**Supplemental data**

**"Sample size determination in group-sequential clinical trials with two co-primary endpoints"**

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**Table S1**. Impact of sample size recalculation on the power and Type I error rate. The planned MSS per intervention group is calculated to detect the joint effect for two endpoints with the overall power of 80% at the one-sided significance level of 2.5%, where one interim and one final analysis are to be performed. The critical values are determined by the OF boundary for both endpoints with the LD alpha-spending method. The upper limit of recalculation sample size is $n_2' = \lambda n_2$ with $\lambda = 1.5$. The number of replications for simulation is set to 1,000,000 for evaluation of the Type I error rate and 100,000 replications for the power. (DF-1)

| Information time | Power/ Type I error rate | Mean difference $(\delta_1, \delta_2)$ | Correlation (MSS) | | (i) Only decreasing sample size (ASN) | | (ii) Only increasing sample Size (ASN) | | (iii) Increasing or decreasing sample size (ASN) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.25 | Power | (0.2, 0.2) | 0.0 | ( 516) | 71.0 | ( 448) | 88.9 | ( 640) | 79.7 | ( 571) |
| | | | 0.3 | ( 504) | 69.6 | ( 425) | 88.5 | ( 616) | 77.9 | ( 537) |
| | | | 0.5 | ( 492) | 68.9 | ( 406) | 88.1 | ( 596) | 76.7 | ( 509) |
| | | | 0.8 | ( 460) | 67.5 | ( 365) | 87.4 | ( 549) | 74.6 | ( 455) |
| | | | 0.99 | ( 412) | 66.1 | ( 313) | 86.9 | ( 484) | 72.6 | ( 384) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 516) | 0.06 | ( 515) | 0.06 | ( 578) | 0.06 | ( 577) |
| | | | 0.3 | ( 504) | 0.24 | ( 502) | 0.24 | ( 573) | 0.24 | ( 571) |
| | | | 0.5 | ( 492) | 0.46 | ( 489) | 0.46 | ( 565) | 0.46 | ( 562) |
| | | | 0.8 | ( 460) | 1.10 | ( 453) | 1.10 | ( 537) | 1.10 | ( 530) |
| | | | 0.99 | ( 412) | 2.17 | ( 401) | 2.17 | ( 490) | 2.18 | ( 478) |
| | | (0.0, 0.2) | 0.0 | ( 516) | 2.17 | ( 509) | 2.37 | ( 620) | 2.29 | ( 613) |
| | | | 0.3 | ( 504) | 2.39 | ( 493) | 2.47 | ( 603) | 2.41 | ( 593) |
| | | | 0.5 | ( 492) | 2.46 | ( 479) | 2.50 | ( 588) | 2.46 | ( 576) |
| | | | 0.8 | ( 460) | 2.50 | ( 446) | 2.50 | ( 549) | 2.50 | ( 535) |
| | | | 0.99 | ( 412) | 2.50 | ( 399) | 2.50 | ( 491) | 2.49 | ( 479) |
| 0.50 | Power | (0.2, 0.2) | 0.0 | ( 518) | 74.0 | ( 448) | 91.3 | ( 618) | 85.2 | ( 564) |
| | | | 0.3 | ( 506) | 74.0 | ( 429) | 90.9 | ( 591) | 84.7 | ( 536) |
| | | | 0.5 | ( 492) | 73.8 | ( 411) | 90.4 | ( 566) | 84.2 | ( 511) |
| | | | 0.8 | ( 460) | 73.6 | ( 376) | 89.6 | ( 517) | 83.2 | ( 463) |
| | | | 0.99 | ( 410) | 73.3 | ( 327) | 88.8 | ( 449) | 82.0 | ( 399) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 518) | 0.06 | ( 518) | 0.06 | ( 582) | 0.06 | ( 582) |
| | | | 0.3 | ( 506) | 0.23 | ( 506) | 0.23 | ( 580) | 0.23 | ( 580) |
| | | | 0.5 | ( 492) | 0.46 | ( 491) | 0.46 | ( 571) | 0.45 | ( 571) |
| | | | 0.8 | ( 460) | 1.08 | ( 459) | 1.08 | ( 546) | 1.09 | ( 545) |
| | | | 0.99 | ( 410) | 2.17 | ( 407) | 2.16 | ( 499) | 2.17 | ( 496) |
| | | (0.0, 0.2) | 0.0 | ( 518) | 2.17 | ( 516) | 2.37 | ( 637) | 2.33 | ( 635) |
| | | | 0.3 | ( 506) | 2.41 | ( 503) | 2.46 | ( 620) | 2.46 | ( 617) |
| | | | 0.5 | ( 492) | 2.48 | ( 488) | 2.50 | ( 602) | 2.48 | ( 599) |
| | | | 0.8 | ( 460) | 2.49 | ( 456) | 2.49 | ( 563) | 2.49 | ( 559) |
| | | | 0.99 | ( 410) | 2.50 | ( 407) | 2.51 | ( 502) | 2.51 | ( 498) |
| 0.75 | Power | (0.2, 0.2) | 0.0 | ( 528) | 79.7 | ( 462) | 91.9 | ( 557) | 91.3 | ( 552) |
| | | | 0.3 | ( 516) | 79.8 | ( 449) | 91.6 | ( 538) | 91.0 | ( 534) |
| | | | 0.5 | ( 500) | 79.5 | ( 434) | 91.1 | ( 518) | 90.5 | ( 515) |
| | | | 0.8 | ( 468) | 79.5 | ( 403) | 90.3 | ( 480) | 89.9 | ( 476) |
| | | | 0.99 | ( 416) | 79.6 | ( 356) | 89.4 | ( 422) | 89.0 | ( 418) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.05 | ( 528) | 0.05 | ( 594) | 0.05 | ( 594) |
| | | | 0.3 | ( 516) | 0.22 | ( 516) | 0.21 | ( 592) | 0.22 | ( 592) |
| | | | 0.5 | ( 500) | 0.45 | ( 500) | 0.44 | ( 582) | 0.43 | ( 582) |
| | | | 0.8 | ( 468) | 1.07 | ( 467) | 1.07 | ( 558) | 1.08 | ( 558) |
| | | | 0.99 | ( 416) | 2.17 | ( 415) | 2.17 | ( 509) | 2.18 | ( 509) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.17 | ( 527) | 2.33 | ( 653) | 2.32 | ( 653) |
| | | | 0.3 | ( 516) | 2.41 | ( 515) | 2.46 | ( 637) | 2.46 | ( 637) |
| | | | 0.5 | ( 500) | 2.47 | ( 499) | 2.51 | ( 617) | 2.49 | ( 617) |
| | | | 0.8 | ( 468) | 2.50 | ( 467) | 2.52 | ( 577) | 2.49 | ( 577) |
| | | | 0.99 | ( 416) | 2.49 | ( 415) | 2.49 | ( 513) | 2.50 | ( 513) |

**Table S2**. Impact of sample size recalculation on the power and Type I error rate. The planned MSS per intervention group is calculated to detect the joint effect for two endpoints with the overall power of 80% at the one-sided significance level of 2.5%, where one interim and one final analysis are to be performed and the critical values are determined by the OF boundary for both endpoints with the LD alpha-spending method. The upper limit of recalculation sample size is $n'_2 = \lambda n_2$ with $\lambda = 1.5$. The number of replications for simulation is set to 1,000,000 for evaluation of the Type I error rate and 100,000 replications for the power. (DF-2)

| Information time | Power/ Type I error rate | Mean difference $(\delta_1, \delta_2)$ | Correlation (MSS) | | (i) Only decreasing sample size (ASN) | | (ii) Only increasing sample Size (ASN) | | (iii) Increasing or decreasing sample size (ASN) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.25 | Power | (0.2, 0.2) | 0.0 | ( 516) | 71.0 | ( 449) | 88.9 | ( 640) | 79.8 | ( 573) |
| | | | 0.3 | ( 504) | 69.7 | ( 426) | 88.4 | ( 616) | 77.9 | ( 537) |
| | | | 0.5 | ( 492) | 68.8 | ( 406) | 88.1 | ( 596) | 76.8 | ( 512) |
| | | | 0.8 | ( 460) | 67.4 | ( 366) | 87.4 | ( 549) | 74.6 | ( 455) |
| | | | 0.99 | ( 412) | 66.1 | ( 312) | 86.9 | ( 484) | 72.6 | ( 385) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 516) | 0.06 | ( 515) | 0.06 | ( 578) | 0.06 | ( 577) |
| | | | 0.3 | ( 504) | 0.24 | ( 502) | 0.24 | ( 573) | 0.24 | ( 571) |
| | | | 0.5 | ( 492) | 0.46 | ( 489) | 0.46 | ( 565) | 0.46 | ( 561) |
| | | | 0.8 | ( 460) | 1.09 | ( 453) | 1.10 | ( 537) | 1.10 | ( 530) |
| | | | 0.99 | ( 412) | 2.17 | ( 401) | 2.17 | ( 489) | 2.17 | ( 478) |
| | | (0.0, 0.2) | 0.0 | ( 516) | 2.17 | ( 509) | 2.36 | ( 620) | 2.29 | ( 613) |
| | | | 0.3 | ( 504) | 2.39 | ( 493) | 2.47 | ( 604) | 2.42 | ( 593) |
| | | | 0.5 | ( 492) | 2.46 | ( 479) | 2.50 | ( 588) | 2.46 | ( 575) |
| | | | 0.8 | ( 460) | 2.50 | ( 446) | 2.50 | ( 549) | 2.50 | ( 535) |
| | | | 0.99 | ( 412) | 2.50 | ( 399) | 2.50 | ( 492) | 2.50 | ( 479) |
| 0.50 | Power | (0.2, 0.2) | 0.0 | ( 518) | 74.4 | ( 448) | 91.3 | ( 618) | 85.7 | ( 563) |
| | | | 0.3 | ( 506) | 74.3 | ( 428) | 91.0 | ( 591) | 85.1 | ( 536) |
| | | | 0.5 | ( 492) | 74.0 | ( 411) | 90.5 | ( 566) | 84.4 | ( 512) |
| | | | 0.8 | ( 460) | 73.6 | ( 376) | 89.7 | ( 516) | 83.4 | ( 462) |
| | | | 0.99 | ( 410) | 73.4 | ( 327) | 88.8 | ( 449) | 82.1 | ( 398) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 518) | 0.06 | ( 518) | 0.06 | ( 582) | 0.06 | ( 582) |
| | | | 0.3 | ( 506) | 0.24 | ( 506) | 0.24 | ( 580) | 0.24 | ( 580) |
| | | | 0.5 | ( 492) | 0.46 | ( 491) | 0.46 | ( 571) | 0.46 | ( 570) |
| | | | 0.8 | ( 460) | 1.09 | ( 459) | 1.09 | ( 546) | 1.09 | ( 544) |
| | | | 0.99 | ( 410) | 2.17 | ( 407) | 2.18 | ( 498) | 2.18 | ( 496) |
| | | (0.0, 0.2) | 0.0 | ( 518) | 2.21 | ( 516) | 2.40 | ( 637) | 2.37 | ( 635) |
| | | | 0.3 | ( 506) | 2.43 | ( 503) | 2.47 | ( 620) | 2.46 | ( 617) |
| | | | 0.5 | ( 492) | 2.49 | ( 488) | 2.50 | ( 603) | 2.48 | ( 599) |
| | | | 0.8 | ( 460) | 2.50 | ( 456) | 2.50 | ( 563) | 2.49 | ( 559) |
| | | | 0.99 | ( 410) | 2.50 | ( 407) | 2.50 | ( 502) | 2.50 | ( 499) |
| 0.75 | Power | (0.2, 0.2) | 0.0 | ( 528) | 79.9 | ( 461) | 91.9 | ( 556) | 91.4 | ( 551) |
| | | | 0.3 | ( 512) | 79.3 | ( 446) | 91.5 | ( 534) | 90.9 | ( 530) |
| | | | 0.5 | ( 500) | 79.6 | ( 433) | 91.2 | ( 518) | 90.6 | ( 514) |
| | | | 0.8 | ( 468) | 79.5 | ( 403) | 90.4 | ( 480) | 89.9 | ( 476) |
| | | | 0.99 | ( 416) | 79.5 | ( 356) | 89.4 | ( 422) | 89.0 | ( 418) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.06 | ( 528) | 0.06 | ( 594) | 0.06 | ( 594) |
| | | | 0.3 | ( 512) | 0.23 | ( 512) | 0.23 | ( 588) | 0.24 | ( 588) |
| | | | 0.5 | ( 500) | 0.46 | ( 500) | 0.45 | ( 582) | 0.46 | ( 582) |
| | | | 0.8 | ( 468) | 1.08 | ( 467) | 1.08 | ( 558) | 1.09 | ( 558) |
| | | | 0.99 | ( 416) | 2.16 | ( 415) | 2.16 | ( 510) | 2.15 | ( 509) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.24 | ( 527) | 2.38 | ( 653) | 2.40 | ( 653) |
| | | | 0.3 | ( 512) | 2.44 | ( 511) | 2.48 | ( 632) | 2.47 | ( 632) |
| | | | 0.5 | ( 500) | 2.48 | ( 499) | 2.50 | ( 617) | 2.50 | ( 617) |
| | | | 0.8 | ( 468) | 2.49 | ( 467) | 2.51 | ( 578) | 2.50 | ( 577) |
| | | | 0.99 | ( 416) | 2.51 | ( 415) | 2.52 | ( 513) | 2.51 | ( 513) |

**Table S3**. Impact of sample size recalculation on the power and Type I error rate. The planned MSS per intervention group is calculated to detect the joint effect for two endpoints with the overall power of 80% at the one-sided significance level of 2.5%, where three interims and one final analysis are to be performed at equal time intervals and the critical values are determined by the OF boundary for both endpoints with the LD alpha-spending method. The upper limit of recalculation sample size is $n_2' = \lambda n_2$ with $\lambda = 1.5$. The number of replications for simulation is set to 1,000,000 for evaluation of the Type I error rate and 100,000 replications for the power. (DF-1)

| Interim analysis | Power/ Type I error rate | Mean difference $(\delta_1, \delta_2)$ | Correlation (MSS) | | (i) Only decreasing sample size (ASN) | | (ii) Only increasing sample Size (ASN) | | (iii) Increasing or decreasing sample size (ASN) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1st | Power | (0.2, 0.2) | 0.0 | ( 528) | 71.3 | ( 459) | 89.1 | ( 655) | 80.4 | ( 586) |
| | | | 0.3 | ( 516) | 70.2 | ( 435) | 88.6 | ( 631) | 78.6 | ( 551) |
| | | | 0.5 | ( 504) | 69.5 | ( 416) | 88.3 | ( 611) | 77.4 | ( 523) |
| | | | 0.8 | ( 468) | 67.9 | ( 373) | 87.4 | ( 558) | 75.4 | ( 464) |
| | | | 0.99 | ( 420) | 67.0 | ( 319) | 87.0 | ( 494) | 73.7 | ( 394) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.05 | ( 527) | 0.05 | ( 591) | 0.05 | ( 591) |
| | | | 0.3 | ( 516) | 0.21 | ( 514) | 0.22 | ( 587) | 0.22 | ( 585) |
| | | | 0.5 | ( 504) | 0.44 | ( 501) | 0.44 | ( 579) | 0.44 | ( 576) |
| | | | 0.8 | ( 468) | 1.07 | ( 461) | 1.07 | ( 547) | 1.07 | ( 540) |
| | | | 0.99 | ( 420) | 2.17 | ( 409) | 2.17 | ( 499) | 2.17 | ( 488) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.07 | ( 521) | 2.30 | ( 635) | 2.21 | ( 628) |
| | | | 0.3 | ( 516) | 2.35 | ( 506) | 2.45 | ( 619) | 2.38 | ( 608) |
| | | | 0.5 | ( 504) | 2.44 | ( 491) | 2.48 | ( 603) | 2.45 | ( 591) |
| | | | 0.8 | ( 468) | 2.50 | ( 454) | 2.50 | ( 559) | 2.50 | ( 545) |
| | | | 0.99 | ( 420) | 2.51 | ( 407) | 2.51 | ( 502) | 2.51 | ( 489) |
| 2nd | Power | (0.2, 0.2) | 0.0 | ( 528) | 74.4 | ( 454) | 91.4 | ( 628) | 85.5 | ( 571) |
| | | | 0.3 | ( 516) | 74.3 | ( 435) | 91.1 | ( 600) | 85.1 | ( 543) |
| | | | 0.5 | ( 504) | 74.4 | ( 418) | 90.9 | ( 578) | 84.8 | ( 520) |
| | | | 0.8 | ( 468) | 73.8 | ( 380) | 89.8 | ( 524) | 83.6 | ( 468) |
| | | | 0.99 | ( 420) | 74.0 | ( 332) | 89.2 | ( 458) | 82.6 | ( 405) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.05 | ( 528) | 0.05 | ( 594) | 0.05 | ( 593) |
| | | | 0.3 | ( 516) | 0.21 | ( 516) | 0.22 | ( 592) | 0.22 | ( 591) |
| | | | 0.5 | ( 504) | 0.43 | ( 503) | 0.43 | ( 585) | 0.44 | ( 585) |
| | | | 0.8 | ( 468) | 1.07 | ( 467) | 1.08 | ( 555) | 1.08 | ( 554) |
| | | | 0.99 | ( 420) | 2.17 | ( 417) | 2.15 | ( 511) | 2.15 | ( 508) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.12 | ( 526) | 2.32 | ( 649) | 2.28 | ( 647) |
| | | | 0.3 | ( 516) | 2.39 | ( 513) | 2.44 | ( 633) | 2.43 | ( 630) |
| | | | 0.5 | ( 504) | 2.47 | ( 500) | 2.48 | ( 618) | 2.48 | ( 614) |
| | | | 0.8 | ( 468) | 2.51 | ( 464) | 2.50 | ( 573) | 2.50 | ( 570) |
| | | | 0.99 | ( 420) | 2.49 | ( 416) | 2.51 | ( 514) | 2.51 | ( 511) |
| 3rd | Power | (0.2, 0.2) | 0.0 | ( 528) | 79.4 | ( 455) | 91.8 | ( 549) | 91.1 | ( 545) |
| | | | 0.3 | ( 516) | 79.6 | ( 437) | 91.6 | ( 525) | 91.0 | ( 522) |
| | | | 0.5 | ( 504) | 79.9 | ( 422) | 91.3 | ( 508) | 90.7 | ( 503) |
| | | | 0.8 | ( 468) | 79.5 | ( 387) | 90.4 | ( 464) | 89.8 | ( 459) |
| | | | 0.99 | ( 420) | 79.8 | ( 342) | 89.7 | ( 407) | 89.2 | ( 403) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.05 | ( 528) | 0.05 | ( 594) | 0.05 | ( 594) |
| | | | 0.3 | ( 516) | 0.22 | ( 516) | 0.22 | ( 592) | 0.22 | ( 592) |
| | | | 0.5 | ( 504) | 0.43 | ( 504) | 0.43 | ( 587) | 0.43 | ( 587) |
| | | | 0.8 | ( 468) | 1.09 | ( 467) | 1.08 | ( 558) | 1.08 | ( 558) |
| | | | 0.99 | ( 420) | 2.17 | ( 419) | 2.15 | ( 515) | 2.16 | ( 514) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.14 | ( 527) | 2.30 | ( 653) | 2.30 | ( 653) |
| | | | 0.3 | ( 516) | 2.41 | ( 514) | 2.45 | ( 637) | 2.47 | ( 636) |
| | | | 0.5 | ( 504) | 2.48 | ( 502) | 2.49 | ( 622) | 2.49 | ( 621) |
| | | | 0.8 | ( 468) | 2.50 | ( 466) | 2.50 | ( 577) | 2.52 | ( 577) |
| | | | 0.99 | ( 420) | 2.49 | ( 419) | 2.48 | ( 518) | 2.50 | ( 518) |

**Table S4**. Impact of sample size recalculation on the power and Type I error rate. The planned MSS per intervention group is calculated to detect the joint effect for two endpoints with the overall power of 80% at the one-sided significance level of 2.5%, where three interims and one final analysis are to be performed at equal time intervals and the critical values are determined by the OF boundary for both endpoints with the LD alpha-spending method. The upper limit of recalculation sample size is $n_2' = \lambda n_2$ with $\lambda = 1.5$. The number of replications for simulation is set to 1,000,000 for evaluation of the Type I error rate and 100,000 replications for the power. (DF-2)

| Interim analysis | Power/ Type I error rate | Mean difference $(\delta_1, \delta_2)$ | Correlation (MSS) | | (i) Only decreasing sample size (ASN) | | (ii) Only increasing sample Size (ASN) | | (iii) Increasing or decreasing sample size (ASN) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1st | Power | (0.2, 0.2) | 0.0 | ( 528) | 71.8 | ( 459) | 89.2 | ( 655) | 80.6 | ( 585) |
| | | | 0.3 | ( 516) | 70.2 | ( 433) | 88.4 | ( 626) | 78.7 | ( 547) |
| | | | 0.5 | ( 504) | 69.4 | ( 413) | 88.2 | ( 606) | 77.4 | ( 519) |
| | | | 0.8 | ( 468) | 68.0 | ( 372) | 87.5 | ( 559) | 75.4 | ( 463) |
| | | | 0.99 | ( 420) | 67.0 | ( 319) | 87.0 | ( 494) | 73.6 | ( 394) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.06 | ( 527) | 0.06 | ( 591) | 0.06 | ( 591) |
| | | | 0.3 | ( 516) | 0.23 | ( 510) | 0.23 | ( 582) | 0.23 | ( 580) |
| | | | 0.5 | ( 504) | 0.45 | ( 497) | 0.45 | ( 574) | 0.45 | ( 571) |
| | | | 0.8 | ( 468) | 1.09 | ( 461) | 1.09 | ( 546) | 1.08 | ( 540) |
| | | | 0.99 | ( 420) | 2.17 | ( 409) | 2.17 | ( 499) | 2.17 | ( 489) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.17 | ( 521) | 2.36 | ( 635) | 2.29 | ( 628) |
| | | | 0.3 | ( 516) | 2.39 | ( 502) | 2.47 | ( 613) | 2.41 | ( 603) |
| | | | 0.5 | ( 504) | 2.45 | ( 488) | 2.49 | ( 598) | 2.46 | ( 585) |
| | | | 0.8 | ( 468) | 2.50 | ( 454) | 2.50 | ( 559) | 2.49 | ( 545) |
| | | | 0.99 | ( 420) | 2.50 | ( 407) | 2.50 | ( 502) | 2.50 | ( 489) |
| 2nd | Power | (0.2, 0.2) | 0.0 | ( 528) | 74.8 | ( 453) | 91.5 | ( 629) | 86.0 | ( 571) |
| | | | 0.3 | ( 516) | 74.3 | ( 431) | 90.9 | ( 597) | 85.1 | ( 540) |
| | | | 0.5 | ( 504) | 74.4 | ( 414) | 90.7 | ( 574) | 84.8 | ( 516) |
| | | | 0.8 | ( 468) | 74.0 | ( 380) | 89.9 | ( 524) | 83.7 | ( 467) |
| | | | 0.99 | ( 420) | 73.9 | ( 332) | 89.1 | ( 458) | 82.7 | ( 405) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.06 | ( 528) | 0.06 | ( 594) | 0.06 | ( 593) |
| | | | 0.3 | ( 516) | 0.23 | ( 512) | 0.23 | ( 587) | 0.23 | ( 587) |
| | | | 0.5 | ( 504) | 0.45 | ( 499) | 0.45 | ( 581) | 0.45 | ( 580) |
| | | | 0.8 | ( 468) | 1.08 | ( 466) | 1.08 | ( 555) | 1.08 | ( 554) |
| | | | 0.99 | ( 420) | 2.17 | ( 417) | 2.16 | ( 511) | 2.17 | ( 508) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.21 | ( 526) | 2.38 | ( 649) | 2.37 | ( 647) |
| | | | 0.3 | ( 516) | 2.42 | ( 509) | 2.48 | ( 628) | 2.46 | ( 625) |
| | | | 0.5 | ( 504) | 2.47 | ( 496) | 2.50 | ( 613) | 2.48 | ( 609) |
| | | | 0.8 | ( 468) | 2.51 | ( 464) | 2.51 | ( 573) | 2.49 | ( 570) |
| | | | 0.99 | ( 420) | 2.49 | ( 416) | 2.50 | ( 514) | 2.50 | ( 511) |
| 3rd | Power | (0.2, 0.2) | 0.0 | ( 528) | 79.7 | ( 453) | 91.9 | ( 549) | 91.1 | ( 544) |
| | | | 0.3 | ( 512) | 79.2 | ( 434) | 91.3 | ( 525) | 90.7 | ( 518) |
| | | | 0.5 | ( 500) | 79.5 | ( 419) | 91.1 | ( 506) | 90.5 | ( 500) |
| | | | 0.8 | ( 468) | 79.6 | ( 387) | 90.4 | ( 463) | 89.7 | ( 460) |
| | | | 0.99 | ( 420) | 79.9 | ( 342) | 89.7 | ( 407) | 89.1 | ( 403) |
| | Type I error rate | (0.0, 0.0) | 0.0 | ( 528) | 0.06 | ( 528) | 0.06 | ( 594) | 0.06 | ( 594) |
| | | | 0.3 | ( 512) | 0.23 | ( 512) | 0.23 | ( 588) | 0.23 | ( 588) |
| | | | 0.5 | ( 500) | 0.45 | ( 500) | 0.46 | ( 582) | 0.45 | ( 582) |
| | | | 0.8 | ( 468) | 1.09 | ( 467) | 1.08 | ( 558) | 1.08 | ( 558) |
| | | | 0.99 | ( 420) | 2.16 | ( 419) | 2.18 | ( 514) | 2.16 | ( 514) |
| | | (0.0, 0.2) | 0.0 | ( 528) | 2.23 | ( 527) | 2.39 | ( 653) | 2.41 | ( 653) |
| | | | 0.3 | ( 512) | 2.44 | ( 510) | 2.48 | ( 632) | 2.47 | ( 632) |
| | | | 0.5 | ( 500) | 2.48 | ( 498) | 2.49 | ( 617) | 2.49 | ( 616) |
| | | | 0.8 | ( 468) | 2.51 | ( 466) | 2.50 | ( 577) | 2.51 | ( 577) |
| | | | 0.99 | ( 420) | 2.51 | ( 419) | 2.50 | ( 518) | 2.49 | ( 518) |