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SPATIAL DISTRIBUTION OF CARDIOVASCULAR DISEASES (CVDs) AND THE RISK AREAS IN GOMBE STATE, NIGERIA

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Abstract

Cardiovascular diseases and coronary heart disease are leading causes of death globally. Though, a number of studies have been carried out in both developed and developing countries including Nigeria on the subject of cardiovascular diseases. However, most of the researches are clinically based. This study therefore sought to examine the distribution of the disease over space and the demographic characteristics of patients affected by the disease in Gombe State. Data for the study was derived exclusively from secondary sources via medical records of patients in all tertiary health institutions in the state and were subjected to descriptive analysis. The findings from the study showed that Gombe LGA had the highest incidences of CVD in the State. It accounted for nearly two-third of the total reported cases of CVD between 2010 and 2015. Nafada LGA recorded the lowest occurrences of CVD in the state (1.3%) . In addition, the study revealed that the urban areas have the highest reported cases of CVD in Gombe State and it is more prevalent among the female group. The study therefore, recommends increase awareness on control mechanism against the disease through mass campaign by the ministry of health and cardiologist association of Nigeria.
Key words: Cardiovascular, Diseases, Risk, Spatial,

1. Introduction

The prevalence of risk factors for cardiovascular diseases (CVDs) is on the increase in the developing world. Globally, CVD accounts for the majority of deaths due to chronic diseases (Paradis and Chiolero, 2011), and more than three – quarter of the global burden of CVD is likely to occur in low and middle-income countries (Global atlas). Cardiovascular Diseases (CVDs) particularly the coronary heart disease is the main cause of death in industrialized countries, which is rising at an alarming rate in most of the developing countries (Oguoma et al., 2015). Heart Disease and stroke are referred to as cardiovascular disease, which are disorders of the heart and blood vessel system. Coronary heart disease can be said to be a disease of the blood vessels of the heart that causes heart attacks. A heart attack occurs when an artery becomes blocked, preventing the supply of oxygen and nutrients from getting to the heart. CVDs have a major impact on both developed and developing nations owing to the fact that it is the chief

cause of death worldwide (Oguoma et al., 2017). Although, the spotlight is more often on the global burden of mortality associated with malaria, tuberculosis, and HIV/AIDS, however, CVDs cause more than three times the annual deaths of these three diseases combined. Nearly 30percent of all deaths in low and middle-income countries are attributed to CVDs, and more than 80 percent of CVDs-related deaths worldwide now occur in low and middle countries (WHO, 2008).

Several studies have been conducted in Nigeria as well in Gombe State on the incidence of CVDs. These include the studies of Ayoola (2020), Omoaghe (2020), American Heart Association (AHA) (2015) and many more, however, all these studies are clinically based research and did not make attempt to study the spatial distribution of CVD and the high risk areas. It is against this background this study seek to examine the spatial distribution of CVDs and the high-risk areas in Gombe State.

2. The Study Area

Gombe State (the Jewel in the Savannah) is located between Latitude 10^0 15^1 N and Longitude 11^0 10^1E in the northeastern part of Nigeria within the Sudan savannah region. It lies to the Northeast of river Benue and East of Yankari Game Reserve sharing borders with Adamawa, Bauchi, Borno and Yobe states. The state has an area of 20,256.5sq/km^2 and a population of 2,353,000 people (census, 2006).The approximate altitude of Gombe ranges from 400-500m above mean sea level. It is mainly mountainous, undulating and hilly to the Southeast and has open plains in the central Northeast, west and northwest (Abbas, 2012).

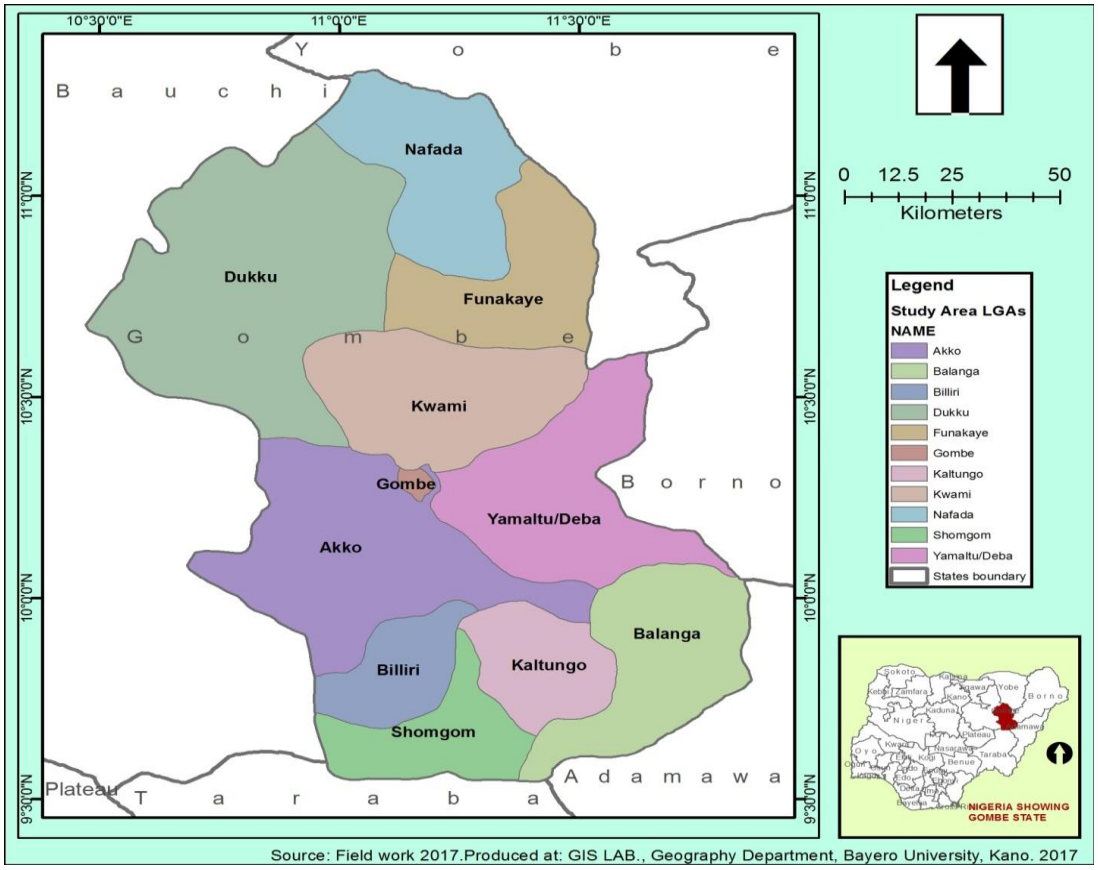

Figure1: Map of Gombe State showing the Study Areas

2. Literature Review

According to WHO (2013), cardiovascular diseases (CVDs) are a group of disorders that affect mainly the heart and blood vessels. Smith (2012) opines that CVDs is a global health emergency that is affecting all ages and socio-economic clusters. CVDs are therefore diseases that occur irrespective of the age or the socio-economic status and this negates the general belief that CVDs are diseases of the rich. CVDs are manifested in different forms such as coronary heart disease, cerebrovascular disease (e.g. stroke), peripheral arterial disease, rheumatic heart disease, congenital heart disease, heart failure, hypertensive heart disease, deep vein thrombosis and pulmonary embolism (WHO, 2013). The U.S. national institutes of health, national heart, lung, and blood institute (2012) conceptualize cardiovascular diseases to mean diseases and congenital malformations of the circulatory system. The update identifies a second issue that is concerning continuing, and sometimes worsening racial disparities in the prevalence of and deaths caused by CVDs. Based on data for 2012, the prevalence of CVDs was 36.1% among white men, 46.0% among black men, 31.9% among white women, and48.3% among black women. Similar disparities were found in the prevalence of heart failure (HF). In contrast to the continuing decline in CHD nationally, the prevalence of HF is predicted

to increase 46% between 2012 and 2030. These changing patterns in the burden of heart disease (HD) reflect important geographic shifts, although smoking is a major risk factor for both Coronary Heart Disease and Heart Failure, temporal changes in the geographic pattern of cigarette smoking showed similarities to the changes observed for heart disease mortality (Casper, Kramer, Quick, Scheib, Yaughan and Greer, 2010). Ogunmola *et al* (2013) studied prevalence of cardiovascular risk factors among adults without obvious cardiovascular disease in a rural community in Ekiti State. The cross sectional study included participants aged ≥40 years in the community were data on arterial hypertension, diabetes mellitus, obesity, dyslipideamia, smoking; physical activity, alcohol consumption and socio demographic parameters were collected. The study shown that traditional cardiovascular risk factors apart from hypertension, obesity, physical inactivity and low HDL-C had a low prevalence in the rural Nigerian community, the high prevalence of hypertension in the community suggest a high risk of a future cardiovascular events.

2.1 Types of Cardiovascular Disease

The different types of cardiovascular disease include; Coronary Heart Disease, Hypertensive Heart Disease, Rheumatic Heart Disease, Inflammatory Heart Disease and stroke,(Eapen, 2015).

2.2 Etiology of Cardiovascular Disease

Cardiovascular disease, cardiac attack or disease of the heart is a life and death emergency were every seconds counts. Not all the signs occur in every attack sometimes they go away and return. Today, victims of heart disease benefit from new medication and treatment, which is unavailable to patient's years ago. Most heart attacks starts slowly with mild pain and discomfort (American Heart Association, 2015).

2.3 Clinical presentation of Cardiovascular Disease

During attack, symptoms last 30 minutes or longer and are not relieved by rest or nitroglycerin under the tongue, but some people experience heart attacks without any symptom showing(the silent myocardial infarction)which is more common among people with diabetes. The symptoms of cardiovascular disease include (WebMD, 2005).

i. Discomfort, heaviness or pain in the chest or below the breastbone.

ii. Fullness, indigestion, or chocking feeling like heartburn.

iii. Sweating, nausea and vomiting.

iv. Shortness of breath, extreme weakness or anxiety.

v. Rapid and irregular heartbeat.

2.4 Diagnosis of Cardiovascular Disease

To diagnose a heart attack, the patient symptoms are known first before evaluating the patient. The diagnosis of heart attack is based on symptoms and test results because the goal of treatment is to limit the heart tissue damage. Tests to diagnosed cardiac disease include;

i. ECG (Electrocardiogram) tells how much damage has been done to the

heart muscles were the heart rate and rhythm can be monitored too.

ii. Blood Test; helps to know the level of cardiac enzymes found inside the cells of the heart.

iii. Echocardiography; is an imaging test that can be used during and after heart attack to see how the heart is pumping and the areas that are not pumping normally.

Cardiac Catherization; also called cardiac cath is used during the first hour of attack if medications are not reliving the symptoms. The cardiac cath can be used to directly visualize the blocked artery in order to ease the procedure needed to treat the blockage, (WebMD, 2005).

Delisle *et al* (2011) examined the mediating role of nutrition transition in the relationship of urbanization level and socio-economic status (SES) to cardio metabolic risk markers. 541 subjects in apparent good health were randomly selected from the main city of Cotonou and its surrounding rural areas. In the study, SES was assessed based on a proxy for income and on education. Dietary intake and physical activity were assessed with at least two non-consecutive 24h recalls. Scores for micronutrient adequacy and preventive diet were used as indicators of diet quality. The study shows that Cardio metabolic risk markers were BMI, waist circumference (WC), blood pressure, serum cholesterol and insulin resistance according to homeostasis model assessment. A more advanced stage of nutrition transition, which correlated with lower diet quality scores and less physical activity, was observed in the large city compared with less urbanized locations. More obesity and more adverse cholesterol profiles, but also lower blood pressure, were present in the large city. Urbanization, income, sedentary lifestyle and alcohol consumption, but not diet quality, independently contributed to higher BMI and WC. Higher micro nutrient adequacy was independently associated with a better cholesterol profile. The study confirmed the positive rural–urban gradient in nutrition transition and cardio metabolic risk, except for blood pressure. This risk could be mitigated by a more adequate diet, particularly micronutrient intake, and a more active lifestyle.

Hendriks *et al* (2012) in their study hypertension in sub-Saharan Africa performed four cross sectional household surveys in Kwara state(Nigeria),Nandio district (Kenya), Dar es Salaam (Tanzania) and Greater Windhoek (Namibia) with the primary measure on the prevalence of hypertension in each of the population under study. The result of the study shows that hypertension was the most frequently observed risk factor for CVD in both urban and rural communities in SSA and will continue to the growing burden of CVD in SSA. Uche (2010) in his study Changing Trend in Coronary Heart Disease in Nigeria shows that the disease is still uncommon in the country with a rising trend in the incidence over the past four decades in urban areas. The study reveals that CHD is still uncommon in the country and does not contribute significantly to morbidity and mortality from CVD with substantial evidence that the incidence of the disease has increase over the last four decades due to increasing prevalence of CHD risk factors, urbanization and adaption of western diet and lifestyle. Yusuf *et al* (2014) carried out study on cardiovascular risk and events in 17 Low, Middle and high-income countries were 156,424 persons were enrolled from 628

urban and rural communities in 17 countries. The cardiovascular mean was assessed using the INTERHEART Risk score where the mean INTERHEART score is highest in the high-income countries intermediate in the middle-income countries and lowest in the low-income countries. It also shows that the rates of major cardiovascular events (deaths from cardiovascular causes, myocardial infarction, stroke or heart failure) were lower in high-income countries than in middle and low-income countries. The study also revealed that urban communities had a higher risk factor burden than the rural communities but lower rates of cardiovascular events and fatality rates.

2.5 Risk Factors Associated with Cardiovascular Disease

According to WHO (2011), the risk factors for deaths resulting from cardiovascular diseases are precipitated by factors such as; Hypertension, High cholesterol, Obesity, Diabetes, Physical Inactivity, Smoking, and Air Pollution (as identified by the US Department of Health Committee on the Medical Effect of Air pollutants, 2006).

Tamilenthi, *et al* (2011) also indicate that the risk factors associated with cardiovascular disease include; Cigarette smoking, High Blood Pressure, High Blood Cholesterol, Overweight, Physical inactivity and Diabetes.

Lang, Lepage *et al* (2012) suggest that social determinants should not only be juxtaposed with traditional risk factors acting directly on CVD, but also be examined as underlying determinants of some CVDs, and, indeed, as factors acting along causal chains, influencing the incidence and management of traditional risk factors as well as the management of acute coronary events.

Sekhri *et al* (2014) carried out a study to assess the prevalence of risk factors for coronary artery disease among government employees in India were 10 642 men and 1966 women sampled population were carried out which comprise of various ethnic groups living in different environmental condition. The study revealed that 4.6% of the study population had a family history of premature CAD. The overall prevalence of diabetes was 16%, hypertension was present in 21%, and dyslipidemia was significantly high with 45.6%having high totaled cholesterol/high density lipoprotein in ratio. The study shows 78.6% of the overall subjects had two or more risk factors for CAD. The result demonstrates a high prevalence of CAD risk factors in the India urban population. Iyengar, Gupta *et al* (2016) assess the risk factors and treatment pattern in young patients presenting with acute coronary syndrome (ACS) and stable ischemic heart disease (IHD). The result showed a conventional risk factors including family history playing a vital role in premature CAD among Indians with women having more metabolic risk factors, which is present at a later age, and have non-ST elevation ACS more often.

Agyemang *et al* (2012) carried out a study in Ghana to determine stroke morbidity and mortality. The study employed the use of patient records from the hospital and these were analyzed. The risk ratio and the 95% confidence interval were estimated by the means of poisson regression analysis. It was observed that stroke constituted 9.1% of total medical adult admissions and 13.2% of all

medical adult deaths within the period under review. The stroke case fatality rate was 5.7% at 24 hours, 32.7% at 7 days, and 43.2% at 28 days. Njelekela *et al* (2009) studied Gender-related differences in the prevalence of cardiovascular disease risk factors and their correlates in urban Tanzania. A total sample of 209 participants aged between 44 and 66 years were included in the study were structured questionnaire was used to evaluate socioeconomic and lifestyle characteristics. Blood samples were collected and analyzed to measure lipid profile and fasting glucose levels. Cardiovascular risk factors were defined using World Health Organization criteria. The study revealed that the age-adjusted prevalence of obesity (BMI $\geq$ 30) was 13% and 35%, among men and women ($p = 0.0003$), respectively. The prevalence of abdominal obesity was 11% and 58% ($p < 0.0001$), and high WHR (men: >0.9, women: >0.85) was 51% and 73% ($p = 0.002$) for men and women respectively. Women had 4.3 times greater odds of obesity (95% CI: 1.9–10.1), 14.2–fold increased odds for abdominal adiposity (95% CI: 5.8–34.6), and 2.8 times greater odds of high waist hip-ratio (95% CI: 1.4–5.7), compared to men. Women had more than three-fold greater odds of having metabolic syndrome ($p = 0.001$) compared to male counterparts, including abdominal obesity, low HDL-cholesterol, and high fasting blood glucose components. In contrast, female participants had 50% lower odds of having hypertension, compared to men (95%CI: 0.3–1.0). It also shows that among men, BMI and waist circumference were significantly correlated with blood pressure, triglycerides, total, LDL-, and HDL-cholesterol (BMI only), and fasting glucose; in contrast, only blood pressure was positively associated with BMI and waist circumference in women. The result indicated that the prevalence of CVD risk factors was high in the population, particularly among women. Health promotion, primary prevention, and health screening strategies were recommended to reduce the burden of cardiovascular disease in Tanzania.

Hendriks *et al* (2012) in their study hypertension in sub-Saharan Africa performed four cross sectional household surveys in Kwara state(Nigeria),Nandio district (Kenya), Dar es Salaam (Tanzania) and Greater Windhoek (Namibia) with the primary measure on the prevalence of hypertension in each of the population under study. The result of the study shows that hypertension was the most frequently observed risk factor for CVD in both urban and rural communities in SSA and will continue to the growing burden of CVD in SSA.

Fabiyi and Garuba (2015) examined the spatial pattern of the CVD disease burden in Ibadan city and among the neighborhoods and the spatial pattern of biomedical risk factors. Hospital records, population data and geocode map of Ibadan were acquired for the study. Global Moran, Anselin Moran, Geographically Weighted Regression (GWR) and logistic regression were employed to examine the spatial pattern of CVD, and correlation between CVD and biomedical risk factors. The relationship between the spatial pattern of CVD and the biomedical risk factors was found to be statistically significant which indicated a very strong positive spatial autocorrelation in the study area. Ogunmola and Akintomide, (2013) also conducted a similar study the in the south-western part of the country, hypertension accounted for the most prevalent risk factor for cardiovascular admissions into the

hospital and about 70% of cardiovascular deaths were recorded among the elderly.

Oyeyemi and Adeyemi(2013) in their study Relationship of physical activity to cardiovascular risk factors in an urban population of Nigerian (Maiduguri) adults shows that Physical activity level of the working population of Nigerian adults was low and related with adverse risk factors for CVD. Time spent in walking and sitting during occupational activity was assessed through a cross-sectional study, that assessed health enhancing moderate-to-vigorous physical activity (MVPA) among 292 government employees (age: 20–65 years, 40% female, 24% obese and 79.8% response) using the self-administered version of International Physical Activity Questionnaire (IPAQ-SF). The result shows that more women were less physically active, obese and reported more diagnoses of component of metabolic syndrome ($p < 0.05$) compared with men. It also shows that Participants whose work activities were highly sedentary tend to accumulate less minutes of MVPA compared with those who reported their work as moderately active or highly active ($p < 0.001$) as well as health enhancing MVPA was inversely related with body mass index (BMI), waist circumference, heart rate, and systolic and diastolic blood pressure ($p < 0.05$).

Ejim *et al* (2011) Prevalence of Cardiovascular Risk Factors in the Middle-Aged and Elderly Population of a Nigerian Rural Community. A cross sectional population-based survey in Imezi-Owa, a rural community in South East Nigeria was used to estimate the prevalence of major cardiovascular risk factors in both men and women aged 40–70 years. 858 individuals made up of 247 (28.8%) males and 611 (71.2%) females were recruited. The mean age of the subjects was 59.8±9.9 years. The prevalence of the different cardiovascular risk factors among the 858 subjects as shown in the study was as follows: hypertension 398 (46.4%) subjects, generalized obesity as determined by BMI 257 (30%) subjects, abdominal obesity 266 (31%) subjects, dysglycaemia 38 (4.4%) subjects and hypercholesterolaemia 32 (3.7%) subjects. The result shows the Prevalence of hypertension and dysglycaemia was higher in men while the others were higher in women. Only hypertension ($P = .117$) and hyperactive cholesterol aemia ($P = .183$) did not reveal any significant association with gender. Prevalence of CVD risk factors was higher in subjects aged 65 to 70 years. Ogunmola *et al* (2013) studied prevalence of cardiovascular risk factors among adults without obvious cardiovascular disease in a rural community in Ekiti State. The cross sectional study included participants aged $\geq$40 years in the community were data on arterial hypertension, diabetes mellitus, obesity, dyslipideamia, smoking; physical activity, alcohol consumption and socio demographic parameters were collected. The study shown that traditional cardiovascular risk factors apart from hypertension, obesity, physical inactivity and low HDL-C had a low prevalence in the rural Nigerian community, the high prevalence of hypertension in the community suggest a high risk of a future cardiovascular events.

Okolie *et al* (2012) conducted a study to determine the Electrocardiographic patterns among professional footballers, involved in the sport for more than 4 years in Gombe State. They were age matched with non-sports men as controls. Their constitutional and cardiovascular parameters were obtained

with their Electrocardiographic studies. it was observed that Electrocardiographic abnormalities were present in 32 (94%) of Footballers and Most of the ECG abnormalities remain that of common and training related ECG changes but significant footballers had uncommon and training unrelated ECG changes.

3. Materials and Method

The population of the study constitutes the total population of people that were residing in Gombe State, which is 2,353,879 (NPC 2006). The sample for the study constitutes only patient with cardiovascular diseases that were admitted into secondary and tertiary hospitals and were residing in Gombe State. This is due to the fact that reliable information will be obtained from these hospitals and patients admitted into these hospitals were a good representative of the entire population of the State (because such a disease is only treated in specialist and teaching hospital of the State as such the patient there represent the people in the State). Data collected for each patient covers the following; Date in which patient were admitted in the hospital, residential address of patients, age of patient, gender of patient, occupation of patient as well as the diagnosis. The data/variables collected were cross-tabulated using the statistical package for social sciences (SPSS) software version 16.0 in mapping the areas to achieve the spatial distribution of the disease across the state. Descriptive statistics was used were the data were presented in tables and maps while chi square was used to test the significant difference in the number of CVD cases between the groups.

4. Results and Discussion

4.1 Spatial Distribution of CVDs in Gombe State

The findings from this study as observed in Table 1 and Figure 1 indicated that CVD is high in Gombe Local Government area, which is the State capital and has the highest population in the State. It accounted for 60% of the total reported cases of CVD between 2010 and 2015, while Akko Local Government, which has the largest land mass in the State accounted for 11.7%. The other Local Governments accounted for an average of 3% each with Nafada and Shongom Local Government areas having the least reported cases accounting for 1.3% and 1.6% respectively. From these findings, it could be observed that the urban areas have the highest reported cases of CVD in Gombe State. This could be based on the people's life style, health care systems available, and their physical and social environment. This collaborates with the findings of Ogunmola *et al* (2013) where it was observed that CVD has a low prevalence in the rural Nigerian community. The findings of Yusuf, Rangarajan, Islam and Liu (2014) also revealed that urban communities had a higher risk factor burden of CVD than the rural communities
.

LGAs	Frequency	Percent	Valid Percent	Cumulative Percent
Akko	81	11.7	11.7	11.7
Balanga	21	3.0	3.0	14.8
Billiri	21	3.0	3.0	17.8
Dukku	23	3.3	3.3	21.2
Gombe	414	60.0	60.0	81.2
Kaltungo	22	3.2	3.2	84.3
Kwami	26	3.8	3.8	88.1
Nafada	9	1.3	1.3	89.4
Funakaye	22	3.2	3.2	92.6
Shongom	11	1.6	1.6	94.2
Yamaltu	40	5.8	5.8	100.0
Total	**690**	**100.0**	**100.0**	

Source: Hospital Record, 2016

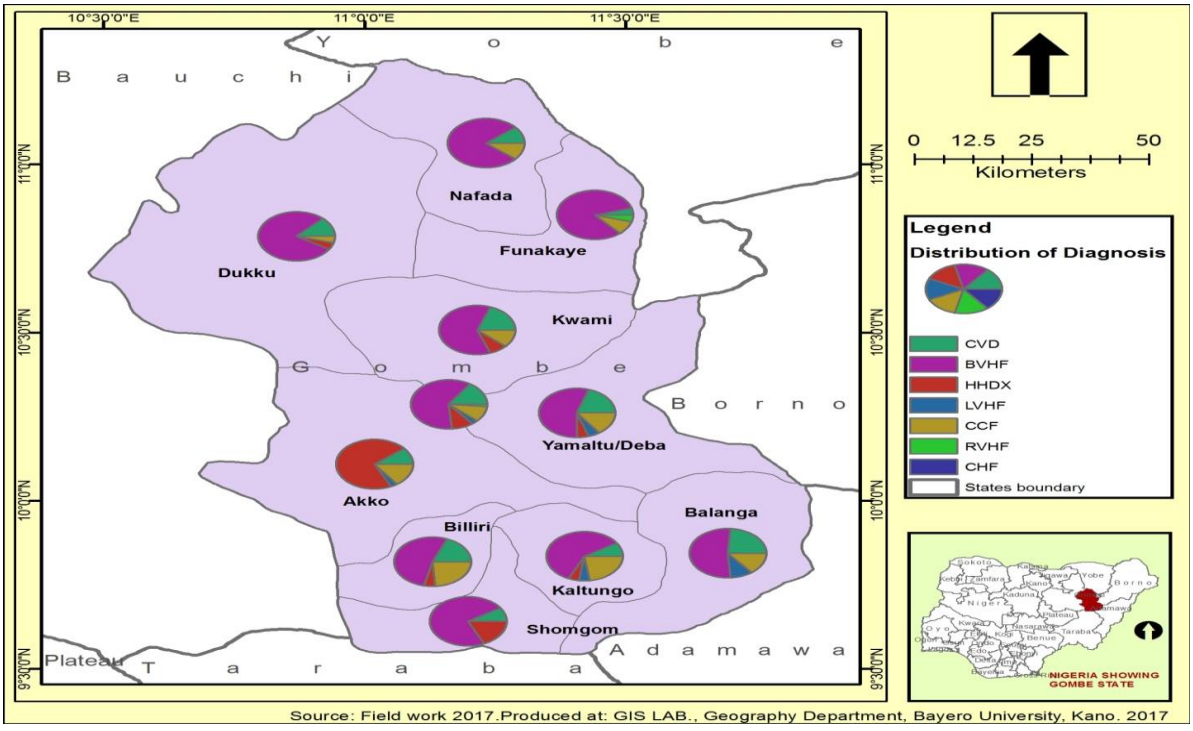

Figure 1 Spatial Distribution of Cardiovascular Disease in Gombe State

4.2 Demographic Characteristics of Patients with Cadiovascular Disease in Gombe State

4.2.1 Age Distribution

From Figure 4, it could be seen that CVD is prevalence among the age group of 60-64 years, which accounted for 12.6% of the total reported cases from 2010-2015 while age group between75 and above account for 11.9%. The findings revealed low cases of CVD among the age group below 19years, which recorded 0.3% this is because CVD is very uncommon among children and teenagers. It could also be observed that CVD is more prevalent among elderly age group in Gombe State. The value of R^2 is 0.532, which is indicating that age has accounted for more than 53% of CVD while other factors accounted for the 47%. This collaborates with the study of Ogunmola and Akintomide (2013) where it was observed that 70% of cardiovascular deaths were recorded among the elderly and the study of Ejim *et al* (2011) where it was also observed that the mean age of the group that CVD is most prevalence was 59.8 ± 9.9 years.

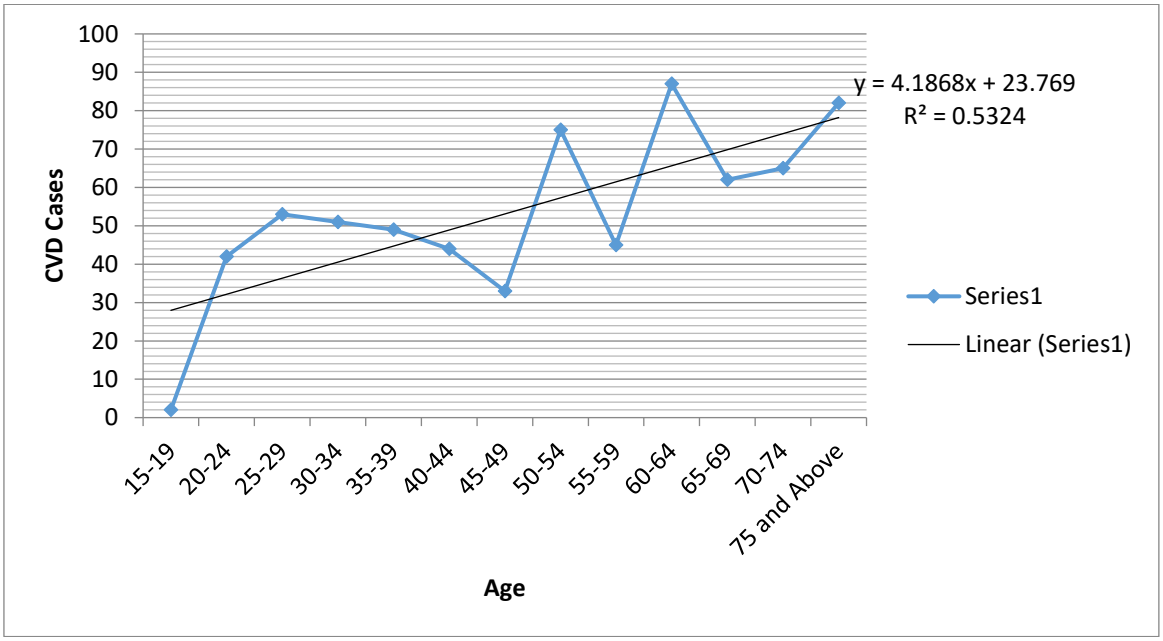

Figure 4.2: Age Distribution
Source: Hospital Record, 2016

4.2.2 Gender Characteristic

The findings from this study indicate that CVD is higher among females than male (Fig.3). This can be observed from Figure 4.3 where the female gender accounted for 63.6% compared to only 36.4% of females of the total reported cases of CVD from 2010-2015. Female are considered more prone to CVD due to their less physical activities. This also confirms with the findings of Oyeyemi and Adeyemi, (2013) as it was observed that women were less physically active, obese and

reported more diagnoses of component of metabolic syndrome compared with men.

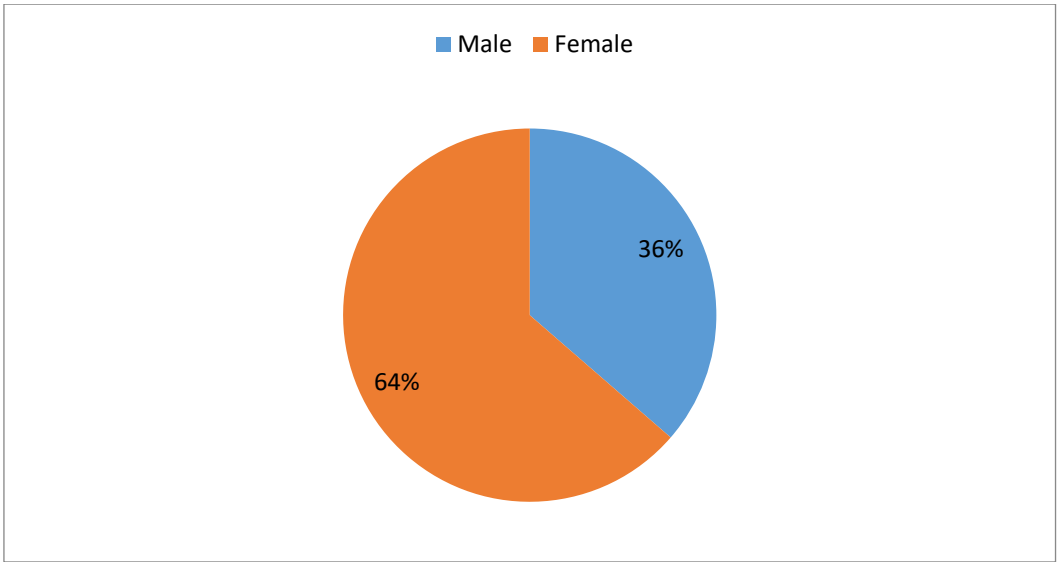

Figure 3: Gender Characteristic of Cardiovascular Disease in Gombe State
Source: Hospital Record, 2016

4.2.3 Age and Sex distribution

The findings from this study shows that CVD is higher among females with the ages 25-29 years followed by those between the ranges of 30-34 years of age and this could be due to life style, pregnancy induced complications as well as occupation. This is because they are considered the active age group among all. The age group 15-19 years record low cases of CVD because it is very uncommon among children and teenagers. CVD cases were higher in men among the ages 50-54 years, 60-64 years and 75 years and above because cardiovascular deaths were recorded more among the elderly. This correspond with the study of Ogunmola *et al* (2013) and Ejim *et al* (2011).

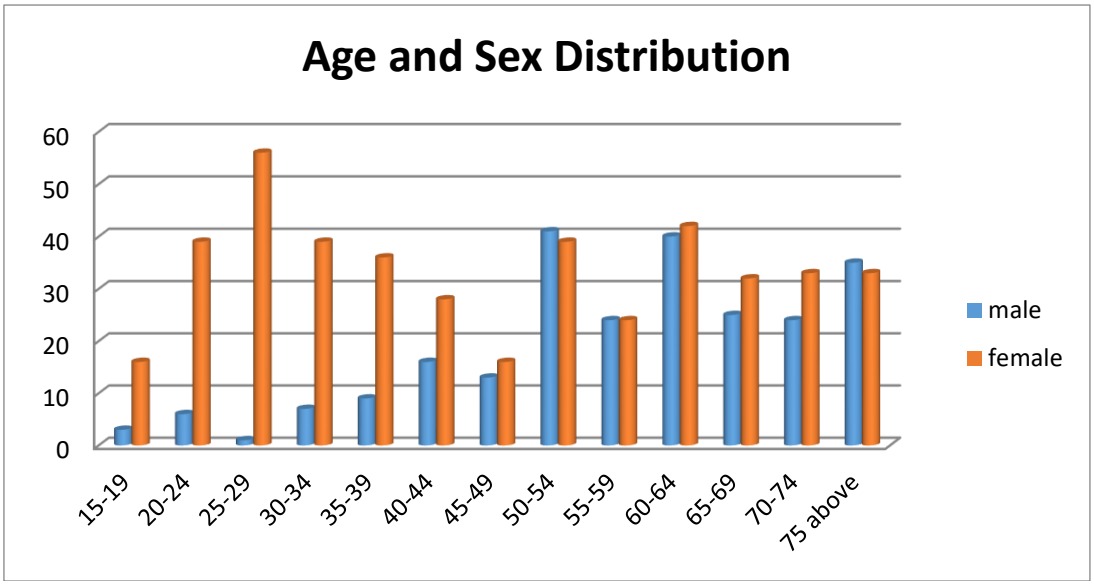

Figure 4: Age and Gender Characteristics of Cardiovascular Disease in Gombe State
Source: Hospital Record, 2016

4.2.4 Gender and Location

CVD in Gombe State varies between different years within each local government area with females than males from Gombe Local Government, which have the highest cases in the State (Fig. 5) Next to this is Akko Local Government. This can be attributed to pregnancy related complications, physical inactivity of women, low level of education and awareness as well as lifestyle in the localities. Gombe Local Government has the highest record due to high rate of urban activities as well as the release of carbon monoxide from automobiles vehicles into to the atmosphere. Akko is not left behind due to resulting effect of the Maiganga mining activities, pregnancy related complications and their sedentary life style. Nafada has the least reported cases of CVD among the localities followed by Shongom in both male and female.

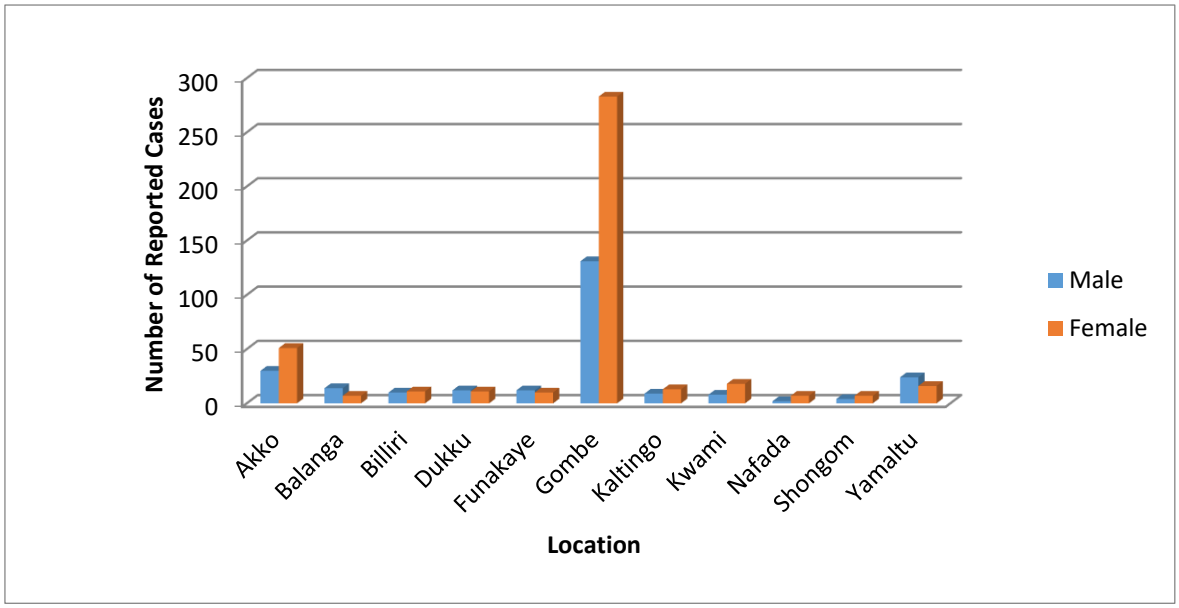

Figure 5: Gender and Location Distribution of Cardiovascular Disease in Gombe State
Source: Hospital Record, 2016

5. Conclusion

Conclusively, CVDs are common among adults and constitute a major public health challenge in Gombe State. The prevalence rate is higher among females than males. The pattern of variation of occurrence of CVDs between the LGAs indicated that Gombe and Akko accounted for the highest prevalence, while Nafada and Shongom had the least of cases. In terms of occupation, high cases were found in homemakers followed by farmers and widows while the least were found in retired civil servants. Furthermore, CVDs have a low prevalence in the rural areas as compared to urban areas such as Gombe and Akko in the State because of population density resulting from rural –urban migration.

6. Recommendations

Base on the findings of the study, the following recommendations were made:

i. Annual public campaigns by the State Ministry of Health and Cardiologist Association of Nigeria in collaboration with the Ministry of Information about CVD risk factors should be organized from time to time to create more awareness.

ii. Hospitals are to encourage patients to engage in regular exercises, life style modification as well as healthy eating habits via seminars for affected persons by the State Ministry of Health and Cardiologist Association of Nigeria (CAN) the State chapter.

iii. There is need to engage women in both governmental and non-governmental activities as they are more prone to the disease than men are.

iv. There should also be efforts to characterize and standardize LGAs (regional) differences in CVD-related healthcare, which should be targeted at those less than 55 years of age.

v. In addition, more feasible population-based interventions, such as advocating for smoking cessation, healthy diet, and increased physical activities, are suggested to reduce the prevalence and the clustering of CVD risk factors.

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