STATISTICAL ANALYSIS ON HYPERTENSIVE PATIENTS: A CASE STUDY OF MURTALA MUHAMMED SPECIALIST HOSPITAL KANO, NIGERIA

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Abstract
Hypertension is a common Disease that is affecting Human life globally. In this research we present the result of Hypertensive patients Data obtained from Murtala Muhammed Specialist Hospital for one year which is analyzed using one-way Analysis of Variance (Anova) technique, to compare groups of patients across, Sex, Admission, Discharge and Death. From the result we found that there is significant difference between the Means of these four Variables at (0.05) level of significance.

***Keywords**: Hypertension, Anova, Multiple Comparisons and Murtala Muhammed Specialist Hospital.*

1 Introduction

1.1 Hypertension (HT or HTN)

Also known as high blood pressure (hbp) is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. High blood pressure usually does give obvious symptoms. Long terms high blood pressure, however, is a major risk factor for coronary artery disease, stroke, heart failure, peripheral vascular disease, vision loss, and chronic kidney disease.

High blood pressure is classified as either primary (essential) high blood pressure or secondary high blood pressure. About (90−95)% of cases are primary, defined as high blood pressure due to nonspecific lifestyle and genetic factors. Lifestyle factors that increase risk include excess salt, excess body weight, smoking and alcohol. The remaining (5-10)% of cases are categorized as secondary high blood pressure defined as blood pressure due to an indefinable cause such as chronic kidney disease narrowing of the kidney arteries an endocrine disorder or the use of birth control pills.

Blood pressure is expressed by two measurements, the systolic (maximum) blood pressure and diastolic pressure (minimum) blood pressure. For most adults, normal blood pressure at rest is within the range of (100−140) millimeter mercury (mmHg) systolic and (60-90) millimeter mercury (mmHg) diastolic. For most adults, high blood pressure is present if the resting blood pressure is persistently below 130/90 or above 140/90 mmHg. Different numbers applied to children. Ambulatory blood pressure monitoring over a 24 hours period appears more accurate than office base blood pressure measurement [6].

1.2 Causes of Hypertension

Hypertension results from a complex interaction of genes and environmental factors. Many common genetics variants with small effects on blood pressure having identified as well as some rare genetic variants with large effects on blood pressure. In [16], Zheng et al. identified factors influencing blood pressure were newly found. Sentinel SNP for each new genetic loci identified has shown and associated with the DNA methylation at multiple nearby Cpg sites. Several environmental factors influence blood pressure. High salt intake raise the blood pressure in salt sensitive individuals, lack of exercise, obesity, and depression can play a vital role in individual cases. The possible role of other factors such as caffeine consumption, and vitamin D deficiency are less clear. Insulin resistance, which is common in obesity and is component syndrome X (or the metabolic syndrome), is also though contributed to hypertension [15].

In [8], Okunbadejo et al. conducted a comparative analysis based on recent guideline recommendations of the prevalence of hypertension and blood pressure profile amongst urban-dwelling adults in Nigeria. The participants (1287) were selected using multistage sampling from the population (5365) and categorized based on blood pressures. Their results show a significant correlation between systolic and diastolic blood pressures based on Pearson correlation. They concluded that over half of the adult's population in Nigeria are classified to have hypertension and recommended an urgent need to develop and implement strategies for primordial prevention of hypertension. In [9], Ozoemena et al. studied the effects of a health education intervention on hypertension-related knowledge, prevention and self-care practices in Nigeria retirees: a quasi-experiment study. They considered 400 participants in Enugu and Nsuka cities in Enugu state, Nigeria. The participants were assigned into the treatment and control groups. The data were collected at baseline (before intervention), 16 weeks (4th month) and follow-up (5th month) include demographic variables, knowledge about hypertension, prevention, and self-care practices. They analyzed the data using paired samples t-test, Chi-square test and one-way *Anova* repeated measures. Their result show that mean in hypertension knowledge score significantly increased in the T-group between baseline and 1 month (4th month) post-intervention compared to those in the C-group ($p < 0.0001$). Also, PA($p = 0.007$), sleep pattern and quality ($p = 0.003$), substance use abstinence ($p = 0.000$), healthy diet between baseline and 1 month after intervention. The repeated measures showed statistically significant effects (between-groups analysis) for all outcomes with small to large effects sizes. Similarly, the repeated measures *Anova* showed significantly time-by group interaction effects (within-groups) for all the outcomes with small to large effects sizes. They concluded that community-based health education intervention targeted at older adults can increase hypertension knowledge, improve prevention, and self-care practices of hypertension at the population level.

In [1], Arias-Hernandez et al. studied the efficacy of diltiazem for the control of blood pressure in puerperal patients with severe preeclampsia. A randomized, single-blind longitudinal clinical trial of 42 puerperal patients with severe preeclampsia was carried out. Patients were randomized into two groups: the experimental group ($N = 21$) received diltiazem (60mg) and the control group ($N = 21$) received nifedipine (10mg). Both drugs were orally administered every 8 hours. Systolic, diastolic, and mean blood pressures as well as the heart rate were recorded and analyzed (two-way *Anova*) at baseline and after 6, 12, 18, 24, 30, 36, 42, and 48 hours. Primary outcome measures were all the aforementioned blood pressure parameters. Secondary outcome measures included the number of hypertension and hypotension episodes along with the length of stay in the intensive care unit. Their results show that no statistical differences were found between groups (diltiazem vs. nifedipine) regarding basal blood pressure parameters. Interim differences in blood pressure (systolic, diastolic, and mean) and heart rate were statistically significant between treatment groups from 6 to 48 hours. Patients in the diltiazem group had lower blood pressure levels than patients in the nifedipine group. Significantly, patients who received diltiazem had fewer hypertension and hypotension episodes and stayed fewer days in the intensive care unit than those treated with nifedipine. They concluded that Diltiazem controlled arterial hypertension in a more effective and uniform manner in patients understudy than nifedipine. Patients treated with diltiazem had fewer collateral effects and spent less time in the hospital.

In [2], Capplleti et al. conducted a study "What hypertensive patients want to know [and from whom] about their disease: a two year longitudinal study". The study was conducted using N = 202 hypertensive patients and *Anova*, Bonferroni post hoc tests, and Cochran's Q-test were used to analyze the data. Their result shows a significant reduction in all the domains of information needs related to disease management over time. They concluded that hypertensive patients show little interest in health communication topics as their disease progressed.

In [11], Piskin examined, a canonical correlation analysis of the relationship between clinical attributes and patient specific hemodynamic indices in adult pulmonary hypertension. They obtained their data from computational fluid dynamics *CFD* simulations and post processed resulting in hemodynamic indices respectively of the blood flow dynamics. Statistical analysis and canonical correlation analysis (*CCA*) were performed for the clinical variables and hemodynamic indices. Their results show that systolic pulmonary artery pressure (*SPAP*), diastolic pulmonary artery pressure (*DPAP*), cardiac output (*CO*), and stroke volume (*SV*) were moderately correlated with spatially averaged wall shear stress ($0.60 \leq R^2 \leq 0.66$; p <0.05). Similarly, the *CCA* revealed a linear and strong relationship (p = 0.87; p <0.001). They concluded that slico models of *PH* blood flow dynamics have a high potential for predicting the relevant clinical attributes of *PH* if analyzed in a group-wise manner using *CCA*.

2 Study Area and Source of Data

Murtala Muhammad Specialist Hospital Kano is the biggest government owned tertiary health care institution in the State. Besides its primary function of providing health-care services, it also serves as training and research center for both the state and federal owned institutions in the State. Patronage of the hospital is very high due to affordable health care and availability of all medical sub-specialties' as well as qualified personnel who are well experienced in various fields of specialization. The secondary data for one year from June 2016 to June 2017 was collected for this research work from Murtala Muhammad specialist Hospital Kano health record department.

3 Analysis and Discussion of Result

Analysis of variance was used to analyze the secondary Data obtained from Murtala Muhammed Specialist Hospital Kano. Analysis of variance is essentially an arithmetic process for partitioning a total sum of squares into components associated with recognized sources of variation.

Table 1: Abbreviation Used in the Analysis

Abbreviation	Meaning
MH	Male Hypertensive Patients
FH	Female Hypertensive Patients
ADH	Admitted Hypertensive Patients

DISH	Discharged Hypertensive Patients
DH	Dead Hypertensive Patients

Table 2: Descriptive

RESPONSE								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MH	12	373.7500	131.91121	38.07949	289.9376	457.5624	245.00	750.00
FH	12	776.0833	212.49233	61.34125	641.0721	911.0945	340.00	1010.00
ADH	12	1149.6667	249.45152	72.01045	991.1727	1308.1606	685.00	1455.00
DISH	12	898.5833	209.02956	60.34164	765.7723	1031.3944	491.00	1270.00
DH	12	251.0833	101.19869	29.21354	186.7848	315.3819	90.00	413.00
Total	60	689.8333	382.32842	49.35839	591.0674	788.5992	90.00	1455.00

Descriptive table gives us information on the Mean, the Standard Deviation, the Standard Error, and the number of cases for each group.

Table 3: Test of Homogeneity of Variances

RESPONSE			
Levene Statistic	df_1	df_2	Sig.
1.810	4	55	0.140

Test of homogeneity of variances table. If the significance level of the Levene statistic that is P_{value} is greater than or equal to 0.05, then *Anova* is used otherwise Robust Tests of Equality of Means would be used instead of the *Anova*.

Table 4: Anova Table for Completely Randomized Design (RCD)

RESPONSE					
Levene Statistic	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6658470.667	4	1664617.667	46.572	.000
Within Groups	1965855.667	55	35742.830		
Total	8624326.333	59			

From the *Anova* table if the significance P_{value} is less than 0.05, then there is significance difference in the Means somewhere across the groups of patients. But *Anova* does not tells us which of the Means are really difference until we go to multiple comparisons. If *Anova* is used, then Turkey *HSD* will be used for multiple comparisons.

Table 5: Robust Test of Equality of Means

RESPONSE				
	Statistic[a]	df_1	df_2	Sig.
Brown-Forsythe	46.572	4	42.701	.000
a. Asymptotically F distributed				

If the significance P_{value} of the Robust Test of Equality of Means is less than 0.05, then there is significance difference somewhere across the Means of groups of patients.

Table 6: Multiple Comparisons

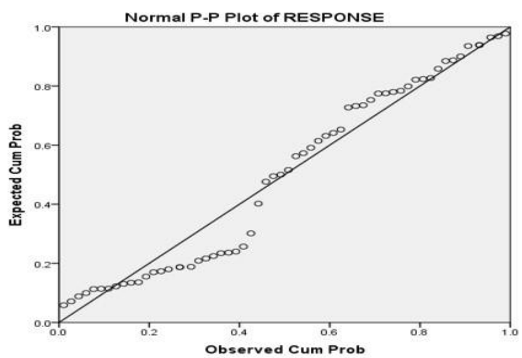
Dependent Variable RESPONSE							
	Factors I	Factors J	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Tukey HSD	MH	FH	-402.33333*	77.18250	0.000	-620.0133	-184.6534
		ADH	-775.91667*	77.18250	0.000	-993.5966	-558.2367
		DISH	-524.83333*	77.18250	0.000	-742.5133	-307.1534
		DH	122.66667	77.18250	0.510	-95.0133	340.3466
	FH	MH	402.33333*	77.18250	0.000	184.6534	620.0133
		ADH	-373.58333*	77.18250	0.000	-591.2633	-155.9034
		DISH	-122.50000	77.18250	0.512	-340.1799	95.1799
		DH	525.00000*	77.18250	0.000	307.3201	742.6799
	ADH	MH	775.91667*	77.18250	0.000	558.2367	993.5966
		FH	373.58333*	77.18250	0.000	155.9034	591.2633
		DISH	251.08333*	77.18250	0.016	33.4034	468.7633
		DH	898.58333*	77.18250	0.000	680.9034	1116.2633
	DISH	MH	524.83333*	77.18250	0.000	307.1534	742.5133
		FH	122.50000	77.18250	0.512	-95.1799	340.1799
		ADH	-251.08333*	77.18250	0.016	-468.7633	-33.4034
		DH	647.50000*	77.18250	0.000	429.8201	865.1799
	DH	MH	-122.66667	77.18250	0.510	-340.3466	95.0133
		FH	-525.00000*	77.18250	0.000	-742.6799	-307.3201
		ADH	-898.58333*	77.18250	0.000	-1116.2633	-680.9034
		DISH	-647.50000*	77.18250	0.000	-865.1799	-429.8201
*: The mean Difference is significant at the 0.05 level							

	Factors I	Factors J	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Games-Howell	MH	FH	-402.33333*	72.19970	.000	-620.1767	-184.4900
		ADH	-775.91667*	81.45890	.000	-1024.2385	-527.5948
		DISH	-524.83333*	71.35237	.000	-739.9063	-309.7604
		DH	122.66667	47.99457	.116	-20.5484	265.8817
	FH	MH	402.33333*	72.19970	.000	184.4900	620.1767
		ADH	-373.58333*	94.59521	.006	-654.8502	-92.3165
		DISH	-122.50000	86.04570	.620	-377.8017	132.8017
		DH	525.00000*	67.94248	.000	316.4488	733.5512
	ADH	MH	775.91667*	81.45890	.000	527.5948	1024.2385
		FH	373.58333*	94.59521	.006	92.3165	654.8502
		DISH	251.08333	93.95008	.092	-28.3923	530.5589
		DH	898.58333*	77.71059	.000	657.6258	1139.5409

	DISH	MH	524.83333*	71.35237	.000	309.7604	739.9063
		FH	122.50000	86.04570	.620	-132.8017	377.8017
		ADH	-251.08333	93.95008	.092	-530.5589	28.3923
		DH	647.50000*	67.04136	.000	441.9360	853.0640
	DH	MH	-122.66667	47.99457	.116	-265.8817	20.5484
		FH	-525.00000*	67.94248	.000	-733.5512	-316.4488
		ADH	-898.58333*	77.71059	.000	-1139.5409	-657.6258
		DISH	-647.50000*	67.04136	.000	-853.0640	-441.9360

*: The mean Difference is significant at the 0.05 level

From our multiple comparisons table under Turkey HSD since *Anova* is used any value with a steric (*) means there is significant different between the Means of groups of patients.



From the above graph the normal probability plot indicates that our data is normally distributed, which confirm with one of the assumption of *Anova*.

Conclusion

In this research work, we found that females are more susceptible to hypertension than their male counterpart on the average, and number of discharges are significantly higher than the number of deaths on the average which means that people who are recovering from the hypertension are much more than those who die as a result of it.

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