

**Table S1.** Posterior estimates of the remission rate, treatment effect, and between-study SD in the case study.

Approach	Posterior estimate of remission rate control parameter		Posterior estimate of treatment effect parameter		Posterior estimate of between-study SD, $\tau$		
	Median	95% CI	Median	95% CI	Prior	Median	95% CI
MAC	0.3445	(0.2017, 0.5196)	0.2144	(-0.0278, 0.4348)	U(0, 1)	0.8008	(0.4332, 0.9902)
	0.3350	(0.1914, 0.5140)	0.2240	(-0.0229, 0.4449)	HD(1)	0.9962	(0.4603, 1.9903)
	0.3399	(0.1942, 0.5171)	0.2194	(-0.0238, 0.4416)	Ga(1.571, 2.590)	0.8810	(0.4154, 1.7835)
	0.3343	(0.1900, 0.5130)	0.2245	(-0.0195, 0.4446)	Ga(0.577, 0.624)	1.0207	(0.4444, 2.4792)
MAP (Normal)	0.3350	(0.1954, 0.5113)	0.2237	(-0.0175, 0.4431)	U(0, 1)	0.7989	(0.3994, 0.9905)
	0.3226	(0.1829, 0.5037)	0.2357	(-0.0086, 0.4557)	HD(1)	1.0417	(0.4470, 2.1283)
	0.3258	(0.1860, 0.0506)	0.2294	(-0.0108, 0.4525)	Ga(1.571, 2.590)	0.9068	(0.3864, 1.8937)
	0.3193	(0.1795, 0.5017)	0.2389	(-0.0063, 0.4591)	Ga(0.577, 0.624)	1.1013	(0.4383, 2.9380)

95% CI: the 2.5th to 97.5th percentile

**Table S2.** Simulated TIE rates and power values under Scenario 2 ( $p_E=0.25$  &  $p_C, p_{C_1}=0.1$ ) with nominal power of 0.5.

No. of historical trials	$p_{C_2}$	Use of new trial data alone (%)						Use of historical data (%)											
		Chi-square		Beta-binomial		% of Hetero	MAC		MAP (Normal)		MAP100 (Beta- binomial)		MAP10 (Beta- binomial)		MJPP		MMPP		
		TIE	Power	TIE	Power		TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power	
4	0.05	5.7	51.1	7.6	56	0	2.3	57.6	1.9	54.2	3.5	64.3	3.9	56.6	5.0	66.3	4.4	63.1	
						25	2.7	59.9	2.1	55.9	4.6	68.6	4.5	58.6	6.5	69.8	6.7	71.3	
						50	3.5	61.8	2.8	57.6	6.4	72.8	5.2	60.0	8.1	73.9	10.2	78.9	
	0.15	0	2.3	57.6	1.9	54.2	3.5	64.3	3.9	56.6	5.0	66.3	4.4	63.1					
		25	1.4	53.4	1.3	50.5	2.4	59.8	3.3	54.9	3.7	62.7	2.3	54.8					
		50	1.1	48.5	1.1	47.0	1.8	54.6	3.0	53.1	2.8	58.6	1.5	46.1					
10	0.05	0	2.0	61.1	1.7	57.8	3.3	66.9	3.7	60.0	4.3	71.7	3.7	70.1					
		10	2.3	62.3	1.9	58.6	3.9	69.2	3.9	60.8	5.0	73.9	4.7	73.0					
		30	2.8	64.6	2.2	60.6	5.1	72.3	4.4	62.2	6.9	77.9	7.0	78.9					
		50	3.6	66.9	3.0	63.0	6.6	76.0	5.3	63.7	10.0	82.1	10.4	84.0					
	0.15	0	2.3	61.1	1.7	57.8	3.3	66.9	3.7	60.0	4.3	71.7	3.7	70.1					
		10	1.9	57.8	1.5	55.4	2.9	64.5	3.4	58.4	3.9	69.1	3.4	66.3					
		30	1.3	53.5	1.1	51.1	2.2	60.0	2.9	56.5	2.8	64.6	2.1	59.7					
		50	0.8	49.2	0.9	47.6	1.6	56.1	2.6	53.9	1.9	60.1	1.3	53.6					

**Table S3.** Simulated TIE rates and power values under Scenario 2 ( $p_E=0.25$  &  $p_C, p_{C_1}=0.1$ ) with nominal power of 0.8.

No. of historical trials	$p_{C_2}$	Use of new trial data alone (%)						Use of historical data (%)										
		Chi-square		Beta-binomial		% of Hetero	MAC		MAP (Normal)		MAP100 (Beta-binomial)		MAP10 (Beta-binomial)		MJPP		MMPP	
		TIE	Power	TIE	Power		TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power
4	0.05	5.4	78.2	5.5	80.1	0	3.7	88.4	3.6	86.1	4.1	89.6	4.2	83.7	4.9	90.7	5.1	88.3
						25	4.8	88.8	4.4	87.0	5.6	91.1	4.9	84.4	6.8	92.0	9.0	92.3
						50	5.9	89.5	5.2	87.6	6.9	92.4	5.3	85.2	8.9	93.3	15.5	95.9
	0.15	0	3.7	88.4	3.6	86.1	4.1	89.6	4.2	83.7	4.9	90.7	5.1	88.3				
		25	2.8	85.8	2.8	84.4	2.9	86.7	4.0	83.4	3.7	88.0	2.4	81.3				
		50	2.0	83.8	2.2	83.3	2.2	84.3	3.5	82.7	2.7	85.7	1.2	73.0				
10	0.05	0	3.1	89.9	3.1	88.1	3.6	90.5	4.0	85.5	4.7	94.1	4.5	94.1				
		10	3.7	90.1	3.5	88.3	4.3	90.9	4.4	85.8	5.7	94.8	6.0	95.3				
		30	4.9	90.8	4.1	88.9	5.6	91.7	5.1	86.6	8.4	96.5	10.0	97.5				
		50	6.4	91.6	5.4	89.7	7.4	92.6	5.6	87.2	12.5	97.8	16.4	98.8				
	0.15	0	3.1	89.9	3.1	88.1	3.6	90.5	4.0	85.5	4.7	94.1	4.7	94.1				
		10	2.9	88.4	2.8	86.8	3.4	89.3	3.9	85.2	4.2	92.7	3.7	91.8				
		30	2.0	86.4	2.2	85.4	2.6	87.1	3.5	84.2	2.7	90.6	1.8	87.1				
		50	1.5	84.4	1.9	83.5	2.0	85.2	3.1	83.3	1.9	87.7	0.9	81.6				

**Table S4.** Simulated TIE rates and power values under Scenario 3 ( $p_E=0.95$  &  $p_C, p_{C_1}=0.85$ ) with nominal power of 0.5.

No. of historical trials	$p_{C_2}$	Use of new trial data alone (%)						Use of historical data (%)											
		Chi-square		Beta-binomial		% of Hetero	MAC		MAP (Normal)		MAP100 (Beta- binomial)		MAP10 (Beta- binomial)		MJPP		MMPP		
		TIE	Power	TIE	Power		TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power	
4	0.75	4.7	50.7	5.7	54.8	0	3.9	43.8	3.9	41.3	6.5	68.7	5.9	62.5	5.5	63.5	4.8	59.9	
						25	5.0	48.5	4.4	44.8	8.2	74.8	6.5	64.8	6.8	68.5	8.8	72.7	
						50	5.9	52.5	5.0	48.0	11.2	80.2	7.4	67.1	8.8	73.4	14.8	83.3	
	0.95	0	3.9	43.8	3.9	41.3	6.5	68.7	5.9	62.5	5.5	63.5	4.8	59.9					
		25	3.3	39.2	3.6	38.0	3.9	59.7	5.2	58.9	3.7	56.4	1.7	41.8					
		50	2.9	33.7	3.3	34.8	2.8	51.4	4.7	55.7	2.8	48.4	0.5	26.2					
10	0.75	0	3.8	49.1	3.7	46.1	5.9	70.9	5.7	63.9	5.5	70.7	6.0	73.2					
		10	4.3	51.1	4.2	47.6	6.9	72.9	6.4	65.1	6.6	73.5	8.2	79.0					
		30	5.4	54.8	4.9	50.6	8.7	76.5	7.1	67.6	9.3	79.4	13.6	87.4					
		50	6.9	58.6	5.8	55.2	11.3	80.9	8.0	70.1	12.8	85.2	20.7	93.4					
	0.95	0	3.8	49.1	3.7	46.1	5.9	70.9	5.7	63.9	5.5	70.7	6.0	73.2					
		10	3.1	45.8	3.4	42.6	4.5	65.5	5.1	61.1	4.2	66.0	4.0	65.7					
		30	2.7	39.2	3.0	37.9	3.5	57.3	4.6	57.9	2.7	55.9	1.7	51.2					
50	2.3	33.1	2.6	34.0	2.8	50.9	4.1	54.5	1.7	44.5	0.8	35.6							

**Table S5.** Simulated TIE rates and powers under Scenario 3 ( $p_E=0.95$  &  $p_C, p_{C_1}=0.85$ ) with nominal power of 0.8.

No. of historical trials	$p_{C2}$	Use of new trial data alone (%)						Use of historical data (%)										
		Chi-square		Beta-binomial		% of Hetero	MAC		MAP (Normal)		MAP100 (Beta- binomial)		MAP10 (Beta- binomial)		MJPP		MMPP	
		TIE	Power	TIE	Power		TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power	TIE	Power
4	0.75	5.3	81.4	5.4	82.5	0	4.3	85.7	4.3	83.7	5.3	90.3	5.4	86.4	4.9	89.6	5.0	84.7
						25	5.5	86.8	4.9	84.8	6.9	92.3	5.9	87.3	6.7	91.7	11.5	93.7
						50	6.5	87.6	5.4	85.6	9.6	93.9	6.5	88.3	9.2	93.7	23.3	98.2
	0.95	0	4.3	85.7	4.3	83.7	5.3	90.3	5.4	86.4	4.9	89.6	5.0	84.7				
		25	3.6	81.4	4.0	80.6	3.7	85.0	5.0	84.4	3.4	85.1	1.2	63.4				
		50	3.4	77.7	3.7	78.2	3.0	80.7	4.5	82.8	2.6	78.6	0.1	36.4				
10	0.75	0	4.4	87.6	4.5	85.7	5.1	91.2	5.3	87.7	5.0	93.6	5.4	94.5				
		10	4.9	87.4	4.7	85.7	5.7	91.5	5.6	88.1	5.9	95.0	8.9	97.0				
		30	5.6	88.0	5.2	86.4	7.2	92.4	6.1	89.0	9.4	96.7	17.5	99.0				
		50	6.8	89.0	6.1	87.6	8.7	93.4	7.0	90.0	14.3	98.2	31.2	99.8				
	0.95	0	4.4	87.6	4.5	85.7	5.1	91.2	5.3	87.7	5.0	93.6	5.4	94.5				
		10	3.6	84.8	3.9	83.4	3.6	88.1	4.7	86.1	3.7	91.5	3.1	90.7				
		30	3.4	80.9	3.7	80.2	3.2	84.0	4.5	84.0	1.9	85.1	0.9	75.3				
		50	3.1	77.7	3.4	78.1	3.2	81.2	4.3	82.6	1.1	74.3	0.2	53.1				