

## Univariate Anova on Cases of Domestic Violence in North East Region of Nigeria (Case Study of NSCDC, 2015-2020)

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**Abstract:** This research is determine to investigate the rampant cases of domestic violence in North East region of Nigeria. In some state in north eastern region of Nigeria, many women are brutally treated by their intimate partners who in some cases lead to their death. Domestic violence affects all social groups and can consist of physical, sexual or psychological abuse. The level of violence against women is highly increasing by the day and many certain communities experiencing violence in their families. Many women do not report their cases as they are ashamed that their futures will be in jeopardy. So they suffer in silence. It is against this background that the researcher looks into cases of domestic violence against women in Nigeria specifically in north east, types, causes, effects, and management. The model used to carry out this study is Latin square design (LSD) as cases between 2015-2020 are critically examined. The results shows that there is significant difference on domestic violence between the state, years and rates of violence. The research recommended comprehensive and extensive premarital counseling should be given to intending couples on how to manage their marital relationship; and the government should establish and fund counseling centers at the community, Local Government levels and State levels and employ professional counselors to help victims and perpetrators of domestic violence. Also government should provide a means of livelihood such as employment and financial support to people to reduce the hardship and suffering, so that the rates of violence will reduce.

**Keywords:** Univariate Anova, Latin Square Design, Domestic, Violence and Abuse.

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## **I. INTRODUCTION**

Domestic violence affects men and women of all races, religious and incomes. However due to "secrecy" of domestic violence, it is often a hidden social problem. The "invisibility of the problem attributed to the belief that it is a private family matter, which should not be made to known to outsiders. This problem is not confined only to Nigeria but is a worldwide concern. In 1994, the World Bank compiled a study on domestic violence experienced by women in 35 countries. The result indicated that one quarter to one half of women in the countries studied had been physically beaten by their partners (Heise, Pitanguy, & Germaine, 1994). It is estimated that one in every three women worldwide are victims of intimate partner violence (Seager, 2009). Domestic violence has a long history but it was only "uncovered "in the 1970s when the women's movement highlighted the problems and demanded that it should be addressed. In Nigeria, the Domestic Violence Act (DVA) was implemented in June 1996, after much lobbying by women's groups. Prior to its implementation, victims of domestic abuse had little legal protection. The implementation of this act has been described as having a " powerful symbolic value as it is a clear indication of society's abhorrence of the abuse." (Herbert, 1997). However (Moh'd, 1996) asserted that "laws are limited in impact and cannot be carried out effectively in isolation from the social attitudes and policies". He recommended that the attitude of friend's family members and professionals be changed as it is this attitude of ignorance and insensitivity that serves at present to keep the victims locked in their shame and isolation. Another study by (Herbert, 1997) indicated that even after almost twenty years during which various movements had tried to eradicate gender violence, violence against women in Nigeria appeared to be growing both in frequency and severity. Because of the hidden nature of the problem and lack of systematic reporting across the country, the actual incidence of domestic violence is difficult to determine. Domestic violence is not simply an argument. It is a pattern of coercive controls that one person exercises over another. Abusers use physical and sexual violence, threats, emotional insults and economic deprivation as a way to dominate their victims and get their way. (Siemienuk, Krentz, Gish, & Gill, 2010). Domestic Violence is a social problem that although well recognized, is still associated with uncertainty and taboos. Many women, in their intimate or immediate social environment, experience psychological and only be assumed, as it is not easy for the affected person to speak about their experiences or to ask for help. The reason for this may be feeling of shame or guilt, fear or perceptions based on traditional ideas of marriage and family. Since the police are rarely notified in cases of domestic violence, the estimate number of unknown cases is high (most

cases remain unrecorded) and reliable epidemiological data are scarce. WHO study on women's health and domestic violence in 10 different countries representing diverse cultural, geographical and urban or rural settings (Bangladesh, Brazil, Ethiopia, Japan, Peru, Namibia, Samoa, Serbia and Montenegro, Thailand and Tanzania) documents the horrifying extent of violence against women demands a public health response, because the impact of such violence goes for beyond the immediate harm and also affects many aspects of the women's future health. For medical personnel who encounter victims of violence, it is usually not easy to recognize the problem or to voice the suspicion that a man might have suffered domestic violence; accordingly it is difficult to offer adequate help and support. Data concerning the prevalence of violence in someone's immediate social environment are routinely collected. Risk factors as well as the association between experience violence and physical, emotional and psychosomatic sequel and not well investigated. Domestic violence is considered one of the most common forms of gender related violence and various studies estimate that between 10 and 35% of women experience domestic violence at some point in the lives. There seems to be neither a definite risk profile nor a specific association with a psychopathological profile. Women who have been victimized find it hard to share their experiences and seek help. It is often difficult for medical personnel who encounter these women to recognize violence and discuss this problem with them; just as it is difficult to offer adequate help. Medical personnel should be altered to this subject and prepare guidelines for the further management and treatment of abused women. Information and support for medical staff can help to identify domestic violence, and encourage communication about this problem, there by leading to a better and more efficient use of available services and resources. The protection of women from domestic violence Act, 2005 says that any act, conduct, omission or commission that harms or injuries or has the potential to harm or injure will be considered domestic violence by the law. Even a single act of omission or commission may constitute domestic violence. In other words, women do not have to suffer a prolonged period of abuse before taking recourse to law. Domestic Violence: is a pattern of abusive behavior in any relationship that is used by one partner to gain or maintain power and control over another intimate partner. The definition adds that domestic violence can happen to anyone regardless of race, age, sexual orientation, religion or gender, and can take many forms, including physical abuse, emotional, economic and psychological abuse (Women, 2007). Domestic violence (also named domestic abuse or family violence) is violence or other abuse in a domestic setting such as in marriage or cohabitation. It is also defined as a pattern of abusive behaviors by one partner against another in an intimate

relationship such as marriage, dating family or cohabitation. Every individual are expected to be protected from any form of abuse or violence. Domestic violence is a breach of fundamental right of the victim; it violates the right to life and dignity of its victim. It is one of the most pervasive of human right violation that denies women of their security, equality, dignity, self-worth and right to enjoy fundamental freedom. Efforts have been made on several occasions locally and international in a bid to protect women from domestic violence, these efforts led to the enactment of law and recognition of various conventions on the rights and protection of people against domestic violence. Apart from the conventions prohibiting domestic violence there was no specific or national law prohibiting domestic violence prior to the enactment of the violence against persons (prohibition) Act 2015. This protect both men and women against domestic violence, it does not make specific provision prohibiting domestic violence against women. The violence against persons(Prohibition)Act protect against any form of domestic violence, such as forceful ejection from home, abandonment of spouse, children and other dependents, and other harmful traditional practices.

## II. MATERIALS AND METHOD

### 2.1. Source of Data

The data used for this study was secondary, obtained from State offices of the Nigerian Security and Civil Defense Corps (NSCDC) database for the period of six years. That is, from 2015-2020.

### 2.2. Latin Square Design (LSD)

Is an arrangement of m- treatment in m square plots layout represented in m rows and m columns such that each treatments occurs in each row one and in each column one. The design provide a means of investigating the effects of three factors at the same time hence it is called a three dimensional design. This design control blocking in two ways the rows and the columns constitute a factor each while the treatment are normally indicated with Greek letters hence is called a Latin square. Latin square design is an incomplete block design, because it has M3 which is to be compared with M2.

### 2.3. Assumptions of Latin Square Design

1.  $e_{ijk} \sim N(0, \sigma^2)$ ; 2.  $E(e_{ijk}) = 0$ ; 3.  $\text{Var}(e_{ijk}) = \sigma^2$ ; 4.  $\sum_{i=1}^k \alpha_i = \sum_{j=1}^k \beta_j = \sum_{k=1}^k \gamma_k = 0$

5. All the terms are independent

### 2.4. Model for Latin Square Design

The model is given as:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + e_{ijk} \quad 1$$

Where  $Y_{ijk}$  is the response variable,  $\mu$  is the overall mean

$\alpha_i$  is the effect of the  $i^{\text{th}}$  factor (row)

$\beta_j$  is the effect of  $j^{\text{th}}$  factor (column)

$\gamma_k$  is the effect of  $k^{\text{th}}$  factor (treatment effect)

$e_{ijk}$  is the random error associated with  $y_{ijk}$ .

To obtain the formula for sum of squares, we will sum and square the model in equation 2 and differentiate with respect to the parameters involve by making error subject of the formular,

$$e_{ijk} = Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k \quad 2$$

$$\sum_{ijk} (e_{ijk})^2 = \sum_{ijk} (Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k)^2 \quad 3$$

$\sum_{ijk} (e_{ijk})^2$  is the sum of square due to error = SSE

Differentiate equation (3) with respect to  $\mu$ ,  $\alpha_i$ ,  $\beta_j$ , and  $\gamma_k$

$$\text{SSE} = \sum_{ijk} (Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k)^2 \quad 4$$

$$\frac{\delta \text{SSE}}{\delta \mu} = -2 \sum_{ijk} (Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k) \quad 5$$

$$\frac{\delta \text{SSE}}{\delta \alpha_i} = -2 \sum_{ijk} (Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k) \quad 6$$

$$\frac{\delta \text{SSE}}{\delta \beta_j} = -2 \sum_{ijk} (Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k) \quad 7$$

$$\frac{\delta \text{SSE}}{\delta \gamma_k} = -2 \sum_{ijk} (Y_{ijk} - \mu - \alpha_i - \beta_j - \gamma_k) \quad 8$$

Setting equation (5), (6), (7) and (8) to zero, then solve for  $\mu$ ,  $\alpha_i$ ,  $\beta_j$ , and  $\gamma_k$   
From equation (5)

$$\sum_{ijk} (Y_{ijk} - \hat{\mu} - \alpha_i - \beta_j - \gamma_k) = 0$$

$$\sum_{ijk} Y_{ijk} - \sum_{ijk} m_i \hat{\mu} - \sum_{ijk} m_i \alpha_i - \sum_{ijk} m_i \beta_j - \sum_{ijk} m_i \gamma_k = 0$$

$$\sum_{ijk} m_i \hat{\mu} = \sum_{ijk} Y_{ijk} - \sum_{ijk} m_i \alpha_i - \sum_{ijk} m_j \beta_j - \sum_{ijk} m_k \gamma_k$$

Where  $\sum_{ijk} m_i \alpha_i = \sum_{ijk} m_i \beta_j = \sum_{ijk} m_i \gamma_k = 0$

$$\sum_{ijk} m_i \hat{\mu} = \sum_{ijk} Y_{ijk} \text{ Where } \sum m_i = M$$

$$\hat{\mu} = \frac{\sum Y_{ijk}}{\sum m_i} = \bar{Y} \dots$$

Also from equation (6)

$$\sum_{ijk} (Y_{ijk} - \mu - \hat{\alpha}_i - \beta_j - \gamma_k) = 0$$

$$\sum_{ijk} Y_{ijk} - m_i \mu - m_i \hat{\alpha}_i - \sum_{ijk} m_j \beta_j - \sum_{ijk} m_k \gamma_k = 0$$

$$\sum_{ijk} Y_{ijk} - m_i \mu - m_i \hat{\alpha}_i = 0, \text{ Where } \sum_{ijk} m_j \beta_j - \sum_{ijk} m_k \gamma_k = 0$$

$$m_i \hat{\alpha}_i = \sum_{ijk} Y_{ijk} - m_i \mu$$

$$\hat{\alpha}_i = \frac{\sum Y_{i..}}{m_i} - \hat{\mu}$$

$$= \bar{Y}_{i..} - \bar{Y} \dots$$

Also from equation (7)

$$\sum_j (Y_{.j.} - \mu - \alpha_i - \beta_j - \gamma_k) = 0$$

$$\sum_j Y_{.j.} - m_j \mu - \sum m_i \alpha_i - m_j \beta_j - \sum m_k \gamma_k = 0$$

$$\sum_j Y_{.j.} - m_j \mu - m_j \beta_j = 0, \text{ Where } \sum_j m_i \alpha_i = \sum m_k \gamma_k = 0$$

$$\hat{\beta}_j = \frac{\sum_j Y_{.j.}}{m_j} - \hat{\mu}$$

$$\hat{\beta}_j = \bar{Y}_{.j.} - \bar{Y} \dots$$

Also from equation (8)

$$\sum_k (Y_{..k} - \mu - \alpha_i - \beta_j - \gamma_k) = 0$$

$$\sum_k Y_{..k} - m_k \mu - \sum m_i \alpha_i - \sum m_j \beta_j - m_k \gamma_k = 0$$

$$\sum_k Y_{..k} - m_k \mu - m_k \gamma_k = 0, \text{ Where } \sum m_i \alpha_i - \sum m_j \beta_j = 0, \hat{\gamma}_k = \frac{\sum Y_{..k}}{m_k} - \hat{\mu}$$

$$\hat{\gamma}_k = \bar{Y}_{..k} - \bar{Y} \dots$$

∴ Replacing the values of  $\hat{\mu}, \hat{\alpha}_i, \hat{\beta}_j$  and  $\hat{\gamma}_k$  in the SSE we have

$$\begin{aligned} \text{SSE} &= \sum_{ijk} (Y_{ijk} - \hat{\mu} - \hat{\alpha}_i - \hat{\beta}_j - \hat{\gamma}_k)^2 \\ &= \sum (Y_{ijk} - \bar{Y} \dots - \{\bar{Y}_{i..} - \bar{Y} \dots\} - \{\bar{Y}_{.j.} - \bar{Y} \dots\} - \{\bar{Y}_{..k} - \bar{Y} \dots\})^2 \\ &= \sum (Y_{ijk} - \bar{Y} \dots - \bar{Y}_{i..} + \bar{Y} \dots - \bar{Y}_{.j.} + \bar{Y} \dots - \bar{Y}_{..k} + \bar{Y} \dots)^2 \\ \text{SSE} &= \sum (Y_{ijk} - \bar{Y}_{i..} - \bar{Y}_{.j.} - \bar{Y}_{..k} + 2\bar{Y} \dots)^2 \\ \text{SSE} &= \sum Y_{ijk}^2 - \frac{\sum Y_{i..}^2}{m} - \frac{\sum Y_{.j.}^2}{m} - \frac{\sum Y_{..k}^2}{m} + 2 \frac{\sum Y \dots^2}{m^2} \\ \text{SSE} &= \text{SST} - \text{SS}\hat{\alpha}_i - \text{SS}\hat{\beta}_j - \text{SS}\hat{\gamma}_k \end{aligned}$$

### 2.5. Parameters Estimation

$$\begin{aligned} \text{C.F} &= \frac{Y \dots^2}{M^2} \\ \text{SST} &= \sum Y_{ijk}^2 - \frac{Y \dots^2}{M^2} \\ \text{SS}\alpha_i &= \frac{Y_{i..}^2}{M} - \text{C.F} \\ \text{SS}\beta_j &= \frac{Y_{.j.}^2}{M} - \text{C.F} \\ \text{SS}\gamma_k &= \frac{Y_{..k}^2}{M} - \text{C.F} \\ \text{SSE} &= \text{SST} - \text{SS}\alpha_i - \text{SS}\beta_j - \text{SS}\gamma_k \end{aligned}$$

2.1: Anova Table for Latin Square Design

Source of variation	Degree of freedom	Sum of square	Mean sum of square	$F_{cal}$	$F_{tab}$
Rows	M-1	$\text{SS}\alpha_i$	$\frac{\text{SS}\alpha_i}{M-1}$	$\frac{\text{MS}\alpha_i}{\text{MSE}}$	M-1, $M^2-3M+2$
Column	M-1	$\text{SS}\beta_j$	$\frac{\text{SS}\beta_j}{M-1}$	$\frac{\text{MS}\beta_j}{\text{MSE}}$	M-1, $M^2-3M+2$
Treatment	M-1	$\text{SS}\gamma_k$	$\frac{\text{SS}\gamma_k}{M-1}$	$\frac{\text{MS}\gamma_k}{\text{MSE}}$	M-1, $M^2-3M+2$

Error	$M^2-3M+2$	SSE	$\frac{SSE}{M^2 - 3M + 2}$
Total	$M^2-1$	SST	

$$\text{Least significance difference} = t_{\frac{\alpha}{2}, \text{d.f.}} \sqrt{\frac{2MSE}{M}}$$

### 2.6. Software for the Analysis

The statistical package/software to be used for the study is R package. R is a language and environment for statistical computing and graphics. It is a GNU project which is similar to the S language and environment which was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S language.

### III. ANALYSIS

Analysis on the secondary data on domestic violence in North East Region was presented using R package and the discussion of the results obtained as follows;

**3.1: Anova Table for LSD**

Source of Variation	DF	Sum of Squares	Mean Squares	F-value	P-value
States	5	44382	8876.5	30.69399	0.00000000972
Violence	5	33911	6782.3	23.4524	0.00000009888
Years	5	2792	558.5	1.9312	0.0139
Residuals	20	5784	343.1		

Table 3.1 shows the result of the analysis of state and violence with the corresponding probabilities as (p-values = 0.00000000972, 0.00000009888, 0.1339). Compare the corresponding probabilities (p-values) with level of significance ( $\alpha=0.05$ ) and draw conclusion. Since, p-values of (states and violence)  $< \alpha$  we reject the null hypothesis  $H_0$  and conclude that there is significance difference between the states and the violence. This indicates that the rates of violences with respect to each states are different as a result of ethnic, religious and cultural disparities. While p-value of (years) also  $< \alpha$  we reject null hypothesis  $H_0$  again and conclude that there is significance difference between the rates of crimes happening in each years. This indicates that from 2015 to 2020 the percentage rate of violence in each states of North east are not the same. Hence, rates of domestic violence increases as the year increases.



### 3.2: Comparing the Means of the Constituencies using Least Significance Difference

<i>States</i>	<i>Diff</i>	<i>Lwr</i>	<i>Upr</i>	<i>P adj</i>
Gombe/Bauchi	43.500000	10.544852	76.4551483	0.0049728
Yobe/Maiduguri	95.333333	62.378185	128.2884817	0.0000000
Yola/Taraba	80.333333	47.378185	113.2884817	0.0000010
Gombe/Yobe	39.166667	6.211518	72.1218150	0.0132617
Bauchi/Yola	5.500000	-27.455148	38.4551483	0.01599129
Maiduguri/Taraba	51.833333	18.878185	84.7884817	0.0007085
Gombe/Maiduguri	36.833333	3.878185	69.7884817	0.0221253
Bauchi/Taraba	-4.333333	-37.288482	28.6218150	0.0284166
Yola/Yobe	-38.000000	-70.955148	-5.0448517	0.0171588
Taraba/Gombe	-15.000000	-47.955148	17.9551483	0.0350763
Maiduguri/Yola	-56.166667	-89.121815	-23.2115183	0.0002545
Yobe/Bauchi	-89.833333	-122.788482	-56.8781850	0.0000001
Gombe/Yola	-41.166667	-74121815	-8.2115183	0.0084684
Bauchi/Maiduguri	-74833333	-107.788482	-41.8781850	0.0000034
Taraba/Yobe	-33.666667	-66.621815	-0.7115183	0.0432206

Table 3.2 shows the interactions of violence between the states. This indicates that there is significant difference between the means of all states of north east.

### 3.3: Means Comparison for Violence Based on Gender, Age and the Rate of Damage

<i>Violence</i>	<i>Diff</i>	<i>Lwr</i>	<i>Upr</i>	<i>P - adj</i>
Age26-Age25	-26.333333	-59.288482	6.621815	0.1737290
Discharge-Age25	-18.500000	-51.455148	14.455148	0.5259247
Gender-Age25	48.666667	15.711518	81.621815	0.0014941
Injuries-Age25	-3.000000	-35.955148	29.955148	0.9997337
Victim-Age25	52.000000	19.044852	84.955148	0.0006812
Discharge-Age26	7.833333	-25.121815	40.788482	0.9758879
Gender-Age26	75.000000	42.044852	107.955148	0.0000033
Injuries-Age26	23.333333	-9.621815	56.288482	0.2808567
Victim-Age26	78.333333	45.378185	111.288482	0.0000016
Gender-Discharge	67.166667	34.211518	100.121815	0.0000194
Injuries-Discharge	15.500000	-17.455148	48.455148	0.6976816
Victim-Discharge	70.500000	37.544852	103.455148	0.0000091
Injuries-Gender	-51.666667	-84.621815	-18.711518	0.0007369
Victim-Gender	3.333333	-29.621815	36.288482	0.9995544
Victim-Injuries	55.000000	22.044852	87.955148	0.0003352

Table 3.3 shows the interactions of means of violence between the victims for the period of study. From the above table, we see that there is no different between the age 26 - age 25, discharge - age 25, injuries - age 25, discharge - age 26, injuries - age 26, injuries - discharge and victim - gender while the remaining comparison indicates that the means are statistically different.

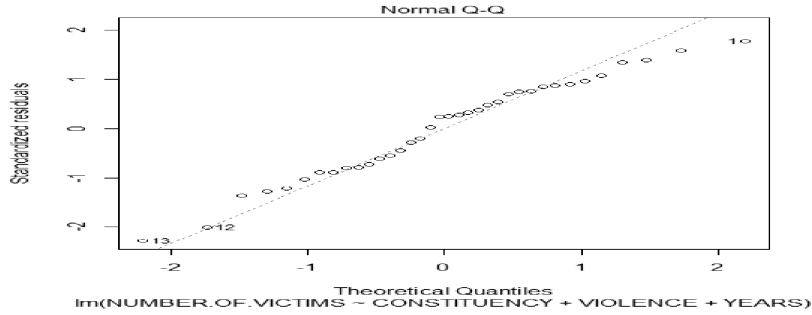


Figure 3.1: Shows the number of victims, states, violence and years

It shows that some variables follow normal distribution while others don't. Also, it indicates that the data exhibit linearity in nature which two or more outliers. Hence, we conclude that the data is normally distributed and have same variance.

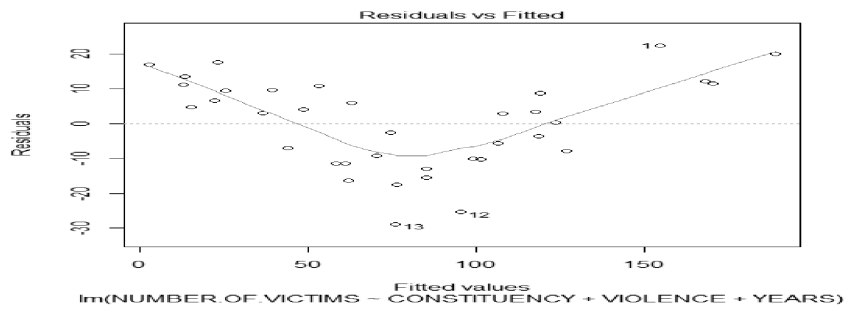


Figure 3.2: Shows the residuals vs fitted values for the period cover in this research and how the rates of violence defer

Table 3.2 shows that the residuals are not linearly distributed as it gives a u shape

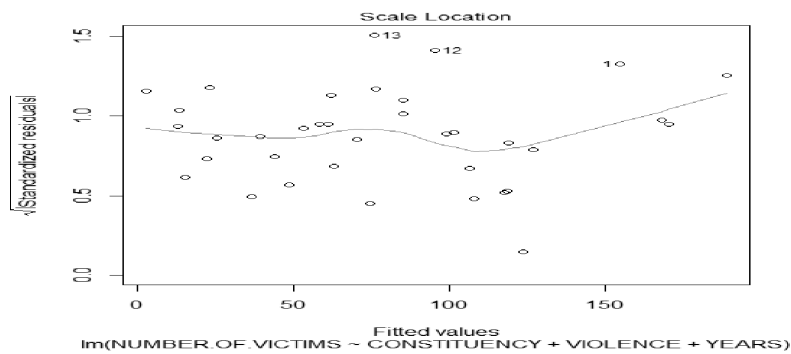


Figure 3.3 shows the scale location for standardized residuals vs fitted values of the domestic violence across the six states of the north east region and there disparity.

#### IV. CONCLUSION

In this research, the general interpretations as observed above shows that there is high rates of violence in each State of the region, which plays significance effect on society and affect the attitude of our teeming youths. We also observed that there is a significance difference in the number of violence happening in each year at different state and the rate is highly alarming. This further signifies that domestic violence occurs to women of different age before, during and after marriage. The major causes of domestic violence in north east region are over population, unemployment, inflation, corruptions and weakness of law and order in the region. Hence government need to address the aforementioned causes to reduce the menace of women abuse and domestic violence in north east region of Nigeria.

#### References

- AIDS, G. S. (2008). Daily Increase and Fear of HIV Victims . Gombe: Ministry of Health.
- Akbas, Y., Firat, M. Z., & Yakupoglu, C. (2001). Comparison of Different Models used in the Analysis of Repeated Measurements in Animal Science and their SAS Application. Agricultural Information Technology Symposium, 20-22.
- Alaja, O. P. (2010). Three Years Post UTME Screening. Influence on Science Education Students Achievement. Abraka: Delta State University.
- Algina, J., Wilcox, R. R., & Kowalchuk, R. K. (2000). The Analysis of Repeated Measure. A Quantitative Research Synthetic. *British Journal of Mathematical and Statistical Psychology*, 1735-1748.
- Amodara, H. (2004). Effectiveness of JAMB and POST - JAMB Examinations on the Academic Performance of Nigerian Undergraduate Students. Akungba, Akoko: Adekunle Ajasin University.
- Anho, J. E. (2011). An Evaluation of the Quality and Employ Ability of the Graduates of Nigerian Universities. *African Journal of Social Sciences*, 179-185.
- Babatunde, G. K. (2012). Statistical Evaluation of the Impact of ICT on Nigerian University. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, 104-120.
- Barcikowski, R. S., & Robey, R. R. (1984). Decision in Single Group Repeated Measures Analysis: Statistical Test and Three Computer Packages. *The American Statistician*, 148-150.
- Brandon, L. (2013). Misspecification of the Covariance Matrix in the Linear Mixed Model: A Monte Carlo Simulation. MN, USA: University of Minnesota.
- Bundy, L. G., Andraski, T. W., & Powell, J. M. (2001). Management Practice effect of Phosphorus Losses in Runoff in Corn Production Systems. *Journal of Environmental Quality*, 1822-1828.

- Ergun, G., & Aktas, S. (2009). Comparisons of Sum of Squares Method in Anova Models. Kaftas: Kaftas University, Veterinary Faculty.
- Everitt, B. S. (2006). An R and S - PLUS Companion to Multivariate Analysis. London: Springer Science and Business Media.
- Eyduran, E., Yazkan, K., & Ozdemir, T. (2008). Utilization of Profile Analysis in Animal Science. *Journal of Animal Veterinary Advances*, 796-798.
- Ferron, J., Dailey, R., & Yi, Q. (2002). Effect of Misspecifying the First Level error Structure in Two Level Models of Change. *Multivariate Behav. Res.*, 379-403.
- Fisher, R. A. (1935). *The Design of Experiment*. Scotland: Oliver and Boyd.
- Galton, F. (1894). *Natural Inheritance* (5th edition ed.). New York: Macmillan and Company.
- Girden, E. R. (1992). *ANOVA: Repeated Measures*. Sage: Newbury Park CA.
- Greenhouse, S. W., & Geisser, S. (1959). On Methods in the Analysis of Profile Data. *Psychometrika*, 95-112.
- Gurbuz, F. E., Baspinar, H. C., & Keskin, S. (2003). *Terkrarlı Oculumlu Deneme Duzenlerinin Analizleri*. YYU: Matbaasi.
- Guttman, L. A. (1954). *New Approach to Factor Analysis: The Radex* in P. F. Lazarsfeld (Ed.), *Mathematical thinking in the Social sciences*. New York: Columbia University Press.
- Hamid, M. (January 1985). ARC Training Report. An maido daga <http://www.avrdc.org/LC/tomato/practices.:html>
- Health, F. M. (2003). *National HIV/AIDS and Reproductive Health Survey*. Abuja: Ministry of Health .
- Heise, L. L., Pitanguy, J., & Germaine, A. (1994). *Violence Against Women; The Hidden Health Burden*. Washington, DC: World Bank.
- Herbert, L. (1997). *Monitoring the Domestic Violence Act 1994*. Women's Aid Organization.
- Hotelling, H. (1951). The Generalization of Students Ratio. *Annals of Mathematical Statistics*, 360-378.
- Hun, M. P. (2008). *Univariate Analysis and Normality Test Using SAS, Stata, and SPSS*. University Information Technology Services Center for Statistical and Mathematical Computing. Indiana University, 278-290.
- Huynh, H., & Feldt, L. S. (1970). Conditions under which Mean Square ratios in Repeated Measurements Design have exact F - Distributions. *Journal of the American Statistical Society*, 1582-1589.
- Huynh, H., & Feldt, L. S. (1976). Estimation of the Box Correction for Degrees of Freedom from Sample Data in the Randomized Block and Split Plot Design. *Journal of Educational Statistics*, 15-51.
- Jennrich, R. I., & Schluchter, M. D. (1986). Unbalanced Repeated Measures Models with Structured Covariance Matrix. *Biometrics*, 805-820.
- Kazeem, K. (2010). *Status of the Nigerian Education System*. Lagos: Delight Press.
- Keselman, H. J., Cariere, K. C., & Lix, L. M. (1993). Testing Repeated Measures Hypotheses when Covariance Matrices are Heterogeneous. *Journal of Educational Statistics*, 305-319.
- Lefter, C. (2004). *Marketing Researches*. Brasov: Infomarket.
- Lemma, D., Yayeh, Z., & Herath, E. (1992). *Agronomic Studies in Tomato and Capsicum*. In Herath and Lemma (eds). *Proceedings of the Second National Horticultural Workshops* (pp. 153-163). Addis Ababa, Ethiopia: Horticulture, Research and Development.

- Levene, H. (1960). Robust testes for equality of variance in contributions to probability and statistics. Palo Alto: Stanford Univ. Press, CA MR0120709.
- Littell, R. C., Milleken, G. A., Stroup, W. W., & Wolfinger, R. D. (1996). SAS System for Mixed Models. Cary: NC; SAS Institute.
- Maxwell, S. D., & Delaney, H. D. (2004). Designing Experiments and Analyzing Data: A Model Comparison Perspective (2nd ed.). Mahwah, NJ: Laurence Erlbaum Associated Publishers.
- McDonald, R. P. (1985). Factor Analysis and Related Methods. Lawrence Erlbaum Associates.
- Mehla, C. P., Srivastava, B. K., Jage, S., Mangat, R., Singh, J., & Ram, M. (2000). Response of Tomato Varieties to N and P Fertilization and Spacing. *Indian Journal of Agricultural Research*, 182-184.
- Minke, A. (1997). Conducted Repeated Measures Analysis: Experimental Design Considerations. Texas: Paper Presented at the Annual Meeting of the Southwest Educational Research Association, Austin.
- Moh'd, S. M. (1996). The Legal and Social Issues of Wife Batterin and Marital Rape in Malaysia. Kuala Lumpur: Dewan Bahasa Dan Pustaka.
- Mulaik, S. A. (1972). The Foundation of Factor Analysis. New York: McGray Hill.
- Nezlek, J. B., & Robert, S. (2003). Using Multilevel Random Coefficient Modelling to Analyze Social Interaction Diary Data. *Journal of Social Relation*, 437-469.
- Nwaosu, S. C. (2008). Notes on Regression Analysis. Gombe.
- Organization, W. H. (2004). Fifty Seven World Health Assembly. Geneva: World Organization.
- Oshima, T. C., & Algina, J. (1994). Type 1 Error Rates for Huynh's General Approximation and Improved General Approximation Tests. *British Journal of Mathematical and Statistical Psychology*, 151-165.
- Pandey, R. P., Solanki, P. N., Seraf, R. K., & Parihar, M. S. (December 1996). Effect of Nitrogen and Phosphorus on Growth and Yield of Tomato Varieties. *Punjab Vegetable Grower*, pp. 1-5.
- Pearson, K. (1896). Mathematical Contributions to the Theory of Evolution. III. Regression, Heredity and Panmixia. London: Transactions of the Royal Society of London.
- Pillai, K. C. (1965). On the Distribution of the Largest Characteristics Root of a Matrix in Multivariate Analysis. *Biometrika*, 405-414.
- Popoola, O. P., Adesanya, K. K., Odusina, T. M., & Ayanrinde, A. W. (2015). A Quadratic Regression Analysis of the Effect of Three Levels of NPK Fertilizer on the yield of Yellow Maize. *American Journal of Computational Mathematics*, 426-430.
- Popoola, O. P., Adesanya, K. K., Odusina, T. M., & Ayandire, A. W. (2015). A Quadratic Resgion Analysis of the Effect of Three Levels of NPK Fertilizer on the Yield of Yellow Maize. *American Journal of Computational Mathematics*, 426-430.
- Rauf, N. K. (2008). Classification of Multivariate Repeated Measures data with Temporal Autocorrelation. *Advances in Data Analysis and Classifiation*, 175-199.
- Salim, B. A. (2016). Case Study for Common and Unified Entrance Examination into Nigerian University. Paper Presented at the 6 NAPEUAP Leadership Forum in Calabar.
- Sanchez, P. A., Buresh, S., & Leakey, R. B. (1997). Land Use Transformation in Africa. Three Determinant for Balancing Food Security with Natural Resource Utilization. *European Journal of Agronomy*, 1-9.

- Sangare, M. I., Landrette, C., Mungroop, R. R., & Berthe, T. (1998). Animal Power in Farming Systems Proceedings of Network. Federal Republic of Germany, 191-211.
- Seager, J. (2009). Murders of Women by Intimate Partners. *Environment and Planning*, 22-87.
- Sherma, K. C., Singh, A. K., & Sherma, S. K. (1999). Studies on Nitrogen and Phosphorus requirement of Tomato hybrids. *Annals of Agricultural Research*, 339-402.
- Siemienuk, R. A., Krentz, H. B., Gish, J. A., & Gill, M. J. (2010). Domestic Violence Screening. *Social Forces*, 473-491.
- Starkey, P. H. (1988). Animal Traction Research in Southern Malt Consultancy. Report for Division de Recherchesurles Systemes de Production Rurale (DRSPR), 30-36.
- Stevens, J. P. (2002). *Applied Multivariate Statistics for the Social Science* 4th edition. Lawrence Erlbaum Associates Publishers .
- Tabachnik, B. G., & Fidel, L. S. (2001). *Using Multivariate Statistics*. U.S.A: Allyn & Bacon.
- Wahua, T. A. (1999). *Applied Statistics for Scientific Studies*. Lagos: Macmillan Publishing.
- White, S. (1985). The Bauchi State Agricultural Development Project: Draught Animals News. Centre for Tropical Veterinary Medicines, Edinburgh, 17-20.
- Wilks, S. S. (1963). *Multivariate Statistical Outliers*. Sankhya Series.
- Winter, W. R. (1991). *Conducting Repeated Measures Analyses using Regression* . New Orleans, Louisiana: The General Linear Model Lives. Paper Presented at the annual meeting of the Mid - South Educational Research Association.
- Women, O. o. (2007). About Domestic Violence. Retrieve June 13. Practical Guide for Researchers and Activists, 22-87.
- Yanosky II, D. J. (2007). *Comparability of Covariance Structures and Accuracy of Information Criteria in Mixed Model Methods for Longitudinal Data Analysis*. Athens, Georgia: University of Georgia Press.
- Yule, G. U., & Kendall, M. G. (1937). *An Introduction to the Theory of Statistics* (2nd ed.). london: Griffin.