Multiple risk factors (at least 3) were found in 67% of these patients (8). Diabetes/hyperglycaemia (26%), and hyperuricaemia (20%) (8). Obesity (80%), Hypertension (60%), dyslipidaemia (43%), smoking (36%), (M1) being the most frequent (43%) (8). The cardiovascular risk factors were becoming common so also are its risk factors. A Cameroonian study showed the alleviation of poverty (6). Coronary Heart Disease (CHD) is gradually.

A large proportion of the victims of CVD will be middle-aged people (6). The poor will be at the receiving end as a consequence of their higher disease burden of CVD faced by African countries will double (6). Projections major cause of chronic illness and disability (6). African countries therefore face a double burden of communicable diseases and CVD (6). Projections from the Global burden of Disease project suggest that from 1990 to 2020, the burden of CVD faced by African countries will double (6).

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The burden of cardiovascular disease (CVD) in the world is enormous and growing, and the majority of those affected are in the developing countries (1,2). In 2002, it was estimated that 29% of deaths worldwide (46.7 million deaths) were due to CVD and that 43% of global moribidity and mortality, measured in disability adjusted life years (DALYS) was caused by CVD (3). Furthermore, 78% of global moribidity and 86% of mortality and morbidity from CVD occurs in developing countries (3).

It is estimated that by 2020, CVD will become the leading cause of the global health burden, accounting for 73% of total global mortality and 56% of total morbidity (4,5). This global tide has also not spared Africa (6). In most African countries CVD is now the second most common cause of death after infectious disease, accounting for 11% of total deaths (7), and CVD is a major cause of chronic illness and disability (6). African countries therefore face a double burden of communicable diseases and CVD (6). Projections from the Global burden of Disease project suggest that from 1990 to 2020, the burden of CVD faced by African countries will double (6).

CVD risk factors such as tobacco, refined foods and life styles are being exported to Africa through television and films by the developed countries in the name of globalization/civilization (2). Although the epidemic of CHD was heralded globally in the 1980s (9), in Africa, it is still being expected.

The major modifiable risk factors are Hypertension (BP >140/90), Diabetes Mellitus (DM), Dyslipidaemia, Tobacco use, physical inactivity, obesity, unhealthy diets (10). Other modifiable risk factors were low socioeconomic status, mental ill health, psychosocial stress, alcohol use, use of certain medications e.g. oral contraception and hormone replacement therapy, lipoprotein, left ventricular hypertrophy (LVH) (10), and use of cocaine (11). Non-modifiable risk factors are advancing age, heredity or family history, gender (male), ethnicity or race. The novel risk factors are excess homocysteine in blood, inflammation and abnormal blood coagulation (increase serum fibrinogen) (10).

In recent times kidney disease has been identified as a risk factor for CVD (12). Proteinuria and elevation of the serum creatinine even at moderate levels are risk factors for CVD (12). In patients with end stage renal disease (ESRD), the risk of CVD is 10–20 times higher than that of the general population (13-15). Kidney disease itself is common, treatable and preventable (16).

More recently hyperuricaemia has also been incriminated in CVD predisposition (17). Oladapo et al. reported high prevalence of cardiometabolic risk factors amongst the dwellers of a rural Yoruba community in South West Nigeria (18). Similarly, in another rural community in this same tribe, hypertension, obesity, physical inactivity and low HDL-C were prevalent (19).

BACKGROUND: Urbanization and westernization now predisperse rural dwellers to many of the modifiable risk factors for cardiovascular disease (CVD).

OBJECTIVES: We assessed the prevalence of CVD risk factors and electrocardiographic (ECG) pattern in 2 rural communities of Osun State, South West Nigeria.

METHODS: Descriptive cross-sectional study was carried out in March 2011 in two agrarian communities as part of the activities commemorating the World Kidney Day and World Glaucoma day. A total of 259 consenting adults (age ≥ 18 years) participated in the study. Pretested, standardized, structured questionnaire was used to collect data on socio-demographic characteristics and cardiovascular risk factors. Only 64 participants had ECG done on them. Data were analyzed using the SPSS 17 software. Approval was obtained from the institution’s ethical research committee.

RESULTS: Hypertension was present in 23.9%, 7.3% had diabetes mellitus. Left ventricular hypertrophy was present in 12.5% and 23.4% had prolonged QTc. Obesity was present in 11.5%, 17.8%, 13.5% and 38.2% had high total cholesterol, LDL and TG levels respectively, while 49.8% had low HDL values. Multiple risk factors were present in 28.2% of the total respondents. Predictors of obesity include female gender, high total cholesterol level and low HDL levels. Predictors of hypertension include age >45 years, being obese, having high total cholesterol and low HDL levels.

DISCUSSION: The preponderance of multiple cardiovascular risk factors found in this study compounds the possible epidemic of CVD and its sequelae. Prolonged QTc calls for caution in administration of contraindicated drugs.

CONCLUSION: CVD risk factors are present in rural areas of Nigeria hence the need for primordial and primary prevention efforts.

Key Words: Hypertension; Diabetes mellitus; Obesity; Left ventricular hypertrophy; Multiple risk factors

Akinwusi PO, Asekun-Olarinmoye EO, Adelbimpe WO, et al. Cardiovascular risk factors and electrocardiographic pattern in two rural communities of Osun State in South West Nigeria. Curr Res Cardiol 2017;4 (2):144-150.
MATERIALS AND METHODS

Study design
This was a community-based descriptive cross-sectional study of cardiovascular risk factors carried out in these two rural communities in March 2011 during the research outreach that formed a part of the activities marking the celebration of the World Kidney Day and World Glaucoma Day.

Setting
The study areas included two rural communities in Osun State namely Alajue and Ilobun, with a total population of about five thousand people according to the 2006 Nigerian national population census. Majority of the dwellers were farmers while some were artisans and traders. There is a primary health care center in each of the communities.

Participants
The inclusion criteria were that all eligible participants be permanent residents in either community for at least 5 years, should be aged >18 years and were able to provide informed consent. The Nigerian demographic structure is such that only about 55% of the total population could normally be eligible (age >18 years) (21); then the total number of eligible population could be estimated at 2750. All consenting adults who met the inclusion criteria were screened. Due to limitation of funding in this low resource setting (research was self-funded) a subgroup of all respondents (about 25%) was randomly selected and ECG was performed on them.

Ethical approval
Ethical approval to conduct the study was obtained from the Ethical Research Committee of Osun State University College of Health Sciences, and further permissions were given by concerned LGA authorities and community Kings. Written informed consent was obtained from each participant before commencement of the study.

Data source
This study was carried out as a part of a larger community-based screening programme to raise awareness towards kidney diseases. Two of three senatorial districts (Osun west and Osun East) were selected at random, employing simple balloting. One Local Government Area (LGA) per district and eventually one rural town (categorized as highly populated) per LGA were randomly selected also by simple balloting. These emerged as Alajue and Ilobun communities.

After paying series of advocacy visits to community gatekeepers, members of the two communities were mobilized to a town hall meeting and sensitized on cardiovascular diseases. At the meetings, community members eligible for the study were encouraged to come out en-masse, with the assurance that all would consented to the exercise would have it done for free.

Research instruments
An interviewer administered pre-tested questionnaire was used to collect some basic data pertaining to socio-demographic characteristics and cardiovascular risk factors among respondents. To standardize survey measurements and procedures, ten research assistants were trained with specially prepared survey manuals that conformed to recommended non-communicable disease survey protocols. Before the main study, a field test was carried out to fine-tune survey procedures.

Operational definitions and screening procedures
Venous blood samples for various biomarkers were collected by venepuncture after an overnight fast of 8-12hr, stored at 12°C and delivered to the laboratory unit of the College of Health Sciences same day. Lipids profile and glucose levels were measured by qualified laboratory Technologists within the services of the Osun State University College of Health Sciences. Serum Creatinine was measured by enzymatic method. ECG was conducted by trained ECG Technicians and reported by two consultant cardiologists.

Hypertension- means systolic BP ≥ 140 mmHg and/or mean diastolic BP ≥ 90 mmHg or history of anti-hypertensive treatment fifteen days before the survey. Pre-hypertension is BP of 120/80 mmHg – 139/89 mmHg (JNC 7) (22). Normal chemistry values used include HCO3, (20-30 mg/dL), Cl- (90-110 mg/dL), Na+ (120-140 mg/dL), Urea (2.5-5.8 mmol/L), Creatinine (60-120 umol/l), K+ (3.5 mmol/L), TG (<1.71), Total Cholesterol (<5.17), LDL (<3.32), HDL (>1.3).

Measurements and calculations
ECG Measurements: After 10 minutes rest, each subject had a resting 12 lead ECG with a long rhythm strip of lead II recorded. Three portable ECG machines (model Cardovit AT_1ECG Machines) and a generator were utilized in the communities for the screening. A generator was needed to prevent incessant power outages from militating against the exercise. Each ECG recording was independently reported by two cardiologists. Left ventricular hypertrophy (LVH) was assessed using Arroyo (23) and Sokolow-Lyon (24) criteria independently.

Arroyo criteria: R in lead-I (R1) >12 mm, or SV2 + RV6 ≥ 35 mm in females (40 mm in males) with or without T wave inversion/flattening in V5, V6.

Sokolow-Lyon criteria: SV1 + RV5 (or RV6) ≥ 35 mm in females (40 mm in males) with or without T wave inversion/flattening in V5, V6.

Corrected QT (QTc) was calculated for each patient using Bazett’s formula (25); a normal value in females is 0.370-0.44 and in males 0.340-0.43 (26).

Body weight was measured (to the nearest 0.5 kg) with the subject standing and without excessive clothing. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Based on their BMI, individuals were classified into four groups: thin (BMI <18.5 kg/m 2), normal (BMI=18.5-24.9 kg/m 2), overweight (BMI = 25.0-29.9 kg/m 2) and obese (BMI >30.0 kg/m 2); all according to WHO classification.

BP was measured to the nearest 2 mmHg on two occasions at an interval of one to two minutes. BP measurements were made on the right arm of each study subject. Subjects were not permitted to smoke. In cases where the two readings differed by over 10 mmHg, a third reading was obtained, and the three measurements were averaged (22). The pressures at which sound appeared and disappeared were taken as systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. BP was classified as normal, hypertensive or isolated systolic or diastolic hypertension.

A subject was considered to have diabetes mellitus if (i) the fasting venous blood glucose >7.0 mmol/L (126 mg/dL), or (ii) the subject was taking a hypoglycaemic drug or insulin. Normal fasting blood glucose was taken as 3.3-5.5 mmol/L and pre-diabetes or impaired fasting glucose as 5.6-6.9 mmol/L based on the American Diabetes Association criteria (27). Body Mass Index was calculated as weight in kilograms divided by height in meters squared. Based on their BMI, individuals were classified into four groups: thin (BMI <18.5 kg/m²), normal (BMI=18.5-24.9 kg/m²), overweight (BMI = 25.0-29.9 kg/m²) and obese (BMI >30.0 kg/m²); all according to WHO classification.

Data analysis
The Statistical Package for Social Sciences (SPSS) software version 17 (IBM Corporation Armonk, NY, USA) was used for data entry and analysis. Validity of data was ensured by double entry and random checks for errors and outlier values. Blood chemistry variables were recorded based on normal and abnormal values for that variable. Relevant frequency distributions tables and summary indices were generated. The Chi-square test was used to demonstrate relationships between categorical variables (in only those respondents who had complete and comprehensive test results), while level of significance was set at P values ≤ 0.05 and confidence interval of 95% for all inferential analysis of categorical variables.
Study limitations

Not all the study participants completed all the necessary tests. Only 64 were able to complete all tests including ECG due to fund limitation and informed consent. Another limitation to this study was our not asking questions related to smoking of cigarette, the duration and frequency of smoking.

RESULTS

A total of 259 subjects volunteered to participate in the study. Table 1 shows the socio-demographic data of the subjects.

Mean age was 49.7 (+1.6) years. The age range was 18-90 years whilst mode and median were 50.0 years each respectively. Male to female ratio was 1:1.59 (M: F = 1:1.59).

Table 2 shows the risk factors for CVD disease. The total number of patients with high blood pressure (BP) ≥ 140/90 was 62 (23.9%), 48 (18.5%) had ever taken anti-hypertensives on regular basis before. A total of 28 (10.8%) had pre-hypertension (BP = 120/80-139/89) and this included 15 (15.0%) of males and 13 (8.2%) of females. A total of 19 respondents had DM confirmed by FBS, and this included 8 (3.1%) of male and 11 (4.2%) of female respondents.

Thirty-seven (14.3%) have impaired fasting glucose, out of which 16 (43.2%) were males and 21 (56.8%) were females. Thirty (11.5%) were obese, 236 (91.1%) said they were involved in daily exercises lasting at least 30 minutes, 46 (17.8%), 35 (13.5%) and 99 (38.2%) had high total cholesterol, LDL and TG levels respectively, while only 129 (49.8%) had low HDL values. Age and sex were found to be statistically significantly associated with hypertension respectively.

The mean of the total values for the various parameters were systolic BP 138.9 ± 5.7mmHg, diastolic BP 79.9mmHg ± 4.9, total cholesterol 4.3 mmol/L ± 3.0, TG 1.6 mmol/L ± 0.8, HDL 1.4 mmol/L ± 0.7 and LDL 1.9 mmol/L ± 1.2, urea 4.2 mmol/L ± 2.2, creatinine 0.45 umol/L ± 0.035, FBS 5.0 mmol/L ± 1.6, K + 3.9 mmol/L ± 0.82 waist circumference in all 1.9 mmol/L ± 1.2, urea was elevated in 12 (4.6%) and creatinine in only 1 (0.4%). Age and sex were found to be statistically significantly associated with hypertension and obesity respectively.

Table 3 shows the electrocardiography (ECG) result of the patients. The ECG pattern of majority of these rural dwellers was normal. Majorities (82.8%) of the people had normal heart rates and were in normal sinus rhythm whilst 9.4% and 7.8% had sinus bradycardia and sinus tachycardia respectively. First degree heart block was present in 4 (6.3%) whilst one subject (1.6%) had second degree heart block (Type 1). The QRS frontal plane electrical axis was normal in 76.5% of the people with 10.9% having left axis deviation (LAD), another 4.7% having right axis deviation (RAD) and 7.8% having indeterminate axis.

The ST segment was normal in 95.3% of the subjects and only 4.7% had non-significant ST changes; similarly, the T wave was also normal in 85.9%, inverted in 7.9% and nonspecific in 6.2%. By Araoye criteria, no LVH was confirmed by FBS, and this included 8 (3.1%) of male and 11 (4.2%) of females. A total of 19 respondents had DM confirmed by FBS, and this included 8 (3.1%) of male and 11 (4.2%) of females. A total of 46 (17.8%) had pre-hypertension (BP – 120/80 -139/89) and this included 15 (15.0%) of males and 31 (20.4%) of females. A total of 28 (10.8%) had high blood pressure (BP) ≥ 140/90 was 62 (23.9%), 48 (18.5%) had ever taken anti-hypertensives on regular basis before. A total of 28 (10.8%) had pre-hypertension (BP = 120/80-139/89) and this included 15 (15.0%) of males and 13 (8.2%) of females. A total of 19 respondents had DM confirmed by FBS, and this included 8 (3.1%) of male and 11 (4.2%) of females. A total of 1 (1.6%) of male and 7 (11.0%) of females had high blood pressure (BP) ≥ 140/90.

TABLE 1

| Variables (n=259) | Frequency | Percentage |
|------------------|-----------|------------|
| Age group        |           |            |
| 18-29 (or ≤29 years) | 36        | 13.9       |
| 30-49            | 75        | 29.0       |
| 50-69            | 109       | 42.0       |
| 70-89            | 38        | 14.6       |
| 90 above         | 1         | 0.4        |
| Mean age 49.7 (+1.6) years |   |            |
| Sex              |           |            |
| Male             | 100       | 38.6       |
| Female           | 159       | 61.4       |
| Occupation       |           |            |
| Trading          | 111       | 42.9       |
| Farming          | 84        | 32.4       |
| Artisans         | 18        | 6.9        |
| Others           | 46        | 17.8       |

TABLE 2

| Risk variables | Frequency | Percentage |
|----------------|-----------|------------|
| Body Mass Index category |           |            |
| Overweight       | 51        | 19.6       |
| Obesity          | 30        | 11.5       |
| Mean Body Mass Index was 23.4 (±4.9) kg/m². Usually have daily exercises lasting at least 30mins | 236 | 91.1 |
| Past medical history |           |            |
| Hypertension     | 48        | 18.5       |
| Past history of High Blood Pressure | 4 | 1.6 |
| Family history of hypertension | 8 | 3.1 |
| Past history of Diabetes mellitus |           |            |
| BP measurements (mmHg) |           |            |
| Normal           | 197       | 76.1       |
| Hypertension     | 34        | 13.1       |
| Systolic hypertension | 17 | 6.6 |
| Diastolic hypertension | 11 | 4.2 |
| Hypertension – Total | 62 | 23.9 |
| Pre-hypertension | 28        | (10.8)     |
| Fasting blood sugar |           |            |
| Low              | 5         | 2.0        |
| Normal           | 235       | 90.7       |
| High (Diabetes mellitus) | 19 | 7.3 |
| Impaired fasting glucose | 37 | 14.3 |
| Dyslipidaemia    |           |            |
| Total cholesterol | 213 | 82.2 |
| Normal           | 154       | 59.5       |
| High             | 35        | 13.5       |
| No class         | 70        | 27.0       |
| High Density Lipoprotein |           |            |
| Normal           | 130       | 50.2       |
| Low              | 129       | 49.8       |

CVD – Cardiovascular Disease
LVH by Sokolow-Lyon criteria. The mean QTc was 0.42 ± 0.04.

Table 4 showed that a statistically significant association was found between obesity and gender of respondents, and blood pressure (p<0.05) while none existed between obesity and HDL levels, total cholesterol levels and fasting blood glucose level. (p>0.05). A statistically significant association was found between hypertension and age of respondents (p<0.05) while none existed between hypertension and gender, HDL levels, total cholesterol levels and fasting blood glucose level. (p>0.05). Similarly, there was no statistically significant association when those with normal and prolonged QTc were compared with either hypertension or obesity as a status (p>0.05).

While age is not a predictor of obesity (OR 1.08), respondents older than 45 years of age were three (1/0.34) times more likely to have developed hypertension compared to those respondents less than 45 years old (OR 1.34, 95% CI 0.651-2.157, p=0.001) and this observation was found to be statistically significant.

Female respondents were 1.4 times more likely to be obese compared to male (OR 1.43, 95% CI 0.651-3.157, p=0.188); however, gender was not found to be a predictor of hypertension (OR 0.87). Obese respondents were 1.7 times more likely to become hypertensive compared to the non-obese (OR 1.43, 95% CI 0.651-3.157, p=0.188); however, gender was not found to be a predictor of hypertension (OR 0.87). Obese respondents were 1.7 (1/0.60) times more likely to become hypertensive compared to the non-obese (OR 0.60, 95% CI 0.284-1.291, p=0.102).

Respondents with high total cholesterol levels were 1.5 times more likely to

**TABLE 3**
ECG pattern of respondents (N=64)

| Variables               | N   | %   |
|------------------------|-----|-----|
| Heart rate/minute      |     |     |
| <60                    | 6   | 9.4 |
| 60-100                 | 53  | 82.8|
| >100                   | 5   | 7.8 |
| Rhythm                 |     |     |
| Normal Sinus           | 53  | 82.8|
| Sinus bradycardia      | 6   | 9.4 |
| Sinus tachycardia      | 5   | 7.8 |
| QRS axis               |     |     |
| Normal                 | 49  | 76.6|
| LAD                    | 7   | 10.9|
| RAD                    | 3   | 4.7 |
| Indeterminate          | 5   | 7.8 |
| QTc interval           |     |     |
| Normal                 | 49  | 76.6|
| Prolonged              | 15  | 23.4|
| ST segment             |     |     |
| Normal                 | 61  | 95.3|
| Others                 | 3   | 4.7 |
| T wave                 |     |     |
| Normal                 | 55  | 85.9|
| Inverted               | 5   | 7.8 |
| Non specific           | 4   | 6.3 |
| Pathological q wave    |     |     |
| Absent                 | 64  | 100.0|
| Present                | 0   | 0   |
| Conduction             |     |     |
| 1st degree heart block | 4   | 6.3 |
| 2nd degree heart block | 1   | 1.6 |
| Normal                 | 59  | 92.2|
| Sokolow-Lyon           |     |     |
| Male normal            | 26  | 40.5|
| Male LVH               | 1   | 1.6 |
| Female normal          | 30  | 46.9|
| Female LVH             | 7   | 11.0|
| Ectopics               |     |     |
| Nil                    | 60  | 93.8|
| Occasional VPCs        | 4   | 6.3 |
| Atrioventricular       |     |     |
| Male normal            | 27  | 42.1|
| Male LVH               | 0   | 0   |
| Female normal          | 37  | 57.9|
| Female LVH             | 0   | 0   |

**TABLE 4**
Associations between categorical variables and CVS risk factors on bivariate and logistic regression (N=259)

| Variables          | Obesity Proportion | Hypertension Proportion |
|--------------------|--------------------|-------------------------|
|                    | Yes | No | X² | P value | Yes | No | X² | P value |
| Age (years)        |     |    |    |         |     |    |    |         |
| <45                | 11  | 90 | 1.896 | 0.198 | 81  | 1.557 |
| >45                | 16  | 142| 0.059 | 0.418 | 92  | 0.001 |
| Gender             |     |    |    |         |     |    |    |         |
| Male               | 13  | 87 | 2.105 | 0.310 | 69  | 0.244 |
| Female             | 15  | 144| 0.05  | 0.340 | 105 | 0.621 |
| Blood pressure level |    |    |    |         |     |    |    |         |
| Normal             | 25  | 172 | 4.543 | 0.05  | 2.17 |
| High               | 12  | 50 | 0.05  | 84.6 | 0.338 |
| HDL                |     |    |    |         |     |    |    |         |
| Normal             | 20  | 110 | 2.058 | 0.377 | 81  | 2.17 |
| Low                | 14  | 115 | 0.842 | 0.310 | 89  | 0.338 |
| Total cholesterol level |    |    |    |         |     |    |    |         |
| Normal             | 23  | 194 | 2.403 | 0.343 | 120 | 0.51 |
| High               | 3   | 39 | 0.326 | 0.261 | 34  | 0.522 |
| Glucose level      |     |    |    |         |     |    |    |         |
| Normal             | 27  | 213 | 0.354 | 0.329 | 161 | 0.014 |
| High               | 3   | 16 | 0.552 | 0.316 | 13  | 0.905 |
| QTc interval (N=64) |    |    |    |         |     |    |    |         |
| Normal             | 7   | 42 | 1.505 | 0.184 | 40  | 0.013 |
| Prolonged          | 3   | 12 | 0.681 | 0.205 | 3   | 0.908 |

**Binary logistic regression**

| Variable                                 | Obesity OR | 95%CI | P value | Hypertension OR | 95%CI | P value |
|------------------------------------------|------------|-------|---------|-----------------|-------|---------|
| Age (reference category= >45 years)      | 1.08       | 0.481 | 0.192   | 0.001           |
| Gender (reference category= male)        | 1.43       | 0.651 | 0.511   | 0.313           |
| Obesity (reference category= obese)      | 3.157      | 1.493 |         |                 |
| Total cholesterol level ref. category= low| 1.54       | 0.441 | 0.721   | 0.144           |
The level of awareness of hypertension was high as 48 (77.4%) of the 62 those with normal HDL levels (OR 1.34, 95% CI, 0.80-2.25, p=0.130), to be hypertensive compared to those with normal or low total cholesterol (OR 1.54, 95% CI 0.44-5.386, p=0.264). Likewise, with high total cholesterol levels were also 1.5 times more likely to be hypertensive compared to those with normal or low total cholesterol level (OR 1.47, 95% CI 0.72-3.024, p=0.144).

Respondents with a low HDL level were 5 times more likely to be obese compared to those with high HDL (OR 1.49, 95%CI 0.718-3.103, p=0.144). Likewise, respondents with low HDL levels were 1.3 times more likely to be hypertensive compared to those with normal HDL levels (OR 1.34, 95% CI, 0.80-2.522, p=0.130), though these observations were not statistically significant.

The prevalence of hypertension increases with age (29,30). The association between hypertension and age >45 years was statistically significant (OR 0.34, 95% CI 0.19-0.616, p=0.001). This is supported by all other previous studies in the same tribe (18,19). This higher prevalence was because majority of these rural dwellers were 49.7 ± 1.6 years. This is also very close to the mean age of 42.1 ± 21.6 years of the subjects in one of the earlier Nigerian studies (18).

Obesity was also found to be statistically significantly associated with hypertension in this study (p=0.050); this is supported by other studies (30,31). Obese respondents were 1.7 times more likely to become hypertensive compared to the non-obese (OR 0.60, 95% CI 0.28-1.291, p=0.03). Obesity was found in 11.5% of the subjects while overweight was present in 19.6% of them. This is similar to 11.12% obesity obtained in a study conducted in the South East of Nigeria using selected urban and rural Igbo communities (32) but much higher than the 3.9% obtained for general obesity in another study (18). Our finding on the prevalence of obesity also falls within the range of the prevalence of obesity in Nigeria as reported in a systematic review of literature by Chukwonye et al. (33).

Obesity was significantly associated with the female sex (p<0.050). Female respondents were 1.4 times more likely to be obese compared with males (OR 1.43, 95% CI 0.61-3.175, p = 0.389). Although more females (2.4%) were obese in the earlier study as against 1.3% of the males, there was however no association calculated with which to compare our study (18). A study done in Latin America and the Caribbean lends credence to this with the females having higher prevalence of obesity than the males (34). This study also showed that high total cholesterol level and low HDL were predictors of obesity (Table 4). A chinese study supports that low HDL was associated with obesity and overweight (BMI) and the association was stronger with central obesity using waist circumference (p<0.001) (35). Respondents with high total cholesterol levels were 1.5 times more likely to be obese compared to those with normal or low total cholesterol level (OR 1.54, 95% CI 0.44-5.386, p=0.264). Similarly, respondents with a low HDL level were 5 times more likely to be obese compared to those with high HDL (OR 1.49, 95%CI 0.718-3.103, p=0.144). A 26 year follow up of participants in the Framingham Heart risk factor found obesity to be an independent risk factor for cardiovascular diseases in both sexes (36). This was similarly observed amongst Finnish men and women after adjusting for confounding factors (37). About one-tenth of our respondents had pre-hypertension; this is much lower than the prevalence of 31.0% reported in the study in American adults (38).

This is expected as westernization of diet and lifestyle is at its peak in America. A meta-analysis from 18 prospective cohort studies showed elevated CVD risk in patients with prehypertension, after adjusting for multiple cardiovascular risk factors (39). Diabetes mellitus was detected in 19 (7.3%) of the subjects, lower prevalence was reported in rural areas in the South West and South East of Nigeria (2.5%, 4.8%, and 3.6% respectively) (18,19,29).

Obese respondents were 1.7 (1/0.60) times more likely to become hypertensive compared to those with normal or low total cholesterol level (OR 1.47, 95% CI 0.72-3.024, p=0.144). A 26 year follow up of participants in the Framingham Heart risk factor found obesity to be an independent risk factor for cardiovascular diseases in both sexes (36). This was similarly observed amongst Finnish men and women after adjusting for confounding factors (37). About one-tenth of our respondents had pre-hypertension; this is much lower than the prevalence of 31.0% reported in the study in American adults (38).
in Table 3, this was expected as they were apparently normal healthy subjects within the community. Majorities (82.8%) of the people had normal heart rates and were in normal sinus rhythm whilst 9.4% and 7.8% had sinus bradycardia and sinus tachycardia respectively. Sinus bradycardia occurs in people accustomed to exercise such as trained athletes (40), we opine that those with sinus bradycardia might be doing more trekking and farming activities than others. Sinus tachycardia could also have occurred in some subject’s due to fear since they had never had ECG run on them before.

First degree heart block was present in 4 (6.3%) whilst one subject (1.6%) had second degree heart block (Type 1). Morbidity type 1 heart block originally considered to be benign has now been found not to be benign in those aged ≥ 45 years (41). The QRS frontal plane electrical axis was normal in 76.5% of the people with 10.9% having left axis deviation (LAD), another 4.7% having right axis deviation (RAD) and 7.8% having indeterminate axis. Although a majority of the subjects had their QRS frontal plane electrical axis within the normal range, but their percentage (26.5%) was lower than the 97.0% reported in normal healthy adult Nigerians by Anoye (42); conversely the proportion of those with LAD (10.9%) and RAD (4.7%) were higher in this study than the 2.9% and 0.1% obtained respectively in the earlier study (42). The LAD is likely to be 57.0% of this study subjects were in the age group ≥ 50 years as shown in Table 1. There is a normal leftward shift of the QRS axis with age, RAD could also be a variant of normal (43). The indeterminate axis seen in 7.8% of the subjects however calls for more investigations of those affected as this is rare in normal subjects and when present it indicates serious cardiac condition (43). There were no atrial premature complexes but occasional ventricular premature complexes (VPCs) occurred in 4 (6.3%) of the subjects. Occasional VPCs can be found in normal subjects and are not true as long as they are not more than or of previous and this has been reported in 1.4% of the normal population on regular 12 lead resting ECG (44), and in 40-75% of subjects on 24-48 hours holter monitoring (45).

There was no ECG evidence of ischaemic heart disease in any of the subjects as majority (95.3%) of them had normal ST segment, only 4.7% had nonsignificant ST changes; similarly, the T wave was also normal in 85.9%, inverted in 7.9%, nonspecific in 6.2% and there were no pathological q waves. Although ischaemic heart disease was not found in these two communities but there is already a constellation of risk factors within these rural communities buttressing an earlier study that the rural communities are at risk of a dual burden of communicable diseases to non-communicable diseases (NCDs) (18). Also, it had been shown in our earlier study that the NCDs are now emerging as the most common cause of hospital admission in Nigeria (46). Furthermore, hypertensin and its related complications have been shown to be the commonest cause of sudden death in Nigeria (47).

The QTc interval was prolonged in 23.4%, this is rather high and caution must be exercised in administering drugs that are known to prolong QTc interval especially antibiotics such as the macrolides (Erythromycin>Clarithromycin), trimetoprim-sulphamethoxazole, penamidime, azoles and fluoroquinolones (sparfloxacin, ciprofloxacin) to these in these two communities so as to avoid lethal arrhythmias, torsades des pointes and sudden death (48). Also, the 23.4% may not be representative of the community because only 25% of those screened had ECG done and this is a limitation of the study. It is also pertinent to note that none of the patients who had ECG was on any illicit drug such as methadone, halofantrine or any other drugs that could prolong the QTc.

This study appears to be the first in Nigeria that will do a community survey incorporating ECG. This is because of logistic problems associated with this, some of these we were able to surmount by carrying portable ECG machines and a generator for the supply of electricity into these two communities. The seemingly apparently normal rural dwellers were found to have the above stated ECG abnormalities. It is also the first time LVH will also be assessed alongside with some other risk factors. LVH on its own predisposes an individual to sudden death irrespective of its cause on account of the lethal arrhythmias it induces hence aggressive management of those with it is the ultimate goal (49-51).

The preponderance of multiple risk factors as seen in this study further compounds the possible epidemic of CVD and its sequelae. Multiple risk factors were present in 73 respondents (28.2%) and 51 (69.9%) had double while 18 (24.7%) had triple risk factors (Figure 1). This is higher than what was reported in an earlier study amongst a rural Yoruba community in South West Nigeria in which multiple cardiometabolic risk factors were reported in 2.1% of men and 2.7% of women (18). It is also noteworthy that a minor percentage had four or five risk factors as shown in Figure 1. This may be an indication of continuing urbanization and westernization of our rural communities. A study in Abuja among the aboriginal inhabitants of Abuja comparing the prevalence of cardiovascular risk factors among the urban population with that of the rural population corroborates this despite the same ancestry of these two communities, urbanization increased the prevalence of most of the traditional CVS risk factors (52).

This study also showed that 23.4% of respondents that had ECG done on them had prolonged QTc in both communities. This is a significant finding, because prolonged QTc calls for caution in the administration of contraindicated drugs. Therefore, this work has the potential of furthering our understanding and makes primary prevention efforts in rural areas of Nigeria more feasible.

All the subjects identified to be having these risk factors were counseled and sent to our cardiology clinic at the Ladoke Akintola University Teaching Hospital for more thorough investigations and appropriate treatment; after which they were sent back to the primary health centre or comprehensive health centre to continue their treatment and follow up. A few of the patients however opted for continuation of their treatment in the teaching hospital and are still being followed up.

CONCLUSION
It is important to conclude that obesity/overweight, physical inactivity, existence of hypertension, pre-hypertension, diabetes, impaired fasting glucose, and dyslipidemia are all modifiable risk factors that could be tackled to prevent emergence of cardiovascular diseases in epidemic proportions. Concerted effort must be made by all stakeholders in the health sector to increase awareness and knowledge among the rural communities where there is usually limited access to electronic and print media as a means of health education. Thus, stakeholders should devise acceptable methods of reaching these remote areas with appropriate messages that would address modifiable risk factors for non-communicable diseases as well as strengthen the health systems to take care of non-modifiable and other risk factors and determinants thereby preventing a future epidemic of CVD.

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We declare there are no competing interests.

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