Supplementary File 4. Futility Analysis

Conditional Power and Sample Size Reestimation of Superiority by a Margin Tests for Two Proportions

Numeric Results

Solve For:	Conditional Power	
Groups:	1 = Reference, 2 = Treatment	
Test Type:	Two-Sample Z-Test	
Higher Proportions Are:	Better	
Hypotheses:	H0: δ ≤ δ0 vs. H1: δ > δ0	

Power		Sample Size					Proportion			Difference				
		Target			Look k		Ref.	Superiority	Actual	Superiority	Actual	Test Statistic		
Conditional	Predictive	N1	N2	N	n1k	n2k	P1	P2.0	P2.1	δ0	δ1	Zk	Alpha	Futility
0.00001	0.00369	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	-1.00	0.05	0.99999
0.00002	0.00650	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	-0.85	0.05	0.99998
0.00031	0.08449	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	0.00	0.05	0.99969
0.00490	0.47133	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	1.00	0.05	0.99510
0.00008	0.00877	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	-1.00	0.10	0.99992
0.00013	0.01464	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	-0.85	0.10	0.99987
0.00161	0.14193	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	0.00	0.10	0.99839
0.01746	0.59169	18	27	45	8	10	0.5	0.9	0.65	0.4	0.15	1.00	0.10	0.98254

Conditional Power	The probability of rejecting a false null hypothesis at the end of the study given the data that have emerged so far.
Predictive Power	The result of averaging the conditional power over the posterior distribution of the effect size.
N1, N2, and N	The target sample sizes at the end of the study of groups 1, 2, and both, respectively.
n1k and n2k	The sample sizes of groups 1 and 2 through stage k, respectively.
P1	The response proportion for group 1.
P2.0	The superiority proportion for group 2 used to compute δ0.
P2.1	The actual proportion for group 2 to detect under the alternative hypothesis used to compute δ1.
δ	The difference in proportions. δ = P2 - P1.
δ0	The superiority difference used to construct the hypotheses. δ0 = P2.0 - P1.
δ1	The actual difference to detect under the alternative hypothesis at which conditional power is calculated. δ1 = P2.1 - P1.
Zk	The value of the test statistic from the observed data at stage k.
Alpha	The probability of rejecting a true null hypothesis.
Futility	Equal to one minus the conditional power. A value greater than 0.9 or 0.8 indicates the study should be stopped because there is little chance of achieving statistical significance.

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Summary Statements

A parallel two-group design is used to test whether the Group 2 (treatment) proportion (P2) is superior to the Group 1 (reference) proportion (P1) by a margin, with a superiority margin of $\delta 0 = P2.0 - P1 = 0.9 - 0.5 = 0.4$ (H0: $\delta \leq 0.4$ versus H1: $\delta > 0.4$, $\delta = P2 - P1$). The comparison is made using a one-sided, two-sample Z-test, with a Type I error rate (α) of 0.05. The desired difference to detect is $\delta 1 = P2.1 - P1 = 0.65 - 0.5 = 0.15$. With current sample sizes of $n1k = 8$ and $n2k = 10$ out of target sample sizes of 18 and 27, respectively, and with a current z-value of -1, the conditional power is 0.00001. The predictive power is 0.00369, and the futility index is 0.99999. The conditional power was computed using PASS 2024, version 24.0.2.

References

Jennison, C., and Turnbull, B.W. 2000. Group Sequential Methods with Applications to Clinical Trials. Chapman & Hall/CRC. New York.
Proschan, M., Lan, K.K.G., Wittes, J.T. 2006. Statistical Monitoring of Clinical Trials. Springer. New York.
Chang, Mark. 2008. Classical and Adaptive Clinical Trial Designs. John Wiley & Sons. Hoboken, New Jersey.
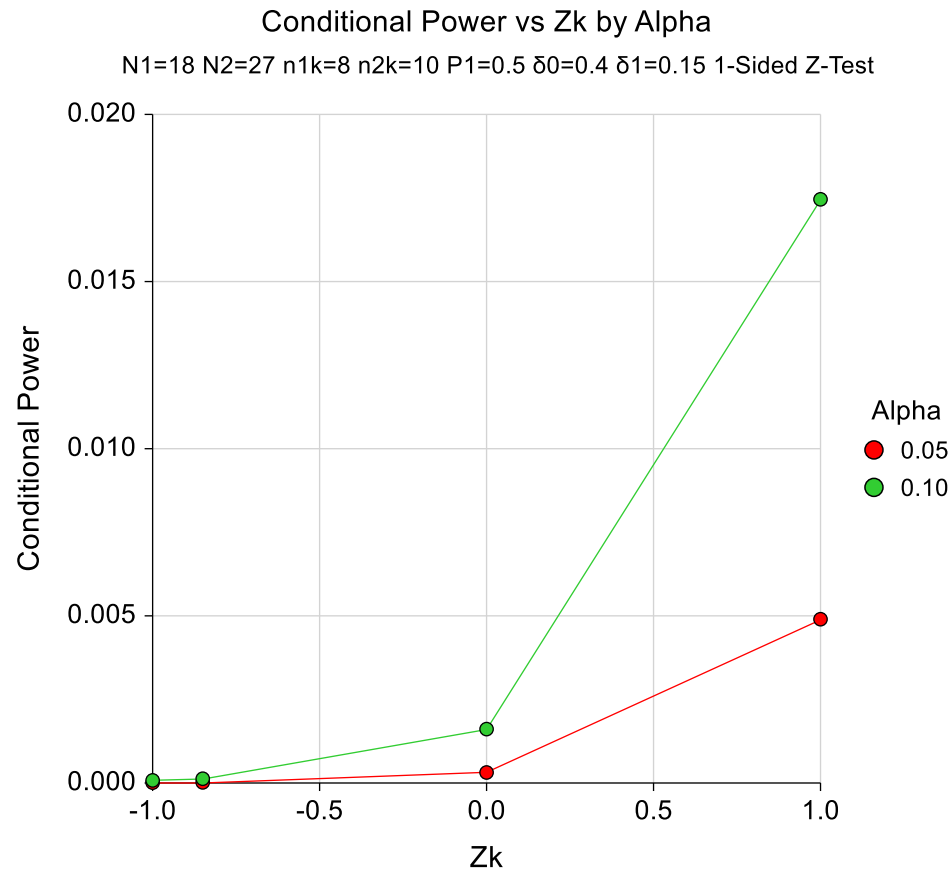Chang, Mark. 2014. Adaptive Design Theory and Implementation Using SAS and R. CRC Press. New York.

Citation

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Plots

Conditional Power vs Zk by Alpha
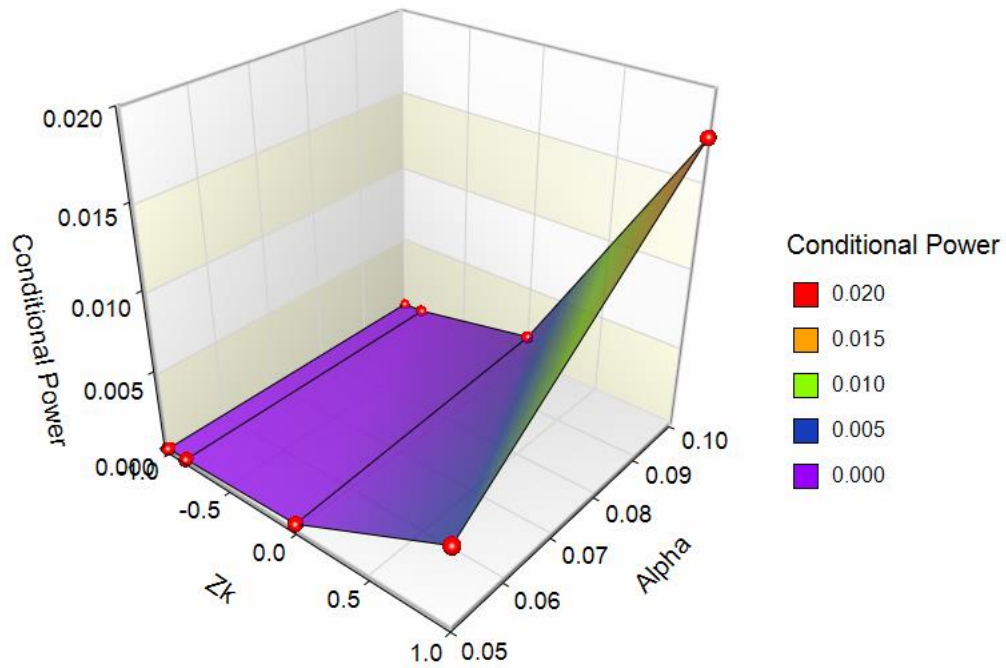
N1=18 N2=27 n1k=8 n2k=10 P1=0.5 δ0=0.4 δ1=0.15 1-Sided Z-Test

Conditional Power and Sample Size Reestimation of Superiority by a Margin Tests for Two Proportions

Conditional Power vs Zk and Alpha

N1=18 N2=27 n1k=8 n2k=10 P1=0.5 δ0=0.4 δ1=0.15 1-Sided Z-Test

Conditional Power and Sample Size Reestimation of Superiority by a Margin Tests for Two Proportions

Procedure Input Settings

C:\Users\Warren Bacorro\OneDrive\Documents\PASS 2024\Procedure Settings\Autosave\Conditional Power and Sample Size Reestimation of
Superiority by a Margin Tests for Two Proportions - Autosaved 2024_8_31-12_21_58.t523

Design Tab

Solve For:	Conditional Power
Higher Proportions Are:	Better (H1: $\delta > \delta_0$)
Alpha:	0.05 0.1
N1 (Group 1 Target Sample Size):	18
N2 (Group 2 Target Sample Size):	27
R (Sample Allocation Ratio):	0.67
n1k (Group 1 Sample Size at Look k):	8
n2k (Group 2 Sample Size at Look k):	10
Input Type:	Differences
P1 (Group 1 Proportion):	0.5
δ_0 (Superiority Difference):	0.4
δ_1 (Actual Difference to Detect):	0.15
Zk (Current Test Statistic):	-1 -0.85 0 1