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Research Article

Risk and Determinants of Non-communicable Diseases Among Adolescents in Public and Private Secondary Schools in Port Harcourt, Rivers State, Nigeria

Fredrick Chuks Enuagwuna[1, 2, *], Efemierhere Tamaramiebibo Asiboje[1], Ifeoma Chinyere Ofurum[1], Shekinah Adonye Wilcox[3]

[1]Department of Preventive and Social Medicine, University of Port Harcourt, Port Harcourt, Nigeria
[2]Department of Community Medicine, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria
[3]College of Health Sciences, University of Port Harcourt, Port Harcourt, Nigeria

Abstract

Background: Non-communicable diseases (NCDs) are the leading causes of poor health and premature mortality worldwide. Although NCDs are majorly prevalent in middle to late adulthood, most lifestyle habits are started during adolescence a significant period of development. This research evaluated the risk and determinants of non-communicable diseases among adolescents in public and private secondary schools in Port Harcourt, Rivers State. *Methods*: The study used a comparative cross-sectional design to collect research data from 640 adolescents. Participants were selected through a multi-stage sampling technique and data was analysed with IBM Statistical Product for the Service Solution version 29. *Results*: Private and public school respondents report on NCDs (asthma, diabetes and high blood pressure) was 3.4% and 2.5% respectively. NCDs behavioural and metabolic risk factors were prevalent among both private and public school adolescents. Private school students exhibited higher prevalence of physical activity (75% vs. 61.6%), soft drink consumption (96.3% vs. 92.5%), alcohol consumption (45.6% vs. 36.9%), overweight (17.3% vs. 7.5%), obesity (5.9% vs. 1.6%), prehypertension (12.8% vs. 5%) and hypertension (6.6% vs. 1.6%). Conversely, public school students had higher prevalence of daily fruit intake (19.4% vs. 8.8%) and tobacco use (7.5% vs. 2.2%). Socioeconomic status, behavioural risk factors and metabolic risk factors were statistically significant ($p<0.05$). *Conclusion*: This study identified NCDs risk factors among adolescents that can lead to development of NCDs in adulthood, hence there is need for preventive measures that are targeted and data-driven to ensure adolescents adopt healthy lifestyles.

Keywords

Non-communicable Diseases, Risk Factors, Adolescents, Public Schools, Private Schools

[*]Corresponding author: drfred.enuagwuna@yahoo.com (Fredrick Chuks Enuagwuna)

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1. Introduction

Non-communicable diseases (NCDs) have become a major worldwide health concern, adding to the burden of morbidity and mortality among people. NCDs have a prolonged illness course that can lead to functional impairment and disability [1]. These chronic diseases account for about 70% of total annual deaths of which 77% occur in low and middle-income countries. This is due to the greater populations of people with NCDs in these regions with those in the working-age accounting for the highest percentage of these deaths [2]. The priority NCDs to the World Health Organization (WHO) are cardiovascular diseases (CVDs), diabetes, cancers, and chronic respiratory disorders (CRDs). Global health estimates from WHO [3] indicated that NCDs cause 44% of deaths worldwide from cardiovascular disease, 9% from cancer, 9% from chronic respiratory disorders, and 4% from diabetes. Nigeria had an estimated 792,600 deaths from NCDs in 2008, according to the Global Status Report on NCDs [4].

In countries like South Africa, Nigeria and Ghana the prevalence of NCDs is on the rise even as these countries are still struggling with the prevention and management of infectious and poverty-related diseases [5]. NCDs are predicted to overtake infectious and poverty-related diseases in Africa by 2030 [3]. Deaths from chronic noncommunicable diseases are already predominant in several developing countries, like Pakistan and India [3].

Although NCDs mostly affect middle-aged and older adults, lifestyle habits formed during adolescence contribute to approximately 70% of premature deaths in adulthood [6]. A systematic review showed a growing burden of NCDs among children and adolescents, with a projected global impact on over 2.1 billion individuals in this age group [7]. Adolescents comprised 1.2 billion of the world's population in 2012 [8] and 21.5% of Nigeria's population as of 2013 [9].

NCDs result from a combination of non-modifiable and modifiable risk factors. Non-modifiable factors include age, gender, race, ethnicity, and genetics [5]. Modifiable factors encompass behavioral aspects such as tobacco use, unhealthy diet, harmful alcohol consumption, and physical inactivity, as well as metabolic factors like overweight/obesity, elevated blood pressure, high cholesterol, and elevated glucose levels [1].

The co-existence of multiple risk factors significantly increases an individual's likelihood of developing NCDs. Over 40% of adolescents and young adults drink alcohol, and nearly 50% of them continue to do so into adulthood [1]. Overweight and obesity during childhood and adolescence are associated with a substantially increased risk of physical morbidity and premature death later in life, including asthma, heart disease, and certain types of cancers. Adolescent high blood pressure is linked to several adult NCDs and ailments, which are diabetes, cardiovascular diseases, and early mortality [10].

In developing countries, the prevalence of chronic diseases among adolescents has also been linked to other factors such as rapid urbanization and economic growth. They have led to nutritional transition, marked by increased calorie intake and/or reduced physical activity [5]. Socioeconomic status plays a crucial role in physical health, significantly influencing the prevalence of overweight among children, adolescents, and adults [11]. A systematic review of the relationship between SES and four major NCD risk factors in low- and lower-middle-income countries (LLMICs) found that social factors significantly influence the burden of NCDs modifiable risk factors in these regions. [12].

Determining the prevalence and determinants of non-communicable diseases among adolescents in public and private secondary schools can inform tailored interventions that account for the unique challenges and opportunities present in each setting, contributing to more effective public health strategies. This study assessed and compared the prevalence and determinants of non-communicable diseases among adolescents in public and private secondary schools in Port Harcourt, Rivers State.

2. Methods

2.1. Study Design

This study employed a comparative cross-sectional design.

2.2. Study Settings

The study was conducted in Public and Private Secondary Schools in Port Harcourt, Rivers State. Rivers State is known for its diverse population and economic activities in Nigeria and Port Harcourt the capital is a major industrial area. It is located along the Bonny River in the Niger Delta region. English is the state's official language, and the major tribal languages spoken are Ikwerre, Okrika, and Kalabari. Rivers State consists of three Senatorial Districts—Rivers East, Rivers South-East, and Rivers West—comprising a total of 23 Local Government Areas (LGAs) with a projected population of 7.3 million according to National Bureau of Statistics in 2016. Port Harcourt is made up of Port Harcourt, Obio-Akpor and parts of Eleme local government area. Obio-Akpor local government area, with an estimated population of 665,000 in 2022 [13], comprises 17 wards and has 42 public and 742 registered private secondary schools [14].

2.3. Study Participants

The research was conducted among adolescents from 10-19 years of age in selected Public and Private Secondary Schools, and Wards in Obio-Akpor local government area in Port Harcourt, Rivers State.

2.4. Sample Size

The minimum sample size was estimated using the formula for two proportions [15].

$$n = \frac{(Z\alpha + Z\beta)^2 (P_1 (1- P_1) + P_2 (1 - P_2))}{(P_1 - P_2)^2}$$

Zα = the test statistic at a 95% confidence interval given as 1.96; Zβ =The critical value of the standard normal distribution at the desired power is 80% (0.84); P_1 = Prevalence of prehypertension and hypertension among adolescents in private school 2.44%; P_2 = Prevalence of prehypertension and hypertension among adolescents in public school 8.84% from a study in Anambra State, Nigeria [16]. With 20% non-response rate [17], the minimum sample size for this study was 250 for each group. However, the sample size was increased to 320 to ensure robust comparison as prevalence obtained was from a non-comparative study with unequal sample sizes [18, 19].

2.5. Sampling Technique

A multistage sampling procedure was used to select participants for the study.

The first stage involved selecting one local government area (LGA) at random from the two LGAs (Obio-Akpor and Port Harcourt) in the Port Harcourt metropolis using a balloting method. Obio-Akpor Local Government Area was selected for this study. The second stage involved the random selection of four wards from the seventeen wards in Obio-Akpor LGA by balloting, to ensure diverse student participation. The selected wards were 7, 9, 13, and 15. In the third stage, one community was selected from ward 7 (6 communities), 9 (2 communities), and 15 (5 communities), and two communities were selected from ward 13 (4 communities) using a simple random sampling method. The five communities selected were Rumuokoro (ward 7), Rumuepirikom (ward 9), Rumuosi (ward 15), and Rumuokuta/Mgbouba (ward 13). During the fourth stage, one secondary school was randomly selected from each of the five communities. A list of schools in each community was compiled, and the balloting method was used to select two public and three private secondary schools, totaling five schools. The fifth stage used simple random sampling to proportionately select 320 adolescents from the chosen public and private secondary schools. Students were selected from junior secondary class three to senior secondary class three. Each student was assigned a number, and those selected through balloting were included in the study according to the inclusion and exclusion criteria.

2.6. Study Instrument

A structured questionnaire, adapted from the WHO [20] standard STEPS instrument on NCDs and the study by Eviano [21], was self-administered and included both open-ended and multiple-choice questions. The questionnaire, written in English, was divided into three sections: Section A focused on socio-demographic characteristics, family structure and socio-economic status, as well as the personal and family medical history of respondents. Section B focused on lifestyle, while Section C on anthropometric measurements conducted on each student.

Weight and height were measured in metres and kilograms respectively. The respondents were instructed to remove their shoes, stand with their backs to the tape measure, and hold their heads up so they could stare straight ahead at a place on the opposite wall, head high. The respondent's head was covered with a flat rule to press the hair if any, flat. At the point where the flat rule hit the height was measured to the nearest centimetre and then converted to meters. Respondents were instructed to take off bulky empty their pockets, and go onto a weighing scale that was set up on a flat, firm surface to determine their weight. Body mass index (BMI) was calculated as a weight-to-height ratio for each respondent (Kg/m2). WHO BMI-for-age z cut-off categorized obesity as z score >2SD, overweight as z score >1SD to ≤ 2SD, normal z score between >-2SD to ≤ 1SD, and z score below -2SD is classified as underweight [22]. Respondent's blood pressure were measured in the left arm in a sitting position using a Digital blood pressure monitor. Two readings were taken, and the was calculated and recorded in mmHg. The average value was used to group respondents into normal (< 90th), pre-hypertension (>90th to ≤ 95th), and hypertension stage 1 (>95th to ≤ 99th).

The questionnaire was pretested in a secondary school in Port Harcourt local government area (PHALGA) outside the study area to ensure clarity and consistency of the questionnaire. The pretest data was in line with the hypotheses to be tested, and the information gathered accurately captured the intended variables relevant to the research questions. Respondents in the pretest provided consistent responses. Based on the responses, minor adjustments were made to the questionnaire to improve clarity. Cronbach's alpha values for the sections of the questionnaire were as follows: Family structure and socioeconomic characteristics (0.80), Personal and family medical history (0.75) and Lifestyle of respondents (0.83) at α=0.05. These values indicate that the items in each section effectively measured their intended constructs, ensuring the accuracy and consistency of the responses.

2.7. Data Analysis

Data collected from the participants were coded and entered into a Microsoft Excel spreadsheet, followed by statistical analysis using IBM Statistical Product and Service Solution (SPSS) software version 29.0. Both descriptive and inferential statistics were employed in the analysis. Descriptive statistics were presented as means and standard deviations for continuous variables such as blood pressure, weight, height, and body mass index. Categorical variables like sex, religion, and ethnicity were summarized using proportions and percentages. Inferential statistics were

conducted using the Chi-squared test to compare categorical variables and independent t-tests for continuous variables. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful relationship between the variables.

2.8. Study Duration

This study was carried out from September 2023 to September 2024

3. Results

Table 1 shows that majority of students, are in SSS 1 for private schools (40.94%) and SS 2 for public schools (41.25%), with SS 2 comprising 30.78%. Gender distribution differed between school types, with private schools having more females (58.44%) and public schools having more males (56.88%). Age distribution also varied, with private schools having a higher proportion of 10-14 year (74.06%) compared to public schools (55.63%). Ethnicity and religion distribution was relatively similar between school types, with Igbo and Christianity being the largest group in both.

Table 1. *Socio-demographic Characteristics.*

Variable	Private (N=320) n (%)	Public(N=320) n (%)	Total (N=640) n (%)
Class			
JSS 3	97 (30.31)	97 (30.31)	194 (30.31)
SS 1	131 (40.94)	91 (28.44)	222 (34.69)
SS 2	65 (20.31)	132 (41.25)	197 (30.78)
SS 3	27 (8.44)	0 (0.00)	27 (4.22)
Sex			
Male	133 (41.56)	182 (56.88)	315 (49.21)
Female	187 (58.44)	138 (43.12)	325 (50.78)
Age in group (years)			
10 - 14	237 (74.06)	178 (55.63)	415 (64.84)
15 - 19	83 (25.94)	142 (44.37)	225 (35.16)
Ethnicity			
Igbo	131 (40.94)	160 (50.00)	291 (45.47)
Yoruba	10 (3.12)	17 (5.31)	27 (4.22)
Hausa	6 (1.87)	0 (0.00)	6 (0.94)
Ikwerre	55 (17.19)	28 (8.75)	83 (12.97)
Kalabari	11 (3.44)	8 (2.50)	19 (1.41)
Others	107 (33.44)	107(33.44)	214 (33.44)
Religion			
Christianity	303 (94.69)	306 (95.62)	609 (95.16)
Islam	15 (4.69)	8 (2.50)	23 (3.59)
Traditional	2 (0.62)	6 (1.88)	8 (1.25)

Table 2. *Family Structure and Socio-economic Characteristics of Respondents.*

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	X2	P-value
Family type					
Monogamous	297 (92.8)	306 (85.6)	603 (94.2)	2.324	0.127
Polygamous	23 (7.2	14 (4.4	37 (5.8)		
Family size					
≤ 3	27 (8.4)	12 (3.8)	39 (6.1)		
4 - 6	178 (55.6)	187 (58.4)	365 (57.0)	6.144	0.046
> 6	115 (35.9)	121 (37.8)	236(36.9)		
Father's educational level					
No formal education	2 (0.6)	2 (0.6)	4 (0.6)		
Primary	13 (4.1)	9 (2.8)	22 (3.4)		
Secondary	37 (11.6)	43 (13.4)	80 (12.5)	7.042	0.134
Tertiary	159 (49.7)	133 (41.6)	292 (45.6)		
I don't know	109 (34.1)	133 (41.6)	242 (37.8)		
Mother's educational level					
No formal education	6 (1.9)	0 (0.00)	6 (0.9)		
Primary	4 (1.3)	8 (2.5)	12 (1.9)		
Secondary	44 (13.8)	55 (17.2)	99 (15.5)	17.170	0.002
Tertiary	175 (54.7)	137 (42.8)	312 (48.8)		
I don't know	91 (28.4)	120 (37.5)	211 (33.0)		
Father's occupation					
Petty trader	6 (1.9)	20 (6.3)	26 (4.1)		
Artisan	9 (2.8)	14 (4.4)	23 (3.6)		
Retired civil servant	10 (3.1)	11 (3.4)	21 (3.3)	12.873	0.012
Businessman	154 (48.1)	122 (38.1)	276 (43.1)		
Others (civil servant, lawyer etc)	141 (44.1)	153 (47.8)	294 (45.9)		
Mother's occupation					
Petty trader	22 (6.9)	61 (19.1)	83 (13.0)		
Retired civil servant	17 (5.3)	10 (3.1)	27 (4.2)	27.531	0.001
Businesswoman	175 (54.7)	130 (40.6)	305 (47.7)		
Others (farmer, civil servant, artisan, lawyer)	106 (33.1)	119 (37.2)	225 (35.2)		
Father's estimated monthly income (₦)					
≤ 30,000	18 (5.6)	22 (6.9)	40 (6.3)		
31,000- 60,000	9 (2.8)	24 (7.5)	33 (5.2)		
61,000-90,000	18 (5.6)	22 (6.9)	40 (6.3)	18.549	0.002
91,000- 120,000	65 (20.3)	37 (11.6)	102 (15.9)		
>120,000	91 (28.4)	75 (23.4)	166 (25.9)		
I don't know	119 (37.2)	140 (43.8)	259 (40.5)		

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	X2	P-value
Mother's estimated monthly income (₦)					
≤ 30,000	31 (9.7)	36 (11.3)	67 (10.5)		
31,000- 60,000	52 (16.3)	41 (12.8)	93 (14.5)		
61,000-90,000	26 (8.1)	46 (14.4)	72 (11.3)		
91,000- 120,000	42 (13.3)	38 (11.9)	80 (12.5)	10.352	0.066
>120,000	62 (19.4)	45 (14.1)	107 (16.7)		
I don't know	107 (33.4)	114 (35.6)	221 (34.5)		

Table 2 shows that majority of respondents from both private (92.8%) and public (85.6%) schools came from monogamous families, most families had 4-6 members (55.6% private, 58.4% public). Fathers in both school types primarily had tertiary education (49.7% private, 41.6% public), and a similar pattern was observed for mothers. Business was the most common occupation for both fathers (48.1% private, 38.1% public) and mothers (54.7% private, 40.6% public). Higher income levels (above ₦120,000) were more common in private schools and, lower income levels (₦30,000 and below) in public schools. There were significant differences between private and public school respondents in terms of family size, parents' education, occupation, and income ($p<0.05$).

Table 3. *Personal and Family Medical History of the Respondents.*

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	Fishers' Exact test	P-value
Respondent long-standing illness: Heart problem					
Yes	7 (2.2)	0 (0.00)	7 (1.1)	7.077	0.008
No	313 (97.8)	320 (100.0)	633 (98.9)		
Diabetes					
Yes	0 (0.00)	2 (0.6)	2 (0.3)	2.006	0.157
No	320 (100.0)	318 (99.4)	638 (99.7)		
Obesity/overweight					
Yes	1 (0.3)	0 (0.00)	1 (0.2)	1.002	0.317
No	319 (99.7)	320 (100.0)	639 (99.8)		
High blood pressure					
Yes	0 (0.00)	1 (0.3)	1 (0.2)	1.002	0.317
No	320 (100.0)	319 (99.7)	639 (99.8)		
Cancer					
No	320 (100.0)	320 (100.0)	640 (100.0)		
Asthma					
Yes	11 (3.4)	5 (1.6)	16 (2.5)	2.308	0.129
No	309 (96.6)	315 (98.4)	624 (97.5)		
Others (myopia, ulcer, migraine, etc)					
Yes	30 (9.4)	9 (2.8)	39 (6.1)	12.041	0.001

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	Fishers' Exact test	P-value
No	290 (90.6)	311 (97.2)	601 (93.9)		
Respondent currently on medication					
Yes	36 (11.3)	6 (1.9)	42 (6.6)	22.934	0.001
No	284 (88.8)	314 (98.1)	598 (93.4)		
History of family illness: Heart problem					
Yes	6 (1.9)	1 (0.3)	7 (1.1)	3.611	0.057
No	314 (98.1)	319 (99.7)	633 (98.9)		
Diabetes					
Yes	13 (4.1)	12 (3.8)	25 (3.9)	0.042	0.838
No	307 (95.9)	308 (96.3)	615 (96.1)		
Obesity/overweight					
Yes	4 (1.3)	0 (0.00)	4 (0.6)	4.025	0.045
No	316 (98.8)	320 (100.0)	636 (99.4)		
High blood pressure					
Yes	44 (13.8)	41 (12.8)	85 (13.3)	0.122	0.727
No	276 (86.3)	279 (87.2)	555 (86.7)		
Cancer					
Yes	1 (0.3)	2 (0.6)	3 (0.5)	0.335	0.563
No	319 (99.7)	318 (99.4)	637 (99.5)		
Asthma					
Yes	13 (4.1)	2 (0.6)	15 (2.3)	8.260	0.004
No	307 (95.9)	318 (99.4)	625 (97.7)		
Asthma					
Yes	13 (4.1)	2 (0.6)	15 (2.3)	8.260	0.004
No	307 (95.9)	318 (99.4)	625 (97.7)		
Others (myopia, ulcer, migraine, etc)					
Yes	25 (7.8)	2 (0.6)	27 (4.2)	20.456	0.001
No	295 (92.2)	318 (99.4)	613 (95.8)		
If yes, family member with long-standing illness:					
Mother	39 (39.8)	18 (32.7)	57 (37.3)		
Father	30 (30.6)	19 (34.5)	49 (32.0)		
Both parents	9 (9.2)	9 (16.4)	18 (11.8)	2.490	0.477
Grandparent	20 (20.4)	9 (16.4)	29 (19.0)		
Total	98 (100.0)	55 (100.0)	153 (100.0)		

Table 3 shows that private school respondents reported slightly higher prevalence of heart problems (2.2%), asthma (3.4%) compared to public school students, who had similar but lower prevalence. About 35.3% of public school students on medication were fully aware of their treatment, while 44.4% of the 73.5% of private school students on medication knew

their treatment details. The most prevalent family health issue was high blood pressure (13.3%), particularly affecting mothers (37.3%) and fathers (32.0%). Significant differences were found in asthma, obesity/overweight and heart problems between the two groups ($p<0.05$).

Table 4. *Lifestyle of the Respondents.*

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	X2	P-value
Respondents engage in regular physical activity at school					
Yes	250 (78.1)	197 (61.6)	447 (69.8)	20.839	0.001
No	70 (21.9)	123 (38.4)	193 (30.2)		
Hours physical activity per week					
< 1 hour	184 (57.5)	128 (40.0)	312 (48.8)		
1-2 hours	88 (27.5)	89 (27.8)	177 (27.7)		
3-4 hours	24 (7.5)	38 (11.9)	62 (9.7)	32.106	0.001
> 4 hourss	24 (7.5)	65 (20.3)	89 (13.9)		
Total	320 (100.0)	320 (100.0)	640 (100.0)		
Activity during leisure time					
Watching Television/listening music	167 (52.2)	165 (51.6)	332 (51.9)		
Using computer to play game/Phone	56 (17.5)	54 (16.9)	110 (17.2)	1.133	0.769
Reading story book	72 (22.5)	81 (25.3)	153 (23.9)		
Others (Singing/ sleeping/crafting)	25 (7.8)	20 (6.3)	45 (7.0)		
Hours spent on computer/ Television					
1-2 hours/day	144 (45.0)	138 (43.1)	282 (44.1)		
3-4 hours/day	65 (20.3)	84 (26.3)	149 (23.3)	3.753	0.289
5-6 hours/day	35 (10.9)	27 (8.4)	62 (9.7)		
>6 hours/day	76 (23.8)	71 (22.2)	147 (23.0)		
Ever smoked cigarette or tobacco					
Yes	7 (2.2)	24 (7.5)	31 (4.8)	9.797	0.002
No	313 (97.8)	296 (92.5)	609 (95.2)		
If yes, frequency of smoking					
Occasionally	2 (28.6)	15 (62.5)	17 (54.8)		
Rarely	5 (71.4)	9 (37.5)	14 (45.2)	2.519	0.112
Total	7 (100.0)	24 (100.0)	31 (100.0)		
Had ever taken alcohol					
Yes	147 (45.6)	117 (36.9)	264 (41.3)	5.055	0.025
No	173 (54.4)	203 (63.1)	376 (58.8)		
If yes, alcohol intake frequency					
Daily	5 (3.4)	7 (6.0)	12 (4.5)		
Occasionally	47 (32.0)	42 (35.9)	89 (33.7)	1.699	0.428

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	X2	P-value
Rarely	95 (64.6)	68 (58.1)	163 (61.7)		
Total	147 (100.0)	117 (100.0)	264 (100.0)		
Fast food consumption					
Always	38 (11.9)	31 (9.7)	69 (10.8)		
Often	47 (14.7)	37 (11.6)	84 (13.1)		
Sometimes	202 (63.1)	211 (65.9)	413 (64.5)	2.962	0.398
Never	33 (10.3)	41 (12.8)	74 (11.6)		
Salty food consumption					
Always	30 (9.4)	32 (10.0)	62 (9.7)		
Often	31 (9.7)	36 (11.3)	67 (10.5)		
Sometimes	135 (42.2)	148 (46.3)	283 (44.2)	2.789	0.425
Never	124 (38.8)	104 (32.5)	228 (35.6)		
Intake of soft drinks					
Yes	308 (96.3)	296 (92.5)	604 (94.4)	4.238	0.040
No	12 (3.8)	24 (7.5)	36 (5.6)		
Soft drinks frequency					
1/week	132 (42.9)	104 (35.1)	236 (39.1)		
2/week	61 (19.8)	68 (23.0)	129 (21,4)		
3/week	33 (10.7)	62 (20.9)	95 (15.7)	22.405	0.001
4/week	44 (14.3)	47 (15.9)	91 (15.1)		
> 5/week	38 (12.3)	15 (5.1)	53 (8.8)		
	308 (100.0)	296 (100.0)	604 (100.0)		
Consume > 2 types of fruits/day					
Always	28 (8.8)	62 (19.4)	90 (14.1)		
Often	60 (18.8)	53 (16.6)	113 (17.7)		
Sometimes	191 (59.7)	175 (54.7)	366 (57.2)	15.682	0.001
Never	41 (12.8)	30 (9.4)	71 (11.1)		
Consume vegetables in meals					
Always	76 (23.8)	72 (22.5)	148 (23.1)		
Often	75 (23.4)	107 (33.4)	182 (28.4)		
Sometimes	163 (50.9)	129 (40.3)	292 (45.6)	11.693	0.009
Never	6 (1.9)	12 (3.8)	18 (2.8)		

Table 4 shows that most students in both private (78.1%) and public (69.8%) schools were physically active, with private school students more likely to exercise less than an hour (57.5%) compared to public school students (40%). Smoking was infrequent in both groups, but alcohol consumption was more common, especially in private schools (45.6% vs 36.9% in public). Fast food and salty food consumption was high in both groups, as was soft drink intake (over 90% in both). Fruit and vegetable consumption was moderate, with fruits being more popular than vegetables. Significant differences were

observed between private and public schools in various health behaviors, including physical activity patterns, substance use, and dietary habits ($p<0.05$).

Table 5. Anthropometric Measurements.

Variable	Private (N=320) n (%)	Public (N=320) n (%)	Total (N=640) n (%)	X2	P-value
Body Mass Index for Age (BMIA)					
Underweight (< -2SD)	3 (0.9)	4 (1.2)	7 (1.1)		
Normal (>-2SD to ≤ 1SD)	243 (75.9)	287 (89.7)	530 (82.8)		
Overweight (>1SD to ≤ 2SD)	55 (17.3)	24 (7.5)	79 (12.3)	40.502	0.023
Obese (>2SD)	19 (5.9)	5 (1.6)	24 (3.7)		
Blood Pressure					
Normal (< 90^{th})	263 (82.2)	294 (91.9)	557 (87.0)		
Pre-hypertension (>90^{th} to ≤ 95^{th})	41 (12.8)	21 (6.6)	62 (9.7)	13.939	0.001
Hypertension Stage 1 (>95^{th} to ≤ 99^{th})	16 (5.0)	5 (1.6)	21 (3.3)		

Table 5 shows that body mass index (BMI) classifications differed significantly between private and public-school students ($p<0.05$). In private schools, 75.9% had normal weight, 17.3% were overweight, and 5.9% were obese, compared to 89.7%, 7.5%, and 1.6% respectively in public schools. Blood pressure classifications also varied significantly ($p<0.05$), with 82.2% of private school students having normal blood pressure, 12.8% pre-hypertension, and 5% hypertension stage 1, versus 91.9%, 6.6%, and 1.6% respectively in public schools. Overweight, obesity, pre-hypertension and hypertension were more prevalent among private school students.

Table 6. Physical Characteristics of the Respondents.

Variable	N	Minimum-Maximum	Private (X ±SD)	Public (X ±SD)	Total (X ±SD)	t-test	P-value
Height (m)	640	1.41-1.82	1.59 ±0.08	1.60 ±0.08	1.59 ±0.08	-0.870	0.385
Weight (kg)	640	37-91	53.6 ±11.5	50.2 ±7.7	51.9 ±9.9	4.413	0.001
Body Mass Index(kg/m^2)	640	15.0-32.5	21.0 ±3.6	19.6 ±2.5	20.3 ±3.1	5.706	0.001
Systolic Blood Pressure(mmHg)	640	95-149	113.4 ±12.1	117.2 ±11.6	115.3 ±11.8	-4.017	0.001
Diastolic Blood Pressure(mmHg)	640	52-96	72.5 ±8.9	70.6 ±6.2	71.6 ±7.7	3.226	0.001

Table 6 shows that significant difference was observed in the mean weight, body mass index, systolic and diastolic blood pressure of respondents from private and public schools respectively ($p<0.05$).

4. Discussion

Health education and promotion is important during adolescence, a period of major social, psychological, and physical development. In this study, gender, ethnicity, and religion were similarly distributed among adolescents from public and private schools. Majority of respondents from both school types came from monogamous families with 4-6 members. Private school students, however, were more likely to come from families with smaller sizes, better-educated parents, and higher income levels, while public school students often had

parents with lower incomes and less formal education. These differences highlighted the impact of socioeconomic status on school choice and educational outcomes.

Supporting evidence from other research, such as Akinsanya et al. [23] in Ogun State, showed that higher parental education and income levels influenced school choice, with wealthier families preferring private schools, leading to better academic performance. In the West African region, a study by Oduro-Ofori et al [24] in Ghana found similar socioeconomic disparities between private and public school students. It highlighted that student in private schools generally came from families with higher socioeconomic status, including better-educated parents, higher family incomes, and access to more resources. A study across Australia, Canada, Denmark, Switzerland and United States by the Organisation for Economic Cooperation and Development based on the Programme for International Student Assessment (PISA) indicated that students from advantaged backgrounds are more likely to attend schools with better educational resources and perform better academically [25]. Conversely, Heyneman and Stern [26] observed that in certain developing countries, the quality of schools and parental perceptions could have a greater influence than socioeconomic factors. Students from both socioeconomic backgrounds may face similar challenges in their academics, hence, other factors such as personal motivation, persistence, and parental support will enhance academic performance [27]. Using Ibadin & Akpede [28] classification of socioeconomic status, this study showed that a higher proportion of private school students are between high to middle SES categories, and public school students middle to low SES categories.

The reported prevalence by respondents was low in conditions such as obesity, asthma, hypertension, and diabetes, with no significant difference in the prevalence of hypertension and obesity between the two school types. Since genetics play a role in disease risk, children from these families are more at risk for the development of NCDs [29]. However, private school students reported higher prevalence of asthma and other conditions (myopia, ulcer, migraine). Low prevalence reported could be attributed to multiple reasons such as low awareness and knowledge, access and availability of healthcare services [30], and very little or no screening exercises for this age group. Additionally, private school respondents reported more long-standing family illnesses, except for cancer. Significant differences were noted in family histories of obesity and asthma, but not for heart problems, diabetes, hypertension, or cancer. This could be attributed to the fact that NCDs become more prevalent in middle to late adulthood as well as the increased awareness about NCDs which has led to regular health checks and screening [6, 31].

There was high engagement in physical activity among both private (78.1%) and public (61.6%) school students. Public school students engaged in more weekly physical activity hours compared to private school students, with significant differences in both regular engagement and weekly hours ($p<0.05$). A study by Adebusoye et al. [32] in Lagos showed that 82.8% of participants reached the recommended MVPA (Moderate to Vigorous Physical Activity) level, with public school students four times more likely to meet the recommended MVPA level compared to those in private schools. Tobacco use was low overall, with 2.2% in private and 7.5% in public schools. Public school students had a higher proportion of tobacco users, while alcohol consumption was more prevalent among private school students, with significant differences observed in both behaviors ($p<0.05$). A study by Onoh et al. [33] in Ibadan, Nigeria revealed low prevalence of tobacco use (4.5%). In other comparative study by Sharma et al. [34] alcohol consumption was higher in private school students compared to government school students. Both private and public-school students had similar consumption patterns for fast food and salty foods, but differences were noted in soft drink intake and the frequency of fruit and vegetable consumption. The study linked these patterns to the convenience and affordability of fast food and soft drinks, with vegetables being a common and inexpensive food item. A comparative study among adolescents by Jain et al. [35] revealed high consumption of fast food and low intake of vegetables among government school students compared to those in private schools.

The study found that private school students had a higher prevalence of overweight and obesity (23.2%) compared to public school students (9.1%). This pattern aligns with studies by Abraham et al. [36] and Arora et al. [37], where overweight and obesity rates were also higher among private school students. Factors such as gender and dietary habits has shown to influence BMI [38] and being from higher socioeconomic background with more purchasing power for calorie-dense and nutrient-poor fast foods [39]. Additionally, the prevalence of pre-hypertension and hypertension was higher in private school students (17.8%) compared to public school students (8.2%). Similar trends were observed in studies by Arora et al. [37] and Jain et al. [35] with prevalence of pre-hypertensive and hypertensive in private schools two times higher than those attending government schools. Factors influencing blood pressure include genetics, lifestyle, birth weight, socioeconomic status, and environmental factors [37, 40]. The study highlighted that adolescent prehypertension and obesity are strong predictors of these conditions in adulthood. A significant difference in metabolic risk factors for non-communicable diseases was observed between the school types ($p<0.05$).

4.1. Limitations of the Study

The study's cross-sectional design limits its ability to determine cause-and-effect relationships between the observed factors and outcomes. Additionally, the use of self-administered questionnaires may introduce biases, such as recall and response bias. Important metabolic risk factors for non-communicable diseases (NCDs), like blood glucose

levels, cholesterol, and triglycerides, were not measured. Furthermore, the research only included students from private and public schools, potentially overlooking adolescents not enrolled in school, who may have different risk profiles and health behaviors.

4.2. Implications of the Findings of the Study

With low prevalence of chronic conditions (obesity, asthma, hypertension and diabetes) among students, this will be a favourable condition if students in school have been given appropriate education on NCDs risk factors as well as have access to health services in and out of schools where appropriate screening can be done but this is not the case due to the current state of the healthcare system in Nigeria [41], and with global reports of NCDs on the rise among adolescents especially in low and middle-income countries [3, 7]. The most common lifestyle risk factors were unhealthy diet (consumption of fast food, salty food, soft drinks), physical inactivity and alcohol consumption. Tobacco use prevalence was low in both school types. With high prevalence of the metabolic risk factors, there is need for further research on risks factors for each school type and identifying the associations between adolescents and relatives diagnosed with chronic diseases, and the co-occurrence of risk factors among students in both school types. This is needful to understand the underlying causes specific to each school type, and exploring how genetic predispositions, environmental factors, lifestyle choices, and socioeconomic status contribute to these health outcomes [42]. In the face of the current arising issues on NCDs risks factors among adolescents, the ministry of health can develop interventions to prevent and manage risk factors with focus on reducing the likelihood of chronic conditions in later life. Other strategic approaches include comprehensive health education programs in both public and private schools to improve knowledge and awareness of NCDs such as physical activity, nutrition, and substance use education [43, 44]. These engagements aim to improve adolescent health outcomes through education, prevention, and policy measures, recognizing adolescence as a significant developmental stage for establishing lifelong health behaviors.

5. Conclusion

Socioeconomic status, family health history, and risky behaviors like alcohol consumption, physical inactivity, tobacco use, and poor diet are key contributors to non-communicable diseases (NCDs). Private school respondents showed higher prevalence of overweight/obesity, pre-hypertension/hypertension, physical activity, soft drink consumption, and alcohol use, except for tobacco use and fast-food intake. Significant differences were noted between private and public-school students, highlighting the need for ongoing surveillance of NCDs and their risk factors to create targeted interventions.

Abbreviations

NCDs	Non-Communicable Diseases
WHO	World Health Organization
WHO	World Health Organization STEPwise
STEPS	Approach to NCD Risk Factor Surveillance
CVDs	Cardiovascular Disease
CRDs	Chronic Respiratory Disorders
SES	Socioeconomic Status
LLMICs	Low- and Lower-middle-income Countries
MVPA	Moderate to Vigorous Physical Activity
PISA	Programme for International Student Assessment
SPSS	Statistical Product for the Service Solution
LGA	Local Government Area
PHALGA	Port Harcourt Local Government Area
JSS	Junior Secondary School
SS	Senior Secondary School

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Author Contributions

All authors were involved in conceptualization, planning and implementation of the study. Data collection team was led by Enuagwuna FC, Asiboje ET, Ofurum IC, Wilcox AS. All authors contributed to the interpretation of the results, read and approved the final manuscript.

Ethical Clearance

The University of Port Harcourt's Ethics Committee granted approval for the study [UPH/CEREMAD/REC/MM92/012]. Written informed consent was obtained from the participants before the study commenced. The researcher was the only one with a passcode to the password-protected computer where the data was kept.

Conflicts of Interest

The authors declare no conflicts of interest.

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