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PREVALENCE OF RISK FACTORS OF NON-COMMUNICABLE DISEASES AMONG ADOLESCENTS IN UASIN GISHU COUNTY, KENYA

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ABSTRACT

**Objective:** This study aimed to establish the prevalence of risk factors (tobacco use, alcohol abuse, physical inactivity and unhealthy diet) of non-communicable diseases (NCDs) among secondary school students in a developing country.

**Design:** A descriptive cross-sectional study using the self-administered WHO STEP-wise questionnaire for chronic disease risk factor surveillance on adolescents attending secondary schools in Kenya. The study was carried out in the period between May and July 2018.

**Setting:** Ten secondary schools were randomly selected in Uasin Gishu County, using stratified proportional sampling.

**Subjects:** A total of 1,281 students assented to participate in the study. The mean age of the participants was 16.6 (SD±1.509) with the majority being female (55%, n=704)

**Results:** The prevalence of alcohol abuse was 30.8%(n=394) with males having statistically significant higher rates than females ( $p < 0.05$ ) and 6.8% of the participants were smokers. Of those that reported smoking, 60.9% were between 15-17 years of age. Adequate intake of three (3) servings of vegetables per day was seen in 13.5% of the respondents and 54.4% (n=697) of the total sample were found to be physically inactive.

**Conclusion:** The prevalence of NCD risk factors among secondary school students in Uasin Gishu County is significant. As a result, health education and targeted interventions should be implemented in order to promote a healthy lifestyle which is important in preventing NCDs in future.

## INTRODUCTION

Non-communicable diseases (NCDs) and its associated risk factors (tobacco use, alcohol abuse, physical inactivity and unhealthy diet) continue to increase in African countries due to rapid urbanization, aging process, poor access to health care services and adoption of unhealthy lifestyles.<sup>1</sup> Non-communicable or chronic diseases (NCDs) include cardiovascular diseases which amounts to most NCD deaths globally at approximately 17.9 million annually, followed by cancers (9.3 million), chronic respiratory diseases and diabetes at 4.1 million and 2 million respectively as reported by the Global Burden of Disease.<sup>1</sup> Exposure to risk factors of NCDs begins in early life especially during adolescents while morbidity and mortality occur mainly in adulthood.

Increased NCD risk factors have been identified among the young people globally<sup>2,3</sup> including the Kenyan youth. Almost two decades ago, the School Health Survey of 2003<sup>4</sup> conducted among Kenyan students aged 13 to 15 years found that only 11.1% met the required regular physical activity threshold of at least 60 min per day while 40.9% were reported to have sedentary habits. The 2016 Kenya Report Card<sup>5</sup> further indicated that only half of Kenyan children and adolescents were engaging in sufficient levels of physical activity. The observed increase in overweight and obesity was 14.4% and 6.4% respectively and this may have been influenced by the low levels of physical activity.<sup>6</sup> Studies have also reported an increase in consumption of sweetened beverages, junk food and inadequate intake of fruits among Kenyan children and adolescents.<sup>6,7,8</sup> Another risk factor is tobacco use and the Kenya Global Adult Tobacco Survey (GATS) (2014)<sup>9</sup> reported that 13.5% of the current smokers-initiated

smoking at the age of 15-16 years and 7.5% when they were younger than 15 years of age. A majority of the studies from Kenya focus on individual risk factors of NCDs,<sup>4-9</sup> little information is available on all the risk factors of NCDs combined especially in this region. The paucity of data on the prevalence of NCD risk factors among secondary school students in Kenya has serious implications on the success of any interventions aimed at reducing this problem. The importance of documenting this problem cannot therefore be overstated. Physical activity and dietary patterns as well as substance abuse among adolescents are the most modifiable risk factors for non-communicable diseases. Recently, there has been rising cases of NCDs in developing countries<sup>1</sup> including Kenya, hence the need for assessment of prevalence of risk factors in school going adolescents to implement preventive measures early. The present study, therefore, was conducted to determine the prevalence of multiple risk factors for non-communicable diseases among secondary school students in a semi-urban setting in Kenya.

## MATERIALS AND METHODS

### *Study Setting*

The study was conducted in 10 public mixed (day/boarding) secondary schools within Eldoret town in Uasin Gishu County, Kenya. The county has a total of 198 secondary schools out of which 140 are mixed schools (students of both gender). Mixed schools were preferred over single gender schools since it has the largest student population. In addition, both genders co-exist and experience similar predisposing factors, behavioral influence and environmental conditions.

### *Sampling*

Stratified proportional sampling was used in the selection of schools. Using a schools list provided by the ministry of education as per the year 2018, Eldoret East, Eldoret West and Wareng sub-counties formed the strata and every 10<sup>th</sup> school was picked from the three sub-counties. Within each class, simple random sampling was used to select the participants based on the student registration numbers obtained from the institutions' heads. Yamane formula  $n = \frac{N}{1 + N(e)^2}$  was used to calculate the student sample in each school. The representative sample size of students was 1,310.

#### *Study Design*

The study used a cross-sectional descriptive survey design involving the administration of WHO-STEPwise instrument for chronic disease risk factor surveillance. The WHO STEP-wise instrument is valid and reliable and has been employed in over 122 countries<sup>10</sup>.

#### *Definition of risk factors*

The first step required the participants to give information concerning socio-demographics such as age, gender, year of study and socio-economic status. Tobacco use was assessed by asking the participants if they used any tobacco products either daily or on some days while non-smokers were defined as those who do not smoke cigarettes currently or were never smokers. Alcohol consumption was defined with terms such as ever use (at least once in a person's lifetime), alcohol use at least once in the past 12 months; alcohol use in the past 30 days and alcohol use in the past 7 days. Fruits, vegetables and salt intake were used as indicators of a proper diet in this study. Participants were asked about the number of days they ate fruits and vegetable in a typical week and the number of servings taken on those days. Adequate consumption of fruits and vegetables was defined as three servings of vegetables and two servings of fruits daily.

Physical inactivity was defined as less than 60 minutes of moderate to vigorous physical activities. Active transport such as walking, and bicycle use represent moderate physical activity. BMI in this study was classified using the World Health Organization (WHO)<sup>11</sup> classification for BMI: Underweight (<18.5kg/m<sup>2</sup>), normal weight (18.5-24.9 kg/m<sup>2</sup>), overweight (25-29.9 kg/m<sup>2</sup>) and obese (>30kg/m<sup>2</sup>). BMI was calculated by dividing weight by height<sup>2</sup> (kg/m<sup>2</sup>). Blood pressure was taken using an automatic digital blood pressure monitor with the participants seated and their left arms supported on a flat surface level with the heart. Samuels & Samuel<sup>12</sup> blood pressure classification for people aged 13 years and above was used. The classification includes; hypotension SBP <90 and DBP <60; normal blood pressure <120/<80; pre-hypertensive SBP 120-139, DBP 80-89; stage 1 hypertension SBP 130-139 DBP 80-89 and stage 2 hypertension  $\geq 140/90$ . Body weight was measured using a portable electronic weighing scale. Standing height was measured using a tape measure with the participants standing barefoot on a flat surface. Reliability of the physical measurements was assured by taking three measurements of each participant and calculating the mean value.

#### *Ethics and Approval*

The study was carried out in the period between May and July 2018. Ethics approval was obtained from the Biomedical Research Ethics Committee at the University of the Western Cape (BM18/1/1) and the Institutional Research and Ethics Committee of Moi University and Moi Teaching and Referral Hospital (IREC/2017/234). Approval and permission was also obtained from the National Commission for Science, Technology and Technology (NACOSTI/P/20/2457), Uasin Gishu District Education Officer and the heads of the respective institutions. An information

sheet concerning the study was provided and explained before written consent was obtained from both the parents and the students. No names or identifying information were indicated on the questionnaires, and all participants were assured of absolute confidentiality.

#### *Data analysis*

Data was captured and analyzed using SPSS version 25. Descriptive analyses expressed as percentages for categorical variables and means for continuous variables were used to summarize the NCD risk factors among the participants. The Chi-square and independent-t tests were used to assess differences in NCD risk behaviour across gender, age and year of study.

A value of  $p < 0.05$  was considered statistically significant.

## RESULTS

#### *Demographic characteristics of study participants*

A total number of 1,310 students were approached in the ten selected schools and 1,281 respondents consented to participate, yielding a response rate of 97.8%. Among the respondents, 577 (45%) were male and 704 (55%) females. The mean age of the participants was 16.6 (SD±1.509) with the majority being female aged between 15 and 17 years 504(71.6%). Results on demographic characteristics is presented in table 1.

**Table 1**  
*Sociodemographic characteristics of the participants by gender (n=1281)*

Characteristic	Total Population		Male	Female
	n (%)	n (%)	n (%)	
Age				
12-14	109(8.5)		33(5.7)	76(10.8)
15-17	849(66.3)		345(59.8)	504(71.6)
18-20	316(24.7)		194(33.6)	122(17.3)
21-23	7(0.5)		5(0.9)	2(0.3)
Year of study				
Form 1	393(30.7)		170(29.4)	223(31.7)
Form 2	299(23.3)		136(23.6)	163(23.2)
Form 3	428(33.4)		187(32.4)	241(34.2)
Form 4	161(12.6)		84(14.6)	77(10.9)
Social Economic Status (n=1227)				
High Income	70(5.7)		35(6.4)	35 (5.1)
Middle Income	162(13.2)		87(16.0)	75(11.0)
Low Income	995(81.1)		423(77.6)	572(83.9)

#### *Prevalence of tobacco use*

In this study, 6.8% (n=87) of the respondents were smokers and 21% (n=18) admitted using it daily. More than half (57.5%; n=50) were male with a statistical significance of  $\chi^2=5.824$ ;  $p<0.016$ . The average age at which the

respondents started smoking was 14.5 years (9-18 years; S.D=1.74). Thirty-three (47.2%) of the participants started smoking between the ages of 14 and 15 while more than three quarter (84.6%, n=55) reported to have begun smoking about 1-3 years ago.

### Alcohol Consumption

The prevalence of alcohol abuse among the participants was 30.8% (n=394) with a significantly higher percentage of males reporting alcohol abuse (51%, n=201) ( $p<0.004$ ;  $\chi^2=8.199$ ) than female. Just more than half of the respondents (52%, n=185) admitted having used alcohol in the past one year while almost one third (31.6%, n=94) took alcohol in the past 30 days. Using the Pearson Chi-square ( $p<0.05$ ), a statistically significant association

was found between smoking and alcohol use ( $p<0.000$ ). About 59.1% students aged between 15-17 years admitted having used alcohol and this was statistically significant at  $p<0.000$ . In this study, almost three quarters (76.0%; n=289) of the students using alcohol were from lower income families, hence a significant association between alcohol abuse and SES of the participants' family ( $p<0.02$ ). Results on alcohol consumption among the participants is presented in Table 2.

**Table 2**  
*Prevalence of alcohol abuse*

Alcohol Use Characteristic	Yes n(%)	No n(%)	P-value
Gender			$p<0.004^{**}$
Male	201(51.0)	376(42.4)	
Female	193 (49.0)	511(57.6)	
Total	394(30.8)	887(69.2)	
Age			$p<0.000^{**}$
12-14	22(5.6)	87(9.8)	
15-17	233(59.1)	616(69.4)	
18-20	136(34.5)	180(20.3)	
21-23	3(0.8)	4(0.5)	
Total	394(100)	887(100)	
Year of study			$p<0.059$
Form 1	97(24.6)	296(33.4)	
Form 2	95(24.1)	204(23.0)	
Form 3	129(32.7)	299(33.7)	
Form 4	73(18.6)	88(9.9)	
Total	394(100)	887(100)	
Status			$p<0.02^{**}$
High income	30(7.9)	40(4.7)	
Middle income	61(16.1)	101(11.9)	
Low income	289(76.0)	706(83.4)	
Total	380(100)	847(100)	

Key: **\*\* Significant P-Value**  
*Body Mass Index*

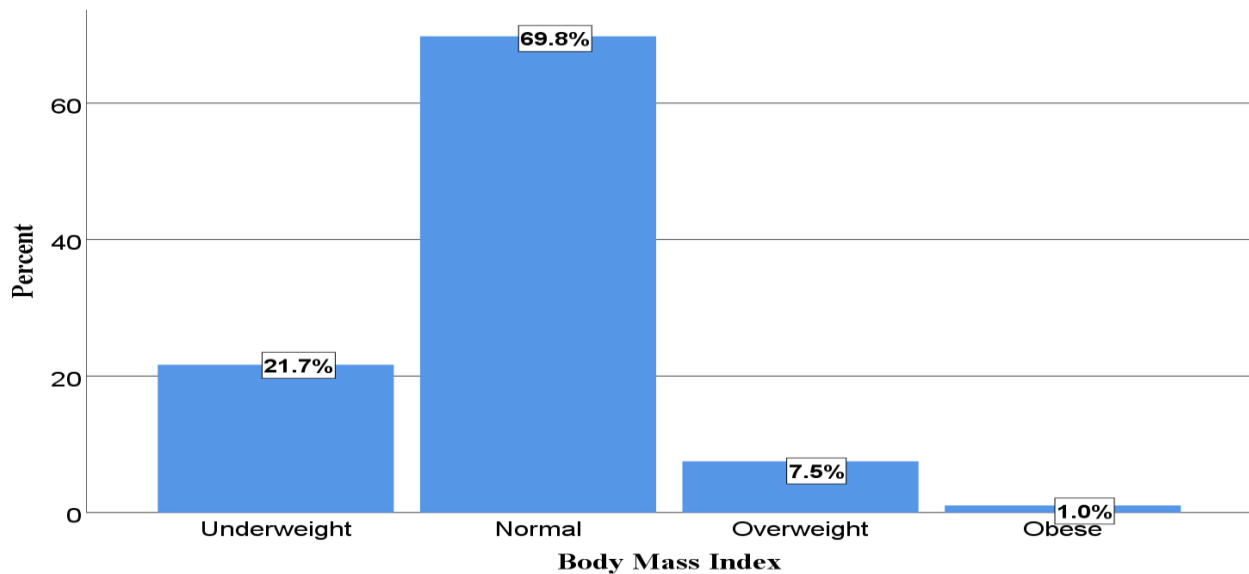


Figure 1: Body Mass Index

The mean weight of the participants was 55.3 kg ranging between 26kg and 146kg. The average BMI was 20.7kg/m<sup>2</sup> with a standard deviation of 3.18. The findings indicated that 69.8% (n=809) of the respondents had a normal weight, 21.7% (n=251) were underweight, while 7.5% (n=87) and 1% (n=12) were overweight and obese respectively. More males (30.4%, n=163) than females (14.1%,

n=88) were underweight of the 22% participants classified as being underweight.

#### Blood Pressure

Almost half of the participants presented with normal values in both systolic (45.9%, n=526) and diastolic (48.5%, n=555) blood pressure. However, four hundred and seventy-four (41.4%) participants had pre-hypertension on SBP.

Table 3

Blood pressure values (n=1281)

Blood Pressure	Systolic Blood Pressure (SBP)	Diastolic Blood Pressure (DBP)
Mean (SD) Variable	122.82(16.93)	79.61(12.5)
Hypotension	12(1.1)	55(4.8)
Normal	526(45.9)	555(48.5)
Prehypertension	474(41.4)	316(27.6)
Hypertension (stage 1 and 2)	133(11.6)	218(19.1)

#### Physical activity

The participants who engaged in moderate and vigorous physical activities daily (MVPA) were 45.6% (n=584) while the mean daily time spent in MVPA was 26 minutes with only 9.1% of participating adolescents meeting the recommendation of  $\geq 60$  minutes of daily MVPA. Walking/bicycle use was reported by

69.3% (n=736) of the respondents and 40.4% (n=291) walked or used a bicycle daily (7 days a week). Physical activity among the participants is illustrated in Table 4.

**Table 4***Physical activity participation among the study sample*

Physical Activity	Categories	Frequencies	Percentages (%)
Moderate & Vigorous physical activity (MVPA)	Yes	584	45.6
	No	697	54.4
Walking/bicycle use (n=1062)	Yes	736	69.3
	No	326	30.7
Number of days walking/ bicycle was used per week	1-3 days	189	25.2
	4-6 days	241	33.4
	7 days	291	40.4

### *Diet*

Fruit, vegetables and salt intake were used as indicators of a proper diet in this study. Almost half (46.9%, n=540) of the participants reported that salt is added in preparing food in their households and more than a third (39.0%, n=462) admitted adding salt sometimes in their food before eating. Concerning fruit and vegetables intake, the results indicated that 20.1% (n=160) of the participants ate fruit daily while 44.2%, (n=307) took one serving every day. Half of the participants (50%, n=441) ate vegetables daily, the majority (40.3%, n=279) consumed at least one serving per day while adequate intake of three servings per day was seen in only 13.5% of the respondents. There was a low consumption of fruit and vegetables among male respondents, and this was statistically significant at  $p < 0.041$  and  $p < 0.001$  respectively.

### **DISCUSSION**

This current study assessed the prevalence of NCD risk factors among secondary school students in Uasin Gishu County, Kenya and found a low (6.8%) but still significant prevalence of tobacco considering the health risks posed by cigarette smoke. It also suggests that nicotine dependence could have set in and

this may cause problems in important areas including school, family and social functioning. Furthermore, a prevalence of 42.8% of tobacco use among college students in the same region as this study (Eldoret) has been reported.<sup>13</sup> In the present study, the average age at which the respondents started smoking was 14.5 years (9-18 years; S.D=1.74) which is consistent with other studies which reported early age onset of tobacco use<sup>14, 15</sup>. Therefore, it is important to plan and implement early intervention strategies among adolescents to prevent smoking initiation since it has been found to be one of the most promising strategies for tobacco control.

Alcohol consumption is another major common risk factor of non-communicable diseases such as type 2 diabetes, hypertension and eight different types of cancers. The prevalence of alcohol abuse among the respondents in this study was 30.8% (n=394) with a statistically significant male dominance of 51% (n=201) ( $p < 0.004$ ). The results of this study are consistent with another study done among adolescents in Nairobi Kenya<sup>16</sup>. The prevalence for this study is high compared to a study conducted in Ethiopia<sup>17</sup>. The main explanation for this is probably that Eldoret town where this study was conducted is a semi-urban setting and students are more

likely to be exposed to drinking while on the other hand Harar town where the Ethiopian study was conducted is more cultural and value oriented and could contribute to the lower drinking level<sup>17</sup>. The present study findings were low in comparison to the prevalence of alcohol abuse among students in South Africa and United Kingdom<sup>18,19</sup>. The primary reason for the comparatively lower alcohol drinking level in this study could be because of economic reasons. Majority of the participants in this study were from a low socio-economic status (n=995; 81.1%). The implication of the early age of onset and high prevalence of alcohol in this study is that a large proportion of the respondents are at a high risk of developing alcohol-related disorders as adults.

Fruit and vegetable consumption are very important components of a balanced diet. In the present study, 13.5% and 32.7% consumed an adequate amount of vegetables and fruit respectively (adequate amount being three servings of vegetables and two servings of fruit every day). This percentage is still low and it has a negative impact on the health of adolescence. Inadequate intake of fruits and vegetables has been reported in similar studies<sup>7,8</sup>. Regular salt intake was reported in 46.9% (n=540) of the families and half of the participants (54.0%, n=631) reported to consume just the right amount of salt in their food. High dietary sodium intake is a major risk factor for hypertension<sup>20</sup> and is considered an important risk factor for death worldwide<sup>21</sup>.

In the present study, the number of students engaging in MVPA was below half (45.6%) while the mean daily time spent in MVPA was 26 minutes, with only 9.1% of participating adolescents meeting the recommendation of  $\geq 60$  minutes of daily MVPA. These findings are slightly lower than those of Ojiambo et al.<sup>22</sup>

who reported 44 minutes of MVPA. The respondents who used active transport daily in the present study is comparable to findings (45.7%) of Muthuri et al.<sup>6</sup>. Students traveling to school using the active mode have an opportunity to increase the overall amount of time they spend being physically active each day. Unfortunately, numbers of students using active transport may be declining due to increased automobile availability and use. Many parents opt for boda boda's (motorcycles) which are readily available and convenient as well as school buses instead of walking to school. The findings on overweight and obesity in this study (7.5% and 1%) were lower than that of school children in Nairobi (Children in this region may be of higher socioeconomic status)<sup>6</sup> and close to a study in Morocco<sup>23</sup>.

#### *Limitations*

Self-reported measures were used in data collection. Therefore, participants may have either over-estimated or under-estimated their NCD related behavior leading to desirability bias. However, one of the major strengths of this study is that it is the first study to assess the prevalence of NCD risk factors among secondary school students in Uasin Gishu County.

### **CONCLUSION**

In this present study, the findings revealed that the risk factors of NCDs among the adolescents was unsatisfactory, hence the need for a comprehensive school-based intervention program as part of NCD prevention and control strategy of Kenya.

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## REFERENCES

1. Global Burden of Disease. Global Burden of Disease Study 2019. 2021. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME). Accessed on August 2023 from <https://doi.org/10.6069/1D4Y-YQ37>
2. Tassitano, M. R., Dumith, C. S., Chica, G. D., & Tenorio, M. C. Aggregation of the four main risk factors to non-communicable diseases among adolescents. *Rev. bras. epidemiol.*, 2014. 17(02). Retrieved from <https://doi.org/10.1590/1809-4503201400020014ENG> on
3. Puwar, T., Saxena, D., Yasobant, S., & Savaliya, S. Noncommunicable Diseases among School-going Adolescents: A Case Study on Prevalence of Risk Factors from Sabarkantha District of Gujarat, India. *Indian Journal of Community Medicine*. 2018; 43(1): S33-S37.
4. Ministry of Health. Global School-Based Student Health Survey. 2003. Accessed on August 2020 from: <https://extranet.who.int/ncdsmicrodata/index.php/catalog/13>
5. Onywera, V. O., Muthuri, S., Hayker, S., Wachira, L.-J., Kyallo, F. M., Ojiambo, R., . . . Mireri, C. (2016). Results From Kenya's 2016 Report Card on Physical Activity for Children and Youth. *Journal of Physical Activity and Health*, 13(11), S195-S200. doi:10.1123/jpah.2016-0359
6. Muthuri, S., Wachira, L. J., Onywera, V. O., & Tremblay, M. (2014). Correlates of objectively measured overweight and obesity and physical activity in Kenyan school children: Results from ISCOLE Kenya. *BMC Public Health*, 14, 436.
7. Ssewanyana, D., Abubakar, A., Van, B. A., Mwangala, P. N., & Newton, C. R.. Perspectives on underlying factors of unhealthy diet and sedentary lifestyle of adolescents at a Kenyan coastal setting. *Frontiers in Public Health*. 2018; doi:10.3389/fpubh.2018.00011
8. Kigaru, D., Loech, C., Moleah, T., Macharia-Mutie, C., & Ndungu, Z. Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: a KAP study. *BMC Nutrition*. 2015; 1(1): 44.
9. Ministry of Health Global Adult Tobacco Survey (GATS). Kenya Report, 2014. Accessed on July 2023 from: <https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/data-reporting/keynya/gats/kenya-report-2014-gat>
10. Riley, L., Guthold, R., Cowan, M., Savin, S., Bhatti, L., Armstrong, T., & Bonita, R. The World Health Organization STEPwise Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and Opportunities. *American Journal of Public Health*. 2016; 106(1): 74-78.
11. World Health Organization. Body Mass Index. A healthy lifestyle - WHO recommendations. 2010. Accessed on September 2020 from: <https://www.who.int/europe/news-room/factsheets/item/a-healthy-lifestyle>
12. Samuels, J., & Samuel, J. New guidelines for hypertension in children and adolescents. *The Journal of Clinical Hypertension*. 2018; 20(5). Accessed on March 2020 from: <https://doi.org/10.1111/jch.13285>
13. Atwoli, L., Mungla, P. A., Ndungu, M. N., Kinoti, K. C., & Ogot, E. M. Prevalence of substance use among college students in Eldoret, western Kenya. *Biomed Central Psychiatry*. 2011; 11: 34. doi:10.1186/1471-244X-11-34
14. Peltzer, K. Smokeless Tobacco and Cigarette Use Among Black Secondary School Students in South Africa. *Substance Use and Misuse*. 2003; 38(7):1003-1016. Accessed on June 2020 from <https://doi.org/10.1081/JA-120017621>
15. Ngahane, M. B., Ekobo, A. H., & Kuaban, C. Prevalence and determinants of cigarette smoking among college students: a cross-sectional study in Douala, Cameroon. *Archives of Public Health*. 2015; 73:47. doi:10.1186/s13690-015-0100-1
16. Shoko, G., Nyavanga, J. E., & Makobu, K. (2016, June 14). *Shocking Details of Alcohol Use by Secondary School Students in Nairobi, Kenya*. Accessed on August 2020 from Science PublishingGroup:<http://article.sciencepublishinggroup.com/html/10.11648/j.sjph.20160403.16.html>
17. Reda, A. A., Moges, A., Wondmagegn, B. Y., & Biadgilign, S. Alcohol drinking patterns among high school students in Ethiopia: a cross-sectional study. *Biomed Central Public Health*. 2012; 12, 213: doi:10.1186/1471-2458-12-213
18. Ghuman, S., Meyer-Weitz, A., & Knight, S. Prevalence patterns and predictors of alcohol abuse among secondary school students in Southern

KwaZulu-Natal, South Africa: demographic factors and the influence of parents and peers. *South African Family Practice*. 2012; 54(2): 132-138.

19. Bellis, M., Hughes, K., Morleo, M., Tocque, K., Hughes, S., Allen, T., . . . Fe-Rodriguez, E. Predictors of Risky Alcohol Consumption in School children and Their Implications for Preventing Alcohol-Related Harm. *Substance Abuse Treatment, Prevention and Policy*. 2007; 2(15): doi:org/10.1186/1747-597X-2-15

20. Karppanen, H., & Mervaala, E. Sodium intake and hypertension. *Progress in Cardiovascular diseases*. 2006; 49(2): 59-75.

21. World Health Organization. Global health risks : mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization, 2009.

22. Ojiambo, R. C., & Casajus J.A., K. K. Effect of urbanisation on objectively measured physical activity levels, sedentary time, and indices of adiposity in Kenyan adolescents. *J Phys Act Health*. 2012; 9, 115-123.

23. El Kabbaoui, M., Chda, A., Bousfiha, A., Aarab, L., Bencheikh, R., & Tazi, A. Prevalence of and risk factors for overweight and obesity among adolescents in Morocco. *East Mediterreanean Health Journal*, 2018; 24(6), 512-521.