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RESEARCH ARTICLE OPEN ACCESS

Statistical Analysis of Nipah Virus Using R

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Abstract:

Nipah Virus infection is an emanating zoonotic disease. This infection was first out-broken in the year 1998 in Malaysia at Kampung Sungai Nipah and then spread to Singapore in the year 1998,due to which about one million pigs were brutally killed in order to control the transmission of the virus. A whilst later the virus spread to India and Bangladesh as well which resulted in a massive number of diseased victims. It was identified that ingesting of raw date palm sap contaminated with fruit bat urine or saliva is the major cause for the virus attack. This paper "Statisticalanalysis of Nipah virus victims, using R" mainly deals with the comparison between different country regarding number of cases registered and number of deaths. In this article, as it's name implies, we compared the statistical data of number of victims by creating bar charts using R.

Keywords — **Fruit Bats, Nipah Virus, Niv, Zoonotic.**

I. INTRODUCTION

This document is a template.Zoonotic disease may be defined as a disease which is transmitted from animals to humans. Precisely a disease which normally exists in animals but infect the humans is termed as a zoonotic disease. Most of the zoonotic diseases (i.e., nearly 70%) originate from the animals. Some examples for zoonotic diseases are Ebola, Marburg, SARS and Melaka viruses. Nipah is considered as a zoonotic disease. The name NIPAH is given to this virus because of it's place of git go in a village "Kampung Sungai Nipah" in Malaysia.

Nipah virus (NiV) is an emerging zoonotic and dangerous viral disease that carries with it a high mortality rate. NiV is an enveloped RNA virus and along with Hendra virus make up the Henipah viruses. The natural host of the virus are fruit bats of the Pteropodidae family, Pteropus genus.

The Nipah Virus or the Disease was first discovered by a Professor **Dr. Kam Bing Chua** of Malaysia who first examined the virus in his lab. He is the first person who found that the infection is due to pigs. Almost 1 million pigs were killed to control the spread of this disease. After that all had a doubt that where did the pigs get the virus?

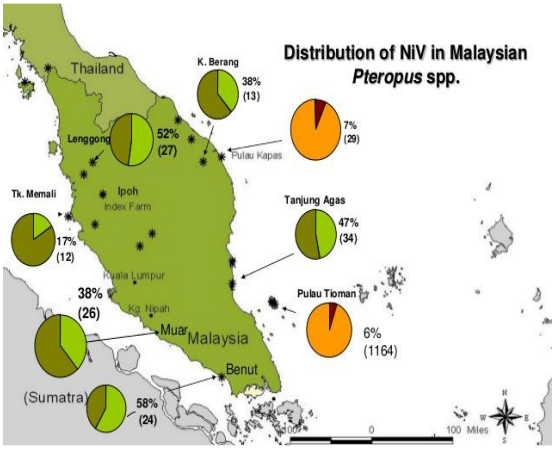
Later on, it is theorized that the pigs got infected by consuming partially bat-eaten fruits. And thereby declared that pigs acts as the intermediate host for this virus. But however, recent outbreaks had no intermediate hosts.

The emergence of Nipah into the pig population from fruit eating bats through direct or indirect transmission and ultimately into human population is believed to be due to changes in ecological conditions. Urbanization, deforestation and droughts resulting in a shortage of resources for bat populations could have agricultural areas. Among the factors that contributed to the disease emerging in Malaysia is the establishment of pig farms within the range of natural host that led to initial introduction into the pig population. The presence of massive, exaggerating host population facilitated transmission of the virus to human.

II. FIRST OUTBREAK OF NIPAH VIRUS:

The first flare-up of Nipah virus is in Malaysia in a village "Kampung Sungai Nipah" in the year 1998[4]. At the time of it's first outbreak, 265 cases were reported in Malaysia in which there were 105 death cases. Most of the people who are in contact with the sick pigs and Nipah virus infected patients became the victims of this virus. During the time of it's first out-burst it tensed all the people in Malaysia. In the year 1999, from Malaysia it has been unknowingly exported to Singapore along with pigs. However until till day there have been no cases of Nipah virus in Malaysia as well as in Singapore since May 1999.

COUNTRY	NUMBER OF CASES	NUMBER OF DEATHS
Malaysia	265	105



III. RECENT OUT BREAK OF NIPAH VIRUS IN KERALA: [6,7]

The most recent out burst of Nipah virus took place in Kerala, India in the year 2018. This NiV had infected in Kozhikode and left with a mortality rate of nearly 89%. The out burst of the nipah virus in Kerala has created panic not only to thepeopleofKerala but also it has threatened entire south - Asia. It has claimed 17 lives out of 18 cases

STATE	NUMBER OF CASES	NUMBER OF DEATHS
KERALA	18	17

(*As per up to 10th JUNE 2018,But there is no confirmed information. Only 16 deaths cases are confirmed as deaths due to Nipah. Total number of cases are not yet confirmed.)

IV. TRANSMISSION OF NIPAH VIRUS:

At the first out break of Nipah virus in Malaysia, it was found that the cause for the spread of this virus is pigs. But all had a doubt that "Where did these pigs get that virus?". The actually story behind this is that these pigs just acted as a intermediate host for the virus. The fruit eating bats of *Pteropus* genus are the natural reservior for this virus. The pigs may be infected either by consumption of fruits half-eaten by fruit eating bats or by consumption of raw date palm sap contaminated with NiV

There are mainly two routes for transmission of Nipah virus from its natural reservoir to humans: One way is by consumption of raw date palm sap or half eaten fruits by bats contaminated with Nipah virus. The other is by direct physical contact with the Nipah virus infected patients.

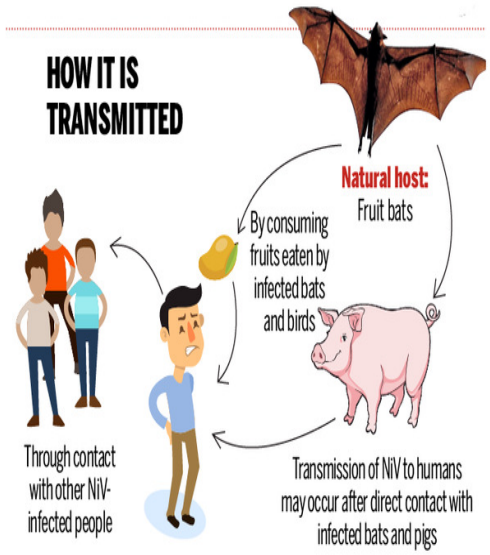


Figure1: This figure shows how do the nipah virus gets transmitted from bats to pigs and humans.

The above figure shows how do the Nipah virus get transmitted.

V. METHOD:

- Create two lists (data1,data2) which contains the data about number of cases reported and death cases in a country and in a year.(as shown)

```
> data1<-structure(list(B=c(260,197),I=c(89,71),M=c(265,105),S=c(11,1)),.Names=c("BANGLADESH","INDIA","MALAYSIA","SINGAPORE"),row.names=c(NA,-2L),class="data.frame")
> data2<-structure(list(A=c(265,105),B=c(11,1),C=c(0,0),D=c(79,58),E=c(0,0),F=c(12,8),G=c(67,50),H=c(12,11),I=c(0,0),J=c(23,14),K=c(11,9),L=c(4,1),M=c(16,14),N=c(44,40),O=c(12,10),P=c(24,21),Q=c(18,9),R=c(9,6),S=c(0,0),T=c(0,0),U=c(18,17)),.Names=c(1998,1999,2000,2001,2002,2003,2004,2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015,2016,2017,2018),row.names=c(NA,-2L),class="data.frame")
```

- Create bar charts for the collected data as follows

  and

- Display text on the top of bars in the bar charts

```
> bc-barplot(as.matrix(data1),main="Number of cases and deaths in a country",ylim=c(0,300),beside=TRUE,col=colors)
> text(x<-b,y<-c(260,197,89,71,265,105,11,1),label=c(260,197,85,66,265,105,11,1),pos=3,cex=0.8)
> legend("topright",c("Number of cases reported","Number of deaths"),cex=0.6,fill=colors)
> bc-barplot(as.matrix(data2),main="Number of cases and deaths per year",ylim=c(0,300),cex.main=1.4,beside=TRUE,col=colors,width=c(10,10))
> text(x<-b,y<-c(265,105,11,1,0,0,79,58,0,0,12,8,67,50,12,11,0,0,23,14,11,9,4,1,16,14,44,40,12,10,24,12,18,9,9,6,0,0,0,0,14,12),label=y,pos=3,cex=0.9)
> legend("topright",c("Number of cases reported","Number of deaths"),cex=0.8,fill=colors)
```

VI. STATISTICS:

The first outbreak of Nipah virus is recorded in Malaysia in 1998 with 265 cases of which 105 are dead. From them onwards there is no Nipah case in Malaysia

The following table shows the number of cases and deaths recorded per year.

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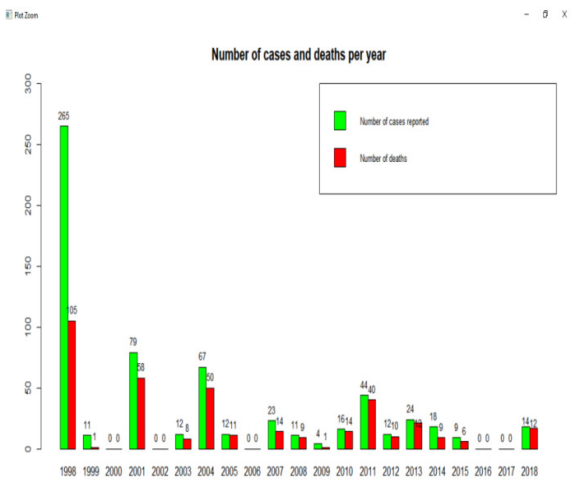
	YEAR	CASES	DEATHS
1	1998	265	105
2	1999	11	1
3	2000	0	0
4	2001	79	58
5	2002	0	0
6	2003	12	8
7	2004	67	50
8	2005	12	11
9	2006	0	0
10	2007	23	14
11	2008	11	9
12	2009	4	1
13	2010	16	14
14	2011	44	40
15	2012	12	10
16	2013	24	18
17	2014	18	9
18	2015	9	6
19	2016	0	0
20	2017	0	0
21	2018	14	12

Table1: This table consists of the number of cases and deaths 24th May 2018

The bar charts for the above data are as follows:



From the above graph, it is evident that the highest number of cases i.e.., 265 cases was recorded in the first outbreak of Nipah virus in the year 1998.

However, the recent outbreak results in 17 death cases out of 18 reported cases.

Table 2 shows the number of cases and deaths recorded in each country.

RStudio

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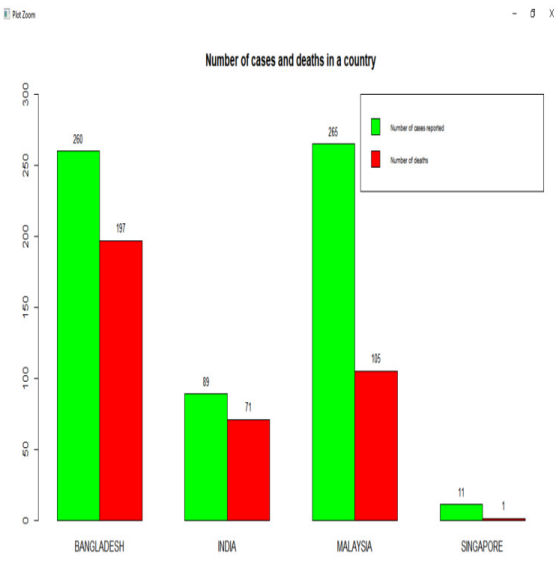
Filter

	COUNTRY	CASES	DEATHS
1	MALAYSIA	265	105
2	BANGLADESH	260	197
3	SINGAPORE	11	1
4	INDIA	85	66

Table2:This table shows the number of cases and deaths reported in each country due to NiV



From the above bar chart, it is very clear that highest number of cases were recorded in Malaysia. Even though, the highest number of NiV cases were recorded in **Malaysia** but the mortality rate is high

in **Bangladesh**. Bangladesh has failed to control the impact of the Nipah virus. Malaysia and Singapore are the two countries which successfully controlled the spread of Nipah virus. After 2000, there is no Nipah virus infected victim in Malaysia as well as in Singapore.

VII. SYMPTOMS:

In humans: In case of humans, the symptoms of Nipah are: severe fever, severe tiredness, aches, muscle pain, and severe respiratory problems. Inflammation of the brain can also cause disorientation. Late onset of Encephalitis can also occur. Sometimes a person can have an asymptomatic infection, and can act as a carrier of Nipah and may not show any symptoms. The incubation period generally varies from four days to 2 weeks, but may be extended up to 45 - 60 days.

In Domestic Animals: Nipah outbreaks in pigs and other domestic animals (horses, goats, sheep, cats and dogs) were first reported during the initial Malaysia outbreak in 1999. Many Nipah Virus infected pigs may not have symptoms, but others developed intense deliriousillness, arduous breathing, and neurological symptoms such as trembling, twitching and muscle spasms.

VIII. DIAGNOSIS:

There are many different types of tests for diagnosing Nipah virus infection. Nipah is classified as a bio safety level 4 (BSL4) agents. Because of this classification many number of major precautions must be undertaken in the collection, submission and processing of samples. Bio safety considerations require that this work be carried out only in a physical containment level 4 (PC4) facilities. Many numbers of different types of strategies have been developed in order to reduce the risk of laboratory sera, including gamma-irradiation or sera dilution and heat inactivation. For the use of ELISA henipa virus antigens are derived from tissue culture. This henipa virus antigen can be irradiated with 6kilo Greys prior which can be used with negligible effect on antigen titre.

Confirmatory tests include

- Serum Neutralization Test
- ELISA
- RT-PCR

IX. TREATMENT:

Since it is a Virus, until today, there are no vaccines for both humans and animals. Intensive supportive care is given to humans infected by Nipah virus. According to WHO, ribavain can reduce the symptoms of nausea, vomiting and convulsions associated with the disease. Individuals infected need to be hospitalized and isolated. It is very important to take special care to prevent human-to-human transmission. Surveillance systems should be established to detect the virus quickly and to initiate appropriate control measures.

A non-patented drug, Human Monoclonal Antibody (M102.4) was developed by Dr. **Christopher C Broder** from Australia. As clinical trials are yet to

be completed, the antibody is still referred by a number and not a name. This is an antibody and not a vaccine, which can neutralize the effects of the Nipah Virus. It has been found to be effective in vitro (in cells or micro-organisms placed in a test tube or culture dish). According to reports it has not been tested on humans so far but can be used on compassionate grounds.

Even though the people who survived this dangerous viral disease are expected to make full recovery, but almost all the survivors have shown neurological conditions like seizure disorder and personality changes for a long time, maybe through out their entire lives. After recovery, only very few number of survivors are leading some what healthy life when compared to remaining survivor.

X. PREVENTION:

- Avoid close (unprotected) physical contact with infected people.
- Wear NH95-grade and higher masks.
- Wash hands regularly with soap.
- Avoid consuming partly eaten fruits or coarse fruit juices.
- Avoid being around animals.
- Boil freshly collected date palm juice before consuming.
- Thoroughly wash and peel fruits before consuming.
- Maintain your and children's personal hygiene.Cover your household properly

XI. CONCLUSIONS

The number of cases recorded due to Nipah Virus is more in Malaysia. Next to that of Malaysia Bangladesh is the highest in recording the cases for Nipah. However, the deaths are high in Bangladesh. Therefore, we can say that the Bangladesh failed to control the virus.

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