



Power and Sample Size Analysis Using SAS

**THE
POWER
TO KNOW.®**

Probabilities of Outcomes of Hypothesis Testing

“Truth”	Decision	
	H_0 : No Difference	H_A : Difference
H_0 : No Difference	Pr(Correct Negative) = $(1 - \alpha)$	Pr(False Positive) = Pr(Type I error) = α
H_A : Difference	Pr(False Negative) = Pr(Type II error) = β	Pr(Correct Positive) = $(1 - \beta)$ = Power

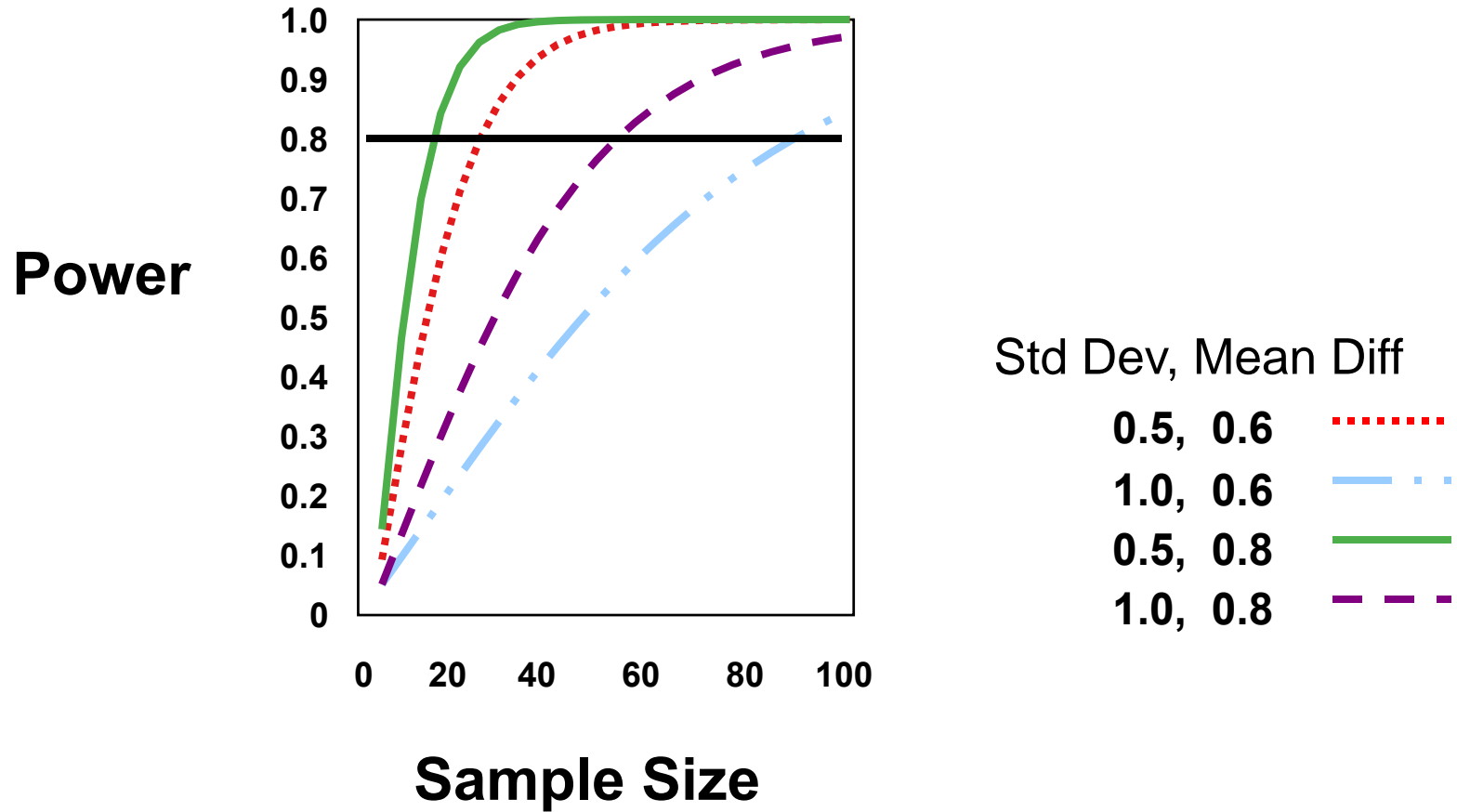
Power Analysis

- Statistical power analysis characterizes the ability of a statistical test to detect effects.
- Power can be computed for more than one scenario at a time by varying the parameters that affect power.
- During the planning phase of the study, statistical power analysis enables researchers to increase the efficiency of the study design and analysis.

Sensitivity Analysis

- A sensitivity analysis is when you vary some combination of parameters to see how it affects power.
- An example is to fix alpha and the study design, and to vary the sample size, standard deviation, and surmised pattern of mean differences.
- The results of the analysis can assist the researcher in planning a study.

Sensitivity Analysis



Concrete Study

Brand

- Graystone
- EZMix



Parameters for Concrete Study

- Statistical Method = two-sample t -test with equal variances
- Mean Difference = 400 to 500 by 50
- Standard Deviation = 300 400
- Sides = two-sided test
- Ratio of Group Sample Sizes = 1:1 1:2 1:3
- Power = 0.90
- Alpha = 0.05



Performing Power and Sample Size Analyses for a Two-Sample t -Test

This demonstration illustrates how to compute a power and sample size analysis for a two-sample t -test.

Aspirin and Heart Attack Study

Study Objective: examine the effect of low-dose aspirin on reducing the risk of death due to heart attacks.

Study Design: randomly assign patients to aspirin treatment and placebo treatment and follow the groups for three years.

Outcome: proportion of deaths due to myocardial infarction.



Parameters for Aspirin and Heart Attack Study

- Statistical Method = likelihood-ratio chi-square test
- Reference Proportion = 0.04
- Relative Risk = 0.3 0.4 0.5 0.6
- Ratio of Group Sample Sizes = 1:1 1:2 1:3
- Sides = 1
- Power = 0.90
- Alpha = 0.01



Power and Sample Size Analyses for the Test of Two Independent Proportions

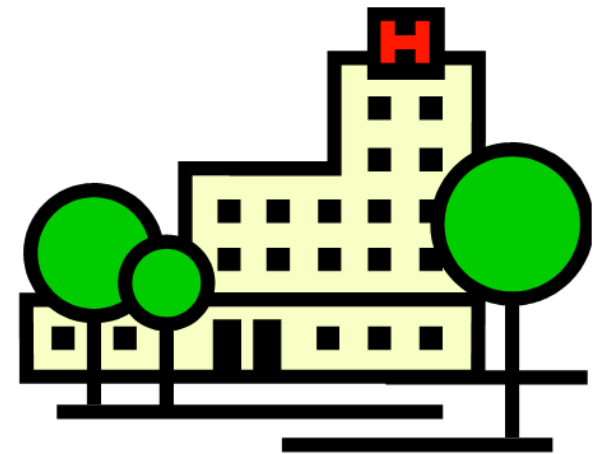
This demonstration illustrates how to compute a power and sample size analysis for a test of two independent proportions.

Nosocomial Infection Study

Objective: determine whether infection surveillance and control programs reduce the rates of nosocomial (hospital-acquired) infection

Response Variable: percentage of patients that acquired infection in the hospital

Predictors: 6 covariates



Parameters for Nosocomial Study

- Statistical Method = Type III *F*-tests in multiple linear regression
- Type of Model = unconditional with random predictors
- Number of Predictors in Full Model = 6
- Number of Predictors being tested = 1
- Partial correlation for **Services** = 0.20 0.25 0.30
- Power = 0.80 0.85 0.90
- Alpha = 0.01



Performing Power and Sample Size Analyses for Multiple Linear Regression

This demonstration illustrates how to compute a power and sample size analysis for multiple linear regression.

The GLMPOWER Procedure

The GLMPOWER procedure performs prospective power analysis for general linear models. The procedure supports:

- Type III tests and contrasts of fixed class effects
- continuous and categorical covariates
- unbalanced designs
- customized graphics.

GLMPOWER Procedure

```
PROC GLMPOWER <options>;  
  CLASS variables;  
  MODEL dependent-variables = classification-effects;  
  WEIGHT variable;  
  CONTRAST 'label' effect values<...effect values>  
    </options>;  
  POWER <options>;  
  PLOT <plot-options></graph-options>;  
RUN;
```


Exemplary Data Set

PROC GLMPOWER requires an exemplary data set for the input of some parameters. The parameters include the following:

- the conjectured response means in the underlying population
- the design weights for an unbalanced design
- additional response means to simulate multiple scenarios.

Tire Study

Objective: Compare the wear of four brands of tires.

Response Variable: Amount of wear in millimeters over 1,000 miles

Predictor: Brand of tire (A, B, C, D)



Parameters for Tire Study

- Statistical Method = one-degree-of-freedom test of a contrast of means
- Study Design = Balanced Design
- Group Means = 2.50 | 2.72 | 2.30 | 2.24
- Cell Weights = 1.20 | 1.10 | 1.00 | 1.30
- Error Standard Deviation = 0.32
- Power = 0.80
- Alpha = 0.01



Performing Power and Sample Size Analyses Using PROC GLMPOWER

This demonstration illustrates how to compute a power and sample size analysis in PROC GLMPOWER.

Logistic Regression

- PROC POWER performs power and sample size analyses for the likelihood ratio chi-square test of a single predictor in binary logistic regression, possibly in the presence of one or more covariates.
- All predictor variables are assumed to be independent of each other.
- The distributions of the predictor variables must be specified along with the parameters.
- You can express effects in terms of response probability and odds ratios, or in terms of regression coefficients.



Performing Power and Sample Size Analyses for Multiple Logistic Regression

This demonstration illustrates how to compute a power and sample size analysis for multiple logistic regression.