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Factors associated with of symptoms of attention deficit hyperactivity disorder among medical students in Cameroon: a web-based survey

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Abstract

Introduction: Attention Deficit/Hyperactivity Disorder (ADHD) is a chronic disease which is associated with poor productivity, with a significant impact on the quality of life.

Objectives: To determine the prevalence and factors associated with symptoms of ADHD among medical students in a sub-Saharan African setting.

Setting: This was a web-based cross-sectional analytic study conducted from the June 24 to the September 2, 2018.

Participants: Medical students aged 18 years and older from seven medical schools in Cameroon. All non-medical students and all medical residents were excluded.

Results: We had a total of 491 eligible participants. The median age 25.0 (interquartile range [IQR] = 21 – 25) years and 54% were females. The prevalence of self-reported symptom of ADHD was 24.4% with a female predominance (55.8%). Histories of chronic disease (adjusted OR [AOR] = 2.96; 95% CI = 1.49 – 5.86); $p = 0.002$), family history of ADHD (AOR = 3.38; 95% CI = 1.04 – 10.44; $p = 0.035$), severe depression (AOR = 3.49; 95% CI = 1.82 – 6.77; $p < 0.001$) and anxiety disorder (AOR = 2.06; 1.25 – 3.36; $p = 0.004$) were found to be independently associated with the symptoms of ADHD.

Conclusion: ADHD may be highly prevalent mental disorder among medical students, and is associated with severe depression, anxiety disorders and chronic diseases. We recommend screening of the disorder among Cameroonian medical students, with follow up clinical confirmation and treatment as per the guidelines.

Patient and Public Involvement: Patients and/or the public were not directly involved in this study.

Keyword: Attention Deficit Hyperactivity Disorder; ADHD; Epidemiology; Medical students; Adults; Cameroon; Sub-Saharan Africa.

Strength and limitation

1. There exists a complex interaction between the symptoms of ADHD and other psychiatric affections like depression which could be a potential source of confusion when responding to the questionnaire. Consequently, the high prevalence of self-reported severe depression (12%) and anxiety (31.2%), and the absence of clinical interviews to ascertain ADHD status could lead to overestimation of the prevalence of ADHD especially the diagnosis of ADHD could not be confirmed clinically.
2. With the skewed representation of medical students in terms of the different universities and academic level and the use of a non-probability sampling technique, we caution on generalizing our findings to medical students in Cameroon.
3. This study is the premier study to highlight the determinants of ADHD among medical students in Cameroon.
4. The study will serve as a baseline for more epidemiological studies to be carried out, not only among medical students but also in the general population. The findings herein are relevant for hypothesis generation.
5. This study adds to the few evidences on the prevalence of ADHD in sub-Saharan Africa, for an eventual meta-analysis on the subject in the region.

Introduction

Attention-Deficit Hyperactivity Disorder (ADHD) is a common psychiatric disorder of childhood which manifests as inattention, hyperactivity and impulsivity [1, 2]. There is a male predominance [3] with higher chances of persistence of the condition among affected children into adulthood [4, 5]. Globally, the pooled prevalence of ADHD among a total of 171,756 children and adolescents is estimated at 5.29% [1]. Bakare *et al* in 2012 estimated the prevalence of ADHD to vary between 5.4 and 8.7% among children in sub-Saharan Africa [6, 7]. In fact, it has been estimated that 60 to 70% of children diagnosed with ADHD will continue to experience symptoms in adulthood [8, 9]. Some studies have shown the prevalence of ADHD in adults to be 4% with rates varying between 2.8% and 12.3% among university students [10].

ADHD is a chronic disorder which affects personal, interpersonal and social interactions, and negatively impacts the quality of life of affected individuals and their families [9]. Adults with ADHD who present in primary care settings often appear disorganized, have chaotic lifestyles, associated psychiatric comorbidities and may rely on drugs and alcohol to cope [8]. Possible complications of adult ADHD include poor productivity, poor school performances, employment difficulties, inability to sustain relationships, substance abuse and increased motor vehicle accidents [11, 12].

The low importance accorded to mental health is portrayed by the paucity of data on ADHD in Africa and Cameroon in particular. To the best of our knowledge, this is the first study reporting the prevalence of ADHD in Cameroon. We sought to evaluate the prevalence and factors associated with ADHD among medical students in Cameroon. This group is of particular interest as their study curriculum and career requires academic and occupational skills which could be compromised by a diagnosis of ADHD. This information will guide policy-makers to implement effective screening, treatment and follow-up strategies to prevent complications and ensure fulfilling academic and eventually professional careers.

Methodology

Study design, duration and setting

This was a web-based cross-sectional study conducted from 24 June to 2 September 2018, a period of three months. Cameroon is a bilingual country with English and French as her official languages. Currently, Cameroon has eight accredited medical schools: Three English majority universities (Faculty of Health Sciences [FHS] of the University of Buea, FHS of the University of Bamenda and The Catholic Medical School in Kumbo), a bilingual university (Faculty of Medicine and Biomedical Sciences [FMBS] of the University of Yaoundé) and three French majority universities/schools (the Faculty of Medicine and Pharmaceutical Sciences [FMPS] of the University of Douala, Institut Supérieure des Technologies Médicale (ISTM) in Yaoundé and Institut Supérieure des Sciences Médicale (ISSM) in Banganté).

Annually, about 800 medical students are enrolled into the first year in all the accredited medical schools in Cameroon. Since medical studies in Cameroon lasts for seven years, we estimated that about 5,600 undergraduates are enrolled in these schools every year.

Study population

We included students undertaking General Medicine, Pharmacy and Dental Medicine in Cameroon, aged 18 years and older, without any language restriction. We excluded students undertaking other healthcare specializations and non-healthcare-related disciplines from our study.

Sampling

A snowballing sampling technique was used to recruit students for the survey.

Data collection

Using a pre-established Google Form, we collected data on: sociodemographic data (age [in years], gender, name of school, academic level, number and types of social media accounts), past history (diagnosis of ADHD, family history of ADHD, learning disability, chronic disease, current illness, histories of head injury, snoring, recreational drug use, severe depression, anxiety) and the six-item Adult ADHD Self-Report Scale (ASRS) v1.1 Screener [13, 14]. The diagnosis of severe depression and anxiety were based on a self-reported physician and/or specialist's diagnosis of the condition. The 6-items adult ASRS v1.1 screener is based on the 18-item DSM-IV ADHD symptom criteria and assesses symptoms of ADHD that occurred in the last six-months. Each of the six-items constitutes of responses of "never", "rarely", "sometimes", "often" or "very often". Each question has a threshold level that is used to screen a participant's symptoms as either related to ADHD or not. A participant's symptoms were considered to be consistent with ADHD if their response to at least four of the questions correspond to the threshold level for the question. The ASRS-v1.1 has been reported to have moderate sensitivity, excellent specificity, and excellent accuracy of 68.7%, 99.5% and 97.9% in the general population, respectively. The questionnaire was translated from English to French to improved comprehension for French-speaking students.

Study procedure

After obtaining ethical clearance, the pre-established Google Form was piloted with the help of 20 medical students (ten English-speaking and ten French-speaking students) to identify technical issues that could prevent smooth filling of the questionnaire, issues with comprehension due to a poor translation and to determine the average time required to complete the questionnaire. After which we got in contact with a representative of each class from all the medical schools. A class representative was only selected if he had a WhatsApp account (<https://www.whatsapp.com/>) and was part of the class WhatsApp group. We realized that all the classes had a WhatsApp group. With the permission of the representatives, we created

seven WhatsApp groups, one for each school and included representatives. This was to facilitate communication. These representatives were briefed on the study after which the link to the Google Form was shared to them. They were encouraged to respond to the questionnaire and before disseminating to their respective WhatsApp class groups. The participants were encouraged to respond to the questionnaire just once. The representatives we encouraged through constant weekly reminders to repost the link to the questionnaire on their various class pages, for those missed the previous post. This was done until we reached saturation (no more participants filling the questionnaire after two successive reminders).

Definitions

1. Presence of symptoms of ADHD was defined as an overall score of four or over on the six-item adult ASRS v1.1 screener.
2. Institutions with less than 10% of the study participants (University of Douala, ISTM Yaoundé, ISSM Baganté and Catholic University, Kumbo) were classified as “Others” before logistic regression analysis.
3. Academic level was categorized into preclinical years (levels 1 – 3) and clinical years (levels 4 – 7) before logistic regression analysis.

Ethical consideration

Authorization to conduct this study was granted by the National Ethics Committee of the Ministry of Public Health Cameroon. Data was protected according to the General Data Protection Regulation (GDPR) [15]. The text message bearing the link to the Google Form which was shared to the participants contained information on the title and aim of the study, the eligibility of participants, information on the benefits and harm, and the average duration to required fill a questionnaire which was three minutes. This information was also found on the first page of the Google Form and participants were given the option

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3 to either consent to participate (which will give them access to the questionnaire) or decline to participate
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5 (which will automatically submit a blank form).
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8 **Statistical analysis**

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11 Participants' responses from the online Google Form was exported to a 2016 Excel Spreadsheet for data
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13 cleaning and curation. The statistical software R was used for analysis. The mean or median were used to
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15 summarize quantitative variables where appropriate, while categorical variables were summarised as
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17 counts and percentages. The Shapiro-Wilk's test, QQ-plots and histograms were used to assess for
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19 normality of continuous variables and outliers. Multivariable logistic regression analysis was used to
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21 identify factors independently associated with ADHD in our study population. The Odd's ratio (OR)
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23 alongside its corresponding 95% CI were used to measure the degree of association between the outcome
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25 and independent variables. Only independent variables with a p-value < 0.20 on univariable logistic
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27 analysis were included in the multivariable analysis. Variables that were eligible for the multivariable
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29 logistic regression analysis were sequentially added to the model starting with: sociodemographic factors
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31 (age, gender, institution, number of social media account, and use of recreational drugs), family history of
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33 ADHD, and past medical history (history of chronic disease, head injury, anxiety, and severe depression).
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35 The contribution of each variable in explaining the total variance in the outcome on multivariable analysis
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37 was assessed using the maximum likelihood ratio (LR) test. The LR test was also used to evaluate a
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39 possible interaction between history of severe anxiety and depression. The variables "number of social
40
41 media accounts" was excluded from the final model as it did not significant improve the model fit. The
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43 accuracy or predictive power of the final multivariable model was assessed using the C-statistics. A C-
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45 statistics of 0.5, above 0.5 to 0.7, above 0.7 to 0.8 and above 0.8 indicated a poor, fair, good and strong
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47 (or excellent) model, respectively [16]. The Cronbach alpha statistic was used to assess reliability of the
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different items of the Adult ADHD Self-Report Scale (ASRS) v1.1 Screener in screening for ADHD in our study population. The threshold of statistical significance was set at a two-tailed p-value of 0.05.

Results

In total, 498 participants responded to our questionnaire. Seven participants did not give the consent and were not considered in the analysis. Therefore, our 491 participants were considered for the final analysis.

Sociodemographic characteristics of the study participants

As depicted in **Table 1**, the ages of the participants ranged from 18 – 32 years with a median age of 25.0 (interquartile range [IQR] = 21 – 25) years, 56.4% of whom were females. Over 75% of our participants were students from the Universities of Yaoundé 1 (30.3%), Bamenda (27.7%) and Buea (19.3%). Majority of the participants were fifth year (IQR = 4.0 – 7.0) medical students, with three (IQR = 2.0 – 4.0) social media accounts and spent four hours (IQR = 2.0 – 4.0) on social media per day. All participants were users of WhatsApp as this was the forum used for data collection. We also noted that most participants used more than one social media account. Facebook (80.7%), Instagram (44.8%) and Snapchat (18.7%) were commonly used social media accounts in conjunction to WhatsApp.

Past history of the study participants

The commonest past histories were histories of anxiety disorder (31.2%), snoring in sleep (37.5%) and severe depression (12.0%). Family history of ADHD (2.9%), personal history of ADHD (1.2%) and history of learning disability (0.6%). About 7.5% of the participants were users of recreational drugs, with tramadol (51.4%) being the most common, Table 1.

Prevalence of symptoms of ADHD

In total, 120 students reported symptoms consistent with ADHD, giving a prevalence of 24.4% (95% CI = 20.6 – 28.3) with a female predominance (55.8%), Table 1.

Factors associated with symptom of ADHD

After adjusting for age, gender and institution, on multivariable logistic regression analysis, histories chronic diseases (adjusted OR [AOR] = 2.96; 95% CI = 1.49 – 5.86); $p = 0.002$), family history of ADHD (AOR = 3.38; 95% CI = 1.04 – 10.44; $p = 0.035$), severe depression (AOR = 3.49; 95% CI = 1.82 – 6.77; $p < 0.001$) and anxiety disorder (AOR = 2.06; 1.25 – 3.36; $p = 0.004$) were independently associated with symptoms of ADHD, Table 2. There was no significant interaction between anxiety and depression.

The final multivariable model predicted ADHD with good accuracy (C-statistics = 70.3%). The reliability of the Adult ADHD Self-Report Scale (ASRS) v1.1 Screener was 0.72 (95% CI, 0.67 – 0.76) indicating an acceptable reliability.

Discussion

This study adds to the limited evidence of ADHD in sub-Saharan Africa with a focus on medical students [17]. The prevalence of self-reported ADHD symptoms of 24.4% in our study is similar to the 23.7% among medical students in sub-Saharan Africa [17] and elsewhere [18, 19]. However, our prevalence was higher than the prevalence of 8.7% reported Shi *et al* in China [10] and other populations [1, 20]. This disparity is most likely due to the difference in methodological approaches used in our study and that of the Chinese authors. In addition to evaluating the symptoms of ADHD in adulthood, they also evaluated childhood symptoms of ADHD. Only participants with symptoms consistent with ADHD in both their child- and adulthood were considered to have ADHD. The effect of recall bias is higher in the study by Shi *et al* as the participants were required to remember experiencing symptoms of ADHD in both the child- and adulthood. Socioeconomic and cultural differences could also contribute to the observed

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3 heterogeneity in the prevalence of adult ADHD. In addition, we used the ASRS which has been shown to
4 have a high sensitivity albeit its low specificity [21]. Further clinical investigation could have reduced the
5 prevalence of ADHD in our study. In our study, we found that just 1.2% of our study population had a
6 previous diagnosis of ADHD which suggests a very low diagnostic rate in our setting. ADHD is associated
7 with very poor long-term outcomes in almost every aspect of life [11]. Mental wellbeing research to
8 ascertain the burden of ADHD among medical students in Cameroon should be considered a priority.
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11 Severe depression, anxiety disorder and chronic disease were associated with significantly higher odds of
12 symptoms of ADHD in our study population. This is consistent with the report of Almeida Montes *et al*
13 [20], suggesting a strong correlation between symptoms of ADHD and depression [22]. Psychiatric
14 disorders are emerging global health concerns especially among medical students in Sub-Saharan Africa.
15 Van Der Walt and collaborators highlighted a rising trend from 2018 to 2020 in the prevalence of
16 depression and anxiety, 21.2% to 25% and 18.65 to 20.5% respectively, among medical students in South
17 Africa [23]. In Ethiopia, depression and anxiety was found to be prevalent in 51.3% and 30.1%
18 respectively among the medical students in a medical college in Addis Ababa [24]. Njim et al also recorded
19 a prevalence of major depressive symptom 23.0% among medical students in Cameroon. These increasing
20 trends in depression and anxiety among medical students, which are closely related to ADHD, could imply
21 increasing prevalence of ADHD in this population. Long-standing ADHD, especially among medical
22 students with a very demanding program, would lead to poor school performances and consequently poor
23 career performances. However, it is important highlight that depression and anxiety could be
24 consequences of ADHD. The issue of temporality can only be addressed using a prospective cohort study
25 design.
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53 In addition, chronic diseases has been demonstrated to be strongly associated with ADHD in both pediatric
54 and adult ADHD [25, 26]. Many diseases have been incriminated with complex mechanisms of
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3 association. For example, obesity and obesity-related conditions could produce ADHD-like symptoms but
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5 the most incriminated mechanism is the association between ADHD and somatic diseases is the
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7 dopaminergic system. The comorbidity of ADHD and chronic disease will lead to a clinical diagnostic
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9 and management dilemma as a chronic disease can depict ADHD-like symptoms.
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13 We found no association between gender and ADHD. This is consistent with the findings of Montes et al
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15 reported that boys are more affected than girls in ADHD in childhood, but these disparities are disrupted
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17 as they grow up [27].
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20 21 **Conclusion**

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24 This study reveals that about one in four medical students in Cameroon experience symptoms of ADHD.
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26 Histories of severe depression, anxiety and chronic diseases are most commonly associated with ADHD
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28 in the population. There is a need to conduct a large-scale prospective cohort study with interviews to
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30 estimate the true prevalence and/or incidence of ADHD among medical students in Cameroon, and assess
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32 a possible causal relationship between ADHD and depression and anxiety.
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36 37 **List of abbreviations**

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39 **ADHD:** Adult Deficit/Hyperactivity Disorder; **LMICs:** Low- and middle-income countries; **AOR:**
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41 Adjusted Odd's ratio; **IQR:** Interquartile range; **FHS:** Faculty of Health Sciences; **FMBS:** Faculty of
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43 Medicine and Biomedical Sciences; **FMPS:** Faculty of Medicine and Pharmaceutical Sciences; **ISSM:**
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45 Institut Supérieure des Technologies Médicale; **ISSM:** Institut Supérieure des Sciences Médicale.
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49 50 **Declarations**

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54 study and contributed to its realization.
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Authors' contribution: Conception of study: VNA. Data collection: KFN, LPS, LLN, ANF, CP, VNA. Data curation and analysis: VNA. Interpretation of results: KFN, NB, VNA; First draft of manuscript: KFN, VNA. Manuscript revisions: KFN, LPS, LLN, ANF, CP, FLT, NB, VNA. Critical revision of the manuscript: NB, FLT, VNA. All authors read and approved the final version of the manuscript.

Conflict of interest: The authors declare no competing interests.

References

1. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: a systematic review and meta-regression analysis. *Am J Psychiatry*. 2007;164:942–8.
2. DSM: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision: DSM-IV-TR Quick Reference to the Diagnostic Criteria from DSM-IV-TR. *JAMA*. 2001;285:811–2.
3. Wamulugwa J, Kakooza A, Kitaka SB, Nalugya J, Kaddumukasa M, Moore S, et al. Prevalence and associated factors of attention deficit hyperactivity disorder (ADHD) among Ugandan children; a cross-sectional study. *Child Adolesc Psychiatry Ment Health*. 2017;11:18.
4. Fayyad J, De Graaf R, Kessler R, Alonso J, Angermeyer M, Demyttenaere K, et al. Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *Br J Psychiatry*. 2007;190:402–9.
5. McGough JJ, Barkley RA. Diagnostic Controversies in Adult Attention Deficit Hyperactivity Disorder. *Am J Psychiatry*. 2004;161:1948–56.
6. Bakare M. Attention deficit hyperactivity symptoms and disorder (ADHD) among African children: a review of epidemiology and co-morbidities. *Afr J Psychiatry*. 2012;15. doi:10.4314/ajpsy.v15i5.45.
7. Umar MU, Obindo JT, Omigbodun OO. Prevalence and Correlates of ADHD Among Adolescent Students in Nigeria. *J Atten Disord*. 2018;22:116–26.
8. Gentile JP, Atiq R, Gillig PM. Adult ADHD: Diagnosis, Differential Diagnosis, and Medication Management. *Psychiatry Edgmont*. 3:25.
9. Schoeman R, Klerk M de. Adult attention-deficit hyperactivity disorder: A database analysis of South African private health insurance. *South Afr J Psychiatry*. 2017;23:6.

10. Shi M, Liu L, Sun X, Wang L. Associations between symptoms of attention-deficit/ hyperactivity disorder and life satisfaction in medical students: the mediating effect of resilience. *BMC Med Educ*. 2018;18. doi:10.1186/s12909-018-1261-8.
11. Shaw M, Hodgkins P, Caci H, Young S, Kahle J, Woods AG, et al. A systematic review and analysis of long-term outcomes in attention deficit hyperactivity disorder: effects of treatment and non-treatment. *BMC Med*. 2012;10:99.
12. Erskine HE, Norman RE, Ferrari AJ, Chan GCK, Copeland WE, Whiteford HA, et al. Long-Term Outcomes of Attention-Deficit/Hyperactivity Disorder and Conduct Disorder: A Systematic Review and Meta-Analysis. *J Am Acad Child Adolesc Psychiatry*. 2016;55:841–50.
13. Kessler RC, Adler L, Ames M, Demler O, Faraone S, Hiripi E, et al. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. *Psychol Med*. 2005;35:245–56.
14. National Comorbidity Survey. <https://www.hcp.med.harvard.edu/ncs/asrs.php>. Accessed 10 Oct 2018.
15. Key Changes with the General Data Protection Regulation – EUGDPR. <https://eugdpr.org/the-regulation/>. Accessed 10 Oct 2018.
16. Stephanie. C-Statistic: Definition, Examples, Weighting and Significance. *Statistics How To*. 2016. <https://www.statisticshowto.datasciencecentral.com/c-statistic/>. Accessed 29 Jul 2019.
17. Atwoli L, Owiti P, Manguro G, Ndambuki D. Attention deficit hyperactivity disorder symptom self-report among medical students in Eldoret, Kenya. *Afr J Psychiatry*. 2011;14. doi:10.4314/ajpsy.v14i4.5.
18. Gadow KD, Nolan EE, Litcher L, Carlson GA, Panina N, Golovakha E, et al. Comparison of Attention-Deficit/Hyperactivity Disorder Symptom Subtypes in Ukrainian Schoolchildren. *J Am Acad Child Adolesc Psychiatry*. 2000;39:1520–7.
19. Guardiola A, Fuchs FD, Rotta NT. Prevalence of attention-deficit hyperactivity disorders in students. Comparison between DSM-IV and neuropsychological criteria. *Arq Neuropsiquiatr*. 2000;58:401–7.
20. Almeida Montes LG, Hernández García AO, Ricardo-Garcell J. ADHD Prevalence in Adult Outpatients With Nonpsychotic Psychiatric Illnesses. *J Atten Disord*. 2007;11:150–6.
21. Mattos P, Nazar BP, Tannock R, Mattos P, Nazar BP, Tannock R. By the book: ADHD prevalence in medical students varies with analogous methods of addressing DSM items. *Rev Bras Psiquiatr*. 2018;40:382–7.
22. Humphreys KL, Katz SJ, Lee SS, Hammen CL, Brennan PA, Najman JM. The association of ADHD and depression: Mediation by peer problems and parent-child difficulties in two complementary samples. *J Abnorm Psychol*. 2013;122:854.

- 1
2
3 23. Walt S van der, Mabaso WS, Davids EL, Vries PJ de. The burden of depression and anxiety among
4 medical students in South Africa: A cross-sectional survey at the University of Cape Town. *S Afr Med*
5 *J*. 2019;110:69-76–76.
6
7
8 24. Kebede MA, Anbessie B, Ayano G. Prevalence and predictors of depression and anxiety among
9 medical students in Addis Ababa, Ethiopia. *Int J Ment Health Syst*. 2019;13:30.
10
11 25. Instanes JT, Klungsøyr K, Halmøy A, Fasmer OB, Haavik J. Adult ADHD and Comorbid Somatic
12 Disease: A Systematic Literature Review. *J Atten Disord*. 2018;22:203.
13
14 26. Hegvik T-A, Instanes JT, Haavik J, Klungsøyr K, Engeland A. Associations between attention-
15 deficit/hyperactivity disorder and autoimmune diseases are modified by sex: a population-based cross-
16 sectional study. *Eur Child Adolesc Psychiatry*. 2018;27:663.
17
18 27. Das D, Cherbuin N, Butterworth P, Anstey KJ, Eastaer S. A Population-Based Study of Attention
19 Deficit/Hyperactivity Disorder Symptoms and Associated Impairment in Middle-Aged Adults. *PLOS*
20 *ONE*. 2012;7:e31500.
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26 **List of Tables**

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31 **Table 2:** Factors associated with symptoms of ADHD among medical students on bivariable and
32 multivariable analysis
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Table 1. General characteristics of the study population

Variables	Frequency	Proportion (%)
Sociodemographic characteristics		
Age in years, Mean (SD)		23.4 (2.6)
Gender		
Male	214	43.6
Female	277	56.4
Institution		
University of Yaoundé 1	149	30.3
University of Buea	95	19.3
University of Douala	26	5.3
University of Bamenda	136	27.7
ISTM Yaoundé	33	6.7
ISSM Baganté	31	6.3
Catholic University, Kumbo	21	4.4
Academic Level, Median (IQR)		5.0 (4.0 – 7.0)
Number of social media accounts		3.0 (2.0 – 4.0)
Type of social media account*		
WhatsApp	491	100.0
Facebook	395	80.7
Google+	62	12.6
Telegram	35	7.1
Instagram	220	44.8
Snapchat	92	18.7
Twitter	91	18.5
Others	81	16.5
Time spent on social media per day, Median (IQR)		4.0 (3.0 – 6.0)
Past History		
Family history of ADHD		
Yes	14	2.9
No	477	97.1
Ever been diagnosed with ADHD?		
Yes	6	1.2
No	485	98.8
Ever been diagnosed with learning disability		
Yes	3	0.6
No	488	99.4
History of chronic disease		
Yes	46	9.4

No	445	90.6
History of head injury		
Yes	41	8.4
No	450	91.6
History of heart disease		
Yes	17	3.5
No	474	96.5
Ever been told you snore in your sleep?		
Yes	184	37.5
No	307	62.5
Recreational drug use		
Yes	37	7.5
No	454	92.5
Type of recreational drug use (n=37)		
Cannabis	7	18.9
Marijuana	7	18.9
Tramadol	19	51.4
Others	4	10.8
History of severe depression		
Yes	59	12.0
No	432	88.0
History of anxiety disorder		
Yes	153	31.2
No	338	68.8

*Majority of the participants have more than one social media account; IQR = Interquartile range; SD=Standard deviation; ADHD = Attention deficit hyperactivity disorder; ISTM= Institut Supérieure des Technologies Médicale; ISSM= Institut Supérieure des Sciences Médicale; n = relative frequency

Table 2. Factors associated with symptoms of ADHD among medical students on univariable and multivariable logistic regression analysis

Variables	OR	95% CI	p value	Adjusted OR	95%CI	p value
Age (in years)&	1.06	0.98 – 1.15	0.131	1.01	0.92 – 1.10	0.855
Gender (Female/ Ref: Male)&	0.96	0.63 – 1.45	0.842	0.83	0.52 – 1.33	0.416
Institution& (Ref: University of Yaoundé 1)						
University of Bamenda	0.79	0.44 – 1.41	0.431	0.77	0.41 – 1.43	0.406
University of Buea	1.62	0.91 – 2.90	0.102	1.44	0.75 – 2.76	0.252
Others	1.42	0.81 – 2.51	0.220	0.44	0.32 – 1.39	0.165
Academic level (Clinical year/Ref: Pre-clinical year)	0.86	0.54 – 1.38	0.514			
Number of social media account&	1.10	0.96 – 1.27	0.160			
Number of hours spent on social media per day (Four or more/ Ref: Below four)	1.25	0.82 – 1.90	0.300			
Family history of ADHD (Yes/Ref: No)&	2.39	0.80 – 7.01	0.114	3.38	1.04 – 10.44	0.035*
History of chronic diseases (Yes/Ref: No)&	3.25	1.74 – 6.05	<0.001*	2.96	1.49 – 5.86	0.002*
History of head injury (Yes/ Ref: No)	1.31	0.62 – 2.60	0.453			
History of heart disease (Yes/Ref: No)	0.95	0.26 – 2.74	0.929			
Snores in sleep (Yes/Ref: No)	1.38	0.91 – 2.10	0.722			
Use of recreational drugs (Yes/Ref: No)	0.84	0.35 – 1.81	0.679			
History of severe depression (Yes)&	4.63	2.64 – 8.19	<0.001*	3.49	1.82 – 6.77	<0.001*
History of anxiety disorder (Yes)&	3.29	2.14 – 5.06	<0.001*	2.06	1.25 – 3.36	0.004*

OR = Odd's ratio; CI = Confidence interval; *significant p-value; &Included in the multivariable analysis C-statistics = 70.3%

STROBE Statement—checklist of items that should be included in reports of observational studies

Item No	Recommendation
Title and abstract [Page 1-3]	1 (a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction	
Background/rationale [Page 4]	2 Explain the scientific background and rationale for the investigation being reported
Objectives [Page 4-5]	3 State specific objectives, including any prespecified hypotheses
Methods	
Study design [Page 5]	4 Present key elements of study design early in the paper
Setting [Page 5]	5 Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants [Page 5]	6 (a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables [Page 6-8]	7 Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement [Page 6-8]	8* For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias [Page 3]	9 Describe any efforts to address potential sources of bias
Study size [Page 6]	10 Explain how the study size was arrived at
Quantitative variables [Page 7-8]	11 Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods [Page 8]	12 (a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy

(e) Describe any sensitivity analyses

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60**Results**

Participants [Page 8-9]	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data [Page 8-9]	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data [Page 9]	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results [Page 8-9]	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(b) Report category boundaries when continuous variables were categorized
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses [NA]	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results [Page 10]	18	Summarise key results with reference to study objectives
Limitations [Page 3]	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation [Page 10]	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability [Page 3]	21	Discuss the generalisability (external validity) of the study results

Other information

Funding [Page 12]	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors associated with symptoms of attention deficit hyperactivity disorder among medical students in Cameroon: a web-based cross-sectional study

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Factors associated with symptoms of attention deficit hyperactivity disorder among medical students in Cameroon: a web-based cross-sectional study

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Abstract

Introduction: Attention Deficit/Hyperactivity Disorder (ADHD) is a chronic disease which is associated with poor productivity, with a significant impact on the quality of life.

Objectives: To determine factors associated with symptoms of ADHD among medical students in Cameroon.

Design: A web-based cross-sectional study

Setting: Participants were recruited through a social media platform, Whatsapp, June 24 to September 2, 2018.

Participants: Medical students aged 18 years and older from seven medical schools in Cameroon. All non-medical students and all medical residents were excluded.

Results: A total of 491 eligible participants. The median age 25.0 (interquartile range [IQR] = 21 – 25) years and 54% were females. The prevalence of self-reported symptoms of ADHD was 24.4% with a female predominance (55.8%). Histories of chronic disease (adjusted OR [AOR] = 2.96; 95% CI = 1.49 – 5.86); $p = 0.002$), family history of ADHD (AOR = 3.38; 95% CI = 1.04 – 10.44; $p = 0.035$), severe depression (AOR = 3.49; 95% CI = 1.82 – 6.77; $p < 0.001$) and anxiety disorder (AOR = 2.06; 1.25 – 3.36; $p = 0.004$) were found to be independently associated with the symptoms of ADHD.

Conclusion: ADHD may be highly prevalent mental disorder among medical students, and is associated with severe depression, anxiety disorders and chronic diseases. We recommend screening of the disorder among Cameroonian medical students, with follow up clinical confirmation and treatment as per the guidelines.

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2
3 **Keyword:** Attention Deficit Hyperactivity Disorder; ADHD; Epidemiology; Medical students; Adults;
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5 Cameroon; Sub-Saharan Africa.
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8 **Strength and limitation**

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12 1. With the use of a non-probabilistic sampling technique, we caution on generalizing the prevalence
13 of ADHD in this study to medical students in Cameroon.
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- 16 2. Being observational in nature, our study is subject to residual confounding.
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- 18 3. The use of the updated Adult ADHD Self-Report Screening Scale for DSM V (ASRS 5) rather
19 than the ASRS v1.1 would have improved the accuracy and reliability of our outcome measure.
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- 22 4. The findings herein are relevant for hypothesis generation, and adds to the limited evidence of
23 ADHD in sub-Saharan Africa, and Cameroon.
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Introduction

Attention-Deficit Hyperactivity Disorder (ADHD) is a common psychiatric disorder of childhood which manifests as inattention, hyperactivity and impulsivity [1, 2]. There is a male predominance [3] with higher chances of persistence of the condition among affected children into adulthood [4, 5]. Globally, the pooled prevalence of ADHD among a total of 171,756 children and adolescents is estimated at 5.29% [1]. Bakare *et al* in 2012 estimated the prevalence of ADHD to vary between 5.4 and 8.7% among children in sub-Saharan Africa [6, 7]. In fact, it has been estimated that 60 to 70% of children diagnosed with ADHD will continue to experience symptoms in adulthood [8, 9]. Some studies have shown the prevalence of ADHD in adults to be 4% with rates varying between 2.8% and 12.3% among university students [10].

ADHD is a chronic disorder which affects personal, interpersonal and social interactions, and negatively impacts the quality of life of affected individuals and their families [9]. Adults with ADHD who present in primary care settings often appear disorganized, have chaotic lifestyles, associated psychiatric comorbidities and may rely on drugs and alcohol to cope [8]. Possible complications of adult ADHD include poor productivity, poor school performances, employment difficulties, inability to sustain relationships, substance abuse and increased motor vehicle accidents [11, 12].

The low importance accorded to mental health is portrayed by the paucity of data on ADHD in Africa and Cameroon in particular. To the best of our knowledge, this is the first study reporting the prevalence of ADHD in Cameroon. We sought to evaluate the prevalence and factors associated with ADHD among medical students in Cameroon. This group is of particular interest as their study curriculum and career requires academic and occupational skills that could be compromised by a diagnosis of ADHD. This information will guide policy-makers to implement effective screening, treatment and follow-up strategies to prevent complications and ensure fulfilling academic and eventually professional careers.

Methodology

Study design, duration and setting

This was a web-based cross-sectional study conducted from 24 June to 2 September 2018, a period of three months. Cameroon is a bilingual country with English and French as her official languages. Currently, Cameroon has eight accredited medical schools: Three English majority universities (Faculty of Health Sciences [FHS] of the University of Buea, FHS of the University of Bamenda and The Catholic Medical School in Kumbo), a bilingual university (Faculty of Medicine and Biomedical Sciences [FMBS] of the University of Yaoundé) and three French majority universities/schools (the Faculty of Medicine and Pharmaceutical Sciences [FMPS] of the University of Douala, Institut Supérieure des Technologies Médicale (ISTM) in Yaoundé and Institut Supérieure des Sciences Médicale (ISSM) in Banganté).

Annually, about 800 medical students are enrolled into the first year in all the accredited medical schools in Cameroon. Since medical studies in Cameroon lasts for seven years, we estimated that about 5,600 undergraduates are enrolled in these schools every year.

Study population

We included students undertaking General Medicine, Pharmacy and Dental Medicine in Cameroon, aged 18 years and older, without any language restriction. We excluded students undertaking other healthcare specializations and non-healthcare-related disciplines from our study.

Sampling

A snowballing sampling technique was used to recruit students for the survey.

Data collection

Using a pre-established Google Form, we collected data on: sociodemographic data (age [in years], gender, name of school, academic level, number and types of social media accounts), past history (diagnosis of ADHD, family history of ADHD, learning disability, chronic disease, current illness, histories of head injury, snoring, recreational drug use, severe depression, anxiety) and the six-item Adult ADHD Self-Report Scale (ASRS) v1.1 Screener [13, 14]. The diagnosis of severe depression and anxiety were based on a self-reported physician and/or specialist's diagnosis of the condition. The 6-items adult ASRS v1.1 screener is based on the 18-item DSM-IV ADHD symptom criteria and assesses symptoms of ADHD that occurred in the last six-months. Each of the six-items constitutes of responses of "never", "rarely", "sometimes", "often" or "very often". Each question has a threshold level that is used to screen a participant's symptoms as either related to ADHD or not. A participant's symptoms were considered to be consistent with ADHD if their response to at least four of the questions correspond to the threshold level for the question. The ASRS-v1.1 has been reported to have moderate sensitivity, excellent specificity, and excellent accuracy of 68.7%, 99.5% and 97.9% in the general population, respectively. The questionnaire was translated from English to French to improved comprehension for French-speaking students.

Study procedure

After obtaining ethical clearance, the pre-established Google Form was piloted with the help of 20 medical students (ten English-speaking and ten French-speaking students) to identify technical issues that could prevent smooth filling of the questionnaire, issues with comprehension due to a poor translation and to determine the average time required to complete the questionnaire. After which we got in contact with a representative of each class from all the medical schools. A class representative was only selected if he had a WhatsApp account (<https://www.whatsapp.com/>) and was part of the class WhatsApp group. We realized that all the classes had a WhatsApp group. With the permission of the representatives, we created

seven WhatsApp groups, one for each school and included representatives. This was to facilitate communication. These representatives were briefed on the study after which the link to the Google Form was shared to them. They were encouraged to respond to the questionnaire and before disseminating to their respective WhatsApp class groups. The participants were encouraged to respond to the questionnaire just once. The representatives we encouraged through constant weekly reminders to repost the link to the questionnaire on their various class pages, for those missed the previous post. This was done until we reached saturation (no more participants filling the questionnaire after two successive reminders).

Definitions

1. Presence of symptoms of ADHD was defined as an overall score of four or over on the six-item adult ASRS v1.1 screener.
2. Institutions with less than 10% of the study participants (University of Douala, ISTM Yaoundé, ISSM Baganté and Catholic University, Kumbo) were classified as “Others” before logistic regression analysis.
3. Academic level was categorized into preclinical years (levels 1 – 3) and clinical years (levels 4 – 7) before logistic regression analysis.

Ethical consideration

Authorization to conduct this study was granted by the National Ethics Committee of the Ministry of Public Health Cameroon. Data was protected according to the General Data Protection Regulation (GDPR) [15]. The text message bearing the link to the Google Form which was shared to the participants contained information on the title and aim of the study, the eligibility of participants, information on the benefits and harm, and the average duration required to fill a questionnaire which was three minutes. This information was also found on the first page of the Google Form and participants were given the option

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3 to either consent to participate (which will give them access to the questionnaire) or decline to participate
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5 (which will automatically submit a blank form).
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8 **Statistical analysis**

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11 Participants' responses from the online Google Form was exported to a 2016 Excel Spreadsheet for data
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13 cleaning and curation. The statistical software R was used for analysis. The mean or median were used to
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15 summarize quantitative variables where appropriate, while categorical variables were summarized as
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17 counts and percentages. The Shapiro-Wilk's test, QQ-plots and histograms were used to assess for
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19 normality of continuous variables and outliers. Multivariable logistic regression analysis was used to
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21 identify factors independently associated with ADHD in our study population. The Odd's ratio (OR)
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23 alongside its corresponding 95% CI were used to measure the degree of association between the outcome
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25 and independent variables. Only independent variables with a p-value < 0.20 on univariable logistic
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27 analysis were included in the multivariable analysis. Variables that were eligible for the multivariable
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29 logistic regression analysis were sequentially added to the model starting with: sociodemographic factors
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31 (age, gender, institution, number of social media account, and use of recreational drugs), family history of
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33 ADHD, and past medical history (history of chronic disease, head injury, anxiety, and severe depression).
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35 The contribution of each variable in explaining the total variance in the outcome on multivariable analysis
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37 was assessed using the maximum likelihood ratio (LR) test. The LR test was also used to evaluate a
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39 possible interaction between history of severe anxiety and depression. The variables "number of social
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41 media accounts" was excluded from the final model as it did not significantly improve the model fit. The
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43 accuracy or predictive power of the final multivariable model was assessed using the C-statistics. A C-
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45 statistics of 0.5, above 0.5 to 0.7, above 0.7 to 0.8 and above 0.8 indicated a poor, fair, good and strong
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47 (or excellent) model, respectively [16]. The Cronbach alpha statistic and confirmatory factor analysis
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49 (CFA) were used to assess reliability and construct validity of the different items of the ASRS v1.1
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3 screener, respectively. For the CFA, we built a model with the first four factors loading on attention deficit
4 and the last two items on hyperactivity. The CFA model fit was assessed by using the following measures:
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6 comparative fit index (CFI) [17], chi-squared, normed chi-squared (the chi-square statistic divided by the
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8 degree of freedom) [18], and root-mean-squared error of approximation (RMSEA) [19]. $RMSEA < 0.08$,
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10 CFI values > 0.9 , and/or a normed chi-squared < 3 were considered to indicate good fit. The threshold of
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12 statistical significance was set at a two-tailed p-value of 0.05.
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18 **Patient and Public Involvement:** Patients and/or the public were not directly involved in this study.
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20 21 **Results**

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24 In total, 498 students responded to our questionnaire, seven of who did not consent to participate.
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26 Therefore, 491 participants were considered for the final analysis.
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29 **Sociodemographic characteristics of the study participants**

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32 As depicted in **Table 1**, the ages of the participants ranged from 18 – 32 years with a median age of 25.0
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34 (interquartile range [IQR] = 21 – 25) years, 56.4% of whom were females. Over 75% of our participants
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36 were students from the Universities of Yaoundé 1 (30.3%), Bamenda (27.7%) and Buea (19.3%). Majority
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38 of the participants were fifth year (IQR = 4.0 – 7.0) medical students, with three (IQR = 2.0 – 4.0) social
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40 media accounts and spent four hours (IQR = 2.0 – 4.0) on social media per day. We also noted that most
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42 participants used more than one social media account. Facebook (80.7%), Instagram (44.8%) and
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44 Snapchat (18.7%) were commonly used social media accounts in conjunction to WhatsApp.
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48 **Past history of the study participants**

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52 The commonest past histories were histories of anxiety disorder (31.2%), snoring in sleep (37.5%) and
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severe depression (12.0%). Family history of ADHD (2.9%), personal history of ADHD (1.2%) and history of learning disability (0.6%). About 7.5% of the participants were users of recreational drugs, with tramadol (51.4%) being the most common, Table 1.

Prevalence of symptoms of ADHD

In total, 120 students reported symptoms consistent with ADHD, giving a prevalence of 24.4% (95% CI = 20.6 – 28.3) with a female predominance (55.8%), Table 1.

Factors associated with symptom of ADHD

After adjusting for age, gender and institution, on multivariable logistic regression analysis, histories of chronic diseases (adjusted OR [AOR] = 2.96; 95% CI = 1.49 – 5.86); $p = 0.002$), severe depression (AOR = 3.49; 95% CI = 1.82 – 6.77; $p < 0.001$), anxiety disorder (AOR = 2.06; 1.25 – 3.36; $p = 0.004$), and family history of ADHD (AOR = 3.38; 95% CI = 1.04 – 10.44; $p = 0.035$), were independently associated with symptoms of ADHD, Table 2. There was no significant interaction between anxiety and depression ($P_{\text{interaction}} = 0.846$).

The final multivariable model predicted ADHD with good accuracy (C-statistics = 70.3%). The reliability of the 6-item Adult ADHD Self-Report Scale (ASRS) v1.1 Screener was 0.72 (95% CI, 0.67 – 0.76) indicating an acceptable reliability.

Construct validity of the 6-item ASRS v1.1 Screener

The two-factor model suggest a good-fit for the data with CFI = 0.996, normed $\chi^2(1) = 1.67$, and RMSEA = 0.052. Figure 1 shows good factor loadings ($r > 0.60$).

Discussion

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3 This study adds to the limited evidence of ADHD in sub-Saharan Africa with a focus on medical students
4 [20]. The prevalence of self-reported ADHD symptoms of 24.4% in our study is similar to the 23.7%
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6 among medical students in sub-Sahara African [20] and elsewhere [21, 22]. However, our prevalence was
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8 higher than the prevalence of 8.7% reported by Shi *et al* in China [10] and other populations [1, 23]. This
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10 disparity is most likely due to the difference in methodological approach used in our study and that of the
11
12 Chinese authors. In addition to evaluating the symptoms of ADHD in adulthood, they also evaluated
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14 childhood symptoms of ADHD. Only participants with symptoms consistent with ADHD in both their
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16 child- and adulthood were considered to have ADHD. The effect of recall bias is higher in the study by
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18 Shi *et al* as the participants were required to remember experiencing symptoms of ADHD in both the
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20 child- and adulthood. Socioeconomic and cultural differences could also contribute to the observed
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22 heterogeneity in the prevalence of adult ADHD. In addition, we used the ASRS which has been shown to
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24 have a high sensitivity albeit its low specificity [24]. Further clinical investigation could have reduced the
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26 prevalence of ADHD in our study. In our study, we found that just 1.2% of our study population had a
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28 previous diagnosis of ADHD which suggests a very low diagnostic rate in our setting. ADHD is associated
29
30 with poor long-term outcomes in most aspect of life [11]. While we caution on over-interpreting the
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32 prevalence of this study because participants were sampled using a non-probabilistic method, further
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34 research to ascertain the burden of ADHD among medical students in Cameroon should be considered a
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36 priority. The ASRS v1.1 showed acceptable reliability and good validity in screening for ADHD among
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38 Cameroonian students.
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48 Severe depression, anxiety disorder and chronic disease were associated with significantly higher odds of
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50 symptoms of ADHD in our study population. This is consistent with the report of Almeida Montes *et al*
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52 [23], suggesting a strong correlation between symptoms of ADHD and depression [25]. Psychiatric
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54 disorders are emerging global health concerns especially among medical students in Sub-Saharan Africa.
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3 Van Der Walt and collaborators highlighted a rising trend from 2018 to 2020 in the prevalence of
4 depression and anxiety, 21.2% to 25% and 18.65 to 20.5% respectively, among medical students in South
5 Africa [26]. In Ethiopia, depression and anxiety was found to be prevalent in 51.3% and 30.1%,
6 respectively, among the medical students in a medical college in Addis Ababa [27]. Njim et al also
7 recorded a prevalence of major depressive symptom 23.0% among medical students in Cameroon. These
8 increasing trends in depression and anxiety among medical students, which are closely related to ADHD,
9 could imply increasing prevalence of ADHD in this population. Long-standing ADHD, especially among
10 medical students with a very demanding program, would lead to poor school and consequently poor career
11 performances if not identified and managed early. It is important highlight to that depression and anxiety
12 could be consequences of ADHD, but the temporality of this relationship can only be confirmed through
13 a prospective cohort study design.
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29 In addition, chronic diseases is strongly associated with ADHD in both pediatric and adult ADHD [28,
30 29]. Many diseases have been incriminated with complex mechanisms of association. For example,
31 obesity and obesity-related conditions could produce ADHD-like symptom. However, the most
32 incriminated mechanism is the association between ADHD and somatic diseases is the dopaminergic
33 system. The co-existence of ADHD and chronic disease will lead to a clinical diagnostic and management
34 dilemma as a chronic disease can depict ADHD-like symptoms.
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44 We found no association between gender and ADHD. This is consistent with the findings of Montes et al
45 reported that boys are more affected than girls in ADHD in childhood, but these disparities disappear with
46 age [30].
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51 **Conclusion**

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3 This study reveals that about one in four medical students in Cameroon experience symptoms of ADHD.
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5 Histories of severe depression, anxiety and chronic diseases are most commonly associated with ADHD
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7 in the population. There is a need to conduct a large-scale prospective cohort study with interviews to
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9 estimate the true prevalence and/or incidence of ADHD among medical students in Cameroon, and assess
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11 a possible causal relationship between ADHD and depression and anxiety.
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14 15 **List of abbreviations**

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18 **ADHD:** Adult Deficit/Hyperactivity Disorder; **LMICs:** Low- and middle-income countries; **AOR:**
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20 Adjusted Odd's ratio; **IQR:** Interquartile range; **FHS:** Faculty of Health Sciences; **FMBS:** Faculty of
21
22 Medicine and Biomedical Sciences; **FMPS:** Faculty of Medicine and Pharmaceutical Sciences; **ISSM:**
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24 Institut Supérieure des Technologies Médicale; **ISSM:** Institut Supérieure des Sciences Médicale.
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28 29 **Declarations**

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31 **Acknowledgement:** The authors will like to acknowledge the medical students who participated in this
32
33 study and contributed to its realization.
34

35 **Funding:** None
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37
38 **Availability of data and materials:** The datasets for this study are available from the corresponding
39
40 author on reasonable request.
41

42 **Authors' contribution:** Conception of study: VNA. Data collection: KFN, LPS, LLN, ANF, CP, VNA.
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44 Data curation and analysis: VNA. Interpretation of results: KFN, NB, VNA; First draft of manuscript:
45
46 KFN, VNA. Manuscript revisions: KFN, LPS, LLN, ANF, CP, FLT, NB, VNA. Critical revision of the
47
48 manuscript: NB, FLT, VNA. All authors read and approved the final version of the manuscript.
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50 **Conflict of interest:** The authors declare no competing interests.
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References

1. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: a systematic review and metaregression analysis. *Am J Psychiatry*. 2007;164:942–8.
2. DSM: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision: DSM-IV-TR Quick Reference to the Diagnostic Criteria from DSM-IV-TR. *JAMA*. 2001;285:811–2.
3. Wamulugwa J, Kakooza A, Kitaka SB, Nalugya J, Kaddumukasa M, Moore S, et al. Prevalence and associated factors of attention deficit hyperactivity disorder (ADHD) among Ugandan children; a cross-sectional study. *Child Adolesc Psychiatry Ment Health*. 2017;11:18.
4. Fayyad J, De Graaf R, Kessler R, Alonso J, Angermeyer M, Demyttenaere K, et al. Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *Br J Psychiatry*. 2007;190:402–9.
5. McGough JJ, Barkley RA. Diagnostic Controversies in Adult Attention Deficit Hyperactivity Disorder. *Am J Psychiatry*. 2004;161:1948–56.
6. Bakare M. Attention deficit hyperactivity symptoms and disorder (ADHD) among African children: a review of epidemiology and co-morbidities. *Afr J Psychiatry*. 2012;15. doi:10.4314/ajpsy.v15i5.45.
7. Umar MU, Obindo JT, Omigbodun OO. Prevalence and Correlates of ADHD Among Adolescent Students in Nigeria. *J Atten Disord*. 2018;22:116–26.
8. Gentile JP, Atiq R, Gillig PM. Adult ADHD: Diagnosis, Differential Diagnosis, and Medication Management. *Psychiatry Edgmont*. 3:25.
9. Schoeman R, Klerk M de. Adult attention-deficit hyperactivity disorder: A database analysis of South African private health insurance. *South Afr J Psychiatry*. 2017;23:6.
10. Shi M, Liu L, Sun X, Wang L. Associations between symptoms of attention-deficit/ hyperactivity disorder and life satisfaction in medical students: the mediating effect of resilience. *BMC Med Educ*. 2018;18. doi:10.1186/s12909-018-1261-8.
11. Shaw M, Hodgkins P, Caci H, Young S, Kahle J, Woods AG, et al. A systematic review and analysis of long-term outcomes in attention deficit hyperactivity disorder: effects of treatment and non-treatment. *BMC Med*. 2012;10:99.
12. Erskine HE, Norman RE, Ferrari AJ, Chan GCK, Copeland WE, Whiteford HA, et al. Long-Term Outcomes of Attention-Deficit/Hyperactivity Disorder and Conduct Disorder: A Systematic Review and Meta-Analysis. *J Am Acad Child Adolesc Psychiatry*. 2016;55:841–50.
13. Kessler RC, Adler L, Ames M, Demler O, Faraone S, Hiripi E, et al. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. *Psychol Med*. 2005;35:245–56.

14. National Comorbidity Survey. <https://www.hcp.med.harvard.edu/ncs/asrs.php>. Accessed 10 Oct 2018.
15. Key Changes with the General Data Protection Regulation – EUGDPR. <https://eugdpr.org/the-regulation/>. Accessed 10 Oct 2018.
16. Stephanie. C-Statistic: Definition, Examples, Weighting and Significance. Statistics How To. 2016. <https://www.statisticshowto.datasciencecentral.com/c-statistic/>. Accessed 29 Jul 2019.
17. Butler PM. Comparative Fit Indexes in Structural Models. *Psychological bulletin*. 1990. doi:10.1037/0033-2909.107.2.238.
18. Structural Equations with Latent Variables | Wiley. Wiley.com. <https://www.wiley.com/en-gb/Structural+Equations+with+Latent+Variables-p-9780471011712>. Accessed 19 Mar 2020.
19. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Model Multidiscip J*. 1999;6:1–55.
20. Atwoli L, Owiti P, Manguro G, Ndambuki D. Attention deficit hyperactivity disorder symptom self-report among medical students in Eldoret, Kenya. *Afr J Psychiatry*. 2011;14. doi:10.4314/ajpsy.v14i4.5.
21. Gadow KD, Nolan EE, Litcher L, Carlson GA, Panina N, Golovakha E, et al. Comparison of Attention-Deficit/Hyperactivity Disorder Symptom Subtypes in Ukrainian Schoolchildren. *J Am Acad Child Adolesc Psychiatry*. 2000;39:1520–7.
22. Guardiola A, Fuchs FD, Rotta NT. Prevalence of attention-deficit hyperactivity disorders in students. Comparison between DSM-IV and neuropsychological criteria. *Arq Neuropsiquiatr*. 2000;58:401–7.
23. Almeida Montes LG, Hernández García AO, Ricardo-Garcell J. ADHD Prevalence in Adult Outpatients With Nonpsychotic Psychiatric Illnesses. *J Atten Disord*. 2007;11:150–6.
24. Mattos P, Nazar BP, Tannock R, Mattos P, Nazar BP, Tannock R. By the book: ADHD prevalence in medical students varies with analogous methods of addressing DSM items. *Rev Bras Psiquiatr*. 2018;40:382–7.
25. Humphreys KL, Katz SJ, Lee SS, Hammen CL, Brennan PA, Najman JM. The association of ADHD and depression: Mediation by peer problems and parent-child difficulties in two complementary samples. *J Abnorm Psychol*. 2013;122:854.
26. Walt S van der, Mabaso WS, Davids EL, Vries PJ de. The burden of depression and anxiety among medical students in South Africa: A cross-sectional survey at the University of Cape Town. *S Afr Med J*. 2019;110:69-76–76.
27. Kebede MA, Anbessie B, Ayano G. Prevalence and predictors of depression and anxiety among medical students in Addis Ababa, Ethiopia. *Int J Ment Health Syst*. 2019;13:30.
28. Instanes JT, Klungsoyr K, Halmøy A, Fasmer OB, Haavik J. Adult ADHD and Comorbid Somatic Disease: A Systematic Literature Review. *J Atten Disord*. 2018;22:203.

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2
3 29. Hegvik T-A, Instanes JT, Haavik J, Klungsøyr K, Engeland A. Associations between attention-
4 deficit/hyperactivity disorder and autoimmune diseases are modified by sex: a population-based cross-
5 sectional study. *Eur Child Adolesc Psychiatry*. 2018;27:663.
6
7
8 30. Das D, Cherbuin N, Butterworth P, Anstey KJ, Eastal S. A Population-Based Study of Attention
9 Deficit/Hyperactivity Disorder Symptoms and Associated Impairment in Middle-Aged Adults. *PLOS*
10 *ONE*. 2012;7:e31500.
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18 **List of Tables**

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21 **Table 1:** General characteristics of the study population
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23 **Table 2:** Factors associated with symptoms of ADHD among medical students on univariate and
24 multivariable analysis
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Table 1. General characteristics of the study population

Variables	Frequency	Proportion (%)
Sociodemographic characteristics		
Age in years, Mean (SD)		23.4 (2.6)
Gender		
Male	214	43.6
Female	277	56.4
Institution		
University of Yaoundé 1	149	30.3
University of Buea	95	19.3
University of Douala	26	5.3
University of Bamenda	136	27.7
ISTM Yaoundé	33	6.7
ISSM Baganté	31	6.3
Catholic University, Kumbo	21	4.4
Academic Level, Median (IQR)		5.0 (4.0 – 7.0)
Number of social media accounts		3.0 (2.0 – 4.0)
Type of social media account*		
WhatsApp	491	100.0
Facebook	395	80.7
Google+	62	12.6
Telegram	35	7.1
Instagram	220	44.8
Snapchat	92	18.7
Twitter	91	18.5
Others	81	16.5
Time spent on social media per day, Median (IQR)		4.0 (3.0 – 6.0)
Past History		
Family history of ADHD		
Yes	14	2.9
No	477	97.1
Ever been diagnosed with ADHD?		
Yes	6	1.2
No	485	98.8
Ever been diagnosed with learning disability		
Yes	3	0.6
No	488	99.4
History of chronic disease		
Yes	46	9.4

No	445	90.6
History of head injury		
Yes	41	8.4
No	450	91.6
History of heart disease		
Yes	17	3.5
No	474	96.5
Ever been told you snore in your sleep?		
Yes	184	37.5
No	307	62.5
Recreational drug use		
Yes	37	7.5
No	454	92.5
Type of recreational drug use (n=37)		
Cannabis	7	18.9
Marijuana	7	18.9
Tramadol	19	51.4
Others	4	10.8
History of severe depression		
Yes	59	12.0
No	432	88.0
History of anxiety disorder		
Yes	153	31.2
No	338	68.8

*Majority of the participants have more than one social media account; IQR = Interquartile range; SD=Standard deviation; ADHD = Attention deficit hyperactivity disorder; ISTM= Institut Supérieure des Technologies Médicale; ISSM= Institut Supérieure des Sciences Médicale; n = relative frequency

Table 2: Factors associated with symptoms of ADHD among medical students on univariate and multivariable analysis

Variables	OR	95% CI	p value	Adjusted OR	95%CI	p value
Age (in years)&	1.06	0.98 – 1.15	0.131	1.01	0.92 – 1.10	0.855
Gender (Female/ Ref: Male)&	0.96	0.63 – 1.45	0.842	0.83	0.52 – 1.33	0.416
Institution& (Ref: University of Yaoundé 1)						
University of Bamenda	0.79	0.44 – 1.41	0.431	0.77	0.41 – 1.43	0.406
University of Buea	1.62	0.91 – 2.90	0.102	1.44	0.75 – 2.76	0.252
Others	1.42	0.81 – 2.51	0.220	0.44	0.32 – 1.39	0.165
Academic level (Clinical year/Ref: Pre-clinical year)	0.86	0.54 – 1.38	0.514			
Number of social media account&	1.10	0.96 – 1.27	0.160			
Number of hours spent on social media per day (Four or more/ Ref: Below four)	1.25	0.82 – 1.90	0.300			
Family history of ADHD (Yes/Ref: No)&	2.39	0.80 – 7.01	0.114	3.38	1.04 – 10.44	0.035*
History of chronic diseases (Yes/Ref: No)&	3.25	1.74 – 6.05	<0.001*	2.96	1.49 – 5.86	0.002*
History of head injury (Yes/ Ref: No)	1.31	0.62 – 2.60	0.453			
History of heart disease (Yes/Ref: No)	0.95	0.26 – 2.74	0.929			
Snores in sleep (Yes/Ref: No)	1.38	0.91 – 2.10	0.722			
Use of recreational drugs (Yes/Ref: No)	0.84	0.35 – 1.81	0.679			
History of severe depression (Yes)&	4.63	2.64 – 8.19	<0.001*	3.49	1.82 – 6.77	<0.001*
History of anxiety disorder (Yes)&	3.29	2.14 – 5.06	<0.001*	2.06	1.25 – 3.36	0.004*
OR = Odd's ratio; CI = Confidence interval; *significant p-value; &Included in the multivariable analysis C-statistics = 70.3%						

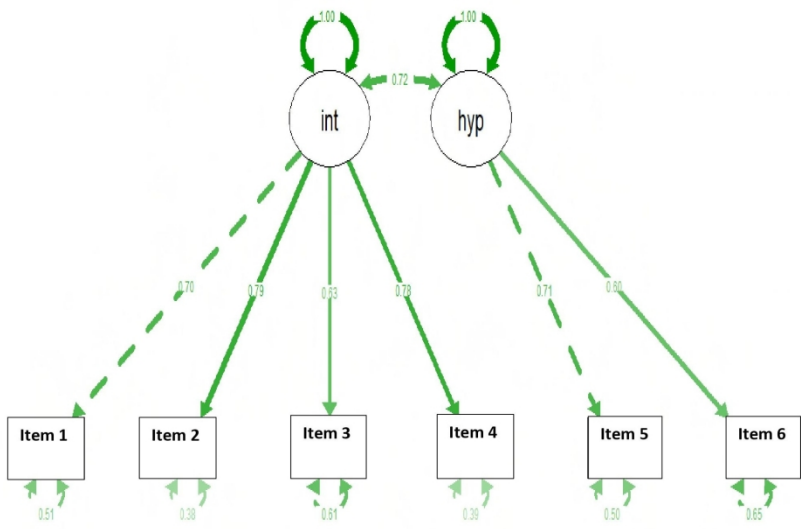


Figure 1: Confirmatory factor analysis for two-factor (Int = Attention deficit, hyp = hyperactivity)

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STROBE Statement—checklist of items that should be included in reports of observational studies

Item No	Recommendation
Title and abstract [Page 1-3]	1 (a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction	
Background/rationale [Page 4]	2 Explain the scientific background and rationale for the investigation being reported
Objectives [Page 4-5]	3 State specific objectives, including any prespecified hypotheses
Methods	
Study design [Page 5]	4 Present key elements of study design early in the paper
Setting [Page 5]	5 Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants [Page 5]	6 (a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables [Page 6-8]	7 Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement [Page 6-8]	8* For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias [Page 3]	9 Describe any efforts to address potential sources of bias
Study size [Page 6]	10 Explain how the study size was arrived at
Quantitative variables [Page 7-8]	11 Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods [Page 8]	12 (a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy

(e) Describe any sensitivity analyses

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60**Results**

Participants [Page 8-9]	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data [Page 8-9]	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data [Page 9]	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results [Page 8-9]	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(b) Report category boundaries when continuous variables were categorized
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses [NA]	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results [Page 10]	18	Summarise key results with reference to study objectives
Limitations [Page 3]	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation [Page 10]	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability [Page 3]	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding [Page 12]	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.