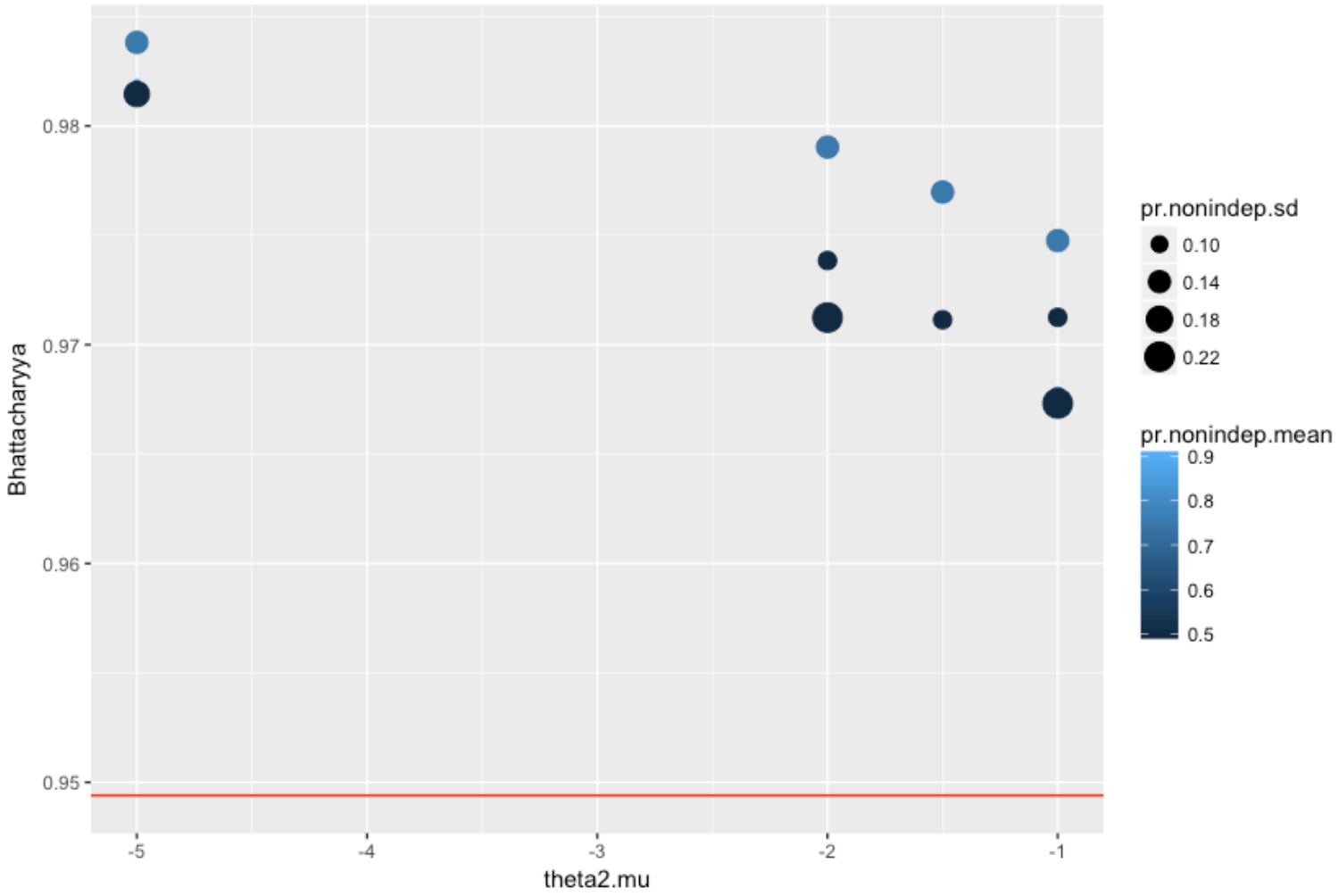
$$\Theta_2 = (-1.5, -1.5, -1.5, -1.5, 0.0, 0.0, -1.5, -1.5, -1.5, -1.5)$$

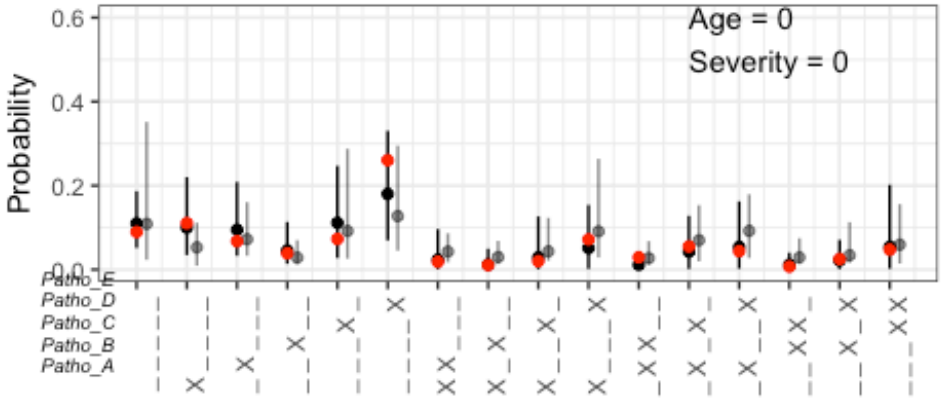
Mu	[1]	[2]	[3]	[4]	[5]
00	0.245	0.240	0.126	0.224	0.469
10	0.222	0.166	0.180	0.241	0.497
01	0.184	0.265	0.105	0.206	0.552
11	0.230	0.234	0.106	0.271	0.507

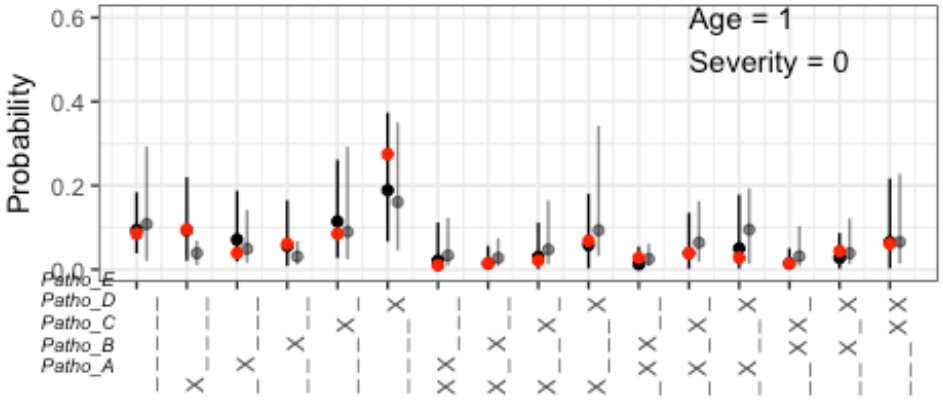
Pr(s)	[0]	[1]	[2]	[3]	[4]	[5]
00	0.090	0.550	0.329	0.031	0.000	0
10	0.085	0.555	0.328	0.031	0.000	0
01	0.081	0.558	0.329	0.032	0.000	0
11	0.076	0.536	0.351	0.036	0.001	0

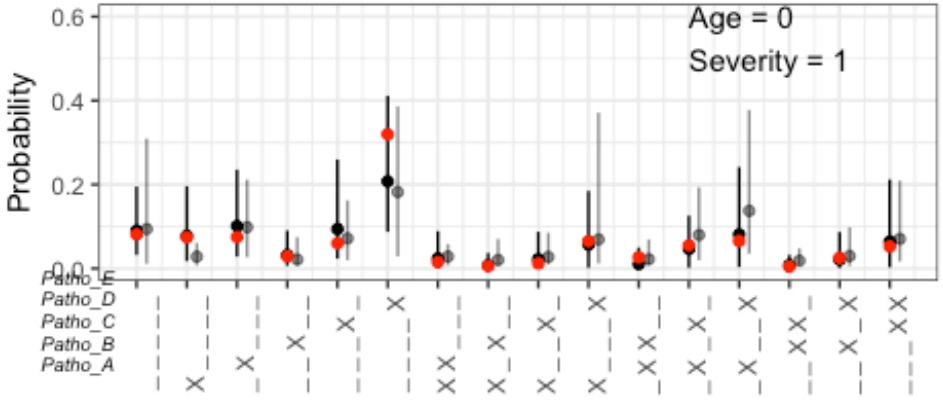
Comparison between Models

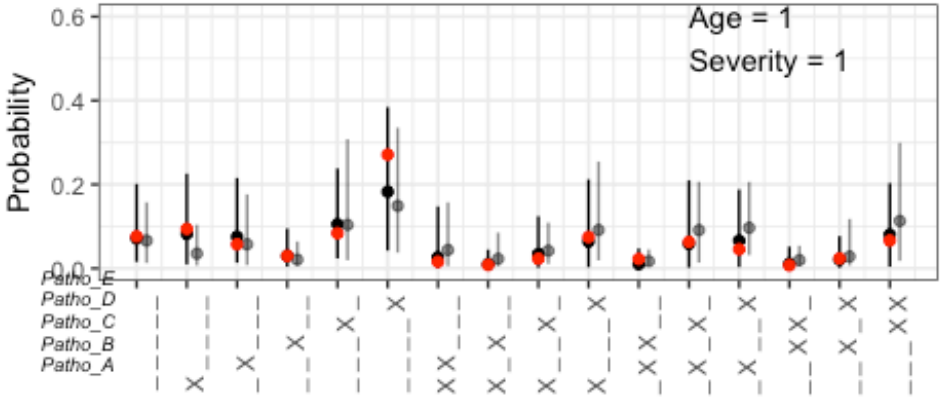
Model	theta2.mu	pr.nonindep.mean	pr.nonindep.sd	MAE.mu	MAE.prnum	Bhattacharyya	expKL
Sparse orrelation Model	-5	0.75	0.14	0.0408	0.0148	0.9838	0.9121
	-5	0.9	0.07	0.0374	0.0123	0.9820	0.9018
	-5	0.5	0.17	0.0411	0.0231	0.9815	0.9040
	-2	0.75	0.14	0.0372	0.0232	0.9790	0.8926
	-2	0.75	0.09	0.0367	0.0249	0.9790	0.8932
	-1.5	0.9	0.07	0.0375	0.0256	0.9770	0.8851
	-1.5	0.75	0.14	0.0383	0.0279	0.9770	0.8856
	-1	0.75	0.14	0.0378	0.0302	0.9748	0.8759
	-2	0.5	0.11	0.042	0.0367	0.9738	0.8697
	-1	0.5	0.11	0.0408	0.0392	0.9713	0.8601
	-2	0.5	0.22	0.0417	0.0384	0.9712	0.8610
	-1.5	0.5	0.11	0.0411	0.0388	0.9711	0.8595
	-1	0.75	0.09	0.0517	0.0192	0.9677	0.8303
	-1	0.5	0.22	0.0439	0.043	0.9673	0.8462
3aker.nplcm	NA	NA	NA	0.0453	0.0675	0.9494	0

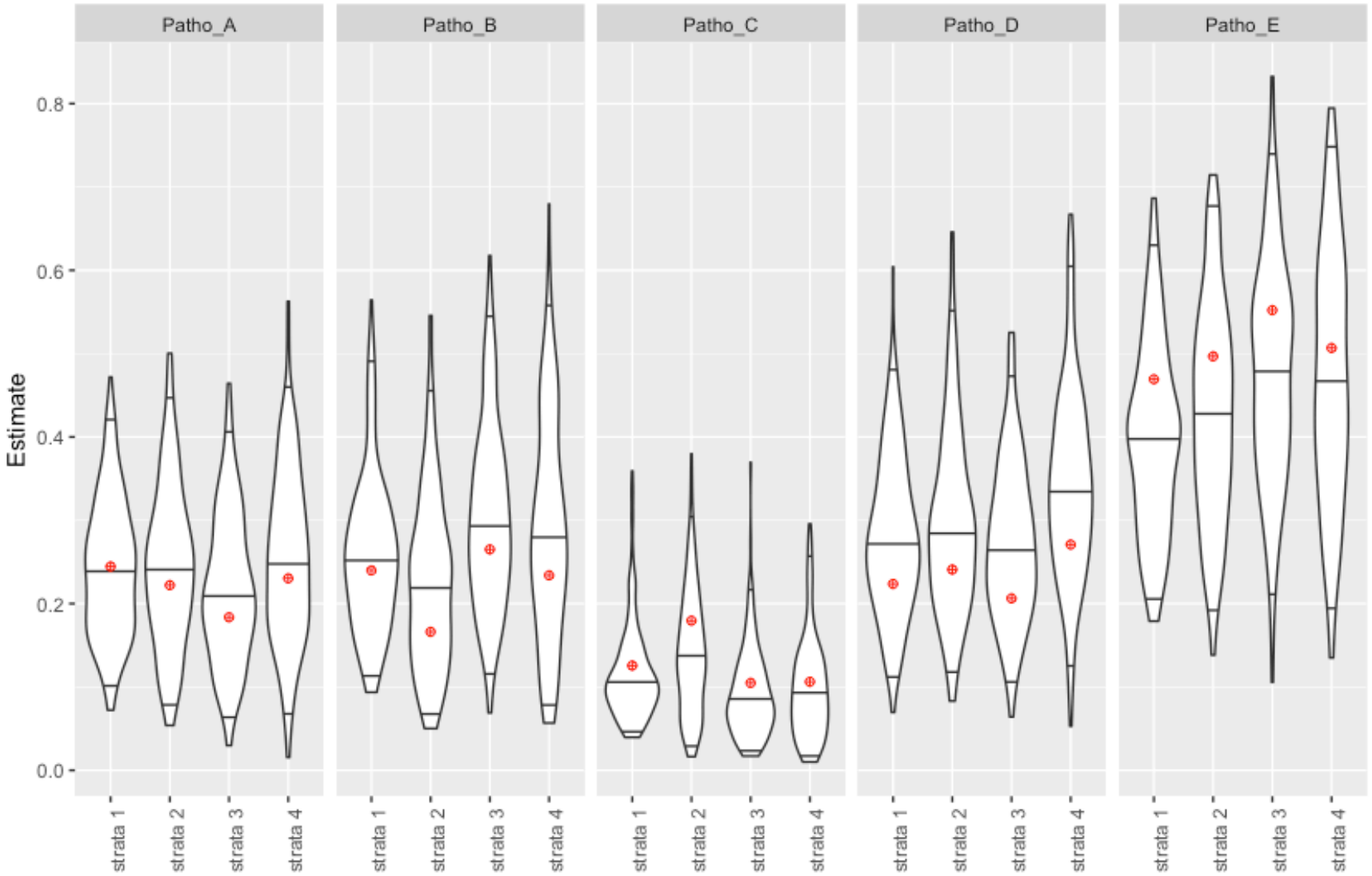












Kenya Site Analysis