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*Research Article*

## **Knowledge and Perception of Cardiovascular Disease and its Risk Factors among Secondary School Adolescents in Ibadan North Local Government, Southwestern Nigeria.**

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### **ABSTRACT**

Cardiovascular disease (CVD) is a global leading cause of mortality, with increasing prevalence among the younger population in developing countries. Though its clinical manifestation is often seen in adulthood, its risk factors develop during adolescence, hence the need for urgent intervention among this sub-population. This study employed a mixed method design (cross-sectional survey with 442 participants and qualitative study with 43 participants) to investigate the knowledge and perception of CVD and its risk factors among adolescents. Multi-stage sampling technique was used to recruit participants for the survey while participants for the qualitative phase were purposively selected. Two self-administered questionnaires were used to obtain information on knowledge and perception of participants. Data from the quantitative survey were analyzed using descriptive statistics of mean, standard deviation and percentages while qualitative data were analyzed using content thematic analysis. The cross-sectional survey showed that 82.4% of the participants had low and average knowledge while only 17.6% of the participants had high knowledge of CVD and its risk factors. Also, 72.7% had a poor perception of CVD and its risk factors. Smoking was the most commonly reported (91%) risk factor for cardiovascular disease. The qualitative study corroborated and explained findings from the quantitative study, as participants demonstrated low knowledge and poor perception of CVD and its risk factors. There is an urgent need for development of CVD awareness, prevention and health education programs in secondary schools so that adolescents can adopt healthier lifestyles, in order to prevent the development of CVD in future.

**Keywords:** *Knowledge, perception, cardiovascular disease, cardiovascular disease risk factors, adolescents, Nigeria*

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### **INTRODUCTION**

Cardiovascular disease (CVD) is a major public health concern of the twenty-first century and the global leading cause of death (Boateng *et al.*, 2017). Cardiovascular disease alone accounts for 31% of global deaths and causes the death of 17.9 million people annually (World Health Organization, 2017). The development of CVD is greatly dependent on the presence of risk factors (National Health Service, 2018). In developing countries, the prevalence of CVD has increased among younger adults aged 25 to 44 years, who are the working population in comparison with the older population of adults aged 65 years and above in developed countries (Leppert *et al.*, 2019). This change has been linked to a rise in unhealthy lifestyle factors such as poor diets, physical

inactivity, smoking and alcohol use (Hancock *et al.*, 2011; Andersson and Vasan, 2018).

The risk factors for CVD are often developed during childhood and adolescence and established in adulthood (Bogdańska *et al.*, 2005). Therefore, early identification of its risk during childhood and adolescence could help prevent or delay the onset of CVD (Hong, 2010). Adolescents who are between the ages of ten to nineteen (World Health Organization, 2019) go through changes in their social environment and social life as they transit to adulthood. This is evident as they struggle to establish regular eating and sleeping patterns which in turn results in low exercise level, poor feeding habits, weight gain and inadequate sleep (Frech, 2013). Insufficient awareness of CVD and its risk factors in the general population poses a barrier to the effective

prevention and treatment of CVDs (Boateng *et al.*, 2017). Therefore, identifying the knowledge gaps about CVD and its perception in adolescents is pivotal to the development of a CVD prevention program for this sub-population (Odunaiya *et al.*, 2015).

Improved knowledge of a condition and predisposition to it has been shown to improve adherence to lifestyle changes (Safeer *et al.*, 2006). The knowledge of CVD and its risk factors are essential for the primary and secondary prevention of CVD (Magnani *et al.*, 2018). At least one in three adolescents and young adults have limited health literacy and thus, tend to exhibit poor health behaviours (Magnani *et al.*, 2018). Good knowledge and understanding of CVD will lead to better health-seeking behaviour, which will in turn influence judgements and decisions in CVD prevention and control (Angosta *et al.*, 2014; Kanungo *et al.*, 2015). Cardiovascular disease poses an enormous economic burden due to its effect on the working population and the high cost of its care (Akintunde *et al.*, 2014). For a developing country like Nigeria, CVD prevention is therefore the best approach. In this study, we sought to investigate the knowledge and perception of adolescents in selected Nigerian public and private secondary schools about CVD. It is hoped that findings from this study will facilitate the development of CVD awareness and prevention program for this sub-population.

## MATERIALS AND METHODS

**The Setting:** This study utilized a mixed method design, involving a cross-sectional survey and an exploratory qualitative study. The study involved adolescents from seventeen randomly selected secondary schools (nine private schools and eight public schools) from the twelve wards in Ibadan North Local Government, Nigeria.

**Sample Size and Sampling Procedure:** Multi-stage sampling was used to recruit participants for the cross-sectional survey while participants for the qualitative study were purposively selected. Sample size for the survey was calculated using Slovin's formula  $n = \frac{N}{1+N(e^2)}$  where  $n$ = required sample size,  $N$ = Estimated total population of secondary school students in Ibadan North Local Government is 52800, and  $e$ =confidence level is 0.05 (Cochran, 1977). A minimum sample size of 397 was deemed fit for the cross-sectional survey but to take care of non-response, 442 participants were recruited for the survey while 43 participants were purposively selected for the exploratory qualitative study.

**Instruments for Data Collection:** The quantitative data were collected using The Heart Disease Fact Questionnaire and The Perception of Risk of Heart Disease Scale.

**Heart Disease Fact Questionnaire (HDFQ):** is a 25-item questionnaire that measures the knowledge of major risk factors for the development of CVD. It demonstrates good internal consistency (Kuder-Richardson-20 formula=0.77) as shown in a group of 524 people with diabetes. It also demonstrates good content and face validity and test retest reliability was .89. (Wagner *et al.*, 2005). This instrument was self-administered and was used to obtain information from

participants on the knowledge of CVD and its risk factors. Each item on the scale has "true", "false" or "I don't know" responses. Scores were calculated by adding the total number of correct answers. Incorrect response and "I don't know" were given a score of zero. Higher scores indicated higher level of knowledge. Scores of 0-12 were classified as low level of knowledge, scores of 13-17 were classified as average level of knowledge and scores of 18-25 were classified as high level of knowledge.

**The Perception of Risk of Heart Disease Scale (PRHDS):** is a 20-item instrument that assesses an individual's perception of the probability of developing a heart disease (Ammouri and Neuberger, 2008). Testing with a primary care sample of 295 persons aged fifteen years and above without heart disease showed internal consistency values ranging from .68 to .80. The total scale alpha was .80. Evidence of the instrument's stability over time was supported by subscale test-retest reliabilities ranging from .61 to .76. Construct validity was also shown by attaining a positive correlation between PRHDS and the Health Promotion Lifestyle Profile II ( $r = .20$  to  $.39$ ,  $p < .01$ ). Scoring was done on a four-point Likert scale and each item score ranged from 1 to 4, with 1 being strongly agree and 4 being strongly disagree. Reverse scoring was used for items 6,10,11,12,13,14,15,16,17,18,19,20 (Ammouri and Neuberger, 2008). This instrument was used to obtain information from participants on their perception of CVD and its risk factors. Correct answers to questions indicated positive perception while wrong answers indicated negative perception.

**Data Collection Procedure:** The HDFQ and the PRHDS were self-administered by the 442 participants for the cross-sectional survey. Socio-demographic information of age, sex, name of school, level of school (senior or junior) was also recorded with a biodata form. The exploratory qualitative study was achieved through focus group discussions, aimed at exploring the adolescents' perception of CVD and its risk factors. We decided to use focus group discussion as the matter relates to adolescents' perspective of a phenomenon. Focus group discussion is valuable for research relating to group norms, meanings and processes. It is useful in generating information on collective views and the meanings that lie behind those views. It is also useful in generating a rich understanding of participants' experiences and beliefs. We needed to understand knowledge of and perceptions about CVD and its risk factors among adolescents in Ibadan. The qualitative aspect of the study involved forty-three participants from two randomly selected secondary schools, in four focus groups. The focus group discussions took place at the locations of the respective schools. Three of the focus groups had ten participants each, while one focus group had thirteen participants. Though the focus groups appeared larger than usual, the groups were effectively managed. A focus guide consisting of questions exploring various dimensions of participants' perspective of CVD and risk factors was used. These questions only served as a guide, as the moderator asked other questions and used probes where necessary to stimulate the discussions. One of the authors, knowledgeable in the

techniques of focus group discussion, moderated the focus group discussions. Notes were taken by an independent observer and all information given by the participants during the discussions was recorded using a tape recorder. Each session of the group discussion lasted for about thirty minutes. The discussion could not be longer than that because most of the participants were not familiar with the term “Cardiovascular disease”. Therefore, we could only explore information from very few of the participants who had some idea of CVD. We decided to find explanation for possible lack of awareness in the course of the discussion too. The recorded information from the discussions was transcribed verbatim by a transcriptionist and the transcribed work served as the basis for analysis. Data check and validity was done by comparing the recorded conversation with the notes taken.

**Data Management and Analysis:** Data were collected over a period of about three months. Quantitative data were coded and entered into the Excel spreadsheet. Descriptive statistics of mean, standard deviation, frequency, percentages, bar charts and range were used to summarize the results. The focus group discussions were recorded and later transcribed verbatim. Content and context analysis using a thematic approach was used for analysis. The transcript was first read for identification of trends and differences across transcript and descriptions were applied to relevant sections of the text. These descriptions were then interpreted to suggest possible meanings and finally, they were grouped into themes. This analysis was done by an expert in the field of qualitative studies. The analyzed text was studied by two of the authors individually with the note taken and later the two authors discussed and agreed on developed themes. Generally, our first thought was that participants in the groups were ignorant of CVD and risk factors. We naturally expected private school students to have more knowledge but surprisingly they did not have better knowledge. A major challenge of our educational system was brought to fore by the qualitative component of this study. Given the resulting conversations, analysis took an inductive, exploratory approach.

**Ethical Considerations:** Ethical approval was sought and obtained from the University of Ibadan/University College Hospital (UI/UCH) Research Ethics Committee. Approval and informed consent was obtained from school authorities who had informed the parents and assent was obtained from the participants.

**RESULTS**

A total of 442 copies of each of the questionnaires was distributed to the participants in their various schools. There was 100% response rate, as all the questionnaires were completely filled and thus deemed fit for analysis.

**Socio-demographic Data:** 442 secondary school adolescents participated in the cross-sectional survey. 200 were males and 242 were females. 234 of the students were from private schools, while 208 were from public schools. 221 were junior secondary school students while 221 were senior secondary school students. Their mean age was 14.35±1.759 (Table 1).

It was observed that majority of the participants (82.4%) had low and average knowledge of CVD and its risk factors

**Table 1:** Socio-demographic Characteristics of Participants (N=442)

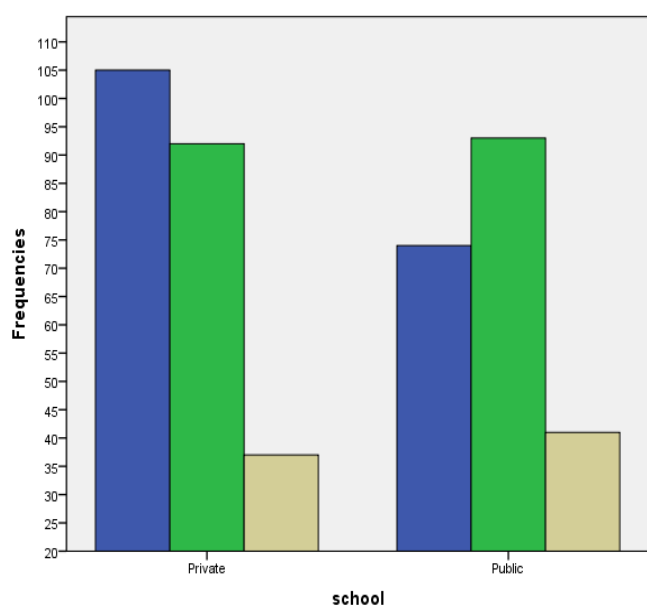
Variables	Frequency (n)	Percentage (%)
<b>Age (years)</b>		
10-14	208	47.5
14-19	210	52.5
<b>School</b>		
Private School	234	52.9
Public School	208	47.1
<b>Class</b>		
Junior Secondary	221	50.0
Senior secondary	221	50.0
<b>Sex</b>		
Male	200	45.2
Female	242	54.8

**Knowledge of Cardiovascular Disease and its Risk Factors among Participants:** It was observed that 179 (40.5%), 185 (41.9%) and 78 (17.6%) of the participants had low, average and high level of knowledge of CVD and its risk factors respectively. The mean knowledge of the participants was 13.33±4.063 (Table 2). For private secondary schools, 37 (47.4%), 92 (49.7%) and 105 (58.7%) had high, average and low level of knowledge respectively while for public secondary schools, 41 (52.6%), 93 (50.3%) and 74 (41.3%) participants had high, average and low level of knowledge respectively (Figure 1). For junior secondary schools, 42(53.8%), 107 (57.8%) and 72 (40.2%) of the participants had a high, average and low level of knowledge respectively. For the senior secondary schools, 36 (46.2%), 78 (42.2%) and 107 (59.8%) had high, average and low level of knowledge respectively (Figure 2).

**Table 2:** Knowledge Level of Participants

Variables	Frequency (n)	Percentage (%)		
<b>Knowledge level</b>	<b>Low</b>	179	40.5	
	<b>Average</b>	185	41.9	
	<b>High</b>	78	17.6	
<b>Knowledge score</b>	<b>Mean±S.D</b>	13.33±4.063	<b>Minimum</b>	<b>Maximum</b>
			2.00	21.00

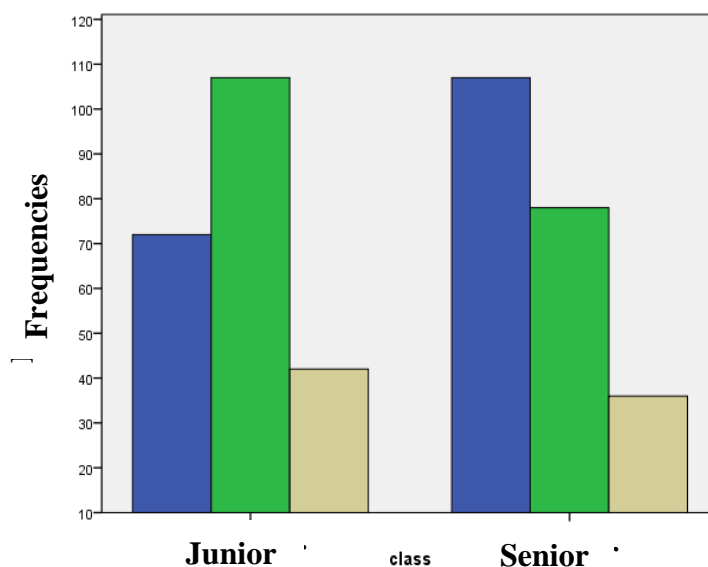
Most (58.7%) of the private school adolescents had low knowledge of CVD while majority (102.9%) of the public-school adolescents had average and high knowledge. A high percentage (59.8%) of the senior school adolescents had low knowledge of CVD and its risk factors while majority (57.8%) of the junior school students had average knowledge.



**Figure 1:** Distribution of Participants' Knowledge Between Adolescents in Public and Private Schools

From the items on the Heart Disease Fact Questionnaire, 402 participants (91%) knew smoking is a risk factor for heart disease and 343 (77.6%) participants knew that a person who stops smoking will lower their heart disease. Only 119 (26.9%) participants knew that men with diabetes do not have

a higher risk of heart disease than women with diabetes and 131 (29.6%) participants knew that if your good cholesterol (HDL) is high, you are not at risk for heart disease (Table 3).



**Figure 2:** Distribution of Participants' Knowledge Between Classes (junior and senior)

**Table 3:** Participants' Knowledge of Specific Cardiovascular Disease Risk Factors (N=442)

Statements	Correct	Incorrect
	n (%)	n (%)
Smoking is a risk factor heart disease (True)	402 (91)	40(9)
A person who stops smoking will lower their risk of heart disease (True)	343 (77.6)	99(22.4)
If your blood sugar is high over several months it can cause your cholesterol level to go up and increase your risk of heart disease (True)	301(68.1)	141(31.9)
High blood sugar puts strain on the heart (True)	300 (67.9)	142 (32.1)
A person who has diabetes can reduce their risk of developing heart disease if they keep their blood sugar levels under control (True)	297 (67.2)	145 (32.8)
Regular physical activity will lower a person's chance of getting heart disease (True)	293 (66.30)	149 (33.7)
High blood pressure is a risk factor for heart disease (True)	290 (65.6)	152 (34.4)
Keeping blood pressure under control will reduce a person's risk for developing heart disease (True)	288 (65.2)	154 (34.8)
A person who has diabetes can reduce their risk of developing heart disease if they keep their blood pressure under control (True)	282 (63.8)	160 (36.2)
People with diabetes tend to have low HDL (good) cholesterol (True)	164 (37.1)	278 (62.9)
Being overweight increases a person's risk for heart disease (True)	152 (34.4)	290 (65.6)
People with diabetes rarely have high cholesterol (False)	148 (33.5)	294 (66.5)
A person always knows when they have a heart disease (False)	137 (31.0)	305 (69.0)
If your good cholesterol (HDL) is high you are at risk for heart disease (False)	131 (29.6)	311 (70.4)
Men with diabetes have a higher risk of heart disease than women with diabetes (False)	119 (26.9)	323 (73.1)

**Table 4:**  
**Overall Distribution of Participants' Responses to Perception of CVD and its Risk Factors (N=442)**

Statements	Strongly disagree and Disagree	Strongly agree and Agree
	n (%)	n (%)
There is a possibility that I have heart disease	396 (89.6)	46 (10.4)
There is a good chance I will get heart disease in the next 10 years	422 (95.5)	20 (4.6)
A person who gets heart disease has no chance of being cured	353 (79.9)	90 (20.2)
I have a high chance of getting heart disease because of my past behaviours	376 (85)	66 (15)
I feel sure that I will get heart disease	416 (94.1)	26 (5.9)
Healthy lifestyle habits are unattainable	121 (27.4)	321 (72.6)
It is likely that I will get heart diseases	403 (91.2)	39 (8.9)
I am at risk for getting heart disease	317 (83.1)	75 (16.9)
It is possible that I will get heart disease	385 (87.1)	57 (12.9)
I am not doing anything now that is unhealthy to my heart	253 (57.2)	189 (42.8)
I am too young to have heart disease	209 (47.3)	233 (52.7)
People like me do not get heart disease	158 (35.7)	284 (64.2)
I am very healthy so my body can fight of heart disease	265 (60)	177 (40)
I am not worried that I might get heart disease	188 (42.5)	254 (57.5)
People my age are too young to get heart disease	148 (33.4)	294 (66.6)
People my age do not get heart disease	113 (25.6)	329 (74.4)
My lifestyle habits do not put me at risk for heart disease	261 (59.1)	181 (41)
No matter what I do, if I am going to get heart disease, I will get it	111 (25.1)	331 (74.9)
People who don't get heart disease are just plain lucky	180 (40.7)	262 (59.2)
The causes of heart diseases are unknown	131 (29.6)	311 (70.4)

**Perception of the Risk of Cardiovascular Disease:** Majority (95.5%) of the participants did not agree that there was a good chance they will get heart disease in the next 10 years. Also 396 (89.6%) didn't agree that there was a possibility that they had heart disease. 329 (74.4%) participants did not disagree that people their age are too young to get heart disease, 321 (72.6%) participants did not disagree that healthy lifestyles are unattainable. Also, 261 (59.1%) participants did not agree that their lifestyle habits do put them at risk for heart disease. 311 (70.4%) participants agreed that the causes of heart disease are unknown (Table 4).

**Exploration of Participants' Knowledge and Perception of CVD and its Risk Factors:** The focus group discussions employed in the study was useful for further explanation and exploration of knowledge and perception of CVD and its risk factors among the participants. During the discussions, knowledge of CVD, perception of CVD, problems associated with CVD, prevention of CVD and treatment of CVD were explored. 43 students (20 males; 23 females) participated in the focus group discussions. There were four focus groups, with the first group consisting of thirteen participants (5 males; 8 females), the second group consisting of ten participants (5 males; 5 females), the third group discussion consisting of ten participants (3 males; 7 females), and fourth group discussion consisting of ten participants (7 males; 3 females). For the purpose of the discussion, participants in each group were called by numbers; 1,2,3 till 10 or 13, as

appropriate. Their socio-demographic characteristics and information on how they got to know about CVD was obtained after the discussion. Participants were asked questions in relation to the aim of the study and five themes along with four sub-themes was generated (Table 5).

### Knowledge of Cardiovascular Disease

**Definition of Cardiovascular Disease:** Most of the participants stated that they did not know about CVD nor had heard about it. Most participants did not know that heart disease is CVD. They could not talk about CVD until the term was replaced with "heart disease". A few participants could make contributions about their knowledge of CVD, while a few could only say it is a "disease of the heart". This is as seen in the excerpts below:

*"I don't know anything about it, I've never heard of it"* (Participant 13, FGD 1)

*"I don't know anything about it"* (Participant 12, FGD 1)

*"I've never heard of it before"* (Participant 1, FGD 1)

*"Cardiovascular diseases is a disease that affects the heart, lungs and oesophagus"* (Participant 8, FGD 1)

*"In my own opinion, I think that heart disease is the disease that can damage the heart unexpectedly"* (Participant 1, FGD 2)

*"It is a disease that can affect the heart, it can cause a lot of problems, it can lead to death"* (Participant 3, FGD 2)



“Heart disease is a disease which damage the heart, for example if one smoke, the heart.....is going to be black and it causes heart disease” (Participant 5, FGD 2)

“Cardio is like heart muscle, diseases of the heart, something like that” (Participant 3, FGD 3)

“I think heart disease, disease of the heart” (Participant 1, FGD 3)

“heart disease, this is a type of disease that affects the heart and make human being die quickly and faster” (Participant 10, FGD 4)

“It is a disease that stops them from working and it can lead to untimely death” (Participant 9, FGD 4)

“Heart disease is a disease that, it may not really affect the heart alone, it may affect some of the other parts since the blood is gotten from the heart so like the blood will stop flowing and they can lead to clotting which can cause death” (Participant 6, FGD 4)

A participant thought that CVD was the same as respiratory conditions. This is as shown in the excerpt below:

“I know that it destroys people’s lungs because as it has happened because you will not be able to breathe well like some people who has asthma and if and it.... to breathe and like they breathe a little bit, and they have and you give them some drugs” (Participant 1, FGD 4)

**Table 5:**  
Themes and Sub-themes Generated from the Discussions

S/N	Themes	Sub-themes
1	Knowledge of cardiovascular disease	Awareness, meaning of cardiovascular disease, causes and consequences.  Causes or risk factors of cardiovascular disease
2	Perception of cardiovascular disease risk factors	Individual perceived risk of developing cardiovascular disease and consequences of cardiovascular disease.  Risk of young people developing cardiovascular disease
3	Problems associated with cardiovascular disease	
4	Management of cardiovascular disease	
5	Prevention of cardiovascular disease	

**Risk factors for Cardiovascular Disease:** The participants stated that they did not know what “risk factors” were but when asked of the “causes” of CVD, some contributions were made. A few of the participants mentioned high blood pressure, excessive alcohol, excess fat, smoking, drug abuse. This is as seen in the excerpts below:

“high blood pressure” (Participant 10, FGD 2)

“Smoking” (Participant 9, FGD 2)

“I don’t know” (Participant 8, FGD 2)

“Excessive alcohol” (Participant 7, FGD 2)

“If someone drink too much cold water” (Participant 2, FGD 2)

“If someone smoke Indian hemp” (Participant 4, FGD 2)

“When someone smoke heroin” (Participant 5, FGD 2)

“if someone takes cocaine” (Participant 6, FGD 2)

“Drinking of dangerous substances like tramadol” (Participant 1, FGD 2)

“cholesterol” (Participant 4, FGD 3)

“Too much sugar” (Participant 6, FGD 3)

“Excess fat” (Participant 9, FGD 3)

“Smoke” (Participant 4, FGD 4)

Some participants were also of the opinion that bad food can cause CVD

“expired food” (Participant 1, FGD 2)

“rotten food” (Participant 5, FGD 2)

“Like canned stuffs” (Participant 6, FGD 2)

**Perception of Cardiovascular Disease Risk Factors**

**Individual Perceived Risk of developing Cardiovascular disease:**

Participants were asked if they had any risk factors that could predispose them to CVD. Their responses are seen in these excerpts:

“no idea” (Participant 5, FGD 4)

“no” (Participant 6, FGD 6)

**Risk of Young People Developing CVD:**

Participants mentioned things young people do that put them at risk of developing CVD in future. Some of the factors mentioned are seen in the excerpts below:

“drugs” (Participant 7, FGD 3)

“too much drinks” (Participant 9, FGD 3)

“Stress....overworking (school work)” (Participant 1, FGD 3)

“ehmm ehmm, gases like ..” (Participant 5, FGD 4)

“Smoke ..... from fire and cigarette” (Participant 1, FGD 4)

A participant mixed up risk of developing CVD with respiratory conditions as seen in this excerpt:

“convulsion. When you breathe, like me as an example, I am an asthmatic patient so I’m not really triggered but whenever I see dust or smoke that’s when the trigger comes” (Participant 6, FGD 4)

**Problems Associated with Cardiovascular Disease:**

During the discussions, participants mentioned that the problems associated with CVD are heart failure, stroke, diabetes, high blood pressure, death, pain, activity limitation. This is seen in the excerpts below:

“like heart failure” (Participant 8, FGD 1)

“Lack of appetite” (Participant 1, FGD 2)

“You won’t be able to do any activities you have been doing before because of the heart disease. For example, if you run now your heart is going to be doing you something” (Participant 5, FGD 2)

“If you have heart disease you won’t be able to breathe well” (Participant 10, FGD 2)

“It can lead to death” (Participant 3, FGD 2)

“It can cause discomfort, the person will not be able to enjoy his life” (Participant 9, FGD 2)

“You can feel pain inside you” (Participant 7, FGD 2)

“maybe cardiac arrest.....stroke” (Participant 9, FGD 3)

“diabetes” (Participant 7, FGD 4)

“high blood pressure” (Participant 4, FGD 4)

**Management of CVD:** A participant mentioned surgery as the management of CVD, while others had nothing to say about its management.

“it can be operated through surgery” (Participant 8, FGD 1)

### **Prevention of Cardiovascular Disease**

Participants mentioned avoidance of smoking and alcohol, regular medical check-up as CVD preventive measures. This is seen in the excerpts below:

“By not taking alcohol” (Participant 5, FGD 2)

“Look at the NAFDAC number of products” (Participant 3, FGD 2)

“Avoid smoking” (Participant 8, FGD 2)

“Checking the expiry date of products before using” (Participant 7, FGD 2) “Avoid rotten food” (Participant 10, FGD 2)

“dust, smoke, ehm and not really smoke from only cigarettes it also comes from car, vehicle exhaust and the likes” (Participant 6, FGD 4)

“we should be careful of...where we stay like cause.....it can determine....of what we breathe” (Participant 9, FGD 4)

“like when we are having if we are having , if we are already seeing the symptoms of some diseases we should go for check-up so that we can know what to do” (Participant 10, FGD 4)

## **DISCUSSION**

Findings from the study revealed that majority of the adolescents did not have high knowledge of CVD. This is in keeping with findings from a study by Bogdanska *et al.*, (2005) among secondary school students in Poland where poor knowledge of CVD was also reported. A study from Nigeria by Odunaiya *et al.*, (2020) among university students showed that the participants had fair knowledge of CVD and its risk factors. However, a study among college students in the United States of America found that the students had good knowledge of CVD and its risk factors (Tran *et al.*, 2017). The differing factor between findings from the US college students and that of this study is attributable to the fact that America has adopted the teaching of CVD prevention and education programs in their schools, thereby improving CVD awareness and knowledge among the students.

Participants demonstrated good knowledge of some specific CVD risk factors. Smoking, high blood pressure and physical inactivity were identified as risk factors for CVD. This finding corroborates the outcome of previous studies where participants identified smoking, high blood pressure and physical inactivity as risk factors for CVD (Bogdanska *et al.*, 2005; Cioe *et al.*, 2014, Amadi *et al.*, 2018). This could be due to the high prevalence of hypertension in Nigeria, as studies have shown that one out of every two Nigerian adults is hypertensive (World Health Organization, 2015), thus making high blood pressure a household name in Nigeria. Hypertension and CVD share common risk factors therefore many young people could identify these risk factors. There has also been public campaign against smoking and increasing

awareness of the importance of physical activity among Nigerians, hence the knowledge. However, participants had poor knowledge about diabetes, overweight and cholesterol as risk factors for CVD. Participants could not identify the relationship between overweight and CVD and the importance of obesity as a CVD risk factor. This finding is similar to a study among Croatian Medical students where participants also had low awareness of obesity as an important CVD risk factor (Reiner *et al.*, 2012). Other studies by Cioe *et al.*, (2014) and Akintunde *et al.*, (2015) reported similar findings, as participants had poor knowledge of diabetes and cholesterol as CVD risk factors. The cross-sectional survey revealed that participants had knowledge about some CVD risk factors, they however could not tell how the risk factors related to CVD and the interrelationship among these factors in the development of CVD. There is therefore an urgent need for adolescents to be educated on CVD and its risk factors. This is important because the development of CVD risk factors often begins during adolescence.

Findings from the study showed that the overall perception of the risk of developing heart disease among the participants was negative, only few of the participants had a positive perception of the risk of developing heart disease. This result is similar to a study conducted among college students in the United States of America where most of the participants had negative perception of their risk for cardiovascular disease (Tran *et al.*, 2017). However, this result differs from a study conducted among undergraduate students in Ethiopia where most participants showed positive perception towards CVD risk factors (Abdela *et al.*, 2019). This difference could be associated to some religious beliefs held in Nigeria where people do not want to admit their risk of developing any form of disease, even when they are at risk or actually have the disease.

Most participants had a negative perception of their past behaviours putting them at risk of getting CVD. Some however believed that their lifestyle put them at risk of CVD and that a healthy lifestyle is unattainable. Majority of the participants were not worried that they might get a CVD, being adolescents and some believed no matter what they do if they are to get heart disease, they will get it. Participants agreed that people who don't get CVD are plain lucky and that people their age are too young to get the disease. They showed a poor understanding of the concept of risk which is similar to findings from a study among adults in South Africa where participants had poor knowledge and understanding of the concept of risk (Surka *et al.*, 2015). The participants' low level of knowledge about CVD and its risk factors was observed to have had an impact on their perception, as most of the participants believed that they couldn't get heart disease in the present day and in the future. But in the event that they did, it would be by reason of chance, not necessarily as a result of their lifestyle. This finding is similar to a study among patients with Rheumatoid arthritis where those that underestimated their risk for CVD also had the lowest level of knowledge of CVD (Boo *et al.*, 2017).

The findings from this study showed that public school adolescents had higher mean knowledge scores and higher proportion of participants with high knowledge level than private school participants. Junior school participants also had

higher mean knowledge scores and higher proportion of participants with high knowledge level than senior school participants. This finding could not be explained scientifically. However, findings from the qualitative study gave an insight to possible reasons for this difference. Some of the participants from public schools made it clear during the qualitative study that out of personal motivation and interest, they decided to do some search on information about CVD. In Nigeria, it is commonly believed that the standard of education in public schools is poorer than that of private schools and teaching is not as effective and efficient in public schools as in private schools. However, our finding from the qualitative component of this study showed that brilliant adolescents in public schools, who could not afford to be in private schools due to parents' inability to afford the fees, could be more self-motivated to study hard and to search for knowledge. This could have accounted for why many public-school adolescents have more knowledge than private school adolescents. It is also possible that since private school adolescents are better taught, they may not be diligent enough in self-directed learning like the public-school adolescents.

This aspect of the study provided more insight into the participants' knowledge and perception of CVD and its risk factors in addition to the information obtained from the cross-sectional survey. Findings from the qualitative study revealed that participants did not have good knowledge of CVD and its risk factors, which buttresses the findings from the cross-sectional survey. Only a few participants knew that the term CVD includes heart disease and some thought CVD implied respiratory conditions. As regards the risk factors for CVD, participants could only relate to "causes" of CVD instead of "risk factors". They mentioned high blood pressure, smoking, excessive alcohol, excess fat, smoking and drug abuse as possible causes of CVD.

The perception of CVD risk factors as it relates to young people was also explored. The participants could not tell if they had any risk factors that could predispose them to CVD. This could be as a result of their limited knowledge of CVD risk factors and how it relates to their personal life. However, when asked the factors that could increase the risk of young people developing CVD, the response included drugs, "too much soft drinks", stress and smoke. The response on stress as a risk factor for CVD is similar to the result from a study among secondary school students in Poland where 85% of the participants agreed that stressful work can increase the risk of CVD (Bogdanska *et al.*, 2005). On problems associated with CVD, participants mentioned heart failure, lack of appetite, reduced ability to carry out activities of daily living, breathing difficulty, death, pain, discomfort, stroke, cardiac arrest. However, some participants confused problems associated with CVD with the risk factors for CVD, for example, diabetes and high blood pressure. This is attributable to participants' low level of knowledge about CVD risk factors. On prevention of CVD, participants demonstrated poor knowledge by dwelling more on food, in terms of expiration date, NAFDAC authorization, rotten food. This finding is similar to a study by Pikala *et al.* (2011) where participants also had poor awareness of CVD prevention methods and majority could not name any specific approach to CVD prevention. On the management of CVD, participants demonstrated poor

knowledge and only one participant was able to identify surgery as a form of management. This is in contrast to findings from a study in the United States by Katz *et al.* (2019) where majority of the participants were able to identify healthy diets, exercise and compliance with health care providers' instructions as strategies in the management of CVD. This widespread knowledge on CVD management among teenagers in the US is attributable to the CVD awareness and education teaching they receive at school.

In conclusion, majority of adolescents in this study had poor knowledge or at best average knowledge of CVD and its risk factors. They also had negative perception of CVD and risk factors. CVD epidemic may be looming in Nigeria, except there is an urgent awareness campaign of CVD and CVD prevention programs in secondary schools. This can be in the form of public health awareness and health education programs. Efforts should be made by relevant stakeholders in Nigeria to include CVD and its risk factors as a topic in a general studies subject, to be taught to all secondary school adolescents as part of their curriculum. Further studies are recommended to explore the socio-cultural determinants of knowledge and perception of CVD and its risk factors among Nigerian adolescents. We also recommend the replication of this study in the various geo-political zones of Nigeria

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