

# SWRK4011

## Hypotheses

**Dr. M. Vijay Kumar Sharma**

Associate Professor,  
Department of Social Work,  
Mahatma Gandhi Central University,  
Motihari, Bihar– 848401.



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**Formulation of  
Hypothesis & Testing**

# Introduction

- The hypothesis is an assumption that is made on the basis of some evidence.
- This is the initial point of any investigation that translates the research questions into a prediction.
- It includes components like variables, population and the relation between the variables.
- A research hypothesis is a hypothesis that is used to test the relationship between two or more variables.

# Definition

- Hypothesis is defined as “A tentative assumption made in order to draw out and test its logical or empirical consequences.”
- A hypothesis is a tentative relationship between two or more variables which direct the research activity to test it.
- A hypothesis is a statement that introduces a research question and proposes an expected result.

# What is a Hypothesis?

- A *supposition* or *proposed explanation* made on the basis of *limited* evidence as a *starting point* for further *investigation*. (Oxford Dictionary)
- Hypothesis testing is an act in statistics whereby an analyst tests an assumption regarding a population parameter. The methodology employed by the analyst depends on the nature of the data used and the reason for the analysis (Statistical Meaning).
- Hypothesis testing is used to infer the result of a hypothesis performed on sample data from a larger population.
- In social science, it is a tool for Theory Building.

# Elements of Hypothesis

So, to clarify a hypothesis is a statement about the relationship between two or more variables. The researcher set out the variables to prove or disprove. Hypothesis essentially includes three elements.

For example-

- Variables
- Population
- Relationship between variables.

# Example of Hypothesis

- Rewards increase reading achievements
- Rewards decrease reading achievements
- Or rewards have no effect on reading achievements
- In the above examples- variables are  
Rewards & Achievements.

# Characteristics of Hypothesis

- The hypothesis should be clear and precise so as to consider it to be reliable.
- If the hypothesis is relational hypothesis, then it should be stating the relationship between variables.
- The hypothesis must be specific and should have scope for conducting more tests.
- The way of explanation of hypothesis must be very simple and it should also be understood that simplicity of hypothesis is not related to its significance.



# Functions of Hypothesis

- Hypothesis helps in making an observation and experiments possible.
- It becomes the start point for the investigation.
- Hypothesis helps in verifying the observations.
- It helps in directing the inquiries in the right directions.

# Types of hypothesis

- Simple Hypothesis
- Complex Hypothesis
- Empirical Hypothesis
- Null Hypothesis
- Alternative Hypothesis
- Logical Hypothesis
- Statistical Hypothesis

# Simple Hypothesis

Simple hypothesis is that one in which there exists relationship between two variables one is called independent variable or cause and other is dependent variable or effect.

For example

- Smoking leads to Cancer
- The higher ratio of unemployment leads to crimes.

# Complex Hypothesis

- Complex hypothesis is that one in which as relationship among variables exists. I recommend you should read **characteristics of a good research hypothesis**. In this type dependent as well as independent variables are more than two. For example
- Smoking and other drugs leads to cancer, tension chest infections etc.
- The higher ration of unemployment poverty, illiteracy leads to crimes like dacoit, Robbery, Rape, prostitution & killing etc.

# Empirical Hypothesis

- Working hypothesis is that one which is applied to a field.
- During the formulation it is an assumption only but when it is put to a test become an empirical or working hypothesis.

# Null Hypothesis

- A null hypothesis is a statistical hypothesis that is tested for possible rejection under the assumption that it is true (usually that observations are the result of chance). The concept was introduced by R. A. Fisher.
- Null hypothesis is contrary to the positive statement of a working hypothesis.
- According to null hypothesis there is no relationship between dependent and independent variable.
- It is denoted by 'H<sub>0</sub>'.

# Alternative Hypothesis

- The alternative hypothesis is the hypothesis used in hypothesis testing that is contrary to the null hypothesis. It is usually taken to be that the observations are the result of a real effect (with some amount of chance variation superposed).
- Firstly, many hypotheses are selected then among them select one which is more workable and most efficient.
- That hypothesis is introduced latter on due to changes in the old formulated hypothesis.
- It is denote by “H1”.

# Logical Hypothesis

- It is that type in which hypothesis is verified logically.
- J.S. Mill has given four cannons of these hypothesis e.g. agreement, disagreement, difference and residue.



# Statistical Hypothesis

- A hypothesis which can be verified statistically called statistical hypothesis.
- The statement would be logical or illogical but if statistic verifies it, it will be statistical hypothesis.

# Steps in Formulation of Hypothesis

- **Define Variables**
- **Study In-Depth the Variables**
- **Specify the Nature of Relationship**
- **Identify Study Population**
- **Make Sure Variables are Testable**

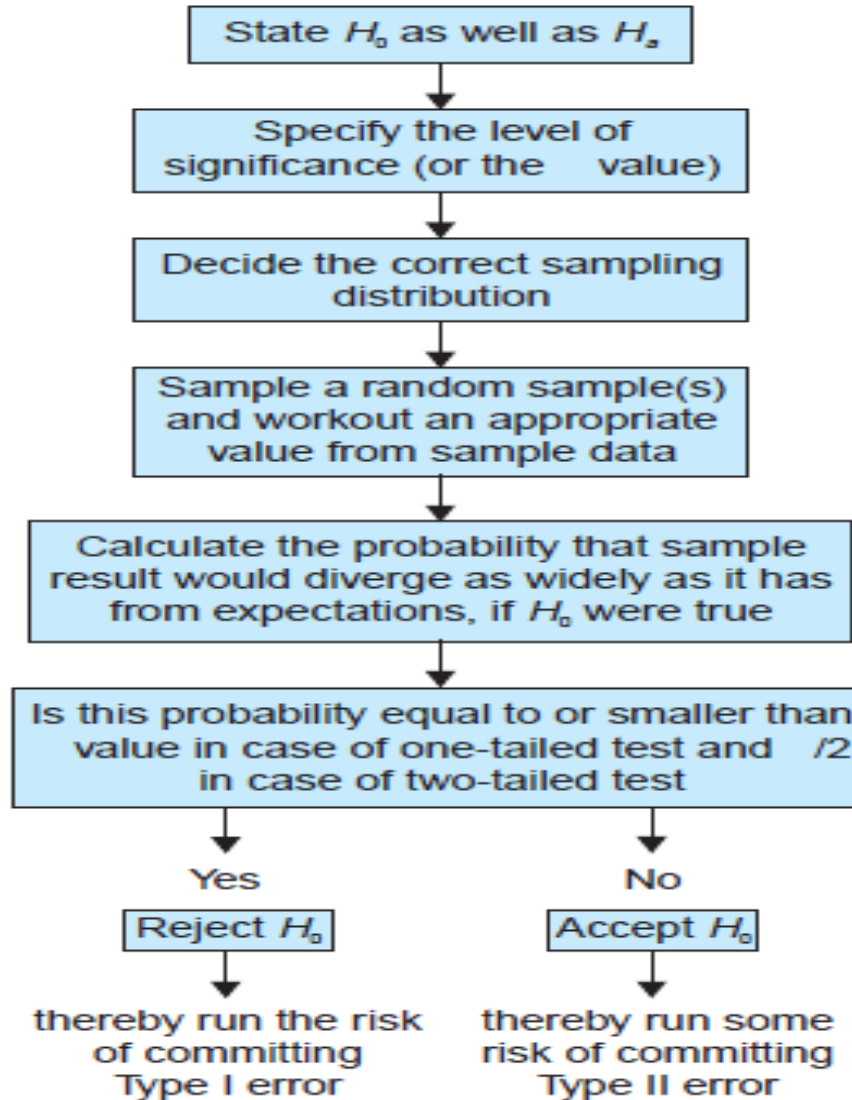
# Hypothesis Testing

**Hypothesis testing** was introduced by Ronald Fisher, Jerzy Neyman, Karl Pearson and Pearson's son, Egon Pearson.

Hypothesis testing is a statistical method that is used in making statistical decisions using experimental data. Hypothesis Testing is basically an assumption that we make about the population parameter.

# Steps in Hypothesis Testing

## FLOW DIAGRAM FOR HYPOTHESIS TESTING



# Null & Alternative Hypotheses

- In simple terms, a hypothesis is an assumption.
- World is dynamic, therefore, at times assumptions can be dangerous.
- When we test the assumptions, there are two possibilities:
  - 1) The assumption continues to hold good.
  - 2) We have reasons to believe that the assumption doesn't hold good anymore.

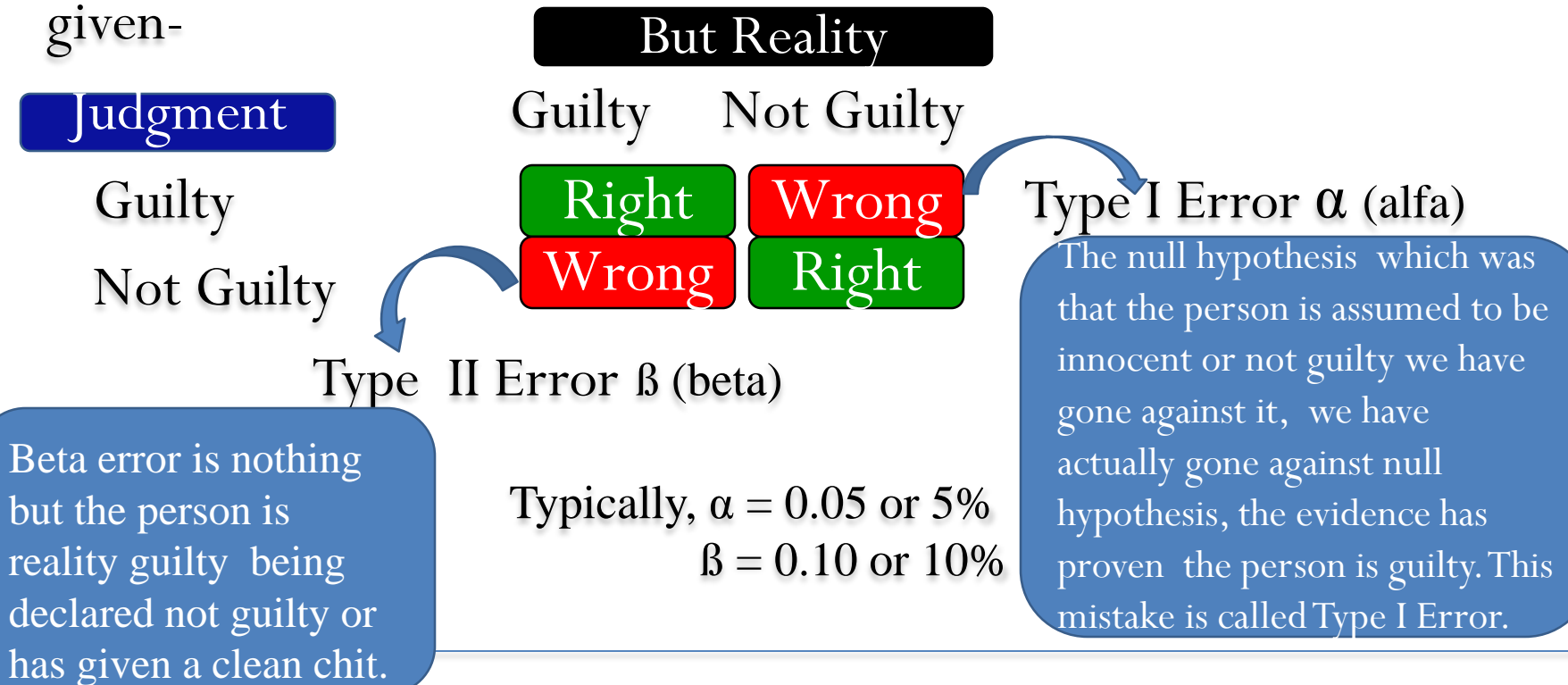
$H_0$  (assumed to be true)

&

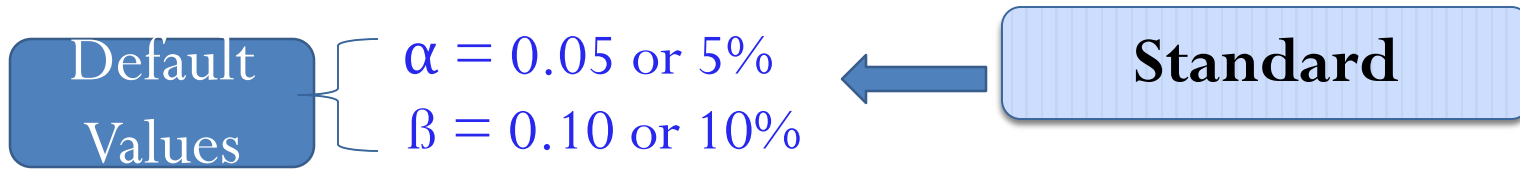
$H_a$  ( a claim against the assumption)

# Example- A judicial trial

- Presumption of innocence
- Assumed to be innocent until proven guilty ( $H_0$ )
- Prosecution's claim is...The person is guilty ( $H_a$ )
- Finally, after evaluating the evidences there will be a judgment given-

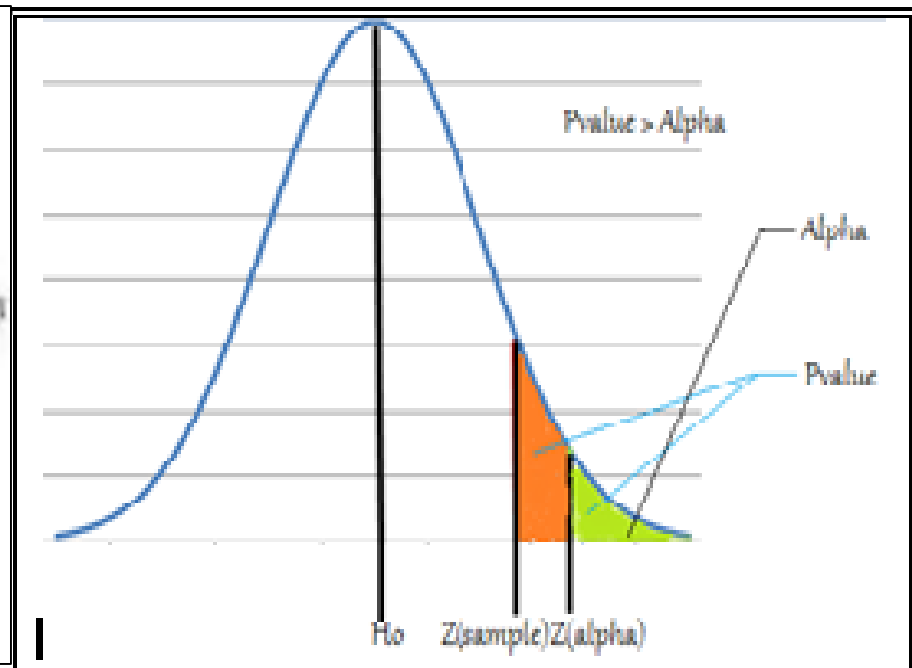
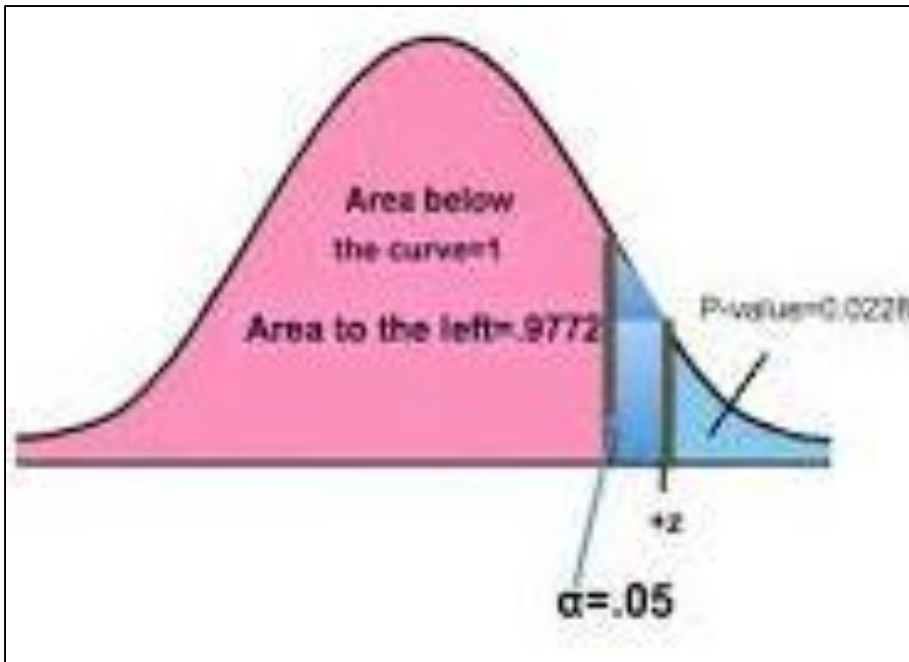


# Cont...



- Alfa is also known as thus level of significance. Its very important term.
- More terms are- extending the example from previous slide-
- $1 - \alpha$  is known as the confidence level
- $1 - \beta$  is known as the power of test.
- **p-value**- Calculated probability of making Type I error.
- Calculated Probability – here,  $\alpha$  that are kept at 0.05 or 5% whatever state in a problem is nothing but a Standard, it's a Point of Reference, but against the standard you will always look at where your given data stands, so you calculate the probability of making a Type 1 Error for data set on which you are working and you will compare it with the standard which are allowed to you.
- If **p-value**  $< \alpha$ , we reject  $H_0$  , if **p-value**  $> \alpha$ , we fail to reject  $H_0$ .

# Type I Error-Incorrectly rejecting the Null Hypothesis



If **p-value** <  $\alpha$ , we reject  $H_0$   
if **p-value** >  $\alpha$ , we fail to reject  $H_0$

Now a significance value (alpha) means how much error (5%) we can tolerate and still say the null hypothesis is true whereas the p-value shares actual amount of error that our sample data is tolerating. Suppose the case is P-value > alpha, so it means that our model is tolerating more than 5% error



**Right-Tailed Hypothesis Test**

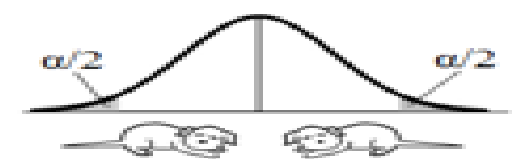
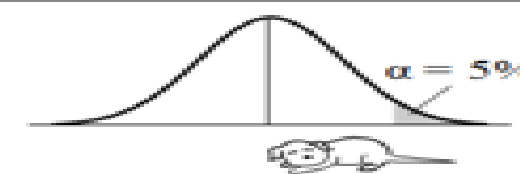
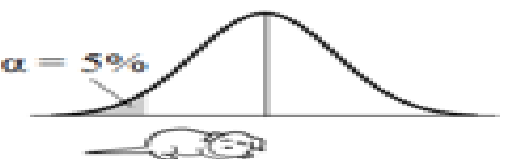
A Hypothesis Test where the rejection region is located to the extreme right of the distribution. A right-tailed test is conducted when the alternative hypothesis ( $H_A$ ) contains the condition  $H_A > x$  (greater than a given quantity).

**Left-Tailed Hypothesis Test**

A Hypothesis Test where the rejection region is located to the extreme left of the distribution. A left-tailed test is conducted when the alternative hypothesis ( $H_A$ ) contains the condition  $H_A < x$  (less than a given quantity).

**Two-Tailed Hypothesis Test**

A Hypothesis Test where the rejection region is divided equally between 2 critical values at the extremities of the distribution. A two-tailed test is applied when an alternative hypothesis ( $H_A$ ) equals a given quantity ( $H_A = x$ ).

| Comparison Operator |        | Tails of the Test      |   |
|---------------------|--------|------------------------|---|
| $H_A$               | $H_0$  |                        |   |
| $\neq$              | $=$    | 2-tailed               |   |
| $>$                 | $\leq$ | 1-tailed, right-tailed |  |
| $<$                 | $\geq$ | 1-tailed, left-tailed  |  |

# Type I and Type II Error

- A Type I error occurs when the null hypothesis ( $H_0$ ) is true, but is rejected.
- It is ascertaining something that is absent, a false hit
- An error in a statistical test which occurs when a false hypothesis is accepted (a false positive in terms of the null hypothesis).
- A Type II error occurs when the null hypothesis ( $H_0$ ) is false, but mistakenly fails to be rejected
- it is failing to assert what is present ,a miss
- An error in a statistical test which occurs when a true hypothesis is rejected (a false negative in terms of the null hypothesis).

Table of Error Types

| Table of error types                |                | Null hypothesis (H0) is  |   |
|-------------------------------------|----------------|--|---|
|                                     |                | True   | False   |
| Decision about null hypothesis (H0) | Fail to reject | Correct inference (true negative)<br>(probability = $1-\alpha$ ) | Type II error (false negative)<br>(probability = $\beta$ )      |
|                                     | Reject         | Type I error (false positive)<br>(probability = $\alpha$ )       | Correct inference (true positive)<br>(probability = $1-\beta$ ) |

# Hypothesis testing tools

- T-test,
- Z-test,
- Chi square test,
- ANNOVA etc.

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**Thank You**