

## An Analysis of Demographic and Occupational Categories at Risk of Diabetes in Metropolitan Kano, Nigeria

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### Abstract

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*This study is aimed to analyze the influence of age, sex and occupational categories as risk factors of diabetes mellitus in Kano Metropolitan Kano, Nigeria. The study was conducted from January, 1<sup>st</sup> 2005 to December 31<sup>st</sup> 2014 covering the period of about ten years and examined a total of 8126 diabetic case files. Purposive sampling was used in selecting the facilities. A total of four health facilities were identified and selected for the purpose of this study. The facilities are Murtala Muhammad Specialist Hospital MMSH, Muhammad Abdullahi Wase University Teaching Hospital, Sheikh Muhammad NJidda General Hospital and Waziri Shehu Gidado General Hospital. The following data were sourced from the case files: date admitted in to the facility, occupation, sex, age and address. Arc GIS 10.2 software was used to generate the spatial maps. However, Chi-square test was used in testing the hypotheses using Statistical Package for Social Science 20.0. The result indicated that demographic and occupational categories of people at risk of diabetes significantly varied in Metropolitan Kano. Therefore, there is significant difference in the number of diabetes mellitus cases among the age groups. The most affected age groups are from Kano municipal local government and falls within the age group of 56-60 years with total cases of 197 (2.4%). Also, the findings revealed there is significant difference in the number of diabetes mellitus cases between the gender groups, with men having high cases of diabetes mellitus. The study further revealed that there is significant difference in the number of diabetes cases among the occupational categories with house wives accounted for the highest cases of 1946 cases (23.9%), followed by civil servants recorded the least number of 1035 cases (12.7%) in Kano metropolis. The State governments should establish, staffed and fund testing and counseling centers at all levels of primary health care centers across the state. Ministry of health and diabetic association of Nigeria should organize routine public enlightenment programmes specifically targeting the most vulnerable age, gender and occupational groups. However, long term intervention strategy should be directed towards establishing diabetic speciality hospitals in Metropolitan Kano.*

**Keywords:** Analysis, Demographic, Occupational, Diabetes Mellitus, Kano

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### 1.0 Introduction

Diabetes as a non-communicable disease has increased in both developed and developing countries in the last decade. However, great proportions of mortality from non-communicable diseases especially diabetes mellitus occurred in middle-income and low income countries (WHO, 2016). Diabetes is one among the major

factor for cardiovascular diseases and there are reports of rise in prevalence of pre-diabetes in Nigeria. It continued to remain a silent killer especially in the developing nations of the world. Poor knowledge and awareness are the major predisposing factors, which leads to delay in presentation of the diseases at the health facility (Oguoma, *et.al.*2017).

The number of diabetic patients with varying degrees of complications continue to increase significantly, a quite number of admission is largely either as a result of diabetes or diabetes related diseases which can be one of the following diseases such as stroke, hypertension, nephropathy, neuropathy and retinopathy (Adiseshiah, 2005). However, world prevalence of the diabetes was estimated to be 2.8% in 2000. The global prevalence of diseases among adults (aged 20-79 years) was estimated at 6.4% affecting 285 million adults in 2010. It is expected to rise to 7.7% and affecting 438 million adults in 2030. However, from 2010 to 2030, it is predicted to rise to about 69% in developing countries and a rise of 20% in developed countries. However, .36% of the global rise of 154 million people with the diseases is predicted to manifest in countries like China and India (Shaw, *et.al.*, 2010). The global effect of the diseases is increasing rapidly especially in developing countries (Mbanya, 2010 and Whiting, *et.al* 2011). Similarly, worldwide about 387 million persons with the prevalence of 46.3% and 8.3% of undiagnosed in the age group of 20-79 years were estimated to have diabetes (IDFA, 2014).

A lot of studies were carried out in relation to diabetes mellitus using the case study of states across Nigeria. For example, Adeleke, *et.al.*(2010) conducted a study on childhood diabetes mellitus in Kano, North Western Nigeria. The study reviewed hospital records of pediatric patients managed for diabetes mellitus at Aminu Kano Teaching Hospital. Ugege, *et.al* (2013) studied childhood diabetes mellitus in Sokoto, North western Nigeria: a ten year review. The study reviewed case files of children aged 15 years and below with childhood diabetes mellitus at the Usman Danfodio University Teaching Hospital (UDUTH) Sokoto. Chijioke, *et.al* (2010) studied pattern among Type-2 diabetic patients in Ilorin, Nigeria. Akinjinmi, (2014) studied the prevalence of diabetes mellitus in Abeokuta, Ogun State Nigeria. Ebenezer, *et.al.* (2003) studied prevalence and risk factor type-2 diabetes among adult Nigerians in Port Harcourt, Nigeria. Olaitan, (2012) studied patients' knowledge of causes, effects and complications of diabetes mellitus in Ilorin, Kwara state, Nigeria. This study intends to assess and analyze both the demographic and occupational categories of persons at risk of diabetes mellitus in

the study area. This is important because the study explains the spatial and temporal patterns of health and diseases outcomes. Therefore, the objective of the study is aimed at analyzing the demographic and occupational categories at risk of diabetes mellitus in Metropolitan Kano. The specific objectives of this study are to examine the influence of age, sex and occupation as risk factors of diabetes mellitus in Metropolitan Kano, Nigeria. Based on this objective, this study formulated the following null hypothesis.

1. Ho: There is no significant difference in the number of diabetes mellitus cases between the age groups.
2. Ho: There is no significant difference in the number of diabetes mellitus cases between the sex groups.
3. Ho: There is no significant difference in the number of diabetes mellitus cases between the occupational categories.

## **2.0 Materials and Methods**

### **2.1 Study Area**

The area of study comprises of the eight local governments areas of Kano State which include; Nassarawa, Fagge, Gwale, Ungogo, Municipal, Nassarawa, Tarauni, Kumbotso and Dala. Kano metropolis lies from Lat.  $11^{\circ} 52'N$  to  $12^{\circ} 7'N$  and Long.  $8^{\circ} 22.5'E$  to  $8^{\circ} 47'E$ . It is 472 meters above sea level. Metropolitan Kano is bordered by Minjibir Local Government, on the North East and Gezawa Local Government Area to the East. While Dawakin Kudu Local Government to the South East, Madobi and Tofa Local Government Areas to the South West, lastly Dawakin Tofa Local Government to the North West (Ahmed, 2010). The study area comprises of the urban areas within the sixty square kilometers. While the built up land is contained within forty eight square kilometers (Marafa, 1992).

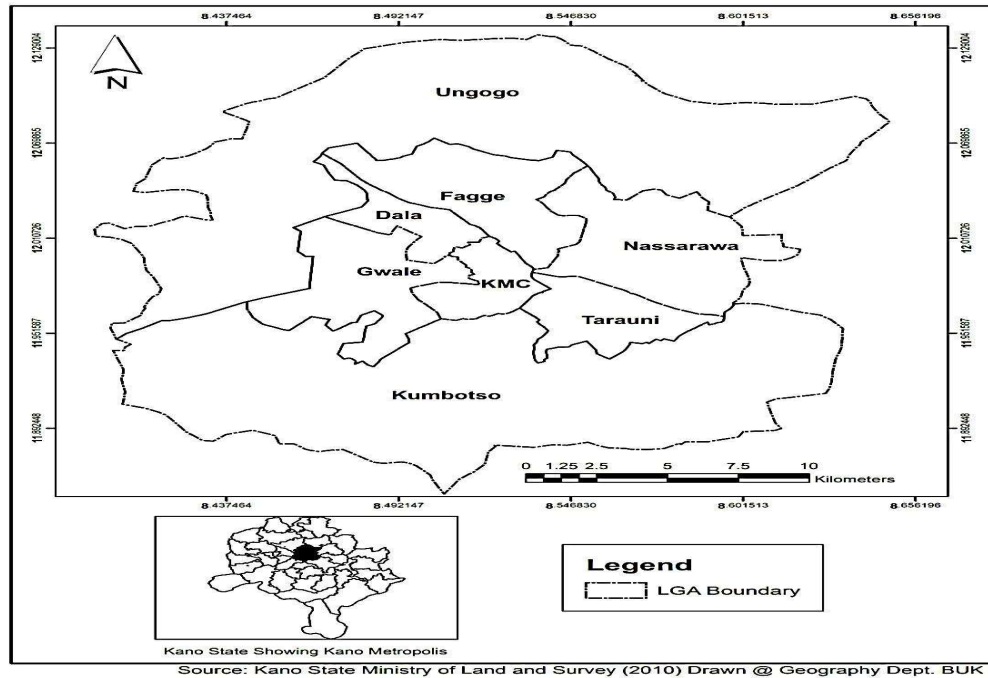


Figure 1: Metropolitan Kano

### 2.1.1 Climate

Kano is characterized by distinct wet and dry seasons. The climate is coded as Aw according to Koppens classification of climate. The fluctuations of the wet and dry seasons are dictated by the movement of Inter Tropical Convergence Zone (ITCZ). The total annual rainfall ranges from 850–870mm. The average temperature  $27^{\circ}\text{C}$  and ranges from warm to hot throughout the year (Olofin & Tanko, 2002). The wet season last from June–September, while the dry season last from mid-October to mid-May. Long term meteorological records revealed that relative humidity of 50%, evaporation of 1772mm and  $8\frac{1}{2}$  hours of sunshine per day (Liman, Abdulkadir & Mohammed, 2014).

### 2.1.2 Population of the Study Area

Metropolitan Kano is one of the emerging cities in Sub Saharan Africa. It is the largest city in Northern Nigeria. It had a population of about 96,805 persons in 1931. In 1952, the population increased to 130,170. However, in 1963, the population rose to 295,432 (Maiwada, 2000). Additionally, the 1991 census put the population of Kano state to stood at 5,810,340 persons where Metropolitan Kano

had a total of 1,432,255 which represented 24.3% of the population of the entire State (Bala, 2000). However, the 2006 population census, reported Kano State with a total of 9,383,683 persons where metropolitan Kano recorded 2,165,223 persons (NPC, 2006).

### **2.1.3 Socio economic activities**

Kano metropolis is the second largest commercial and industrial centre in Nigeria that has been experiencing rapid growth rate ( Nabegu, 2008, in Gambo 2016). Metropolitan as an integral part of the old Hausa city state which enjoyed eminent position of being a foremost center of commerce, Islamic thought and culture (Yarzever, 2014). Although, in the 60s and 70s the predominant occupation was trades and agriculture, however, due to the change in land use, the vast agricultural lands have been converted to commercial and residential areas. This has pushed many people to abandoned agriculture and embraced other means of livelihood (Mohammed, 2006). Additionally, Kano metropolis is characterized with many secondary economic activities and also served as the center of commerce as well as seat of government (Yarzever, 2014). Therefore, Kano metropolis being a center of commerce as well as a seat of government, it is presumably certain that the predominant occupations of the inhabitants are business/trading and civil service.

### **2.1.4 Culture**

Culture of the people especially the types of food and the eating habits exposed many individuals to greater risk and make them more vulnerable to develop diabetes. It is evident that when one examines the usual meal and the pattern of breakfast, lunch and dinner, in most homes in both urban and rural Kano, it is predominantly foods that contain carbohydrates and fats such as rice, maize, millet, guinea corn, wheat and dairy products. It has been part of the culture for many years, which affects the normal functioning of the pancreas and insulin production. Some studies have established association between the risk of Type-2 diabetes and different patterns of food intake (Liese, 2009, Schulze, 2004). High amount sugar in foods has been associated with increased risk of Type-2 diabetes (Villegas, 2007).

## **2.2 Data Types and Sources**

This study used secondary type of data from the Health Records Units of Murtala Muhammad Specialist Hospital, Muhammad Abdullahi Wase University Teaching Hospital, Sheik Muhammad Jidda General Hospital and Waziri Shehu Gidado General Hospital. Reported, diagnosed and hospitalized patients from January 1<sup>st</sup>,

2005 –December 31<sup>st</sup>, 2014 were included in the study. A total number of 8126 case files were analyzed in the study. The data obtained for the study included the date of patient admission into the hospital, sex, age, address and condition of the patient on discharge from the hospital which includes: Discharged home, referred, dead, absconded and discharged against medical advice (DAMA). This data is very reliable because it only included cases that were diagnosed and documented in the health facilities.

### **2.3 Data Collection Methods**

The data were directly sourced from the documented information in the diagnosed case folders from the selected health facilities. At the data coding stage some addresses, were merged as well as treated as a single ward. This resulted from the fact that at the time of admission into the clinic their addresses of place of residences were not captured on the case files. However, on many case files the actual age of the patients was not captured rather the columns showed AD which signified that the diagnosed person is adults. All case files with missing information were coded and treated as others during the analysis. Additionally, only diagnosed persons that died in the health facility were included during the data analysis. However, in order to address the limitation of missing information on the case folders, all missing information were treated as **not indicated** in the final analysis.

### **2.4 Sampling Techniques**

This study used purposive sampling in selecting the health facilities. These include two Specialist Health care facilities and two General Health facilities. This study selected these hospitals because they are the major secondary health facilities with qualified physicians that run free consultancy services for diabetic clinics in Kano Metropolis. The study used purposive sampling because it is convenient for the researchers to locate such facilities.

### **2.5 Method of Data Analysis**

This study captured both demographic and occupational variables which included age and sex. Statistical Package for Social Sciences (SPSS) software version 20.0.was used to conduct the Chi-square test. Chi-square was used to test whether there is significant difference in terms of diagnosed cases among the age groups, gender groups and occupational groups. Therefore, age, sex and occupation were treated as independent variables, while the number of diabetes cases were analyzed as dependent variables.

Therefore, at 0.05 level of significance and 5% degree of freedom, if the result indicated a significant difference in the number of diabetes mellitus cases between the age groups when  $p$  value is 0.00 which is less than 0.05 alpha, we can reject the null hypothesis which stated that 'there is no significant difference in the number of diabetes cases between the age group' and accept the alternative hypothesis and conclude that there is significant difference in the number of diabetes cases between the age groups. Similarly, the 2<sup>nd</sup> null hypothesis that stated 'there is no significant difference in the number of diabetes mellitus cases between the sex groups' can be rejected and the alternative hypotheses be accepted at 0.05 level of significance if the  $p$  value is 0.00. However, the 3<sup>rd</sup> null hypotheses which stated that 'there is no significant difference in the number of diabetes mellitus cases between the occupational categories can be rejected and the alternative hypothesis be accepted if the  $p$  value is 0.00 which is less than 0.05 alpha.

### **3.0 Results and Discussion**

#### **3.1 Demographic Characteristics (Age) and Diabetic Cases**

The findings of the study revealed higher diabetes mellitus cases in the following age groups, for example; 56-60 years which accounts for 13.6% of the total cases, 46-50 years (12.7%), while the age group of 36-40 years accounts for 9.9% of the total cases. The most affected age groups are from Kano municipal local government and falls within the age group of 56-60 years with total cases of 197 (2.4%). It is high in the above age groups because they are age groups that are more obese than other age groups. Obesity as a risk factor is more common among the people in the city than in the periphery. This conforms to the study of Almdal (2008) that reported a strong linkage between obesity and type 2 diabetes in men and women. This finding conforms within the age groups 20-79 years as stated by International Diabetes Federation Atlas update (2014). This findings revealed Low cases of diabetes in age groups of (<15) years with 18 cases (0.2%) and the age groups of 16-20 years with 137 cases (1.7%), because diabetes mellitus is very uncommon among children and teenagers. This result conforms with that of Adeleke, *et.al* (2010), Ugege, *et.al* (2013), John, *et.al* (2013). However, variations in the diabetes age groups do exist both generally and within the local government. For example, generally the age group of 56-60 years has the highest diabetes cases of 1104 (13.6%). Variations among age groups do exist at the level of individual local governments areas. For example, within Gwale local government the age groups of 36-40 and 56-60 years have the same cases of 129 (1.6%). In Ungogo local government the age groups of 46-50 and 56-60 years, accounts for 1.3% generally and within the local government. One of the reasons for these variations

in diabetes mellitus among the age groups within a local government area is probably dictated by time of diagnosis or hospitalization. This is because in some patients the disease is detected and diagnosed early while in some patients the disease is detected after the manifestation of the clinical complications such as retinopathy, nephropathy and cardiovascular disease.

These clinical complications may take more than 10 years to manifest. However, the chi-square test revealed a big gap in the number of cases between the age groups in the Kano Metropolitan Wards, because the  $p$  value 0.00 which is  $<0.05$  alpha. Therefore, the ( $H_0$ ) that there is no significant difference in the total number of cases between the age groups is rejected and the alternative hypothesis ( $H_1$ ) that there is a significant difference in the total number of cases between the age groups is accepted. However, the spatial distribution map that shows diabetes mellitus cases has indicated a significant difference in diabetes mellitus cases between the age groups. This indicated that the age group of people 56-60years accounted for 13.6% of the total cases of the diseases in the study area. Therefore, in terms of health care planning, government need prioritize more resources to the most affected age group.



**Table 1: Age and Diabetes Mellitus Cases in the Eight Kano Metropolitan Local Governments**

	Gwale	Dala	Fagge	Kano Municipal	Kumbotso	Nassarawa	Tarauni	Ungogo	Other LGAs	Total cases
Age	%	%	%	%	%	%	%	%	%	%
Age not indicated	.8	1.0	1.5	1.5	.5	.6	.3	1.7	2.2	10.2
<15	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
16-20	.2	.1	.1	.4	.1	.3	.1	.2	.2	1.7
21-25	.1	.1	.5	.2	.1	.2	.1	.1	.4	1.9
26-30	.6	.2	.7	.6	.2	.7	.3	.3	.6	4.2
31-35	.5	.4	.3	.6	.4	.4	.1	.2	.6	3.3
36-40	1.6	1.0	1.2	1.5	.6	1.2	.7	1.1	1.0	9.9
41-45	1.0	1.6	.6	1.3	.8	1.1	.6	.7	.9	8.6
46-50	1.5	1.4	1.0	2.0	1.3	2.1	1.1	1.3	1.0	12.7
51-55	1.2	1.2	.5	1.4	1.1	1.0	.6	.7	.9	8.5
56-60	1.6	1.0	1.4	2.4	1.1	2.2	.9	1.3	1.6	13.6
61-65	1.2	.3	.4	1.3	1.0	1.2	.9	.6	.7	7.5
66-70	.6	.5	.6	1.2	.4	1.6	.6	.2	.6	6.3
71-75	.5	.3	.1	.8	.3	.7	.4	.1	.1	3.3
>75	1.0	.4	.5	1.5	.8	1.2	1.1	.3	1.1	8.0
<b>Total</b>	<b>12.3</b>	<b>9.6</b>	<b>9.3</b>	<b>16.7</b>	<b>8.6</b>	<b>14.6</b>	<b>8.0</b>	<b>8.8</b>	<b>12.0</b>	<b>100</b>

Source: Data Analysis 2015

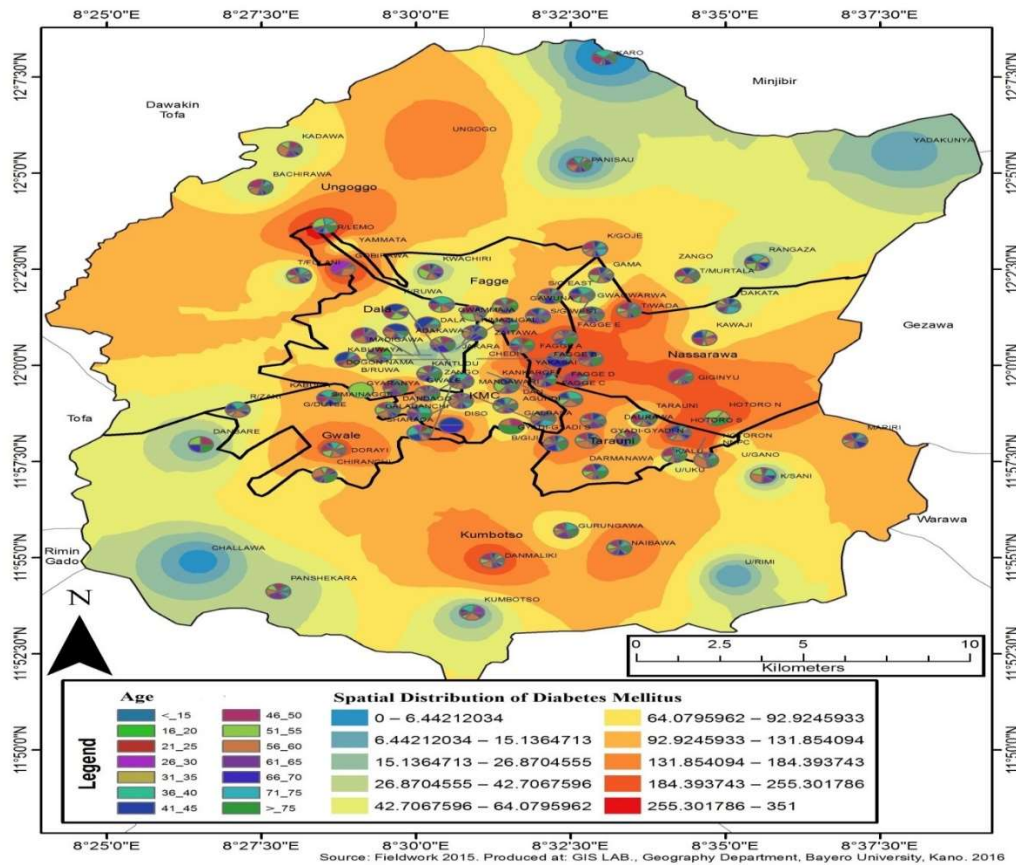


Figure 2: Spatial Distribution of Diabetes by Age

### 3.2 Gender and Diabetes Mellitus Cases

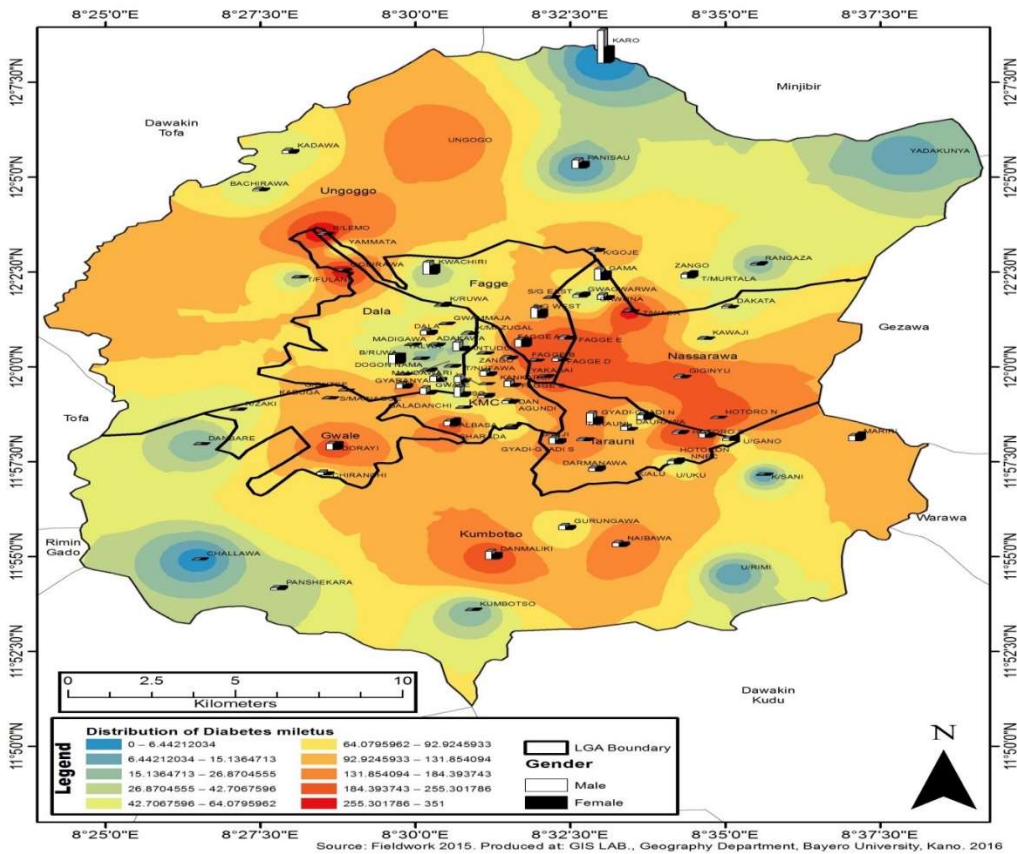
Table 2 indicated that diabetes are higher in males than in females in the eight metropolitan local governments with the exception of Ungoggo local government where females are more diabetic than males. The findings revealed high cases of diabetes mellitus in men 4878 cases (60%), while women accounted for 3209 cases (39.5%), while not indicated gender accounted for only 0.5% of the total cases. Kano municipal local government accounted for the highest number of male cases of 763 (9.4%) and the highest female cases of 583 (7.2%). Nassarawa local government accounted for the second highest male cases of 747 (9.2%) and second highest female cases of 438 (5.4%). However, in Ungoggo local government females are more diabetic 360 cases than males 354 cases. The chi-square test revealed a difference in the number of cases between the gender groups in the Kano Metropolitan wards because the  $p$  value 0.00 is  $<0.05$  alpha. Therefore, the ( $H_0$ )

that there is no significant difference between the gender groups is rejected and the ( $H_1$ ) that there is significant difference in the number of diabetes mellitus cases between the gender groups is accepted. However, the spatial distribution of gender has shown a wide difference between gender and spatial distribution of diabetes (Figure 3). This difference could be attributed to the fact that males are more enlightened and aware of diabetes and present themselves to the clinics more often than females. This is in conformity with Mohammed, (2011), Chris, *et.al* (2003), John, *et.al.* (2013) and Khan, *et.al* (2014).

**Table 2: Gender and Spatial distribution of Diabetes Mellitus Metropolitan Local Governments**

	Gwale	Dala	Fagge	Kano Municipal	Kumbotso	Nassarawa	Tarauni	Ungogo	Other LGAs	Total
<b>Sex</b>	%	%	%	%	%	%	%	%	%	%
Sex Not Indicated	.1	.0	.0	.1	.0	.0	.0	.0	.0	.5
Male	6.8	5.3	5.7	9.4	6.1	9.2	5.5	4.4	7.7	60.0
Female	5.4	4.3	3.6	7.2	2.5	5.4	2.4	4.4	4.3	39.5
<b>Total</b>	<b>12.3</b>	<b>9.6</b>	<b>9.3</b>	<b>16.7</b>	<b>8.6</b>	<b>14.6</b>	<b>8.0</b>	<b>8.8</b>	<b>12.0</b>	<b>100</b>

Source: Data Analysis 2015



**Figure 3: Gender and Spatial Distribution of Diabetes**

### 3.3 Occupation and Diabetes Mellitus Cases

Table 3 indicated that diabetes are higher among occupational groups of house wives with 1946 cases (23.9%) where Kano Municipal accounted for 334 cases (4.1%), Nassarawa local government accounted for 256 cases (3.3%) and Gwale local government accounted for 250 cases (3.1%). Trading and business accounted for 1615 cases (19.9%) out of which Ungogo local government accounted for 249 cases (3.1%) and Dala local government accounted for 206 cases (2.5%), while Kano Municipal accounted for 189 cases (2.3%). Civil servants with total of 1035 cases (12.7%) where Kano Municipal accounted for 209 cases (2.6%), while Nassarawa local government accounted for 198 cases (2.4%). Housewives in Kano Metropolis are more diabetic than any other occupational category because women

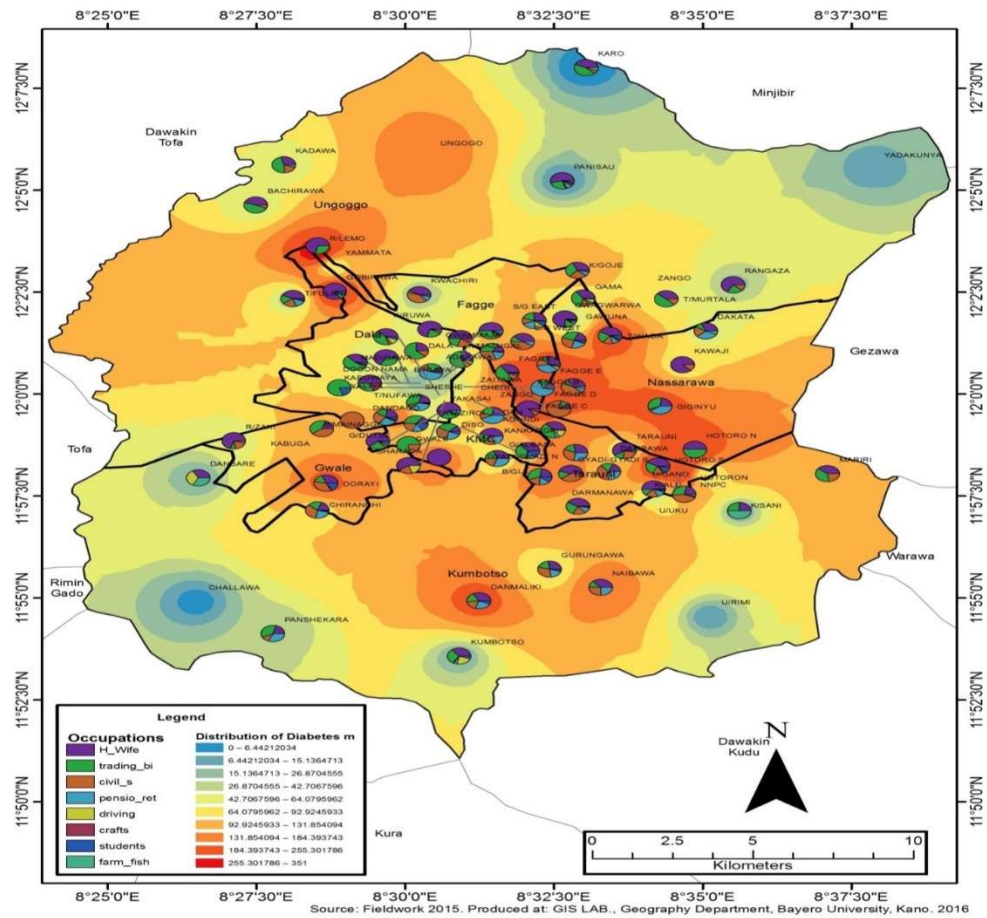
do experienced gestational diabetes mellitus which is explained as a type of intolerance of glucose which affects women during pregnancy. Deshpande (2008) reported that most gestational diabetes mellitus become stable after delivery, however, 5-10% of women affected during pregnancy were diagnosed to be diabetic at post pregnancy. This gestational diabetes is risk factors that affects women only and make them to develop diabetes later in life. It is also high among house wives, trading/business, civil servants and pensioners/retirees because these occupational groups are mostly physically inactive and obese. Similarly, sedentary nature of works of businesses/trading and civil servants makes people to be physically inactive and more likely to be diabetic. However, diabetes is low among the occupational groups of driving, crafts and fishing/farming because they participate in physically active occupations. Diabetes is also low among students because children of school age and teenagers mostly have the Type-1 diabetes mellitus which is very uncommon in Nigeria (Adeleke, *et. al* 2010, Ugege, *et. al.* 2013 and John, *et.al*2013).

However, chi-square test revealed a significant difference in the recorded number of cases between the occupational categories in the Kano Metropolitan wards because the p value 0.00 is  $<0.05$  alpha. Therefore, the ( $H_0$ ) that there is no significant difference in the number of cases between the occupational categories is rejected. Therefore, conclude that there is significant difference in the number of diabetes mellitus cases between the occupational categories is accepted. However, the spatial distribution map has indicated a significant difference in diabetes mellitus cases between occupational categories in Metropolitan Kano. While the core center of the metropolitan Kano has the highest concentration of persons diagnosed with the diseases. This map indicated a significant correlation between physical activity and diabetes. People with less active occupations concentrated at the center of the study area. Therefore, looking at the map, there are fewer number of diagnosed persons with diabetes at the fringes of the study area. This is related to the fact that people at the fringes of the study area engaged in a more active occupations especially farming and crafts (see Figure 4).

**Table 3: Occupational Characteristics of Diabetes Mellitus Cases in the Eight Kano Metropolitan LGAs**

	Gwale	Dala	Fagge	Kano Municipal	Kumbotso	Nassarawa	Tarauni	Ungogo	Other LGAs	Total cases
<b>Occupations</b>	%	%	%	%	%	%	%	%	%	%
Occupation NotIndicated	3.7	3.1	1.9	5.1	2.2	3.1	1.7	1.2	4.1	26.1
House Wives	3.1	2.5	2.2	4.1	1.7	3.2	1.5	3.1	2.6	23.9
Trading/Business	2.1	2.5	2.5	2.3	1.5	2.2	1.8	3.1	1.8	19.9
Civil Servants	1.6	.7	.5	2.6	1.3	2.4	1.4	.6	1.7	12.7
Penr/Retiree	1.1	.1	.9	1.5	1.6	2.6	1.1	.2	.7	9.9
Driving	.0	.2	.8	.1	.0	.4	.0	.4	.0	2.0
Crafts	.0	.1	.1	.1	.0	.0	.0	.0	.1	.4
Students	.4	.1	.2	.4	.2	.5	.4	.3	.2	2.7
Farming/ Fishing	.0	.0	.0	.1	.1	.1	.0	.0	.5	.9
Corporate Serv.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Other occupations	.2	.2	.1	.4	.1	.1	.1	.0	.2	1.4
<b>Total</b>	<b>12.3</b>	<b>9.6</b>	<b>9.3</b>	<b>16.7</b>	<b>8.6</b>	<b>14.6</b>	<b>8.0</b>	<b>8.8</b>	<b>12.0</b>	<b>100</b>

Source: Data Analysis 2015



**Figure 4: Spatial Distribution of Diabetes Mellitus and Occupation Superimposed**

## 5.0 Conclusion and Recommendations

This study concluded that there is significant difference in the number of diabetes mellitus cases among the age groups, this is because there were more cases among the following age groups of (56-60) years which accounted for (13.6%) of the total cases, (46-50) years (12.7%), while the age group of (36-40) years accounted (9.9%) of the total cases. The most affected age groups were from Kano municipal local government and falls within the age group of 56-60 years with total cases of 197 (2.4%). There is significant difference in the number of diabetes mellitus cases

between the gender groups. The findings revealed that there were higher cases of diabetes mellitus in men 4878 cases (60%), while women accounted for 3209 cases (39.5%). The study also revealed that there is a significant difference in the number of diabetic cases among the occupational categories. Diabetes mellitus cases were higher among the occupational groups of housewives with 1946 cases (23.9%), where Kano Municipal accounted for the highest of 334 cases (4.1%). Trading and business accounted for 1615 cases (19.9%) out of which Ungogo local government accounted for 249 cases (3.1%) while Civil servants accounted for a total of 1035 cases (12.7%). Therefore, on the basis of these findings, the following recommendations were made:

1. There is the need for more awareness campaigns so that people will be aware and conscious of their health conditions.
2. The State governments should establish, staffed and fund testing and counseling centers at all levels of primary health care centers across the state. However, long term intervention strategy should be directed towards establishing a diabetic speciality hospitals in Metropolitan Kano.
3. Ministry of health and diabetic association of Nigeria should organize routine public enlightenment programmes specifically targeting the most vulnerable age, gender and occupational groups.
4. Government and private individuals should establish gymnastic centers with different apparatus in both the general and specialist hospitals where both the staff and the patients can benefit from the exercise as a therapy for prevention and control.

## **References**

- Adiseshiah, M. (2005). Effective care of patients with type 2 diabetes and dyslipidemia: a nurse's perspective. *Diabetes Research and Clinical Practice*. University College London NHS Foundation Trust Hospitals, London, 68(2), 23-27. DOI:10.1016/J.diabres.2005.03.017
- Adeleke, S. I, Asani, M. O., Belonwu, R. O, Gwarzo, D. G. & Farouk Z. L. (2010). Childhood diabetes mellitus in Kano northwestern Nigeria: *Niger Medical Journal*, 19(2), 145-7. DOI:10.4314/njm.VI9i2.56502
- Ahmed, M., (2010). Creating a GIS application for local health care planning in Kano metropolis. An Unpublished PGD GIS/Remote Sensing Dissertation, Department of Geography Ahmadu Bello University, Zaria.



- Almdal, T. (2008). Higher prevalence of risk factors for type 2 diabetes mellitus and subsequent higher incidence in men (electronic version). *Eur Journal International Medicine*, 19(1), 40-5. DOI:10.1016/j.ejim.2007.05.011
- Akinjinmi, A. A., Adeyoye, O.A., Akingbade, O.A., & Okerentugba, P.O. (2014). Prevalence of diabetes mellitus in Abeokuta, Ogun state, Federal Medical Center Abeokuta Ogun state Nigeria. *Researcher*, 6(2), 73-75
- Bala, B.A., (2000). Distribution of secondary health care facilities in Kano metropolis. Unpublished b.sc. Dissertation, department of Geography, Bayero University Kano.
- Chris, G., Robert, D., Hoppa T., Kue, Y., & Blanchard, J. F. (2003). Geographic analysis of diabetes prevalence in an urban area. *Journal of Social Science & Medicine*, 57(3), 551–560. DOI:10.1016/S0277-9536(02)00380-5
- Chijioke, A, Adamu A. N. and Makusidi A. M., (2010) Mortality pattern among type-2 diabetes patients in Ilorin, Nigeria. *JEMDSA*, 15(2) ISSN:2220-1009
- Deshpande, A.D. (2008). Epidemiology of diabetes and diabetes-related complications. *Diabetes Research and Clinical Practice*, 66, 33-35. [Doi-org/10.2522/ptj.200820](https://doi.org/10.2522/ptj.200820)
- Ebenezer, A.N., Osaretin J.O., Anele E.I., Aaron O., Seye B. (2003). Type-2 Diabetes in adult Nigerians: a study of its prevalence and risk factors in Port Harcourt, Nigeria. *Diabetes Res Clin Pract*, 62, 177-185. DOI:10.1016/diabres.2003.07.002
- Gambo, B. (2016). Spatial concentration of traders in specialized agricultural food products markets in Kano metropolis Nigeria. An Unpublished paper presented at Department of Geography 2016.
- International Diabetes Federation (IDF) Diabetes Atlas (2006). Type-2 Diabetes Mellitus. <http://www.eatlas.idf.org/Types-of-diabetes>. Accessed 20th August, 2014.
- Iyun, B.F.(1998) *Fifty Years of Geography Nigeria: The Ibadan Story*. Ibadan University Press p 230.
- John, C., Abok, I. I. & Yilgwan, C.,(2013). Clinical profile of childhood type-1 diabetes in Jos, Nigeria. *African Journal of Diabetes Medicine*, 21, 11-13. <http://hdl.handle.net/123456789/352>
- Khan, M. M., Gruebner, O., & Kraemer, A. (2014). The Geography of diabetes among the general adults aged 35 years and older in Bangladesh: Recent Evidence from a cross-sectional survey. *Journal pone*, 9(10), 11-20. Doi:10.1371/journal.pone.0110756

- Liese, A. D. (2009). Food intake patterns associated with incident type-2 diabetes: the insulin resistance atherosclerosis study. *Diabetes Care*, 32(2), 263-268. <http://doi.org/10.2337/dc08-1325>
- Liman, M., Idris H. A. & Mohammed, U. (2014). Weather and Climate in Tanko A.I. and S.B. Momale (Eds) Kano: Environment Society and Development. Adonis and Abbey Publishers Ltd London.
- Maiwada, A. D. (2000). Disappearing open spaces in Kano metropolis. in proceedings of the national workshop on land administration and development in northern Nigeria. Department of Geography Bayero University Kano, Nigeria.
- Marafa, I. S. (1992). Access to Residential Land in Kano Metropolis. Unpublished M.Sc. Dissertation, Department of Geography, Bayero University Kano.
- Mbanya, J. C. (2010). From yesterday to tomorrow: making a difference to global diabetes. *Diabetes Research and Clinical Practice*, 87(1), 132-135. Doi:10.1016/J.diabres.2009.12.006
- Mohammad, A. A. (2011) Awareness of Diabetes Among Non Diabetic Population in Al qassim Region, Saudi Arabia; *Journal of Diabetes and Endocrinology*, 2, 14-19.
- Mohammed, B. (2006). Constraints to teaching and learning Geography in Nassarawa local government Kano. An Unpublished Postgraduate Diploma in Education Dissertation Submitted to Department of Education Federal College of Education Kano.
- National Population Commission, NPC (2006). Report of Nigeria's National Population Commission on 2006 Census. National Bureau of Statistics, Nigeria.
- Olaitan, O. L. (2012). Reproductive health professional forum patients' knowledge about causes and solutions of infertility in south west Nigeria. *International Journal of Collaborative Research on Internal Medicine & Public Health* 4(7), 1-12.
- Olofin, E. A. & Tanko, A.I. (2002). Some aspect of physical geography of kano region and related human responses. Hand Book for Students Field Trip, Geography Department Bayero University, Kano.
- Schulze, M. B. (2004). Glycemic index, glycemic load, and dietary fiber intake and incidence of type-2 diabetes in younger and middle-aged women. *American Journal Clin Nutr*, 80(2), 348-356. Doi:10.1093/ajcn/80.2.348
- Shaw, J. E., Sicree, R. A. & Zimmet P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, 87(1), 4. Doi:10.1016/j.diabres.2009.10.007

- Ugege, O., Ibitoye, P. K., & Jiya, N. M., (2013). Childhood diabetes mellitus in Sokoto northwestern Nigeria: A ten year review, *Sahel Med J*, 16,(3) 97-101. Doi:10.4103/1118-8561.121910
- Villegas, R. (2007). Prospective study of dietary carbohydrates, glycemic index, glycemic load, and incidence of type-2 diabetes mellitus in middle-aged Chinese women. *Arch Intern Med*, 167, 21. Doi:10.1001/archinte.167.21.2310
- Whiting, D. R., Guariguata, L., Weil, C., & Shaw, J., (2011). Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Research and Clinical Practice*, 94, 311-312. Doi:10.1016/j.diabres.2011.10.029
- Yarzever, S. (2014). Temporal analysis of maternal mortality in Kano State Northern Nigeria. A six year review. *American Journal of Public Health Research*, 2, (2), 62-67. Doi:10.12691/ajphr-2-2-5