Supplemental Material

The specifics on generating the data for each simulation case are given below.

Let $Y\_{ji}$ be the response for patient $i$ in subgroup $j$ with response rate $p\_{ji}$ and let $X\_{ji}=(X\_{ji}^{1}, …, X\_{ji}^{6})$ be the vector of covariates for the same patient. Then throughout the simulations a patient’s response is generated as

 $Y\_{ji}∼Bernoulli(p\_{ji})$ with $logit\left(p\_{ji}\right)= X\_{ji}β\_{j}$ ,

where $β\_{j}$ is the subgroup-specific regression parameter capturing a subgroup-specific covariate-response relationship.

Scenario 1, Homogenous Case:

In this case all the subgroups have the same covariate-response relationship with $β=(\frac{2}{3},1, 1,\frac{1}{3},1,1)$ and the response rates for each subgroup are similar.

Subgroup 1:

$$η\~N\left(1, σ=0.1\right)$$

$$X\_{1i}^{2}\~N\left(η, σ=0.01\right)$$

$$X\_{1i}^{3}\~N\left(logit\left(0.2\right)-η, σ=0.01\right)$$

$X\_{1i}^{k}=0$ for $k=1, 4, 5, 6$

Subgroup 2:

$$X\_{2i}^{3}\~N\left(logit\left(0.2\right), σ=0.01\right)$$

$$X\_{2i}^{4}\~N\left(3\left[logit\left(0.21\right)-logit\left(0.2\right)\right], σ=0.01\right) $$

$X\_{2i}^{5}\~N\left(logit\left(0.22\right)-logit\left(0.21\right), σ=0.01\right)$

$X\_{2i}^{k}=0$ for $k=1, 2, 6$

Subgroup 3:

$$X\_{3i}^{1}\~N\left(logit\left(0.21\right)-logit\left(0.2\right), σ=0.01\right)$$

$$X\_{3i}^{3}\~N\left(logit\left(0.2\right), σ=0.01\right) $$

$$X\_{3i}^{4}\~N\left(logit\left(0.21\right)-logit\left(0.2\right), σ=0.01\right)$$

$X\_{3i}^{k}=0$ for $k=2, 5, 6$

Subgroup 4:

$$X\_{4i}^{3}\~N\left(logit\left(0.2\right), σ=0.01\right),X\_{4i}^{4}\~N\left(3\left[logit\left(0.21\right)-logit\left(0.2\right)\right], σ=0.01\right) $$

$$X\_{4i}^{5}\~N\left(logit\left(0.22\right)-logit\left(0.21\right), σ=0.01\right), X\_{4i}^{5}\~N\left(logit\left(0.23\right)-logit\left(0.22\right), σ=0.01\right)$$

Scenario 2, Semi-homogenous Case:

In this case all the subgroups have the same covariate-response relationship with $β=(\frac{2}{3},1, \frac{1}{3},1,1,1)$ and three of the subgroups have similar response rates, but subgroup 2 has a larger response rate.

Subgroup 1:

$$X\_{1i}^{3}\~N\left(3logit\left(0.2\right), σ=0.01\right)$$

$$X\_{1i}^{4}\~N\left(logit\left(0.6\right)-logit(0.2), σ=0.01\right)$$

$$X\_{1i}^{5}\~N\left(logit\left(0.3\right)-logit(0.6), σ=0.01\right)$$

$X\_{1i}^{k}=0$ for $k=1, 2, 6$

Subgroup 2:

$$X\_{2i}^{3}\~N\left(3logit\left(0.2\right), σ=0.01\right)$$

$$X\_{2i}^{4}\~N\left(logit\left(0.25\right)-logit\left(0.2\right), σ=0.01\right) $$

$$X\_{2i}^{5}\~N\left(logit\left(0.3\right)-logit\left(0.25\right), σ=0.01\right)$$

$X\_{2i}^{6}\~N\left(logit\left(0.2\right)-logit\left(0.3\right), σ=0.01\right)$

$X\_{2i}^{k}=0$ for $k=1, 2$

Subgroup 3:

$$X\_{3i}^{1}\~N\left(logit\left(0.2\right), σ=0.01\right)$$

$$X\_{3i}^{3}\~N\left(logit\left(0.2\right), σ=0.01\right) $$

$X\_{3i}^{k}=0$ for $k=2, 4, 5, 6$

Subgroup 4:

$$X\_{4i}^{2}\~N\left(\frac{2}{3}logit\left(0.2\right), σ=0.01\right)$$

$$X\_{4i}^{3}\~N\left(logit\left(0.2\right), σ=0.01\right) $$

$$X\_{4i}^{4}\~N\left(logit(0.25)-logit\left(0.2\right), σ=0.01\right) $$

$X\_{3i}^{k}=0$ for $k=1, 5, 6$

Scenario 3, Heterogeneous Case:

In this case all the subgroups have the same covariate-response relationship with $β=(1, \frac{2}{3}, \frac{1}{3},1,1,1)$ but the response rate varies across all subgroups.

Subgroup 1:

$$X\_{1i}^{1}\~N\left(\frac{2}{3}logit\left(0.05\right), σ=0.01\right)$$

$$X\_{1i}^{3}\~N\left(logit\left(0.0.05\right), σ=0.01\right)$$

$$X\_{1i}^{4}\~N\left(logit\left(0.25\right)-logit(0.05), σ=0.01\right)$$

$X\_{1i}^{k}=0$ for $k=2, 5, 6$

Subgroup 2:

$$X\_{2i}^{2}\~N\left(logit\left(0.05\right), σ=0.01\right)$$

$$X\_{2i}^{3}\~N\left(logit\left(0.05\right), σ=0.01\right) $$

$X\_{2i}^{k}=0$ for $k=1, 4, 5, 6$

Subgroup 3:

$$X\_{3i}^{3}\~N\left(3logit\left(0.05\right), σ=0.01\right)$$

$$X\_{3i}^{4}\~N\left(logit\left(0.25\right)-logit\left(0.05\right), σ=0.01\right)$$

$$X\_{3i}^{5}\~N\left(logit\left(0.65\right)-logit(0.25), σ=0.01\right) $$

$X\_{3i}^{k}=0$ for $k=1, 2, 6$

Subgroup 4:

$$X\_{4i}^{3}\~N\left(3logit\left(0.05\right), σ=0.01\right)$$

$$X\_{4i}^{4}\~N\left(logit\left(0.25\right)-logit(0.05), σ=0.01\right) $$

$$X\_{4i}^{5}\~N\left(logit\left(0.65\right)-logit\left(0.25\right), σ=0.01\right)$$

$$X\_{4i}^{6}\~N\left(logit(0.45)-logit\left(0.65\right), σ=0.01\right) $$

$X\_{3i}^{k}=0$ for $k=1, 2$

Scenario 4, Heterogeneous Case with Subgroup Specific Covariate-Response Relationships:

In this case all the subgroups have a different covariate-response relationship $β\_{i}\ne β\_{j}$ for $i\ne j$, but the response rates are similar across subgroups.

Subgroup 1: $β\_{1}=(-0.8, -0.8,-0.8,-0.8,-0.8, 0)$

$X\_{1i}^{k}\~N\left(0.1, σ=0.037\right)$ for $k=1, 2, 3, 4, 5, 6$

Subgroup 2: $β\_{2}=(-0.4054, -0.4054,-0.4054,-0.4054,-0.4054, 0)$

$X\_{2i}^{k}\~N\left(0.2, σ=0.077\right)$ for $k=1, 2, 3, 4, 5, 6$

Subgroup 3: $β\_{3}=(0.134, 0.134, 0.134, 0.134, 0.134, 0)$

$X\_{3i}^{k}\~N\left(0.3, σ=0.2255\right)$ for $k=1, 2, 3, 4, 5, 6$

Subgroup 4: $β\_{4}=(-0.0267,-0.0267, -0.0267, -0.0267, -0.0267, 0)$

$X\_{4i}^{k}\~N\left(0.6, σ=1.118\right)$ for $k=1, 2, 3, 4, 5, 6$