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Sociodemographic predictors of non-communicable diseases risk-related knowledge and behaviours: A cross-sectional study of in-school adolescents in a southern Nigerian State

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ABSTRACT

Background: The adolescence period is a significant phase in development of non-communicable diseases. Public health interventions that reduce risky behaviours among adolescents are beneficial across the life course. This study assessed the level of NCDs' risk-related knowledge, the prevalence of NCDs' risk behaviour, and the sociodemographic predictors of NCDs' risk-related knowledge and behaviours among in-school adolescents in a southern Nigerian State.

Methods: A cross-sectional study design was employed to assess the NCDs' risk-related knowledge and behaviours among a random multistage sample of 607 students age between 10 and 19 years. Data was collected using an interviewer-administered semi-structured questionnaire adapted from the WHO STEPS questionnaire. Descriptive and inferential analyses of data collected were carried out using the IBM SPSS version 22 software.

Results: The mean age of the students was 14.7 (SD = 1.52) years, 57.2% (n=347) of which were females, and 42.8% (n=260) were males. The proportion of students with good overall NCDs risk-related knowledge was 22.7% (n=138). Age, place of residence, family's socioeconomic status, and mother's level of education were significant sociodemographic predictors of good overall NCD risk-related knowledge. Among the students, 66.2% (n=402) self-report inadequate physical activity, 65.7% (n=399) self-report consumption of unhealthy diets, 29.2% (*n* = 177) self-report current alcohol use, and 3.3% (*n* = 20) self-report they were current cigarette smokers.

Conclusion: A significant proportion of the surveyed students had poor overall NCDs risk-related knowledge and engaged in NCDs risk behaviours. The relevant stakeholders concern with prevention of NCDs in government and non-governmental organisations should target adolescents in NCD control strategies in the study setting.

Keywords: Non-communicable diseases, non-communicable chronic diseases, Non-infectious diseases, Risk-related knowledge, Risk behaviours, Lifestyle, Practices, In-school adolescents, School-age children

Introduction

Non-communicable diseases (NCDs) are a group of heterogeneous non-infectious, and not transmissible chronic conditions [1]. They are costly and highly prevalent worldwide, making their prevention a public health priority [2,3]. The global burden of NCDs is substantial as it significantly contributes to poor health and inequalities in health [4]. The costs of NCDs in 'human, social and economic terms' are largely preventable and avoidable [3,4]. Unfortunately, about seventy per cent of global deaths annually are NCDs-related, with a large proportion occurring prematurely [1,5]. The enormous morbidity and mortality accrued to NCDs occur disproportionately in low- and middle-income countries (LMICs) [1,3,5]. Over sixty per cent of NCD-related deaths occur in LMICs [1]. The reasons for the glaring inequity in NCDs-related burden distribution are multiple. They include poverty, weak health systems, rapidly growing populations, ignorance of NCDs-related risk factors and increasing adoption of unhealthy lifestyle choices [6-8].

NCDs are sometimes described as lifestyle diseases because many risk factors are behavioural and modifiable. Behaviours like physical inactivity, tobacco smoking, harmful use of alcohol, and consumption of an unhealthy diet rich in trans-fat and dietary salt but low in fresh fruits and vegetables are important modifiable ones [7,9]. These behavioural risk factors are particularly patterned during adolescence, which is a significant phase in the life cycle of NCDs [10].

Being a chronic disease, the latency period of NCDs is long, and the effects of engaging in NCD risk-related behaviours may not be immediately apparent. Thus, the adoption of healthy behaviour during the adolescence period is a critical NCDs-preventive strategy [10]. Public health interventions that reduce risky behaviours such as tobacco smoking, harmful use of alcohol, consumption of unhealthy food, and physical inactivity among adolescents are beneficial across the life course and will consequently reduce the burden of NCDs when they eventually become adults [10].

In Nigeria, over one-fifth of the population are adolescents (persons aged between 10 and 19 years) [11]. This large population of adolescents in Nigeria calls for action by the relevant stakeholders in the health and education sectors to implement school-based NCDs-preventive interventions. This study was conducted to assess the level of NCDs' risk-related knowledge, the prevalence of NCDs' risk behaviours, and the sociodemographic predictors of NCDs' risk-related knowledge and behaviours among in-school adolescents in Delta State, Nigeria.

Methods

Study setting, design, and participants:

The study setting was at nine secondary schools randomly selected across the three senatorial districts of Delta State in the oil-rich Niger Delta region of Nigeria. Delta State is a culturally diverse State with a total of 758 secondary schools with a total population of 262,242 students distributed across the three senatorial districts [12]. The study design was a school-based cross-sectional survey carried out between December 2021 and May 2022 among a random multistage sample of apparently healthy students aged between 10 and 19 years enrolled in secondary schools in Delta State, Nigeria. The Health Research Ethics Committee (HREC), Delta State University Teaching Hospital provided ethical clearance for the study (HREC/PAN/2021/016/0326). The study conducted followed relevant guidelines and regulations. The authorities of the selected schools provide access permission before the commencement of the study. Participation in the survey was without coercion or inducement. The right to withdraw participation in the survey without untoward consequences was made known to the study participants and their parents/guardians. The study participants and their parents/guardians provided assent and written informed consent, respectively.

Sample size determination and sampling procedure:

Fisher's formula was employed to determine the minimum sample size. Because it was impossible to precise the extent of the various NCD-related risk behaviours in secondary school students in Nigeria, the prevalence was set at 50%. Based on a prevalence of 50%, an error margin of 5 % and a standard normal variate at a 95% confidence level, the minimum sample size was estimated at 384 students. However, 607 students participated in the study.

Sample selection was in two stages. In the first stage, a table of random numbers was used to select nine secondary schools (three per senatorial district) from a sampling frame of 758 secondary schools in Delta State [12]. In the second stage, apparently healthy students between 10 and 19 years enrolled in the nine selected secondary schools, who gave assent and whose parents/guardians gave informed consent to participate in the study were proportionately allocated into sex strata by their class levels to allow for adequate representation. A table of random numbers was then used to randomly select students from the register in each class level by sex strata. Students who were not within the age bracket of 10 and 19 years were excluded from the sampling process.

Study instrument and data collection:

Data were collected using an interviewer-administered semi-structured questionnaire adapted from the WHO STEPS questionnaire [13]. The questionnaire comprised three sections which assessed the sociodemographic characteristics, NCDs risk-related knowledge and behaviours of the students.

Outcome and independent variables:

The outcome variables were NCDs risk-related knowledge and behaviours among the students. Knowledge of NCDs risk factors (behavioural and biomedical) was assessed with 11 questions on a 3-Likert scale (agree, disagree, not sure). Each correct response scored one, and every wrong response was zero. There was a maximum of 11 points on the NCDs' risk-related knowledge. Scores of 6 to 11 points were categorised as good overall knowledge, while a scores of 0 to 5 points was categorised as poor overall knowledge.

NCDs risk-related behaviours were assessed by questions on cigarette smoking, alcohol consumption, diet/nutritional habits, and physical activity habits. Students who self-report that they currently smoke cigarettes were considered as smokers, while those who previously smoked or never smoked cigarettes were considered as non-smokers. Students who self-report that they currently consume alcohol were considered as consumers of alcohol. In contrast, those who previously consumed alcohol or who have never consumed alcohol were considered as non-consumers of alcohol. students who self-report a daily intake of fewer than five servings of fruits/vegetables (raw or cooked) or regular high intake of saturated fat or sugary meals were categorised as consumers of unhealthy diets. Students who self-report less than 150 minutes/week of moderate to vigorous-intensive physical activity (walking, recreational exercise, cycling) were considered to have inadequate physical activity [14].

The independent variables include age, sex, place of residence, family socioeconomic status and mothers' educational attainment. Family socioeconomic status was determined using the scoring scheme for classifying socioeconomic status in Nigeria. The scoring scheme takes into cognisance both parents' educational attainment and occupation [15].

Statistical analyses:

Data generated was analysed using the IBM SPSS version 22 software. Descriptive and inferential analysis of data collected was carried out. Categorical variables were summarised as frequencies and percentages (summarised data were presented in tables and figures).

Bivariate and multivariate analysis using Pearson's chi-square and binary logistic regression respectively was carried out. The statistical significance for both bivariate and multivariate analysis was set at $p < 0.05$. The 95 % confidence intervals (CI) and p-values obtained was reported in two tail form and statistical significance determined at p-value less than 0.05. The binary logistic regression was performed to identify predictors of the outcome variables of interest (NCDs risk related knowledge and behaviours). All variables significant during bivariate analysis using Pearson's chi-square at a p-value < 0.2 were entered stepwise into the binary regression model to obtain the adjusted odds ratio (AOR) of each factor on the outcome variable at 95 % confidence interval. The model fitness was measured by the Hosmer-Lemeshow test. The statistical significance of the models (p-value ≥ 0.776) revealed that the binary logistic regression models (with independent variables included) were good fit to the data.

Results

The total number of students included in this study was 607, all of whom were included in the analyses.

Sociodemographic characteristics:

The mean age of the students was 14.7 (SD = 1.52) years, 63.3% (*n* = 384) of which were aged 14 – 16 years, 24.2% (n=147) were aged 11 – 13 years, and 12.5% (n=76) were aged 17 – 19 years. Their sex distribution revealed that 57.2% (n=347) were female students, while 42.8% (n=260) were male students. The highest proportion of the students were urban residents (56.2%: n=341), compared to those who were rural residents (43.8%: n=266). The highest proportion of the students' families belonged to the middle socioeconomic stratum (68.7%: n=417), compared to those whose families belonged to the lower (18.6%: n=113) and upper (12.7%: n=77) socioeconomic stratum (SES) respectively. The highest proportion of the students' mothers had secondary education (55.8%: *n* = 339) compared to those whose mothers had primary education (24.1%: n=146) and (20.1%: n=122), respectively (Table 1).

Knowledge of NCDs behavioural and biomedical risk factors:

The proportion of students who had good overall NCDs risk-related knowledge was 22.7% (n=138), compared to those who had poor overall NCDs risk-related knowledge (77.3%: n=469) (Table 2). The knowledge of the behavioural and biomedical risk factors among the

students was well below average across all the domains assessed (Figures 1 and 2). There was a statistically significant age difference ($\chi2 = 7.79$; df = 2; P = 0.02), urban-rural difference ($\chi2 = 5.93$; df = 1; P = 0.02), family SES difference ($\chi2 = 21.69$; df = 2; P < 0.001), and mother's educational level difference ($\chi2 = 13.98$; df = 2; P = 0.001) in the level of NCDs risk-related knowledge among the students (Table 2).

The students aged 17 – 19 years (AOR=2.06; 95% CI: 1.53 – 6.09) had two-fold increased odds of having good overall NCDs risk-related knowledge compared to those aged 10 – 13 years. Students who were rural residents (AOR=0.53; 95% CI: 0.34 – 0.83) had 47% decreased odds of having good overall NCDs risk-related knowledge compared to urban residents. Students whose family belonged to the upper SES (AOR=2.32; 95% CI: 1.30 – 5.28) had two-fold increased odds of having good overall NCDs risk-related knowledge compared to those whose family belonged to the lower SES. Students whose mothers had tertiary education (AOR=2.44; 95% CI: 1.22 – 5.93) had two-fold increased odds of having good overall NCDs risk-related knowledge compared to those whose mothers had primary education.

NCDs risk-related behaviours:

The proportion of students who self-report consumption of unhealthy diets was 65.7% (n=399) compared to those who did not self-report consumption of unhealthy diets (34.3%: n=208) (Figure 3). There was a statistically significant family SES difference ($\chi2 = 9.32$; df = 2; P = 0.009), and mothers' educational level difference ($\chi2 = 10.29$; df = 2; P = 0.006) in the proportion of students who self-report consumption of unhealthy diet (Table 3). Students whose families belonged to the lower SES (AOR=2.36; 95% CI: 1.07– 5.24) had a two-fold increased odds of self-reporting consumption of unhealthy diet compared to those whose families belonged to the upper SES (Table 3).

The proportion of students who self-report inadequate physical activity was 66.2% (n=402), compared to those who self-report adequate physical activity (33.8%: n=205) (Figure 3). There was a statistically significant age difference ($\chi2 = 8.01$; df = 2; P = 0.02), urban-rural difference ($\chi2 = 17.47$; df = 1; P < 0.001), family SES difference ($\chi2 = 10.71$; df = 2; P = 0.01), and mothers' educational level difference ($\chi2 = 6.49$; df = 2; P = 0.04) respectively in the proportion of students who self-report inadequate physical activity (Table 4). Students who were rural residents (AOR=1.75; 95% CI: 1.20 – 2.54) had a two-fold increased odds of self-reporting adequate physical activity compared to urban residents (Table 4).

The proportion of students who self-report current alcohol use was 29.2% (*n* = 177), compared to those who self-report they were not current alcohol users (70.8%: n=430) (Figure 3). There was a statistically significant age difference ($\chi 2 = 15.59$; df = 2; $P < 0.001$), and sex difference ($\chi 2 = 17.51$; df = 1; $P < 0.001$) in the proportion of students who self-report current alcohol use (Table 5). Students aged 14 – 16 years (AOR=1.76; 95% CI: 1.06 – 3.64), and 17 – 19 years (AOR=1.52; 95% CI: 1.15 – 3.10), had two-fold increased odds respectively of self-reporting current alcohol use compared to those aged 10 – 13 years. Female students (AOR=0.45; 95% CI: 0.31 – 0.64) had 55% decreased odds of self-reporting that they were current alcohol users compared to their male counterparts (Table 5).

The proportion of students who self-report they were current cigarette smokers was 3.3% (*n* = 20), compared to the proportion who self-report they were not current cigarette smokers (96.7%: n=587) (Figure 3). There was a statistically significant sex difference ($\chi 2 = 4.15$; df = 1; $P = 0.04$) in the proportion of students who self-report that they were current cigarette smokers (Table 6). Female students (AOR=0.39; 95% C.I: 0.15 – 0.95) had 61% decreased odds of self-reporting that they were current cigarette smokers compared to their male counterparts (Table 6).

Discussion

The overall NCDs' risk-related knowledge among a significant proportion of the students was generally poor. An assessment of all the NCDs' risk-related knowledge domains tested among them were below average. This a worrisome development which calls for urgent intervention of all stakeholders in the education and health sectors involved in adolescent health in Nigeria. This is important because risk behaviours that promote NCDs thrive in the background of poor risk-related knowledge [16].

The adolescence period is a critical transitory stage in life between childhood and adulthood. It is a period of life characterised by the development of mental capacity, and significant physical, emotional, and behavioural changes. Potentially, the patterns of NCDs risk behaviours are shaped during this period and tend to persist in adulthood [10]. Therefore, the need to equip adolescents with the knowledge and skills to adopt healthy behaviours and choices before they become adults cannot be overemphasized.

Overall, only one-fifth of the students had good overall NCDs' risk-related knowledge. This observation corroborates with findings from previous studies conducted in Nigeria [17,18], and elsewhere in India [19], Sri Lanka [20], and Thailand [21] which have revealed similar poor levels of NCDs risk-related knowledge among in-school adolescents.

Knowledge impacts health and it is in turn determined by several factors that are sometimes complex and interrelated. In this study, sociodemographic factors such as age, place of residence, family's socioeconomic status and mothers' education were the predictors of good overall NCDs risk-related knowledge among the students. Indeed, age, work and living environment, family income, and mother's educational attainment are well-described social determinants of health [22]. The likelihood of having good overall NCDs risk-related knowledge was two-fold higher respectively among students who were older (late adolescents; 17-19 years), whose family belonged to the upper socioeconomic class, and whose mothers had tertiary education. Furthermore, students who were rural dwellers had forty-seven percent decreased likelihood of having good overall NCDs risk-related knowledge compared to their urban counterpart. It is not unlikely that the older students surveyed had amassed more knowledge over time as most of them were in higher school grades. It is also not unlikely that the students living in urban areas, whose family belonged to the upper socioeconomic stratum and whose mothers had tertiary education (more than 12 years of formal education) may have access to diverse sources of information aside from school-based health education, including the internet and other forms of electronic media, and thus acquire more knowledge. However, this study did not assess the sources of NCDs related information among the students.

In addition to the poor overall NCDs' risk-related knowledge, a high rate of risk behaviours that favour the development of NCDs was observed among the students. About two-thirds of the students consumed unhealthy diets (majorly low in fruits and vegetables). This observation corroborates with findings from a previous study in Ghana conducted among in-school adolescents [23]. Correspondingly, a meta-analysis of seventy-two countries drawn from all the World Health Organisation (WHO) regions, and a UNICEF report respectively revealed high consumption of unhealthy diets (low in fruits and vegetables, and high in sugar and saturated fat) [24,25]. Consumption of unhealthy diets among the students differed by family socioeconomic status. The likelihood of consuming unhealthy diets was two-fold higher among students whose family belonged to the lower socioeconomic stratum. Evidence have shown that individual choices of diet are constrained by socioeconomic factors including

environmental, political, and cultural factors [4]. Therefore, affordability of healthy diet is a critical factor for low incomes families in all countries. Consequently, low incomes families consume lower quantities of fruit and vegetables than high income families [4].

Similarly, about two-thirds of the students were physically inactive. This was not surprising as over the past decades, sub-Saharan African adolescents have transitioned mainly from being quite physically active to being sedentary [26]. Walking as a mode of transportation is often replaced with riding in motorized vehicles, and video/computer games have largely replaced engagement in outdoor sporting activities. Also, increased screen time (spent on computers, television and mobile phones) has adversely affected physical activity among adolescents. Other studies among adolescents outside the African continent have reported a preponderance of physical inactivity [27,28]. Indeed, according to the World Health Organisation (WHO), more than 80% of global adolescents lead sedentary lifestyles [29]. In this study, students who were rural dwellers were more physically active compared to their urban counterpart. The likelihood of being physically active was two-fold higher among students who were rural dwellers.

In this study, about a third of the students admit to current alcohol use. The prevalence for current alcohol use observed among the students falls within the range previously reported among adolescents in Nigeria [30,31]. Alcohol consumption, a self-harming behaviour, is rife among adolescents [30-33]. Despite policies against underage drinking, alcohol consumption remains the most common substance of abuse among young people in Nigeria [34, 35]. Alcohol consumption was significantly associated with age and sex. Students aged 14-16 years (mid adolescents) and 17-19 years (late adolescents) had 2-fold higher odds of consuming alcohol compared with early adolescents (10-13 years). Furthermore, a significantly lower proportion of female students admit current alcohol use and they had fifty-five percent decreased likelihood of alcohol use compared to their male counterpart. Previous studies had similarly reported male preponderance in alcohol consumption among adolescents in Nigeria [32,33]. It is noteworthy that some studies report no sex difference in the prevalence of alcohol consumption among adolescents unlike adult drinkers with consistent male preponderance [31, 36].

Tobacco smoking, another harmful social habit, was reported by 3.3% of the students. The significant sociodemographic predictor for tobacco smoking in this study was sex, with female students having sixty-one percent decreased likelihood of smoking cigarettes compared to their

male counterpart. The preponderance of male smokers in this study corroborates with the findings of a systematic review which revealed a higher prevalence of male adolescent smokers in Nigeria [37].

The findings of our study should be interpreted considering the following strengths and limitations. The main strength of our study is that it targeted a relatively larger population of in-school adolescents. However, our study has some limitations: firstly, the self-report nature of NCDs risk behaviours by the students leaves room for reporter bias. Secondly, this study employed a cross-sectional descriptive design; thus, it is not possible to determine either causality or directionality of the variables analysed.

Conclusion

A significant proportion of the students in this study had poor overall NCDs risk-related knowledge. Age, place of residence, family's socioeconomic status, and mother's level of education were significant sociodemographic predictors of good overall NCDs risk-related knowledge. In addition, a high rate of risk behaviours that favour the development of NCDs was observed among the students.

There is need for concerted efforts by the relevant stakeholders that are concern with prevention of NCDs in government and non-governmental organisations to prioritise in-school adolescents in NCD control strategies in the study location. This calls for urgent implementation of interventions at all ecological levels that will improve adolescents' NCDs risk-related knowledge and equip them with the skills to adopt healthy lifestyles and choices. This consequently will deter their engagement in unhealthy behaviours.

What is known about this topic

- NCDs is a significant public health problem world-wide.
- Adolescence period is a significant phase in the life cycle of NCDs.

What this study adds

- Poor levels of NCDs risk-related knowledge among in-school adolescents.
- High rates of NCDs risk-related behaviours among in-school adolescents.

Competing interest

The authors declare no competing interest.

Authors' contributions

The conception and study design were done by Patrick Oyibo; while Ejiroghene Martha Umuerri, Mamodesan Tudjegbe Okumagba, and Iyabo Aduke Oyibo were involved in the training of data collectors, data collection and analysis. Patrick Oyibo, and Ejiroghene Martha Umuerri wrote the initial draft of the manuscript and all the authors participated in its finalisation. All authors read and approved the final manuscript.

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Tables

Figures

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Table 1: Sociodemographic characteristics of the surveyed adolescents.

Variables	Categories	N = 607 (%)
Age (Years)	10 - 13	147 (24.2)
	14 - 16	384 (63.3)
	17 - 19	76 (12.5)
Mean age ± SD (years)	14.7 ± 1.52 years	
Sex	Male	260 (42.8)
	Female	347 (57.2)
Place of residence	Urban	341 (56.2)
	Rural	266 (43.8)
Family SES	Upper	77 (12.7)
	Middle	417 (68.7)
	Lower	113 (18.6)
Mothers' education	Primary	146 (24.1)
	Secondary	339 (55.8)
	Tertiary	122 (20.1)

*SES (Socioeconomic stratum)

Table 2: Predictors of good overall NCDs risk-related knowledge among the surveyed adolescents

Variables	Level of knowledge		Bivariate Analysis (Chi-Square)	Regression Analysis AOR (95% CI.)
	Good n=138 (22.7%)	Poor n=469 (77.3%)		
Age (Years)				
10 - 13	23 (15.6)	124 (84.4)	$\chi2 = 7.79$;	1
14 - 16	91 (23.7)	293 (76.3)	df = 2;	1.69 (0.96 – 2.97)
17 - 19	24 (31.6)	52 (68.4)	P = 0.02	2.06 (1.53 – 6.09)
Sex			$\chi2 = 0.65$;	
Male	55 (21.2)	205 (78.8)	df = 1;	-
Female	83 (23.9)	264 (76.1)	P = 0.42	
Place of residence			$\chi2 = 5.93$;	
Urban	90 (26.4)	251 (73.6)	df = 1;	1
Rural	48 (18.0)	218 (82.0)	P = 0.02	0.53 (0.34 – 0.83)
Family SES				
Upper	33 (42.9)	44 (57.1)	$\chi2 = 21.69$;	2.32 (1.30 – 5.28)
Middle	78 (18.7)	339 (81.3)	df = 2;	0.99 (0.41 – 2.41)
Lower	27 (23.9)	122 (76.1)	P < 0.001	1
Mothers' education				
Primary	26 (17.8)	120 (82.2)	$\chi2 = 13.98$;	1
Secondary	69 (20.4)	270 (79.6)	df = 2;	1.64 (0.97 – 2.75)
Tertiary	43 (35.2)	79 (64.8)	P = 0.001	2.44 (1.22 – 5.93)

*SES - Socioeconomic status

*EAC (Excessive alcohol consumption); *CS (Cigarette smoking); *PI (Physical inactivity); *LFVC (Low fruit and vegetable consumption); *IDS (Increased Dietary sugar); *ISI (Increased Salt intake); *ISFI (Increased Saturated fat intake)

Figure 1: Knowledge of NCDs behavioural risk factors among the surveyed adolescents.

*BP (Blood pressure); *BS (Blood sugar); *BL (Blood lipids)

Figure 2: Knowledge of biomedical-related NCDs risk factors among the surveyed adolescents.

Figure 3: Self-reported NCDs risk behaviours among the surveyed adolescents.

Table 3: Predictors of consumption of healthy diet among the surveyed adolescents.

Variables	Consume healthy diet		Bivariate Analysis (Chi-Square)	Regression Analysis AOR (95% CI.)
	Yes n=208 (34.3%)	No n=399 (65.7%)		
Age (Years)				
10 - 13	48 (32.7)	99 (67.3)	$\chi2 = 1.68$;	
14 - 16	129 (33.6)	255 (66.4)	df = 2;	-
17 - 19	31 (40.8)	45 (59.2)	P = 0.43	
Sex			$\chi2 = 1.04$;	
Male	95 (36.5)	165 (63.5)	df = 1;	-
Female	113 (32.6)	234 (67.4)	P = 0.34	
Place of residence			$\chi2 = 0.44$;	
Urban	113 (33.1)	228 (66.9)	df = 1;	-
Rural	95 (35.7)	171 (64.3)	P = 0.55	
Family SES				
Upper	39 (50.6)	38 (49.4)	$\chi2 = 41.80$;	1
Middle	158 (37.9)	259 (62.1)	df = 2;	1.33 (0.78 – 2.26)
Lower	11 (9.7)	102 (90.3)	P < 0.001	2.36 (1.07– 5.24)
Mothers' education				
Primary	65 (44.5)	81 (55.5)	$\chi2 = 10.29$;	1
Secondary	100 (29.5)	239 (70.5)	df = 2;	1.01 (0.54 – 1.89)
Tertiary	43 (35.2)	79 (64.8)	P = 0.006	1.59 (0.98 – 2.56)

Table 4: Predictors of physical activity among the surveyed adolescents.

Variables	Physical activity		Bivariate Analysis (Chi-Square)	Regression Analysis AOR (95% CI.)
	Adequate n=205 (33.8%)	Inadequate n=402 (66.2%)		
Age (Years)				
10 - 13	37 (25.2)	110 (74.8)	$\chi2 = 8.01$;	1
14 - 16	145 (37.8)	239 (62.2)	df = 2;	1.10 (0.59 – 2.08)
17 - 19	23 (30.2)	53 (69.8)	P = 0.02	0.67 (0.39 – 1.16)
Sex			$\chi2 = 0.44$;	
Male	84 (32.3)	176 (67.7)	df = 1;	-
Female	121 (34.9)	226 (65.1)	P = 0.51	
Place of residence			$\chi2 = 17.47$;	
Urban	91 (26.7)	250 (73.3)	df = 1;	1
Rural	114 (42.9)	152 (57.1)	P < 0.001	1.75 (1.20 – 2.54)
Family SES				
Upper	24 (42.9)	53 (57.1)	$\chi2 = 10.71$;	1.86 (0.89 – 2.83)
Middle	128 (18.7)	289 (81.3)	df = 2;	1.59 (0.78 – 2.41)
Lower	53 (23.9)	60 (76.1)	P = 0.01	1
Mothers' education				
Primary	59 (40.4)	87 (59.6)	$\chi2 = 6.49$;	1
Secondary	100 (29.5)	239 (70.5)	df = 2;	1.46 (0.76 – 2.82)
Tertiary	46 (37.7)	76 (62.3)	P = 0.04	1.56 (0.96 – 2.50)

Table 5: Predictors of alcohol consumption among the surveyed adolescents.

Variables	Alcohol consumption		Bivariate Analysis (Chi-Square)	Regression Analysis AOR (95% CI.)
	Yes n=177 (29.2%)	No n=430 (70.8%)		
Age (Years)				
10 - 13	24 (16.3)	123 (83.7)	$\chi2 = 15.59$;	1
14 - 16	129 (33.6)	255 (66.4)	df = 2;	1.76 (1.06 – 3.64)
17 - 19	24 (31.6)	52 (68.4)	P < 0.001	1.52 (1.15 – 3.10)
Sex			$\chi2 = 17.51$;	
Male	99 (38.1)	161 (61.9)	df = 1;	1
Female	78 (22.5)	269 (77.5)	P < 0.001	0.45 (0.31 – 0.64)
Place of residence			$\chi2 = 2.31$;	
Urban	91 (26.7)	250 (73.3)	df = 1;	-
Rural	86 (32.3)	180 (67.7)	P = 0.13	
Family SES				
Upper	19 (24.7)	58 (75.3)	$\chi2 = 1.25$;	
Middle	127 (30.5)	290 (69.5)	df = 2;	-
Lower	31 (27.4)	82 (72.6)	P = 0.54	
Mothers' education				
Primary	37 (25.3)	109 (74.7)	$\chi2 = 4.04$;	
Secondary	110 (32.4)	229 (67.6)	df = 2;	-
Tertiary	30 (24.6)	92 (75.4)	P = 0.13	

Table 6: Predictors of cigarette smoking among the surveyed adolescents.

Variables	Smoke cigarette		Bivariate Analysis (Chi-Square)	Regression Analysis AOR (95% CI.)
	Yes n=20 (3.3%)	No n=587 (96.7%)		
Age (Years)				
10 - 13	3 (2.0)	144 (98.0)	*χ2 = 1.66;	
14 - 16	13 (3.4)	371 (96.6)	df = 2;	-
17 - 19	4 (5.3)	72 (94.7)	P = 0.44	
Sex			χ2 = 4.15;	
Male	13 (5.0)	247 (95.0)	df = 1;	1
Female	7 (2.0)	340 (98.0)	P = 0.04	0.39 (0.15 – 0.95)
Place of residence			χ2 = 0.12;	
Urban	12 (3.5)	329 (96.5)	df = 1;	-
Rural	8 (3.0)	258 (97.0)	P = 0.73	
Family SES				
Upper	4 (5.2)	73 (94.8)	*χ2 = 1.12;	
Middle	12 (2.9)	405 (97.1)	df = 2;	-
Lower	4 (3.5)	109 (96.5)	P = 0.57	
Mothers' education				
Primary	6 (4.1)	140 (95.9)	*χ2 = 0.57;	
Secondary	11 (3.2)	328 (96.8)	df = 2;	-
Tertiary	3 (2.5)	119 (97.5)	P = 0.75	

STROBE Statement—checklist of items that should be included in reports of observational studies:

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3	
Objectives	3	State specific objectives, including any prespecified hypotheses	3	
Methods				
Study design	4	Present key elements of study design early in the paper	4	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	4	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5	
Bias	9	Describe any efforts to address potential sources of bias		
Study size	10	Explain how the study size was arrived at	4	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why 5,6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions 5,6
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures 6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	8 - 11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.