

Power and Type I Error

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Learning Objectives

Define Type I error.

Define Type II error

Define power.

Understand how to specify Type I error in GLIMMPSE.

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DEFINITIONS

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A type I error is an incorrect rejection of the null hypothesis, H_0

	True H_0	False H_0
Fail to reject	Correct decision	Type II error
Reject	Type I error	Correct decision

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A type II error is an incorrect acceptance of the null hypothesis, H_0

	True H_0	False H_0
Fail to reject	Correct decision	Type II error
Reject	Type I error	Correct decision

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Decision Errors in Research

A Type I error is a false positive, i.e., saying there is a difference when there is not.

A Type II error is a false negative, i.e., saying there is no difference when there is one.

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Power is the probability of rejecting the null hypothesis, H_0

	True H_0	False H_0
Fail to reject	Correct decision	Type II error
Reject	Type I error	Correct decision ← POWER

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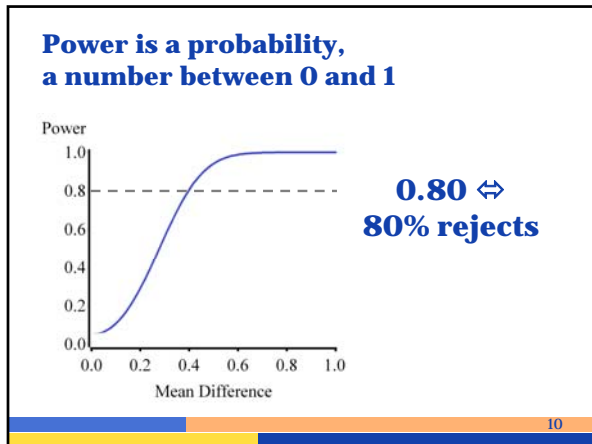
Non-statisticians often define power as the probability of a correct rejection

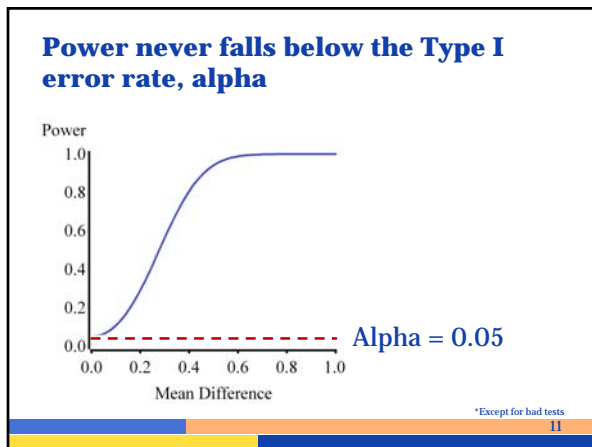
	True H_0	False H_0
Fail to reject	Correct decision	Type II error
Reject	Type I error	Correct decision ← POWER

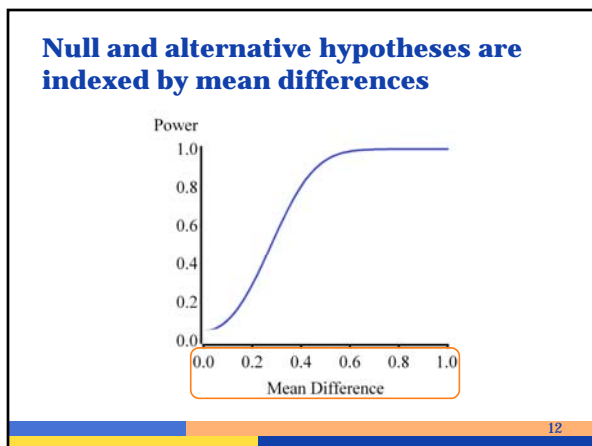
8

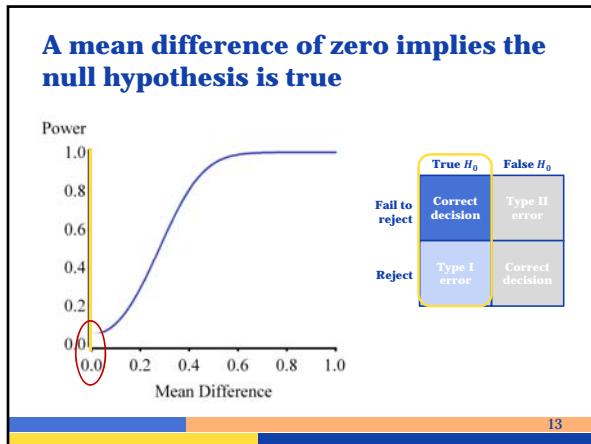
Power curves display the impact of changing study properties

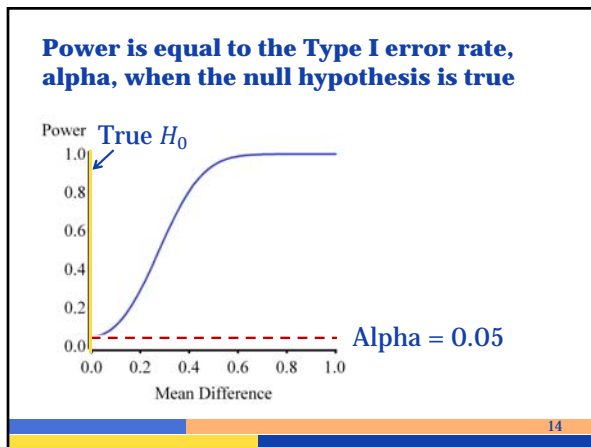
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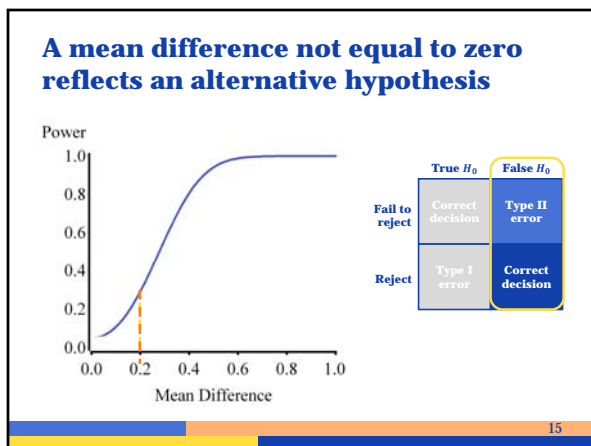


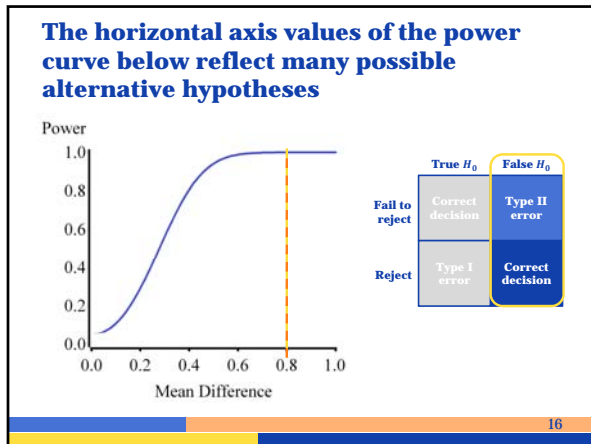


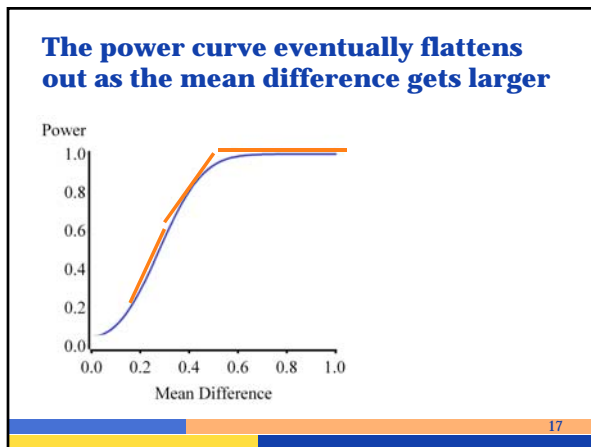


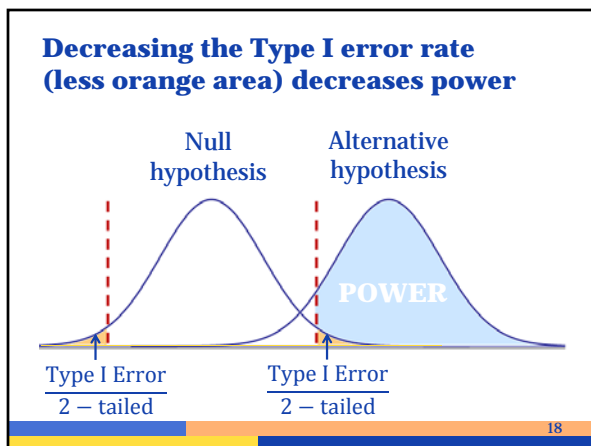












Lowering the Type I error rate requires a greater sample size to achieve the same power

The effect is very modest in many applications, including correcting for a handful of multiple outcomes.

The effect can be substantial when accounting for high dimensional outcomes such as metabolites or genes.

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USING GLIMPSE

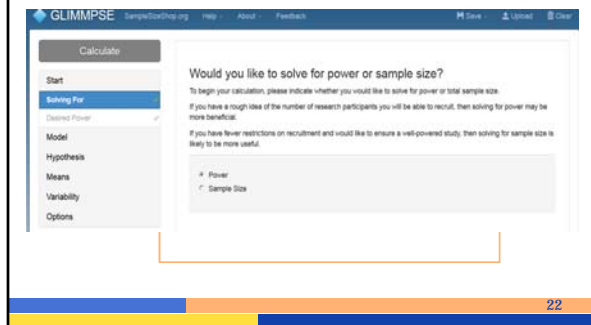
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GLIMPSE supports two design approaches

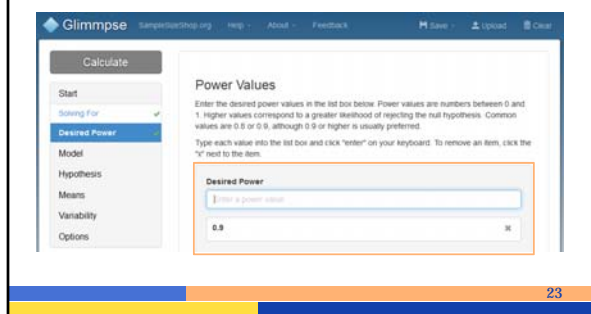
1. The user selects a study design and a specific sample size in GLIMPSE, which then computes power.
2. The user selects a study design and a specific power value in GLIMPSE, which then computes a sample size.

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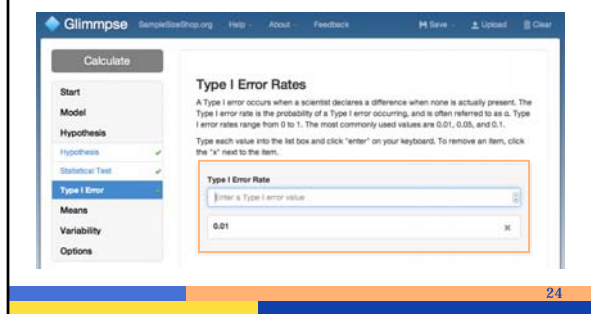
The start menu allows choosing power or sample size computation



If solving for required sample size, specify the power you would like to achieve in the Start menu



For either power or sample size computation, specify the Type I error rate and press 'Enter'



REVIEW OF LEARNING OBJECTIVES

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Define Type I error rate

Type I error rate is the probability of rejection of the null hypothesis when the null hypothesis is in fact true.

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Define Type II error rate

Type II error rate is the probability of acceptance of the null hypothesis when the null hypothesis is not true.

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Define power

Power is the probability of rejecting the null hypothesis.

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Which one of the following is a plausible power value?

- a. 0.10
- b. 1.2
- c. -3.6
- d. 500%

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Which one of the following is the most desirable power?

- a. 0.10
- b. 0.90
- c. 0.40
- d. 0.60

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