INVESTIGATING THE RELATIONSHIP AMONG SOME SELECTED CASES OF DISEASE IN ZARIA

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Abstract

This research aimed at investigating the relationships among some selected cases of diseases: Hepatitis (A, B, C) and Liver Cirrhosis. Secondary data was used and the data was collected for eleven consecutive years (2011-2021) from the record department of Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, Kaduna State. Analysis was carried out using Spearman Correlation and Friedman Test. The result obtained from the spearman correlation showed that Hepatitis A has a low relationship with other selected diseases. It was equally revealed from the Friedman test that the variations in the selected cases of diseases are not the same and using post hoc test, it was discovered that Hepatitis A is the major significant difference. It was recommended that Awareness and enlightens on improved personal hygiene, targeted vaccination campaign and intensive community health education should be given to the public that could be of help to prevent and control liver cirrhosis and hepatitis diseases.

Key words: Hepatitis (A,B,C), Liver Cirrhosis, Spearman Correlation, Friedman Test

Introduction

Viral hepatitis is one of the most common causes CLD affecting close to 397 million individuals worldwide with both hepatitis B virus (HBV) and (HCV) infection cases (Trepo et al., 2014 and Ott et al.2012) there five main types of hepatitis viruses, namely hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV), and hepatitis E virus (HEV). Viral hepatitis is a major public health concern, infecting millions of people annually; some infections subsequently lead to hepato cellular carcinoma (HCC), liver cirrhosis and fatalities among significant proportion of patients. The World Health Organization (WHO) estimated that 1 in 3 people in the world have been infected by either HBV or HCV and 1.3 million people have died as a result of this disease in 2015. It has been reported that 2 billion people have been infected with HBV, approximately 185 million of those people are infected with HCV and 20 million people are infected with HEV. In high endemic regions more than 90% children get infected by HAV by the age of 10 although few develop complications. About 2.3 billion people of the world are infected with one or more of the hepatitis viruses. Hepatitis is an inflammation of the liver. The condition can be self-limiting or can progress to fibrosis (scarring), cirrhosis

or liver cancer. Liver cirrhosis is a complication of many liver disease characterized by abnormal structure and function of the liver. The dis1ease that leads to cirrhosis does so because they injured and killed liver cells, after which the inflammation and repair that is associated with the dying liver cells causes scar tissue to form. The literature documenting that hepatitis A, hepatitis B. and hepatitis C superimposed on chronic liver disease (CLD) is associated with high rates of morbidity and mortality has been reviewed. There is sample evidence that hepatitis A, B and C vaccination is safe and immunogenic in patients with mild to moderate CLD, although vaccination is less effective in those with decompensate cirrhosis or after liver transplantation.

These diseases can spread among the population and can kill quite a large number of people within a short period. It can even wipe out a population. It is essential to clearly accurately map out strategies towards their reduction. This study will make an appropriate contribution if its finding is implemented.

The aim of this research is to investigate the relationship among some selected cases of diseases (Hepatitis A, Hepatitis B, Hepatitis C and Liver Cirrhosis) and to determine if variation exists among the selected cases of disease.

A study of this kind is very important to Medical Centres and the society at large. It seeks to raise awareness and enlighten the population on the nature of the selected diseases. It will serve as means to guide populace who lack adequate counsel and ignorance of these diseases. This study therefore serves as an eye opener to the government, non- governmental Organization and society at large.

Keeffe Palo Alto: (2009). One interesting bit of information is that there is a declining incidence rate of hepatitis A in the U.S. This has been reported from the 14th edition of the 'pink book' was published August 2021 and Morbidity and Mortality Weekly Report May 10th, 2019. It is probably the result of two things. One factor is improved environmental hygiene, and the other factor is the impact of vaccination programs around the region, because the CDC recommends hepatitis A vaccine in all counties or states where there is a high incidence rate of hepatitis A.

Hepatitis B virus (HBV) has optimized its life cycle for long term persistence in the liver. It is life threatening liver disease by highly contagious blood borne viral pathogen known as hepatitis B virus (HBV). The HBV infection is one of the principle causes of severe liver disorders, including hepatocellular carcinoma, cirrhosis and end stage liver disease. In 1963. HBV was accidently discovered by Baruch Blumberg during his research on Australia antigen. HBV is an enveloped virus which belongs to hepadnaviridae. Humans are only known natural host circular partially double stranded DNA resenting highly compact organization. The HBV is smallest known DNA virus, spherical shape with diameter of about 42 nm and genomic length of approximately 3.2. The infectious virus particle, also referred as Dane particle is responsible for causing infection in approximately five percent of

world's population with 2 billion people infected with the virus and 350 million as carrier of chronic infection. The virus is responsible for 600 000 deaths each year. HBV has been recognized as an important global health problem with prevention and control of viral infection. To date, successful vaccination strategies have been developed to arrest the viral spread among various populations. The need of time is to put major emphasis on awareness about risk factors associated with transmission of hepatitis viral infection and to equip with adequate strategies for prevention of disease at national and international level.

Hepatitis C virus (HCV) is blood borne pathogen which causes severe liver disorders including hepatocellular carcinoma hepatic steatosis, liver cirrhosis end stage liver disease and various metabolic disorders. In 1989, HCV was identified by Choo et al. as a positive stranded RNA molecule related to Togaviridae or Flaviviridae. HCV has been classified into the genus hepacivirus of the family. Flaviviridae. This virus is responsible for causing infection in three percent of world's population with approximately 170 million persons at risk of developing chronic hepatitis. Due to continuous increase in number of viral infected hepatitis patients, World Health Organization (WHO) has recognized HCV as a major global health problem. Various epidemiological patterns and worldwide surveillance strategies are being performed for prevention and control of this disease.

Research Methodology

Nonparametric Tests

Nonparametric statistics is the branch of statistics that is not based solely on parameterized families of probability distributions. Nonparametric statistics is based on either being distribution-free or having a specified distribution but with the distribution's parameters unspecified. Nonparametric statistics includes both descriptive statistics and statistical inference. Non parametric statistics refers to a statistical method in which the data is not required to fit a normal distribution. Non parametric data does not rely on numbers, but rather ranking or order. Ranks are provided based on the magnitude of the variation of values between study groups.

Friedman Test

Friedman test is a non-parametric test, which is in form of two-way analysis of variance design. The layout/ design for Friedman test consist of n-rows of subjects or individuals and k-columns of conditions or items to be compared.

$H_0 : \mu_1 = \mu_2 = ..., = \mu_k$ (*The k treatments are equally effective*)

$H_1 : \mu_1 \neq \mu_2 \neq ..., \neq \mu_k$ (*The k treatments are not equally effective*)

The test statistic for Friedman test is given by:

$$F = \frac{12}{nk(k+1)} \sum_{j=1}^{k} R_j^2 - 3n(k+1)$$

Adjustment needs to be if there are many ties present. The Friedman statistic adjusted for the presence of ties is given by:

$$F = \frac{(k-1)\left[\sum_{j=1}^{k} nC_i\right]}{A_i - C_i}$$

$$F = \frac{(k-1)\sum_{j=1}^{k}\left[R_j - \frac{n(k+1)}{2}\right]^2}{A_i - C_i}$$

Where

$$A_i \sum_{i=1}^{n}\sum_{j=1}^{k} R\left[X_{ij}\right]^2 \; and \; C_i = \frac{n(k+1)^2}{4}$$

$$R(X_{ij}) \, is \, the \, rank \, of \, (i,j)^{th} \, observation$$

Multiple Comparisons

If the null hypothesis is rejected, the need for multiple comparison arises. Treatments i and j are considered different if the following inequality is satisfied.

$$\left|R_i - R_j\right| > t_{(n-1)(k-1)(1-\alpha/2)}\left[\frac{2(nA_i - \sum_{j=1}^{k} R_j^2}{(n-1)(k-1)}\right]^{1/2}$$

$$\left|R_i - R_j\right| > t_{(n-1)(k-1)(1-\alpha/2)}\left[\frac{2n(A_i - C_i)}{(n-1)(k-1)}\left(1 - \frac{F}{n(k-1)}\right)\right]^{1/2}$$

Where

$t_{(n-1)(k-1)(1-\alpha/2)}$ is the $(1-\alpha/2)$ quantile of the t-distribution with $(n-1)(k-1)$ degrees of freedom

If there are no ties, $A_i = \frac{nk(k+1)(2k+1)}{6}$ and $A_i - C_i = \frac{nk(k+1)(k-1)}{12}$

Analysis and Discussion of Results

Spearman Rank Correlation

Table 1: Correlations Coefficients Table

			Hepatitis A	Hepatitis B	Hepatitis C	Liver cirrhosis
Spearman's rho	Hepatitis A	Correlation Coefficient	1.000	.153	.301	.388
		Sig. (2-tailed)	.	.653	.368	.238
		N	11	11	11	11
	Hepatitis B	Correlation Coefficient	.153	1.000	.793**	.697*
		Sig. (2-tailed)	.653	.	.004	.017
		N	11	11	11	11
	Hepatitis C	Correlation Coefficient	.301	.793**	1.000	.973**
		Sig. (2-tailed)	.368	.004	.	.000
		N	11	11	11	11
	Liver cirrhosis	Correlation Coefficient	.388	.697*	.973**	1.000
		Sig. (2-tailed)	.238	.017	.000	.
		N	11	11	11	11

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Findings: The result obtained in table 1 above contained the spearman correlation among the selected case of diseases. The result showed that Hepatitis A has a low relationship with other diseases while the other disease has a high relationship among others.

To determine if variation exist among the selected case of diseases.

H_0 : The variations in the selected cases of diseases are the same

H_1 : The variations in the selected cases of diseases are not the same

Level of significance: $\alpha = 0.05$

Test statistic: $F = \frac{12}{nk(k+1)} \sum_{i=1}^{k} R_j^2 - 3n(k+1)$

Decision Rule: Reject H_0 if p-value < significance level

Friedman Test

Table 2: The Mean Ranks of the selected cases of disease

Ranks

	Mean Rank
Hepatitis A	1.18
Hepatitis B	1.86
Hepatitis C	3.05
Liver cirrhosis	3.91

Table 3: Computations

Test Statistics

N	11
Chi-Square	29.477
Df	3
Asymp. Sig.	.000

a. Friedman Test

Conclusion: Since the p-value (0.000) in table 3 is less than the significance level ($\alpha = 0.05$), we reject H_0 and it is therefore concluded that the variations in the selected cases of diseases are not the same. Since the null hypothesis is rejected, hence we proceed to multiple comparison test.

Table 4: Computations of multiple comparisons

Disease Pairings	t-test value	Asymp. Sig	Status
Hepatitis A & Hepatitis B	-4.582	0.000	Significant
Hepatitis A & Hepatitis C	-5.903	0.000	Significant
Hepatitis A & Liver Cirrhosis	-6.171	0.000	significant
Hepatitis B & Hepatitis C	-1.923	0.069	Not Significant
Hepatitis B & Liver Cirrhosis	-2.120	0.047	Significant
Hepatitis C & Liver Cirrhosis	-0.166	0.870	Not Significant

Findings: The result obtained in table 4 above showed the result of comparison test. Based on the result obtained, it is concluded that Hepatitis A is a major significant difference.

Conclusion

The statistical tools used for the analysis were Spearman Correlation and Friedman test. Table 1 contained the correlation matrix among the selected diseases, it was observed that Hepatitis A is the only disease that has a low relationship with others. Table 3 contained the Friedman test result, the result obtained showed that the null hypothesis cannot be accepted since the p-value of 0.000 is less than the significance level of 0.05. It was therefore concluded that there exist significant differences among the selected diseases and a further test of comparison was performed to know the disease that causes the significant difference. Viewing from the research, it was concluded from Friedman test that the variations in the selected cases of disease are not the same. The result obtained using multiple comparisons shows that Hepatitis A is the significant among the selected disease and it has a very low relationship compare to other diseases.

Recommendations

Based on the proceeding findings on the results of the analysis, it is therefore recommended that Action plan should be structured around direction, information, intervention, delivering, financial and innovation scheme towards all hepatitis viruses, most especially hepatitis A awareness and enlightened on improved personal hygiene, targeted vaccination campaign and intensive community health education should be given to the public that could be of help to prevent and control liver cirrhosis and hepatitis diseases.

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