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Internet addiction during the COVID-19 pandemic among adolescents in southeast Nigeria and implications for adolescent care in the post-pandemic era: A cross-sectional study

Vivian Ozoemena Onukwuli[1], Enebe Nympha Onyinye[2], Ifeoma Bridget Udigwe[3], Uche Marian Umeh[4], Joseph Tochukwu Enebe[5] and Anthony Tochukwu Umerah[6]

Abstract

Objectives: This study aimed to determine the prevalence and associated factors of internet addiction amongst adolescents in Southeast Nigeria during the coronavirus disease 2019 (COVID-19) era.

Methods: A cross-sectional study was carried out in 10 randomly selected secondary schools, 2 (one urban and one rural) each from Abia, Anambra, Ebonyi Enugu and Imo states of southeastern Nigeria between July and August 2021. Data on demographic variables were collected using a structured self-administered questionnaire. Young's Internet Addiction Test was used to assess the extent of internet use. Analysis was done using the IBM SPSS Statistics version 23. The level of significance was set at a p-value of <0.05.

Results: The mean age of the respondents was 16.2 ± 1.8 years and the male: female ratio was 1:1.6. Most of the adolescents (61.1%) used the internet for academic purposes, while 32.8% used it for social interactions and the majority (51.5%) used their phones. The prevalence of internet addiction was 88.1% (24.9% had mild, 59.6% had moderate, while 3.6% had severe addiction) and a good proportion of the respondents (81.1%) perceived addiction as bad. Internet addiction was significantly associated with the respondent's age ($p=0.043$), mother's level of education ($p=0.023$), family size ($p=0.021$), place of residence ($p=0.035$), alcohol intake ($p=0.017$), smoking ($p=0.015$), substance use ($p=0.001$) as well as the duration of internet use ($p<0.001$). Internet addiction was predicted by the male gender (adjusted odds ratio (AOR): 2.054; confidence interval (CI): 1.200–3.518), early adolescent age group (10–13 years) (AOR: 0.115; C1: 0.015–0.895) as well as the duration of internet use (AOR: 0.301; CI: 0.189–0.479).

Conclusions: The prevalence of internet addiction among adolescents during the COVID-19 pandemic era was high. The predictors of addiction were the male gender, early adolescent age group and duration of internet use.

Keywords

Internet addiction, COVID-19 pandemic, adolescents, southeast Nigeria

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Introduction

The World Health Organization for the first time identified the novel coronavirus disease 2019 (COVID-19), in January 2020, but later in March 2020, the spread of COVID-19 was declared a global pandemic.[1] Increased understanding of the epidemiology of the pandemic led to the application of several strategies including both pharmacological and non-pharmacological methods to cut down the widespread of COVID-19 virus transmission in the world.[2–4] Many countries subsequently imposed national lockdowns by closing all schools and workplaces,

[1]College of Medicine, University of Nigeria Ituku/Ozalla, Enugu, Nigeria
[2]University of Nigeria Teaching Hospital (UNTH), Enugu, Nigeria
[3]Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra, Nigeria
[4]Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka, Anambra, Nigeria
[5]ESUT Teaching Hospital, Parklane, Enugu, Nigeria
[6]Federal University of Technology Owerri, Owerri, Imo, Nigeria

Corresponding author:
Joseph Tochukwu Enebe, ESUT Teaching Hospital, Parklane, GRA, Parklane, Enugu 400102, Nigeria.
Email: drenebe2002@yahoo.co.uk

which led to increased virtual learning globally. Social distancing measures were enforced and movement restrictions were implemented by preventing people from visiting public places or organizing public meetings that will allow the physical meeting of people from different households all aimed at reducing the spread of the virus.[5]

Lockdowns are isolation periods that could be distressful psychologically and unpleasant for everyone involved.[6,7] During the lockdown and presently, there are some levels of restrictions to limit movement to prevent the spread of COVID-19. Stay-at-home quarantines and physical distancing mandates have increased the use of digital gadgets. Online class activities have reduced physical interactions and have led to the restriction of recreational activities.[2] These measures forced adolescents to spend most of their time at home, thus increasing the duration of internet use, not only for academic reasons but also for other purposes including playing games and other social interactions with the view of deriving happiness.[8] Adolescents are in a critical and formative period of transition from childhood to adulthood. They spend more time and feel more comfortable expressing their feelings to their peers than their parents. The relationship between adolescents and their parents and peers is crucial, as they consider their peers as a source of affection, trust, inclusivity and self-esteem. Attachment of adolescents to parents and peers has been shown to be associated with internet (Instagram) addiction.[9]

With COVID-19 and its associated limited social interaction, adolescents may feel lonely with escalated risks of mental health problems such as depression, anxiety, traumatic experiences and sleep disorder.[10–12] During the COVID-19 pandemic, internet use behaviour also changed[13] and studies have shown that people had problematic smartphone use[13–15] and Facebook addiction.[16] Addictive behaviours including internet addiction may occur.[15,17] Psychological distress due to the COVID-19 pandemic has impacted negatively on internet addiction and Instagram addiction among people.[18] The internet and the use of various digital devices are among the most important socialization factors and leisure activities in the lives of adolescents. Despite the benefits that the internet offers such as easy access to unlimited information, limitless communication and entertainment, its excessive use can lead to addiction[3] and is also associated with several psychological problems, especially among adolescents.[12,19,20] Psychological distress due to the COVID-19 pandemic causes internet addiction and Instagram addiction in emerging adults that were unduly exposed to excessive use during their adolescent age.

The adolescence period is marked by emotional crises, mood swings, bouts of anxiety and depressive tendencies and this adolescents respond to by exhibiting aggressive reactions, addictions to substances, avoidance of social contacts of some sort and withdrawals from the public.[21,22] During this period of life, the attitude, outcome of development and invariably the general behaviour later in life are greatly influenced by the course of events that occurred within this period.[23]

Internet addiction could be described as a behavioural addiction in which one is dependent on the use of the internet, or other online devices as a maladaptive way of coping with the stresses of life.[24] Before the COVID-19-related lockdown measures, studies had shown that internet addiction was widely recognized as a national health problem affecting a large number of people[25] while others argued that though it spread across all countries, there are yet underlying cultural variations.[20] The internet has become a necessity in everyday life and is immensely utilized in almost all aspects of people's lives. There was a dramatic increase in the proportion of individuals using the internet from 0.9% in 2000 to 17.1% in 2014.[7] Based on data from the Indonesia Internet Service Provider Association, the number of internet users in Indonesia has reached 143 million people, becoming the highest number of internet users in the South East Asia region.[8] Nearly 90% of students were physically cut off from their schools due to the COVID-19 pandemic, and technology became necessary to enable students to access educational materials, interact with each other and do what students need to do most: play.[9] The internet also allows youth to experiment and explore important adolescent-phase questions, including identity, autonomy and sexuality.[10]

Adolescents during their period of development more than any other group have an increased quest and attraction to these technological tools.[26] The adolescents used the internet mostly as a coping measure to the imposed inactive lifestyle during the pandemic.[27] During the lockdown period for these groups of people, most of the activities such as socializing, entertainment, school work and lessons were done virtually.[5] The assessments done on the average time spent daily on the internet in the pre-pandemic period by adolescents showed that this average time markedly increased during the pandemic period and this has led to the increased risk of internet addiction.[17,28,29] According to a meta-analysis, there were more adolescents with internet addiction (24.4%) during the lockdown occasioned by the COVID-19 pandemic[17] than in the period before the pandemic (13.6%).[30] Recently, a study in Ibadan, southwest Nigeria observed a high prevalence (44.9%) of internet addiction among adolescents.[31]

Furthermore, it was observed in recent studies on the effect of the COVID-19 lockdown on the use of the internet in Taiwan, India and Mexico[17,32,33] that the lockdown measures increased the prevalence of problematic internet use (PIU) amongst young people. Reduced quality of sleep, decreased sleep time, anxiety, depressive states, insomnia, excessive fatigue, attention deficit hyperactivity disorder and suicidal tendencies over the years with evident studies showing a strong association with internet addiction.[27,34,35] Internet usage impacts negatively the time being spent doing other useful activities and this may negatively affect the

emotional health and psychological well-being of adolescents and children.[36]

Importantly, in Nigeria, during the COVID-19 pandemic, all schools were closed and online classes at a point were introduced to keep all categories of students busy. Homes were forced to make provisions for internet access. Internet addiction was recorded among students and boredom was a key associated factor to internet addiction among some participants in an Ado-Ekiti, southwest Nigeria study.[37] Ilesami et al. also recorded a high PIU among participants within the same region and the major reasons for the increased PIU were boredom, loneliness, idleness, pleasure gained from internet use, physical isolation and the need for information and communication.[35] Studies that looked at the level of internet use and consequences of such use among adolescents were not easily available in the southeast of Nigeria.

Considering the observed scarcity of information occasioned by the lack of studies on the prevalence and the factors affecting internet addiction among adolescents in the schools in our environment, this study was carried out. This study aimed to determine the prevalence of internet addiction, and ascertain socio-economic and demographic factors that are associated with and predict internet addiction (IA) amongst adolescents in southeast Nigeria during the COVID-19 era.This study will help establish a baseline for this area of study among adolescents in the study area and by extension the whole of Nigeria. The findings of this study were hoped to form the basis for intervention to mitigate the effects of internet addiction among adolescents in the post-COVID-19 era. Also, the evidence generated will be useful to families and health practitioners in monitoring and treatment of internet overuse-related health challenges. Evidence generated will also be useful to non-governmental organizations and governments in developing policies that will curb health-related challenges faced by adolescents that are caught in the web of internet addiction.

Methods

Study Design: A descriptive, cross-sectional study design was used in this study.

Study area: The study was conducted between July and August 2021, in five of the southeast states of Nigeria: Abia, Anambra, Ebonyi, Enugu and Imo. These states have diversified ethnic groups but the predominant language is Igbo. The inhabitants are mainly traders, but a significant proportion is made up of civil servants. There are many educational institutions including primary, secondary and tertiary institutions. Adolescents make up a significant percentage of the population (22.3%) in Nigeria and the majority are in secondary (Net attendance ratio: male – 54.2%, female – 54.3%) and tertiary institutions.[38]

Study participants: The study constituted adolescents attending secondary schools in the five states of southeastern Nigeria.

Eligibility criteria: All the adolescents in the secondary schools of the five states of southeastern Nigeria were eligible to participate in the research.

Exclusion criteria: All adolescents that did not give assent and those whose parents did not give consent to participate in the study were excluded from the study. Also, those who were too ill (both physically and mentally) to participate in the study were excluded from the study.

Determination of sample size: The sample size was determined using the formula for single proportions[39]: $N = Z^2pq/d^2$ where N = sample size required, Z = critical value corresponding to 95% confidence level at p of 0.05 = 1.96, p = prevalence of internet addiction among secondary school adolescents and was taken to be 44.9%,[31] and d = precision or accuracy of sample = 5%. Compensating for the non-response of 10%, the minimum sample size (n) for the study was 418 but to ensure robustness, 1000 adolescents (200 from each state) were studied.

Sampling technique: The studied adolescents were selected in two stages. The secondary schools in the urban and rural areas of these states were ranked according to the population of students (adolescents) in the schools. The first six schools based on this ranking were remarked on. Then, using balloting as a simple random sampling technique, one urban and one rural secondary school was selected from each state. In the second stage, a list of all adolescents (students) in senior secondary classes was made (the senior students had a better understanding of the questionnaires after a pretesting). This list created was used as the sampling frame for the study. The sampling interval was obtained by dividing this number by the sample size allotted to the school. This interval was used in recruiting the students (adolescents) according to their class sitting arrangement. On each day of data collection, the index student (adolescents) was selected using a simple random sampling technique (balloting).

Study instruments: Data collection for this study was done using a pretested interviewer-administered questionnaire. Demographic characteristics (age, sex, religion, household type, birth order, custodian, place of residence), as well as information on the family structure (nuclear or extended), were documented. Oyedeji's classification was used for the determination of the socio-economic class of the participant's parents.[40] Kimberly Young's Internet Addiction Test (IAT) tool was used to assess the presence of excessive internet use and other related problems among the participants.[41] The IAT is a validated self-report instrument with acceptable psychometric properties for the Nigerian population.[42] It is a one-dimensional (one-factor structure) questionnaire that uses a five-point Likert scale. It consists of 20 items that measure psychological dependence, compulsive use and withdrawal symptoms. The total score obtained was subsequently categorized into four groups to determine the severity of internet addiction: normal (0–30), mild internet addiction (31–49, moderate internet addiction (50–79) and severe internet addiction (80–100). Young's IAT instrument

has been validated across the globe, including the United States,[25] the United Kingdom (UK)[26] and Italy[27]. The IAT was shown to have good validity (χ^2 $p < 0.001$; root mean square error of approximation = 0.076; comparative fit index = 0.95; standardized root mean squared residual = 0.057 and Akaike information criterion = 784.63) with a Cronbach's alpha score of 0.855. It was found to have good validity and reliability in a three-dimensional model in an Indonesian study.[28] A Nigerian study[29] found that the observed overall Cronbach's α coefficient of 0.79 was obtained for IAT and was shown to be gender sensitive with acceptable psychometric properties for the Nigerian population.

Pre-testing of the study instrument: A pretesting of the study instrument was done on 10% (100) of the study participants which showed a good understanding of the study instrument, especially among the senior secondary students, hence the informed choice of the study population.

Statistical analysis: The data were processed using the IBM SPSS version 23 statistical software (IBM SPSS Inc., Chicago, IL, USA). Variables related to the demographic characteristics of respondents, their family structure and their parent's socioeconomic status were included in the analysis to control the results. Associations of variables were determined using bivariate analysis (chi-square), and the predictors were obtained by doing a multivariate analysis (binary logistic regression model) of all variables that had a maximum *p*-value of 0.2. The level of statistical significance for all analyses was set at $\alpha = 0.05$ using two-tailed tests.

Outcome measures: The primary outcome measure was the prevalence of internet addiction among the participants. The secondary outcome measures were socio-economic and demographic factors that are associated with and predict internet addiction among the participants.

Ethical approval: This was obtained from the Health Research Ethics Committee of the University of Nigeria Teaching Hospital Enugu with reference number NHREC/05/01/2008B-FWA00002458-IRB0002323. Permission for the study was obtained from the schools' Management. Written informed consent was gotten from the student's parents/caregivers while assent was obtained from all the participants. The class teachers of classes that participated in the study were utilized to send consent forms to parents through the students (participants). The signed returned consent forms were also returned by the participants to the teachers. The details of the study, expectations, benefits and risks inherent in the study were well elaborated in the consent form.

Results

A total of 42 parents did not give consent for their wards to participate in the research. Out of this number, 24 did not sign the consent forms while 18 parents refused to give consent sighting poor understanding (5, 27.8%), lack of interest (6, 33.3%) and financial rewards (7, 38.9%). All participants whose parents gave consent equally assented to participate in the study. Subsequently, a total of 1000 students were recruited for the study and out of this only 851 questionnaires were properly completed and this gave a recovery rate of 85%. The Cronbach's alpha score for IAT in our present study was 0.870. The respondents were drawn from 10 secondary schools with two schools in each state (rural and urban) of the five states of southeast Nigeria.

Baseline information: Mean age of respondents was 16 ± 1.8 years, with 68.7% ($N = 585$) of them falling within the mid-adolescence age, 24.6% (209) late adolescents and 6.7% (57) early adolescents. Male: female ratio was 1:1.6. Majority of the respondents were Christians (720, 84.6%), and lived with both parents (534, 62.7%). About 56.3% (479) had medium family sizes. A total of 396 (46.5%) of the students were from families of upper socio-economic class, while 31.5% (267) were from lower social class. Slightly more than half of the respondents (54.9%, 467) lived in an urban area, 21.9% (186) lived in a rural area and 23.3% (186) lived in a semi-urban area. The details of the socio-demographic characteristics of the respondents are presented in Table 1.

Most of the parents of the respondents were senior public servants (fathers, 427, 50.2%; mothers, 248, 29.1%). The highest level of education of the parents of the respondents was university graduate or its equivalent (fathers, 379, 44.5%; mothers, 333, 39.1%). The details of the respondents' parents' occupations and the highest level of education are shown in Table 2.

The social characteristics of the respondents

Only 15% of the respondents (128) drank alcohol as part of their social life and out of this group, 30% of them (39) believed that alcohol affected their social behaviour. On the other hand, only 6.5% (55) of respondents smoked and more than half of those respondents (58.2%, 32) were affected by that habit. Slightly more respondents (14.1% (120)) used drugs socially and 47.5% of them were affected by the drugs they used. Details are shown in Table 3.

The use of the internet among the respondents

All the respondents have used the internet before the research and more than half of the respondents have used the internet for more than 1 year. More than half of the respondents used their devices to access the internet and the source of internet supply was mainly through personal data (407, 47.8%), Wi-Fi (168, 19.7%) and their parent's device (149, 17.5%). The majority of the respondents (691, 81.2%) have heard about internet addiction, 56.2% (388) of the respondents perceived internet addiction as wrong while 23.3% (161) perceived it as right. The major reasons for the use of the internet

Table 1. Socio-demographic characteristics of the respondents.

Category	Frequency (%)
Age (years)	
Early adolescent	57 (6.7)
Mid-adolescent	585 (68.7)
Late adolescent	209 (24.6)
Mean age (SD) = 16 (1.8)	
Sex	
Male	331 (38.9)
Female	520 (61.1)
Religion	
Christianity	720 (84.6)
Islamic	70 (8.2)
Traditional	40 (4.7)
Others	21 (2.5)
Household type	
Monogamous	707 (83.1)
Polygamous	144 (16.9)
Family structure	
Nuclear	680 (79.9)
Extended	171 (20.1)
Custodian	
Both parents	534 (62.7)
Only mother	122 (14.3)
Only father	55 (6.5)
Other relatives	86 (10.1)
Unrelated guardian	54 (6.3)
Birth order	
1–3	486 (57.1)
>3	365 (42.9)
Family size	
Small (1–5)	237 (27.8)
Medium (6–10)	479 (56.3)
Large (>10)	135 (15.9)
Mean (SD) = 8 (3.5)	
SEC	
High SEC	396 (46.5)
Middle SEC	188 (22.1)
Low SEC	267 (31.4)
Place of residence	
Urban	467 (54.9)
Rural	186 (21.9)
Semi-urban	198 (23.3)

SD: standard deviation; SEC: socio-economic class.

among the respondents were for studies/carrying out assignments (521, 61.2%), downloading music/videos (333, 39.1%), social networking (279, 32.8%), playing games (251, 29.5%) among other reasons. The social media platforms mostly visited by the respondents were mostly Facebook (452, 53.1%) and WhatsApp (274, 32.2%) social media networks among others. The other details on the use of the internet among the respondents are shown in Table 4.

The prevalence of internet addiction among the respondents

The prevalence of internet addiction among the respondents was 88.1% as a total of 750 respondents used the internet addictively. The details of grades of use of the internet among the respondents are shown in Table 5.

Predictors of internet addiction among the respondents

Addiction was significantly associated with the respondent's age ($p=0.043$), mother's level of education ($p=0.023$), family size ($p=0.021$), place of residence ($p=0.035$), alcohol intake ($p=0.017$), smoking ($p=0.015$), substance use ($p=0.001$) as well as the duration of internet use ($p<0.001$). The predictors of internet addiction were age category ($p=0.043$, adjusted odds ratio (AOR): 0.115, confidence interval (CI): 0.015–0.895), sex ($p<0.001$, AOR: 2.054, CI: 1.2–3.518), duration of use of the internet ($p<0.001$, AOR: 0.301, CI: 0.189–0.479). The early adolescents (10–13 years) were about 8.7 times less likely to be internet addicts compared to the mid- and late adolescents. The males were about two times more likely to be internet addicts compared to the female respondents while respondents that had used the internet for less than 6 months were about 3.3 times less likely to be internet addicts compared to those that have used the internet for 6 months and above. The details of the predictors are shown in Table 6.

Discussion

The objectives of the study were to determine the prevalence of internet addiction, and its associated factors (demographic variables, socio-economic status, family structure and social behaviours) among secondary school adolescents in southeast Nigeria during the COVID-19 pandemic. Internet addiction was found in 88.1% of the respondents (24.9% had mild, 59.6% had moderate, while 3.6% had severe) and a good number (81.1%) perceived addiction as bad. Addiction was significantly associated with the respondent's age ($p=0.043$), mother's level of education ($p=0.023$), family size ($p=0.021$), place of residence ($p=0.035$), alcohol intake ($p=0.017$), smoking ($p=0.015$), substance use ($p=0.001$) as well as the duration of internet use. ($p<0.001$). Internet addiction was predicted by the male gender (AOR: 2.054; CI: 1.200–3.518), mid- and late adolescent age groups 14–19 years (AOR: 0.115; C1:0.015–0.895) as well as having used the internet for more than 6 months (AOR: 0.301; CI: 0.189–0.479).

The study has identified different levels of internet addiction among the adolescents studied. All the respondents had used the internet in the past while 24.9%, 59.6% and 3.6%

Table 2. Respondents' parents' characteristics.

Category	Frequency (%)
Fathers' occupation	
Senior public servants, professionals, large-scale business men	427 (50.2)
Intermediate-grade public servants, senior school teachers	98 (11.5)
Junior school teachers, professional drivers	102 (12.0)
Petty traders, labourers, messengers	165 (19.4)
Unemployed, housewives, students, subsistent farmers	59 (6.9)
Mothers' occupation	
Senior public servants, professionals, large-scale business women	248 (29.1)
Intermediate-grade public servants, senior school teachers	158 (18.6)
Junior school teachers, professional drivers	94 (11.0)
Petty traders, labourers, messengers	232 (27.3)
Unemployed, housewives, students, subsistent farmers	119 (14.0)
Fathers' highest level of education	
University graduate or equivalent	379 (44.5)
NCE or OND	111 (13.0)
SSCE, teachers grade II or equivalent	152 (17.9)
JSSCE or FSLC holder	103 (12.1)
No formal education	106 (12.5)
Mothers' highest level of education	
University graduate or equivalent	333 (39.1)
NCE or OND	136 (16.0)
SSCE, teachers grade II or equivalent	171 (20.1)
JSSCE or FSLC holder	110 (12.9)
No formal education	101 (11.9)

FSLC: First School Leaving Certificate; JSSCE: Junior Secondary School Certificate Examination; NCE: national certificate examination; OND: Ordinary National Diploma; SSCE: Senior Secondary Certificate Examination.

Table 3. Social characteristics of the respondents.

Social characteristics	Frequency (%)
Intake of alcohol	
Yes	128 (15.0)
No	723 (85.0)
Does alcohol affect your behaviour	
Yes	39 (30.5)
No	89 (69.5)
Smoking	
Yes	55 (6.5)
No	796 (93.5)
Does smoking affect your behaviour	
Yes	32 (58.2)
No	23 (41.8)
Unpleasant drug use	
Yes	120 (14.1)
No	731 (85.9)
Do drugs affect your behaviour	
Yes	57 (47.5)
No	63 (52.5)

had mild, moderate and severe internet addiction, respectively. The overall prevalence of internet addiction was 88.1% in this study which is quite high and higher than most of the prevalence obtained from different institutions. This can be explained by the COVID-19 pandemic which led to mandatory lockdowns and during which the use of the internet and social media were used to reduce boredom[37] and replaced physical activities. It is documented that the lockdown caused increased use of social media sites, especially by young people with many of them becoming addicted as it became an easy way of communicating with peers and the world.[43] Our study was done at about the same time as a similar study by Afolabi et al.[31] on secondary school adolescents in Ibadan. The findings of Afolabi et al. also showed a high prevalence of IA of 50%. The Afolabi et al. study did not categorize internet addiction into mild, moderate and severe; however, considering that moderate and severe addictions were the categories that were significantly relevant, the prevalence values of the two studies were comparable. Furthermore, this study did not find the state of internet addiction before COVID-19 among the participants, but Ilasanmi et al.[35] in a study among adolescents in southwest Nigeria, noted that PIU (internet addiction) increased from 7.7% to 64.3% before and during the COVID-19 pandemic, respectively. Comparing the PIU rate of 64.3% obtained by Ilesanmi et al.[35] during COVID-19 to our finding (88.1%), it is expected a similar rise in internet addiction may have also occurred among the participants used in the study because of

Table 4. Internet use among the participants.

Variables	Sub-category	Frequency (%)
Ever used the internet before	Yes	851 (100)
	No	0
Duration of use of the internet	Less than 3 months	151 (17.7)
	3–6 months	127 (14.9)
	6–12 months	102 (12.0)
	More than 1 year	471 (55.3)
Owner of the device used to access the internet	Parents	200 (23.5)
	Personal device	438 (51.5)
	Family phone	98 (11.5)
	Cybercafé/business centre	29 (3.4)
	Laptops	66 (7.8)
	Friends	79 (9.3)
	School computers	52 (6.1)
	Others	7 (0.8)
Source of internet	Wi-Fi	168 (19.7)
	Browser/personal data	407 (47.8)
	Parents' device	149 (17.5)
	Friends	100 (11.8)
	Cybercafé	58 (6.8)
	Others	11 (1.3)
Ever heard of internet addiction	Yes	691 (81.2)
	No	160 (18.8)
Perception of internet addiction	Right	161 (23.3)
	Wrong	388 (56.2)
	None	142 (20.5)
Reason for internet use	Studies/assignment	521 (61.2)
	Games	251 (29.5)
	Gambling	52 (6.1)
	Social networking	279 (32.8)
	Making friends	00
	Downloading music/videos	333 (39.1)
	Emailing	101 (11.9)
	Reading sexual messages/pornography	39 (4.6)
	Chatting	146 (17.2)
	Reading and posting news	111 (13.0)
	Abort boredom	117 (13.7)
	Allay anxiety	49 (5.8)
	Others	8 (0.9)
Social media networks mostly visited (Multiple answers accepted)	Facebook	452 (53.1)
	WhatsApp	274 (32.2)
	Twitter	99 (11.6)
	Instagram	139 (16.3)
	Others	94 (11.0)

similar situations the two populations used in the two studies were in and residing in similar environments.

The prevalence of internet addiction obtained in our study was higher than some of the prevalence obtained during the COVID-19 pandemic.[37,44] This finding could be a result of the timing of the different studies and the populations studied. When not controlled, adolescent secondary school students are likely to be swallowed up in the use of social media when compared with university students who may not be new to it as noted in a Taiwan Junior high school students' study.[17] Furthermore, our study was conducted in mid-2021, just a few months after the compulsory lockdown and when all schools had just reopened, individuals and institutions were still mandated to carry out some COVID-19 safety measures which included social distancing. At that time, people were yet to unlearn lifestyle changes learned during the lockdown; therefore, it is logical to assume that uncontrolled internet use practised during the lockdown had

Table 5. Internet addiction among the respondents.

Variables	Frequency (%)
Internet addiction score category	
Normal	101 (11.9)
Mild	212 (24.9)
Moderate	507 (59.6)
Dichotomized internet addiction score	
Normal	101 (11.9)
Addiction	750 (88.1)

resulted in addiction among students even after the lockdown was lifted. Understandably, this may account for the proportion of internet addiction obtained in this study which was higher than those obtained before the pandemic such as studies from Iran (30.5%)[45] and Nigeria (47.2%).[46]

It was interesting to observe from our study that the majority of the respondents owned the devices they accessed the internet with (51.1%) and 47.8% provided data themselves. This could be because students were provided with mobile devices during the pandemic for the numerous online classes that evolved during the period. This was supported by the fact that about 61.2% of the respondents mainly used the internet for studies. A good number of them however used the internet for social networking, especially Facebook (53.1%) and WhatsApp (32.2%). This finding conforms with other studies which also obtained that adolescents spend much time chatting on social media, especially on Facebook.[31,47] The high use of the internet among the respondents was in tandem with the documentation that the use of the internet among Nigerians had progressively increased with over 101 million users in the year 2020 and over 108.5 million users in 2021.[48] This was complemented by the global increase in social media activities during the pandemic. The fact that over half of the respondents had used the internet for more than 1 year before the study showed that an increased surge of internet use may have commenced even before the year of the study. Kimberly Young[42] noted that the internet was a source of addiction to the users the same way others become addicted to tobacco, alcohol and drugs resulting in failure in academics, work performance, marital discord and so on.

In addition, our study also noted that males get addicted to the internet more than females and this is in keeping with the findings of Adiele and Olatokun in southwest Nigeria,[49] Kumari et al. in Jammu, India[50] and Prakash et al. in an Indian online cross-sectional study.[32] Also, the finding that spending more time on the internet, and risky behaviours such as smoking, use of drugs and alcohol use are associated with internet addiction was in tandem with the findings of Zenebe et al.,[51] and Kupus et a.l[47] during the COVID-19 pandemic. This finding supports the correlation between internet addiction and problematic alcohol use already established by Chin-Hung Ko et al.[52] On the other hand, older adolescents also predicted internet addiction in a study by Kupus et al.[47]

Lastly, COVID-19 has provided a new opportunity for increased use of the internet for communication and the discharge of daily services. Lockdown created boredom[37] and forced adolescents to increase the use of the internet even to the extent that many of the participants in our study had internet addiction. This new opportunity for communication/engagement must therefore be closely observed and monitored by parents and guardians so that the abundant energy of the adolescents will be channelled appropriately. Equally, adolescents that have started displaying some ill health especially psychological effects arising from addiction should be promptly identified and an intervention given instantly. Therefore, this research provides the needed evidence for targeted action to be formulated to curb internet addiction and associated health risks for adolescents in periods of lockdowns as experienced in the era of COVID-19.

Limitations: The fact that the respondents had to think back to remember the number of hours they used the internet may introduce bias. Therefore, our study may be influenced by the possibility of recall bias. The participants were not assessed clinically to determine their mental and physical states before participation in the research but those with lots of health challenges were not allowed to participate in the study. Also, the fact that parents gave consent on behalf of their wards, some students that would have liked to participate in the study may have been excluded unnecessarily.

Conclusions

Our study revealed a high prevalence of internet addiction among secondary school students in southeast Nigeria. Internet addiction was associated with the respondent's age, mother's level of education, family size, place of residence, alcohol intake, smoking, substance use as well as the duration of internet use but was predicted by respondent's age, longer use of the internet and male gender. The use of the internet among adolescents during pandemics like COVID-19 should be carefully monitored by parents and guardians to help in the early detection of internet addiction having in mind that male sex, mid-/late adolescence and use of the internet for more than 6 months could increase the possibility of occurrence of internet addition in a given adolescent population. The associated factors of the increased prevalence of Internet addiction following the lockdown of the COVID-19 pandemic will guide future decisions in planning appropriate care for adolescents as the pandemic ends.

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Table 6. Predictors of internet addiction among the participants.

Variables	Sub-category	Internet addiction		*p*-value	AOR	Confidence interval (CI)	
		Yes (%)	No (%)			Lower	Upper
Age category	Early adolescents	56 (98.2)	1 (1.8)	0.043	0.115	0.015	0.895
	Mid-adolescents	509 (87.0)	76 (13.0)		0.971	0.559	1.688
	Late adolescents	185 (88.5)	24 (11.5)				1
Sex	Male	311 (94.0)	20 (6.0)	<0.001	2.054	1.200	3.518
	Female	439 (84.4)	81 (15.6)				
SEC	High	338 (85.4)	58 (14.6)	0.057	1.344	0.525	3.444
	Middle	172 (91.5)	16 (8.5)		0.872	0.409	1.857
	Low	240 (89.9)	27 (10.1)				1
Mothers' occupation	Senior public servant	214 (86.3)	34 (13.7)	–	–	–	NA
	Others	536 (88.9)	67 (11.1)				
Fathers' occupation	Senior public servant	370 (86.7)	57 (13.3)	0.204	1.043	0.555	1.961
	Others	380 (89.6)	44 (10.4)				
HEL of mother	University graduate and more	283 (85.0)	50 (15.0)	0.029	0.824	0.454	1.494
	Others	467 (90.2)	51 (9.8)				
HEL of father	University graduate and more	325 (85.8)	54 (14.2)	0.056	1.046	0.554	1.975
	Others	425 (90.0)	47 (10.0)				
Family structure	Nuclear	595 (87.5)	85 (12.5)	0.291	–	–	NA
	Extended	155 (90.6)	16 (9.4)				
Household type	Monogamous	618 (87.4)	89 (12.6)	0.160	0.643	0.314	1.319
	Polygamous	132 (91.7)	12 (8.3)				
Place of residence	Urban	400 (85.7)	67 (14.3)	0.035	1.228	0.649	2.325
	Rural	167 (89.8)	19 (10.2)		1.486	0.697	3.169
	Semi-urban	183 (92.4)	15 (7.6)				1
Family size	Small (1–5)	202 (85.2)	35 (14.8)	0.124	0.837	0.502	1.395
	Large (>5)	548 (89.3)	66 (10.7)				
Birth order	1–3	420 (86.4)	66 (13.6)	0.086	0.745	0.441	1.256
	>3	330 (90.4)	35 (9.6)				
Custodian	Parents	473 (88.6)	61 (11.4)	0.66	1.364	0.842	2.212
	Others	277 (87.4)	40 (12.6)				
Perception	Right	149 (92.5)	12 (7.5)	0.058	1.817	0.930	3.549
	Wrong	601 (87.1)	89 (12.9)				
Duration of internet use	<6 months	222 (79.9)	56 (20.1)	<0.001	0.301	0.189	0.479
	>6 months	528 (92.1)	45 (7.9)				
Alcohol intake	Yes	121 (94.5)	7 (5.5)	0.017	1.323	0.564	3.105
	No	629 (87.0)	94 (13.0)				
Smoke use	Yes	54 (98.2)	1 (1.8)	0.015	3.341	0.422	26.422
	No	696 (87.4)	100 (12.6)				
Drug use	Yes	116 (98.7)	4 (3.3)	0.001	2.850	0.968	8.392
	No	634 (86.7)	97 (13.3)				

HEL: Highest level of education; SEC: socio-economic class.

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Author contributions

OVO, ENO and UIB were involved in the conceptualization and design of the study, data collection, data analysis and interpretation of results; drafted the original article and reviewed the final draft. UUM, EJT and UAT participated in the design of the study and data collection, and supervised the conduct of the research as well as the review of the final article. All the authors read and approved the final draft of the article.

Availability of data and materials

The datasets used and/or analysed during this study are available from the corresponding author upon reasonable request.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics approval

Ethical approval for this study was obtained from the Health Research Ethics Committee of the University of Nigeria Teaching Hospital Enugu with reference number NHREC/05/01/2008B-FWA00002458-IRB0002323. Permission for the study were obtained from the schools' Management.

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Informed consent

Written informed consent was gotten from the student's parents/caregivers while assent was obtained from all the participants. The class teachers of classes that participated in the study were utilized to send consent forms to parents through the students (participants). The signed returned consent forms were also returned by the participants to the teachers. The details of the study, expectations, benefits and risks inherent in the study were well elaborated in the consent form.

Trial registration

Not applicable.

ORCID iDs

Joseph Tochukwu Enebe https://orcid.org/0000-0002-3517-1104
Anthony Tochukwu Umerah https://orcid.org/0000-0002-3652-627X

Supplemental material

Supplemental material for this article is available online.

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