

Association of Excessive Smartphone Use with Mental Health Disorders among Students of the University of Dschang, Cameroon

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Abstract

Background: Excessive Smartphone Use (ESU) is associated with mental disorders among University students in most developed countries. The aim of this study was to determine the distribution of ESU and its association with mental disorder among students of the University of Dschang.

Method: We conducted a cross-sectional study at the University of Dschang in which randomly selected students completed a survey comprised of a SAS-SV (10 items questionnaire), PHQ-7 (7 items questionnaire), PHQ-9 (9 items questionnaire), to screen for ESU, depression and anxiety respectively. Sleep quality was assessed using a three-item questionnaire. Multiple logistic

regression was used to determine the association between ESU and mental disorder. Mental disorder was considered as the presence of one or more of the following disorders; depression, anxiety and/or sleep disorder.

Results: A total of 636 participants were included in this study. The prevalence of excessive smartphone use was 38.4% [95%CI: 34.6-42.3], and the prevalence of mental disorder was 35.8% [95%CI: 32.2-39.6]. The odds for mental disorder were 2.23 times greater among ESU [aOR =2.33, 5% CI: 1.58-3.16, $p < 0.001$] than in normal users.

Conclusion: There is a high prevalence of ESU among university students and a strong association with mental disorders. There is urgent need for interventions to control ESU among students for optimal academic performance and general wellbeing.

Limitations And Recommendations: This study was a transversal study; A longitudinal study and the use of a mental health specialist to confirm all cases of Mental health disorders could reveal better results.

Keywords: Excessive smartphone use; Mental health; Addiction; Students

Introduction

Smartphones, also called intelligent phones are electronic devices that perform most functions of a computer, typically having a touchscreen interface, internet access, and an operating system, capable of running downloaded applications (oxford language). Smartphones were primarily conceived to ease communication between users, get access to the internet, send and receive mail/fax [1].

Nowadays, a smartphone is a daily life tool used by each and every one, nor matter the social rank and living standards. Smartphones eased the scientific community and improving research, ease teleassistance and teleconsultation [2], health monitoring as in diabetes-related parameters [3], cardiac health monitoring [4], tobacco consumption and body weight monitoring [4]. Smartphone really rendered life liveable. But as a drug, smartphones when not properly used becomes a danger to the user.

Health which is defined as “the full state of complete mental, physical and social wellbeing of an individual and not only the absence of a disease or disability” (WHO, 1948). According to literature Excessive smartphone use (ESU) is known to compromise the three dimensions of health (physical, mental and social well-being). Some health problems associated with ESU include, sleep disorder, depression, anxiety, body muscular mass lost, poor emotional and communication regulation, medical complications such as drowsiness [5], physical fitness, eyesight, migraine and pain, and monophobia (which is when smartphone user become anxious when he/she is separated with his/her smartphone; an irrational state of fear of morbidity and loneliness) [6-8]. A previous study reported that depression and anxiety were respectively four and two times greater among university students that were excessive smartphone users [6]. In 2022, the global active smartphone lines was estimated at 6.648 billion user (83.32% of the world’s population) [9], and is projected to reach 7.33 billion active users by 2025 [10]. The population in Africa is estimated at about 1.3 billion people. The World Bank and African Development Bank estimated 650 million active smartphone users in Africa [11], and these figures keep on increasing. In 2016, the number of homes with smartphones had increased from 43% to 72.2% just in the second half of 2016. Still the same year, Mediametry produced its first report on the performance of social networks in Cameroon showing that, 68.2% of individuals aged above 14 years were registered on a social network [12]. Literature review shows that, 46% of smartphones users reported they “cannot live without” their phones in a study [13]. This is freaky when putting together these information from literature review and the fact that Cameroon is a developing country mainly populated by youth (20-25%) having a median age of 18 years [14]. This needs public health intervention is required for the danger smartphones represent to it population.

Theoretically, smartphone use by students should improves their academic performances. Students use smartphones to visit their class schedules, mailbox and news documents daily, in order to be up to date with academic programs. Some students use their smartphones for study purpose by the help of several social media groups. They interact with teachers and classmates to discuss issues

related to their studies [15]. They consult documents like dictionaries or other internet sources for educational purposes [15].

However, many researchers have pointed a number of disadvantages and negative impacts of smartphones on student achievement. They most often text their friend and discuss on extra academic purpose, listen to music, watch movies and much more. Smartphone excessive use among students generally leads to disorders like depression and anxiety [16, 17], insomnia and other disorders. Many studies report that long term use of smartphone further lead to ringxiety, Nomophobia [18], fear of missing out [16], Insomnia [16, 15]. Smartphone use by students alters their sleep quality [19, 20, 21] and affect academic performance [19, 22, 15].

A report in 2020 illustrates a case of addiction where the parents say “My 14-Year-Old son is addicted to video games, terrorizes house to get what he wants” the child spends almost all his time at house playing games, doesn’t take his daily bath and does not take care of his self. The child is obese, extremely impulsive and aggressive. Parents report their son has tried killing them [23].

According to the adapted definition from the APA-Dictionary of Psychology, addiction is a state of psychological or physical dependence (or both) on the use of a substance or product usually alcohol or other drugs, which sometimes applies to behavioural disorders such as internet, sexual, smartphone and gambling addictions.

The mechanism of addiction wants that, the brain reward system which is a system that compensate every good or satisfying action to human by the production of the hormone Dopamine; enabling this person to latter reproduce the same action in order to be rewarded. Every time the individual does a satisfying action, the reward system secrets Dopamine in very small quantity. It is a normal physiological reaction. Addiction to a substance or behaviour comes in when the individual educates his reward system to produce a good quantity of Dopamine after a specific action. These actions may just be watching a movie, smoking, consuming a specific substance or using its smartphone. Compulsive behaviours related to addiction is manifested when the individual lacks the stimulus that will enables the brain to secrete the adequate quantity of Dopamine in a satisfying quantity (sometimes 10 times higher than the normal dose). The more the person is in lack, the more compulsive and abnormal behaviours is observed. Dopamine in a large quantity can alter the individuals’ ability in taking decisions, judgments and damage memory.

A recent study carried out at the University of Dschang in Cameroon in 2018 reveal the prevalence of depression to be 34.86% [6] and that of smartphone addiction to be 21.98%. Smartphones which are also used for gaming have been reported to be in association with video game addiction, leading to a number of negative psychological health consequences (Choo et al. 2010), such as depression, suicidal ideation, and anxiety [24, 6]. Literature shows that video game addicted boys had higher levels of sleep disturbance [25, 26], University students tend to have higher rates of depression than the general population [6]. Smartphone poses a negative impact on our ability to think, remember, pay attention, and regulate emotion [22, 27]. Studies proved the existence of an association between smartphone excessive use and anxiety [8, 6] among University students in South West Nigeria [28]. Demirci et al. 2015, found that smartphone excessive use of females was higher than those of males. Furthermore, positive correlations were found between the Smartphone Addiction and levels of anxiety and depression [24]. Smartphone itself creates impulsivity, extraversion, and excessive re-assurance seeking, damaging academic performance of students [26]. A systematic review study revealed that the use of smartphones may contribute to the occurrence of clinical and subclinical musculoskeletal changes as well as associated factors in the head-neck, shoulder arm, and hand-thumb areas [29]. A study conducted among university students revealed that excessive smartphone use can cause nerve injury (Megna et al. 2018), induce higher signs of inflammation in the musculoskeletal structures of hand joints [22].

This study, shows the link between the direct and indirect determinants (predictors) of excessive smartphone use on which we can act effectively to improve the health of teenagers and students in a Public Health context. It shows the gap that exist between the use of smartphones by students and the health damage induce by their usage habits. It evaluates the strength of factors related to the excessive use of smartphones by students and the impact on their health state. This study is in line with the Sustainable Development Goals (SDGs) “ensure healthy lives and promote well-being for all at all ages, SDG 3” from the Health Sector Strategy document (HSS) 2016-2027. Thirty-one (31) years of smartphone development and evolution (from SIMON, the first phone created 1992, to our present smartphones 2023) is given to young teenagers in a single screen without human guide and without studying the impact of this device

on the mental and social health of the users. Particularly without studying the academic consequences of this tool on young teenagers. According to the Research Centre of the United Nations Children's Fund (UNICEF) in 2007, "a country's real level is measured by the attention it gives to its children, their health and their security, their material situation, their socialization, as well as their feeling of being loved, appreciated and integrated into the family and the societies in which they live".

Studies provide examples of effective programs targeted at different age groups. Yet there is an enormous gap between mental disorders, treatments need available and the resources available. In developed countries with well-organized health care systems, between 44% and 70% of patients with mental disorders do not receive treatment. In developing countries the figures are even more striking, with the treatment gap being close to 90% [30]. Students report to use their phones to discuss issues related to their studies and usually consult documents for educational purpose. So it seems like using smartphone can improve the efficiency of students' study activities through continuous search of information and facilitating teamwork [15]. However, many researchers have pointed a number inconvenience related to the excessive use of smartphones by students. Decrease in academique performances, daily class sleep and a loose school social life [15], depression [17], anxiety [16], ringxiety, momophobia, fear of missing out [18], and even insomnia, are some suspected effects of smartphone. Excessive smartphone use among student is a phenomenon which is real but usually unknown, and miss understood.

Despite all these, very few researchers try to relate excessive smartphones use as a factor to mental health disorders among students. Especially in low, middle and developing countries like cameroon.

Materials and methods

We conducted a cross-sectional study in 2023 among students of the University of Dschang main campus, in Cameroon. We distributed pre-validated physical questionnaires to 698 participants. To assure representativeness, the questionnaires were distributed according to the proportion each faculty represented in the University of Dschang main campus. A multistage stratified sampling method was used to select participants to this study. The University of Dschang main campus is organized in six faculties which are further divided into departments. Each of these faculties made up a stratum (the primary sampling unit), and a maximum of four departments per faculty were randomly chosen to make up a second strata (the secondary sampling unit). Participants were drawn to participate in the study from the second strata. A list of departments in each faculty was obtained and included departments were selected by a simple random method. The number of participants in each stratum (faculty) was determined by proportion. As shown in table 1, the proportion of each faculty was determined by dividing the number students in a given faculty by that of the total number of students in the university.

<i>Faculty</i>	<i>N° of students</i>	<i>% of students</i>	<i>Sample Size</i>
FS ^d	5893	33%	94
FAAS ^a	1439	8%	23
FLPS ^f	3477	20%	56
FESM ^e	3004	17%	48
FLHS ^b	2879	16%	46
FMPS ^c	1029	6%	16
Total	17721	100%	284

a: Faculty of Agronomy and Agricultural Sciences, b: Faculty of Letters and Human Sciences, c: Faculty of Medicine and Pharmacological Sciences, d: Faculty of Sciences, e: Faculty of Economic Sciences and Management, f: Faculty of Law and Political Sciences.

Table 1: Distribution of the proportions of students recruited by faculty.

A brief description of the study objectives was presented to participants as well as the risk, inconveniences, and advantages for them participating to this study. Participants below 18 years and participants with incomplete forms was excluded after submission. These participants were excluded mainly because of the great difficulty to have parental/tutor consent, and the difficulty to efficiently analyse incomplete forms respectively. The data collected was further stored in an excel data base we created. Participant was assured about the confidentiality of their informations; no personal information was collected.

The data collection tool comprised six sections, namely the participants' socio-demographical characteristics, the Smartphone Addiction Scale Short Version (SAS-SV) [31, 32, 20], the Patient health questionnaire 7 and 9 (PHQ-7 and PHQ-9) [33, 6], and the sleep quality evaluative section. As seen in literature, these tools have been widely used in similar research. Participants' socio-demographical characteristics were Gender, Age, Faculty, Study Cycle, Matrimonial status, Residence of Parent, Monthly allowance. The SAS-SV is a validated scale by Kwon 2013. Similarly, PHQ-7 and PHQ-9 are also validated questionnaire and are widely used for similar research with a strong sensitivity and specificity according to literature (Sonkoue et al., 2018). To assess the level of excessive smartphone use, a 10-item scale questionnaire was used (SAS-SV, adapted for students); each question was scored on 6 points (answer by 1 = Strongly Disagree, 2 = Disagree, 3 = Weakly Disagree, 4 = Weakly Agree, 5 = Agree, 6 = Strongly Agree), giving a total maximum score of 60 and a total minimum score of 10. A total score of " <32 = non excessive user", " ≥ 32 = excessive user" [32]. To assess depression, we used the PHQ-9 scale, 9-item questionnaire, each question was scored on 3 points (0-3) making a total of 27 points. The score was adapted for convenience purposes to have only 2 categories (<11 = non depressed, ≥ 11 = depressed) [33]. Anxiety was assessed using the PHQ-7 scale, a 7-item questionnaire scored from 0-3, making a total score of 21 points. The score was adapted for convenience purposes to have a dichotomy outcome (<11 = non anxious, ≥ 11 = anxious) [33]. Sleep quality (insomnia) was assessed using a self-developed questionnaire comprising 03 questions. Each question was scored on 01 point. The total score for sleep quality was hence 03 points. For analysis, the outcome for sleep quality was scheduled in, Good sleep quality (score < 3) and Poor sleep quality (score = 3). The sleep questionnaire benefited of no validation from any given study but was derivative of the Sleep Quality Scale (SQS) and the Sleep Disorder Questionnaire (SDQ). Mental disorder was simply defined as the presence of one or more of the following health problems: depression, anxiety, and poor sleep quality among participants.

Data were stored and organized using Microsoft Office Excel 2013. The data were analysed using IBM_SPSS 26 (Version 26). Descriptive statistics included the mean, standard deviation, frequencies and percentages. These were mainly used to describe the socio-demographical characteristics of participants. KHI2 test was use to verify association between any variables, were we had a dependent and an independent variable. Odd ratio was obtained to determine any association. The p-value was used to determine whether any association is significant or not. Multiple Regression Logistic was applied to eliminate confounding factors among variables which were significantly associated to mental disorder. The dependent variable was Mental disorder.

An ethical statement (N°/332/29/03/2023/CE/CRERSH-OU/VP) was obtained from the West Regional Ethics Committee of Research on Human Health to approve the present study.

Conceptual Chart

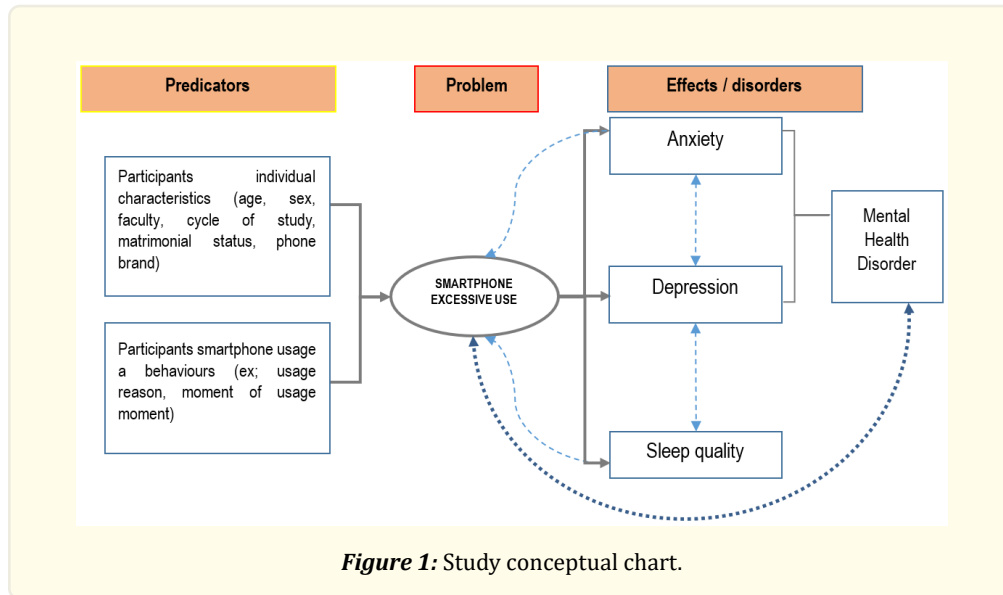


Figure 1: Study conceptual chart.

Results

Description of the socio-demographic factors of the participants

The Table 2 presents the description of the studied characteristics of participants. During this study, we reached a total of 698 student. After excluding unanswered and partially filled questionnaires, 636 students participated to this study (response rate of 91%) of which 310 (48.7%) were Females. The mean age of participants was 21.8 (± 3.0 SD) years. The age group of 18-21 years was mostly represented 318 (50.0%). Student registered for a bachelor’s cycle were 455 (71.5%) of participants. Participants coming from an urban area were 513 (80.7%). Participants with a monthly allowance of 20,000-49,999 F CFA were 270 (42.5%).

<i>Variables</i>	<i>Modalities</i>	<i>Frequency n (%)</i>
	Total	636 (100)
Gender	Female	310 (48.7)
	Male	326 (51.3)
Age group (years)	[18 - 21]	318 (50.0)
	[22 - 26]	285 (44.8)
	[27 - 44]	33 (5.2)
Faculty	FAAS ^a	59 (9.3)
	FLHS ^b	100 (15.7)
	FMPS ^c	57 (9.0)
	FS ^d	200 (31.4)
	FESM ^e	100 (15.7)
	FLPS ^f	120 (18.9)
Study Cycle	Doctorate	19 (3.0)
	Bachelors	455 (71.5)
	Masters	162 (25.5)

Matrimonial status	Single	572 (89.9)
	Dating	64 (10.1)
Residence of Parent	Rural	123 (19.3)
	Urban	513 (80.7)
Monthly allowance (F CFA)	[0 - 9999]	89 (14.0)
	[10000 - 19999]	223 (35.1)
	[20000 - 49999]	270 (42.5)
	[50000 - 99999]	48 (7.9)
	[100000 - 210000]	06 (0.9)

a: Faculty of Agronomy and Agricultural Sciences, b: Faculty of Letters and Human Sciences, c: Faculty of Medicine and Pharmacological Sciences, d: Faculty of Sciences, e: Faculty of Economic Sciences and Management, f: Faculty of Law and Political Sciences, 1= Reference modality.

Table 2: Description of the socio-demographic factors of participants.

Prevalence of excessive smartphone use and mental disorder

The Table 3 below shows the prevalence of excessive smartphone use and mental disorder. The prevalence of ESU and Mental disorder are respectively 38.4% [95%CI: 34.6-42.3] and 35.8% [95%CI: 32.2-39.6].

<i>Variables</i>	<i>Modalities</i>	<i>Frequency</i>	<i>Prevalence (%)</i>	<i>95%CI</i>
	Total		636	100.0
Smartphone use	Non ESU ^a	392	61.6	57.7-65.4
	ESU ^a	244	38.4	34.6-42.3
Mental disorder	No	408	64.2	60.4-67.8
	Yes	228	35.8	32.2-39.6

a: Excessive smartphone users.

Table 3: Distribution of excessive smartphone use and mental disorder.

Predictors of excessive smartphone use

The Table 4 displays the association between excessive smartphone use and the studied predictive factors. The crude OR for the different predictive factors was processed using ESU the dependent variable. Only the significantly associated variables were further inserted in the Multiple logistic regression model using the dependent variable "excessive smartphone use". We noticed an association between ESU and the age group of 22-26 year [aOR=1.65, 95% CI: 1.11-2.44, $p=0.014$], also with students of the FLHS [aOR=0.47, 95% CI: 0.23-0.93, $p=0.029$]. On the other hand, the sex, study cycle, monthly allowance and marital status of the participants were found not to be associated to excessive smartphone use.

Variables	Modalities	Frequency n(%)	cOR (95% CI)	p-value	aOR (95% CI)	p-value
Sex	Female	120 (38.7)	1		-	-
	Male	124 (38.0)	0.97(0.71-1.34)	0.862	-	-
Age group (years)	[18 - 21]	109 (34.3)	1		1	
	[22 - 26]	122 (42.8)	1.44(1.03-2.00)	0.032	1.65 (1.11-2.44)	0.014
	[27 - 44]	13 (39.4)	1.25(0.60-2.60)	0.227	1.47 (0.63-3.47)	0.369
Faculty	FAAS ^a	27 (45.8)	1		1	
	FLHS ^b	29 (29.0)	0.48(0.25-0.95)	0.034	0.47 (0.23-0.93)	0.029
	FMPS ^c	27 (47.4)	1.07(0.51-2.21)	0.862	1.09 (0.51-2.34)	0.819
	FS ^d	67 (33.5)	0.60(0.33-1.08)	0.087	0.64 (0.35-1.18)	0.155
	FESM ^e	43 (43.0)	0.89(0.47-1.71)	0.735	0.95 (0.49-1.86)	0.882
	FLPS ^f	51 (42.5)	0.88(0.47-1.64)	0.679	0.94 (0.50-1.79)	0.854
Study Cycle	Doctorate	07 (36.8)	1		-	-
	Bachelors	172 (37.8)	1.04(.40-2.70)	0.933	-	-
	Masters	65 (40.1)	1.15(0.43-3.07)	0.782	-	-
Marital status	Single	223 (39.0)	1		-	-
	Dating	21 (32.8)	0.76(0.44-1.32)	0.337	-	-
Residence of Parent	Rural	55 (44.7)	1		1	
	Urban	189 (36.8)	0.72(0.48-1.07)	0.108	0.66 (0.44-1.00)	0.048
Monthly allowance (F CFA)	[0 - 9999]	28 (31.5)	1		-	-
	[10000 - 19999]	82 (36.8)	1.27(0.75-2.14)	0.376	-	-
	[20000 - 49999]	110 (40.7)	1.50(0.90-2.50)	0.120	-	-
	[50000 - 99999]	21 (43.8)	1.70(0.82-3.50)	0.154	-	-
	[100000 - 210000]	03 (50)	2.18(0.41- 11.48)	0.358	-	-

h: Excessive smartphone use, a: Faculty of Agronomy and Agricultural Sciences, b: Faculty of Letters and Human Sciences, c: Faculty of Medicine and Pharmacological Sciences, d: Faculty of Sciences, e: Faculty of Economic Sciences and Management, f: Faculty of Law and Political Sciences, 1= Reference modality.

Table 4: Association between excessive smartphone use and the studied predictors using multiple logistic regression.

Association between excessive smartphone use and mental disorder

The Table 5 below displays the association between mental disorder. The crude OR (cOR) for the Excessive Smartphone Use was processed on mental disorder then only the statistically associated variables were further used in a multiple logistic regression model. Multiple logistic regression was processed to determine the association between mental disorder and ESU adjusted with independent variables statistically associated in the univariable analysis. The adjusted odd ratio (aOR) revealed to us a strong association between mental disorder and ESU [aOR: 2.14, 95% CI: 1.51-3.02, $p < 0.001$]. The FS was also found to be associated to ESU [aOR: 1.37, 95% CI: 0.72-2.64, $p = 0.016$]. The sex, age group, cycle of study, marital status, residence of parent and the monthly allowance of participants were found not to be associated to Mental health disorder.

Variable	Modalities	Mental Health Disorder			
		cOR (95% CI)	p-value	aOR (95% CI)	p-value
ESU	No	1	-	1	-
	Yes	2.14(1.53-2.98)	< 0.001	2.14(1.51-3.02)	< 0.001
Sex	Female	1	-	1	-
	Male	0.93 (0.67-1.28)	0.635	-	-
Age group	[18 - 21]	1	-	-	-
	[22 - 26]	1.05(0.75-1.46)	0.793	-	-
	[27 - 44]	0.48(0.20-1.13)	0.092	-	-
Faculty	FAAS	1	-	1	-
	FLHS	0.67(.35-1.28)	0.223	1.46 (0.72-2.97)	0.202
	FMPS	0.93(0.54-1.60)	0.802	0.77 (0.32-1.84)	0.392
	FS	0.41(0.20-0.85)	0.016	1.37 (0.72-2.64)	0.348
	FESM	0.74(0.46-1.18)	0.200	1.39 (0.68-2.85)	0.298
	FLPS	0.82(0.48-1.42)	0.481	1.58 (0.87-3.14)	0.179
Cycle of study	Doctorate	1	-	-	-
	Bachelors	3.43(0.98-11.93)	0.053	-	-
	Masters	2.18(0.61-7.83)	0.232	-	-
Marital status	Single	1	-	-	-
	Dating	1.00 (0.59-1.72)	0.988	-	-
Residence of parents	Rural	1	-	-	-
	Urban	0.68(0.46-1.02)	0.063	-	-
Monthly allowance (F FCA)	[0-9999]	1	-	-	-
	[10000-19999]	0.81(0.49-1.34)	0.407	-	-
	[20000-49999]	0.77(0.47-1.27)	0.306	-	-
	[50000-99999]	0.81(0.39-1.67)	0.564	-	-
	[100000-210000]	1.47(0.28-7.71)	0.647	-	-

ESU: Excessive smartphone use, FAAS: Faculty of Agronomy and Agricultural Sciences, FS: Faculty of Sciences, FLHS: Faculty of Letters and Human Sciences, FESM: Faculty of Economic Sciences and Management, FMPS: Faculty of Medicine and Pharmacological Sciences, FLPS: Faculty of Law and Political Sciences, NA: Not accessible, 1= Reference modality.

Table 5: Association between excessive smartphone use with mental disorder using a multiple logistic regression.

Discussion

This study aimed to determine the distribution of excessive smartphone use (ESU), mental disorder (depression, anxiety and sleep quality) as well as the association between mental disorders and smartphone excessive use among students of the University of Dschang Cameroun in 2023. The remarkable dearth of researches exploring the relation between excessive smartphone use and mental health disorders has always made this topic misunderstood, making it difficult to apprehend. This study brings more light to this relation and remains one of the largest study on this topic in Cameroon and Sub-Saharan Africa.

Prevalence of excessive smartphone use and mental disorder

This study has demonstrated a high prevalence of excessive smartphone use (38.4%) among students of the University of Dschang. Depression (24.7%), anxiety (18.6%) and sleep quality (11.8%) were the common forms of mental disorders present among students.

Compared to other studies, the prevalence of ESU in our study is lower than the reported rate of 96.7% among students of the Universities of Kendari City in Indonesia [5], and 67% among students of Umm Al-Qura University (UQU) in Saudi Arabia [19]. This prevalence remains higher compared to some studies reporting a prevalence of 33.30% among Tehran University Students [34], 28.00% among University students in Tehran [34], and 20.98% among students of the University of Dschang as reported by Sonkoue et al. in 2018 [6]. This difference may be explained by the difference in the socio-demographical characteristics of participants, the assessment method and/or the assessment questionnaire. Recent studies reported that students living in urban areas are more likely to develop excessive smartphone use compared to those living in rural areas. Internet access and daily life behaviours have a great role to play on smartphone usage attitude. Literature shows there is a close relation between internet and the development of excessive smartphone use. This was the case with a study assessing the risk and protective factors associated with smartphone excessive use among college students, then comparing these factors to those linked to internet addiction. Their results shown smartphone features(phone brand) and the gender as being factors risk factors for ESU [35]. The prevalence of depression and anxiety is lower compared to what was reported by Sonkoue et al. [6] sleep quality (Insomnia) is found to be far lesser [19] than what was reported from a study in Indonesia(93.3%) [5]. The results show ESU and mental disorder are widely distributed. This shows it is a Public health problem that requires early control methods. Developing countries like Cameroon are the most exposed. The productive population is generally. The prevalence of mental disorder comes with enough strength to confront to the Sustainable Development Goals (SDGs), not only related to health but also to the economic and political sectors. We stay convinced that mental disorder, as evaluated in this study is only a drop in the ocean compared to the health problems be related to ESU. Differences in prevalence may also be due to the assessment approach and the type of the questionnaire the investigator use to evaluate de problem. Most participants (32.45%) in this study used their phones averagely for 3-4 hours daily. Among the participants, 165 (25.94%) and 271(42.61%) reported to use their smartphones 0-2hours/day and >4hours/day respectively. Concerning the periods at which the smartphone are mostly used by students of the University of Dschang, 397(62%), 26(4%), 132(21%), 173(27%) reported to use their smartphones when they have some free time, while bathing, while in class (even in the presence of the lecturer) and while reading or learning respectively. Social Medias, entertainment, browsing in our study is found smaller compared to what was reported among students in Saudi Arabia [19].

Predictors of excessive smartphone use

Despite the fact that smartphones have help us solve economic problems and much more (John Manson). Smartphones frequently is a source of distraction of its users. This comes along with some undesired effects, like reducing the users' ability to stay focus. Some authors (Timothy Ferriss) in one of his books "The Week of Four Hours", illustrate how smartphones reduce its users level of productivity. In our study, the age group of students ranging from [22-26 years] was significantly associated as a risk factor to the development of ESU, similarly as results reported in a study using similar parameters [36]. This can be explain by the fact that students of this age range are new to the technology of smartphones and are mostly exposed to smartphone use. Participants from the FLHS were significantly associated as protective factors to ESU. This might be explained by the fact that students of the FLHS mostly use physical documentations and have a better control of the time they spend on their smartphone compaired to those from the FMPS which are more subject to technological et electronical researches for their various daily presentations on cases they find on field. Unfortunately for us, we didn't evaluate the presence of chronic disease and alcohol or drug consumptions which were found as an associated predictors of ESU among students of the University of Dschang as was reported by Sonkoue et al. [6], and other institutes in Cameroon as reported by Mbanga et al. [37]. Smartphone excessive use in our study is not associated to gender similarly as was reported by a recent studies [19]; This results contrasts those reported by Wittek et al. in 2016 who found an association between ESU and the male gender [25]. Ahmed et al., using SAS-SV with the same cut-off scale in 2022 reported a predominance of the female gender developing excessive smartphone use among students [20]. No association was found between the student monthly allowance and the status of ESU, conversely to what was reported by Alotaibi et al. in 2022 [19]. H2 is partially proven true in this paragraph because only some of the socio-demographics factors (age, faculty and residence of parents) are associated to ESU.

Association between excessive smartphone use and mental disorder

When associating mental health disorder and excessive smartphone use adjusted with significant independent variables; our study shows the strong association existing between mental health disorder and excessive smartphone use [aOR: 2.14, $p < 0.001$]. These results are similar to those reported by recent studies [19, 22, 25, 35]. Also, Ratan et al. in a systematic review study, published in 2021 reported that excessive smartphone use is high risk factor for the development neurological problems among users [15, 16] depression and anxiety [6, 22, 37], and sleep disorder [19, 20, 21]. Similarly, Kheradmand et al. in 2022 when studying the factors associated to excessive smartphone use among Tehran University students reported a significant relationship between the history of mental disorder (psychiatric illness) and excessive smartphone use [34]. Taking into consideration the results found in this study and the recent studies, all the associations previously found between excessive smartphone use with sleep disorder, depression and anxiety; this shows with enough arguments that, smartphone excessive use is a strong factor for the development of mental disorder. This can be explained by the fact that, the use of smartphone for pleasure purposes produces a little amount of dopamine every time we get satisfied of it use. The more the brain is trained to receive dopamine after a session of smartphone use, the more the brain use to it and the harder it becomes for the brain to stay a long period of time without smartphone use. Hence, the shorter the time a student spends without using his smartphone for pleasure purposes, the greater the addiction. This study reveals a public health nodus. Nevertheless, this study was a transversal study and for better results, a longitudinal study could be carried out. The use of a mental health specialist to confirm all cases of mental health disorder diagnosed using the questionnaire could reflect better significant tant results.

Conclusion

The strong significant association existing between smartphone excessive use and mental disorder illustrates that excessive smartphone use is of a public health impact. The prevalence of excessive smartphone use and mental health are both high. Reasonable smartphone usage should be advised and put in practice among students, with an emphasis on those age between 22-26 years old. This problem is of a global concern and necessitates further investigations.

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Contributorship

These authors contributed equally to this work; LDNM, CBE, VMM, GCMN, Study design, conceptualization; LDNM, CBE, investigation; LDNM, PLK, LTR, FNN, data collection and management; LDNM, CBE, VMM, GCMN, PLK, SIN, LMDE, JCD, LTR, KAM, FNN, AMF, methodology; LDNM, CBE, PLK, formal analysis, data analysis and data interpretation; ATT, VMM, CBE, GCMN, supervision; ATT, LDNM, CBE, PLK, VMM writing original draft; all authors contributed to article review and editing and publishment approval.

Authorizations and ethical statement

All participants gave their verbal consent for participation in this research before providing answers to the questionnaire. The study included only students aged of 18 years and above. This study was approved by the University of Dschang and the ethical committee of the West Region (Ethical Clearance N°/332/29/03/2023/CE/CRERSH-OU/VP).

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Conflict of Interest

The authors declare that there is no conflict of interest.

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