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Suppose we test:



H_0 : $\mu = 10$ H_a : $\mu > 10$

and we reject H_0 at $\alpha = 0.05$.

One of two things occurred:

► The null hypothesis is false and we

- made the correct decision.
- ► The null hypothesis is true, and we made a Type I error.





Possible outcomes of a hypothesis test:

Unknown

Underlying reality

Conclusion Reject H_0 is false H_0 is true

Conclusion Reject H_0 \longrightarrow Correct decision \longrightarrow Type I error

from test Do not reject H_0 \longrightarrow Type II error Correct decision

个 Known Type I error: Convicting a person who, in reality, did not commit the crime.

Type II error: Acquitting a person who, in reality, committed the crime.

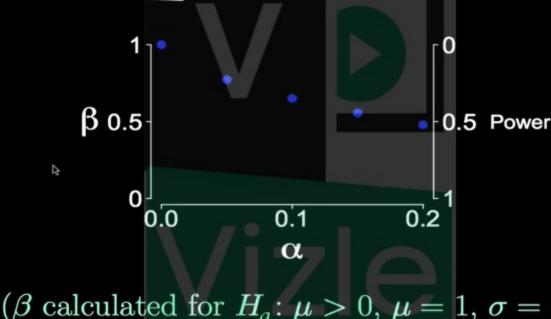


The power of a test is the probability of rejecting the null hypothesis, given it is false.

Power =
$$1 - P(\text{Type II error}) = 1 - \beta$$

The power of a test depends on several factors, including the choice of α , the sample size, and the true value of the parameter.

The relationship between α and β for a test of H_0 : $\mu = 0$:



(
$$\beta$$
 calculated for H_a : $\mu > 0$, $\mu = 1$, $\sigma = 5$, $n = 20$)



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