BMJ Open

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 mental disorder that 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, from 24 June to 2 September 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 Data from a total of 491 eligible participants were analysed. The median age was 25 (IQR 21–25) years and 54% were of the participants were female. The prevalence of self-reported symptoms of ADHD was 24.4% (95% CI 20.6% to 28.3%). Histories of chronic disease (adjusted OR (AOR) 2.96; 95% CI 1.49 to 5.86, p=0.002), family history of ADHD (AOR 3.38; 95% CI 1.04 to 10.44, p=0.035), severe depression (AOR=3.49; 95% CI 1.82 to 6.77, p<0.001) and anxiety disorder (AOR 2.06; 95% CI 1.25 to 3.36, p=0.004) were found to be independently associated with the symptoms of ADHD.

Conclusion ADHD may be a highly prevalent mental disorder among medical students, and is associated with severe depression, anxiety disorders and chronic diseases. There is a need to conduct a large-scale prospective cohort study with interviews to estimate the true prevalence and incidence of ADHD among medical students in Cameroon, and to determinant the risk factors associated with the disorder.

Strengths and limitations of this study

► With the use of a non-probabilistic sampling technique, we caution on generalising the prevalence of attention deficit hyperactivity disorder (ADHD) in this study to medical students in Cameroon.

► Efforts were made to minimise the effect of residual confounding by measuring and adjusting for known confounders.

► Reverse causality is an potential bias in the association reported in this study, and therefore, care must be taken not to infer causality based on these findings.

► The use of the updated adult ADHD Self-Report Scale for DSM [Diagnostic and Statistical Manual of Mental Disorders] V (ASRS 5) rather than the ASRS v1.1 would have improved the accuracy and reliability of our outcome measure.

► The findings herein are relevant for hypothesis generation, and add to the limited evidence of ADHD in Cameroon and sub-Saharan Africa, and Cameroon.

171 756 children and adolescents is 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] About 60%–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 disorganised, have chaotic lifestyles and associated psychiatric comorbidities, and may rely on drugs and alcohol to cope.[8] Possible complications of adult ADHD include poor productivity, poor

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

school performances, employment difficulties, inability to sustain relationships, substance abuse and increased motor vehicle accidents.[11 12]

The limited attention 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 evaluating the factors associated with ADHD in Cameroon. We sought to evaluate the factors associated with ADHD among medical students in Cameroon. This group is of particular interest as its study curriculum and career path require 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 the official languages. At the time of this study, Cameroon had 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 of the University of Yaoundé 1) and three French majority universities/schools (the Faculty of Medicine and Pharmaceutical Sciences 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 last for 7 years, we estimated that about 5600 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 specialisations 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 six-item 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 6 months. Each of the six items constitutes 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. Participants' 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 for 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 (10 English-speaking and 10 French-speaking students) to identify technical issues that could prevent participants from completing the questionnaire, such as issues with comprehension and translation, and to determine the average time required to complete the questionnaire. After this, we contacted a representative of each class from all the medical schools. Class representatives were only selected if they had a WhatsApp account (https://www.whatsapp.com/) and were part of the class WhatsApp group. Every class had a WhatsApp group. With the permission of the representatives, WhatsApp groups were created to facilitate communication between the investigators and class representatives. Class representatives were briefed on the study after which the link to the Google Form was shared with them. They were encouraged to respond to the questionnaire before disseminating to their respective WhatsApp class groups. Participants were encouraged to respond to the questionnaire just once. The class representatives reposted the link to the questionnaire on their respective class pages as a weekly reminder, for those who might have 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 4 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 categorised into preclinical years (levels 1–3) and clinical years (levels 4–7) before logistic regression analysis.

Ethical consideration

Data were protected according to the General Data Protection Regulation.[15] The text message bearing the link to the Google Form which was shared with 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 3 min. This information was also found on the first page of the Google Form and participants were given the option to either consent to participate (which will give them access to the questionnaire) or decline to participate (which will automatically submit a blank form).

Statistical analysis

Participants' responses from the online Google Form was exported to a 2016 Excel Spreadsheet for data cleaning and curation. The statistical software R was used for analysis. The mean or median were used to summarise quantitative variables where appropriate, while categorical variables were described using counts or percentages. Shapiro-Wilk's test, QQ-plots and histograms were used to assess for normality of continuous variables and outliers. Multivariable logistic regression analysis was used to identify factors independently associated with ADHD in our study population. The OR alongside its corresponding 95% CI was used to measure the degree of association between the outcome and independent variables. Only independent variables with a value of p <0.20 on univariable logistic analysis were included in the multivariable analysis. Variables that were eligible for the multivariable logistic regression analysis were sequentially added to the model starting with: sociodemographic factors (age, gender, institution, number of social media account and use of recreational drugs), family history of ADHD and past medical history (history of chronic disease, head injury, anxiety and severe depression). The contribution of each variable in explaining the total variance in the outcome on multivariable analysis was assessed using the maximum likelihood ratio (LR) test. The LR test was also used to evaluate a possible interaction between history of severe anxiety and depression. The variable 'number of social media accounts' was excluded from the final model as it did not significantly improve the model fit. The accuracy or predictive power of the final multivariable model was assessed using the C-statistics. A C-statistic of 0.5, above 0.5–0.7, above 0.7–0.8 and above 0.8 indicated a poor, fair, good and strong (or excellent) model, respectively.[16] The Cronbach's α statistic and confirmatory factor analysis (CFA) were used to assess reliability and construct validity, respectively, of the different items of the ASRS v1.1 screener. For the CFA, we built a model with the first four factors loading on attention deficit and the last two items on hyperactivity. The CFA model fit was assessed by using the following measures: Comparative Fit Index (CFI),[17] χ^2, normed χ^2 (the χ^2 statistic divided by the degree of freedom)[18] and root mean square error of approximation (RMSEA).[19] RMSEA <0.08, CFI values >0.9 and/or a normed χ^2<3 were considered to indicate good fit. The threshold of statistical significance was set at a two-tailed p value of 0.05.

Patient and Public Involvement

Patients and/or the public were not directly involved in this study.

RESULTS

In total, 498 students responded to our questionnaire; of these, seven did not consent to participate. Therefore, 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 years to 32 years with a median age of 25 (IQR 21–25) years, 56.4% of whom were female. Over 75% of our participants were students of the Universities of Yaoundé 1 (30.3%), Bamenda (27.7%) and Buea (19.3%). The 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 they spent 4 (IQR 2–4) hours on social media per day. 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 most common past histories were histories of anxiety disorder (31.2%), snoring in sleep (37.5%) and severe depression (12.0%), and 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% to 28.3%) with a female predominance (55.8%) (table 1).

Factors associated with symptoms 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 to 5.86, p=0.002), severe depression (AOR 3.49; 95% CI 1.82 to 6.77, p<0.001), anxiety disorder (AOR=2.06; 1.25 to 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

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
Continued		

Table 1 Continued		
Variables	Frequency	Proportion (%)
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.
ADHD, attention deficit/hyperactivity disorder; ISSM, Institut Supérieure des Sciences Médicale; ISTM, Institut Supérieure des Technologies Médicale.

significant interaction between anxiety and depression ($P_{interaction}$=0.846).

The final multivariable model predicted ADHD with good accuracy (C-statistics=70.3%). The reliability of the six-item adult ASRS v1.1 screener was 0.72 (95% CI 0.67 to 0.76) indicating an acceptable reliability.

Construct validity of the six-item ASRS v1.1 screener

The two-factor model suggests 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

This study adds to the limited evidence of ADHD in sub-Saharan Africa with a focus on medical students.[20] The prevalence of self-reported ADHD symptoms of 24.4% in this study was similar to 23.7% among medical students in sub-Sahara African[20] and elsewhere.[21,22] However, the prevalence in this study was higher than the prevalence of 8.7% reported by Shi et al in China[10] and other populations.[1,23] This disparity is most likely due to the difference

Table 2 Factors associated with symptoms of attention deficit/hyperactivity disorder (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 to 1.15	0.131	1.01	0.92 to 1.10	0.855
Gender (female/ref: male)*	0.96	0.63 to 1.45	0.842	0.83	0.52 to 1.33	0.416
Institution* (ref: University of Yaoundé 1)						
University of Bamenda	0.79	0.44 to 1.41	0.431	0.77	0.41 to 1.43	0.406
University of Buea	1.62	0.91 to 2.90	0.102	1.44	0.75 to 2.76	0.252
Others	1.42	0.81 to 2.51	0.220	0.44	0.32 to 1.39	0.165
Academic level (clinical year/ref: preclinical year)	0.86	0.54 to 1.38	0.514			
Number of social media accounts*	1.10	0.96 to 1.27	0.160			
Number of hours spent on social media per day (4 or more/ref: below 4)	1.25	0.82 to 1.90	0.300			
Family history of ADHD (yes/ref: no)*	2.39	0.80 to 7.01	0.114	3.38	1.04 to 10.44	0.035†
History of chronic diseases (yes/ref: no)*	3.25	1.74 to 6.05	<0.001*	2.96	1.49 to 5.86	0.002†
History of head injury (yes/ref: no)	1.31	0.62 to 2.60	0.453			
History of heart disease (yes/ref: no)	0.95	0.26 to 2.74	0.929			
Snores in sleep (yes/ref: no)	1.38	0.91 to 2.10	0.722			
Use of recreational drugs (yes/ref: no)	0.84	0.35 to 1.81	0.679			
History of severe depression (yes)*	4.63	2.64 to 8.19	<0.001*	3.49	1.82 to 6.77	<0.001†
History of anxiety disorder (yes)*	3.29	2.14 to 5.06	<0.001*	2.06	1.25 to 3.36	0.004†

*Included in the multivariable analysis C-statistics=70.3%
†Significant p value.

in the methodological approach used in our study and that of Shi *et al*. In addition to evaluating the symptoms of ADHD in adulthood, Shi *et al* evaluated childhood symptoms of ADHD. Only participants with symptoms consistent with ADHD in both their childhood and adulthood were considered to have ADHD. The effect of recall bias is greater in the study by Shi *et al* as the participants were required to remember experiencing symptoms of ADHD in both childhood and adulthood. Socioeconomic and cultural differences could also contribute to the observed

Figure 1 Confirmatory factor analysis for two factors. int, attention deficit; hyp, hyperactivity.

heterogeneity in the prevalence of adult ADHD. Furthermore, we used ASRS which has been shown to have high sensitivity despite its low specificity.[24] Further clinical investigation could have reduced the prevalence of ADHD in our study. Only 1.2% of our study participants had a previous diagnosis of ADHD, which suggests a very low diagnostic rate in this setting. ADHD is associated with poor long-term outcomes in most aspects of life.[11] While we caution on overinterpreting the prevalence of ADHD in this study because participants were sampled using a non-probabilistic method, further research to ascertain the burden of ADHD among medical students in Cameroon should be considered a priority. ASRS v1.1 showed acceptable reliability and good validity in screening for ADHD among Cameroonian students.

Severe depression, anxiety disorder and chronic disease were associated with significantly higher odds of symptoms of ADHD in our study population. This is consistent with the report by Almeida Montes *et al*,[23] suggesting a strong correlation between symptoms of ADHD and depression.[25] Psychiatric disorders are emerging global health concerns especially among medical students in sub-Saharan Africa. Van der Walt *et al* highlighted a rising trend in the prevalence of depression and anxiety, 21.2% to 25% and 18.65% to 20.5%, respectively, from 2018 to 2020 among medical students in South Africa.[26] In Ethiopia, depression and anxiety were found to be prevalent in
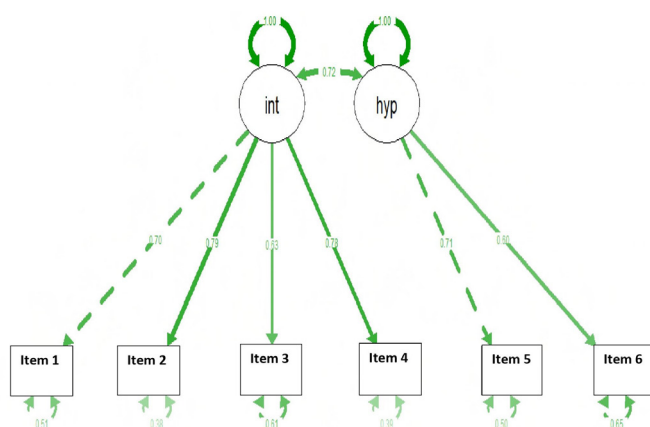
51.3% and 30.1% of the medical students, respectively, in a medical college in Addis Ababa.[27] Njim *et al* also recorded a prevalence of major depressive symptoms in 23.0% of medical students in Cameroon.[28] These increasing trends in depression and anxiety among medical students, could imply increasing prevalence of ADHD in this population. Long-standing ADHD, especially among medical students with a very demanding programme, would lead to poor school and consequently poor career performances if not identified and managed early. It is important to highlight that depression and anxiety could be consequences of ADHD, but the temporality of this relationship can only be confirmed through a prospective cohort study design.

In addition, chronic diseases are strongly associated with both paediatric and adult ADHD.[29 30] Many diseases have been incriminated with complex mechanisms of association. Disruptions in the dopaminergic pathway is most commonly involved in the development of ADHD in somatic diseases. The coexistence of ADHD and chronic disease poses a dilemma in the clinical diagnosis and management of ADHD as chronic disease can manifest with ADHD-like symptoms.

We found no association between gender and ADHD. This is consistent with the findings of Montes *et al* who reported that boys are more affected than girls in ADHD in childhood, but these disparities disappear with age.[31]

CONCLUSION

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

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