Supplementary Tables - Additional Simulations

Table S1: Simulation results for designs with a control arm in the null scenario with all $p_k = 0.20$, for N=500. $\bar{n}$ = mean per-arm sample size. Each $\eta_m = \Pr(N_C > N_k + m)$, the probability that the number of patients randomized to arm C is at least m larger than the number randomized to arm E_k. Values in the row $E_1 - E_4$ are per-arm.

Method	Arm	Pr(Select)	Pr(Stop)	$\bar{n}$(95% CI)	$\eta_{10}, \eta_{20}, \eta_{30}$
AR(1, 0)	C	–	–	37 (10, 64)	–
	E_1-E_4	0.01	0.84	62 (10, 262)	0.4, 0.28, 0.16
			Total	283 (70, 500)	
AR$\left(\frac{1}{2}, 0\right)$	C	–	–	46 (17, 76)	–
	E_1-E_4	0.01	0.92	53 (10, 194)	0.5, 0.39, 0.26
			Total	258 (70, 500)	
AR$\left(\frac{n}{2N}, 0\right)$	C	–	–	49 (16, 79)	–
	E_1-E_4	0.01	0.92	51 (10, 198)	0.54, 0.43, 0.31
			Total	252 (70, 500)	
AR(1, 0.1)	C	–	–	45 (21, 67)	–
	E_1-E_4	0.01	0.96	53 (10, 212)	0.51, 0.39, 0.25
			Total	258 (80, 500)	
ER	C	–	–	74 (17, 157)	–
	E_1-E_4	0	0.99	42 (10, 128)	0.68, 0.54, 0.43
			Total	242 (70, 500)	

Table S2: Simulation results for designs with a control arm in the LFC scenario $p_C = p_1 = p_2 = p_3 = 0.20, p_4 = 0.40$,, for N=500. $\bar{n}$ = mean per-arm sample size. Each $\eta_m = \Pr(N_C > N_k + m)$, the probability that the number of patients randomized to arm C is at least m larger than the number randomized to arm E_k. Values in the row $E_1 - E_4$ are per-arm.

Method	Arm	Pr(Select)	Pr(Stop)	$\bar{n}$(95% CI)	$\eta_{10}, \eta_{20}, \eta_{30}$
AR(1, 0)	C	–	–	27 (10, 65)	–
	E_1-E_3	0.02	0.46	27 (10, 82)	0.34, 0.2, 0.1
	E_4	0.53	0.07	369 (11, 444)	0.03, 0.02,0.01
			Total	477 (130, 500)	
AR$\left(\frac{1}{2}, 0\right)$	C	–	–	47 (13, 95)	–
	E_1-E_3	0.03	0.70	36 (10, 101)	0.54, 0.42, 0.29
	E_4	0.67	0.09	319 (10, 413)	0.05, 0.04,0.03
			Total	474 (130, 500)	
AR$\left(\frac{n}{2N}, 0\right)$	C	–	–	47 (18, 88)	–
	E_1-E_3	0.04	0.70	35 (10, 91)	0.57, 0.43, 0.28
	E_4	0.77	0.09	321 (10, 406)	0.05, 0.04,0.03
			Total	473 (130, 500)	
AR(1, 0.1)	C	–	–	58 (39, 83)	–
	E_1-E_3	0.05	0.81	35 (10, 89)	0.7, 0.59, 0.47
	E_4	0.87	0.08	313 (11, 403)	0.05, 0.05,0.04
			Total	477 (130, 500)	
ER	C	–	–	177 (40, 238)	–
	E_1-E_3	0	0.98	41 (10, 121)	0.95, 0.93, 0.90
	E_4	0.85	0.09	175 (13, 238)	0.32, 0.18,0.08
			Total	475 (140, 500)	

Table S3: Simulation results for designs with a control arm in staircase scenario, $(p_C, p_1, p_2, p_3, p_4) =$ (0.20,0.25,0.30,0.35,0.40) for N=500. $\bar{n}$ = mean per-arm sample size. Each $\eta_m = \Pr(N_C > N_k + m)$, the probability that the number of patients randomized to arm C is at least m larger than the number randomized to arm E_k.

Method	Arm	Pr(Select)	Pr(Stop)	$\bar{n}$(95% CI)	$\eta_{10}, \eta_{20}, \eta_{30}$
AR(1, 0)	C	–	–	25 (10, 63)	–
	E_1	0.061	0.31	36 (10, 112)	0.22, 0.12,0.06
	E_2	0.13	0.22	61 (10, 207)	0.14, 0.07,0.04
	E_3	0.27	0.14	119 (10, 359)	0.08, 0.04,0.02
	E_4	0.49	0.076	251 (10, 417)	0.03, 0.02,0.01
AR$\left(\frac{1}{2}, 0\right)$	C	–	–	40 (12, 88)	–
	E_1	0.10	0.47	48 (10, 120)	0.34, 0.24,0.15
	E_2	0.20	0.31	76 (10, 180)	0.2, 0.14,0.09
	E_3	0.40	0.18	123 (10, 269)	0.11, 0.08,0.05
	E_4	0.65	0.078	206 (11, 360)	0.05, 0.03,0.02
AR$\left(\frac{n}{2N}, 0\right)$	C	–	–	40 (16, 81)	–
	E_1	0.14	0.46	45 (10, 111)	0.35, 0.23,0.13
	E_2	0.28	0.31	71 (10, 179)	0.22, 0.14,0.08
	E_3	0.49	0.17	119 (10, 285)	0.11, 0.07,0.04
	E_4	0.75	0.078	218 (12, 361)	0.05, 0.03,0.02
AR(1, 0.1)	C	–	–	58 (43, 79)	–
	E_1	0.19	0.58	46 (10, 107)	0.51, 0.41,0.32
	E_2	0.39	0.36	67 (10, 180)	0.31, 0.24,0.19
	E_3	0.62	0.19	113 (10, 300)	0.16, 0.12,0.1
	E_4	0.84	0.089	208 (10, 358)	0.07, 0.06,0.05
ER	C	–	–	128 (86, 216)	–
	E_1	0.08	0.67	59 (10, 123)	0.79, 0.72,0.67
	E_2	0.29	0.49	82 (10, 148)	0.58, 0.48,0.42
	E_3	0.60	0.24	104 (10, 170)	0.41, 0.27,0.21
	E_4	0.86	0.084	120 (11, 209)	0.32, 0.16,0.09

Table S4: Simulation results for designs without a control arm in the null scenario $p_1 = \cdots = p_5 = 0.20$, for N=500. $\bar{n}$ = mean per-arm sample size. Each $\eta_m = \Pr(N_C > N_k + m)$, the probability that the number of patients randomized to arm C is at least m larger than the number randomized to arm E_k. All values are per-arm.

Method	Arm	Pr(Select)	Pr(Stop)	$\bar{n}$(95% CI)	$\eta_{10}, \eta_{20}, \eta_{30}$
AR(1, 0)	E_1-E_5	0.01	0.22	100 (10, 294)	0.46, 0.43, 0.39
			Total	499 (500, 500)	
AR$\left(\frac{1}{2}, 0\right)$	E_1-E_5	0.01	0.3	99 (10, 245)	0.45, 0.41, 0.37
			Total	497 (500, 500)	
AR$\left(\frac{n}{2N}, 0\right)$	E_1-E_5	0.01	0.31	99 (10, 255)	0.45, 0.41, 0.38
			Total	495 (500, 500)	
AR(1, 0.1)	E_1-E_5	0.01	0.28	100 (10, 280)	0.45, 0.42, 0.39
			Total	498 (500, 500)	
ER	E_1-E_5	0.01	0.38	98 (10, 221)	0.39, 0.31, 0.27
			Total	492 (370, 500)	

Table S5: Simulation results for designs with no control arm in the LFC scenario $p_1 = p_2 = p_3 = p_4 = 0.20$ and $p_5 = 0.40$, for N=500. $\bar{n}$ = mean per-arm sample size. Each $\eta_m = \Pr(N_C > N_k + m)$, the probability that the number of patients randomized to arm C is at least m larger than the number randomized to arm E_k. Values in the row $E_1 - E_4$ are per-arm.

Method	Arm	Pr(Select)	Pr(Stop)	$\bar{n}$(95% CI)	$\eta_{10}, \eta_{20}, \eta_{30}$
AR(1, 0)	E_1-E_4	0	0.81	28 (10, 93)	0.3, 0.2, 0.12
	E_5	0.95	0.017	289 (14, 435)	0.02, 0.02,0.01
			Total	400 (80, 500)	
AR$\left(\frac{1}{2}, 0\right)$	E_1-E_4	0	0.95	35 (10, 115)	0.33, 0.24, 0.17
	E_5	0.96	0.018	157 (13, 327)	0.01, 0.01,0.01
			Total	296 (70, 500)	
AR$\left(\frac{n}{2N}, 0\right)$	E_1-E_4	0	0.94	36 (10, 105)	0.35, 0.26, 0.19
	E_5	0.96	0.019	140 (11, 338)	0.02, 0.01,0.01
			Total	282 (70, 500)	
AR(1, 0.1)	E_1-E_4	0	0.92	32 (10, 98)	0.32, 0.22, 0.15
	E_5	0.96	0.02	212 (12, 391)	0.02, 0.02,0.02
			Total	340 (80, 500)	
ER	E_1-E_4	0	0.97	45 (10, 152)	0.37, 0.29, 0.23
	E_5	0.93	0.02	82 (11, 180)	0.07, 0.03,0.02
			Total	260 (70, 500)	

Table S6: Simulation results for designs with no control arm in the staircase scenario, $(p_1, p_2, p_3, p_4, p_5)$ = (0.20,0.25,0.30,0.35,0.40), for N=500. $\bar{n}$ = mean per-arm sample size. Each $\eta_m = \Pr(N_C > N_k + m)$, the probability that the number of patients randomized to arm C is at least m larger than the number randomized to arm E_k.

Method	Arm	Pr(Select)	Pr(Stop)	$\bar{n}$(95% CI)	$\eta_{10}, \eta_{20}, \eta_{30}$
AR(1, 0)	E_1	0	0.78	23 (10, 69)	–
	E_2	0	0.61	35 (10, 118)	0.2, 0.12,0.07
	E_3	0.002	0.41	62 (10, 214)	0.14, 0.08,0.05
	E_4	0.04	0.22	122 (10, 358)	0.07, 0.05,0.03
	E_5	0.39	0.067	246 (10, 416)	0.04, 0.03,0.02
AR$\left(\frac{1}{2}, 0\right)$	E_1	0	0.95	26 (10, 87)	–
	E_2	0	0.84	42 (10, 132)	0.21, 0.14,0.09
	E_3	0.002	0.56	73 (10, 195)	0.13, 0.09,0.06
	E_4	0.036	0.28	126 (10, 283)	0.07, 0.05,0.04
	E_5	0.38	0.076	199 (10, 338)	0.03, 0.03,0.02
AR$\left(\frac{n}{2N}, 0\right)$	E_1	0	0.95	26 (10, 80)	–
	E_2	0	0.81	41 (10, 118)	0.21, 0.14,0.08
	E_3	0.002	0.55	69 (10, 191)	0.13, 0.09,0.05
	E_4	0.04	0.27	123 (10, 294)	0.07, 0.05,0.04
	E_5	0.41	0.075	205 (10, 344)	0.03, 0.03,0.02
AR(1, 0.1)	E_1	0	0.93	25 (10, 75)	–
	E_2	0	0.77	39 (10, 116)	0.21, 0.13,0.09
	E_3	0.002	0.502	66 (10, 200)	0.13, 0.09,0.06
	E_4	0.037	0.25	122 (10, 333)	0.07, 0.05,0.03
	E_5	0.38	0.069	226 (10, 382)	0.03, 0.03,0.02
ER	E_1	0	0.99	29 (10, 108)	–
	E_2	0	0.90	50 (10, 162)	0.22, 0.15,0.11
	E_3	0.0019	0.66	88 (10, 218)	0.13, 0.09,0.07
	E_4	0.034	0.32	133 (10, 234)	0.08, 0.06,0.04
	E_5	0.33	0.08	146 (10, 236)	0.04, 0.03,0.02