Problematic Internet Use (PIU) Among Adolescents during COVID-19 Lockdown: A Study of High School Students in Ibadan, Nigeria

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Abstract
Problematic internet use (PIU) has generally been strongly associated with depression and attention deficit hyperactivity disorder, especially among adolescents, with resulting consequences for their health. This study explores the pattern of internet use, and the prevalence of PIU before and during the COVID-19 lockdown, as well as the causes, effects, and potential mitigation measures in respect of PIU during the lockdown, among high school students in Ibadan, Nigeria. A structured questionnaire, including a 20-question internet addiction test (IAT), was administered during the COVID-19 lockdown to 440 adolescents enrolled in high schools. Of these adolescents, 7.7% appeared from their responses to have had PIU before the COVID-19 lockdown period. However, 64.3% of respondents appeared from their responses to have had PIU during the COVID-19 lockdown period. The main reasons for the increased PIU were boredom, loneliness, idleness, pleasure gained from internet use, physical isolation, and the need for information and communication. The effects of PIU reported among the adolescents included reduced family intimacy, poor academic performance, loss of concentration, as well as internet abuse and risky sexual behaviour. To mitigate PIU among high school students, parental monitoring of adolescents, and their internet access and use, should be promoted. In addition, programmes should be organised by the media and academic institutions to keep adolescents engaged in productive tasks.

Keywords
problematic internet use (PIU), internet addiction test (IAT), adolescents, high school students, COVID-19, lockdown, Ibadan, Nigeria

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Declaration
The authors declare that they have no conflicts of interest.

Authors' contributions
OSI, AAA, and AMA conceptualised the study; OSI and AAA analysed the data; AAA wrote the first draft of the article; OSI and AMA reviewed and provided input on the draft; and all authors approved the final draft.

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1. Introduction

The outbreak of novel coronavirus disease (COVID-19), first documented in Wuhan, China in late 2019, was declared a public health emergency by the World Health Organisation in March 2020 (WHO, n.d.; Ilesanmi et al., 2021). As of 10 April 2021, COVID-19 had spread across 213 countries, with 135,945,439 confirmed cases and nearly 3 million deaths recorded globally (Afolabi & Ilesanmi, 2021; Worldometer, n.d.). In Africa, recorded COVID-19 cases and fatalities were highest in South Africa, Morocco, Tunisia, Ethiopia, Egypt, Libya, and Nigeria (Worldometer, n.d.). As of 10 April 2021, Nigeria had documented 163,736 confirmed COVID-19 cases and 2,060 deaths (Worldometer, n.d.). The COVID-19 lockdown period increased the use of computers and the internet as indispensable tools for accessing information and enhancing relationships (Donohue & Miller, 2020). Due to workplace closures, the internet has also been increasingly adopted as a viable means of economic

activity and job retention. Online meetings, the virtual scheduling of religious activities, and online classes became routine during the lockdown period (Donohue & Miller, 2020).

The internet is a technological tool which supports the growth of children and adolescents, and enhances research, intuition, problem solving skills, development of life skills, and critical thinking abilities (Cakmak & Gul, 2018). However, when used in an uncontrolled, purposeless, and excessive manner, it can negatively influence the development of positive and protective habits (Cakmak & Gul, 2018; Park et al., 2018). Problematic internet use (PIU) has been defined as a condition where an individual uses the internet excessively and cannot withdraw from the internet. The occurrence of PIU during the COVID-19 lockdown has been recognised in the literature (Király et al., 2020).

The occurrence of PIU could occur at any stage of life; however, adolescents are at the highest risk for its occurrence (Cakmak & Gul, 2018). Adolescents are particularly vulnerable to PIU because of the rapid mental, emotional, and social developments occurring during this phase of life (Yang & Tung, 2007; Ceyhan, 2008). Due to their quest for knowledge during this developmental period, adolescents are more attracted than any other age group to technological tools (Cakmak & Gul, 2018). It has also been suggested that adolescents adopt internet usage as a means of substituting the challenges faced in real life with the euphoria obtained from the virtual world (Brown, 2006). PIU has generally been strongly associated with reduced sleeping time, the tendency to postpone sleep, insomnia, increased alertness, excessive tiredness, and depression (Brown, 2006; Park et al., 2018). The failure to address the possible effects of PIU and to suggest mitigating factors could result in impaired cognitive capacity among adolescents with a resulting decline in their productivity in later years. This could pose great threats to the overall safety and productivity of Nigeria and the entire world.

To the best of our knowledge, no research has been conducted regarding PIU among adolescents in Nigeria during the COVID-19 lockdown. According to the Nigeria Demographic Health Survey, 15.6% of adolescents aged 15 to 19 years use the internet; most of them reside in urban settings (NPC & ICF, 2019). Research on the causes and effects of PIU is important to the development of further guidelines regarding PIU and its management while coping during a lockdown. This study therefore aimed to assess the pattern of internet use, and the prevalence of PIU before and during the COVID-19 lockdown, as well as the causes, effects, and potential mitigation measures for PIU during the COVID-19 lockdown among high school students in the Nigerian city of Ibadan.

2. Research design

Study sample

The research took place during COVID-19 lockdown—between 27 July and 7 August 2020—in Ibadan, the capital of Oyo State. The study population consisted of adolescents in selected communities in the city. A minimum sample size of 460 was estimated for this study, using the Leshlie Kish formula for cross-sectional studies. (We used an estimated prevalence of 50%, a precision value of 5% due to the unavailability of sample size calculation in existing PIU literature, and a 20% non-response rate.)

All eligible adolescents aged 10 to 18 years who provided consent were included in the study. A two-stage sampling technique was used to enrol respondents. In the first stage, a simple random sampling method was used to select four of the 11 local government areas (LGAs) in Ibadan: Ibadan South-East, Ibadan South-West, Ibadan North, and Ibadan North-East. In the second stage, we selected a political ward from each of the four selected LGAs, again using a simple random sampling technique. In each of the four selected wards, a centre location was identified, and a bottle was rotated once on a map to determine the areas to be targeted in seeking interviewees. From the areas corresponding to the direction of the bottle tip, all eligible adolescents were included in the study. First, each adolescent was approached in their household and asked if they were enrolled in high school before the COVID-19 lockdown. All adolescents who provided positive responses about their school enrolment, and who were confirmed to be users of the internet, were then informed about the purpose of the study. (All those who were not enrolled in high school before the lockdown were excluded.) Respondents were informed that they had the right to withdraw from the study at any time. All participants were assured that all information obtained would remain confidential. Eligible but unwilling adolescents were excluded.

Consent was obtained from each participating adolescent, and from a parent or an adult who could make decisions for the adolescent in the absence of a parent. Of the 460 eligible participants approached, we obtained permission and consent for 440 adolescents, thus yielding a response rate of 95%. No harm was inflicted on participants as a result of their participation in this study.

Data collection instrument

A structured, interviewer-administered questionnaire was used for data collection (see questionnaire in Appendix). The questionnaire covered the following:

- sociodemographic characteristics of the respondents and their parents (closed-ended questions);
- pattern of internet use (closed-ended questions);
- causes, effects, and factors associated with PIU during COVID-19 lockdown (open-ended questions);

- strategies to mitigate PIU during COVID-19 lockdown (open-ended questions); and
- an internet addiction test (IAT), which generated a PIU scale (see Appendix).

The IAT is a 20-question tool, developed by Young (see Young & Rogers, 2009). The IAT has been validated in literature as a standard tool for assessing PIU and internet addiction, including among adolescents and young adults in Nigeria (Oshodi et al., 2012). A shift in paradigm has informed a trend towards focusing on PIU rather than internet addiction. Internet addiction describes uncontrolled engagement in online activities that offer no benefit to the user. PIU, meanwhile, allows for the reality that an online activity may ordinarily provide benefits to the user, but its excessive use can result in negative consequences. To date, there is no consensus on a tool to measure PIU; hence, the IAT is still being used to assess PIU.
Using the IAT tool, 20 questions were asked on elements associated with PIU, both before and during the COVID-19 lockdown. These included questions such as the frequency of staying online longer than intended, the frequency of neglecting household chores to spend more time online, the frequency of sleep loss due to late night log-ins, the frequency of hiding the length of time spent online, the frequency of feeling depressed or moody while offline, and the frequency of a decline in school grades or work performance. In addition to these, we asked questions about the frequency of being secretive about the online activity being engaged in, the frequency of prioritising email checks, the frequency of anticipating the next online schedule, the frequency of receiving complaints from others due to the time spent online, and the frequency of saying "just a minute more" when online. Other questions were asked about the frequency of preferring the internet to family intimacy, the failure to reduce time spent online, and the frequency of snapping or yelling when offline. A slight modification in the IAT was made to capture two different periods: before the COVID-19 lockdown, and during the lockdown.

Data collection

Data were collected by trained research assistants (RAs) who had all obtained at least a Bachelor's degree. The RAs were trained on data collection for two days, on 25 and 26 July 2020. The questionnaire was pre-tested among adolescents in a community that was not selected for this study. After this pre-test, a few questions were modified.

Ethical approval for this study was obtained from the Oyo State Ministry of Health Ethical Review Committee, with reference number AD/13/479/1779[A].

Data analysis

Data analysis was done using SPSS version 23. Mean and standard deviation were used to summarise quantitative continuous variables such as age, while frequencies and percentages were used to summarise categorical variables such as age group.

The pattern of internet use, the number of hours of daily internet access, the average time spent online per day, and the age of onset of internet use were computed using mean and standard deviation. Other details, such as the reasons for going online and the activities engaged in during the immediate past 24 hours, were also computed using frequency tables. Open-ended questions were asked about the causes of PIU, the effects of PIU, and strategies to reduce PIU. Closely related responses were grouped together when analysing the responses to these questions. Bivariate analysis was conducted using the Chi-square test, the t-test, and Pearson correlation. Pearson correlation was used to determine the strength of association between time spent online per day with sociodemographic and other internet use variables. Among the relationships of interest were the sociodemographic determinants of PIU before and during the COVID-19 lockdown, and associations between time spent online per day and sociodemographic characteristics. Statistically significant variables using Chi-square tests were used for the logistic regression model. The level of statistical significance was $p<0.05$.

To determine the prevalence of PIU, IAT scores for each of the 20 questions in the IAT were computed using the frequency of occurrence of each symptom of PIU. A score of "0" was assigned for "not applicable", "1" for "rarely", "2" for "occasionally", "3" for "frequently", "4" for "often", and "5" for "always". Thus, the maximum IAT score for each of the two periods—the pre-lockdown period and the lockdown period—was 100 points across. Cumulative IAT scores ranging between 20 and 49 points were treated as evidence of "complete ability to control/limit one's level of internet use". Cumulative scores between 50 and 70 points were treated as suggestive of "occasional PIU" (i.e., occasional inability to control/limit one's level of internet use). Cumulative IAT scores greater than 70 points were seen as suggesting "significant PIU" (i.e., significant inability to control/limit one's level of internet use).

3. Findings

Respondents' sociodemographic characteristics

A total of 440 respondents were interviewed, with a mean age of 14.15 ± 1.99 years. Of the respondents, 217 (49.3%) were males, 218 (49.5%) had attained junior high school, and 262 (59.5%) had three or fewer siblings. Other sociodemographic characteristics are as shown in Table 1.

Table 1: Sociodemographic characteristics of surveyed adolescents

Variable	Frequency	%
Age group (years)		
10-12	88	20
13-15	238	54.1
16-18	114	25.9
Sex		
Male	217	49.3
Female	223	50.7
Current enrolment level		
Junior high school	218	49.5
Senior high school	222	50.5
Mother's age group (years)		
Less than 45	184	41.8
45 and above	256	58.2
Father's age group (years)		
Less than 45	62	14.1
45 and above	378	85.9
Father's education level		
Primary school or below	36	8.2
High school or above	404	91.8
Mother's education level		
Primary school or below	74	16.8
High school or above	366	83.2
Person lived with		
Parent	389	88.4
Guardian	51	11.6
Number of siblings		
Three or fewer	262	59.5
Four or more	178	40.5

Pattern of internet use

Smartphones were the most owned device, owned by 369 respondents (98.1%). Smartphones were also the most used internet access device, used by 368 respondents (97.9%), and the most common point of internet access was the smartphone, cited by 347 respondents (92.3%). The most frequently cited reason for going online during the lockdown was socialising, cited by 331 respondents (88%), and the most used social networking platforms were Facebook (used by 359 respondents (95.5%)) and WhatsApp (used by 338 respondents (89.9%)). More than a half of respondents (64.2%) used the internet daily (see Table 2).

Table 2: Pattern of internet use

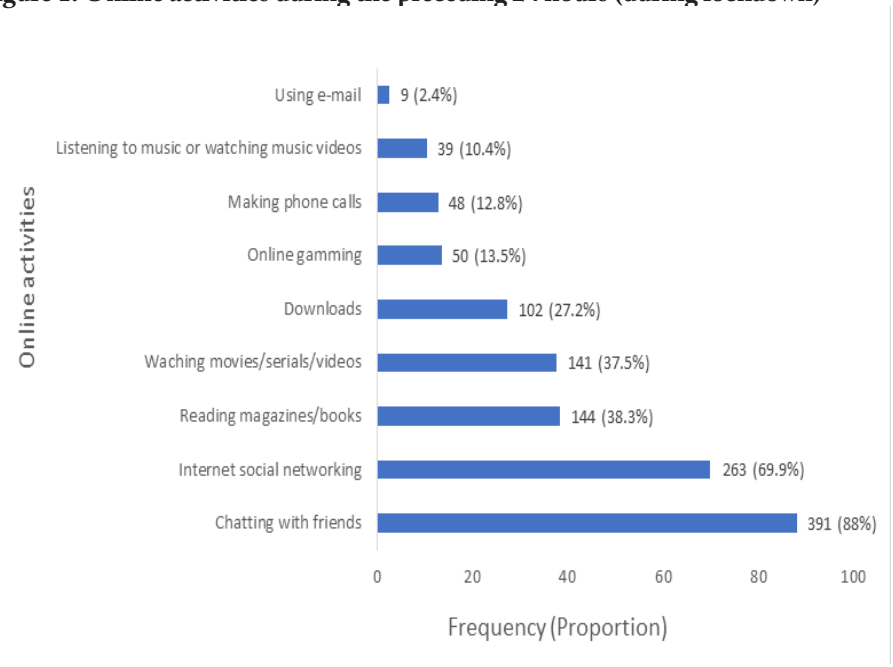
Characteristics of internet use	Frequency	%
Devices currently owned*		
Smartphone	369	98.1
Gaming device	76	20.2
Tablet	26	6.9
Laptop	11	2.9
Desktop computer	3	0.8
Devices used for internet access*		
Smartphone	368	97.9
Gaming device	45	12
Tablet	25	6.6
Laptop	10	2.7
Desktop computer	4	1.1
Internet points of access*		
Personal smartphone	347	92.3
Home	37	9.8
Paid hotspots	5	1.3
School	3	0.8
Free public hotspots	2	0.5
Reasons for going online*		
Socialising	331	88
Communication	266	70.7
School assignment	227	60.4
Information research	119	31.6

Internet social networking tools used*		
Facebook	359	95.5
WhatsApp	338	89.9
Snapchat	40	10.6
Twitter	40	10.6
Instagram	28	7.4
Eskimi	1	0.3
Daily internet use		
Yes	79	64.2
No	44	35.8

* = Multiple responses allowed

As seen in Figure 1, 391 respondents (88%) had, in the past 24 hours, engaged in chatting with friends, while 263 (69.9%) had engaged in internet social networking. Reading magazines and books was also cited by 144 (38.3%), while watching movies, serials and videos was cited by 141 individuals (37.5%).

Figure 1: Online activities during the preceding 24 hours (during lockdown)

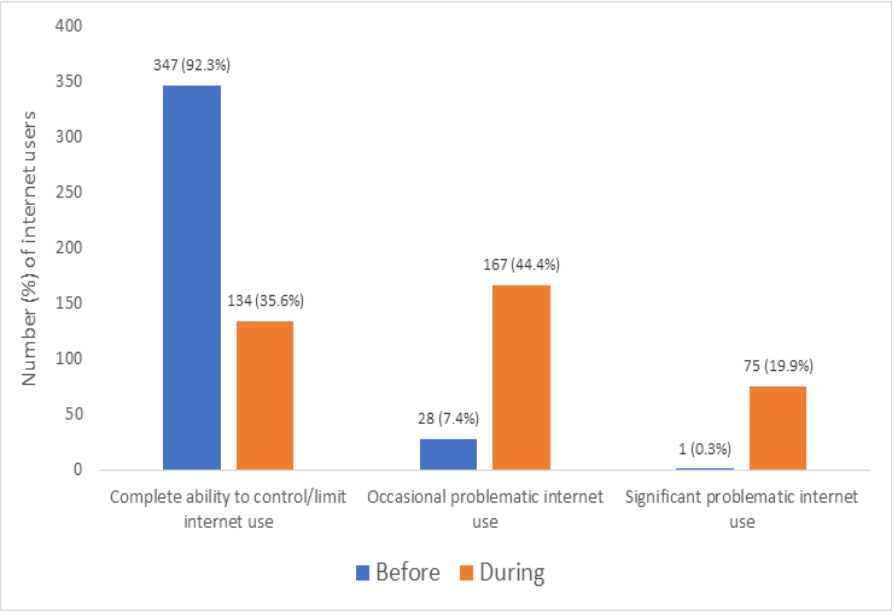


Pattern of PIU before and during the lockdown

As seen in Figure 2, the IAT test scores at the time of the survey suggest that 347 respondents (92.3%) believed they had the complete ability to control their internet use (defined as cumulative IAT scores from 0 to 49 points) during the pre-lockdown period. In contrast, only 134 (35.6%) felt they had the complete ability to control their level of use during lockdown. Before the lockdown, only 28 respondents (7.4%) had occasional PIU (defined as cumulative IAT scores ranging between 50 and 70 points). This figure rose during lockdown to 167 respondents (44.4%) having occasional PIU. Only one respondent (0.3%) had significant PIU (defined as cumulative IAT scores greater than 70 points) before the COVID-19 lockdown. This number rose during the lockdown to 75 respondents (19.9%) with significant PIU (Figure 2).

Aggregating the findings of occasional and significant PIU, 29 respondents (7.7%) appeared from their responses to have had PIU before the COVID-19 lockdown, while 242 (64.3%) appeared from their responses to have had PIU during the lockdown. The mean score of PIU before the lockdown was 30.15±14.13, while the mean score of PIU during the lockdown was 54.49±18.89 (t = -44.183, p = 0.001).

Figure 2: PIU incidence before and during lockdown



PIU causes, effects and mitigation during the lockdown

As seen in Table 3, 142 adolescents (32.3%) cited loneliness or physical isolation as the causes of PIU during the lockdown period. Other causes of PIU stated included poor discipline as cited by 99 (22.5%), and socialising, communication, and pleasure derived from online activities, as cited by 66 (15%). In terms of the effects of PIU, 118 (26.8%) mentioned reduced family intimacy, and 102 (23.2%) noted poor academic performance, and loss of concentration. In addition, 95 adolescents (21.6%) stated that PIU could result in internet abuse or risky sexual behaviour. When asked about the ways in which PIU could be mitigated, 286 respondents (65%) suggested awareness-raising among, and/or monitoring of, adolescents; 136 (30.9%) suggested ending the school closures; and 18 (4.1%) suggested that adolescents should be engaged in more productive tasks.

Table 3: PIU causes, effects and mitigations during the COVID-19 lockdown

Dimension	Frequency	%
Causes of PIU		
Loneliness, physical isolation	142	32.3
Poor discipline	99	22.5
Socialising, communication, pleasure from online activities	66	15
Boredom	60	13.6
Parental neglect	41	9.3
Laziness, idleness	32	7.3
Effects of PIU		
Reduced family intimacy	118	26.8
Poor academic performance, loss of concentration	102	23.2
Internet abuse, risky sexual behaviour	95	21.6
Tiredness, loss of sleep, headaches, reduced eye functioning	74	16.8
Neglecting household chores	51	11.6
Suggestions of ways to mitigate PIU		
Awareness-raising, monitoring	286	65
Suspension of school closures	136	30.9
Engagement of adolescents in more productive tasks	18	4.1

Correlations between sociodemographic variables and PIU

Table 4 shows the correlations between sociodemographic variables and PIU before and during the COVID-19 lockdown. In the pre-lockdown period, it was found that 13.4% of the adolescents aged 16 to 18 years had occasional or significant PIU (p = 0.019), compared to only 5.9% of the 13- to 15-year-olds and 2.3% of the 10- to 12-year-olds. During the lockdown, it was found that 86.6% of adolescents aged 16 to 18 had occasional or significant PIU (p = < 0.001), compared to 61.8% of the 13- to 15-year-olds and 20.5% of the 10- to 12-year-olds. This suggests that older adolescents are more likely than younger adolescents to develop PIU in both non-lockdown and lockdown periods. In turn, 13- to 15-year-olds appear to be less susceptible to PIU than 16- to 18-year-olds, and more susceptible than 10- to 12-year-olds. Table 4 also shows a similar difference in PIU susceptibility between senior high school and junior high school students, with the senior high school students more susceptible during both the pre-lockdown and lockdown periods. In respect of gender differences, Table 4 shows that the male respondents were more susceptible to PIU than the female respondents, both pre-lockdown and during lockdown.

Table 4: Correlations between sociodemographic variables and PIU

Variables	PIU pre-lockdown		PIU during lockdown	
	Present	Absent	Present	Absent
	n (%)	n (%)	n (%)	n (%)
Age group (years)				
10-12	1 (2.3)	43 (97.7)	9 (20.5)	35 (79.5)
13-15	13 (5.9)	207 (94.1)	136 (61.8)	84 (38.2)
16-18	15 (13.4)	97 (86.6)	97 (86.6)	15 (13.4)
	χ^2 = 7.912, p = **0.019**		χ^2 = 61.765, p = < **0.001**	
Sex				
Male	20 (10.9)	163 (89.1)	123 (67.2)	60 (32.8)
Female	9 (4.7)	184 (95.3)	119 (61.7)	74 (38.3)
	χ^2 = 5.181, p = **0.023**		χ^2 = 1.264, p = 0.261	
Current enrolment level				
Junior high school	6 (3.8)	154 (96.2)	67 (41.9)	93 (58.1)
Senior high school	23 (10.6)	193 (89.4)	175 (81.0)	14 (19.0)
	χ^2 = 6.945, p = **0.013**		χ^2 = 61.399, p = <**0.0001**	
Father's age group (years)				

Less than 45	3 (6.4)	44 (93.6)	24 (51.1)	23 (48.9)
45 and above	26 (7.9)	303 (92.1)	218 (66.3)	111 (33.7)
	χ^2 = 0.133, p = 0.715		χ^2 = 4.141, p = **0.042**	
Mother's age group (years)				
Less than 45	8 (5.3)	143 (94.7)	83 (55.0)	68 (45.0)
45 and above	21 (9.3)	204 (90.7)	159 (70.7)	66 (29.3)
	χ^2 = 2.067, p = 0.151		χ^2 = 9.710, p = **0.002**	
Father's education level				
Primary school or below	3 (11.1)	24 (88.9)	19 (70.4)	8 (29.6)
High school or above	28 (7.4)	323 (92.6)	223 (63.9)	126 (36.1)
	χ^2 = 0.472, p = 0.492		χ^2 = 0.458, p = 0.499	
Mother's education level				
Primary school or below	6 (10.9)	41 (89.1)	38 (68.1)	17 (30.9)
High school or above	23 (7.2)	298 (92.8)	204 (63.6)	117 (36.4)
	χ^2 = 0.925, p = 0.336		χ^2 = 0.628, p = 0.428	
Person lived with				
Parent	27 (8.0)	309 (92.0)	219 (65.2)	117 (34.8)
Guardian	2 (5.0)	38 (95.0)	23 (57.5)	17 (42.5)
	χ^2 =0.463, p = 0.496		χ^2 = 0.919, p = **0.038**	
Number of siblings				
Three or fewer	11 (5.0)	210 (95.0)	129 (58.4)	92 (41.6)
Four or more	18 (11.6)	137 (88.4)	113 (72.9)	42 (37.1)
	χ^2 = 5.636, p = **0.018**		χ^2 = 8.388, p = **0.004**	

Notes: χ^2 = Chi-square test; p-values in **bold** indicate finding is statistically significant ($p < 0.05$)

Table 5 shows that the male respondents were, before the lockdown, twice as likely as female adolescents to develop PIU (adjusted odds ratio (AOR) = 2.308; 95% confidence interval (CI) = 1.009–5.281). During the lockdown, however, no statistically significant difference was found between males and females in respect of PIU. The table also shows that, before the lockdown, the respondents aged 16 to 18 years were

twice as likely as those aged 10 to 12 years (AOR = 2.159; 95% CI = 0.202–23.064) to develop PIU, and that, during the lockdown, they were seven times more likely than 10- to 12-year-olds to develop PIU (AOR = 7.093; 95% CI = 2.393–21.023). In respect of school level, the adolescents in senior high school were found to be twice as likely as junior high school students to exhibit PIU before the lockdown (AOR = 2.142; 95% CI = 1.009–5.281), and three times as likely during the lockdown (AOR = 3.228; 95% CI = 1.822–5.719).

Table 5: Sociodemographic determinants of PIU

Determinants of PIU pre-lockdown	Unstandardised regression coefficient	adjusted odds ratio (AOR)	95% confidence interval (CI) for AOR		p-value
			Lower	Upper	
Age group (years)					
10-12	0.770	2.159	0.202	23.064	0.524
13-15	0.365	1.440	0.579	3.579	0.432
16-18		1			
Sex					
Male	0.836	2.308	1.009	5.281	**0.048**
Female		1			
Current enrolment level					
Junior high school	0.762	2.142	0.696	6.592	0.184
Senior high school		1			
Number of siblings					
Three or fewer	0.753	2.123	0.935	4.821	0.072
Four or more		1			

Determinants of PIU during lockdown	Unstandardised regression coefficient	adjusted odds ratio (AOR)	95% confidence interval (CI) for AOR		p-value
			Lower	Upper	
Age group (years)					
10-12	1.959	7.093	2.393	21.023	**<0.001**
13-15	0.671	1.956	0.966	3.961	0.062
16-18		1			
Current enrolment level					
Junior high school	1.172	3.228	1.822	5.719	**<0.001**
Senior high school		1			
Number of siblings					
Three or fewer	0.457	1.579	0.916	2.723	0.100
Four or more		1			
Father's age (years)					
<45	-0.258	0.773	0.354	1.687	0.517
≥45		1			
Mother's age (years)					
<45	0.136	1.145	0.656	1.998	0.633
≥45		1			
Person lived with					
Parent	-0.325	0.723	0.336	1.553	0.405
Guardian		1			

Note: p-values in **bold** indicate finding is statistically significant ($p < 0.05$)

Table 6 shows the correlations between time spent online per day (during the lockdown) and sociodemographic and other internet use variables. It was found that for every unit increase in age, there was a corresponding increase in daily time spent online. Also, an increase in the years in formal education increased the daily time spent online.

Table 6: Correlation of time spent online per day with sociodemographic and other internet use variables

Variable	r	p-value*
Age	0.277	**< 0.001**
Current enrolment level	0.168	**0.001**
Number of siblings	0.116	0.025
Father's age	0.127	**0.014**
Mother's age	0.092	0.075
Hours of daily internet access	0.593	**< 0.001**
Age of onset of internet use	0.036	0.587

Note: p-values in **bold** indicate finding is statistically significant ($p < 0.05$)

4. Analysis, conclusions and recommendations

We found that a complete ability to control/limit one's level of internet use (i.e., an absence of PIU) existed among many adolescents before the COVID-19 lockdown period. The reasons for this could be traced to their active engagement in academic and extramural activities while schools were open. However, during the lockdown, fewer adolescents maintained the complete ability to control/limit their level of internet use, and a rise in the prevalence of PIU during the lockdown period was identified. Thus, the compulsory stay-at-home conditions during the lockdown appear to have increased the risk of PIU among adolescents.

We also noted that an increase in the number of years spent in formal education increases the development of PIU among adolescents. This reveals a higher likelihood for the development of PIU among persons with more years of formal education compared to those with fewer years. However, we noted that adolescents aged 10 to 12 years were two times more likely to develop PIU compared to those aged 16 to 18 years in the period before the COVID-19 lockdown. During the COVID-19 lockdown, on the other hand, adolescents within this same age group (10 to 12 years) were seven times more likely to develop PIU. This may be the result of parents providing internet-enabled devices to their children to enhance their mental development.

We identified the following reasons for PIU among adolescents during the COVID-19 lockdown: boredom, loneliness, idleness, pleasure gained from internet use, peer pressure, poor discipline, parental neglect, physical isolation, and the need for information and communication. This corroborates with findings that when faced with undesirable conditions, many adolescents use the internet as a remedy or strategy for easing the burden of boredom, loneliness, and physical isolation (Brown, 2006). Although this adaptive strategy presents emotional and physical challenges, the internet provides immediate but temporary relief from life's worries (Cakmak & Gul, 2018).

An implication of our findings is that a lack of physical social relationships could lead to the development or worsening of PIU. Many academic institutions have opted for e-learning or home-based schooling due to the imposed lockdown on schools (Donohue & Miller, 2020). This need for access to e-learning has contributed to increasing adolescents' use of the internet beyond the two hours of daily use as recommended by the Australian government (Hoare et al., 2016). This is because most academic programmes last for about three hours every day, with each session lasting about an hour. Undisciplined use of the internet can result, which can expose adolescents to X-rated sites or other platforms which are not age appropriate (Tahiroğlu et al., 2008; Hoare et al., 2016). Thus, more frequent use of the internet, regardless of whether it is under the guise of e-learning or communication or seeking information, can put adolescents at greater risk for PIU.

The suggestions provided by the respondents about ways of mitigating PIU among adolescents included educating adolescents about the threats that PIU can pose to their present and future lifestyle. Parental monitoring of internet use was also cited as a means by which internet use could be kept at more appropriate levels among adolescents. Parental monitoring does not necessary imply excessive parental intervention in internet use, but implies the regulation of internet use for adolescents. The controlled use of the internet has been associated with the development of positive and protective habits that can ensure that adolescents become responsible adults in the future (Cakmak & Gul, 2018; Park et al., 2018).

Suspension of the school closures was also, quite reasonably, stated as a potential mitigating factor for PIU among adolescents. However, a precise public health approach is needed for the resumption of school activities (Donohue & Miller, 2020). Adolescent engagement in more productive tasks could also contribute to the prevention of PIU during the COVID-19 lockdown. These tasks could include practical music, vocational, or writing skills. This finding therefore clarifies that PIU can be prevented if its prevention is seen as a responsibility of both adolescents and their parents/guardians.

In respect of the limitations of our study, it should be noted that, because this study was not conducted at the early stage of the COVID-19 outbreak in Nigeria, our findings could have been limited by recall bias. Also, the nature of this study could have concealed important knowledge that would have been obtained using a longitudinal study design.

It is our recommendation that healthy internet use interventions should commence with children at an early age, to strengthen the positive use of the internet during adolescence. Parents should regulate adolescents' access to the internet. Also, health education sessions on the risks of developing PIU through excessive internet usage should be communicated during health campaigns and should be broadcast on the media. In addition, further research needs to be conducted on the effects of PIU on adolescents' mental and psychological health.

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Appendix: Questionnaire

Sociodemographic characteristics			
1. Age (last birthday):	**2. Sex:**	1. M	2. F
3. Highest class attained:			
4. Who do you live with?	1. Parent	2. Guardian	3. Others (specify):
5. Father's highest educational qualification:			
6. Mother's highest educational qualification:			
7. Father's occupation:			
8. Mother's occupation:			
9. Family type	1. Nuclear	2. Extended	
10. Number of siblings:			
11. Father's age:			
12. Mother's age:			
Pattern of internet use			
13. Which of these devices do you currently own? 1. Smartphone 2. Desktop 3. Laptop 4. Tablet 5. Gaming device			
14. How many hours per day do you have internet access?			
15. Time spent online per day (specify):			
16. Age of onset of internet use (specify):			
17. Frequency of internet use 1. Less than once a week 2. 1-3 times a week 3. 4-6 times a week 4. Daily			
18. Device used for internet access 1. Smartphone 2. Desktop 3. Laptop 4. Tablet 5. Gaming device			
19. Internet point of access 1. Home 2. School 3. Free public hotspots 4. Paid hotspots 5. Personal phone			
20. Reason(s) for going online 1. Communication 2. Socialization 3. School assignment 4. Information research 5. Others (specify):			
21. What have you done online in the past 24 hours? 1. Watching movies/serials/videos 2. Downloads 3. Reading magazines/books 4. Listening/watching music 5. Online gaming 6. Chatting with friends 7. Using e-mails 8. Making phone calls 9. Internet social networking			
22. Parent's awareness of internet use 1. None 2. Good 3. Very good			
23. Used internet social networking type 1. Facebook 2. WhatsApp 3. Instagram 4. Snapchat 5. Twitter 6. Eskimi			
24. Do you perceive you have problematic internet use? 1. Yes 2. No			
25. What are the causes of problematic internet use among high school during the COVID-19 lockdown?			
26. What are the likely effects of problematic internet use on high school during the COVID-19 lockdown?			
27. What are the factors associated with increased internet use among high school during the COVID-19 lockdown?			

28. What can you suggest should be done to reduce problematic internet use among high school students during the COVID-19 lockdown period?

29. Internet Addiction Test

Key: 0: does not apply; 1: rarely; 2: occasionally; 3: frequently; 4: often; 5: always

		Score					
	Questions	**0**	**1**	**2**	**3**	**4**	**5**
1.	a. How often did you stay online longer than you intended before the lockdown?						
	b. How often did you stay online longer than you intended during the lockdown?						
2.	a. How often did you neglect household chores to spend more time online before the lockdown? b. How often do you neglect household chores to spend more time online during the lockdown?						
3.	a. How often did you lose sleep due to late night log-ins before the lockdown?						
	b. How often do you lose sleep due to late night log-ins during the lockdown?						
4.	a. Before the lockdown, how often did you try to hide how long you've been online?						
	b. During the lockdown, how often do you try to hide how long you've been online						
5.	a. Before the lockdown, how often did you feel depressed, moody, or nervous when you're offline, which goes away when you're back online?						
	b. During the lockdown, how often do you feel depressed, moody, or nervous when you're offline, which goes away when you're back online?						
6.	a. Before the lockdown, how often did your school grades or work suffer because of the amount of time you spend online?						
	b. During the lockdown, how often do your school grades or work suffer because of the amount of time you spend online?						
7.	a. Before the lockdown, how often did your job performance or productivity suffer because of the internet?						
	b. During the lockdown, how often does your job performance or productivity suffer because of the internet?						
8.	a. Before the lockdown, how often did you become defensive or secretive when anyone asks you what you do online?						
	b. During the lockdown, how often do you become defensive or secretive when anyone asks you what you do online?						
9.	a. Before the lockdown, how often did you check your e-mail before something else that you need to do?						
	b. During the lockdown, how often do you check your e-mail before something else that you need to do?						

10.	a. Before the lockdown, how often did you find yourself anticipating when you will go online again?						
	b. During the lockdown, how often do you find yourself anticipating when you will go online again?						
11.	a. Before the lockdown, how often did others in your life complain to you about the amount of time you spend online?						
	b. During the lockdown, how often do others in your life complain to you about the amount of time you spend online?						
12.	a. Before the lockdown, how often did you find yourself saying "just a few minutes more" when online?						
	b. During the lockdown, how often do you find yourself saying "just a few minutes more" when online?						
13.	a. Before the lockdown, how often did you try to cut down the amount of time you spend online and fail?						
	b. During the lockdown, how often do you try to cut down the amount of time you spend online and fail?						
14.	a. Before the lockdown, how often did you prefer the excitement of the internet to intimacy with your family?						
	b. During the lockdown, how often do you prefer the excitement of the internet to intimacy with your family?						
15.	a. Before the lockdown, how often did you form new relationships with fellow online users?						
	b. During the lockdown, how often do you form new relationships with fellow online users?						
16.	a. Before the lockdown, how often did you block out disturbing thoughts about your life with soothing thoughts of the internet?						
	b. During the lockdown, how often do you block out disturbing thoughts about your life with soothing thoughts of the internet?						
17	a. Before the lockdown, how often did you fear that life without the internet would be boring, empty, and joyless?						
	b. During the lockdown, how often do you fear that life without the internet would be boring, empty, and joyless?						
18.	a. Before the lockdown, how often did you snap, yell, or act annoyed if someone bothers you while you are online?						
	b. During the lockdown, how often do you snap, yell, or act annoyed if someone bothers you while you are online?						
19.	a. Before the lockdown, how often did you feel preoccupied with the internet when offline, or fantasize about being online?						
	b. During the lockdown, how often do you feel preoccupied with the internet when offline, or fantasize about being online?						
20.	a. Before the lockdown, how often did you choose to spend more time online over going out with others?						
	b. During the lockdown, how often do you choose to spend more time online over going out with others?						