

A case study on COVID-19 in two districts of Kerala state viz. Kannur and Thiruvananthapuram

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ABSTRACT

The COVID-19 pandemic has paralyzed the social and economic life of all the countries throughout the world. Increase in the number of patients and death rates and the relation between such variables are brought under study by various scientific and academic institutions. The present study is an attempt to establish the correlation between the positive cases per day and recovery per day based on the secondary data related to Kannur and Thiruvananthapuram districts of Kerala state. The study reveals that there is no correlation between positive cases per day and recovery per day for Kannur and very weak correlation between positive cases per day and recovery per day for Thiruvananthapuram and a strong correlation between positive cases per day and recovery per day for Kerala. ANOVA is used here to get the information regarding the relationship between the death rate of men and women of certain age group.

Keywords

ANOVA, Chi-square, COVID-19, Correlation, Pandemic.

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

Coronavirus disease 2019 (COVID-19) is a disease which mainly affects our respiratory system. The first case was reported in December 2019 in Wuhan, China. More than 23.6 million cases have been reported across 188 countries and territories, with more than 813,000 death and more than 15.3 million recovery as per 25 August 2020.

Considering Kerala, the first case was reported in Thrissur on 30th January 2020. Later, as months passed, many of the cases were due to community spread. Subsequently, more cases were reported in Thiruvananthapuram. The pandemic has left a huge impact on the Indian economy which sequentially led to a negative growth rate for the first time in decades. After the lockdown was eased the economy started to rebound. Increase in the requirement of consumption had led the government to establish its firms for the manufacture of PPE, hospital beds and ventilators. As a result, during this pandemic India emerged as the second largest manufacturer of PPE. After the initial spread of COVID 19 in Kerala, it was on the month of July that the number of positive cases per day increased rapidly. Even people started dying and the death rate also got increased in various districts of the Kerala state. So the major impact of this pandemic started affecting the economy and the social lives of people from July onwards.

Research Objectives

1. To find the relation between number of positive cases and number of recovery cases per day of Thiruvananthapuram in the month of July.

2. To find the relation between number of positive cases and number of recovery cases per day of Kannur in the month of July.

3. To find the relation between number of positive cases, number of recovery cases and number of death per day in Kerala in the month of July.

Significance of the Study

In our case study, we are using correlation, which helps us in making predictions. If one value is known by respective methods, we will be able to find the value of other data. There can be either a relationship between the data or not.

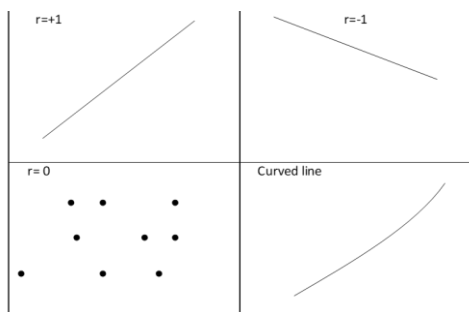
Correlation

In statistical terms, correlation gives the relationship between two data sets. The relationship is linear.

We use Pearson's correlation coefficient to find the degree of association. It can have values from -1 to +1, through 0.

There are three types of correlation:

- Positive correlation
- Negative correlation
- Zero correlation



Statistical Interpretation of Data

A. Sample data and Interpretation

To Determine if the Positive cases and Recovery rates of Covid 19 in Kannur district is correlated.

Table 1 shows the positive cases and recovery rates of Covid 19 per day in the Kannur district in the month of July and Figure 1 indicates the pie chart related to table. 1

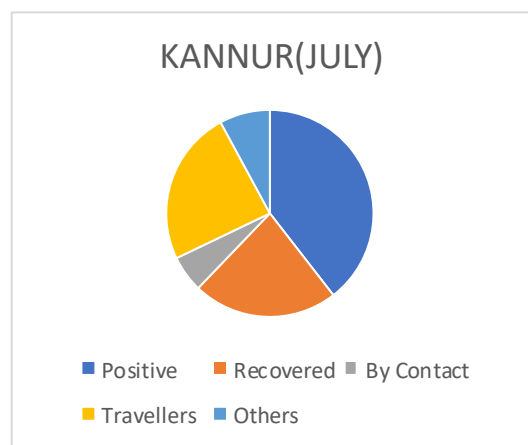


Figure 1

In Figure 1, the blue shaded region denotes the percentage of positive cases in July, orange region shows the percentage of recovery rate. The yellow region denotes the travellers and grey region denotes the people who are tested positive through contact.

DATE	Positive	Recovery
01-07-2020	27	12
04-07-2020	35	14
06-07-2020	11	11
09-07-2020	8	14
10-07-2020	23	13
12-07-2020	17	19
13-07-2020	44	17
14-07-2020	12	49
15-07-2020	35	5
16-07-2020	23	2
17-07-2020	9	11
18-07-2020	39	38
19-07-2020	13	22
20-07-2020	48	3
21-07-2020	57	10
22-07-2020	43	1
23-07-2020	51	4
25-07-2020	62	34
26-07-2020	47	64
27-07-2020	38	33
28-07-2020	43	15
29-07-2020	42	2
30-07-2020	39	48

Table 1

Correlation analysis of the above data

	Positive	Recovery
Positive	1	
Recovery	0.05557	1

Table 2

Interpretation:

We used correlation concept to get the conclusion. From the Table 2 we observe that the correlation coefficient obtained for the positive cases and recovery rates of Covid 19 per day in the Kannur district in the month of July is 0.05. This indicates that there is **no correlation** between the positive cases and the recovery rates per day in Kannur district in July.

To determine if the Positive cases and Recovery rates of Covid 19 in Thiruvananthapuram district is correlated

Table 3 shows the positive cases per day and the recovery cases per day of Thiruvananthapuram in July and table 4 gives the correlation interpretation of these data. Figure 2 indicates the pie chart related to table 2.

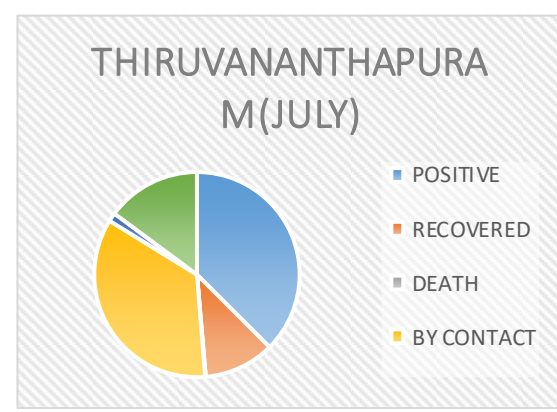


Figure 2

In Figure 2, the blue region shows the percentage of positive cases, red region denotes the percentage of recovery cases, yellow region denotes the people who are tested positive due to contact and grey region shows the percentage of deaths.

DATE	Positive	Recovery
01-07-20	4	3
04-07-20	16	5
06-07-20	7	7
09-07-20	95	9
10-07-20	129	5
12-07-20	40	3
13-07-20	63	3
14-07-20	201	15
15-07-20	157	11
16-07-20	339	1
17-07-20	246	8
18-07-20	173	7
19-07-20	222	25
20-07-20	182	2
21-07-20	151	11
22-07-20	226	9
23-07-20	222	60
25-07-20	240	229
26-07-20	175	51
27-07-20	161	65
28-07-20	222	170
29-07-20	213	26
30-07-20	70	220

Table 3

	Positive	Recovery
Positive	1	0.1509
Recovery	0.150936	1

Table 4

Interpretation:

We used correlation concept to get the conclusion. From the Table 4 we observe that the correlation coefficient obtained for the positive cases and recovery rates per day in Thiruvananthapuram in the month of July is 0.15 which indicates a **weak positive correlation**. The positive correlation coefficient indicates that both the variables are positively correlated, i.e., change in one variable cause a similar change in the other variable.

To determine if the Positive cases, Recovery rates and Death rates of Covid 19 in Kerala state is correlated.

Table 5 shows the positive cases, recovery rates and death rates of Covid 19 per day in Kerala in the month of July and Table 6 gives the correlation interpretation of these data. Figure 3 indicates the pie chart related to Table 5.

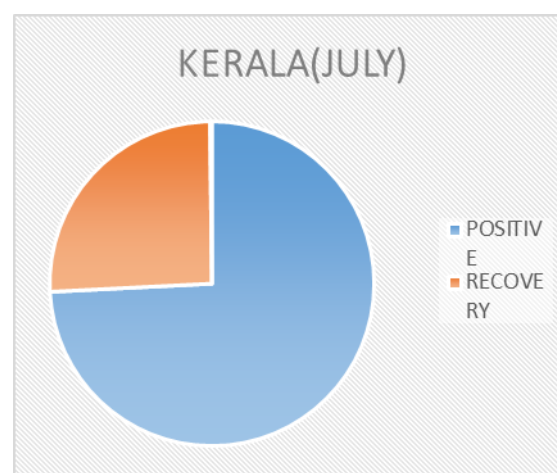


Figure 3

Figure 3 shows the positive rate (blue shaded region) and the recovery rate (red shaded region) of Kerala in July.

DATE	Positive	Recovery	Death
06-07-2020	193	167	2
07-07-2020	272	111	0
08-07-2020	301	107	0
09-07-2020	339	149	0
10-07-2020	416	112	0
11-07-2020	435	143	2
12-07-2020	449	132	2
14-07-2020	608	181	1
15-07-2020	623	196	1
16-07-2020	722	228	2
17-07-2020	791	133	1
18-07-2020	593	204	2
19-07-2020	821	172	2
20-07-2020	794	245	1
21-07-2020	720	274	1
22-07-2020	1038	272	1

23-07-2020	1078	432	5
25-07-2020	1103	1049	4
26-07-2020	927	689	2
27-07-2020	702	745	2
28-07-2020	1167	679	4
29-07-2020	903	641	1
30-07-2020	506	794	2

Table 5

	Positive	Recovery	Death
Positive	1		
Recovery	0.590863	1	
Death	0.622794	0.579415	1

Table 6

Interpretation:

We used correlation concept to get the conclusion. From the Table 6 we observe that the correlation coefficient obtained for the positive cases and death rates of Covid 19 per day in the Kerala state in the month of July is 0.62 which indicates a moderate positive relationship. The correlation coefficient obtained for the positive cases and recovery rate per day is 0.59 which indicates a moderate positive relationship. The correlation coefficient obtained for the recovery rate and death rate per day in the Kerala state in the month of July is 0.57 which shows that the variables are moderately correlated.

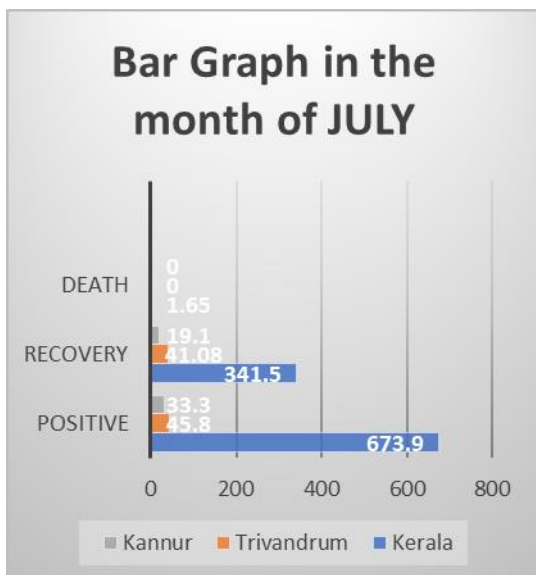


Figure 4

Based on the secondary data related to the districts Kannur, Thiruvananthapuram and the Kerala state, a bar graph is constructed for the month of July. It shows the positive rate, recovery rate and the death rate of the Covid 19.

ANOVA

ANOVA stands for the Analysis Of Variables which we generally use to compare datasets. It allows comparison of more than two groups at the same time to find if any kind of relationship exists between them.

	Men	Women
Above 60	158	93
Below 60	79	32

Table 7

Let Null Hypothesis, H_0 = The death rate of men is not associated with the death rate of Women.

H_1 = The death rate of Men is associated with the death rate of Women.

Anova: Single Factor				
SUMMARY				
Groups	Count	Sum	Average	Variance
Men	2	237	118.5	3120.5
Women	2	125	62.5	1860.5

Table 8: Summary Output

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3136	1	3136	1.259185	0.37843	18.51282
Within Groups	4981	2	2490.5			
Total	8117	3				

Table 9: Summary of ANOVA

At 5% level of significance F-value is 1.2591. For significance, the P-value should be greater than 0.05. From the table 9, we got P-value as 0.3784 which is greater than the significance level. Thus this result allows us to accept the null hypothesis. So there is no association between the death rate of Men and Women.

Chi-square statistics between the death rate of Men and Women

The Chi-Square Test determines the association between variables (whether the variables are independent or dependent). Pearson's chi-square test is used to check whether there is a significant difference between the observed frequencies and the expected frequencies in one or more categories.

From the following table we are calculating the chi-square between two categories

	Men	Women	Total
Above 60	158	93	251
Below 60	79	32	111
Total	237	125	362

Table 10: Observed frequency

Null Hypothesis H_0 . The number of death of men of age above or below 60 is not associated with that of the female. The expected frequency is calculated as

$$= \frac{\text{Product of column total and row total}}{\text{Whole total}}$$

Men\Women	Above 60	Below 60	Total
Above 60	59487/362	31375/362	251
Below 60	26307/362	13875/362	111
Total	237	125	362

Table 11: Expected frequency

Chi Square is calculated by summation of all the values for $\frac{(O_i - E_i)^2}{E_i}$,

where E_i is the expected frequency of each cell and O_i is the observed value

Thus from this table we get,

$$\chi^2 = 0.2437 + 0.46212 + 0.55115 + 1.04498$$

$$\chi^2 = 2.309$$

Tabulated value of χ^2 at 5% level for 1 degree of freedom is 3.841.

Since the calculated value of χ^2 is less than the tabulated value of χ^2 , H_0 is accepted. They are independent i.e, the number of deaths of men of age above or below 60 is not associated with that of female.

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