

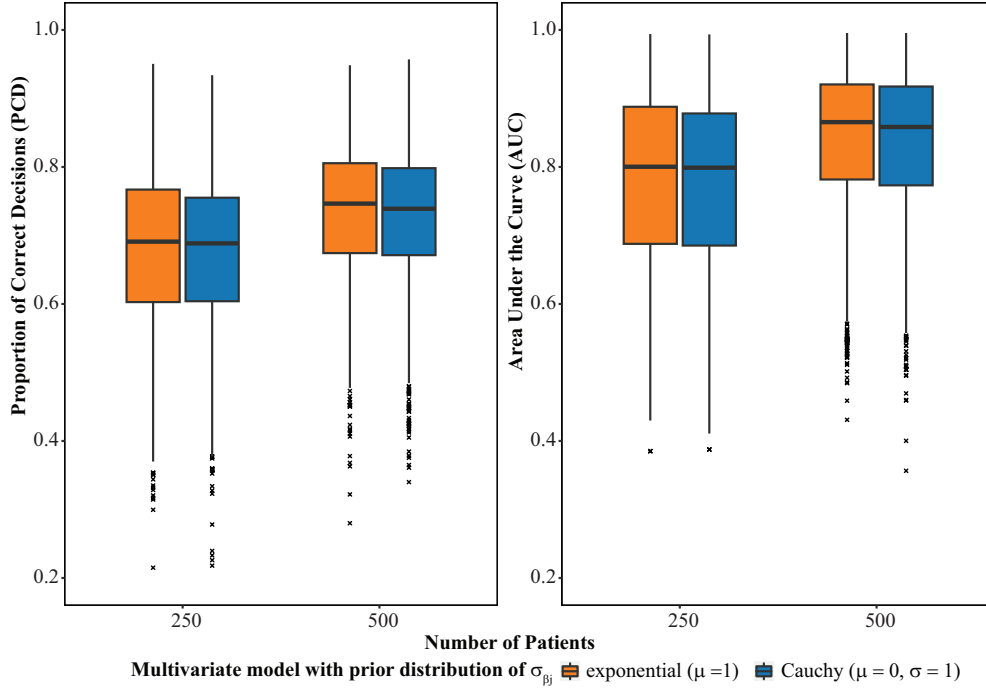
## Additional file 5 — Evaluating the robustness of the proposed multivariate model’s results to different prior distributions.

We included additional sensitivity analyses to illustrate the robustness of our results to a different choice of prior.

We compared priors for  $\sigma_{\beta_j}$  (the standard deviation parameter) in the proposed multivariate model (6), using the simulation setup in Section 2.3.1 for training sample size  $n \in \{250, 500\}$ :

- $\sigma_{\beta_j} \sim \text{exponential}(\mu = 1)$  (Exponential distribution with mean 1)
- $\sigma_{\beta_j} \sim \text{Cauchy}(\mu = 0, \sigma = 1)$  (Cauchy distribution with location 0 and scale 1)

For each scenario, we re-ran the proposed multivariate Bayesian multivariate model with different priors, and compared them with respect to the PCD and AUC. The results of the sensitivity analysis are presented in Figure A3. We found that the exponential prior distribution leads to slightly higher PCD and AUC compared to the Cauchy prior distribution, but the difference is not dramatic or overwhelming, suggesting robustness of the results to this choice of priors.



**Fig. A3** Boxplots of the proportion of correct decisions (PCD) and area under the curve (AUC) in the test sets, comparing the multivariate model with prior distribution of  $\sigma_{\beta_j} \sim \text{exponential}(\mu = 1)$  (orange) and  $\text{Cauchy}(\mu = 0, \sigma = 1)$  (blue) models across different training set sizes (as indicated in the x-axis). Each box shows the interquartile range (IQR), with the horizontal line inside the box representing the median PCD and AUC value. The whiskers extend to the minimum and maximum PCD and AUC values within 1.5 times the IQR. Outliers are represented by small cross symbols.