연구의 검정력 평가
G*Power를 활용한 표본수 추정

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Anesthesiology and Pain Medicine
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Vancouver guideline

It is essential that authors specify which statistical methods they used.

"Describe statistical methods with enough detail to enable a know

표본수의 산정 또한 동일한 원칙을 견지하여야 함.

to verify the reported result"

식견이 많은 독자가 원래의 자료를 가지고 연구결과를 증명할 수 있을 정도로 충분하고 자세한 통계적 방법을 기술하라.

International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals, *Journal of the American Medical Association, 1997; 277: 927-934 .*

표본수 산정의 기술이 잘못된 경우

1) 임의로 연구 대상수의 결정

2) 표본수를 계산하는데 필요한 요인에 대한 내용의 언급이 없는 경우

3) 표본수를 계산하는데 필요한 요인이 있으나, 그 근거의 제시가 없는 경우

4) 근거가 제시 되어 있으나, 받아들이기 힘든 경우

5) 모든 요인이 있으나, 잘못 계산된 경우

Beyond Effect Size: Consideration of the Minimum Effect Size of Interest in Anesthesia Trials

Neville M. Gibbs, MD, FANZCA, and William M. Weightman, MB, FANZCA

outcome.[b5,6] After careful consideration of all factors, including drug costs, they decide that the minimum clinically worthwhile difference or 'threshold for clinical relevance' is 10 mm Hg. This is their minimum effect size of interest.

difference between the new drug versus control. They accept a type I error rate of 5% ($\alpha = 0.05$; i.e., $P < 0.05$ will be considered significant), and a type II error rate of 20% ($\beta = 0.2$, i.e., power = 80% [power = the probability of getting a statistically significant result if there is a true difference $\geq$ the specified minimum effect size of interest]).[1–4] They anticipate that the SD in both groups will be about 10 mm Hg. With these variables they require $n = 16$ in each group.[7] (If they had chosen a minimum effect size of interest = 5 mm Hg, they would have required $n = 63$ in each group; alternatively, with $n = 16$ in each group, their power would be reduced to around 29%.)[7]

THE ROLE OF THE MINIMUM EFFECT SIZE OF INTEREST IN THE INTERPRETATION OF CLINICAL TRIALS

Scenario 1: No Significant Difference

In a hypothetical scenario, the authors find that the mean difference is 6 mm Hg (95% CI −0.4 to 12.4 mm Hg), $P = 0.06$. They accept (or more correctly, fail to reject) their null

The importance of the minimum effect size of interest and power when interpreting nonsignificant findings becomes clearer when we consider the possibility of smaller true effect sizes. For example, let us say that the drug cost turns out to be lower than expected and that most clinicians would accept a 5 mm Hg difference as clinically worthwhile, rather than the 10 mm Hg used by the authors. How then does the information from this trial help them in their decision whether to use the drug? The answer is very little. The trial was designed to have sufficient probability of detecting a difference, given that the true difference is ≥ 10 mm Hg. It provides little information on the probability of detecting a difference, given a true difference <10 mm Hg.

Scenario 3: Significant Difference and Observed Effect < Mi

In yet another hypothetical scenario, the authors find a difference of 6 mm Hg (95% CI 0.3 to 11.7 mm Hg), $P = 0.04$. They correctly conclude that there is a statistically significant treatment effect. But what should they conclude about whether the effect is clinically worthwhile? The hypothesis they tested was that there was no difference between the groups (null). The P value <0.05 supports rejection of this hypothesis. However, it does not provide information on the likely magnitude of the effect or whether it is clinically worthwhile. To assess whether the observed effect size is worthwhile, it is necessary to refer to the minimum clinically worthwhile difference decided before the trial began, and which was entered as the minimum effect size of interest in the power calculation (in this case 10 mm Hg). Therefore, the correct conclusion is that while there is a statistically significant effect in this particular trial (i.e., $P < 0.05$), the observed effect (6 mm Hg) is too small to be clinically worthwhile (i.e., <10 mm Hg).

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Left ventric assessment echocardio

Statistics

A priori sample size determination was not possible as we had no reliable estimates of the variability of the differences in measurements between 2D and 3D TOE methods. We performed a *post hoc* power estimation of our data to detect a 10% difference in EDV, ESV, and EF.

The bias and precision (limits of agreement) of the three methods of measurements were compared using Bland–Altman analysis on a pairwise basis (i.e. 2D *vs* xPlane, 2D *vs* 3D, xPlane *vs* 3D). The methods were compared with pairwis

Reproducibility was ass variability. This was ex from a *t* distribution with *n* − 1 degrees of freedom) and limits of agreement of the difference between the two measurements. Pairwise comparisons of the mean differences (intra- and inter-observer) in EDV, ESV, and EF between the three methods of measurement were assessed with *t*-tests and differences in the standard deviation (i.e. a measure of variability) of the intra- and interobserver differences between the three methods of measurement were assessed with *F* tests.

Post hoc power analysis indicated our study had over 90% power to detect a 10% difference in EDVs and EFs and over 80% power to detect a 10% difference in ESVs (two-sided analysis and alpha value of 0.05).

The Holm–Sidak procedure was used to correct for multiple comparisons.[7]

All statistical analysis was performed using Stata™ 11 (Stata Corp LP, College Station, TX, USA).

JAMA The Journal of the American Medical Association

July 17, 200

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Scott D. Hal

JAMA. 2002

Despite long-standing critiques of the conduct of underpowered clinical trials, the practice not only remains widespread, but also has garnered increasing support. Patients and healthy volunteers continue to participate in research that may be of limited clinical value, and authors recently have offered 2 related arguments to support the validity and value of underpowered clinical trials: that meta-analysis may "save" small studies by providing a means to combine the results with those of other similar studies to enable estimates of an intervention's efficacy, and that although small studies may not provide a good basis for testing hypotheses, they may provide valuable estimates of treatment effects using confidence intervals. In this article, we examine these arguments in light of the distinctive moral issues associated with the conduct of underpowered trials, the disclosures that are owed to potential participants in underpowered trials so they may make autonomous enrollment decisions, and the circumstances in which the prospects for future meta-analyses may justify individually underpowered trials. We conclude that underpowered trials are ethical in only 2 situations: small trials of interventions for rare diseases in which investigators document explicit plans for including their results with those of similar trials in a prospective meta-analysis, and early-phase trials in the development of drugs or devices, provided they are adequately powered for defined purposes other than randomized treatment comparisons. In both cases, investigators must inform prospective subjects that their participation may only indirectly contribute to future health care benefits.

❑ *Rare disease*

Very low incidence: Logistically feasible to recruit enough participants?

Treatments for congenitally abnormal fetuses: Fetal hydrothorax
- Incidence: 1 in 10,000 pregnancies
- p value: 0.05
- β: 0.05
- 10% reduction in mortality (40% to 30%)

For 600 patients/group
Recruitment pool: 12,000,000

❑ *First-in-Human Drug Trials*

- Limited knowledge regarding proper dosing
- Potential for serious adverse events
- Should be a pre-determined plan for larger (adequately powered) phase III trial (ref.) if the drug is successful

Example 1

단일 비율에 대한 표본수 계산

두 종류의 진통제의 효과를 비교한 실험
B에비한 A약의 선호도 70%이상
유의수준 5%
검정력 90%
양측검정

H0 (귀무가설): B에대한 A약의 선호도 50%

Example 1

단일 비율에 대한 표본수 계산

모비율 p의 100(1−α)% 구간추정
표본의 크기가 충분히 큰 경우

$$\left[\hat{p} - z_{\alpha/2} \bullet \sqrt{\frac{\hat{p}(1-\hat{p})}{n}},\ \hat{p} + z_{\alpha/2} \bullet \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right]$$

Example 1

단일 비율에 대한 표본수 계산 (n=20)

귀무가설하에서 표본수 20명일 경우 95%의 구간추정

$$\hat{p} = 0.5$$

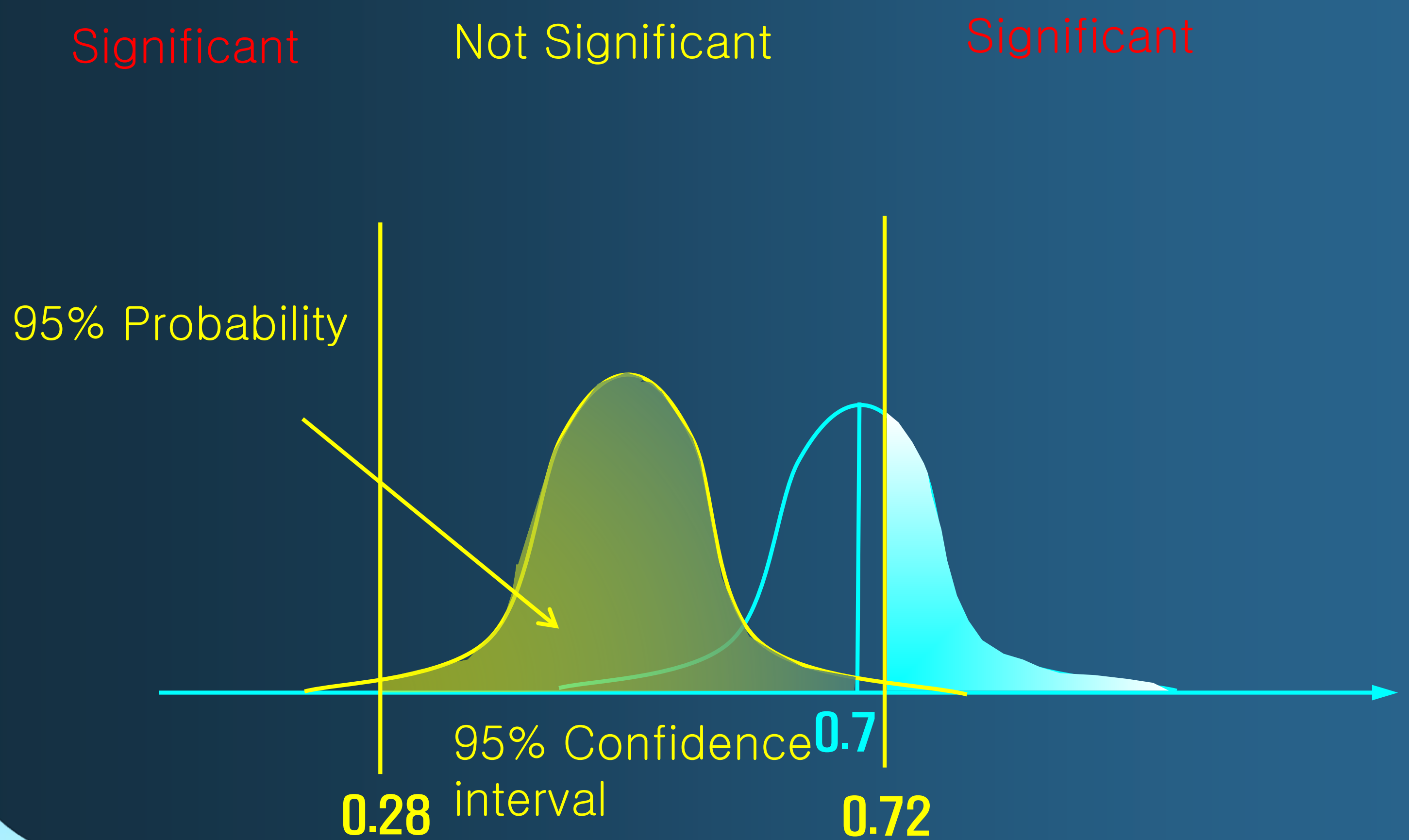
$$Z_{\alpha/2} = 1.96$$

$$n = 20$$

$$\left[0.5 - 1.96 \bullet \sqrt{\frac{0.5(1-0.5)}{20}}, 0.5 + 1.96 \bullet \sqrt{\frac{0.5(1-0.5)}{20}}\right] = [0.28, 0.72]$$

Confidence interval

1) n = 20

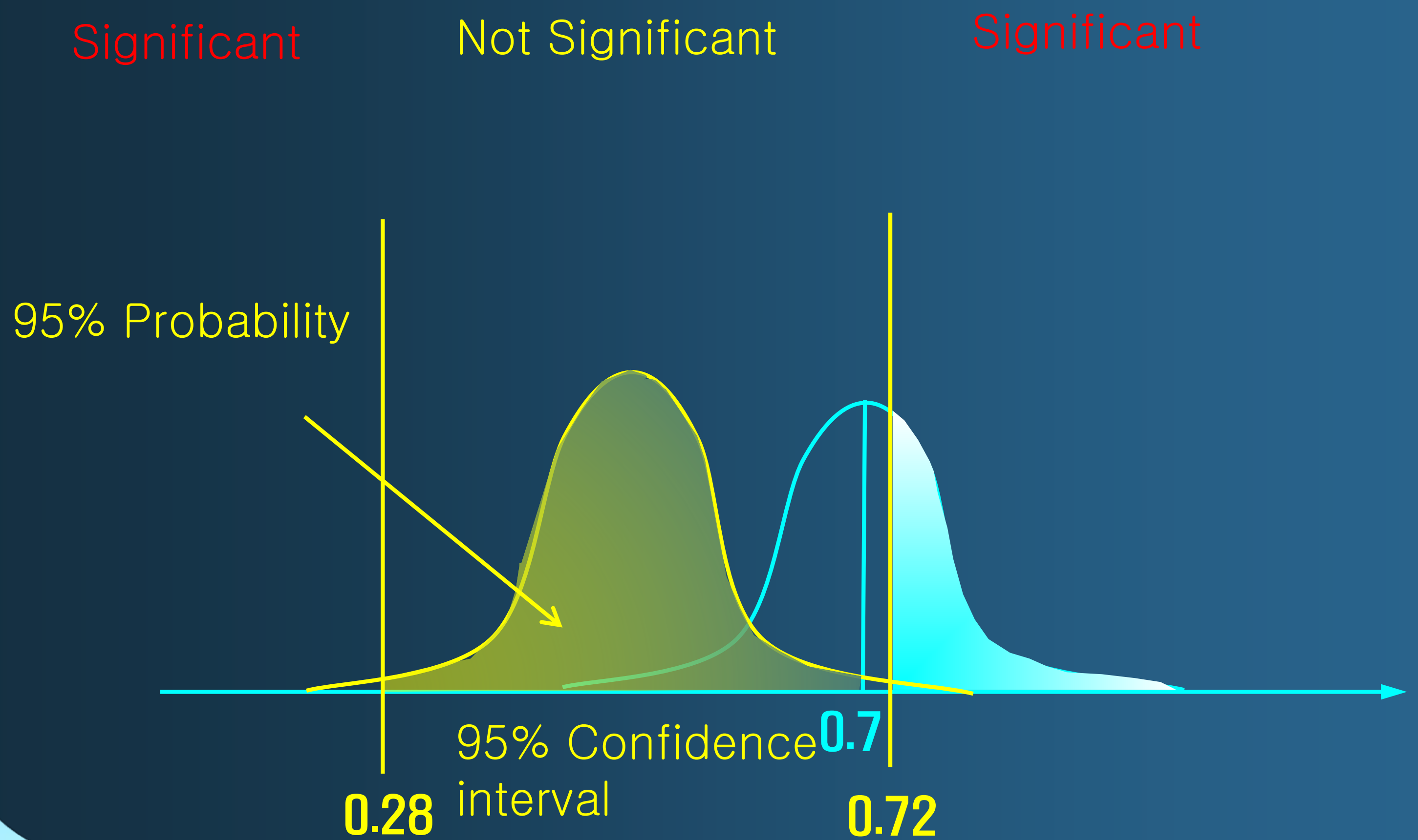


가설 검정시 발생 가능한 4가지 상황

모집단의 사실여부		표본을 이용한 의사결정	
		Accept H0	Reject H0
	H0 is true	Correct (신뢰수준, 1-α)	Type Ⅰ error (α)
	H0 is false	Type Ⅱ error (β)	Correct (검정력,1-β)

Confidence interval

1) n = 20



p가 0.7일 때 0.72이상일 확률

p가 0.7일 때
0.7을 중심으로 하는 정규분포곡선
표준오차

$$SE = \sqrt{\frac{(0.7 \times 0.3)}{20}} = 0.1025$$

0.72에 해당하는 z 값 (표준화)

$$z = \frac{0.72 - 0.7}{0.1025} = 0.20$$

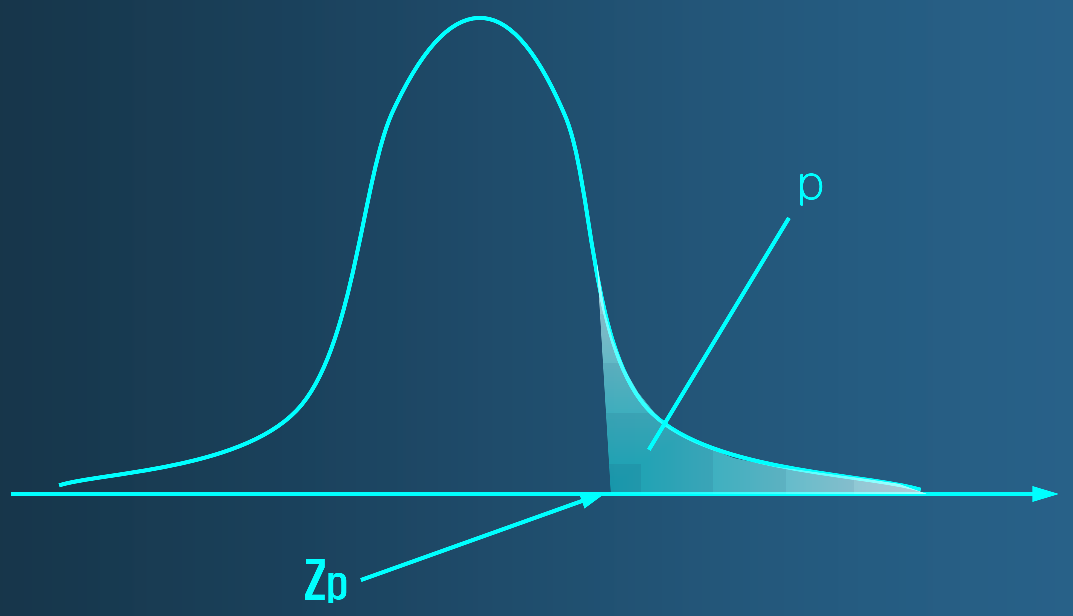
❑ 표준정규분포표

Z	0.00	0.01	0.02	0.03	0.04	0.05
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256
2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018
2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578
2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222
.						

Explanation of p-percentile

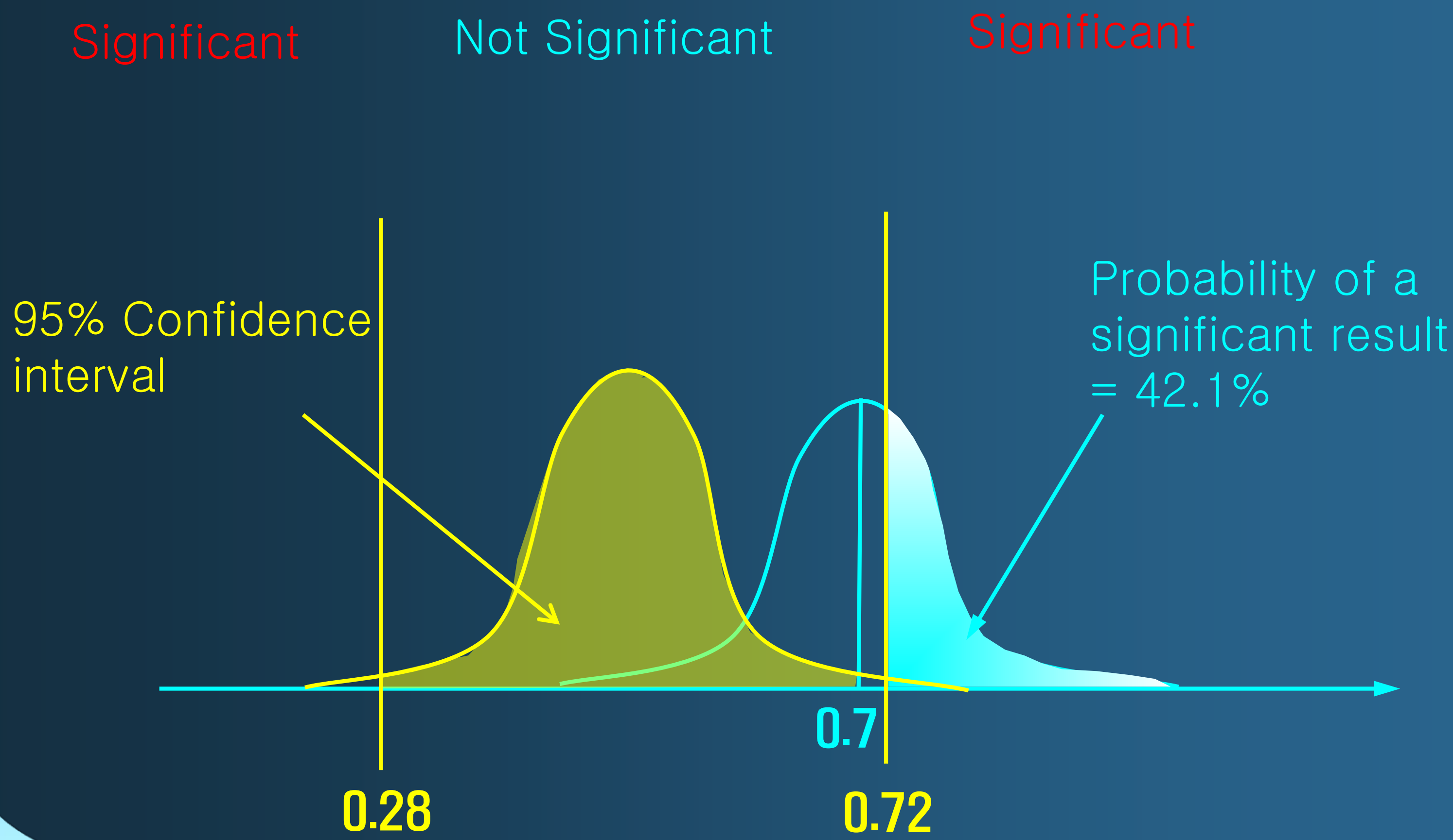
Probability density function of

standard normal distribution



Probabiltiy of obtaining a significant result with various sample size

1) n = 20



Example 1

단일 비율에 대한 표본수 계산 (n=50)

귀무가설하에서 표본수 50명일 경우 95%의 구간추정

$$\hat{p} = 0.5$$

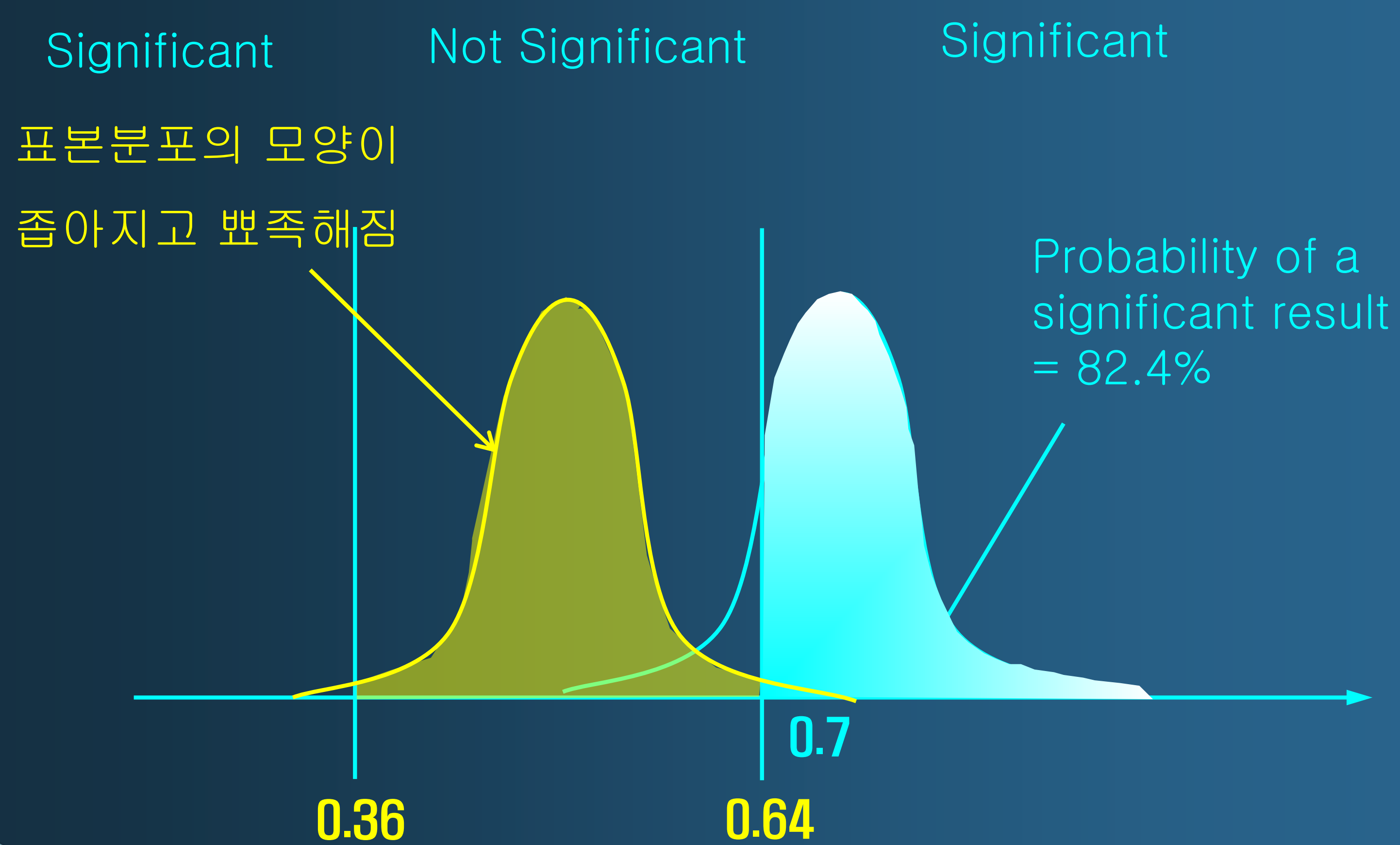
$$Z_{\alpha/2} = 1.96$$

$$n = 50$$

$$\left[0.5 - 1.96 \bullet \sqrt{\frac{0.5(1-0.5)}{50}}, 0.5 + 1.96 \bullet \sqrt{\frac{0.5(1-0.5)}{50}}\right] = [0.36, 0.64]$$

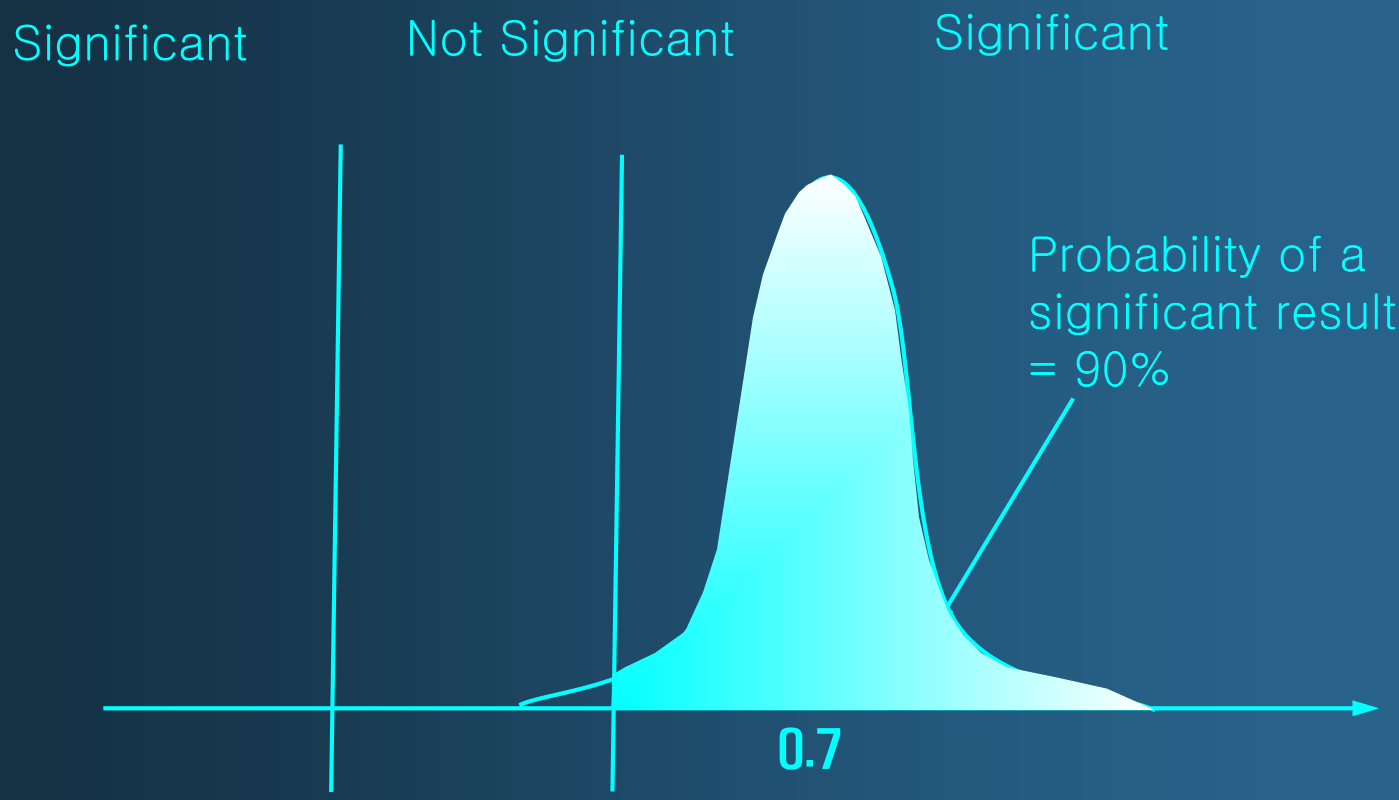
Probabiltiy of obtaining a significant result with various sample size

2) n = 50

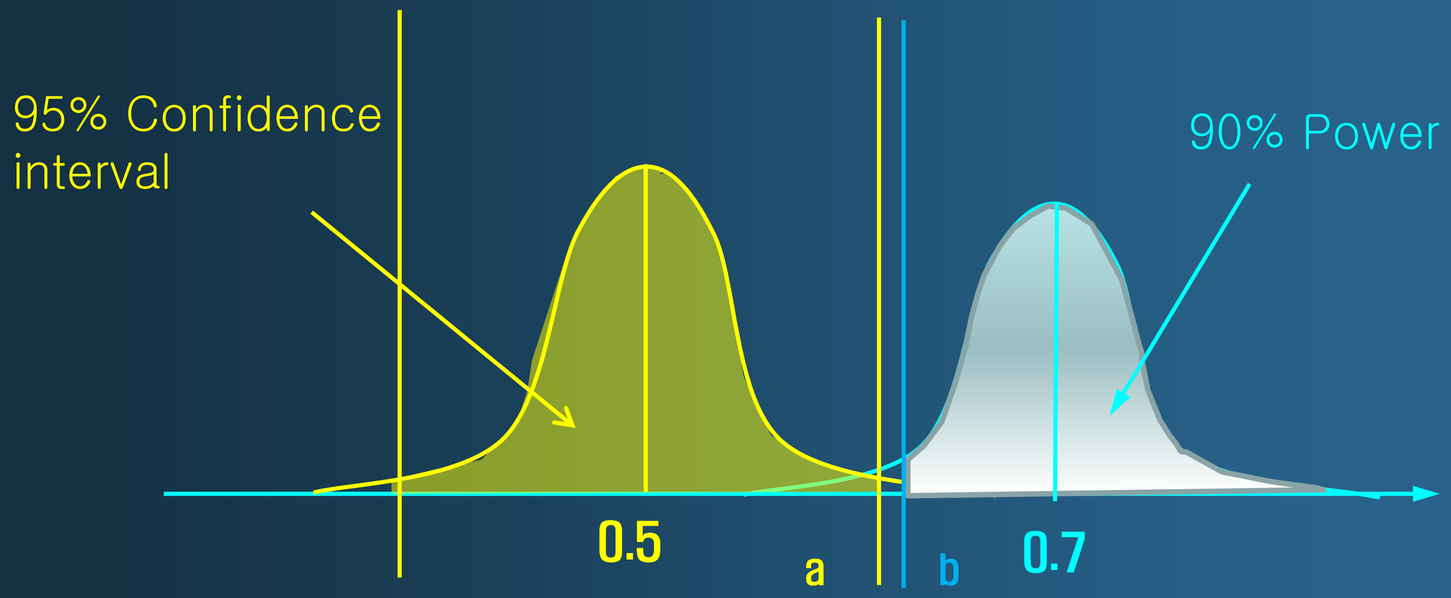


Probabiltiy of obtaining a significant result with various sample size

3) n = 62



단일 비율에 대한 표본수 계산



Example 1

단일 비율에 대한 표본수 계산

$$0.7 - 1.28 \times \sqrt{\frac{(0.7 \times 0.3)}{n}} > 0.5 + 1.96\sqrt{\frac{(0.5 \times 0.5)}{n}}$$

$$0.7 - 0.5 > \frac{1.96 \times \sqrt{(0.5 \times 0.5)} - 1.28 \times \sqrt{(0.7 \times 0.3)}}{\sqrt{n}}$$

$$\sqrt{n} > \frac{1.96 \times \sqrt{(0.5 \times 0.5)} - 1.28 \times \sqrt{(0.7 \times 0.3)}}{0.7 - 0.5}$$

$$n > \frac{\left[1.96 \times \sqrt{(0.5 \times 0.5)} - 1.28 \times \sqrt{(0.7 \times 0.3)}\right]^2}{(0.7 - 0.5)^2} = 61.4$$

Example 1

단일 비율에 대한 표본수 계산 공식

$$n > \frac{\left[\mu \times \sqrt{\pi(1-\pi)} - \upsilon \times \sqrt{\pi_0(1-\pi_0)}\right]^2}{(\pi - \pi_0)^2}$$

n = 요구되는 최소표본수

π = 관심비율

π_0 = 귀무가설에서 설정된비율

μ = 검정력에 해당하는정규분포의단측백분위점

υ = 유의수준에 해당하는정규분포의 백분위점

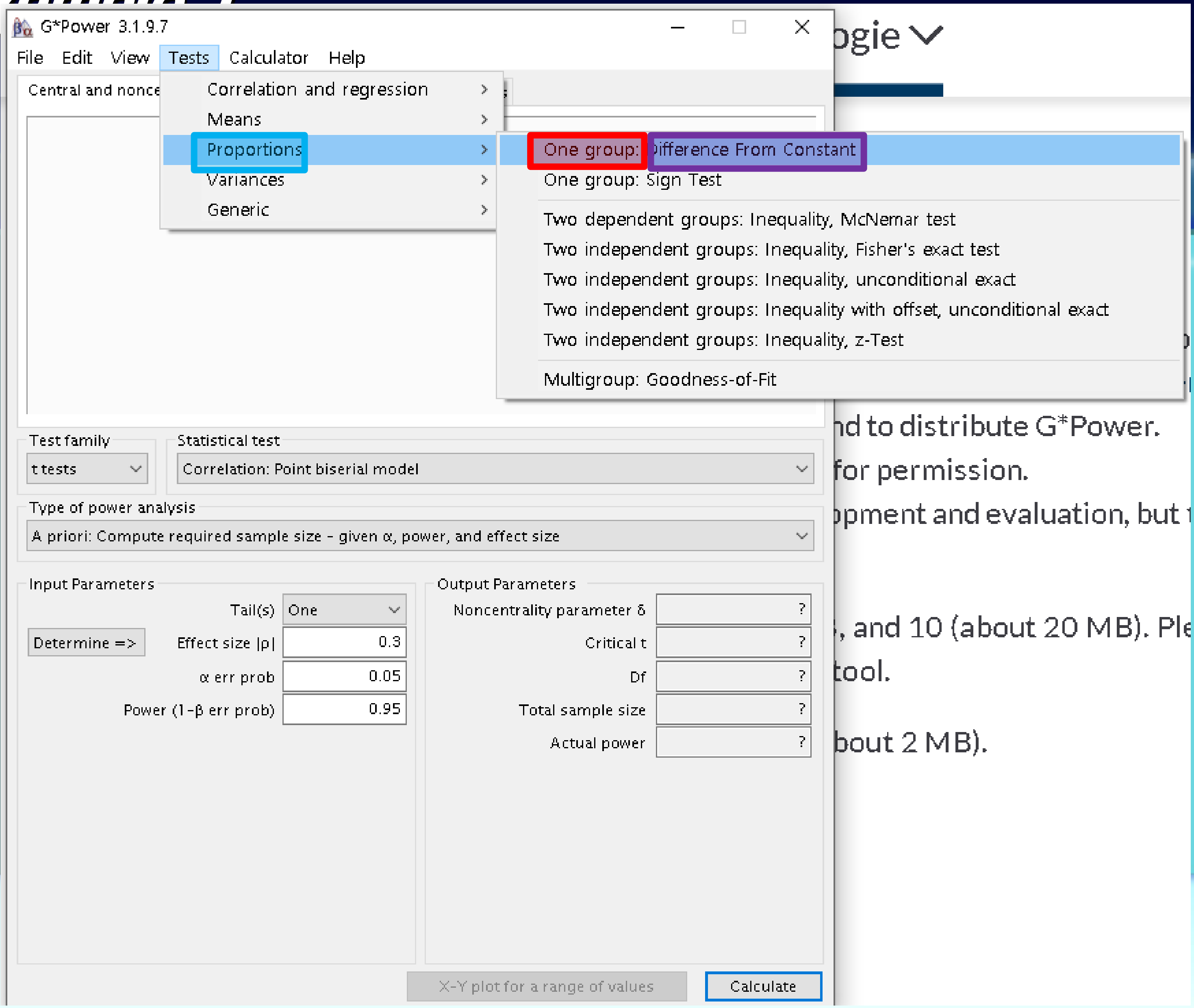
Example 1

단일 비율에 대한 표본수 계산

두 종류의 진통제의 효과를 비교한 실험
B에비한 A약의 선호도 70%이상
유의수준 5%
검정력 90%

H0 (귀무가설): B에대한 A약의 선호도 50%

Exemple 1


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Correlation and regression
Means
Proportions
Variances
Generic
One group: Difference From Constant
One group: Sign Test
Two dependent groups: Inequality, McNemar test
Two independent groups: Inequality, Fisher's exact test
Two independent groups: Inequality, unconditional exact
Two independent groups: Inequality with offset, unconditional exact
Two independent groups: Inequality, z-Test
Multigroup: Goodness-of-Fit
Test family
t tests
Statistical test
Correlation: Point biserial model
Type of power analysis
A priori: Compute required sample size - given α, power, and effect size
Input Parameters
Tail(s) One
Determine =>
Effect size |ρ| 0.3
α err prob 0.05
Power (1-β err prob) 0.95
Output Parameters
Noncentrality parameter δ ?
Critical t ?
Df ?
Total sample size ?
Actual power ?
X-Y plot for a range of values
Calculate
nd to distribute G*Power.
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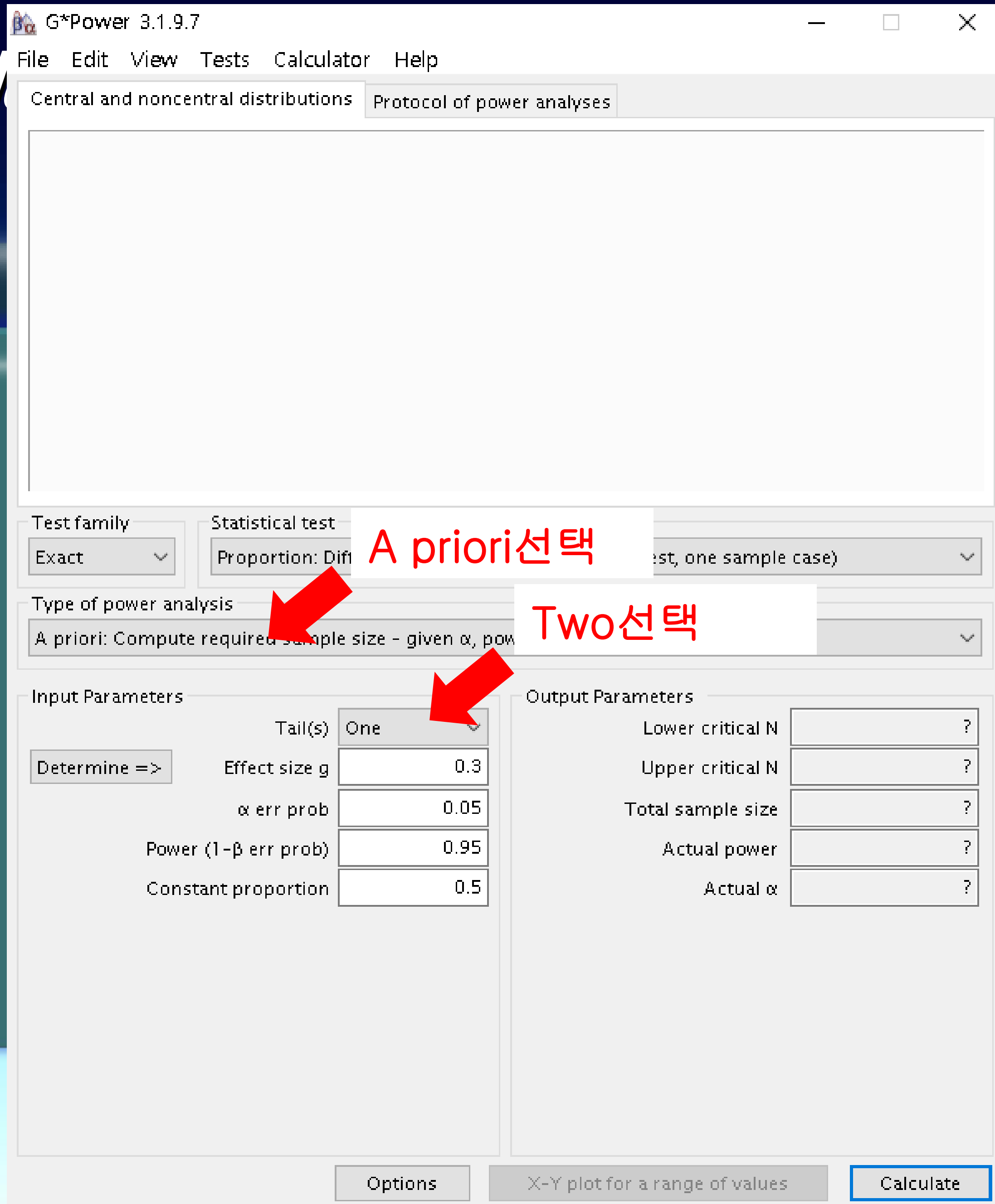
G*Power 3.1.9.7
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Central and noncentral distributions
Protocol of power analyses
Test family
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Statistical test
Proportion: Dif
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A priori선택
Type of power analysis
A priori: Compute required sample size – given α, pow
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Tail(s)
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Determine =>
Effect size g
0.3
α err prob
0.05
Power (1-β err prob)
0.95
Constant proportion
0.5
Output Parameters
Lower critical N
?
Upper critical N
?
Total sample size
?
Actual power
?
Actual α
?
Options
X-Y plot for a range of values
Calculate

Example 1

Table 2. Power analysis methods

Type	Independent variable	Dependent variable
1. A priori	Power (1-β), significance level (α), and effect size	N
2. Compromise	Effect size, N, q = β/α	Power (1-β), significance level (α)
3. Criterion	Power (1-β), effect size, N	Significance level (α), criterion
4. Post-hoc	Significance level (α), effect size, N	Power (1-β)
5. Sensitivity	Significance level (α), power (1-β), N	Effect size

N, sample size; q=β/α, error probability ratio, which indicates the relative proportionality or disproportionality of the 2 values.

An a priori analysis
- performed before conducting the study and at the design and planning stage of the study

Post-hoc analysis
-conducted after the completion of the study

The Abuse of Power: The Pervasive Fallacy of Power Calculations for Data Analysis

John M. H

Post H

Marc Levine

First publish

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Conclusion

Post hoc power analysis based on observed results from a negative study is inappropriate and should not be recommended by reviewers or editors. Instead, reviewers should focus on whether the a priori sample size estimate was reasonable and whether the study met the target enrollment. After results are obtained, confidence intervals should be used to estimate the magnitude of effects that are statistically consistent with the data.[6, 7] Thereafter, it is up to the authors to interpret the potential clinical importance or application of the findings with due regard for the observations of other investigators.

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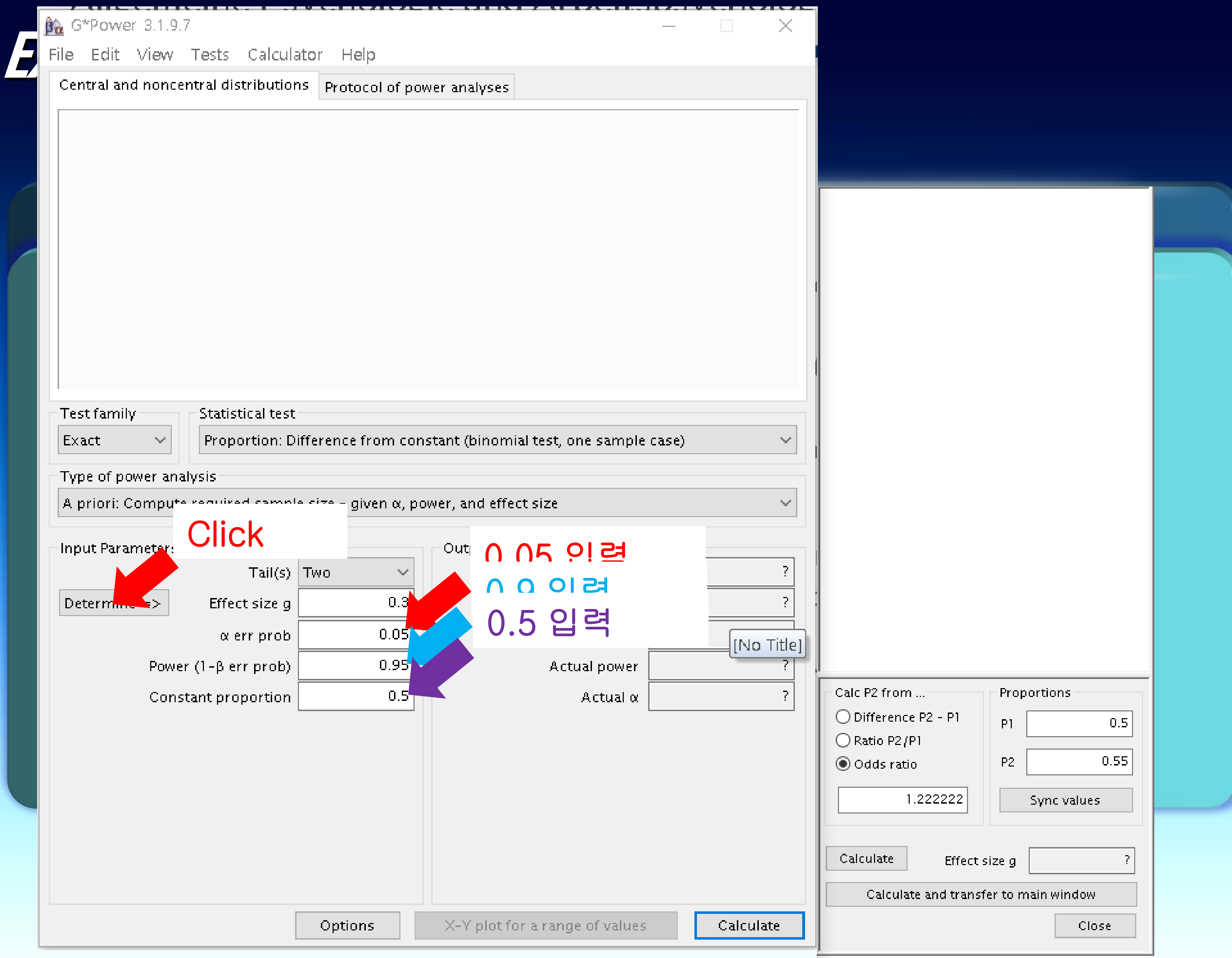
유의수준 5%
검정력 90%

H0 (귀무가설): B에대한 A약의 선호도 50%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Proportion: Difference from constant (binomial test, one sample case)
Type of power analysis
A priori: Compute required sample size – given α, power, and effect size
Input Parameters
Determine =>
Tail(s)
Two
Effect size g
0.3
α err prob
0.05
Power (1-β err prob)
0.95
Constant proportion
0.5
Actual power
?
Actual α
?
[No Title]
Click
0.05 입력
0.5 입력
Options
X-Y plot for a range of values
Calculate
Calc P2 from ...
Difference P2 - P1
Ratio P2/P1
Odds ratio
1.222222
Proportions
P1
0.5
P2
0.55
Sync values
Calculate
Effect size g
?
Calculate and transfer to main window
Close

Example 1

단일 비율에 대한 표본수 계산

두 종류의 진통제의 효과를 비교한 실험
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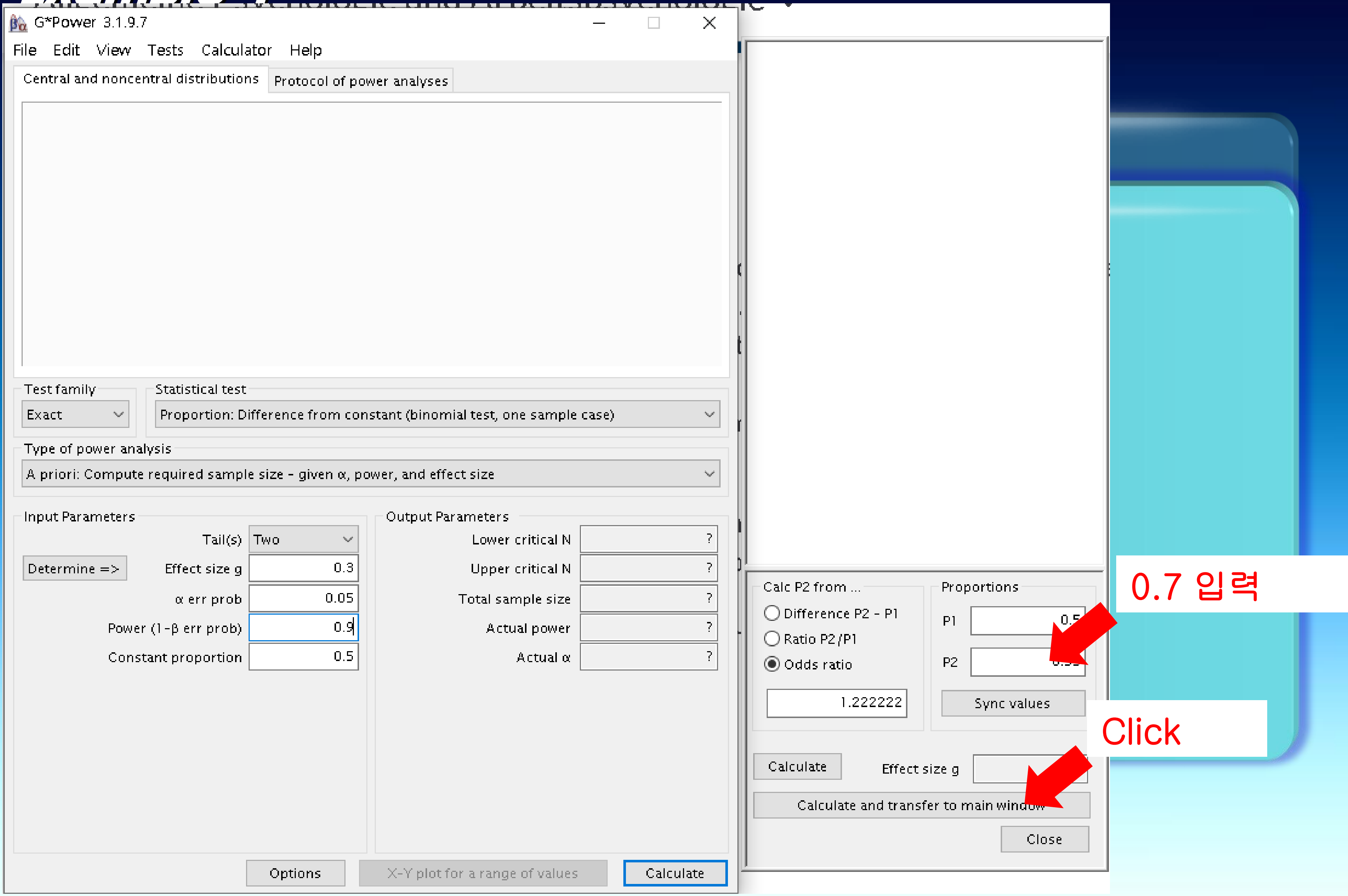
검정력 90%

H0 (귀무가설): B에대한 A약의 선호도 50%

Example 1


G*Power 3.1.9.7
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Tests
Calculator
Help
Central and noncentral distributions
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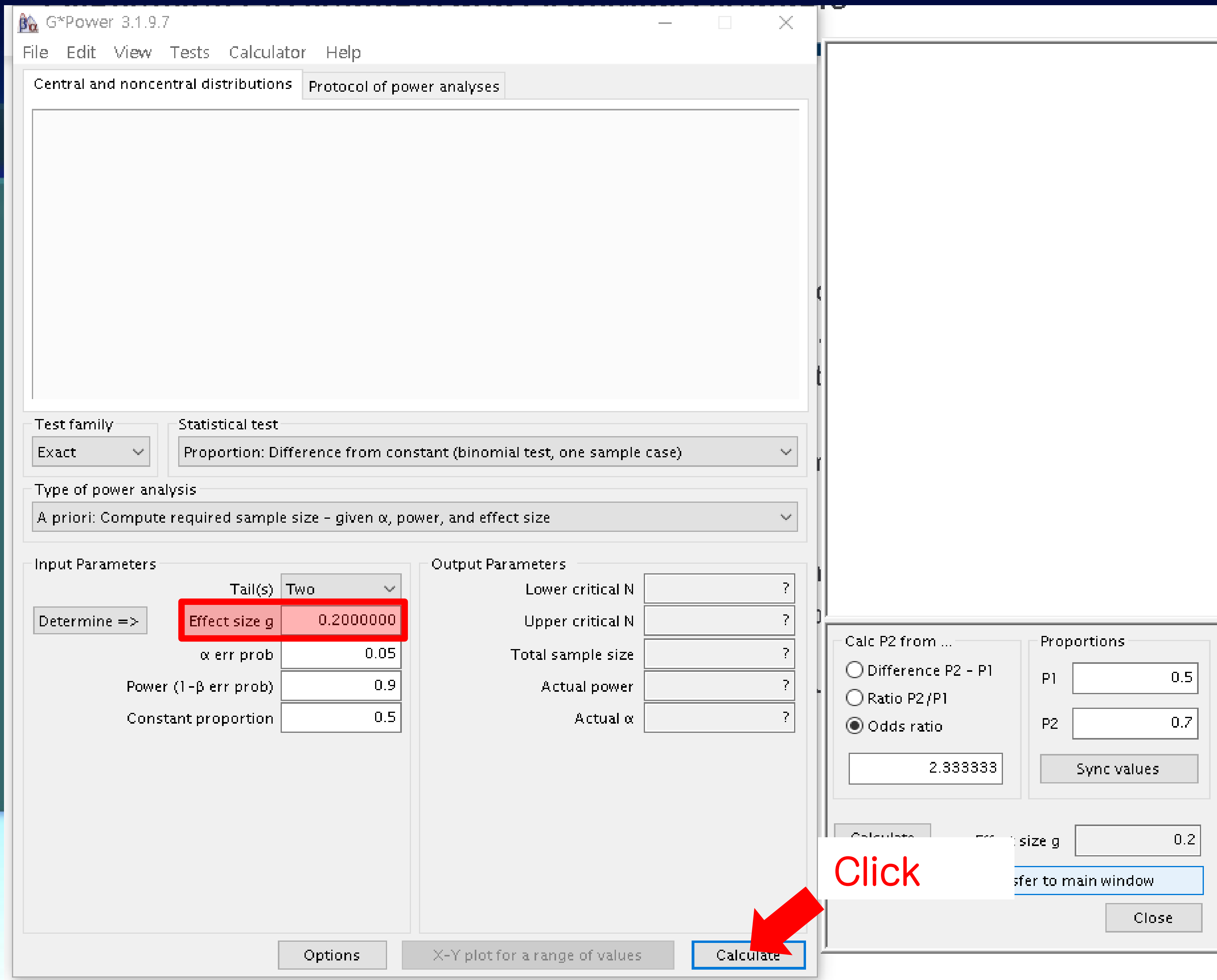
Determine =>
Effect size g
0.3
α err prob
0.05
Power (1-β err prob)
0.9
Constant proportion
0.5
Output Parameters
Lower critical N
Upper critical N
Total sample size
Actual power
Actual α
?
Options
X-Y plot for a range of values
Calculate
Calc P2 from ...
Difference P2 - P1
Ratio P2/P1
Odds ratio
1.222222
Proportions
P1
0.5
P2
Sync values
Calculate
Effect size g
Calculate and transfer to main window
Close
0.7 입력
Click

Example 1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File
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Statistical test
Proportion: Difference from constant (binomial test, one sample case)
Type of power analysis
A priori: Compute required sample size – given α, power, and effect size
Input Parameters
Tail(s)
Two
Determine =>
Effect size g
0.2000000
α err prob
0.05
Power (1-β err prob)
0.9
Constant proportion
0.5
Output Parameters
Lower critical N
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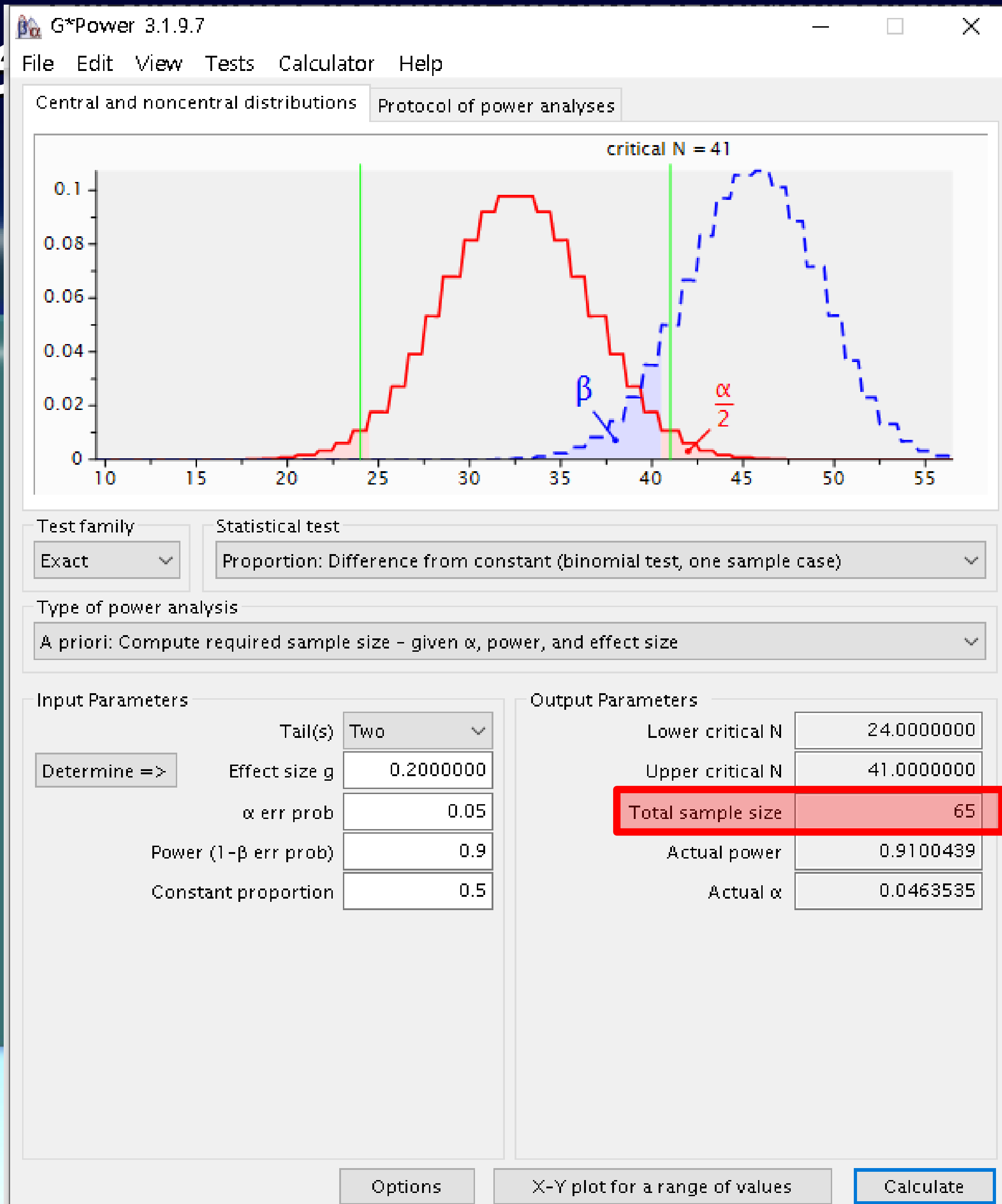
Upper critical N
?
Total sample size
?
Actual power
?
Actual α
?
Options
X-Y plot for a range of values
Calculate
Calc P2 from ...
Difference P2 - P1
Ratio P2/P1
Odds ratio
2.333333
Proportions
P1
0.5
P2
0.7
Sync values
size g
0.2
sfer to main window
Close
Click

Example



G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
critical N = 41
0.1
0.08
0.06
0.04
0.02
0
10 15 20 25 30 35 40 45 50 55
β
α/2
Test family
Exact
Statistical test
Proportion: Difference from constant (binomial test, one sample case)
Type of power analysis
A priori: Compute required sample size – given α, power, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size g 0.2000000
α err prob 0.05
Power (1-β err prob) 0.9
Constant proportion 0.5
Output Parameters
Lower critical N 24.0000000
Upper critical N 41.0000000
Total sample size 65
Actual power 0.9100439
Actual α 0.0463535
Options
X-Y plot for a range of values
Calculate

Example 1

단일 비율에 대한 표본수 계산

$$0.7-1.28\times\sqrt{\frac{(0.7\times0.3)}{n}} > 0.5+1.96\sqrt{\frac{(0.5\times0.5)}{n}}$$

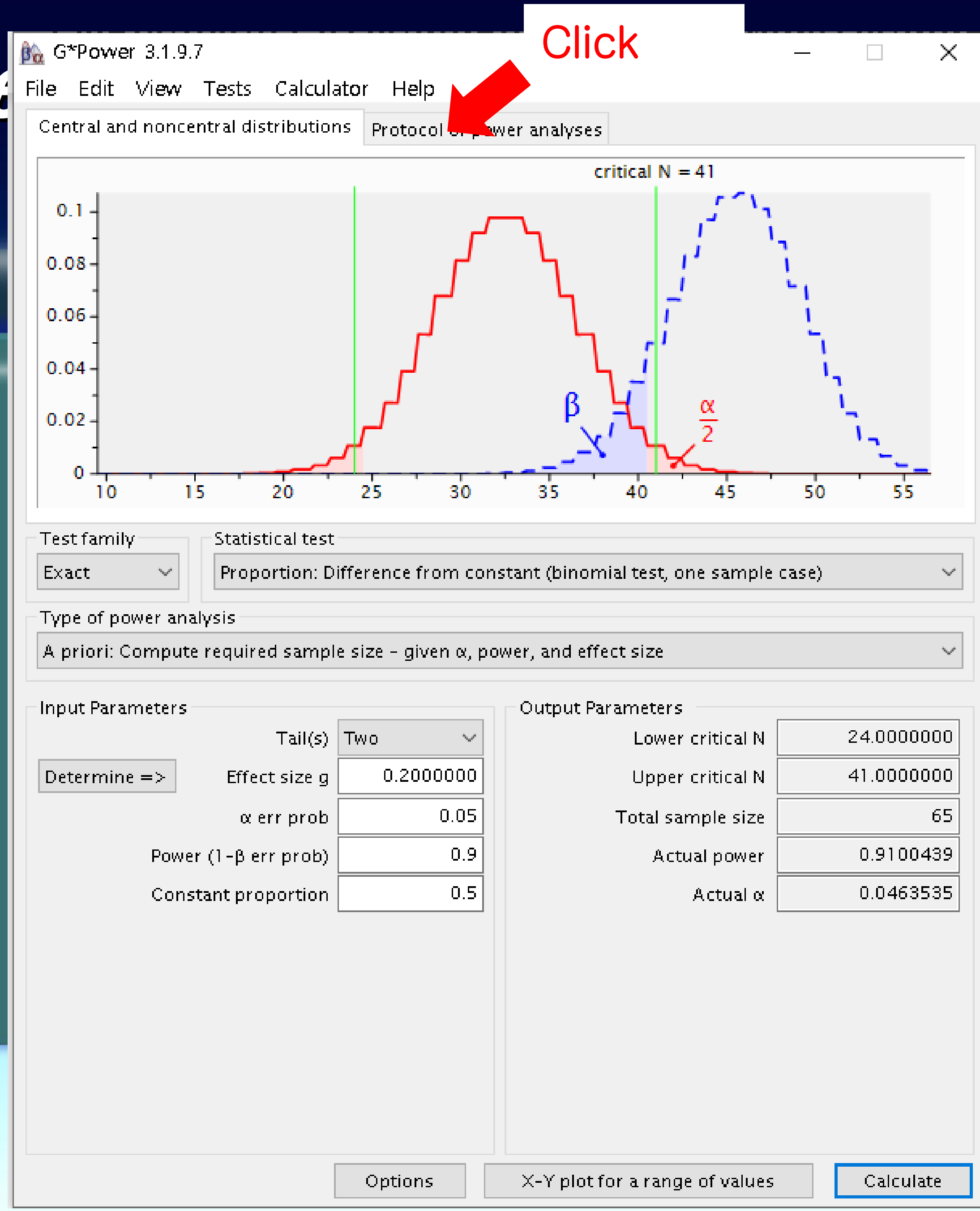
$$0.7-0.5 > \frac{1.96\times\sqrt{(0.5\times0.5)}-1.28\times\sqrt{(0.7\times0.3)}}{\sqrt{n}}$$

$$\sqrt{n} > \frac{1.96\times\sqrt{(0.5\times0.5)}-1.28\times\sqrt{(0.7\times0.3)}}{0.7-0.5}$$

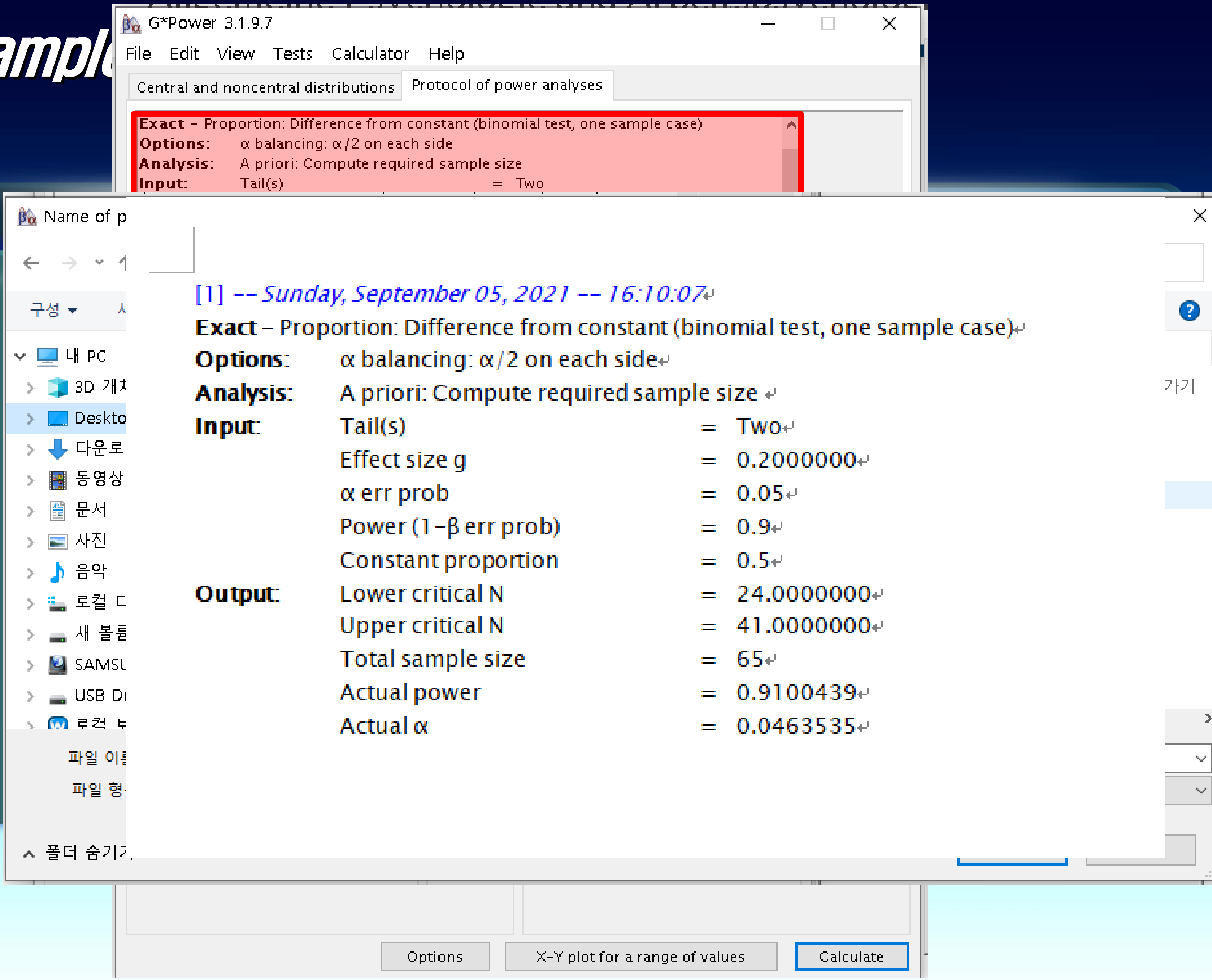
$$n > \frac{\left[1.96\times\sqrt{(0.5\times0.5)}-1.28\times\sqrt{(0.7\times0.3)}\right]^2}{(0.7-0.5)^2} = 61.4$$

≒65

Exampl


Click
G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
critical N = 41
0.1
0.08
0.06
0.04
0.02
0
10 15 20 25 30 35 40 45 50 55
β
α
2
Test family
Exact
Statistical test
Proportion: Difference from constant (binomial test, one sample case)
Type of power analysis
A priori: Compute required sample size – given α, power, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size g 0.2000000
α err prob 0.05
Power (1-β err prob) 0.9
Constant proportion 0.5
Output Parameters
Lower critical N 24.0000000
Upper critical N 41.0000000
Total sample size 65
Actual power 0.9100439
Actual α 0.0463535
Options
X-Y plot for a range of values
Calculate

Exampl



G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Name of p
[1] -- Sunday, September 05, 2021 -- 16:10:07
Exact – Proportion: Difference from constant (binomial test, one sample case)
Options: α balancing: α/2 on each side
Analysis: A priori: Compute required sample size
Input: Tail(s) = Two
Effect size g = 0.2000000
α err prob = 0.05
Power (1−β err prob) = 0.9
Constant proportion = 0.5
Output: Lower critical N = 24.0000000
Upper critical N = 41.0000000
Total sample size = 65
Actual power = 0.9100439
Actual α = 0.0463535
Options
X-Y plot for a range of values
Calculate

Example 2

두 평균의 비교에 대한 표본수 계산

Post-hoc power analysis

두 개의 진통제의 효능을 비교한 연구

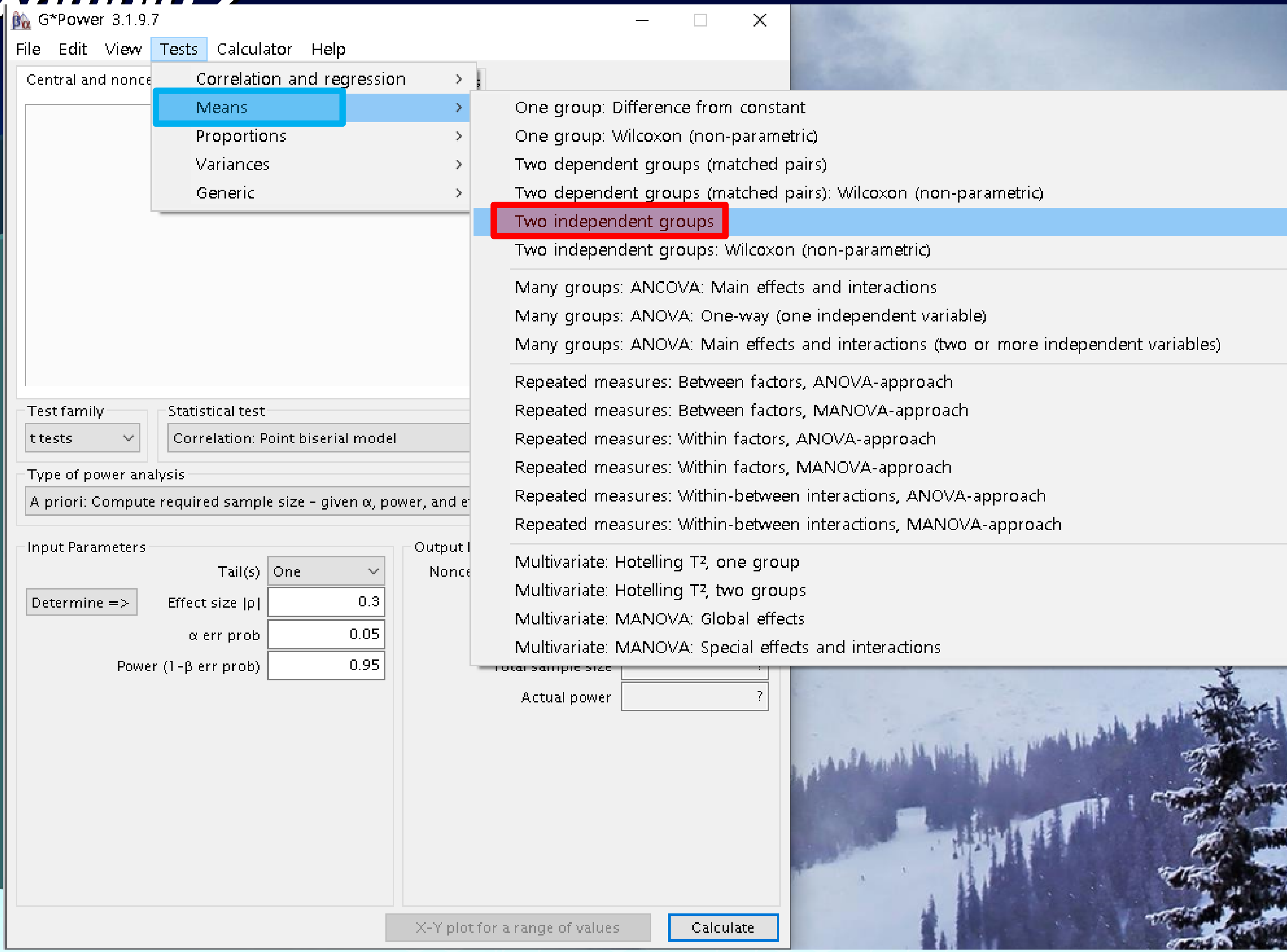
Visual analogue scale (VAS)로 측정한 통증점수

Drug A(n=30): 7 ± 3
Drug B(n=30): 5 ± 2

2-tailed
유의수준 5%

검정력: ?

Example 2


G*Power 3.1.9.7
File
Edit
View
Tests
Calculator
Help
Central and nonce
Correlation and regression
Means
Proportions
Variances
Generic
One group: Difference from constant
One group: Wilcoxon (non-parametric)
Two dependent groups (matched pairs)
Two dependent groups (matched pairs): Wilcoxon (non-parametric)
Two independent groups
Two independent groups: Wilcoxon (non-parametric)
Many groups: ANCOVA: Main effects and interactions
Many groups: ANOVA: One-way (one independent variable)
Many groups: ANOVA: Main effects and interactions (two or more independent variables)
Repeated measures: Between factors, ANOVA-approach
Repeated measures: Between factors, MANOVA-approach
Repeated measures: Within factors, ANOVA-approach
Repeated measures: Within factors, MANOVA-approach
Repeated measures: Within-between interactions, ANOVA-approach
Repeated measures: Within-between interactions, MANOVA-approach
Multivariate: Hotelling T², one group
Multivariate: Hotelling T², two groups
Multivariate: MANOVA: Global effects
Multivariate: MANOVA: Special effects and interactions
Test family
t tests
Statistical test
Correlation: Point biserial model
Type of power analysis
A priori: Compute required sample size - given α, power, and e
Input Parameters
Tail(s)
One
Determine =>
Effect size |ρ|
0.3
α err prob
0.05
Power (1-β err prob)
0.95
Output
Nonce
Actual power
?
X-Y plot for a range of values
Calculate

Example 2

두 평균의 비교에 대한 표본수 계산

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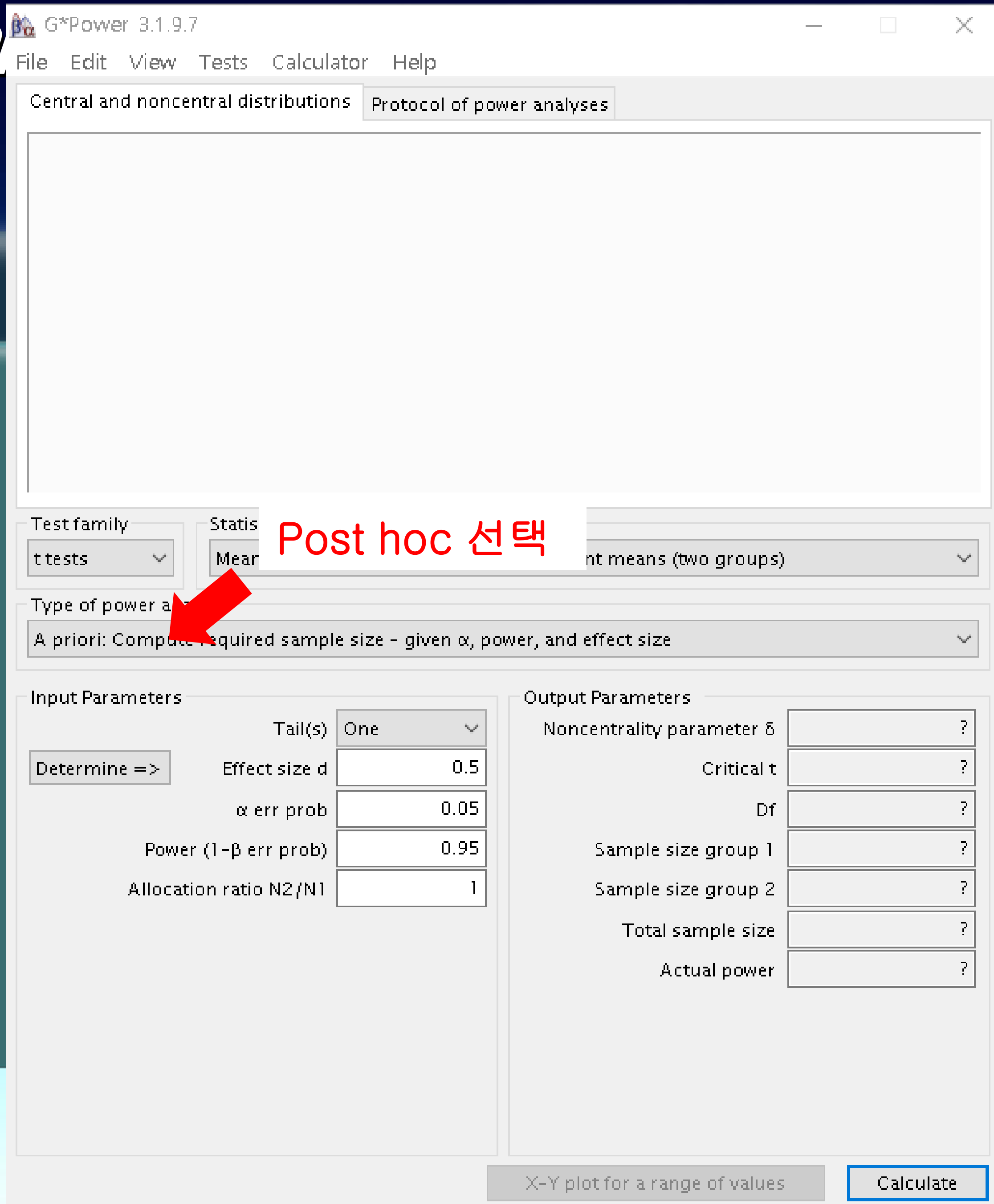
Drug B(n=30): 5 ± 2

2-tailed
유의수준 5%

검정력: ?

Exampl


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Post hoc 선택
Test family
t tests
Statis
Mean
nt means (two groups)
Type of power a
A priori: Compu equired sample size – given α, power, and effect size
Input Parameters
Tail(s)
One
Determine =>
Effect size d
0.5
α err prob
0.05
Power (1-β err prob)
0.95
Allocation ratio N2/N1
1
Output Parameters
Noncentrality parameter δ
?
Critical t
?
Df
?
Sample size group 1
?
Sample size group 2
?
Total sample size
?
Actual power
?
X-Y plot for a range of values
Calculate

Example 2

두 평균의 비교에 대한 표본수 계산

Post-hoc power analysis

두 개의 진통제의 효능을 비교한 연구

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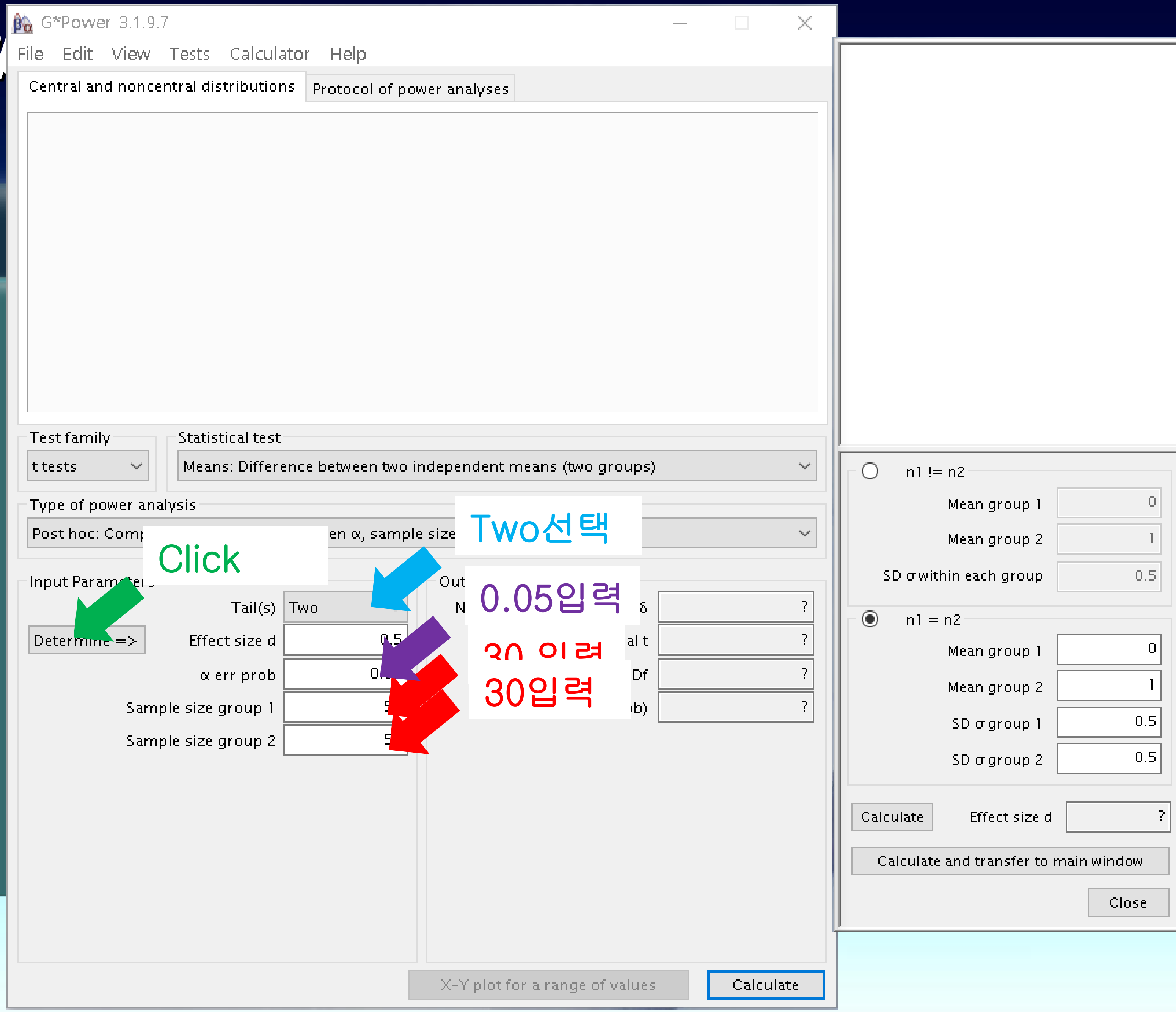
2-tailed
유의수준 5%

검정력: ?

Examp


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
Post hoc: Comp
en α, sample size
Input Param
Tail(s)
Two
Effect size d
0.5
α err prob
Sample size group 1
Sample size group 2
Determine =>
Click
Two선택
0.05입력
30입력
X-Y plot for a range of values
Calculate
n1 != n2
Mean group 1
0
Mean group 2
1
SD σ within each group
0.5
n1 = n2
Mean group 1
0
Mean group 2
1
SD σ group 1
0.5
SD σ group 2
0.5
Calculate
Effect size d
?
Calculate and transfer to main window
Close

Example 2

두 평균의 비교에 대한 표본수 계산

Post-hoc power analysis

두 개의 진통제의 효능을 비교한 연구

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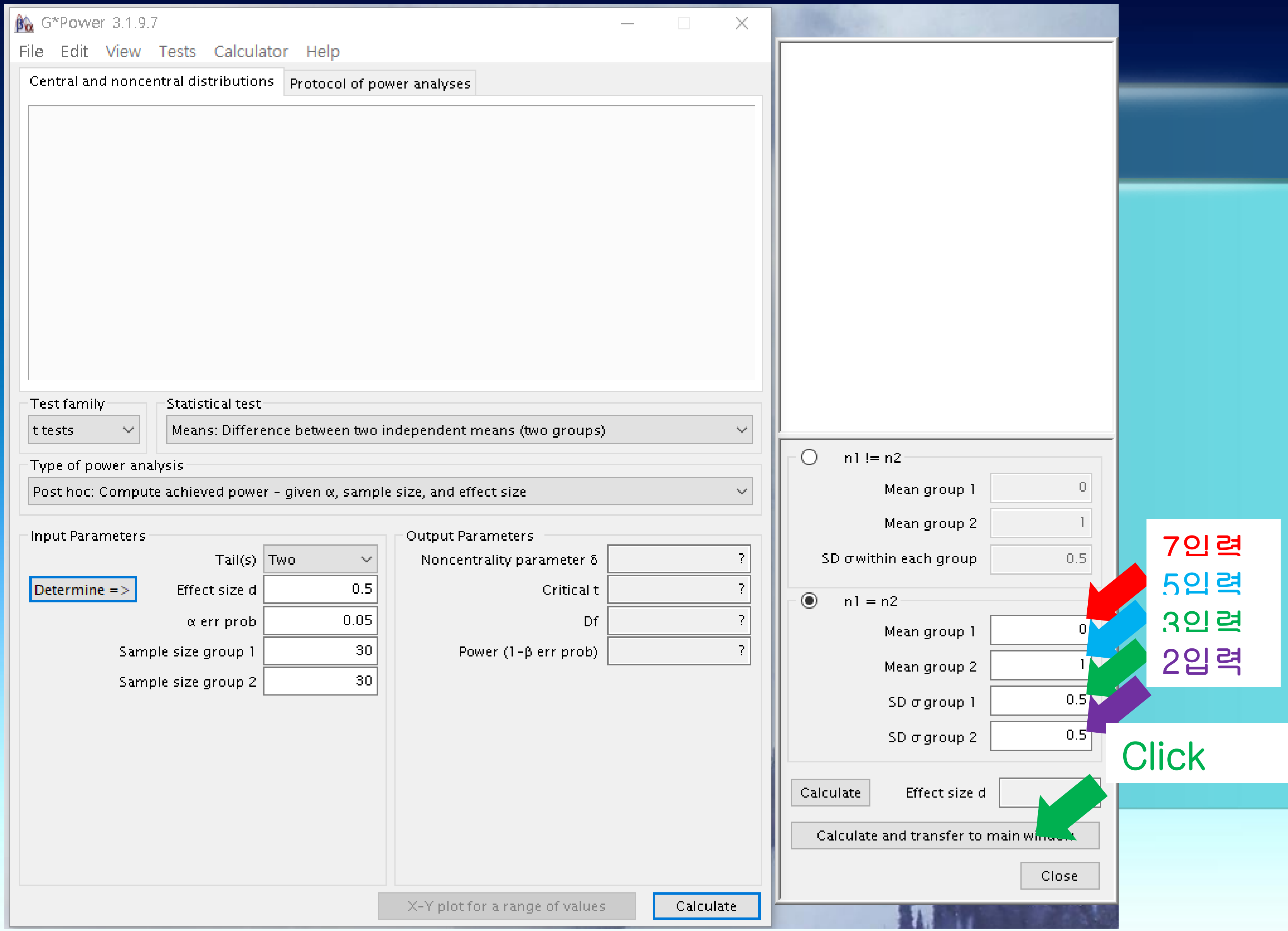
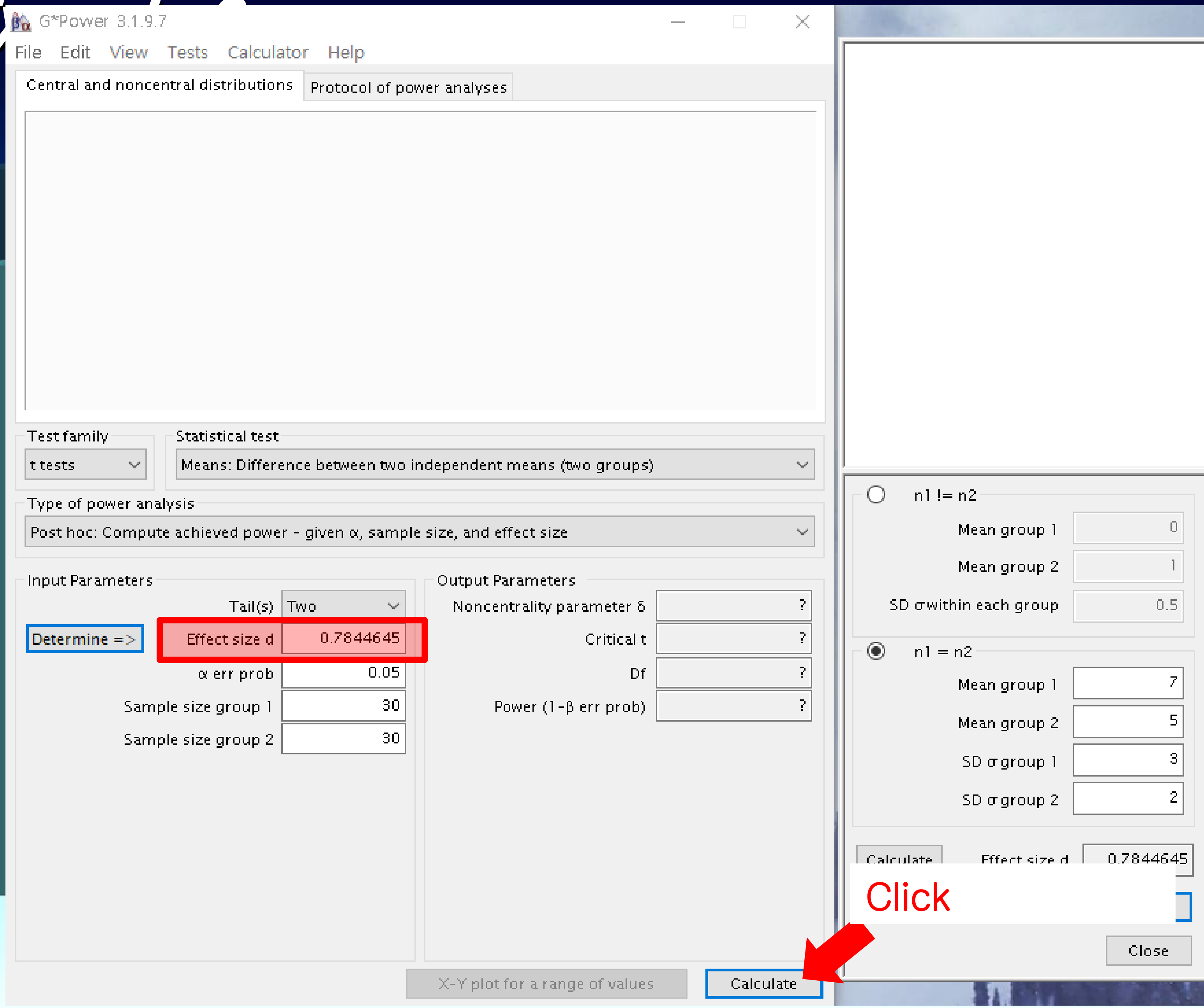
Drug B(n=30): 5 ± 2

2-tailed
유의수준 5%

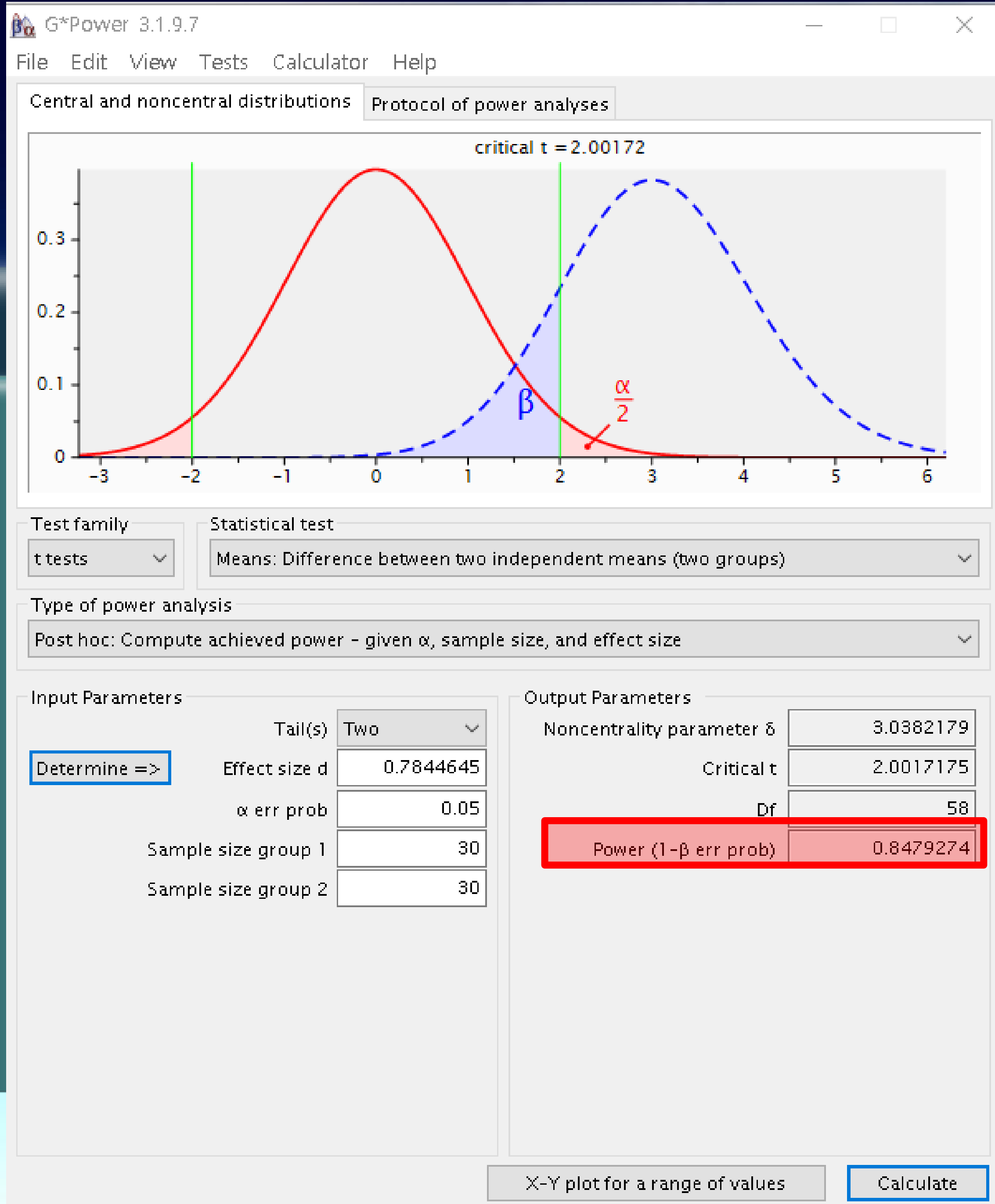
검정력: ?

Example 2


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
Post hoc: Compute achieved power – given α, sample size, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size d 0.5
α err prob 0.05
Sample size group 1 30
Sample size group 2 30
Output Parameters
Noncentrality parameter δ ?
Critical t ?
Df ?
Power (1-β err prob) ?
X-Y plot for a range of values
Calculate
n1 != n2
Mean group 1 0
Mean group 2 1
SD σ within each group 0.5
n1 = n2
Mean group 1 0
Mean group 2 1
SD σ group 1 0.5
SD σ group 2 0.5
Calculate
Effect size d
Calculate and transfer to main window
Close
7입력
5입력
3입력
2입력
Click


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
Post hoc: Compute achieved power – given α, sample size, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size d 0.7844645
α err prob 0.05
Sample size group 1 30
Sample size group 2 30
Output Parameters
Noncentrality parameter δ ?
Critical t ?
Df ?
Power (1-β err prob) ?
X-Y plot for a range of values
Calculate
n1 != n2
Mean group 1 0
Mean group 2 1
SD σ within each group 0.5
n1 = n2
Mean group 1 7
Mean group 2 5
SD σ group 1 3
SD σ group 2 2
Calculate
Effect size d 0.7844645
Click
Close

Example



G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
critical t = 2.00172
0.3
0.2
0.1
0
-3 -2 -1 0 1 2 3 4 5 6
β
α/2
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
Post hoc: Compute achieved power - given α, sample size, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size d 0.7844645
α err prob 0.05
Sample size group 1 30
Sample size group 2 30
Output Parameters
Noncentrality parameter δ 3.0382179
Critical t 2.0017175
Df 58
Power (1-β err prob) 0.8479274
X-Y plot for a range of values
Calculate

"Sample sizes are not provided because there is no prior information on which to base them."

연구에 대한 사전정보가 없는 경우, 표본수의 산출은 연구의 가정과 통계방법에 대한 일반적인 접근 방법-예) 효과크기-을 사용하여 계산 할 수 있다.

Example 3

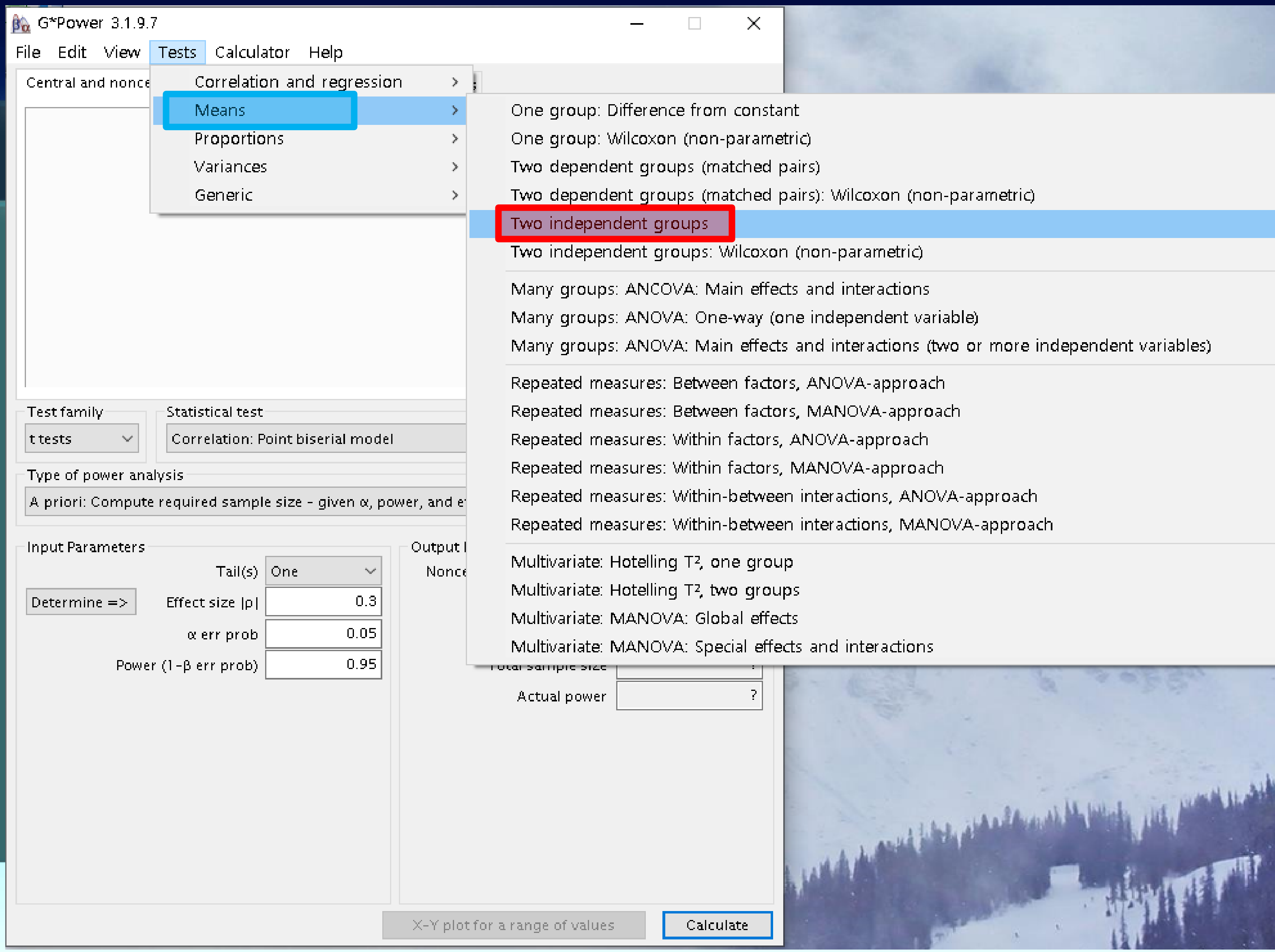
두 평균의 비교에 대한 표본수 계산

이전 연구에서 정보가 주어지지 않은 경우
→ Effect size 이용

Effect size
- Small: 0.2
- Medium: 0.5
- Large: 0.8

유의수준 1%
검정력 95%

Example 3



G*Power 3.1.9.7
File
Edit
View
Tests
Calculator
Help
Correlation and regression
Means
Proportions
Variances
Generic
One group: Difference from constant
One group: Wilcoxon (non-parametric)
Two dependent groups (matched pairs)
Two dependent groups (matched pairs): Wilcoxon (non-parametric)
Two independent groups
Two independent groups: Wilcoxon (non-parametric)
Many groups: ANCOVA: Main effects and interactions
Many groups: ANOVA: One-way (one independent variable)
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Repeated measures: Between factors, ANOVA-approach
Repeated measures: Between factors, MANOVA-approach
Repeated measures: Within factors, ANOVA-approach
Repeated measures: Within factors, MANOVA-approach
Repeated measures: Within-between interactions, ANOVA-approach
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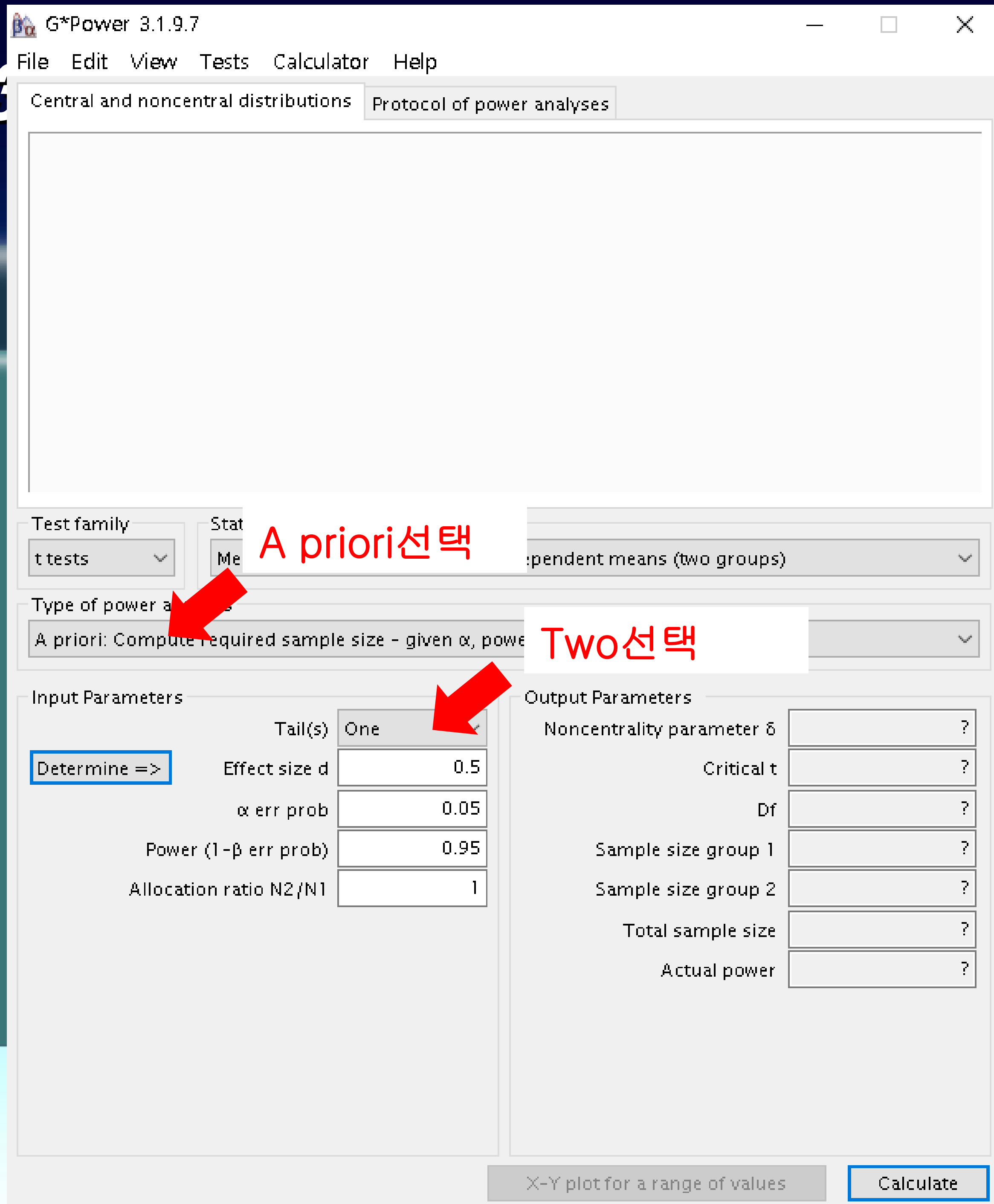
Multivariate: Hotelling T², one group
Multivariate: Hotelling T², two groups
Multivariate: MANOVA: Global effects
Multivariate: MANOVA: Special effects and interactions
Test family
t tests
Statistical test
Correlation: Point biserial model
Type of power analysis
A priori: Compute required sample size - given α, power, and e
Input Parameters
Tail(s)
One
Determine =>
Effect size |ρ|
0.3
α err prob
0.05
Power (1-β err prob)
0.95
Actual power
?
X-Y plot for a range of values
Calculate

Example 3


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Stat
Me
:pendent means (two groups)
A priori선택
Type of power a
A priori: Compute required sample size – given α, powe
Two선택
Input Parameters
Tail(s)
One
Determine =>
Effect size d
0.5
α err prob
0.05
Power (1-β err prob)
0.95
Allocation ratio N2/N1
1
Output Parameters
Noncentrality parameter δ
?
Critical t
?
Df
?
Sample size group 1
?
Sample size group 2
?
Total sample size
?
Actual power
?
X-Y plot for a range of values
Calculate

Example 3

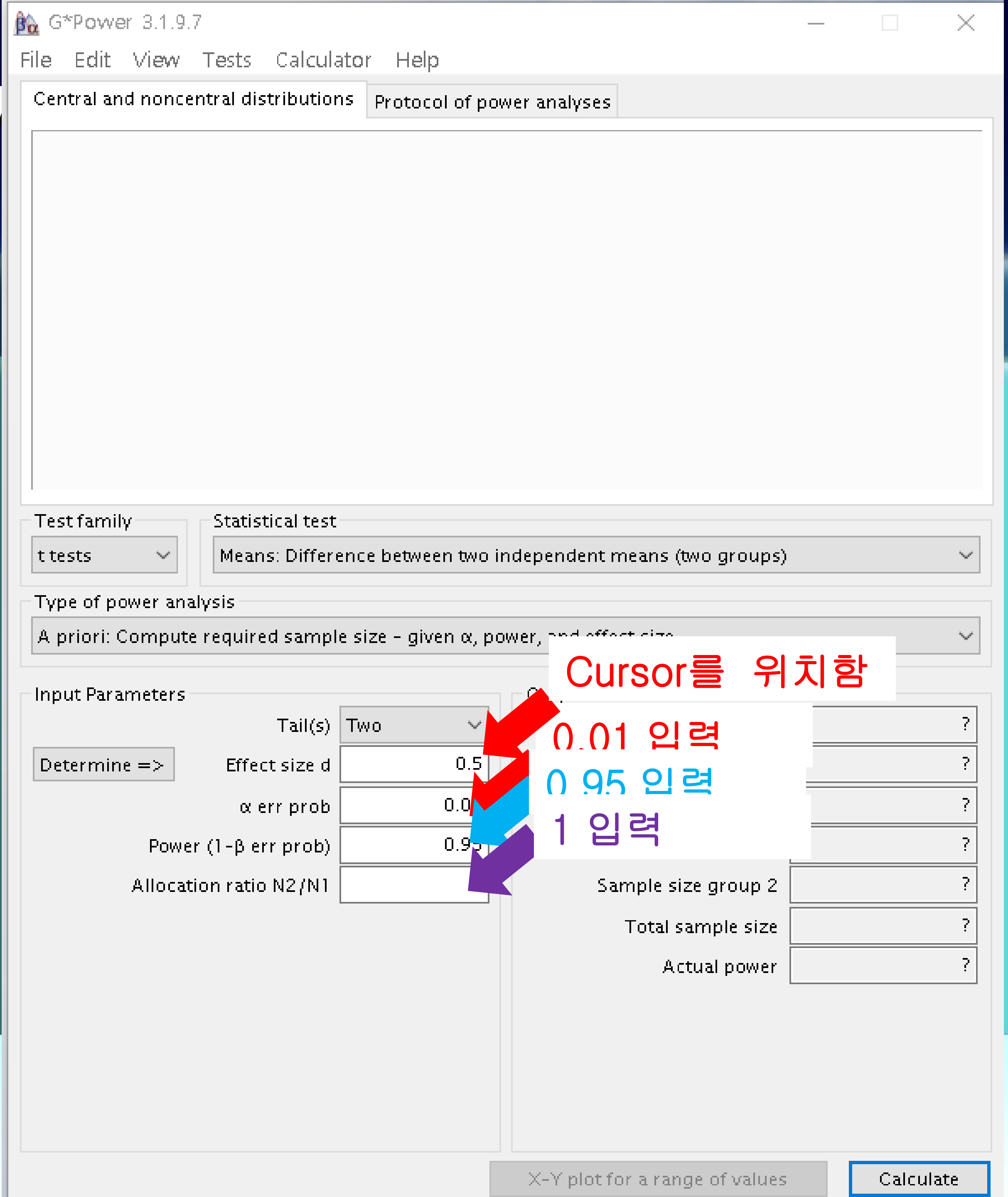
두 평균의 비교에 대한 표본수 계산

이전 연구에서 정보가 주어지지 않은 경우
→ Effect size 이용

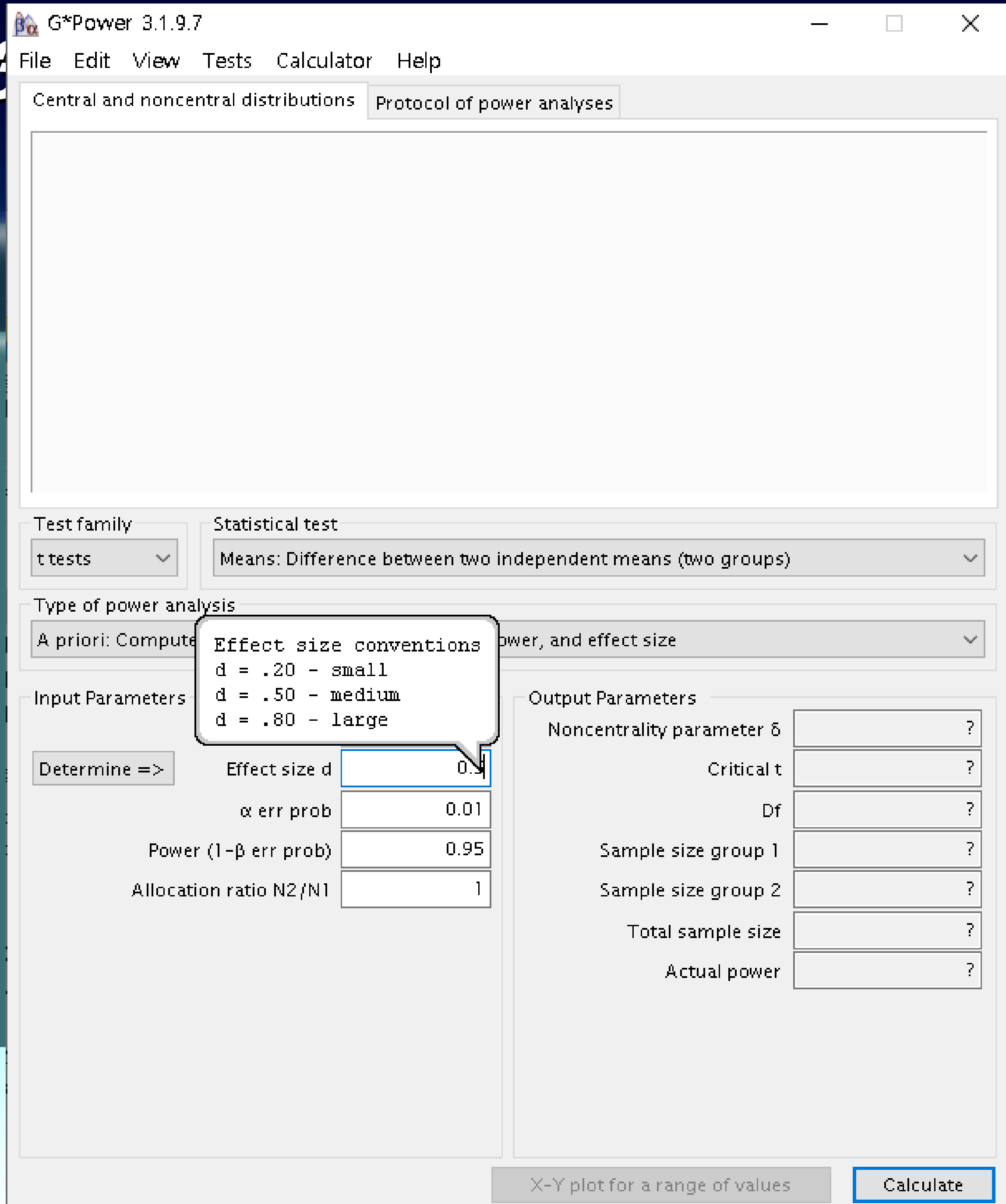
Effect size
  Small: 0.2
  Medium: 0.5
  Large: 0.8

유의수준 1%
검정력 95%

Exam

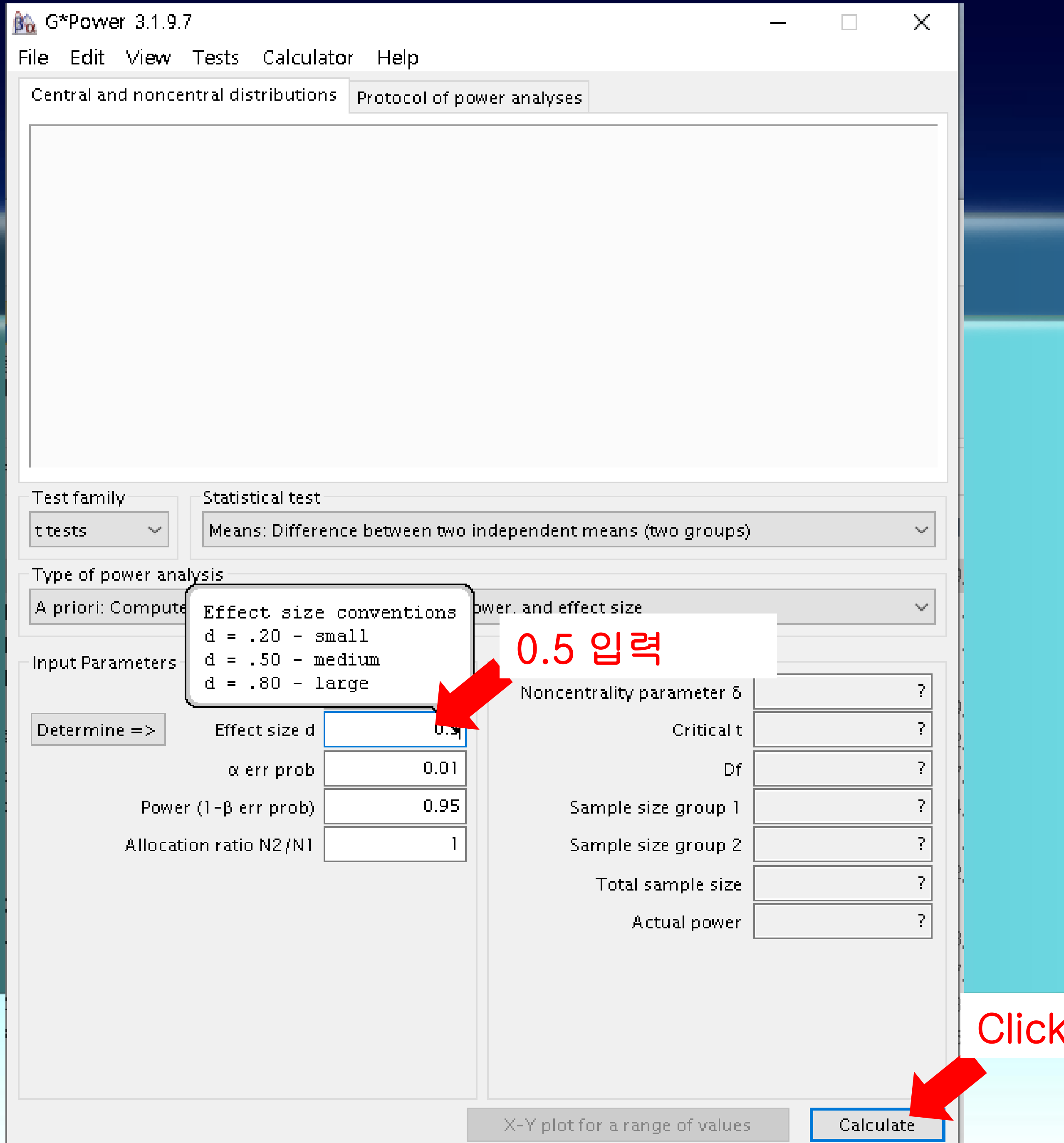

G*Power 3.1.9.7
File
Edit
View
Tests
Calculator
Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
A priori: Compute required sample size – given α, power,
Cursor를 위치함
0.01 입력
0.95 입력
1 입력
Input Parameters
Tail(s)
Two
Determine =>
Effect size d
0.5
α err prob
Power (1-β err prob)
Allocation ratio N2/N1
Sample size group 2
Total sample size
Actual power
X-Y plot for a range of values
Calculate

Example 3

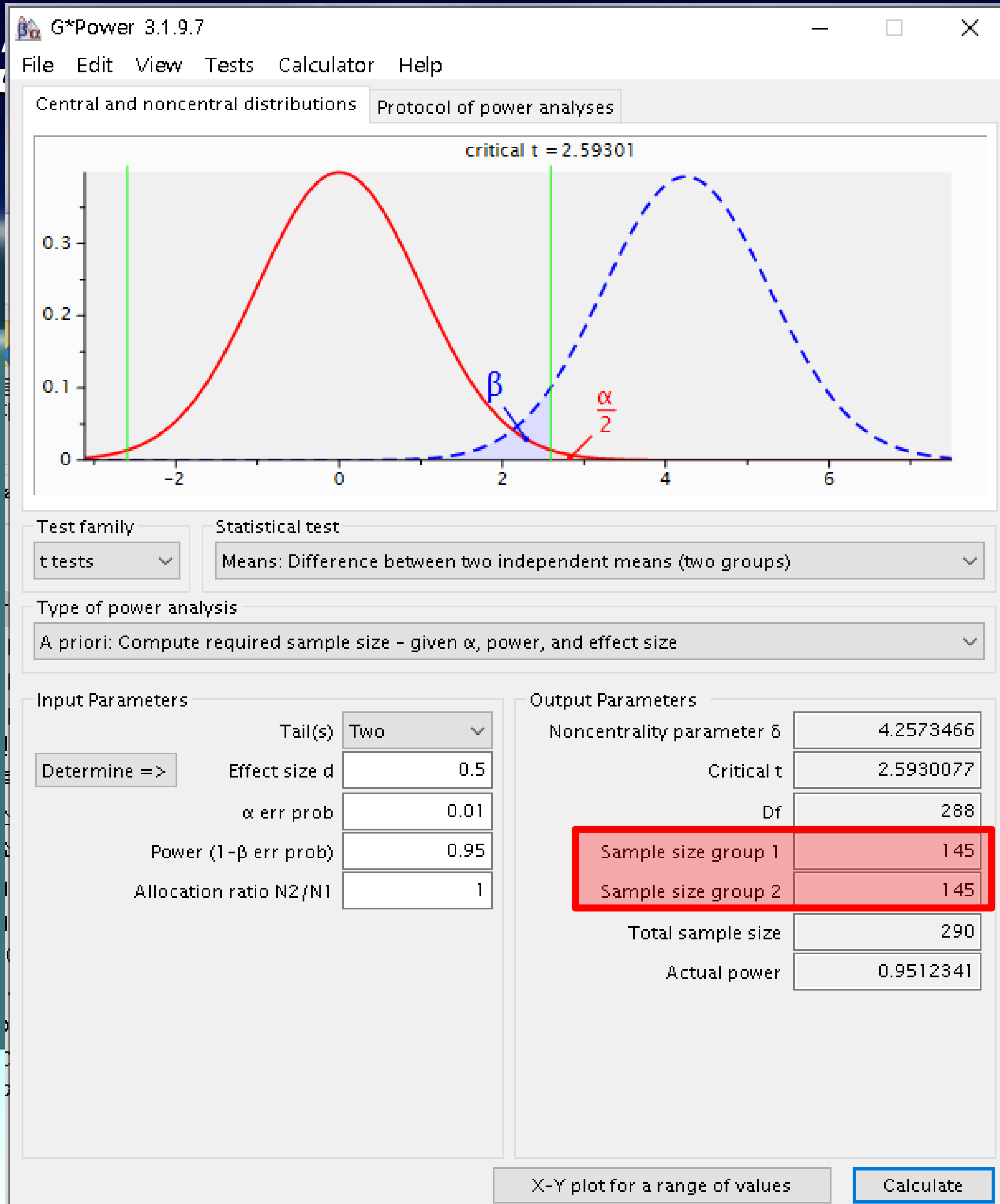


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
A priori: Compute
ower, and effect size
Effect size conventions
d = .20 - small
d = .50 - medium
d = .80 - large
Input Parameters
Determine =>
Effect size d
α err prob
0.01
Power (1-β err prob)
0.95
Allocation ratio N2/N1
1
Output Parameters
Noncentrality parameter δ
?
Critical t
?
Df
?
Sample size group 1
?
Sample size group 2
?
Total sample size
?
Actual power
?
X-Y plot for a range of values
Calculate

Example


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
A priori: Compute
ower, and effect size
Effect size conventions
d = .20 - small
d = .50 - medium
d = .80 - large
0.5 입력
Input Parameters
Determine =>
Effect size d
α err prob
0.01
Power (1-β err prob)
0.95
Allocation ratio N2/N1
1
Noncentrality parameter δ
?
Critical t
?
Df
?
Sample size group 1
?
Sample size group 2
?
Total sample size
?
Actual power
?
X-Y plot for a range of values
Calculate
Click

Example



G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
critical t = 2.59301
0.3
0.2
0.1
0
-2
0
2
4
6
β
α
2
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
A priori: Compute required sample size - given α, power, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size d 0.5
α err prob 0.01
Power (1-β err prob) 0.95
Allocation ratio N2/N1 1
Output Parameters
Noncentrality parameter δ 4.2573466
Critical t 2.5930077
Df 288
Sample size group 1 145
Sample size group 2 145
Total sample size 290
Actual power 0.9512341
X-Y plot for a range of values
Calculate

The end