Differences in risk indicators associated with electronic cigarette use and tobacco smoking among adolescents and young people in Nigeria

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ABSTRACT

Introduction The study determined the proportion of adolescents and young persons (AYP) in Nigeria who use e-cigarettes and smoke tobacco; and identified factors associated with the use of e-cigarettes and tobacco smoking.

Methods AYP aged 11–23 years were recruited to participate in an online survey. The independent variables were respondents' health, HIV and COVID-19 status and their level of anxiety. The dependent variables were tobacco smoking and use of e-cigarettes. Binary logistic regression was used to determine the associations between the dependent and independent variables after adjusting for confounders (age, sex, educational level and vulnerability status).

Results There were 2206 respondents of which 568 (19.8%) used e-cigarettes and 787 (27.4%) smoked tobacco. Individual (18–23 years, having a health condition, high anxiety and being vulnerable) and familial (having father, mother, siblings or friends who used e-cigarettes) factors were associated with both the use of e-cigarettes and tobacco smoking. Tobacco smoking was a significant risk indicator for e-cigarettes use and vice versa. COVID-19 infection (adjusted OR, AOR: 3.602) and living with HIV (AOR: 1.898) were associated with higher odds of using e-cigarettes. Males (AOR: 1.577), 15–17 years (AOR: 6.621) and moderate anxiety (AOR: 2.500) were associated with higher odds of tobacco smoking. AYP with health conditions had higher odds of using e-cigarettes (AOR: 1.514) while AYP with moderate anxiety had lower odds of using e-cigarettes (AOR: 0.627).

Conclusion The proportion of AYP in Nigeria who used e-cigarettes and smoked tobacco is high. Public health interventions that target the common risk factors for e-cigarettes use and tobacco smoking among AYP in Nigeria are urgently needed.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Smoking is associated with more health risks.

WHAT THIS STUDY ADDS

⇒ The high proportion of adolescents and young people who use e-cigarettes and smoke tobacco in Nigeria is a growing public health crisis that needs to be addressed.

⇒ There are a number of common individual and familiar risk indicators for using e-cigarettes and smoking tobacco among adolescents and young people in Nigeria.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ A cost-effective tobacco control policy and guidelines can be designed and implemented in Nigeria to be implemented by agencies who work with young people to actively integrate tobacco use prevention counselling into all their programmes.

INTRODUCTION

Adolescents and young people who smoke have more health problems such as upper respiratory tract infection due to decreased mucociliary clearance of the mucous membrane of the airway, immature lung development, dysfunction of the peripheral airway, reduced maximum vital capacity, bronchial inflammation, increased permeability of airway mucous membrane and fibrosis.[1] Also, smoking causes a decrease in the blood immunoglobulins, weakening antigen–antibody reactions, inhibiting cytokine secretion by weakening the function of phagocytes and decreasing the CD4+ lymphocytes count thereby increasing the risk for viral and bacterial respiratory infections.[1 2] Smoking is also a causal factor for lung cancer and a gateway to substance abuse.[2] The use of e-cigarettes is also associated with deleterious health effects including a high risk for adverse mental health[3] and anxiety disorders.[4 5]

The health problems associated with smoking lead to preventable premature deaths. Yet, the global prevalence of smoking of at least one cigarette per day during the

past 30 days among adolescents aged 13–15 years is as high as 11.3% in boys and 6.1% in girls.[6] In Africa, about 4.6%–36.6% of adolescents are tobacco smokers and the prevalence in boys is 7.8%–35.5%.[7] There is little data on the prevalence and factors associated with the use of e-cigarettes and tobacco smoking among adolescents in sub-Saharan Africa.

In Nigeria, the number of adolescents and young people in Nigeria who use e-cigarettes and smoke tobacco is high.[8 9] Young people also perceive e-cigarettes as less harmful than tobacco smoking.[10] The use of e-cigarettes is higher among males, older young persons, and associated with alcohol use, friend's use, use of other tobacco products and substance use[10] but not with anxiety disorder.[8] Tobacco smoking is also higher among men, starts at an age younger than 18 years and is associated with familial (smoking by parents, siblings and friends)[11–13] and individual (males, older age and lower educational status) factors.[12 13]

The COVID-19 pandemic may also be a risk factor for smoking in adolescents. A diagnosis of COVID-19 its associated with more people using e-cigarettes and smoking of tobacco.[14] Also, tobacco smoking is positively associated with COVID-19 progression and an increased risk of death especially in younger adults.[15] During the pandemic, as high as 60% of e-cigarette users in the USA either quitted or reduced its use.[16] Those who increased tobacco smoking were more likely to have mental and financial stress or felt lonely and isolated during the pandemic.[17 18]

Living with HIV and having other health conditions are also associated with an increase in the risk for mental and financial stress, as well as e-cigarette use and tobacco smoking.[19] There is, however, little information on the pattern of use of e-cigarettes and tobacco smoking among adolescents and young people who have health conditions, who live with HIV, and who had COVID-19 infection. This is important in helping to design targeted tobacco smoking and electronic cigarette use prevention and support programmes during the pandemic or other similar pandemics in the future.

This study is based on the theory of planned behaviour[20] that links parental factor as a risk indicator for smoking. Parental smoking directly affects the attitude, self-efficacy and acceptance of smoking as a social norm by young people.[21] In addition, we explored the threat appraisal (health status, HIV status, COVID-19 status) and coping appraisal pathways (change in the frequency of smoking) of the protection motivation theory[22–24] to explore individual factors that may be associated with the use e-cigarettes and smoking of tobacco by adolescents and young adults in Nigeria during the COVID-19 pandemic. We postulated that identifying the individual and familial risk indicators for the use e-cigarettes and smoking of tobacco will make it easier to plan interventions that can promote tobacco smoking and e-cigarette use cessation programmes using the incremental theory of smoking.[25]

The aim of this study, therefore, was to determine the proportion of adolescents and young persons in Nigeria who use e-cigarettes and smoke tobacco; and identify differences in the factors associated with the use of e-cigarettes and tobacco smoking in this population. We hypothesised that individual and familial factors will be positively associated with higher risk of using e-cigarettes and tobacco smoking.

METHODS
Patient and public involvement in research
This study was implemented along with YouthRise, a non-governmental organisation working with vulnerable populations in Nigeria. YouthRise complemented the work of the study team by engaging its peer educators working in the 36 States of Nigeria and the Federal Capital Territory in Nigeria, to mobilise members of the community to take the survey. The survey was conducted between 1 November and 30 December 2021. Online supplemental file 1 provides details of the distribution of the study participants by state.

The questionnaire began by explaining the purpose of the study, assuring participants of the confidentiality of their responses, and their freedom to withdraw from the survey at any time. Study participants had to check a consent box indicating they had read the information sheet and consented to participate in the study. For minors, parents had to first check the consent box before the information sheet and assent form for the adolescent popped up for checking. All participants who indicated they were not willing to participate in the study after reading the informed consent sheet were thanked and exited from the survey.[26]

Study design, study participants and study setting
This was a cross-sectional study conducted between 1 November 2021 and 30 December 2021. The study participants were 11–23 years who filled an online survey launched using the Survey Monkey platform. There were no exclusion criteria for study participation.

Recruitment of study participants
Study participants were recruited using a combination of non-probability sampling techniques: convenience sampling and respondent-driven sampling. The study investigators reached out to networks of adolescents and young persons, shared their unique survey link with their contacts and encouraged them to share the link with their peers. The survey link was also posted on social media groups (Facebook, Twitter and Instagram) and network email lists and WhatsApp groups of young people. In addition, the study team recruited a diverse population of 37 adolescent and young persons (one per state and the Federal Capital Territory), trained them on the study protocol and asked them to share their unique

link with their peers. Each young person got paid N10 000 (US$26.32) to recruit 50 online participants.

Data collection instrument

Data wer collected using a questionnaire that was developed for a multicountry study exploring the impact of COVID-19 on smoking and oral health of adolescents and young people.[27] The links to the survey were prepared with settings to ensure that participants could change their answers freely before they chose to submit, that responses were anonymous and were not time-limited. Only one submission was allowed for an electronic device. The questionnaire was developed in Arabic and translated by native speakers into French, Malay, Turkish and English. The English version was used for data collection in Nigeria (online supplemental file 2).

The questionnaire was validated by 10 experts who reviewed a draft to assess its comprehensiveness in capturing all the elements of oral health and smoking related to the study objectives; ensure the sequence of the questions was logical; that the questions were culturally appropriate and that they would not breech any ethical concerns. The review was conducted between the 20t October 2021 and 25 October 2021. Four comments were received from 4 of the 10 experts. The finalised questionnaire included 39 questions. The Content Validity Index calculated for the finalised questionnaire was 0.87.[28] The questions were closed-ended, took an average of 10 min to complete and were answered anonymously.

Study variables
Independent variables
Health status

Participants were asked about their health problems. They were required to tick 1 or more of 23 health conditions. There was also an option to select other health conditions not in the list. The health conditions listed were arthritis, diabetes, broken bones, dermatologic problems, cancer, depression, heart condition, hepatitis, herpes, hypertension, migraines, neuropathy, neurological problems, respiratory problems, pneumonia, shingles and other sexually transmitted infections, stroke, hearing loss, vision loss and others. There was also an option to select if the participants had no health condition. These questions were adopted from a questionnaire that had been validated for global use.[29] Participants' responses were dichotomised into those who had no health condition (those who checked the 'none' options) and those who had a health condition (anyone who ticked an option).

HIV status

Participants identified if their HIV status was positive, negative or unknown. Respondents with unknown HIV status were excluded from further analysis.

COVID-19 status

Participants were asked if they had tested positive for COVID-19 (yes/no).

Anxiety level

Participants' psychological status was assessed using the Generalised Anxiety Disorder 7-item scale.[30] The scale included seven items: (1) feeling nervous, anxious or on edge; (2) being able to stop or control worrying; (3) worrying too much about different things; (4) trouble relaxing; (5) being restless; (6) becoming easily annoyed or irritable and (7) feeling afraid as if something awful might happen. The items were assessed on a 4-point scale ranging from 0: not at all to 3: nearly every day. The total score was the sum of points of all items ranging from 0 to 21. The cut-off points were 5, 10 and 15 for mild, moderate and severe anxiety, respectively.[31] The scale had been validated for use in many countries[32 33] and in Nigeria using a large and diverse sample of the population.[34] The Cronbach's alpha score for the score in this study was 0.87.

Dependent variables
Smoking status

Participants were also asked about cigarette smoking (hitherto referred to as tobacco smoking) and the use of e-cigarettes using the Global Youth Tobacco Survey.[35] Participants were asked if they were current, former or never smokers of tobacco. Respondents were categorised as smokers if they selected 'current' and non-smokers if they selected 'former' or 'never'. Respondents were also asked if they had ever used e-cigarettes (yes/ no). In addition, respondents were asked if any of the following persons were e-cigarettes users: father, mother, siblings, close friends on a yes/ no basis.

Confounders

Participant were asked about their age (categorised into 11–14, 15–17 and 18–23 years), sex at birth (male, female and others) and educational level (none, primary, secondary and college/university). Participants were categorised as vulnerable if they ticked any of these options: engaged in transactional sex, used illegal drugs or prescription drugs without prescription and injected drugs without a needle.

Statistical analysis

Frequencies and percentages were calculated for the study variables. The associations between the dependent and independent variables were assessed by using the χ^2 test. Binary logistic regression modelling using IBM SPSS for Windows V.22.0 (IBM) was used to determine the independent variables associated with use of e-cigarettes and with tobacco smoking. Adjusted ORs (AORs), 95% CIs and p values were calculated. Statistical significance was set at p<0.05.

RESULTS

The number of responses per the geopolitical zones in Nigeria is highlighted in online supplemental file 1.

Table 1 shows that there were 2206 (76.9%) of the 2870 respondents who were 18–23 years, 1449 (50.0%) males and 1294 (45.1%) university students. In addition, 568 (19.8%) participants reported using e-cigarettes and 787 (27.4%) participants reported current smoking of tobacco.

Table 1 also shows that 173 (6%) participants reported living with HIV, 344 (12%) participants were infected with COVID-19 and 313 (10.9%) participants had severe anxiety. Also, 1233 (43.0%) participants considered themselves vulnerable. More respondents who were 18–23 years (p<0.001), male (p<0.001), had secondary school level education or less (p<0.001), had a health condition (p<0.001), was living with HIV (p<0.001), was vulnerable (p<0.001), was infected with COVID-19 (p<0.001) or has moderate or severe levels of anxiety (p<0.001) used e-cigarettes. Also, more respondents who used e-cigarettes also currently smoked tobacco (p<0.001), and had father (p<0.001), mother (p<0.001), siblings (p<0.001) or close friends (p<0.001) used e-cigarettes.

Like e-cigarette use, more respondents who were 18–23 years (p<0.001), male (p=0.013), had secondary school level education or less (p<0.001), had a health condition (p<0.001), was living with HIV (p<0.001), was vulnerable (p<0.001), was infected with COVID-19 (p<0.001) or has moderate or severe levels of anxiety (p<0.001) currently smoked tobacco. Also, more respondents who had father (p<0.001), mother (p<0.001), siblings (p<0.001) or close friends (p<0.001) who used e-cigarettes, currently smoked tobacco.

Table 2 shows that risk indicators with statistically significant higher odds with e-cigarette use were: 18–23 years (AOR 3.354; 95% CI 1.507 to 7.465), senior secondary school level of education (AOR 2.082; 95% CI 1.537 to 2.819), with a health condition (AOR 1.514; 95% CI 1.150 to 1.994); with a COVID-19 infection (AOR 3.602; 95% CI 2.199 to 4.263); living with HIV (AOR 1.898; 95% CI 1.276 to 2.823); high anxiety (AOR 1.872; 95% CI 1.335 to 2.627), tobacco smoking (AOR 3.554; 95% CI 2.625 to 4.812) and being vulnerable (AOR 2.000; 95% CI 1.522 to 2.628). On the other hand, respondents with moderate anxiety (AOR 0.627; 95% CI 0.450 to 0.874) had statistically significant lower odds of using e-cigarettes when compared with persons with low anxiety.

The following familial variables were associated with statistically significant higher odds of e-cigarette use: having father (AOR 1.520; 95% CI 1.089 to 2.122), mother (AOR 2.158; 95% CI 1.519 to 3.065), sibling (AOR 2.334; 95% CI 1.731 to 3.148) or close friends (AOR 2.724; 95% CI 2.106 to 3.523) who used e-cigarettes

The risk indicators for tobacco smoking that were associated with significantly higher odds of tobacco smoking were: 18–23 years (AOR 11.335; 95% CI 5.146 to 24.968), 15–17 years (AOR 6.621; 95% CI 2.778 to 15.782), male (AOR 1.577; 95% CI 1.238 to 2.008), had junior

secondary school education (AOR 1.870; 95% CI 1.217 to 2.872), had high (AOR 1.626; 95% CI 1.117 to 2.366) or moderate anxiety (AOR 2.500; 95% CI 1.902 to 3.284), an e-cigarette user (AOR 3.201; 95% CI 2.346 to 4.366) and being vulnerable (AOR 2.931; 95% CI 2.307 to 3.724).

The familial variables associated with significantly higher odds of tobacco smoking were: having a father (AOR 3.680; 95% CI 2.635 to 5.140), mother (AOR 1.573; 95% CI 1.074 to 2.304), sibling (AOR 2.199; 95% CI 1.619 to 2.987) or close friends (AOR 4.142; 95% CI 3.260 to 5.264) who smoked cigarettes.

DISCUSSION

The findings of this study suggest about one in five adolescents and young people in Nigeria use e-cigarettes and one in four adolescents and young people smoke tobacco. The risk indicators common to both using e-cigarettes and currently smoking tobacco were being 18–23 years, high anxiety, being vulnerable and having father, mother, siblings or friends who smoked. Smoking tobacco was a risk indicator for the use of e-cigarettes and vice versa. Respondents with a health condition, COVID-19 infection and who were living with HIV were more likely to use e-cigarettes. Respondents who were males, 15–17 years and who had moderate anxiety were more likely to smoke tobacco. Respondents with moderate anxiety were less likely to use e-cigarettes. The study hypothesis was supported by the study findings.

One of the strengths of this study is the large sample size. The study also provides new evidence on the use of e-cigarettes and tobacco smoking by adolescents and young people living with HIV, who had health conditions, had COVID-19 and who considered themselves vulnerable. This new evidence can inform policy formulation and tobacco cessation programme planning in Nigeria and similar settings. The study, however, has some limitations. It is a cross-sectional study, and so a cause-and-effect relationship between the variables cannot be inferred. It was a convenience sample liable to selection bias though the COVID-19 pandemic precluded the use of probability sampling techniques.[36] We; however, made efforts to ensure the greatest geographical spread and inclusion of all administrative districts in the recruitment process; and the response to the online survey implied that respondents participated because they were interested and felt comfortable answering the questions.[37 38] Also, respondents self-reported their oral health and smoking habit which carries a risk of social desirability and recall biases. There is also a probability of a response bias for respondents who needed parental consent for study participation if parents provided oversight for their responses. Despite these limitations, the study provides new insights on adolescents and young people's use of e-cigarettes and tobacco smoking in Nigeria.

First, the findings suggest that a large number of adolescents and young people in Nigeria use e-cigarettes and smoke tobacco, indicating the country may have a

Table 1 Sociodemographic characteristics associated with the use of e-cigarettes and current tobacco smoking among adolescents and young people 11–23 years in Nigeria (n=2870)

Variables	Ever used e-cigarettes N=2870			Current tobacco smoking N=2870			Total N=2870 n (%)
	Yes N=568 n (%)	No N=2302 n (%)	P value	Yes N=787 n (%)	No N=2083 N (%)	P value	
A) Sociodemographic profile of study participants							
Age (years)							
18–23	521 (23.6)	1685 (76.4)	<0.001	727 (33.0)	1479 (67.0)	<0.001	2206 (76.9)
15–17	38 (11.6)	289 (88.4)		52 (15.9)	275 (84.1)		327 (11.4)
11–14	9 (2.7)	328 (97.3)		8 (2.4)	329 (97.7)		337 (11.7)
Sex at birth							
Male	300 (20.7)	1149 (79.3)	<0.001	427 (29.5)	1022 (65.0)	0.013	1449 (50.5)
Female	268 (18.9)	1153 (81.1)		360 (25.3)	1061 (74.7)		1421 (49.5)
Education status							
Secondary school or less	432 (27.4)	1144 (72.6)	<0.001	553 (35.1)	1023 (65.0)	<0.001	1576 (54.9)
University or higher	136 (10.5)	1158 (89.5)		234 (18.1)	1060 (81.9)		1294 (45.1)
B) Other adolescent and young adults characteristics							
Health condition							
Yes	268 (41.8)	373 (58.2)	<0.001	326 (50.9)	315 (49.1)	<0.001	641 (22.3)
No	300 (13.5)	1929 (86.5)		461 (20.7)	1768 (79.3)		2229 (77.7)
Living with HIV							
Yes	89 (51.4)	84 (48.6)	<0.001	97 (56.1)	76 (43.9)	<0.001	173 (6.0)
No	479 (17.8)	2218 (82.2)		690 (25.6)	2007 (74.4)		2697 (94.0)
Vulnerability							
Yes	436 (35.4)	797 (64.6)	<0.001	599 (48.6)	634 (51.4)	<0.001	1233 (43.0)
No	132 (8.0)	1505 (92.0)		188 (11.5)	1449 (88.5)		1637 (57.0)
Infected with COVID-19							
Yes	210 (61.0)	134 (39.0)	<0.001	215 (62.5)	129 (37.5)	<0.001	344 (12.0)
No	358 (14.2)	2168 (85.8)		572 (22.6)	1954 (77.4)		2526 (88.0)
Anxiety status							
Low	188 (11.4)	1464 (88.6)	<0.001	220 (13.3)	1432 (86.6)	<0.001	1652 (57.6)
Moderate	282 (31.2)	623 (68.8)		463 (51.2)	442 (48.8)		905 (31.5)
Severe	98 (31.3)	215 (68.7)		104 (33.2)	209 (66.8)		313 (10.9)
C. Familiar e-cigarettes experience							
Smoker							
Yes	401 (70.6)	167 (29.4)	<0.001	401 (51.0)	167 (21.3)	<0.001	568 (27.4)
No	386 (16.8)	1916 (83.2)		386 (16.8)	1916 (83.2)		2302 (72.6)
Father use e-cigarettes							
Yes	102 (50.7)	99 (49.3)	<0.001	144 (71.6)	57 (28.4)	<0.001	201 (7.0)
No	466 (17.5)	2203 (82.5)		643 (24.1)	2026 (75.9)		2669 (93.0)
Mother use e-cigarettes							
Yes	160 (56.7)	122 (43.3)	<0.001	193 (68.4)	89 (31.6)	<0.001	282 (9.8)
No	408 (15.8)	2180 (84.2)		594 (23.0)	1994 (77.0)		2588 (90.2)
Sibling use e-cigarettes							
Yes	157 (54.9)	129 (45.1)	<0.001	194 (67.8)	92 (32.1)	<0.001	286 (10.0)
No	411 (15.9)	2173 (84.1)		593 (22.9)	1991 (77.1)		2584 (90.0)
Close friends use e-cigarettes							
Yes	252 (43.2)	332 (56.8)	<0.001	338 (57.9)	246 (42.1)	<0.001	584 (20.3)
No	316 (13.8)	1970 (86.2)		449 (19.6)	1837 (80.4)		2286 (79.7)

*Mann-Whitney test.

Table 2 Binary regression models to identify risk indicators for e-cigarette and current tobacco smoking by adolescents and young people 11–23 years in Nigeria

Variables	E-cigarettes use AOR (95% CI), p value	Current tobacco smoking AOR (95% CI), p value
Individual factors associated with use of e-cigarettes and tobacco smoking		
Age (years)		
18–23	3.354 (1.507 to 7.465), 0.003	11.335 (5.146 to 24.968), <0.001
15–17	1.767 (0.752 to 4.151), 0.191	6.621 (2.778 to 15.782), <0.001
11–14	1.000	1.000
Sex at birth		
Male	1.221 (0.944 to 1.580), 0.129	1.577 (1.238 to 2.008), <0.001
Female	1.000	1.000
Education		
Primary	1.284 (0.619 to 2.663), 0.502	2.138 (0.902 to 5.066), 0.084
Junior secondary school	1.265 (0.814 to 1.968), 0.296	1.870 (1.217 to 2.872), 0.004
Senior secondary school	2.082 (1.537 to 2.819), <0.001	0.981 (0.731 to 1.315), 0.896
Tertiary	1.000	1.000
Health condition		
Yes	1.514 (1.150 to 1.994), 0.003	1.180 (0.869 to 1.601), 0.289
No	1.000	1.000
COVID-19 infection		
Yes	3.602 (2.199 to 4.263), <0.001	0.926 (0.624 to 1.375), 0.702
No	1.000	1.000
Living with HIV		
Yes	1.898 (1.276 to 2.823), 0.002	1.136 (0.708 to 1.822), 0.597
No	1.000	1.000
Anxiety status		
High	1.872 (1.335 to 2.627), <0.001	1.626 (1.117 to 2.366), 0.011
Moderate	0.627 (0.450 to 0.874), 0.006	2.500 (1.902 to 3.284), <0.001
Low	1.000	1.000
Vulnerability		
Yes	2.000 (1.522 to 2.628) <0.001	2.931 (2.307 to 3.724), <0.001
No	1.000	1.000
Tobacco smoking		
Yes	3.554 (2.625 to 4.812), <0.001	
No	1.000	
E- cigarette use		
Yes		3.201 (2.346 to 4.366), <0.001
No		1.000
Familiar factors associated with use of e-cigarettes and tobacco smoking		
Father		
Yes	1.520 (1.089 to 2.122), 0.014	3.680 (2.635 to 5.140), <0.001
No	1.000	1.000
Mother		
Yes	2.158 (1.519 to 3.065), <0.001	1.573 (1.074 to 2.304), 0.020
No	1.000	1.000
Sibling		
Yes	2.334 (1.731 to 3.148), <0.001	2.199 (1.619 to 2.987), <0.001

Table 2 Continued

Variables	E-cigarettes use AOR (95% CI), p value	Current tobacco smoking AOR (95% CI), p value
No	1.000	1.000
Close friends		
Yes	2.724 (2.106 to 3.523), <0.001	4.142 (3.260 to 5.264), <0.001
No	1.000	1.000
AOR, adjusted OR.		

tobacco and e-cigarette use public health problem that needs strategic planning for effective interventions. The proportion of young people who use e-cigarette in this study is higher than the 7.9% e-cigarette users[8] reported in a prior study conducted in Nigeria, and the 9.2% current e-cigarette use among youths in a multicountry study.[39] Also, the proportion to those smoking tobacco is higher than the 10.4% current tobacco smokers reported in a prior study conducted in Nigeria[9] and the 19.1% among youths in Africa.[40] Our study collected data for those with a history of e-cigarette use while the comparative data were those of current e-cigarette use. Nevertheless, the results of this study may indicate a growing prevalence of e-cigarette use and tobacco smoking among the study population of adolescents and young people in Nigeria. A national study on the use of e-cigarettes and tobacco smoking may inform the development of a national strategic plan for effective tobacco use control among adolescents and young adults in Nigeria. Sadly, the country is not taking steps to monitor tobacco and e-cigarette use, In the meantime, programmes working with adolescents and young people in Nigeria should integrate smoking cessation counselling for their clients.

Second, the common familial (father, mother, siblings and close friends who smoked) and individual (age, high anxiety and having a health condition) factors associated with higher risk of using e-cigarettes and smoking tobacco had been reported in previous studies.[41–43] This may be because of the e-liquid in many e-cigarettes contain nicotine.[44] The results of the study also reflect the influence that social network has on health behaviours[45]; and agree with prior studies indicating that children of smokers were more likely to smoke, and become habitual smokers[46]; and mothers' smoking had a stronger impact on the transition of adolescents and young persons to habitual smoking than friends who smoke.[47] The stronger influence of close friends than parents reported in this study may reflect poor parent–child communication on health issues in Nigeria[48] and the stronger ties that adolescents have with their peers than their parents.[48] The findings had been reported by an earlier study conducted in Nigeria.[10] The findings emphasise that smoking interventions in Nigeria need to be sensitive to family and social network contexts; and that prevention messages should be tailored to address these influences.[47]

Third, we also observed that young people who identified themselves as vulnerable seemed more likely to smoke tobacco and use e-cigarettes than those who did not perceive themselves as vulnerable. The perception of vulnerability is diverse, complex, dynamic and often, few people self-identify as being vulnerable.[49] An awareness of one's vulnerability may create stress and anxiety; and may be associated with smoking as a destressor.[50 51] The multiple health programmes in Nigeria working with populations vulnerable to HIV infection—sex workers, drug users, sexual and gender minority—who face stress because of the conflict between their values and the dominant societal values[51] could include tobacco cessation into their programmes. Also, the National Tobacco Control Act 2015[52] should focus on vulnerable populations who are often the targets of marketing by the tobacco industry.[53]

Fourth, though a prior study in Nigeria indicated that e-cigarette use was not associated with anxiety disorder,[8] we observed that respondents with moderate anxiety were more likely to use e-cigarettes and smoke tobacco. These findings may point to a growing tobacco use problem in Nigeria, a country with the highest level of stress in the world[54 55] and where tobacco cessation programmes are poorly implemented.[56] Further studies are needed to understand how anxiety influences decisions related to tobacco use by adolescents and young persons.

Finally, we also observed that respondents with a health condition, COVID-19 infection and living with HIV were more likely to use e-cigarettes than smoke tobacco. The result may reflect a change from tobacco smoking to e-cigarette use by young people with health problems, or that young people with medical problems resort to e-cigarettes as a destressor based on an assumption that e-cigarettes is safer than tobacco smoking. Further studies are needed to explain the reason(s) for this study findings. In the interim, there needs to be more education about the higher risk of heart and lung diseases for users of e-cigarette.[57 58] Also, e-cigarette use has severe implication for COVID-19 co-infection as it may suppress inflammatory and immune-response in nasal epithelial cells in a similar mechanism to tobacco smoke.[59] The effectiveness of e-cigarettes as a tobacco cessation tool remains unclear and tobacco smokers should be advised to quit smoking completelyrather than switching to e-cigarettes.[60]

In conclusion, the proportion of adolescents and young people who use e-cigarettes and smoke tobacco in this population is high. Though we observed that e-cigarette use and tobacco consumption shared individual and familial risk factors, the study findings point to a complex relationship between factors associated with the use of e-cigarettes and smoking of tobacco that needs to be studied further. In the interim, public health programmes should target these common risk factors for e-cigarette use and tobacco smoking.

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