Prevalence of Non-Communicable Diseases and its Risk Factors among Ijegun-Isherhi Osun Residents in Lagos State, Nigeria: A Community Based Cross-Sectional Study

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Abstract
Background
The rapid epidemiologic transition of diseases has adverse implications for low-and middle-income countries (LMICs) due to their limited healthcare, weaker health systems and the westernization of lifestyle. There is the need to evaluate the enormity or otherwise of the NCD burden and address it. However, there is a paucity of literature on the burden of NCDs in Nigeria. We therefore conducted this survey to determine the prevalence of NCDs and its risk factors among the Ijegun- Isheri Osun community residents of Lagos, Nigeria.

Methods
A community-based cross-sectional survey design was applied with 215 participants selected consecutively during a population preventive health campaign. Prevalence of hypertension, diabetes and dyslipidaemia were calculated, with further exploration on associations between these variables done. Multivariable logistic regression was used to estimate the risk factors of the three NCDs (hypertension, diabetes and dyslipidaemia).

Results
The prevalence of hypertension was 35.3% (95%CI 29.0-42.1), diabetes 4.6% (95%CI 2.2–8.4) and dyslipidemia 47.1% (95%CI 41.1–54.8). Three major risk factors evaluated showed prevalence of smoking to be 41.3% (95%CI 34.2-48.6), alcohol consumption 72.5% (95% CI 65.5–78.7), and physical activity 52.9 (95%CI 45.5–60.2). The independent significant risk factors of hypertension were age ≥ 60 years (aOR 4.56 95%CI: 1.72–12.09) and dyslipidaemia (aOR 5.01 95%CI: 2.26–11.13). Age ≥ 60 years (aOR 8.83 95%CI: 1.88–41.55) was an independent risk factor of diabetes. Age ≥ 60 years aOR 29.32 95%CI: 4.78-179.84), being employed (aOR 11.12 95%CI: 3.10-39.92), smoking (aOR 2.34 95%CI: 1.03–5.33) and physical activity (aOR 0.34 95%CI: 0.15–0.76) were independent risk factors of having dyslipidaemia.

Conclusions
The results suggest that prevalence of hypertension, diabetes and dyslipidaemia together with their associated risk factors are high, highlighting the need for further implementation research and policy directions to tackle the NDC burden in the research community, Nigeria, sub-Saharan Africa and the world at large. These strategies must be community specific, prioritizing the various risk factors and
addressing them accordingly.

Background
Globally there is a high burden of non-communicable diseases (NCDs) and developing countries have had their share of this rapid increase, with different risk factors contributing to the surge.\(^1\)

Undoubtedly, NCDs have the potential of becoming the leading public health burden and threat in developing countries including Nigeria, as a result of rapid urbanization, consistent decrease in physical activity due to mechanization, lifestyle changes seen in the rapid change of dietary habits and many more.\(^2\)–\(^7\) Low-and middle-income countries (LMICs) are likely to suffer a greater burden of these diseases compared to the developed nations because of their limited healthcare finances for NCDs; and their relative weak and unprepared health system(s) for these diseases.\(^7\)–\(^10\)

Africa, home to 54 LMICs, is expected to have the world’s largest increase in NCD deaths over the next decade due to the epidemiologic transition of disease.\(^2\) In most countries in Northern and Western Africa, NCDs are responsible for more than three-quarters of all deaths and this will continue to increase if urgent and evidence-based policies to curtail the situation are not successfully implemented.\(^8\),\(^9\),\(^11\) Furthermore, there are clear gaps in the evidence for successful implementation of NCD interventions within the primary health care setting in African countries. In addition, models and approaches to properly inform the design of interventions that address the needs of communities and individuals are still lacking in most developing countries like Nigeria.\(^12\) Therefore, health planners, policy and decision makers need to agree that health systems must address diseases in a discrete manner \(^7\),\(^12\). For many years, public health policies in Nigeria have focused on the control of infectious diseases, with attendant scarcity of necessary data for policy decisions on NCDs.\(^13\) It is crucial to pay attention to NCDs among the Nigerian community, because these health challenges are potentials for economic losses, household poverty and reduction in productivity.\(^14\)

Many of the surveys on NCDs in Nigeria have been largely hospital-based. The few available community surveys have shown differences in urban and rural communities in terms of the burden of NCD risk factors. Alikor et al.\(^15\) found that 38% of rural residents in Nigeria had 2 or more NCD risk
factors while Odugbemi et al. have reported hypertension prevalence and physical inactivity prevalence of 35% and 92% respectively in traders in a popular Lagos market. Prevalence rates from direct enumeration of individuals in a representative community provide credible evidence for healthcare planning, allocation of resources and monitoring trajectory of diseases by government agencies. Lagos being the “de facto” industrial capital of Nigeria is a multi-ethnic society undergoing rapid social and lifestyle dynamics of an industrialised urban society. Measuring the burden of NCDs in urban communities in Lagos is attractive and provide opportunities for health promotion and policy formulation. Hence, we set out in this survey to evaluate the prevalence of NCDs (hypertension, diabetes and dyslipidaemia) and their behavioural risk factors among the Ijegun-Isherì Osun community residents of Lagos, Nigeria.

Methods
Study Design and Setting
This cross-sectional survey was carried out by the NAIJAHEALTH Initiative, a self-funded Non-Governmental Organisation that engages in health promotion in Lagos, Nigeria. The study respondents were residents of the Ijegun-Isherì Osun community, Lagos State, Nigeria who participated in a population preventive health campaign on the 29th and 30th of June, 2018. The sites for the campaign were the Isheri-osun primary healthcare center, Isheri-osun community market and the Christ apostolic worship centre. Target participants who were at least 15 years old were recruited consecutively into the study after giving informed consent. Participants who had severe cognitive impairment that mitigated against remembering past events or giving reliable medical history were excluded from the study.

Sample size
Minimum sample size was calculated using the formula:

\[ N = \left(\frac{Z_{\alpha/2}}{d}\right)^2pq \]

Where,
N = the minimum sample size

\( Z_{\alpha/2} = \) the standard normal deviate corresponding to a level of significance of 0.05 is 1.96

\( p = \) the prevalence rate of hypertension in the community according to available literature is 31.8%.\(^1\)

\( q = 1-p \)

\( d = \) the desired precision: 10%

Applying the formula, the minimum sample size is:

\[
N = (1.96)^2 \left( 0.318 \times 0.682 \right) (0.1)^2
\]

\[ N = 83.3 \]

Applying the minimum sample size formula as calculated above, \( N = 83.3 \), with a 20% increase taken into account for non-response rate, a minimum sample size of 100 would be ideal for the study.

However, a total of 215 respondents who participated in the study were included in the analysis.

**Data Collection**

**Data collection instrument**

A semi structured interviewer administered questionnaire was used for data collection based on a modified WHO Stepwise protocol which consists of three steps.\(^{19,20}\) The questionnaire was divided into subsections of demographic data, medical history, lifestyle risk factors, presenting symptoms and signs, medications in use, examination and laboratory test results. The questionnaire was pre-tested before the main study among 10 respondents. The questionnaire was also translated into the Yoruba language which is the local language spoken by most of the populace in the study community.

**Data collection procedure**

The study questionnaire as described was used for data collection. This was administered by trained assistants while medical care and advice was given by clinicians involved in the study. Baseline clinical and demographic data obtained from the participants included date of birth, age, gender, history of hypertension, diabetes mellitus, alcohol intake, smoking, physical activity, medications and other medical history.

Blood pressure measurements were obtained with a mercury sphygmomanometer according to
standard guidelines. Systolic and diastolic blood pressures were measured at Korotkoff sounds phase I and V, respectively. Two readings were taken at intervals of at least 2 minutes, and the average of the readings was used to represent the patient’s blood pressure. If there was > 5 mm Hg difference between the first and second readings, additional (1 or 2) readings was obtained, and then the average of these multiple readings was used. A participant was considered to have hypertension on the basis of self-reported history of hypertension and/or the use of blood pressure-lowering medication and/or documented blood pressure ≥ 140/90 mmHg. Blood pressure status was categorized into normal, pre-hypertension and elevated blood pressure readings using the cut-offs of the European Society of Cardiology. Diagnosis of diabetes was based on self-reported history and/or plasma random glucose reading ≥ 200 mg/dl with clinical signs of diabetes according to the American Diabetes Association. Smoking status was categorized in to 3 categories. A ‘never smoker’ was someone who had not smoked cigarette in the last 10 years. Occasional or irregular smoker was someone who had smoked at least once while a regular smoker was defined as someone who smoked at least once a week. Alcohol consumption was categorized into three categories. The category ‘Never’ was someone who had never drank alcohol. Occasional or irregular consumption was ≤ monthly consumption and/or 1–2 drinks per day while regular alcohol consumption was defined as drinking > 2 drinks per day. A drink was defined as a bottle or one glass of wine or a shot of any of the spirit. Regular physical activity was defined as at least 150 minutes of moderate intensity exercise per week; irregular physical activity was defined as 30–149 minutes of moderate intensity physical activity per week while “never” was defined as < 30 minutes of moderate intensity physical activity per week. Plasma blood glucose and lipids (total cholesterol and LDL) using finger-prick blood sample were measured with point-of-care devices. Normal total plasma cholesterol was defined as < 200 mg/dl while normal LDL was defined as < 130 mg/dl. Dyslipidaemia was defined as plasma cholesterol ≥ 200 mg/dl and/or LDL cholesterol ≥ 130 mg/dl.
DATA ANALYSIS

Data were analysed using Stata version 15 (StataCorp LLC, Lakeway Drive, College Station, Texas, USA). Normality of data was determined using Shapiro-Wilk test. Proportions were used to summarize categorical data while continuous variables were summarized as means/medians; and standard deviations/interquartile range as appropriate. Non-normally distributed variables were log-transformed to achieve normality. Prevalence of each of the NCDs and cardiovascular risk factors were then calculated. The NCDs (hypertension, diabetes and dyslipidaemia) were modeled as dependent variables while the socio-demographic and lifestyle risk factors were independent variables. The association between each of the NCDs (hypertension, diabetes and dyslipidaemia) and socio-demographic and lifestyle risk factors was determined using chi square. The odds ratios of each of the NCDs (hypertension, diabetes and dyslipidaemia) adjusted for the various socio-demographic and cardiovascular risk factors were determined using multivariable logistic regression models. Interaction terms were tested for in all regression models but there was no significant interaction between any of the variables in the regression models. Finally, Poisson regression analyses were performed to determine the effects of certain co-variates on the clustering of NCDs among the participants. Multivariate models were built using significant variables in initial univariate analyses (purposive confirmatory method) and these models were similar to results obtained by stepwise regression models. The results of the purposive confirmatory approach are presented in this paper. A p value < 0.05 was considered statistically significant in all analyses.

Results

The results of the descriptive analysis (Table 1) showed that of the study participants, 90(41.9%) were male and 125(58.1%) were female, with mean age of 38.4 ± 21.6. About 11(5.1%) had previous history of diabetes while 40 (18.6%) had a history of hypertension. Our study also revealed that about 65 (34.4%) frequently consumed more than 2 drinks of alcohol per day while few 14 (7.4%) smoked cigarettes at least once a week. There were 38 (20.1%) who reported regular physical activity or exercise per week. More than half of those tested had elevated plasma cholesterol level.

Table 1.2 shows the prevalence of NCDs and 3 major risk factors. Hypertension prevalence was 35.3%
and similar in both sexes, 4.6% of the subjects had diabetes with no sex difference while 47.9% had dyslipidaemia which showed a female preponderance (52% in women vs. 42.2% in men).

**Table 1.1**

| Variables               | Frequency(%) | Mean ± SD |
|-------------------------|--------------|-----------|
| Age (years)             | 38.4 ± 21.6  |
| Sex                     |              |           |
| Male                    | 90 (41.9%)   |
| Female                  | 125 (58.1%)  |
| Marital Status          |              |           |
| Single                  | 59 (27.4%)   |
| Married                 | 144 (70.0%)  |
| Divorced                | 4 (1.9)      |
| Widowed                 | 5 (2.3)      |
| Others                  | 3 (1.4)      |
| Occupation              |              |           |
| Employed                | 139 (66.5%)  |
| Unemployed              | 70 (33.5%)   |
| Previous DM history     |              |           |
| Yes                     | 11 (5.1)     |
| No                      | 204 (94.9)   |
| Previous Hypertension history |          |           |
| Yes                     | 40 (18.6%)   |
| No                      | 175 (81.4%)  |
| Alcohol consumption     |              |           |
| Never                   | 52 (27.5%)   |
| Infrequent              | 72 (38.1%)   |
| Frequent                | 65 (34.4%)   |
| Smoking                 |              |           |
| Never                   | 111 (58.7%)  |
| Infrequent              | 64 (33.9%)   |
| Frequent                | 14 (7.4)     |
| Recommended Physical activity levels |          |           |
| No                      | 89 (47.1%)   |
| Infrequent              | 62 (32.8%)   |
| Frequent                | 38 (20.1%)   |
| Blood pressure (171 respondents) |         |           |
| SBP (mmHg)              | 143 ± 24.4   |
| DBP (mmHg)              | 85.7 ± 13.5  |
| RBG (mg/dl)             | 128.7 ± 49.1 |
| Plasma LDL levels (n = 188) |          |           |
| Normal                  | 114 (60.6%)  |
| Elevated                | 74 (39.4%)   |
| Plasma Total cholesterol levels (n = 188) |          |           |
| Normal                  | 90 (47.9%)   |
| Elevated                | 98 (52.1%)   |

**Table 1.2**

| Risk factors            | Total N = 215 | Male N = 90 | Female N = 125 |
|-------------------------|---------------|-------------|----------------|
| Hypertension            | 76 (35.3)     | 32 (35.6)   | 44 (35.2)      |
| Diabetes mellitus       | 10 (4.6)      | 4 (4.4)     | 6 (4.8)       |
| Dyslipidemia            | 103 (47.9)    | 38 (42.2)   | 65 (52)       |
| Total                   | 189           | 72 (56.9)   | 117 (70.9)    |
| Smoking                 | 78 (41.3)     | 41 (56.9)   | 37 (31.6)      |
| Alcohol consumption     | 137 (72.5)    | 54 (75)     | 83 (70.9)     |
| Physical activity       | 100 (52.9)    | 47 (65.3)   | 53 (45.3)     |

Majority of the respondents smoked cigarettes with male preponderance (56.9% in men vs. 31.6% in women), about three-quarters of the respondents consume alcohol with slight male preponderance while about half of the respondents engaged in exercise with male preponderance (65.3% in men vs.
45.3% in women).

Bivariate analysis using chi-square (Table 2) showed significant association between hypertension and increasing age-group. Those who were employed were more likely to have hypertension (p < 0.001). There was a strong association between hypertension and diabetes with all those who were diabetic being also hypertensives. Diabetes also showed increased risk with increasing age-group. Dyslipidaemia also showed increased risk with age and was more likely in those who were employed. Hypertension and diabetes were each significantly positively associated with having dyslipidaemia while smoking was also associated with dyslipidemia (p = 0.01). Physical activity was negatively associated with dyslipidaemia.

Table 2
Distribution and bivariate analysis between risk factors and NCDs

| Variables        | Hypertension |  | DM |  | Dyslipidaemia |  |
|------------------|--------------|---|----|---|---------------|---|
|                  | p-value      |   | p-value |  | p-value       |   |
| Age              |              |   |        |   |              |   |
| < 40 years       | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | < 0.001 |
|                  | 14 (18.4)    | 92 (66.2) | 0 (0.0) | 106 (51.7) | 18 (17.5) | 88 (78.6) | < 0.001 |
| 40-60 years      | 36 (47.4)    | 39 (28.0) | < 0.001 | 3 (30.0) | 72 (35.1) | < 0.001 | 53 (51.5) | 22 (19.6) | < 0.001 |
| > 60 years       | 26 (34.2)    | 8 (5.8) | 7 (70.0) | 27 (13.2) | 32 (31.1) | 2 (1.8) |
| Sex              |              |   |        |   |              |   |
| Male             | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 0.96 |
|                  | 32 (42.1)    | 58 (41.7) | 4 (40.0) | 86 (41.9) | 38 (36.9) | 52 (46.4) | 0.16 |
| Female           | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 6 (60.0) | 119 (58.1) | 65 (63.1) | 60 (53.6) | < 0.001 |
| Marital status   |              |   |        |   |              |   |
| Married          | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 0.88 |
|                  | 67 (89.3)    | 77 (56.2) | 7 (70.0) | 137 (67.8) | 91 (90.1) | 53 (47.7) | < 0.001 |
| Unmarried        | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 1.00 |
|                  | 8 (10.7)     | 60 (43.8) | 3 (30.0) | 65 (32.2) | 10 (9.9) | 58 (52.3) |
| Occupation       |              |   |        |   |              |   |
| Employed         | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 0.81 |
|                  | 63 (84.0)    | 76 (56.7) | 7 (70.0) | 132 (66.3) | 91 (89.2) | 48 (44.9) | < 0.001 |
| Unemployed       | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 1.00 |
|                  | 12 (16.0)    | 58 (43.3) | 3 (30.0) | 67 (33.7) | 11 (10.8) | 59 (55.1) |
| Hypertension     |              |   |        |   |              |   |
| Yes              | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 0.81 |
|                  | 62 (81.6)    | 41 (29.5) | < 0.001 | 9 (90.0) | 94 (45.8) | < 0.01 |
| No               | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 1.00 |
|                  | 14 (18.4)    | 98 (70.5) | 1 (10.0) | 111 (54.2) | - | - |
| DM status        |              |   |        |   |              |   |
| Yes              | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 0.86 |
|                  | 38 (51.5)    | 66 (48.5) | 77 (74.8) | 60 (69.8) | 58 (56.3) | 31 (36.1) |
| No               | yes (%)      | no (%) | yes (%) | no (%) | yes (%) | no (%) | 0.90 |
|                  | 66 (86.8)    | 139 (100.0) | 7 (70.0) | 104 (58.1) | 94 (91.3) | 111 (99.1) |

When blood pressure and age were modelled as continuous variables, systolic (SBP) and diastolic (DBP) blood pressure showed strong positive linear relationship. Also, each of SBP and DBP showed

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strong positive linear relationship with age (see supplementary document).

In Table 3, age, being employed and dyslipidaemia were the independent risk factors of hypertension. Respondents aged ≥ 60 years were about 4.6 times more likely to have hypertension in adjusted analyses, those employed were 4 times at risk of hypertension in unadjusted analysis which was attenuated to about 2-fold increased risk in adjusted analyses. Dyslipidaemia conferred a 10-fold increased risk of hypertension in unadjusted analysis, but this was attenuated by half to 5-fold increased risk of hypertension in adjusted analyses.

| Variables | Hypertension (adjusted for age, occupation and dyslipidaemia) | Diabetes (adjusted for age and dyslipidaemia) | Dyslipidaemia (adjusted for age, occupation, smoking, physical activity and hypertension) |
|-----------|---------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------|
|           | crude OR (95% CI)    | p-value | adjusted OR (95% CI) | p-value | adjusted OR (95% CI) | p-value |
| Age (≥ 60 years) | 8.51 (3.61-20.06) | < 0.05 | 4.56 (1.72-12.09) | < 0.05 | 15.38 (3.75-63.12) | < 0.05 |
| Employed   | 4.01 (1.98-8.11)   | < 0.05 | 2.29 (0.91-5.77)   | 0.08   | 10.63 (1.32-85.42) | < 0.05 |
| Dyslipidaemia | 10.58 (5.34-21.00) | < 0.05 | 5.01 (2.26-11.13) | < 0.05 | 10.58 (5.34-21.00) | < 0.05 |
| Age (≥ 60 years) | 24.79 (5.76-106.67) | < 0.05 | 29.32 (4.78-179.84) | < 0.05 | 24.79 (5.76-106.67) | < 0.05 |
| Employed   | 10.17 (4.89-21.15) | < 0.05 | 11.12 (3.10-39.92) | < 0.05 | 10.17 (4.89-21.15) | < 0.05 |
| Smoking    | 2.14 (1.18-3.89)   | < 0.05 | 2.34 (1.03-5.33)   | < 0.05 | 2.14 (1.18-3.89)   | < 0.05 |
| Physical activity | 0.44 (0.24-0.79) | < 0.05 | 0.34 (0.15-0.76)   | < 0.05 | 0.44 (0.24-0.79) | < 0.05 |
| Hypertension | 10.58 (5.34-21.00) | < 0.05 | 4.31 (1.90-9.77)   | < 0.05 | 10.58 (5.34-21.00) | < 0.05 |

Both age and dyslipidaemia were risk factors of diabetes in crude analyses, but in adjusted analyses, only age was an independent risk factor of diabetes conferring an 8.8-fold increased risk.

Age, being employed, dyslipidaemia, smoking and hypertension were adverse risk factors for having dyslipidaemia while physical activity was protective of having dyslipidaemia in both crude and adjusted analyses. Individuals aged ≥ 60 years were 30 times more likely to have dyslipidaemia, those who were employed had 11-fold increased risk of having dyslipidaemia, those who smoked were twice at increased risk of dyslipidaemia while those with hypertension had a 4-fold increased risk of dyslipidaemia. Individuals who engaged in physical activity were 3 times less likely to have dyslipidaemia.

In multivariable Poisson regression, individuals aged ≥ 60 years had a mean of 2 NCDs while those employed, smokers and the physically inactive each had a mean of 1 NCD (see supplementary document).

Discussion
Non-communicable diseases, an `epidemic in slow motion', have been projected to be a leading cause of morbidity and mortality in Nigeria by 2030. The surveillance of NCD risk factors is one of the key strategies advocated to tackle these emerging public health concerns, particularly in low and middle income countries. Therefore, this study investigated prevalence of NCD and its association with behavioral risk factors in the busy suburb of the Ijegun-Isherì Osun in Lagos State, Nigeria. We found that most of the participants were aged 40 years and above, more than half were female, and majority were married.

Tobacco use, the leading cause of morbidity and mortality globally that claims about 6 million lives annually, was also prevalent in this study. This finding corroborates with reports in other literature where prevalence of tobacco use of was found to be 34.4% in India 43.2% in Bangladesh. It is known that unhealthy lifestyle habits are prevalent in urban cities and industrial hubs in Nigeria. Conversely, low prevalence rates have been reported among the working class in some other parts of Nigeria. The contrast in findings could be as a result of formal civil servants being the focus of previous studies as against this study whose participants were general community residents and traders. The sex differences in smoking in this study is in keeping with similar reports in other parts of the country where more males smoked cigarettes than females. This can be attributed to the risk-taking behaviours of men. There was a significant association between increasing age and smoking, which was similar to other existing literature. Similarly previous health reports conclude that majority of adult smokers initiated the habit of smoking before the age of 18 years, a finding which supports calls for the extension of the focus for tobacco control programs to young adults in order to curtail the habit of smoking as people get older.

Alcohol consumption and harmful use of alcohol were reported in more than half of our study population as 32.8% and 34.4% respectively. Approximately 2.3 million die each year from the harmful use of alcohol, accounting for about 3.8% of all deaths in the world. More than half of these deaths occur from NCDs including cancers, cardiovascular disease and liver cirrhosis. A prevalence
of 26.9% for alcohol consumption has been reported in urban communities in Ibadan.\textsuperscript{22} The differences in our findings and that of the earlier studies could be due to differences in study populations and the prevailing lifestyles present in these different communities. Another reason for inconsistent results with the available literature could be due to differences in assessment methods. Previous studies used self-constructed instrument while this study used standard and pretested questionnaire (WHO Stepwise protocol).\textsuperscript{41}

In our study, physical activity was high (52.9%), which was consistent with previous studies in Ibadan and Abuja, Nigeria which have reported physical activity of 53.6% and 49% respectively among drivers.\textsuperscript{42,43} The similarity in the outcome could be due to driving being the occupation of majority of residents in Iseri-Osun - the study setting of this study. This is especially in keeping with the higher physical activity observed in males. Also, majority of the female respondents in this study were traders who usually sit in their shops throughout the day as reported also in a study in Tejuosho market in Lagos.\textsuperscript{16} Moreover, Lagos is a boisterous city and residents have to engage in demanding jobs and travel long distance daily in search of their daily means of sustenance. However, lower prevalence of physical activity (37.8%) among civil servants in Ibadan have been reported.\textsuperscript{44,45} The differences in the findings could be due to different instruments used for the assessment of physical exercise. Previous studies reported an underestimated level of physical inactivity in their study because of the subjective method of assessment in the use of self-reported questionnaires (International Physical Activity Questionnaire).\textsuperscript{46} Meanwhile, this study used WHO recommendation to classify participants into physical activity categories.\textsuperscript{47,48} One plausible reason for high percentage of physical activity in this study was because most participants were young adults with an average age of 38 years. Also, most of them were employed, even though their occupation were not disclosed but leaving home for work place every day might require walking among most participants. Still, workplace interventions that encourage more physical activity at work should be encouraged in the community.

Raised blood pressure, the major risk factor for cardiovascular diseases, which include coronary heart
disease, cerebrovascular disease, peripheral vascular disease etc., has become a global concern. This is because CVDs are the leading cause of death globally with an estimated 17.5 million deaths yearly, occurring mostly in low-and-middle income countries. This fact was buttressed in this study where about a third had hypertension, which supports previous findings in other researches in Nigeria. This is also in keeping with the landmark meta-analysis by Adeloye et al. who reported prevalence of 30.6% in urban communities in Nigeria. Increasing age has been shown to be a risk factor for raised blood pressure. Participants aged 60 years or above were about nine times more likely to be hypertensive compared to those in age group below 60 years. As a result of aging, changes occurring within the cardiovascular system like thickening of the arterial wall. Thus, the heart does more work in pushing blood against the thickened arterial wall leading to an increase in arterial blood pressure. However, our study did not show any significant gender difference in the occurrence of hypertension. Similarly, there was no significant association between gender and high blood pressure in similar settings although a systematic review on the current prevalence and pattern of hypertension in Nigeria, higher significant prevalence of hypertension was reported among males compared to females. Being employed and having dyslipidaemia were other predictors of hypertension in this study. Dyslipidaemia contributes to atherosclerosis through endothelial dysfunction, inflammation and insulin resistance. Employed individuals living in Lagos generally are exposed to daily stress that is characteristic industrial capitals.

The low prevalence of diabetes in this study is similar to the finding by Ajayi et al., Oguoma et al., and Sani et al. but lower than the reports by Oluyombo et al. in Ekiti and Agaba et al. However, Odugbemi et al. have reported much lower prevalence of diabetes in Tejuosho market in Lagos. It appears that diabetes prevalence is much higher in Nigeria compared to her neighbouring sub-Saharan countries.

Dyslipidaemia was prevalent in almost half of the respondents. In addition, age and the lifestyle risk factors predicted those with dyslipidaemia. Dyslipidaemia usually co-exists with obesity and both are
important in the pathway to hypertension and atherosclerotic vascular disease. Ogunbode et al.\textsuperscript{59} have coined a mnemonic termed “WASHED” for NCD lifestyle modification and health education in those with obesity in primary care settings. “WASHED” stands for weight control, alcohol reduction, smoking cessation, health promotion, exercise and diet. We have shown in our study the important role of smoking and physical activity as dominant risk factors of dyslipidaemia. We believe that health promotion and education in the community and primary care settings geared towards smoking cessation, increased physical activity and healthy diet would play critical roles in stemming the tide of atherosclerotic vascular diseases in Nigeria. This will require concerted efforts by stakeholders and policy makers if Nigeria is to achieve the 2025 voluntary targets of the Global NCD Action Plan.\textsuperscript{57}

This study is an important contribution to the surveillance of NCD risk factors in Nigeria as most of the observations were based on validated tools than self-reported information. Even though it is not a nationally representative survey, an assessment of one community in one of the largest cities in Nigeria can give a minuscular view of the drivers of NCDs within the larger population until the time when nationally representative surveys would be conducted in Nigeria. Although, obesity is one of the four metabolic risk factors of NCDs, it was not assessed in this study However, we have measured blood cholesterol levels which are more important in the pathophysiologic pathway to cardiovascular diseases.\textsuperscript{60,61} Cross tabulation of behavioural risk factors by socio-demographic factors was not computed which makes it difficult to observe the categories of participants that constitute more in one habit or the other. We perhaps underestimated the level of physical inactivity in our study because of the subjective method of assessment in the use of self-reported questionnaires. For future studies, using more objective means of assessing physical activity like pedometers and accelerometers could give better result.

In conclusion, we have shown the prevalence of common NCDs and their risk factors in a representative community in Nigeria’s most busy city. Many of these risk factors are modifiable and this underscores the importance of health promotion and education in reducing the burden of NCDs in Nigeria. Larger surveys of these nature are needed for policy formulation. We plan to conduct more
surveys across Nigeria’s 6 socio-political regions in the future.

Abbreviations
aOR
adjusted odds ratio
DBP
Diastolic blood pressure
LMIC
Low- and middle-income countries
OR
Odds ratio
SBP
Systolic blood pressure
WASHED
weight control, alcohol reduction, smoking cessation, health promotion, exercise and diet
WHO
World Health Organisation

Declarations
Ethics approval and consent to participate
The study protocol and conduct adhered to the principles laid down in the Declaration of Helsinki.

Ethical clearance was obtained from the Lagos State Ministry of Health, Nigeria. Written informed consent was obtained from all study participants.

Consent for publication
Not applicable

Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests
The authors declare that they have no competing interests

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Authors’ contribution
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