

# An Implementation Model to Analyze Immunity System Using U-Test after First and Second Dose of Covishield for COVID-19

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**Abstract:-** Using Hypothesis Testing, we try to interpret or draw conclusions about the population using sample data. A Hypothesis Test evaluates two mutually exclusive statements about a population to determine which statement is best supported by the sample data. Hypothesis testing includes both parametric and non-parametric tests. Parametric tests are those tests for which we have prior knowledge of the population distribution (normal), or if not then we can easily approximate it to a normal distribution. In Non-Parametric tests, we don't make any assumption about the parameters for the given population or the population we are studying. . In The proposed work we have taken populations which are vaccinated by using Covishield to protect people from Covid-19. We want identify the immunity of the people after first dose and after second dose using Covishield vaccine. We used large population which are vaccinated and take random sample size for first and second dose for large population. We have collected data sample from 8 different Zone of Indore city and the population size is more 10,000.

**Keywords:-** Covishield, Population, Sample , Random, Hypothesis, Testing

## I.INTRODUCTION

In hypothesis testing, Statistical tests are used to check whether the null hypothesis is rejected or not rejected. These Statistical tests assume a null hypothesis of no relationship or no difference between groups. Using Hypothesis Testing, we try to interpret or draw conclusions about the population using sample data. A Hypothesis Test evaluates two mutually exclusive statements about a population to determine which statement is best supported by the sample data. Whenever we want to make claims about the distribution of data or whether one set of results are

different from another set of results in applied machine learning, we must rely on statistical hypothesis tests.

A hypothesis test is usually composed by:-

Null Hypothesis (H<sub>0</sub>, read "H zero"): states that all things remain equal. No phenomena is observed or there is not relationship between what we are comparing;

Alternative Hypothesis (H<sub>1</sub>, read "H one"): states the opposite of the Null Hypothesis. That there was some change, or observed relationship between what we are comparing

Hypothesis testing includes both parametric and non-parametric tests

### A. Mann Whitney U Test

The Mann Whitney U test, sometimes called the Mann Whitney Wilcoxon Test or the Wilcoxon Rank Sum Test, is used to test whether two samples are likely to derive from the same population (i.e., that the two populations have the same shape). Using Hypothesis Testing, we try to interpret or draw conclusions about the population using sample data. A Hypothesis Test evaluates two mutually exclusive statements about a population to determine which statement is best supported by the sample data. A popular nonparametric test to compare outcomes between two independent groups is the Mann Whitney U test. The Mann Whitney U test, sometimes called the Mann Whitney Wilcoxon Test or the Wilcoxon Rank Sum Test, is used to test whether two samples are likely to derive from the same population (i.e., that the two populations have the same shape). Some investigators interpret this test as comparing the medians between the two populations.

Every statistical method has assumptions. Assumptions mean that data must satisfy certain

properties in order for statistical method results to be accurate.

The assumptions for the Mann-Whitney U Test include:

- Continuous
- Skewed Distribution
- Random Sample
- Enough Data
- Similar Shape Between Groups

The variable that we care about (and want to see if it is different between the two groups) must be continuous. Continuous means that the variable can take on any reasonable value. Some good examples of continuous variables include age, weight, height, test scores, survey scores, yearly salary, etc.

### II.PROBLEM STATEMENT

There are so many statistical tools are available to analysis for the parametric and Nonparametric Tests. From last year covid-19 has infected so many persons in the entire world including male and female. To protect people from COVID -19 Governments try to vaccinated most of the population in the country. In proposed the main problems are

- A. Decide a Non-parametric tests from so many statistical are difficult
- B. It is Difficult to decide a priori which hypotheses are confirmatory that is, are testing some presupposed relationship.
- C. No single study can support a whole series of hypotheses. A sensible plan is to limit severely the number of confirmatory.
- D. This can be difficult to decide but as a rule of thumb results on the same individual, or from matched individuals, are not independent.

### III.PROPOSED APPROACH

#### A. Introduction Mann-Whitney U test

Mann-Whitney u-Test is a non-parametric test used to test whether two samples were selected from population having the same distribution. Another name for the Mann-Whitney U Test is Wilcoxon Rank Sum Test.

Mann-Whitney U test is the non-parametric alternative test to the independent sample test.

#### B. Test statistic

In the Mann Whitney U Test is denoted U and is the smaller of U1 and U2 Which is calculated by following formula

$$U_1 = n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

$$U_2 = n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_2$$

Here

U1 = test statistics for group1

U2 = test statistics for group2

R1 = sum of all rank assign to group1

R2=sum of all rank assign to group2

n1=sample size for group1

n2= sample size for group2

#### C. Assumptions for a Mann-Whitney U Test

Assumptions mean that data must satisfy certain properties in order for statistical method results to be accurate.

The assumptions for the Mann-Whitney U Test include:

- Continuous
- Skewed Distribution
- Random Sample
- Enough Data
- Similar Shape Between Groups

#### D. Steps of calculating for a Mann-Whitney U Test

Step 1: State the null and alternate hypothesis and rejection criteria

Step 2: Perform a ranking of all the observation

Step 3: Calculate the Rank Sums

Step 4: Calculate the U Statistic for the Two Groups

The formula the U statistic is given as:

$$U_1 = n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

Step 5: Determine the Critical value from U Table

### IV.RESULT

#### A. Comparison of immunity system after first and second Dose

Data have been collected from vaccinated person from 12 different zone in Indore. We have collected 1000 samples from each zone. The COVID-19 vaccine name is COVISHIELD. We Mann-Whitney U Test and want to check that two populations (after first dose and after second dose) are equal or not.

Table 3.1 : Vaccinated person and immunity system after first and second Dose

COVISHIELD	
After First Dose	After Second Dose
4132	7122
7103	8227
6322	7235
5221	8326
5334	9324
7166	7321
3342	9268
8213	8329
5162	6389
6254	9359
5389	7421
7276	8189

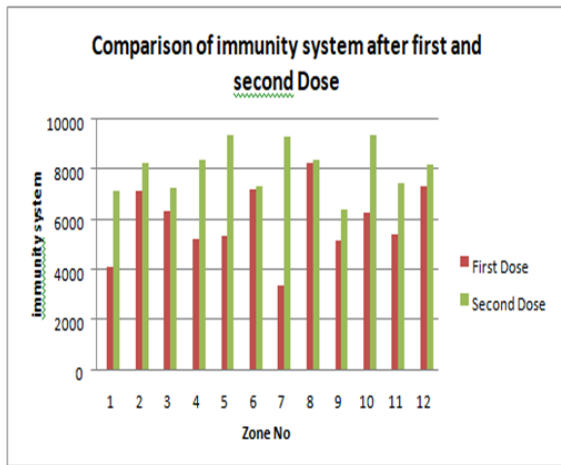


Figure 3.1 : Vaccinated person and immunity system after first and second Dose

In figure 3.1 Indicates that comparison analysis of immunity of individual after first and second dose of covishield. The figure shows immunity after second dose over large number of population has been increased in various zones.

B. Comparison ranks form ordered smallest to largest

This table show the ranks form ordered smallest to largest and Comparison of ranks are shown by the graph

Table 3.2: Assign ranks form ordered smallest to largest

Total Sample (Ordered Smallest to Largest)		Ranks	
First Dose	Second Dose	First Dose rank	Second Dose rank

30		1	
40		2	
50		4.5	
50		4.5	
50		4.5	
50		4.5	
60	60	8	8
60		8	
70	70	13	13
70	70	13	13
70	70	13	13
	70		13
80	80	19	19
	80		19
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	80		19
	80		19
	80		19
	80		19
	90		23
	90		23
	90		23

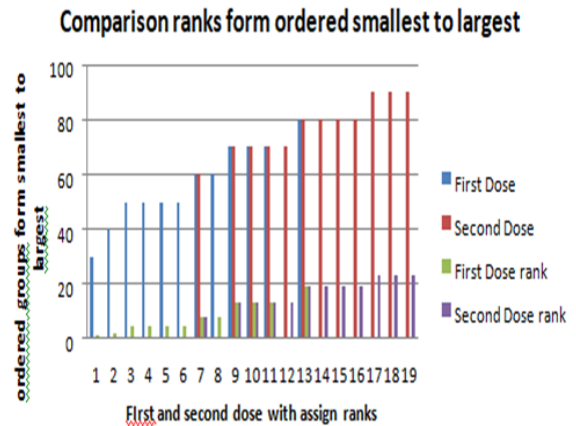


Figure 3.2: Comparison ranks form ordered smallest to largest Test after First and Second Dose of Covishield for COVID

C. Comparison based on tabulated and calculated value U statistics

We calculate the U Statistic for the Two Groups and take the smallest value .Now we check the calculate the U Statistic with tabulated value.

Table 3.3: Tabulated and calculated value U statistics

Calculated value of U statistics	Critical value from U Table
17	37

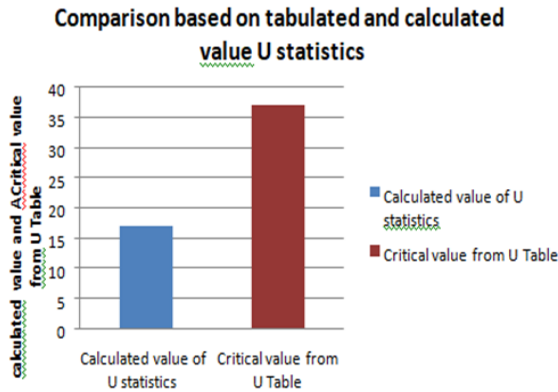


Figure 3.3: Tabulated and calculated value U statistics

Figure 3.3 shows comparison between calculated value of U statistics and critical value form U values

### V.CONCLUSION

The Mann Whitney U test, sometimes called the Mann Whitney Wilcoxon Test or the Wilcoxon Rank Sum Test, is used to test whether two samples are likely to derive from the same population (i.e., that the two populations have the same shape). Some investigators interpret this test as comparing the medians between the two populations. The Mann-Whitney U Test is a statistical test used to determine if 2 groups are significantly different from each other on your variable of interest. This test is used to investigate whether two independent samples were selected from a population having the same distribution.

### VII.LIMITATION

The main limitations are as follows:-

- A. Only one Covid-19 vaccine Covishield is used for experimental but there are other vaccine also used for covid-19.
  - B. Only used 12,000 vaccinated population
- There are several other test are also available, but we used only Mann Whitney U test.

### FUTURE SCOPE

In future the following things may be possible :

- A. Increased number of population and used for different cities.
- B. Used more number of covid-19 vaccine in test
- C. Compare the Mann Whitney U test with other test also

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