data generating model:

$$Y = Cb + E\alpha + G\beta + W\eta + \varepsilon$$

C: clinical factor

$C = (C_1, \dots, C_{q1})$, $b = (b_1, \dots, b_{q1})^T$, q1=3, b is generated from unif (1, 2.2)

E: environmental factor

$E = (E_1, \dots, E_{q2})$, $\alpha = (\alpha_1, \dots, \alpha_{q2})^T$, q1=4, α is generated from unif (1.2, 2.5)

G: genes

$G = (G_1, \dots, G_P)$, $\beta = (\beta_1, \dots, \beta_P)^T$, P=100, the nonzero $(\beta_1, \dots, \beta_8)$ is generated from unif(1, 2.5) and other β is 0.

#nonzero: 8

W: GxE interactions

$W = (G_1 \times E_1, \dots, G_1 \times E_{q2}, \dots, G_p \times E_1, \dots, G_p \times E_{q2},), \eta = (\eta_1, \dots, \eta_{PXq2})^T$

the nonzero $(\eta_1, \eta_2, \eta_3), \eta_{8\,,} (\eta_9, \eta_{10}),\ \eta_{16\,,} (\eta_{17}, \eta_{18}), \eta_{24}, (\eta_{25}, \eta_{26})$ are generated from unif(1.8, 2.5) and other η is 0.

#nonzero: 12

Estimate the coefficients of β and η with marginal model:

$$Y = Cb + E\alpha + X\beta + W'\eta' + \varepsilon$$

$X = G_j$, $W' = (X \times E_1, \dots, X \times E_{q2})$, $\eta' = (\eta'_1, \dots, \eta'_{q2})^T$

Simulation Results

n=200, p=50, error distribution: N(0,1)

Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	6.033333	0.15	6.55	2.15
sd	1.3138	0.3689	1.6067	1.29

Bayesian Lasso Spike and Slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	6.9	1	5.85	0.85
sd	0.8346	0.9882	2.0049	0.8088

LAD Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	6.95	0.65	10.15	3.05
sd	0.8916	0.6271	1.3795	1.703

LAD Bayesian Lasso spike and slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.25	1.75	11.25	17.45
sd	0.731	1.672	1.0202	5.1775