

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

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ABSTRACT

Background: Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by symptoms of inattention and/or hyperactivity-impulsivity. Previous studies had reported a significantly higher lifetime risk for psychoactive substance use disorders in the ADHD adults than the non-ADHD adults. The current study aimed to examine the correlation between ADHD symptoms and substance use among engineering college students. **Methodology:** This cross-sectional survey included a sample of undergraduate engineering students (N=711). The college students were screened using the *Alcohol, Smoking and substance Involvement Screening Test (ASSIST) version 3.0*. The ADHD symptoms such as inattention and hyperactivity were assessed by the *Adult ADHD self-report scale, Symptom Checklist (ASRS-v1.1)* and impulsivity by the *Barratt Impulsiveness Scale (BIS-11)*. **Results:** The symptoms of ADHD were found to be higher in students with substance use. The pattern of substance use in the study sample: tobacco (12.8%), alcohol (19.3%), marijuana (3.1%), sedatives (2.0%), cocaine (1.3%), opioid (0.7%), amphetamine (0.6%), inhalant (0.6%) and hallucinogens (0.4%). **Conclusion:** With the bidirectional data on ADHD and substance use disorder (SUD), the present study shows a significant relationship between the symptoms of ADHD and substance use in students.

Keywords: ADHD, Substance Use Disorders, Adolescents, College Students

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by symptoms of inattention and/or hyperactivity-impulsivity.¹ ADHD persists into adulthood in 40 to 60% of children with ADHD.² It affects between 6 to 9% of children and adolescents, and up to 5% of adults worldwide.³ Studies have shown that between 2 to 8% of college students have ADHD.

The National Survey on Drug Use and Health (NSDUH) studied young adults between the ages of 21 and 25 years. Their past-month's use and lifetime use of alcohol was found to be 68% and 90% respectively. The past-month use and lifetime use of illicit drugs was found to

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Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

be 19% and 61% respectively.⁴ Thus experimentation with substances during emerging adulthood is normative.⁵ However, high risk drinking among adolescents is associated with declined academic performance, high risk sexual behaviour, work absenteeism, physical injuries, mood disturbances and suicidal ideation.⁶

A meta-analysis of 13 studies on ADHD youths growing up, showed that a significant increase in Substance Use Disorders (SUD) was associated with ADHD.⁷ There was a significantly higher lifetime risk for psychoactive SUD in the ADHD adults than the non-ADHD adults (52% versus 27%, $P \leq 0.01$).⁸ The prevalence for possible ADHD in studies of adults with SUD was 23.1%.⁹ Studies have shown that drug users score higher on self-report personality measures of impulsivity.¹⁰

A meta-analysis showed that stimulants used to treat ADHD had protective effects on substance use disorders in the follow up despite the abuse potential of psychostimulants.¹¹ Majority of adolescents with ADHD used alcohol without knowing the negative impact of alcohol on ADHD symptoms and medications. There were misconceptions that Cannabis would make the ADHD symptoms better or helps with the side effects of medications.¹² These issues highlight the importance of effectively screening persons with ADHD for SUD, and screening for ADHD symptoms in SUD patients may improve the outcomes in these patients.

The current study attempted to show the relation of symptoms of ADHD and substance use in a sample of undergraduate Engineering students. Identifying ADHD symptoms and early management of individuals with high risk for substance use disorders, facilitates prevention of the negative outcomes of SUD in individuals with ADHD. Hence, the overlap between the two disorders is relevant to research as well as clinical practice.

Aim and objectives

The Aim is to study the relation of ADHD symptoms and substance use among undergraduate engineering college students. The objectives are to screen symptoms of ADHD, impulsivity, use of psychoactive substances in undergraduate students and to evaluate the relationship between ADHD symptoms and substance use.

METHODOLOGY

Study Design and Setting

This study is a 'Questionnaire based' cross-sectional survey. The sample was collected from a cluster of engineering colleges in the suburbs of Hyderabad, India. Consecutive sampling technique was used. The study period was 6 months. A total of 711 students were included in the study, after excluding 24 students who refused to participate. The study was approved by the institutional ethics committee.

Inclusion and Exclusion Criteria

Students, who were willing to give written informed consent from ages 17-25 years of both genders were included. Students who were previously diagnosed with any major psychiatric illness or any serious neurological illness were excluded.

Assessment Tools

A semi-structured questionnaire was administered to collect all the relevant clinical details.

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

Adult ADHD Self-Report Scale Symptom Checklist (ASRS-v1.1), 2005,¹³ was developed by World Health Organization (WHO). The Symptom Checklist is an instrument consisting of the eighteen DSM-IV-TR criteria. Part A has 6 questions and part B has 12 questions. Six questions of Part A were found to be the most predictive of symptoms consistent with ADHD. It's first 4 questions have the inattention components of ADHD, and it's final 2 has the hyperactivity components. The items are scored 0 (never), 1 (rarely), 2 (sometimes), 3 (often) and 4 (very often). If 4 or more of the 6 items are positively endorsed in part A, the ASRS scores positive. The ASRS is found to be a useful tool to identify individuals with a potential diagnosis of adult ADHD entering SUD treatment.

The Barratt Impulsiveness Scale (BIS-11), 1995,^{14,15} consists of 30 items. It assesses the constructs such as attentional, motor and non-planning impulsiveness. It is a self-reporting scale. Scoring is rated on a Likert scale from 1 to 4, comprising of rarely/never, occasionally, often, almost always/always. The items with reverse scores are 1, 7, 8, 9, 10, 12, 13, 15, 20, 29, 30. The score ranges from 30 to 120. The higher scores indicate greater impulsiveness. A total score of 72 or above was considered as highly impulsive.

The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), 1997, version 3.0,^{16,17} is a physician administered scale developed by the World Health Organization. The instrument was designed to screen for problematic or risky use of tobacco, alcohol, cannabis, cocaine, amphetamine-type stimulants, sedatives, hallucinogens, inhalants, opioids and 'other drugs'. There are 8 questions. A risk score is obtained for each substance.

Procedure

The purpose and nature of the study was explained to all the participants. Complete confidentiality and anonymity was assured to the participants. Informed consent was taken from the participants. The *ASSIST* scale was administered after the students had completed the ADHD self-report scales.

Statistical Analysis

Data was statistically evaluated with IBM SPSS (Statistics for Windows, Version 22.0., IBM Corp., Chicago, IL). Descriptive statistics were reported as Mean and Standard Deviation for continuous variables and frequencies for categorical variables. Chi-Square test is used to find the level of significance. A p value of < 0.05 was considered as statistically significant.

RESULTS

A total of 711 students were included, after excluding the 24 students who refused to participate. The Mean age of students (N=711) was 18.95, Median (19.00) and Standard Deviation (1.045). The minimum and maximum ages included were 17 and 23 respectively with a range of 6. The total number of male and female included in the study were 478 (67.23%) and 233 (32.77%) respectively.

Substance Use

The gender distribution of substance use includes, 136 out of 478 male students (28.5%) and 13 out of 233 female students (5.6%). The following are the percentages of substances, used by the college students screened using *ASSIST*; tobacco (12.8%), alcohol (19.3%), marijuana (3.1%), sedatives (2.0%), cocaine (1.3%), opioid (0.7%) amphetamine (0.6%), inhalant

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

(0.6%), and hallucinogens (0.4%). The total number of students who used substances were 149 out of 711 students (21%).

Risk of Substance Use

The low, moderate and high risk for individual substances were recorded according to ASSIST (table1).

Table 1: Risk Category of Substances Used by the Students

| Substances used | No. of students (N) | Low risk | Moderate risk | High risk |
|-----------------|---------------------|-------------|---------------|-------------|
| Tobacco | 9 | 15 (16.48%) | 70 (76.92%) | 6 (6.6%) |
| Alcohol | 137 | 77 (56.20%) | 46 (33.58%) | 14 (10.22%) |
| Marihuana | 22 | 7 (31.80%) | 13 (59.1%) | 2 (9.1%) |
| Cocaine | 9 | 3 (33.33%) | 6 (66.67%) | 0 (0) |
| Amphetamines | 4 | 0 (0) | 3 (75%) | 1 (25%) |
| Inhalants | 4 | 2 (50%) | 2 (50%) | 0 (0) |
| Sedatives | 14 | 7 (50%) | 7 (50%) | 0 (0) |
| Hallucinogens | 3 | 0 (0) | 1 (33.33%) | 2 (66.67%) |
| Opioids | 5 | 1 (20%) | 3 (60%) | 1 (20%) |

Impulsivity

The BIS Mean scores were 67.38, Median (67) and Standard Deviation (9.291). The minimum and maximum scored were 42 and 98 respectively, with a range of 56. A total of 213 students (29.96%) scored ≥ 72 in the BIS-11 scale indicating higher impulsivity.

Impulsivity and Substance Use

An independent-samples t-test was conducted, to compare BIS scores in subjects with substance use, and those without substance use. There was a significant difference in the scores of BIS in substance use group (M=69.77, SD=9.54) and non-substance use group (M=66.75, SD=9.12) conditions; $t(224.9) = 3.45, p=0.001$. The total number of students who used substances, and scored ≥ 72 in BIS-11 was 58 (27.2%), versus 91 students (18.3%) who used substances and scored <72 in BIS-11. There was a statistically significant difference between the two groups ($\chi^2 = 7.226, p=0.007$) (Figure 1).

BIS score versus ASSIST scores: A Pearson correlation coefficient was computed, to assess the relationship between the BIS score and ASSIST scores for different substances. There was a positive correlation between the two variables [$r = 0.4, n = 23, p = 0.029$] for Marijuana. There was no correlation between these 2 variables for the rest of the substances.

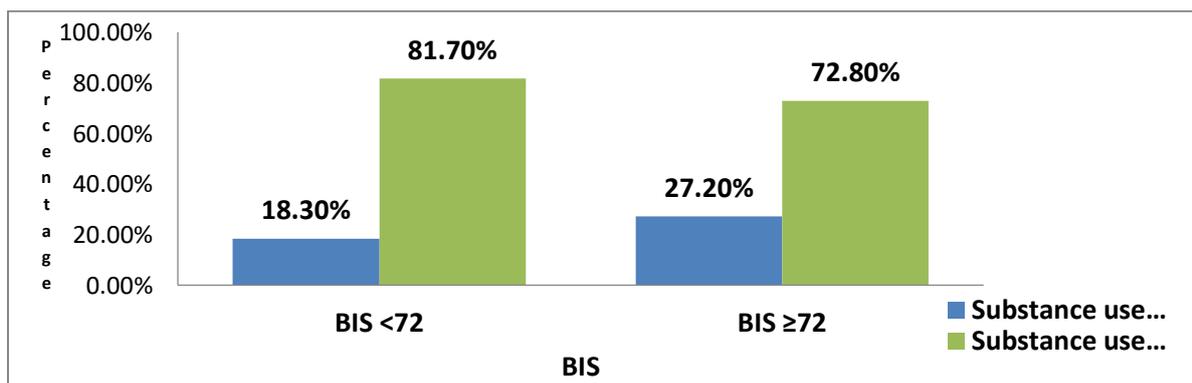


Figure 1: Range of Impulsivity and Substance Use

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

Symptoms of ADHD

About 38 students (5.3%) had scored ≥ 4 in ASRS part A. The total number of students who scored high in ASRS-A and ASRS-B were 29 (4.07%).

A Pearson correlation coefficient was computed to assess the relationship between the ASRS-A and ASRS-B scores. There was a positive correlation between the two variables [$r = 0.55$, $n = 711$, $p = 0.001$].

An independent-samples t-test was conducted to compare ASRS-A scores in subjects with substance use and those without substance use. There was a significant difference in the scores for ASRS-A in substance use group ($M=2.37$, $SD=1.54$), and non-substance use group ($M=1.75$, $SD=1.48$) conditions; $t(225.5) = 4.39$, $p=0.001$. The number of students who used substances and scored ≥ 4 in ASRS-A was 16 (42.1%) versus 133 students (19.8%) used substances and scored < 4 . There were statistically significant differences among the two groups ($\chi^2 = 10.84$, $p=0.001$) (Figure 2).

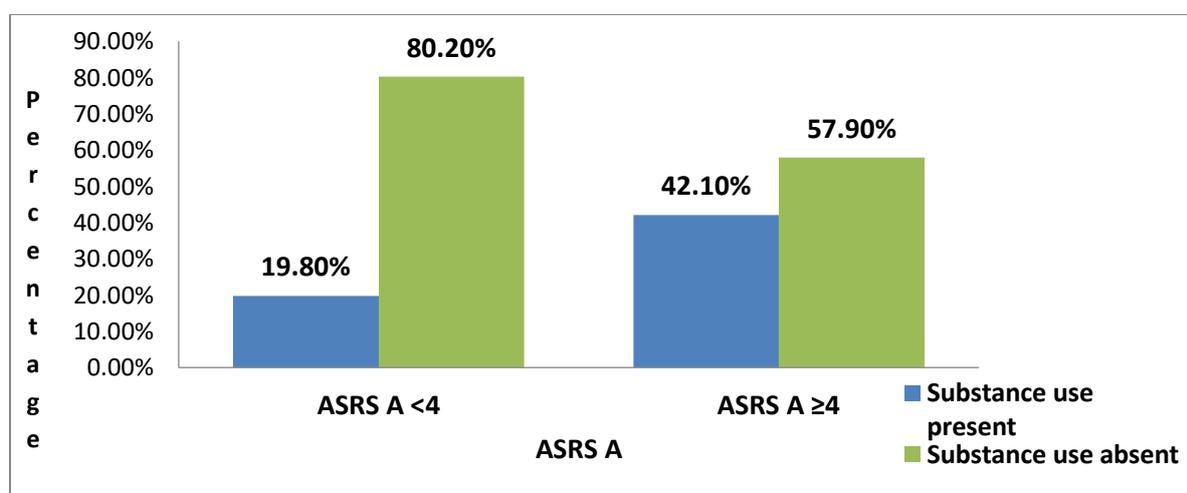


Figure 2: Symptoms of Inattention and Hyperactivity and Substance Use

The Relation of Symptoms of ADHD to BIS

ASRS-A versus BIS scores: A Pearson correlation coefficient was computed to assess the relationship between the ASRS-A and BIS scores. There was a positive correlation between the two variables [$r = 0.216$, $n = 711$, $p = 0.001$]. About 20 students (2.8%) had scored high in ASRS-A ≥ 4 and BIS ≥ 72 . Table 2 consolidated findings of ASRS-A, BIS-11 and ASSIST. All drugs except sedatives, opioids, amphetamines and marihuana, have statistically significant relationship with high scores of ASRS and BIS in students with substance use.

Table 2: Consolidated Findings of SUD, ASRS and BIS scales

| | BIS mean \pm SD | ASRS part A ≥ 4 (n=38) | Chi-square | p value |
|------------------------|-------------------|-----------------------------|------------|---------|
| Tobacco (n=91) | | | | |
| Yes | 71.14 \pm 9.46 | 27 (71.1%) | 9.38 | 0.002** |
| No | 66.83 \pm 9.14 | 11(28.9%) | | |
| Alcohol (n=137) | | | | |
| Yes | 69.98 \pm 9.74 | 22 (57.9%) | 13.45 | 0.001** |
| No | 66.76 \pm 9.07 | 16(42.1%) | | |

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

| | BIS mean±SD | ASRS part A ≥ 4 (n=38) | Chi-square | p value |
|----------------------------|--------------------|-----------------------------------|-------------------|--------------------|
| Marijuana (n=22) | | | | |
| Yes | 70.32±8.47 | 35(92.1%) | 3.08 | 0.07 ^{NS} |
| No | 67.29±9.30 | 3(7.9%) | | |
| Cocaine (n=9) | | | | |
| Yes | 72.22±7.41 | 36(94.7%) | 5.13 | 0.02* |
| No | 67.32±9.30 | 2(5.3%) | | |
| Amphetamines(n=4) | | | | |
| Yes | 74.75±8.26 | 37(97.4%) | 3.07 | 0.08 ^{NS} |
| No | 67.34±9.28 | 1(2.6%) | | |
| Inhalants (n=4) | | | | |
| Yes | 73.25±8.01 | 36(94.7%) | 15.85 | 0.001** |
| No | 67.35±9.29 | 2(5.3%) | | |
| Sedatives (n=14) | | | | |
| Yes | 74.14±8.61 | 37(97.4%) | 0.09 | 0.76 ^{NS} |
| No | 67.25±9.25 | 1(2.6%) | | |
| Hallucinogens (n=3) | | | | |
| Yes | 76.67±4.04 | 37(97.4%) | 4.665 | 0.03* |
| No | 67.34±9.28 | 1(2.6%) | | |
| Opioids (n=5) | | | | |
| Yes | 69.20±6.87 | 38(100%) | 0.28 | 1.00 ^{NS} |
| No | 67.37±9.30 | 0 | | |

[(**is significant at 0.01) and (* is significant at 0.05) (NA is not significant)]

The cumulative frequency graph of substance use frequency and ages of students showed that alcohol, tobacco and sedatives were continued up to 23 years of age, although they had experimented all the drugs between the ages of 17 to 18 years (Figure 3).

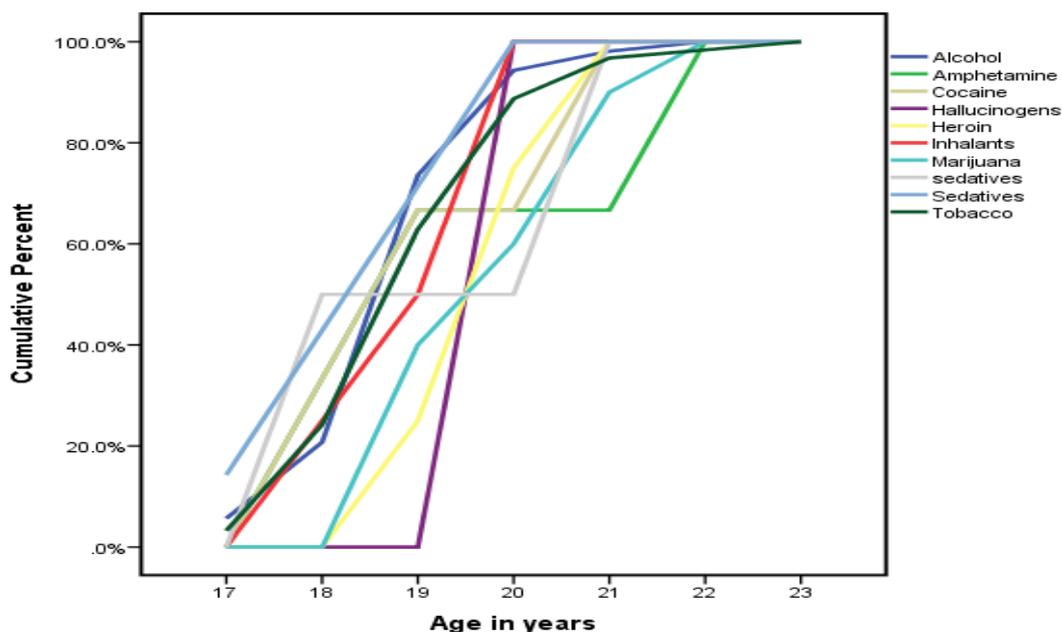


Figure 3: Cumulative frequency graph (n=149)

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

Family History and Substance Use

A total of 12 out of 30 students (40%) who used substances, reported substance use in siblings, compared to 25 out of 120 students (20.8%) who reported substance use in father. It was statistically significant. ($\chi^2=4.74$, $p=0.03$).

There was no significant relationship between family history of substance use and *ASRS-A* scores of students ($\chi^2 1.563$, $p=0.21$). There was no significant relationship between family history of substance use and *BIS* scores of students ($\chi^2 0.973$, $p=0.32$).

DISCUSSION

In the present study, the total number of students who used substances was 149 out of 711 (21%). The types of substances were alcohol (19.3%), tobacco (12.8%), marijuana (3.1%), sedatives (2.0%), cocaine (1.3%), opioids (0.7%) amphetamines (0.6%), inhalants (0.6%), and hallucinogens (0.4%). The National Household Survey of Drug Use in the country is the first to document the nation-wide prevalence of drug use. The Survey reported findings similar to the current study.¹⁸

Higher levels of SUD was also reported in a longitudinal analysis on 'Incidence' of drug use, in ages between 19 and 25 years, during the first 8 years of college life. The study reported the use of marijuana to be the commonest substance used (37.2%).¹⁹

The present study showed that, about 42.1 % of students had high scores in the *ASRS* scale among the group who used substances. The International ADHD in SUD Prevalence Study (*IASP* study) showed that 40.9% were screened positive using *ASRS* scale.¹³ The current study scores are slightly higher, than reported in the *IASP* study.

The positive measure in the current study would be less, if a confirmatory scale was used. A previous study had reported that 92 out of 1064 adults (8.6%) with SUD had scored ≥ 4 on *ASRS*. Later when *Adult ADHD Clinician Diagnostic scale (ACDS) version 1.2* was used, only 53 adults (5%) were diagnosed as having Adult ADHD.²⁰

In the present study, there was a positive correlation in the scores of *BIS-11* and *ASSIST* in marijuana users. Similar findings were reported in another study, where chronic marijuana users exhibited significantly higher total impulsivity scores on *BIS-11* ($p=0.1$), than non-users.²¹

High scores of impulsivities were found in students with substance use. It was hypothesised that impulsivity would relate to the use of substances. The current study shows statistically significant relationship between them. It is supported by studies, which show that the overall impulsivity scores of *BIS-11* and subscale scores of inattentions, motor hyperactivity and non-planning components, were independently predictive of hazardous substance use, especially the drinking pattern.^{22,23} Another study showed no significant relationship between binge drinking and impulsivity, compared to non-binge drinkers. However, the number of drinks consumed was positively correlated with the *BIS* total score ($p < 0.01$).²⁴

A majority of students reported that they had difficulty in organising and finishing the tasks. They had difficulty sitting in a place for longer periods of time.

Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

The relationship between family history and substance use were conventional. A previous study showed that there is a strong association between family history measures and psychoactive substance use and problems in a large sample of college students.²⁵ In the present study, there was a relationship between sibling's substance use history and substance use in college students, compared to the father's history of substance use. A community-based sample of 244 same sex sibling pairs, showed that modelling via older siblings normalizes the use of substance use in younger siblings, or possibly provides access to substance use.²⁶

The strengths of this study include larger sample size. A variety of substances used by adolescent's/young adults were included. All the components of ADHD were included through the use of *ASRS v1.1* and *BIS-11*. There are not many previous studies that had used *ASRS v1.1*, *BIS-11* and *ASSIST* together. Substance use of both genders were reflected in the study. The study Promoted an awareness on substance use among the students and referral was advised for the students with drug use problems.

The limitations were, that the current study did not include students, who study in urban areas. A confirmation scale was not used following the ADHD screening scales. The interventions suggested after administering *ASSIST* scale could not be carried out, except for an advice of referral in cases of drug use.

Future Directions

A longitudinal randomised study may be pursued to understand the course of ADHD and SUD. Identifying ADHD symptoms and early management of individuals with high risk for SUD is important to prevent the negative outcomes.

CONCLUSIONS

1. Substance use was prevalent among 21 % of the student population.
2. About 42.1 % of the students with SUD were screened positive using the *ASRS v1.1*.
3. About 27.2 % of the students with SUD were screened positive using the *BIS-11*.

With the bidirectional data on ADHD and SUD, this study could identify the symptoms of ADHD in individuals who use substances.

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Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

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Relation of substance use to attention deficit hyperactivity disorder among undergraduate students: a cross-sectional survey

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Conflict of Interest

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