

Full Length Research Paper

The potential effect of depression on academic outcomes of students in higher educational institutions of northwest Ethiopia: A cross-sectional study

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The purpose of this study was to document potential effect of depression on academic outcomes. We collected a cross sectional data from 710 pre-engineering university students in northwestern part of Ethiopia using cluster sampling. Depressive symptoms were assessed using a locally validated version of Patient Health Questionnaire (PHQ-9) at a cut off 5-9 and 10 or more indicating mild and major depressive symptoms, respectively. The types of substances that students experienced in the last three months were assessed. Multivariable linear regression was carried out to examine whether depressive symptoms predicted academic outcomes (cumulative GPA and perceived difficulties in learning process). Higher PHQ-9 scores were reported by 71.4% (30% mild and 41.4% major levels): of the students. Increment in depression ($\beta=0.296$, 95% CI: 0.223, 0.370), anxiety score ($\beta=0.119$, 95% CI: 0.011, 0.227), substance use ($\beta=0.169$, 95% CI: 0.045, 0.293) and stressful life events ($\beta=0.306$, 95% CI: 0.080, 0.532) scores were positively correlated with perceived difficulties in learning. Each increment in self-efficacy score ($\beta=0.006$, 95% CI: 0.001, 0.012) was positively associated with semester GPA. However, PHQ-9 score did not independently associate with semester GPA ($\beta = -0.001$, 95% CI: -0.007, 0.00). Depressive symptoms were associated with perceived difficulties in learning. Future follow-up studies and intervention strategies are needed to demonstrate causality.

Key words: Depression, academic outcomes, substance use, universities students.

INTRODUCTION

Depression and substance use are the leading causes of disability and suicide worldwide (WHO, 2017). In the general population, depressive disorders alone accounted for two fifth of Disability Adjusted Life Years (DALYs) caused by mental and substance use disorders (Whiteford et al., 2013). In the general population, depression adversely affected functioning (Senturk,

2012), increased sufferings and reduced productivity (Fisher et al., 2012; Hartley et al., 2011). In Ethiopia, depressive disorders contribute 6.5% of the disease burden, which was even greater than disease burden contributed by either HIV, TB, or malaria (Abdulahi, 2001).

Among adolescent student population, one in every

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eight students were diagnosed with depression (Sajjadi et al., 2013) in spite low diagnosis and recognition of depression among higher educational institution students (Davis, 2005). Using screening tools, three or more students were screened positive in every ten students in Low and Middle Income Countries (LMICs) (Al-Busaidi et al., 2011; Othieno et al., 2014; Sidana et al., 2012). This relatively high prevalence of depressive symptoms in the student population may be due age related emotional turmoil linked to search for identity.

Depression during adolescence increased school dropouts (Boyras et al., 2016); reduced cognition such as sustained attention; verbal memory and planning (Wagner et al., 2014); reduced neuropsychological functioning (Wagner et al., 2014) and reduced sleep quality (Al-Khani et al., 2019); and increased negative emotions and behavioral disorders and reduced social satisfaction (Sadeghi Bahmani et al., 2018) in the adolescent population. However, substance use is a common risk factor for both depression and poor academic outcomes (Alsanosy et al., 2013; Cummings et al., 2014; Ingles et al., 2013) and previous studies did not control substance use to investigate the independent effect of depression on academic outcomes. Indeed, the prevalence of depression and its consequences on academic outcomes independently of substance use and anxiety is seldom examined in the context of higher educational institutions of northwest Ethiopia. Besides, there was high rate of attrition among freshman students in college of technology which motivated the authors to conduct the study.

To prioritize for future intervention to improve academic outcomes, studies on the association between depressive disorders and academic outcome controlling substance use behaviours need to be investigated. This study therefore, aims to investigate the association between depressive symptoms and academic outcomes controlling substance use behaviours of the students.

METHODOLOGY

Study design

Cross-sectional quantitative survey was employed to investigate the association between depression and academic outcomes.

Study area

The study was conducted in higher educational institutions of northwest Ethiopia where there are a total of six universities (DebreMarkos University, Bahir Dar University, Debre Tabor University, University of Gondar, Wollo University and DebreBerhan University) during the study period.

Population

Freshman students in College of Technology during 2016/2017 academic year were the target population. There were about

18,000 freshman students in College of Technology in the six universities during 2016/2017 academic year. The number of students in the Colleges of Technology was historically high because of the government intention to increase the number of technology graduates. Indeed, 70% of the freshman students were assigned to College of Technology and students were pressured to join the college since 2016. We purposively selected freshman students in College of Technology for the highest attrition rate among this group of students in all universities.

Sampling techniques and sample size

The target universities belonged to first, second and third generation as per the Ministry of Science and Higher Education labeling. First generation universities were constructed before 2000 and they were relatively old universities in Ethiopia. In our sample, Bahir Dar University belonged to first generation. DebreMarkos and DebreBerhan universities are labeled as second generation universities, while Debre Tabor University was labeled as third generation. We purposively selected one university from each of the three generations. Accordingly, DebreMarkos University (DMU), Bahir Dar University (BDU) and Debre Tabor University (DTU) were purposefully selected representing first, second and third generations, respectively. These target universities were purposively selected based on accessibility and availability of drugs in the university's local areas.

Sample size was estimated using single proportion formula assuming design effect of 1.5 and non-response rate of 10%. Accordingly, 710 participants were required. Finally, we used cluster sampling to select estimated number of participants where unit of clustering was sectioned. Each section contains an average of 50 students.

Assessment

Data about students' socio-demographic variables, academic performance, current depression status, anxiety, social support and experience of stressful life events and functioning were collected from first year pre-engineering students of selected universities in Amhara region in 2017.

The outcome variable of this study is academic performance of the students as measured both objectively (GPA) and subjectively (perceived difficulties in different areas of schoolwork). Students' objective academic performance was assessed using their semester cumulative grade point (Semester CGPA). To assess perceived difficulty in schoolwork, participants were asked whether they had difficulties in: paying attention to teaching, teamwork, getting along with peers, getting along with teachers, doing homework, preparing for examinations, finding personal learning strategies, doing activities requiring initiative, doing reading tasks and doing writing tasks. The response alternatives for each area of schoolwork was 0 = not at all, 1 = not so much, 2 = quite much, 3 = very much as it was the case in Finland study (Frojda et al., 2008).

The main exposure variable was depressive disorder which was assessed by using a locally validated version of PHQ-9. It has very good sensitivity and specificity to diagnose depression and its severity forms at different cut offs (Gelaye et al., 2013). In addition to socio-economic and demographic variables (sex, age, family income, and occupation), other variables such as substance use, anxiety, self-efficacy, experience of life threatening events were also assessed as potential confounders. Substance use was assessed by items asking how often (never, monthly, weekly, most of the time and daily) did the students use each of the substance in the list (alcohol, tobacco, khat, cannabis, shisa) in the last three months and in their life time.

Anxiety was assessed by a standardized measure of anxiety

Table 1. Characteristics of the parti

Characteristics		Count	%
Sex	Male	475	67.6
	Female	193	27.5
Residence	Urban	425	60.5
	Rural	267	38.0
Religion	Orthodox	615	87.5
	Muslim	30	4.3
	Protestant	35	5.0
	Others	9	1.3
Chronic illness	Yes	45	6.4
	No	653	92.9
Number of substance used	0.00	523	74.4
	1.00	138	19.6
	2.00	12	1.7
	3.00	11	1.6
	4.00	6	0.9
	5.00	13	1.8
Status of depressive symptoms	Nil	201	28.6
	Mild	211	30.0
	Major	291	41.4

(Spitzer et al., 2006) and general anxiety disorder scale (GAD). General self-efficacy scale was used to assess self-efficacy (Zhang and Schwarzer, 1995), an individual's perceived beliefs and confidence in doing things. The general self-efficacy scale consists of 10 items with four point Likert scale (Not at all true, Hardly true, Moderately true and Exactly true). The internal reliability (Cronbach's alpha) of the scale ranged from 0.76 to 0.90 and it is correlated to emotion, optimism, work satisfaction (Zhang and Schwarzer, 1995). It was negatively correlated with depression, stress, health complaints, burnout, and anxiety (Zhang and Schwarzer, 1995).

Analysis

Descriptive statistics was employed to describe participants' characteristics and Pearson's correlation to examine bivariate association between the exposure and outcome variables. Finally, we employed hierarchical multiple regressions to investigate the association between psychiatric problems and academic performance. 95% Confidence Interval (CI) and 5% significance level were used to report statistical significance for the findings. Sex, residence and PHQ-9 were included as independent variables in model 1. Then, GAD and substance use were added as additional predictors in Model2, and finally, self-efficacy and life threatening events score were added in Model 3 as additional predictors to model 2. Normality was observed from histograms and homogeneity of variance from box plots. Durbin Watson's test was observed to test independence. Effect sizes were reported at 95% confidence interval and at a significance level of 0.05.

Ethical considerations

Ethical clearance was obtained from DMU research and publication directorate, and written consent was guaranteed from the participants.

RESULTS

The demographic background of the participants is indicated in Table 1. The analysis showed that 67.6% of the participants were males and 60.5% of the participants were from urban areas while the rest were from rural areas. The majority (87.5%) of the participants were orthodox Christians. In relation to their health history, 6.4% of them reported that they had chronic illnesses (Table 1).

When the number of substances that each student has experience of using is considered, 19.6% of the participants used at least one of the substances and 13 (1.8%) of the participants had experience of using all of the five substances (khat, shisha, alcohol, tobacco, depressants). The prevalence of mild level of depression was about 30% and that of major depression was about 41%. Generally, about 70% of participants had a PHQ-9 score of five or more indicating probable depressive symptoms.

Table 2. Bivariate Pearson's moment correlation.

Correlation	Anxiety score	Substance use	Self-efficacy	LTE	PHQ-9 total score	Semester GPA	Perceived difficulty in learning score
GAD score	1	0.123**	-0.060	0.277**	0.391**	-0.073	0.248**
Substance use score	-	1	-0.066	0.215**	0.178**	-0.128**	0.191**
Self-efficacy	-	-	1	-0.089*	-0.127**	0.105**	-0.139**
Life threatening (LTTE)	-	-	-	1	0.334**	-0.125**	0.252**
PHQ-9 total score	-	-	-	-	1	-0.078	0.399**
Semester GPA	-	-	-	-	-	1	-0.083*

**Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level. LTE: Life Threatening Events.

Table 3. Predictors of semester GPA in multiple regressions.

Variable	B (95.0% Confidence Interval for B)		
	Model 1	Model 2	Model 3
Sex	0.191(0.106, 0.276)**	0.221 (0.135, 0.307)**	0.225 (0.139, 0.311)**
Residence	-0.132 (-0.210, -0.054)**	-0.114 (-0.192, -0.035)**	-0.115 (-0.193, -0.036)**
PHQ-9 total score	-0.006 (-0.012, -0.001)*	-0.003 (-0.009, 0.003)	-0.001 (-0.007, 0.006)
GAD score	-	-0.006 (-0.015, 0.004)	-0.004 (-0.013, 0.005)
Substance use score	-	-0.019 (-0.029, -0.008)**	-0.016 (-0.027, -0.006**
Self-efficacy score	-	-	0.006 (0.001, 0.012)*
Life Threatening Events	-	-	-0.020 (-0.039, -0.001)*
R square	0.241 (F=14.40, 3, 699, p<0.05)	0.277 (F=11.62, 5, 697, p<0.05)	0.299 (F=9.74, 7, 695, p<0.05)

**Correlation is significant at the 0.01 level; *Correlation is significant at the 0.05 level.

The bivariate analysis using Pearson's moment correlation revealed that GAD (0.248**), substance use ($r=0.191$, $p<0.01$), self-efficacy ($r=-0.139$, $p<0.01$), list of threatening events score ($r=0.252$, $p<0.01$), PHQ-9 ($r=0.399$, $p<0.01$) and GPA ($r=-0.083$, $p<0.01$) were significantly associated to perceived difficulty in learning. Semester GPA was statistically significantly and negatively associated with substance use ($r=-0.128$, $p<0.05$), experience of threatening events ($r=-0.125$, $p<0.05$) and positively associated with self-efficacy ($r=0.105$, $p<0.05$). Students' semester GPA was not significantly associated with anxiety score ($r=-0.073$, $p>0.05$) and PHQ-9 ($r=-0.078$, $p>0.05$). However, PHQ-9 becomes significantly associated with student semester GPA after controlling for sex and residence (Table 3).

When other variables (anxiety, self-efficacy, substance use and threatening events) were added into the model (Table 3), the association between depression and semester GPA reduced by half from its effect size in its original model (Model 1) in Table 3. This indicates that anxiety and/or substance use are potential confounders of the association between the exposure and the outcome. Finally, when self-efficacy score and list of threatening events (LTE) were adjusted in a fully adjusted model (model 3), the association between the PHQ-9 score and semester GPA totally disappeared ($\beta=-0.001$, 95% CI: -0.007, 0.006). Thus depressive symptoms were not independently associated with student semester

GPA. But, it may be associated through other potential confounders such as anxiety, substance use, self-efficacy and experience of threatening experiences.

In the bivariate analysis in Pearson's moment correlation (Table 2), perceived learning difficulty of the students was significantly associated with PHQ-9 ($r=0.399$, $p<0.05$). This association remained unchanged after controlling sex and residence. Only slight reduction was observed in the effect size of the association between depressive symptoms and perceived difficulty in learning when the remaining variables were adjusted in model 2 and in the final model (model 3) in Table 4. Thus, depressive symptoms were independently and significantly associated with students' perceived difficulty in learning ($\beta=0.296$, 95% CI: 0.223, 0.370).

In multiple regression model, increment in anxiety score ($\beta=0.119$, 95% CI: 0.011, 0.227), substance use score ($\beta=0.169$, 95% CI: 0.045, 0.293), self-efficacy score ($\beta=-0.073$, 95% CI: -0.138, -0.009) and life threatening scores ($\beta=0.306$, 95% CI: 0.080, 0.532) were significantly associated with increased perceived difficulties in learning process (Table 4).

DISCUSSION

The study examined the potential impact of depressive symptoms on academic outcomes in the context of higher

Table 4. Predictors of perceived difficulty in learning in multiple regression models.

Variable	B (95.0% Confidence Interval for B)		
	Model 1	Model 2	Model 3
Sex	0.965 (-0.132, 2.063)	0.803 (-0.212, 1.817)	0.742 (-0.266, 1.751)
Residence	-0.842 (-1.846, 0.162)	-0.574 (-1.497, 0.350)	-0.581 (-1.500, 0.339)
PHQ-9 total score	0.386 (0.320, 0.452)**	0.328 (0.256, 0.400)**	0.296 (0.223, 0.370)**
GAD score	-	0.328 (0.256, 0.400)**	0.119 (0.011, 0.227)*
Substance use score	-	0.144 (0.037, 0.251)**	0.169 (0.045, 0.293)**
Self-efficacy score	-	-	-0.073 (-0.138, -0.009)*
Life Threatening Events score	-	-	0.306 (0.080, 0.532)*
R square	0.168 (F=46.95, 3, 699, P<0.05)	0.435 (F=32.45, 5, 697, p<0.05)	0.451 (F=25.34, 7, 695, p<0.05)

**Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level.

educational institution students of northwest Ethiopia. The findings of the study are supposed to contribute to design intervention strategies for depressive symptoms so as to improve students' mental wellbeing and so their academic performance. Using a locally validated version of measure of depressive symptoms, 70% of participants had a PHQ-9 score of five or more indicating probable depressive symptoms (about 30% mild and 40% major depressive symptom levels). Increased PHQ-9 score was independently associated with increased perceived difficulties in learning. But, the association between PHQ-9 and semester GPA disappeared after controlling substance use and anxiety.

The prevalence of depression varies across settings depending on cut offs and sampled population. The prevalence of depressive symptoms in our study sample is very high compared to the 12% prevalence of depressive symptoms reported in the general population in southern Ethiopia (Fekadu et al., 2014). This population based study reported about 12% of depressive symptoms using the same measure (Fekadu et al., 2014). But, the finding is comparable with other findings in the student population. For example, a 43.5% prevalence of depression in a meta-analysis of about 53 studies (Sajjadi et al., 2013) was reported. Relatively comparable results have also been reported in University of Gondar (Brugha et al., 1985), Addis Ababa (Wolie, 2014), and Ambo Universities (WHO, 2017) in Ethiopia in similar populations to our study. These studies used screening tools to assess depressive symptoms. The high prevalence of the depressive symptoms among the study population may be explained by (1) worries of exam results since data was collected about three weeks after final exam; (2) anxiety to adapt new university environment and (3) high developmental stage related prevalence of emotional turmoil in the universities students population (Hale et al., 1993).

Our finding about positive association between PHQ-9 score and perceived difficulties in learning independently of substance use supported our hypothesis that assumed substance use as a confounding factor in the association

depression and academic outcomes. In other words, substance use affects both depressive symptoms and academic outcomes. There is well established evidence that both psychoactive and depressant substance ultimately affect depressive symptoms. On the other hand, substance use also affects academic outcomes through the positive and negative emotions linked to use of such substances as reported in previous studies (Sadeghi Bahmani et al., 2018). Thus, the association between depressive symptoms and increased difficulty in learning process may be explained by positive and negative emotions linked to use of substance (Sadeghi Bahmani et al., 2018) and poor sleep quality (Al-Khani et al., 2019), loss of interest on common task and lack of attention linked to depression that may reduce the functioning of the individual.

In a model adjusted for gender and residence, the negative association between PHQ-9 score and academic performance disappeared when anxiety and substance use are controlled in the model. This confirmed that depression was not independently associated with students' academic GPA. That is the association between depression and academic performance was confounded by substance use. This finding is consistent with previous findings which reported negative but weaker association between depression and academic achievement (Sadeghi Bahmani et al., 2018). The weak association between depression and academic performance in this previous study may be because, this previous study did not control substance use and anxiety (Sadeghi Bahmani et al., 2018). Anxiety, substance use and depression are associated with poor sleep quality. But, poor sleep quality was associated with increased academic performance in previous study (Al-Khani et al., 2019). This may be because the poor sleep quality among students with depressive symptoms may also be related to use of psychoactive substance such as khat, which is widely available in the study area. Our finding indicated that the use of such substance was in turn associated with increased difficulty in learning and reduced student GPA. Thus, depressive symptoms might have affected

academic outcomes through substance use and associated poor sleep quality.

The present study found that substance use is associated with reduced cumulative GPA. This finding supports previous studies (Berg, 2018) which reported negative correlation between substance use and academic achievement mainly due to lack of planned behavior among individuals with substance use. Substance use may affect study schedules and study habits and could ultimately lead to poor academic performance. Similarly, low educational success is also found to be an antecedent to different risk behaviors including substance use.

Using locally validated measure of depressive symptoms and relatively large sample, the current study has come up with important findings which will be inputs for future decisions about diagnosis and treatment of depression. But, the findings should be understood in light of the following limitations. Data collection was conducted about three weeks after final exam which might have inflated depressive symptoms. Besides, poor sleep quality, which was not adjusted in our final regression models, might explain the non-significant association between depressive symptoms and semester GPA. The variation of the students' results from the actual might have temporarily affected their emotions and so the association between the exposure and the outcome. As a proxy measure of the students' expectation, we controlled self-efficacy of the students. But, this may not be a fair measure of students' expectation of their results. Thus, students' expectations was not properly assessed and controlled in this study.

Conclusion

The prevalence of depressive symptoms in the study sample was very high with adverse consequences on learning. *Mental well-being of university students is important for smooth academic progress.* Thus, future follow up studies and intervention studies are required to demonstrate causality and then to design intervention strategies for substance use and depression among university students.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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