**Motivation**

*Nowadays, dengue & malaria disease is a serious issue. The number of cases & deaths due to dengue disease increases every year. World Health Organisation (WHO) has specified treatments for curing dengue & malaria disease. We wanted to make a report to check whether these treatments are equally effective in all hospitals of* ***PCMC*** *or not. We wanted to check whether the treatments given by government & private hospitals are equally effective or not. We wished to analyse the data of dengue cases in Maharashtra & India. Simultneously, we wanted to check the effect of treatments for malaria given by government hospitals.*

*We thought about the idea of making a report on this subject, when one of our friend was suffering from dengue disease. That time, we understood the seriousness of this disease. So, we decided to study about it.*

**Objective**

1. To compare the effect of treatments given to dengue patients in different hospitals in Pimpri - Chinchwad Municipal Corporation (PCMC) in year 2014.
2. To check the response to the treatments differs according to different age groups of patients or not.
3. To compare the effect of treatments given to malaria patients in government hospitals in PCMC in year 2014.
4. To analyse the data of dengue cases in Maharashtra from year 2010 to 2017.
5. To analyse the data of dengue cases in India from year 2010 to 2017.
6. To test the independency between sex of patients and diseases by mosquito (malaria and dengue).
7. Considering the effect of treatment, to test the independency between sex of patients and type of hospitals (Government / Private) i.e., to check whether the type of hospital is preferred or not depending on the gender for getting the treatment of dengue or malaria disease.
8. To check the proportion of male & female patients in case of Dengue and Malaria.

**Notations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Private Hospital** | **Notation** | **Government Hospital** | **Notation** |
| Aditya Birla Memorial Hosptial (ABMH) | x1 | Akurdi | x12 |
| Dhanwantari | x2 | Bhosari | x13 |
| Global | x3 | Sangvi | x14 |
| Niramaya | x4 | Yamunanagar | x15 |
| Sant Dnyaneshwar Hospital (SDH) | x5 | Yashwantrao Chavan Memorial Hospital (YCM) | x16 |
| Phoenix | x6 | Talera | x17 |
| D.Y.Patil (DYP) | x7 | Jijamata | x18 |
| Dnyaneshwar | x8 |  |  |
| Lokmanya | x9 |  |  |
| Sahyadri | x10 |  |  |
| New Sant Dnyaneshwar Hospital (NSDH) | x11 |  |  |

**Hospitals taken under analysis of dengue patients**

**Government hospitals taken under analysis of malaria patients**

|  |  |
| --- | --- |
| **Hospital** | **Notation** |
| Bhosari | h1 |
| Kalakhadak | h2 |
| Talera | h3 |
| Yamunanagar | h4 |
| Yashwantrao Chavan Memorial Hospital (YCM) | h5 |

**Age groups taken under analysis of dengue patients**

|  |  |
| --- | --- |
| **Age groups** | **Notation** |
| 0 to 8 | a1 |
| 9 to 18 | a2 |
| 19 to 45 | a3 |
| 46 to 65 | a4 |

**Methodology**

**Ⅰ. ANOVA -**

**1) To analyse or to test whether there is difference between means of treatments, we use ANOVA technique.**

**2) Basic assumptions of CRD :-**

i. Each Xij ~ N(*µ + αi*, σe*2*)

ii. Homoscedasticity – constant variance assumption

**3) Basic assumptions of RBD**

i. Each Xij ~ N(*µ + αi + βj* , σe*2*)

ii. Homoscedasticity – constant variance assumption

**4)** **To check the assumption of normality of data we use chi-square goodness of fit.**

**Ⅱ. Non - parametric test –**

**1)** **To check homoscedasticity of data, we use nonparametric Bartlett’s test.**

**2)** **When basic assumption of normality of ANOVA is violated then we use nonparametric Kruskal Wallis test to check the difference between means of treatments.**

**3) For comparing the response of independent age groups to the given treatment, we use Mann – Whitney test.**

**Ⅲ. Other tests -**

**1) For checking independency of attributes, we use chi - square test of independency.**

**2) For checking the proportion of population, we use proportion test using R – Software.**

**Ⅳ. Graphical tools -**

**1) Pie chart**

**2) Bar diagram**

**3) Scatter plot**

* **Tools used :-**

**1) R - Software**

**2) MS - Excel**

**3) MS - Word**

**Graphical Presentation**

**Proportion of Male & Female dengue patients in year 2014**

**Comment :-**

**Proportion of male dengue patients is more than that of female patients.**

**Seasonal trend of number of dengue patients in year 2014**

**Monthly count of Dengue patients in year 2014**

**Comment :-**

**During the period of June & November month, the count of dengue patients was more.**

**Seasonal trend of number of malaria patients in year 2014**

**Monthly count of Malaria patients in year 2014**

**Comment :-**

**During the period of June & November month, the count of dengue patients was more.**

**Number of dengue patients in states of India in year 2017**

**Comment :-**

**In Tamilnadu, Kerala, Karnataka, Punjab and West Bengal, the count of dengue patients is high respectively.**

**Number of deaths of dengue patients in states of India in year 2017**

**Comment :-**

**In Tamilnadu, Maharashtra, Kerala, Uttar Pradesh, West Bengal and Rajasthan, the count of deaths of dengue patients is high respectively.**

**Analysis of dengue patients**

**Private Hospital :-**

**Xij : Mean of number of admitted days of patients in i th hospital & j th age group**

**Note :** Bold values are estimated by taking average

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Age group** | **0 to 8** | **9 to 18** | **19 to 45** | **46 to 65** |
| **Hospital** | **ABMH** | 6 | 6 | 6 | 9 |
| **Dhanwantari** | **6** | 6 | 6 | 7 |
| **Global** | **6** | 7 | 7 | 9 |
| **Niramaya** | 5 | 7 | 7 | 8 |
| **SDH** | 5 | 7 | 7 | 8 |
| **Phoenix** | 6 | 6 | 7 | **8** |
| **DYP** | **6** | 6 | 7 | **8** |
| **Dyaneshwar** | **6** | 6 | 7 | **8** |
| **Lokmanya** | **6** | **6** | 8 | **8** |
| **Sahyadri** | 6 | **6** | 8 | **8** |
| **NSDH** | **6** | **6** | 8 | 8 |

**Government Hospital :-**

**Xij : Mean of number of admitted days of patients in i th hospital & j th age group**

**Note :** Bold values are estimated by taking average

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Age Group** | **Hospital** | | | | | | |
| **Akurdi** | **Bhosari** | **Sangvi** | **Yamunanagar** | **YCM** | **Talera** | **Jijamata** |
| **0 to 8** | **5** | **5** | 6 | 4 | 5 | **5** | 4 |
| **9 to 18** | 6 | 7 | 7 | 7 | 6 | 5 | **6** |
| **19 to 45** | 6 | **7** | 6 | 6 | 6 | 6 | 6 |
| **46 to 65** | 6 | 7 | 8 | 8 | 8 | **7** | **7** |

**Testing normality of Xij from all hospitals –**

*H0 : Means of admitted days of patients comes from Normal distribution*

*v/s*

*H1 : Means of admitted days of patients does not come from Normal distribution*

**R-Command :**

>x=c(6,6,6,5,5,6,6,6,6,6,6,6,6,7,7,7,6,6,6,6,6,6,6,6,7,7,7,7,7,7,8,8,8,9,7,9,8,8,8,8,8,8,8,8,5,5,6,4,5,5,4,6,7,7,7,6,5,6,6,7,6,6,6,6,6,6,7,8,8,8,7,7)

>shapiro.test(x)

Shapiro-Wilk normality test

data: x

W = 0.91123, p-value = 8.889e-05

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of dengue patients may not come from Normal distribution.**

***\*Since assumption of normality is violated,***

***We use the corresponding non - parametric test.***

**Kruskal Wallis test for mean of admitted days of patients in all hospitals –**

*H0 : Means of admitted days of patients in hospitals are equal*

*v/s*

*H1 : Means of admitted days of patients in hospitals are not equal*

**R-Command :**

>x1=c(6,6,6,9)

>x2=c(6,6,6,7)

>x3=c(6,7,7,9)

>x4=c(5,7,7,8)

>x5=c(5,7,7,8)

>x6=c(6,6,7,8)

>x7=c(6,6,7,8)

>x8=c(6,6,7,8)

>x9=c(6,6,8,8)

>x10=c(6,6,8,8)

>x11=c(6,6,8,8)

>x12=c(5,6,6,6)

>x13=c(5,7,7,7)

>x14=c(6,7,6,6)

>x15=c(4,7,6,8)

>x16=c(5,6,6,8)

>x17=c(5,5,6,7)

>x18=c(4,6,6,7)

> pg=list(x1,x2,x3,x4,x5,x6,x7,x8,x9,x10,x11,x12,x13,x14,x15,x16,x17,x18)

> k=kruskal.test(pg)

>pv=k$p.value

>print(k)

Kruskal-Wallis rank sum test

data: pg

Kruskal-Wallis chi-squared = 11.975, df = 17, p-value = 0.8016

**Decision :**

p-value > l.o.s. = 0.05

We accept H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of dengue patients in hospitals may be equal.**

**Testing normality of admitted days of dengue patients from all age groups -**

**Xij : Admitted days of j th individual dengue patient from i th age group**

**a1 : Patients of age group 0 to 8 years**

**a2 : Patients of age group 9 to 18 years**

**a3 : Patients of age group 19 to 45 years**

**a4: Patients of age group 46 to 65 years**

*H0 : Admitted days of patients comes from Normal distribution*

*v/s*

*H1 : Admitted days of patients does not come from Normal distribution*

**R-Command :**

>a1=c(5,5,5,6,7,4,4,4,4,5,5,6,5,6,4,5,6,7)

>a2=c(7,8,8,8,4,6,6,4,5,6,6,7,7,8,5,5,5,6,9,5,9,4,6,6,7,5,7,6,5,7,6,4,5,6,6,5,6,5,6,7,8,6,7,7,7,7,8,5,7,4,6,7,5,5,7,6,6,8,5,6,5,7,6,6,9,5,5,5,5,6,6,6,7,6,7,6,7,7,9,5,7,10,8,6,8,6)

>a3=c(5,5,5,7,6,6,5,7,8,9,9,9,9,6,7,6,5,5,6,7,7,5,5,9,7,10,7,7,8,5,5,7,7,7,6,6,7,8,7,5,5,7,8,7,5,6,7,5,10,5,5,5,5,5,7,7,7,7,7,7,6,6,6,6,8,8,6,9,8,5,5,8,5,9,7,6,6,7,5,4,5,7,9,5,6,5,5,7,7,6,5,8,7,6,4,6,7,6,8,6,5,6,9,9,10,7,5,8,8,7,5,7,6,5,4,7,8,7,7,7,8,6,7,7,7,7,4,5,5,5,4,6,6,4,7,7,6,6,4,6,6,6,7,7,6,6,5,8,8,6,8,7,9,5,4,4,9,6,5,5,7,6,4,7,7,5,7,7,7,6,6,6,6,8,4,5,6,5,4,7,8,7,6,8,8,6,6,7,5,6,6,6,8,7,7,7,7,7,4,6,7,5,5,6,7,5,4,8,8,8,6,6,10,9,7,6,7,7,7,7,6,8,8,5,8,8,6,9,6,6,7,7,7,7,8,8,8,6,4,7,6,5,5,5,7,7,6,6,6,6,5,7,7,7,7,7,6,6,5,5,8,8,7,7,6,6,6,6,5,7,7,8,10,5,5,6,7,5,8,8,8,6,5,6,7,7,7,6,9,9,7,6,6,6,5,10,7,7,7,7,6,5,8,8,7,6,7,9,7,5,6,6,7,8,6,6,6,7,7,9,7,8,9,8,7,5,8,7,6,7,8,7,9,7,6,5,7,9)

>a4=c(9,5,8,8,9,10,7,8,8,7,7,7,7,9,10,10,10,6,8,8,9,9,10,9,9,5,7,6,6,7,8,9,8,8,7,7,7,8,7,8,6,7,10,8,8,8,8,8,5,8,8,5,5,7,7,8,8,6,9,6,7,6,7,7,6,7,10,9,8,11)

> z=c(a1,a2,a3,a4)

>shapiro.test(z)

Shapiro-Wilk normality test

data: z

W = 0.94575, p-value = 9.614e-13

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Admitted days of dengue patients in all age groups may not come from Normal distribution.**

**Comparison of mean of admitted days from different age groups**

**(Mann – Whiteny Test) :-**

1. **Age group of 0 to 8 and 9 to 18 years -**

*H0 : Means of admitted days of two age groups are equal*

*v/s*

*H1 : Means of admitted days of two age groups are not equal*

**R-Command :**

>a1=c(5,5,5,6,7,4,4,4,4,5,5,6,5,6,4,5,6,7)>a2=c(7,8,8,8,4,6,6,4,5,6,6,7,7,8,5,5,5,6,9,5,9,4,6,6,7,5,7,6,5,7,6,4,5,6,6,5,6,5,6,7,8,6,7,7,7,7,8,5,7,4,6,7,5,5,7,6,6,8,5,6,5,7,6,6,9,5,5,5,5,6,6,6,7,6,7,6,7,7,9,5,7,10,8,6,8,6)

>wilcox.test(a1,a2)

Wilcoxon rank sum test with continuity correction

data: a1 and a2

W = 395.5, p-value = 0.0008348

alternative hypothesis: true location shift is not equal to 0

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 0 to 8 & 9 to 18 years may not be equal.**

1. **Age group of 0 to 8 and 19 to 45 years -**

*H0 : Means of admitted days of two age groups are equal*

*v/s*

*H1 : Means of admitted days of two age groups are not equal*

**R-Command :**

>a1=c(5,5,5,6,7,4,4,4,4,5,5,6,5,6,4,5,6,7)

>a3=c(5,5,5,7,6,6,5,7,8,9,9,9,9,6,7,6,5,5,6,7,7,5,5,9,7,10,7,7,8,5,5,7,7,7,6,6,7,8,7,5,5,7,8,7,5,6,7,5,10,5,5,5,5,5,7,7,7,7,7,7,6,6,6,6,8,8,6,9,8,5,5,8,5,9,7,6,6,7,5,4,5,7,9,5,6,5,5,7,7,6,5,8,7,6,4,6,7,6,8,6,5,6,9,9,10,7,5,8,8,7,5,7,6,5,4,7,8,7,7,7,8,6,7,7,7,7,4,5,5,5,4,6,6,4,7,7,6,6,4,6,6,6,7,7,6,6,5,8,8,6,8,7,9,5,4,4,9,6,5,5,7,6,4,7,7,5,7,7,7,6,6,6,6,8,4,5,6,5,4,7,8,7,6,8,8,6,6,7,5,6,6,6,8,7,7,7,7,7,4,6,7,5,5,6,7,5,4,8,8,8,6,6,10,9,7,6,7,7,7,7,6,8,8,5,8,8,6,9,6,6,7,7,7,7,8,8,8,6,4,7,6,5,5,5,7,7,6,6,6,6,5,7,7,7,7,7,6,6,5,5,8,8,7,7,6,6,6,6,5,7,7,8,10,5,5,6,7,5,8,8,8,6,5,6,7,7,7,6,9,9,7,6,6,6,5,10,7,7,7,7,6,5,8,8,7,6,7,9,7,5,6,6,7,8,6,6,6,7,7,9,7,8,9,8,7,5,8,7,6,7,8,7,9,7,6,5,7,9)

>wilcox.test(a1,a3)

Wilcoxon rank sum test with continuity correction

data: a1 and a3

W = 1271, p-value = 1.928e-05

alternative hypothesis: true location shift is not equal to 0

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 0 to 8 & 19 to 45 years may not be equal.**

1. **Age group of 0 to 8 and 46 to 65 years -**

*H0 : Means of admitted days of two age groups are equal*

*v/s*

*H1 : Means of admitted days of two age groups are not equal*

**R-Command :**

>a1=c(5,5,5,6,7,4,4,4,4,5,5,6,5,6,4,5,6,7)

>a4=c(9,5,8,8,9,10,7,8,8,7,7,7,7,9,10,10,10,6,8,8,9,9,10,9,9,5,7,6,6,7,8,9,8,8,7,7,7,8,7,8,6,7,10,8,8,8,8,8,5,8,8,5,5,7,7,8,8,6,9,6,7,6,7,7,6,7,10,9,8,11)

>wilcox.test(a1,a4)

Wilcoxon rank sum test with continuity correction

data: a1 and a4

W = 97.5, p-value = 2.209e-08

alternative hypothesis: true location shift is not equal to 0

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 0 to 8 & 46 to 65 years may not be equal.**

1. **Age group of 9 to 18 and 19 to 45 years -**

*H0 : Means of admitted days of two age groups are equal*

*v/s*

*H1 : Means of admitted days of two age groups are not equal*

**R-Command :**

>a2=c(7,8,8,8,4,6,6,4,5,6,6,7,7,8,5,5,5,6,9,5,9,4,6,6,7,5,7,6,5,7,6,4,5,6,6,5,6,5,6,7,8,6,7,7,7,7,8,5,7,4,6,7,5,5,7,6,6,8,5,6,5,7,6,6,9,5,5,5,5,6,6,6,7,6,7,6,7,7,9,5,7,10,8,6,8,6)

>a3=c(5,5,5,7,6,6,5,7,8,9,9,9,9,6,7,6,5,5,6,7,7,5,5,9,7,10,7,7,8,5,5,7,7,7,6,6,7,8,7,5,5,7,8,7,5,6,7,5,10,5,5,5,5,5,7,7,7,7,7,7,6,6,6,6,8,8,6,9,8,5,5,8,5,9,7,6,6,7,5,4,5,7,9,5,6,5,5,7,7,6,5,8,7,6,4,6,7,6,8,6,5,6,9,9,10,7,5,8,8,7,5,7,6,5,4,7,8,7,7,7,8,6,7,7,7,7,4,5,5,5,4,6,6,4,7,7,6,6,4,6,6,6,7,7,6,6,5,8,8,6,8,7,9,5,4,4,9,6,5,5,7,6,4,7,7,5,7,7,7,6,6,6,6,8,4,5,6,5,4,7,8,7,6,8,8,6,6,7,5,6,6,6,8,7,7,7,7,7,4,6,7,5,5,6,7,5,4,8,8,8,6,6,10,9,7,6,7,7,7,7,6,8,8,5,8,8,6,9,6,6,7,7,7,7,8,8,8,6,4,7,6,5,5,5,7,7,6,6,6,6,5,7,7,7,7,7,6,6,5,5,8,8,7,7,6,6,6,6,5,7,7,8,10,5,5,6,7,5,8,8,8,6,5,6,7,7,7,6,9,9,7,6,6,6,5,10,7,7,7,7,6,5,8,8,7,6,7,9,7,5,6,6,7,8,6,6,6,7,7,9,7,8,9,8,7,5,8,7,6,7,8,7,9,7,6,5,7,9)

>wilcox.test(a2,a3)

Wilcoxon rank sum test with continuity correction

data: a2 and a3

W = 12705, p-value = 0.06407

alternative hypothesis: true location shift is not equal to 0

**Decision :**

p-value > l.o.s. = 0.05

We accept H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 9 to 18 & 19 to 45 years may be equal.**

1. **Age group of 9 to 18 and 46 to 65 years -**

*H0 : Means of admitted days of two age groups are equal*

*v/s*

*H1 : Means of admitted days of two age groups are not equal*

**R-Command :**

>a2=c(7,8,8,8,4,6,6,4,5,6,6,7,7,8,5,5,5,6,9,5,9,4,6,6,7,5,7,6,5,7,6,4,5,6,6,5,6,5,6,7,8,6,7,7,7,7,8,5,7,4,6,7,5,5,7,6,6,8,5,6,5,7,6,6,9,5,5,5,5,6,6,6,7,6,7,6,7,7,9,5,7,10,8,6,8,6)

>a4=c(9,5,8,8,9,10,7,8,8,7,7,7,7,9,10,10,10,6,8,8,9,9,10,9,9,5,7,6,6,7,8,9,8,8,7,7,7,8,7,8,6,7,10,8,8,8,8,8,5,8,8,5,5,7,7,8,8,6,9,6,7,6,7,7,6,7,10,9,8,11)

>wilcox.test(a2,a4)

Wilcoxon rank sum test with continuity correction

data: a2 and a4

W = 1400, p-value = 5.016e-09

alternative hypothesis: true location shift is not equal to 0

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 9 to 18 & 46 to 65 yearsmay not be equal.**

1. **Age group of 19 to 45 and 46 to 65 years -**

*H0 : Means of admitted days of two age groups are equal*

*v/s*

*H1 : Means of admitted days of two age groups are not equal*

**R-Command :**

>a3=c(5,5,5,7,6,6,5,7,8,9,9,9,9,6,7,6,5,5,6,7,7,5,5,9,7,10,7,7,8,5,5,7,7,7,6,6,7,8,7,5,5,7,8,7,5,6,7,5,10,5,5,5,5,5,7,7,7,7,7,7,6,6,6,6,8,8,6,9,8,5,5,8,5,9,7,6,6,7,5,4,5,7,9,5,6,5,5,7,7,6,5,8,7,6,4,6,7,6,8,6,5,6,9,9,10,7,5,8,8,7,5,7,6,5,4,7,8,7,7,7,8,6,7,7,7,7,4,5,5,5,4,6,6,4,7,7,6,6,4,6,6,6,7,7,6,6,5,8,8,6,8,7,9,5,4,4,9,6,5,5,7,6,4,7,7,5,7,7,7,6,6,6,6,8,4,5,6,5,4,7,8,7,6,8,8,6,6,7,5,6,6,6,8,7,7,7,7,7,4,6,7,5,5,6,7,5,4,8,8,8,6,6,10,9,7,6,7,7,7,7,6,8,8,5,8,8,6,9,6,6,7,7,7,7,8,8,8,6,4,7,6,5,5,5,7,7,6,6,6,6,5,7,7,7,7,7,6,6,5,5,8,8,7,7,6,6,6,6,5,7,7,8,10,5,5,6,7,5,8,8,8,6,5,6,7,7,7,6,9,9,7,6,6,6,5,10,7,7,7,7,6,5,8,8,7,6,7,9,7,5,6,6,7,8,6,6,6,7,7,9,7,8,9,8,7,5,8,7,6,7,8,7,9,7,6,5,7,9)

>a4=c(9,5,8,8,9,10,7,8,8,7,7,7,7,9,10,10,10,6,8,8,9,9,10,9,9,5,7,6,6,7,8,9,8,8,7,7,7,8,7,8,6,7,10,8,8,8,8,8,5,8,8,5,5,7,7,8,8,6,9,6,7,6,7,7,6,7,10,9,8,11)

>wilcox.test(a3,a4)

Wilcoxon rank sum test with continuity correction

data: a3 and a4

W = 6659, p-value = 3.639e-09

alternative hypothesis: true location shift is not equal to 0

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 19 to 45 & 46 to 65 years may not be equal.**

***\*Since means of admitted days of some age groups may not be equal,***

***We compare them with each other individually.***

1. **Age group of 0 to 8 and 9 to 18 years -**

*H0 : Means of admitted days of age group 0 to 8 & 9 to 18 are equal*

*v/s*

*H1 :Means of admitted days of age group 0 to 8 is less than that of 9 to 18*

**R-Command :**

> a1=c(5,5,5,6,7,4,4,4,4,5,5,6,5,6,4,5,6,7)

>a2=c(7,8,8,8,4,6,6,4,5,6,6,7,7,8,5,5,5,6,9,5,9,4,6,6,7,5,7,6,5,7,6,4,5,6,6,5,6,5,6,7,8,6,7,7,7,7,8,5,7,4,6,7,5,5,7,6,6,8,5,6,5,7,6,6,9,5,5,5,5,6,6,6,7,6,7,6,7,7,9,5,7,10,8,6,8,6)

>wilcox.test(a1,a2,alt="less")

Wilcoxon rank sum test with continuity correction

data: a1 and a2

W = 395.5, p-value = 0.0004174

alternative hypothesis: true location shift is less than 0

**Decision :**

p-value<l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 0 to 8 years may be less than that of 9 to 18 years.**

1. **Age group of 0 to 8 and 46 to 65 years -**

*H0 : Means of admitted days of age group 0 to 8 & 46 to 65 are equal*

*v/s*

*H1 : Means of admitted days of age group 0 to 8 is less than that of 46 to 65*

**R-Command :**

> a1=c(5,5,5,6,7,4,4,4,4,5,5,6,5,6,4,5,6,7)

>a4=c(9,5,8,8,9,10,7,8,8,7,7,7,7,9,10,10,10,6,8,8,9,9,10,9,9,5,7,6,6,7,8,9,8,8,7,7,7,8,7,8,6,7,10,8,8,8,8,8,5,8,8,5,5,7,7,8,8,6,9,6,7,6,7,7,6,7,10,9,8,11)

>wilcox.test(a1,a4,alt="less")

Wilcoxon rank sum test with continuity correction

data: a1 and a4

W = 97.5, p-value = 1.105e-08

alternative hypothesis: true location shift is less than 0

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 0 to 8 years may be less than that of 46 to 65 years.**

1. **Age group of 9 to 18 and 46 to 65 years -**

*H0 : Means of admitted days of age group 9 to 18&46 to 65 are equal*

*v/s*

*H1 : Means of admitted days of age group 9 to 18 is less than that of 46 to 65*

**R-Command :**

>a2=c(7,8,8,8,4,6,6,4,5,6,6,7,7,8,5,5,5,6,9,5,9,4,6,6,7,5,7,6,5,7,6,4,5,6,6,5,6,5,6,7,8,6,7,7,7,7,8,5,7,4,6,7,5,5,7,6,6,8,5,6,5,7,6,6,9,5,5,5,5,6,6,6,7,6,7,6,7,7,9,5,7,10,8,6,8,6)

>a4=c(9,5,8,8,9,10,7,8,8,7,7,7,7,9,10,10,10,6,8,8,9,9,10,9,9,5,7,6,6,7,8,9,8,8,7,7,7,8,7,8,6,7,10,8,8,8,8,8,5,8,8,5,5,7,7,8,8,6,9,6,7,6,7,7,6,7,10,9,8,11)

>wilcox.test(a2,a4,alt="less")

Wilcoxon rank sum test with continuity correction

data: a2 and a4

W = 1400, p-value = 2.508e-09

alternative hypothesis: true location shift is less than 0

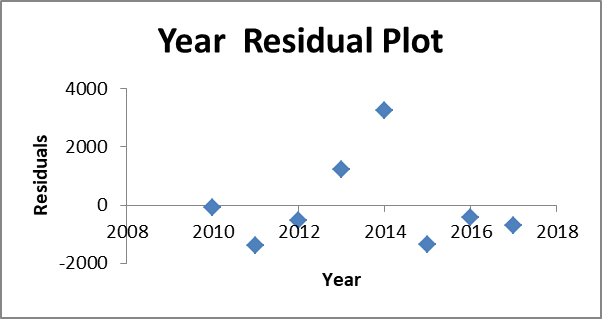
**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Means of admitted days of age group 9 to 18 years may be less than that of 46 to 65 years.**

**Analysis of dengue cases in Maharashtra from year 2010 to 2017**

**Interpretation :**

1. **Residual plots are randomly distributed. Hence, the fitted regression model is adequate.**
2. **There is increase of 940 dengue cases (y) in Maharashtra for every year (x).**

**Analysis of dengue cases in India from year 2010 to 2017**

**Interpretation :**

1. **Residual plots are randomly distributed. Hence we can say the fitted regression model is adequate.**
2. **There is increase of 18665 dengue cases (y) in India for every year (x).**

**Analysis of malaria patients**

**Testing normality of admitted days of malaria patients from government hospitals -**

*H0 :Admitted days of malaria patients comes from Normal Distribution*

*v/s*

*H1 :Admitted days of malaria patients does not come from Normal Distribution*

**R-Command :**

> x=c(7,13,14,15,16)

> f=c(1,40,5,1,1)

> y=rep(x,f)

> am=mean(y)

>vr=(47/48)\*var(y)

>sd=sqrt(vr)

> am

[1] 13.08333

>sd

[1] 1.057381

>ks.test(y,"pnorm",am,sd)

One-sample Kolmogorov-Smirnov test

data: y

D = 0.4478, p-value = 8.755e-09

alternative hypothesis: two-sided

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Admitted days of malaria patients does not comes from Normal Distribution.**

***\* Since assumption of normality is violated,***

***We use the corresponding non - parametric test.***

**Kruskal Wallis test for admitted days of patients in Government Hospitals -**

*H0 : Admitted days of patients in Government Hospitals does not differ significantly*

*v/s*

*H1 : Admitted days of patients in Government Hospitals differ significantly*

**R-Command :**

> h1=c(13,14,16,13,13,13,13,13)

> h2=c(13,13,13,13)

> h3=c(14,13)

> h4=c(14,13)

> h5=c(rep(13,27),15,7,14,14)

> x=list(h1,h2,h3,h4,h5)

> k=kruskal.test(x)

>pv=k$p.value

>print(k)

Kruskal-Wallis rank sum test

data: x

Kruskal-Wallis chi-squared = 5.3047, df = 4, p-value = 0.2574

**Decision :**

p-value = 0.2574 >l.o.s. = 0.05

We accept H0 at 5% l.o.s.

**Conclusion :**

**Admitted days of patients in government Hospitals may not differ significantly.**

**Independency of Attributes**

* **Sex of patients & Diseases by mosquitoes :**

*H0 : Sex of patients & diseases by mosquitoes are independent*

*v/s*

*H1 : Sex of patients & diseases by mosquitoes are not independent*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Dengue** | **Malaria** | **Total** |
| **Male** | **357** | **39** | **396** |
| **Female** | **167** | **9** | **176** |
| **Total** | **524** | **48** | **572** |

**R-Command :**

>x=c(357,167,39,9)

>mx=matrix(x,nrow=2,ncol=2)

>mx

[,1] [,2]

[1,] 357 39

[2,] 167 9

>chisq.test(mx,correct=F)

Pearson's Chi-squared test

data: mx

X-squared = 3.5534, df = 1, p-value = 0.05942

**Decision :**

p-value = 0.05942 > l.o.s. = 0.05

We accept H0 at 5% l.o.s.

**Conclusion :**

**Sex of patients & diseases by mosquito maybe independent.**

* **Sex of patients & type of hospitals (Government / Private) :**

*H0 : Sex of patients & hospitals are independent*

*v/s*

*H1 : Sex of patients & hospitals are not independent*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Government** | **Private** | **Total** |
| **Male** | **148** | **209** | **357** |
| **Female** | **69** | **98** | **167** |
| **Total** | **217** | **307** | **524** |

> x=c(148,69,209,98)

>mx=matrix(x,nrow=2,ncol=2)

>mx

[,1] [,2]

[1,] 148 209

[2,] 69 98

>chisq.test(mx,correct=F)

Pearson's Chi-squared test

data: mx

X-squared = 9e-04, df = 1, p-value = 0.976

**Decision :**

p-value = 0.976 > l.o.s. = 0.05

We accept H0 at 5% l.o.s.

**Conclusion :**

**Sex of patients & type of hospitals maybe independent.**

**Proportionality Test**

* **Proportionality Test of Dengue Patients (Male / Female) :**

*H0 : Proportion of male & female patients is equal*

*v/s*

*H1 : Proportion of male patients is more than that of female patients*

**R-Command :**

> x=357

> n=524

>prop.test(x,n,p=0.5,alternative="greater")

1-sample proportions test with continuity correction

data: x out of n, null probability 0.5

X-squared = 68.17, df = 1, p-value < 2.2e-16

alternative hypothesis: true p is greater than 0.5

95 percent confidence interval:

0.645981 1.000000

sample estimates:

p

0.6812977

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Proportion of male patients may be more than that of female patients.**

* **Proportionality Test of Malaria Patients(Male / Female) :**

*H0 : Proportion of male & female patients is equal*

*v/s*

*H1 : Proportion of male patients is more than that of female patients*

**R-Command :**

> x=39

> n=48

>prop.test(x,n,p=0.5,alternative="greater")

1-sample proportions test with continuity correction

data: x out of n, null probability 0.5

X-squared = 17.521, df = 1, p-value = 1.421e-05

alternative hypothesis: true p is greater than 0.5

95 percent confidence interval:

0.6925295 1.0000000

sample estimates:

p

0.8125

**Decision :**

p-value < l.o.s. = 0.05

We reject H0 at 5% l.o.s.

**Conclusion :**

**Proportion of male patients may be more than that of female patients.**

**Conclusion**

**1. Dengue Patients:**

1. Treatments given by all hospitals of PCMC are equally effective.
2. Response to the treatments differs according to different age groups.

|  |  |
| --- | --- |
| **Patient’s Age group** | **Response to the given treatment** |
| 0 to 8 years | Highly Effective |
| 9 to 18 years | Moderately Effective |
| 19 to 45 years | Moderately Effective |
| 46 to 65 years | Less Effective |

**2. Malaria Patients:**

1. Treatments given by Government Hospitals of PCMC are equally effective.

**3. The fitted regression model tells us there is increase of 940 dengue diseased patients every year in Maharashtra.**

**4. The fitted regression model tells us the increase of 18665 dengue diseased patients every year in India.**

**5. Sex of patients and diseases spread by mosquitoes (Dengue and Malaria) are not associated.**

**6. Considering the equally effective treatments, the type of hospital (Government / Private) is not preferred depending on the gender for getting the treatment of dengue or malaria disease.**

**7. Proportion of male patients is greater than that of female patients in case of Dengue and Malaria.**

**8. The spread of dengue & malaria disease is more in monsoon season.**

**Limitations**

1. We have analysed the data of patients from Pimpri-Chinchwad Municipal Corporation (PCMC) only.
2. We have analysed the data of dengue diseased patients for year 2014 only.
3. We don’t have data of malaria diseased patients of last three months from the year 2014, so we were unable to take it under analysis.
4. We have not considered dengue patients aged above 65 years for testing treatment effect due to less count of them.
5. In some hospitals, there was no single patient from a particular age group, to overcome this problem, we estimated mean of admitted days by taking average of mean of admitted days of patients from that age group of other hospitals.

**Bibliography**

**Secondary data –**

1. We have collected data of dengue & malaria diseased patients of Pimpri – Chinchwad in year 2014 from Pimpri - Chinchwad Municipal Corporation (PCMC).
2. We have collected data of dengue cases in Maharashtra & India from year 2010 to 2017 from the site given below :

<http://nvbdcp.gov.in/den-cd.html>

**Referred Books –**

1. “Applied Statistics” by S.C.Gupta & V.K.Kapoor
2. “Statistical computing using R – Software” by V.R.Pawgi
3. “Modern mathematical statistics” by E.J.Dudeweitz & S.N. Mishra