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ORIGINAL RESEARCH

Predictors of self-reported academic performance among undergraduate medical students of Hawassa University, Ethiopia

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Background: This study was conducted to identify predictors of self-reported academic performance in undergraduate medical students at Hawassa University.

Methods: An analytical cross-sectional study involving 592 undergraduate medical students was conducted in November 2012. The academic performance of the study subjects was measured by self-reported cumulative grade point average (GPA) using a self-administered questionnaire. Data were entered and analyzed using Statistical Package for the Social Sciences version 16 software. Pearson's bivariate correlations, multiple linear regression, and multiple logistic regression were used to identify predictors of academic performance.

Results: The self-reported academic performance of students had been decreasing as the academic years progressed, with the highest and lowest performance being in the premedicine (mean GPA 3.47) and clinical I (mean GPA 2.71) years, respectively. One hundred and fifty-eight (26.7%) of the participants had ever been delayed, 37 (6.2%) had ever re-sat for examination, and two (0.3%) had ever been warned due to academic failure. The overall variation in self-reported academic performance of the students was 32.8%. Participant age alone explained 21.9% of the variation. On the other hand, university entrance examination results, substance use at university, and medicine as first choice by students were identified as predictors of variation in self-reported academic performance, accounting for 6.9%, 2.7%, and <1% of the variation, respectively. Students who had never used tobacco, alcohol, or khat after starting university were twice as likely to score a self-reported cumulative GPA above 3.0 (adjusted odds ratio 1.95, 95% confidence interval 1.25–3.02) and less likely to be delayed, have to re-sit an examination, or be warned (adjusted odds ratio 0.47, 95% confidence interval 0.29–0.77).

Conclusion: Only 32.8% of the variation in self-reported academic performance was explained by the studied variables. Hence, efficacious mechanisms should be designed to combat the intervenable determinants of self-reported academic performance, like substance use and a low medical school entrance examination result. Further studies should also be undertaken to gain a better understanding of other unstudied determinants, like personality, learning style, cognitive ability, and the system used for academic evaluation.

Keywords: predictors, academic performance, medical students, Ethiopia

Introduction

Academic performance is a key component of medical education that is used by governing bodies like ministries of education and health and universities to assess whether a medical graduate is sufficiently competent and fit to practice medicine.[1,2] It is also used to identify students who are displaying the appropriate level of competence, to enable students to ascertain their own academic progress, and to predict the future performance of students.[1,3] The purpose of medical education is to ensure that students meet the

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ethical, clinical, technical, and scientific standards expected of a good physician.[4] Therefore, academic performance of medical students should be evaluated continuously.[5]

In developed countries, various studies have revealed that a number of factors affect the academic performance of undergraduate medical students. Prior academic achievement, such as medical school entrance examination result,[6,7] cognitive ability,[8,9] personality,[10,11] learning style,[12] and stress at medical school[8] were among the identified factors. There is a scarcity of scientific evidence on determinants of academic performance among medical students in developing countries like Ethiopia. However, studies done on substance use among university students found that use of substances like khat and cigarettes negatively affected academic performance.[13,14]

Khat is a stimulant drug derived from a shrub (*Catha edulis*) found in Eastern Africa and Southern Arabia. Leaves of the khat shrub are held in the cheek or chewed as gum, and release their stimulants cathinone and cathine. These chemicals are structurally similar to amphetamine and have a similar stimulant effect on the brain and body.[15]

Ethiopia, one of the developing countries in Eastern Africa, suffers from a shortage of health professionals, particularly physicians. According to the 2011/2012 report of the Federal Ministry of Health, the physician to population ratio was 1:28,847.[16] This figure is far below the international standard recommendation of 1:10,000.[17] Recently, the Ministry of Education, as well as the Ministry of Health, in Ethiopia aimed to increase the number of physicians by opening new medical schools to increase the number of medical students.[18,19] Despite the increased intake of medical students each year, the number of students graduating from these schools is still not as high as needed, largely due to a high attrition rate. Attrition is of concern, because it is a waste not only of the students' time, effort, and money, but also for medical academic institutions and the government.[20]

As it is normal for some students in an educational institution to perform well while others do poorly, even after receiving the same services, researchers are curious to know what makes some students perform poorly. The findings of the current study would help in assisting policy-makers and implementers to come up with policies and strategies that can be employed to improve academic performance, in addition to generating evidence about predictors of self-reported academic performance among medical students in Ethiopia. Hence, this study aimed at identifying the predictors of academic performance in undergraduate medical students.

Materials and methods

This study was conducted among undergraduate medical students of Hawassa University (HU, a public university established in 1999) in Hawassa City, the capital city of the Southern Nations Nationalities and People's Region of Ethiopia. The university has a total of five campuses. It is one of the 32 public universities in Ethiopia, and is engaged in the provision of all-round education, research, and training.

Formal training of medical professionals at HU began in 2003 with the opening of the College of Medicine and Health Sciences (CMHS) and its tertiary teaching hospital, ie, Hawassa University Referral Hospital. At the time of the study, the college had an annual acceptance of 150–200 medical students. Medical students are admitted to the school as per the national criteria set by the Federal Ministry of Education, which are mainly based on students' performance in the Ethiopian National Higher Education Entrance Examinations.[21]

New medical students joining the CMHS at HU initially attend general courses for 6 months in the premedical training program before embarking on the preclinical academic years, ie, preclinical I (year 1) and preclinical II (year 2). All medical students completing preclinical and clinical training, ie, clinical I (year 3) and clinical II (year 4), are required to successfully pass through a 1-year internship program in order to graduate. In general, the duration of undergraduate medical training has a curriculum of 5.5 years. Until the end of 2013, the medical school has graduated more than 340 general medical practitioners.

The curriculum of the medical school during the study period includes the basic medical courses in the preclinical years (years 1 and 2) while the clinical courses are usually covered in the subsequent three years (clinical I, II, and internship). The student evaluation system includes written examinations, oral examinations, individual and group assignments, practical examinations, and progressive assessment. Students are expected to score at least 60% to pass each course. Students who fail to achieve 60% in the basic and clinical courses need to repeat the course or re-sit an examination based on individual academic records.

The grading system of the school is based on the fixed scale system of HU with 85%–100% (A), 80%–84.9% (B+), 70%–79.9% (B), 65%–69.9% (C+), 60%–64.9% (C), 55%–59.9% (D+), 50%–54.9% (D), and less than 50% (F). According to the system, A has a score of 4.0 whereas B+, B, C+, C, D, and F have scores of 3.5, 3.0, 2.5, 2.0, 1.0, and 0, respectively. Accordingly, the maximum and the minimum

cumulative grade point average (GPA) a medical student can achieve will be 4.0 and 0, respectively.

Study design and participants

This analytical cross-sectional study, which used a quantitative data collection method, involved all medical students who had at least one semester GPA (year 1 to internship program) at the CMHS. Medical students who did not have at least one semester GPA were excluded.

Variables

The dependent variable (academic performance) was measured by students' self-reported cumulative GPA for the current academic year.[22] The independent variables were: prior academic performance (university entrance examination result and type of high school), sociodemographic characteristics (age, sex, maternal educational level, paternal educational level, original background, and allowance per month), personal characteristics (choice of medicine as first interest, substance use before and after joining university, history of academic withdrawal, duration of study at university, usual number of sleeping hours per day, estimated length of time spent on extracurricular activities, and missing academic activities).[23]

Academic performance was dichotomized into good and low based on the mean cumulative GPA and/or presence of academic delays, experience of re-sitting examinations, and academic warnings.[24,25]

Substance use in this study represented the use of at least one of chewing khat, smoking cigarettes, or alcohol use in the 30 days preceding the study period.

Data collection and analysis

A self-administered, pretested, structured questionnaire prepared in English was used for data collection, since English is the medium of instruction in all higher education institutions in Ethiopia. Most of the questions were close-ended with precoded responses, and mainly grouped into sociodemographic characteristics, earlier school performance and characteristics, behavioral characteristics, and academic performance and GPA in each academic year. The questionnaire was developed by the authors after reviewing the relevant literature on the subject. Based on their training background, students were divided into two main categories: preclinical (years 1 and 2) and clinical (years 3 and 4 and internship). To minimize the non-response rate, data were collected for each batch of students immediately after they finished written examinations or after bedside teaching; the data collection was conducted in lecture halls. Data collectors as well as the supervisors were trained assistant lecturers from other campuses at HU. Instructions on how to complete the questionnaire correctly, particularly on how to follow skip patterns, was given to the study subjects before embarking on completing the questionnaire. After the questionnaires were collected back from the students, the supervisors checked all questionnaires for completeness.

Data were entered, cleaned, and analyzed using Statistical Package for the Social Sciences version 16 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to summarize and present the data. To determine the relationship between self-reported academic performance and the different independent variables, bivariate Pearson's correlation analysis was done three times (for total participants, and for preclinical, and clinical student subcategories). Multiple linear regression was used to estimate the cumulative and individual effects of each independent variable as well as to control confounding effects.

To explain the variability of the outcome variable according to the explanatory variables and identify the effects of confounding, three multiple linear regression analyses were constructed for total participants, clinical, and preclinical students. Out of the 20 explanatory variables, we used a backward selection procedure to test several combinations of these variables and used a model that gives us the largest adjusted R^2 and the smallest standard error. Regression diagnostics were done for the fitness of model. The correlation between each of the explanatory variables was less than 0.7, and the variance inflation factor was ≤ 5. Moreover, linearity and other assumptions were guided under the umbrella of central limit theory because the sample size was very large.

For the logistic regression models, a P-value <0.2 was taken as a cut-off point for selecting variables to enter into the multiple logistic regression model. A probability value of <0.05 was considered to be statistically significant.

Ethical considerations

Ethical approval was obtained from the institutional review board at CMHS. Further, permission letters were presented to all responsible units in the CMHS to seek permission to engage in data collection. Participation of the students was on a voluntary basis. Written informed consent was obtained after the purpose of the study was explained to the students in their specific subcategories. Identifiers of the study participants were not recorded anywhere on the questionnaire, and appropriate measures (adequate spacing between individuals during completion of the questionnaires, recruiting data col-

lectors, and supervisors from other campuses) were taken to ensure confidentiality of information.

Results

During the study period, a total of 770 undergraduate medical students were registered in the medical school. However, 150 students were in their premedical study period so were excluded from the study as they did not have any GPA. Of the 620 students invited, 610 participated in the study, giving a response rate of 98.4%. Questionnaires from only 592 students were used for the study; questionnaires for 18 students were discarded because of incomplete responses.

Of the total number of respondents, 36.3% were in the preclinical years, and the remaining 63.7% were in the clinical years. More than three-quarters (79.9%) of the participants were male, and the mean age of the participants was 22.16±1.85 years. Participants reported an average monthly allowance of 19.8±14.7 USD; males reported a smaller allowance than females (17.5 USD versus 29 USD, respectively, $P<0.0001$, Table 1).

With regards to preuniversity history, more than three quarters (77.9%) of participants completed their high school education at a government school and the average self-reported university entrance examination result was 72%±3.97%. There was a statistically significant difference between the mean entrance examination results of male and female students (72.4% versus 71.2%, respectively, $P=0.009$). Of the total number of participants, only 33 (5.6%) had ever used any substance before starting university, while about a quarter (24.2%) used any substances during the data collection period. Khat was the most commonly used substance, followed by alcohol and cigarette smoking. When substance use was disaggregated by academic year, the proportion of substance users increased with increment in academic year. The students' mean lengths of time usually spent studying, sleeping, and on extracurricular activities in 24 hours were 7.9±2.8, 6.96±1.22, and 3.2±1.74, respectively, Table 2).

Forty-seven participants (7.9%) had been in medical school for more than 6 years. Self-reported academic performance had been decreasing as the academic years progressed, with the highest and lowest performance being in premedicine (mean GPA 3.47) and clinical I medicine (mean GPA 2.71), respectively. The mean current self-reported cumulative GPA of the participants was 3.08±0.38; more than half (61.7%) of the students had a cumulative GPA ≥3.0, and there was no difference in cumulative GPA between female and male students (3.08 and 3.09, $P=0.804$). However, there was a statistically significant difference in cumulative GPA between clinical and preclinical students (2.95 and 3.31, $P=0.000$, Table 3).

More than a quarter of the participants (26.7%) had ever been delayed (needed to repeat a course) in their time as medical students, but few (6.2%) had needed to re-sit an examination. Self-reported academic performance was good for 61.7% of the students (cumulative GPA ≥3.0).

Table 1 Sociodemographic characteristics of undergraduate medical students at College of Medicine and Health Sciences, Hawassa University, November 2012

Characteristic	Frequency (n)	Percentage
Sex		
Male	473	79.9
Female	119	20.1
Age, years	22.16 (mean)	1.848 (SD)
15–19	53	9.0
20–24	485	81.9
≥25	54	9.1
Religion		
Orthodox Christian	356	60.1
Protestant Christian	123	20.8
Muslim	79	13.3
Other*	34	5.7
Ethnicity		
Amhara	236	39.9
Oromo	168	28.4
Tigre	44	7.4
Gurage	37	6.2
Other**	107	18.1
Original background		
Urban	362	61.1
Rural	230	38.9
Medical education status		
Preclinical I	115	19.4
Preclinical II	101	17.1
Clinical I	144	24.3
Clinical II	149	25.2
Internship	83	14.0
Maternal educational level		
No formal education	237	40.0
Primary school (1–8)	140	23.6
Secondary school (9–12)	79	13.3
College and above	136	23.0
Paternal educational level		
No formal education	157	26.5
Primary school (1–8)	144	24.3
Secondary school (9–12)	74	12.5
College and above	217	36.7
Monthly allowance, USD	19.8 (mean)	14.7 (SD)
<10	167	28.2
10–25	329	55.6
25–50	76	12.8
>50	20	3.4

Notes: *Catholic; **Sidama.
Abbreviation: SD, standard deviation.

Table 2 Former high school background and behavioral characteristics of undergraduate medical students at College of Medicine and Health Sciences, Hawassa University, November 2012

Characteristic	Frequency (n)	Percentage
Completed high school in		
Government school	461	77.9
Private school	131	22.1
University entrance examination result (%)	72.0 (mean)	3.97 (SD)
60–69.9	163	27.5
70–79.9	419	70.8
≥80	10	1.7
Was medicine their first choice?		
Yes	537	90.7
No	55	9.3
Ever use of substances before university		
Yes	33	5.6
No	559	94.4
Type of substance ever use before university (n=33)		
Khat alone	18	3.0
Alcohol and khat	11	1.9
Cigarettes, alcohol, and khat	4	0.68
Current substance use (n=592)		
Yes	143	24.2
No	449	75.8
Type of currently used substances (n=143)		
Khat alone	110	18.6
Alcohol and khat	97	16.4
Cigarettes, alcohol, and khat	33	5.5
Substance use by academic year		
Preclinical I	10	8.7
Preclinical II	26	25.7
Clinical I	42	29.2
Clinical II	34	22.8
Internship	31	37.3
Average daily duration of study, hours	7.9 (mean)	2.8 (SD)
<5	53	9.0
5–10	458	77.4
>10	81	13.7
Average daily duration of sleep, hours	6.96 (mean)	1.22 (SD)
<5	13	2.2
5–10	578	97.6
>10	1	0.2
Average daily duration of extracurricular activities, hours	3.2 (mean)	1.74 (SD)
<1	2	0.3
1–3	373	63.0
>3	217	36.7
Type of missed academic activities		
Lecture	326	55.1
Seminar/tutorial	115	19.4
Bedside/round	33	5.5

Abbreviation: SD, standard deviation.

Table 3 Patterns of academic performance among undergraduate medical students at College of Medicine and Health Sciences, Hawassa University, November 2012

Characteristic	Frequency (n)	Percentage
Withdrawal history with any cause		
Yes	26	4.4
No	566	95.6
University attendance, years		
≤6	545	92.1
>6	47	7.9
GPA	Mean	SD
Premedicine	3.47	0.29
Preclinical I	2.99	0.42
Preclinical II	2.88	0.40
Clinical I	2.71	0.38
Clinical II	2.73	0.40
Current cumulative	3.08	0.38
Have you ever been delayed (repeated courses)		
Yes	158	26.7
No	434	73.3
Academic year of delay (n=158)		
Preclinical	90	56.9
Clinical	68	43.1
Have you ever had to re-sit an examination		
Yes	37	6.2
No	555	93.8
Academic years of re-sit examination, n=37		
Preclinical	34	91.2
Clinical	3	8.8
Academic performance, cumulative GPA		
Good (≥3.0)	365	61.7
Low (<3.0)	227	38.3
Academic performance		
Good (never delayed, had to re-sit, been warned)	416	70.3
Low (delayed, had to re-sit, been warned)	176	29.7

Abbreviations: GPA, grade point average; SD, standard deviation.

Low academic performance (delay, re-sit, and/or warning) was reported by 29.7% of the students (Table 3).

According to the bivariate Pearson's correlation analysis, seven of the independent variables had a significant correlation with self-reported academic performance. Age (r=–0.469, P=0.000), university entrance examination results (r=0.356, P=0.000), substance use at university (r=–0.219, P=0.000), and missing of bedside/round sessions (r=–0.398, P=0.000) were moderately correlated, and history of withdrawal from academic activity (r=0.094, P=0.022), missing lectures (r=0.111, P=0.007), and missing seminars/tutorials (r=0.147, P=0.000) were weakly correlated.

Similar correlation analyses were done for subgroups (clinical and preclinical years): age (r=–0.540, P=0.00), university entrance examination results (r=0.390, P=0.00), substance use at university (r=0.261, P=0.000), missing lectures (r=0.168, P=0.001) and missing seminars/tutorials (r=–0.091, P=0.020) had a statistically significant correlation with academic performance among the preclinical students. Only three variables, ie, history of withdrawal from academic activity (r=0.18, P=0.036), university entrance examination results (r=0.240, P=0.000), and medicine as first choice (r=–0.139, P=0.035) had a statistically significant correlation with academic performance in the clinical years.

The identified independent variables explained 32.8% of the variation in academic performance (R^2=0.328, P=0.000). Four variables (participant age, substance use at university, university entrance examination results, and medicine as first choice), accounted for the statistically significant variation in self-reported academic performance. Multiple linear regression analyses for subgroups revealed that the aforementioned independent variables explained 30.1% and 14.7% of the variation in self-reported academic performance for preclinical and clinical year students, respectively (Table 4).

Stepwise multiple linear regression analysis was also done for all the participants. Participant age alone explained 21.9% of the variation in self-reported academic performance. University entrance examination results, substance use at university, and medicine as first choice explained 6.9%, 2.7%, and <1% of variation in academic performance, respectively. Considering type of substance used versus academic performance, the mean cumulative GPA of substance users was found to be less than that of non-users (alcohol, 2.96 versus 3.12, P=0.000; khat, 2.91 versus 3.12, P=0.000; cigarettes, 2.90 versus 3.12, P=0.007).

To express the strength of relationship in a more interpretable way, bivariate and multivariate logistic regressions were done. Students who have never used any substances at university were twice as likely to have scored a self-reported cumulative GPA of 3.0 and above (adjusted odds ratio [AOR] 1.95, 95% confidence interval [CI] 1.25–3.02) and less likely to have been delayed, to have had to re-sit, and/or be warned (AOR 0.47, 95% CI 0.29–0.77) than their counterparts. Those students whose university entrance examination result was 66%–70% (AOR 3.05, 95% CI 1.25–7.47) and 71%–75% (AOR 3.81, 95% CI 1.91–4.29) were more likely to have scored a self-reported cumulative GPA of 3.0 and above than students whose entrance examination result was ≤65% (Table 6). When the predictive validity of university entrance examination results as a predictor of self-reported academic performance was tested using a receiver operating characteristic curve, the point of the curve that was closer to the left

Table 4 Bivariate correlation between independent variables and academic performance among undergraduate medical students at College of Medicine and Health Sciences, Hawassa University, November 2012

Variables	Performance		Performance		Performance	
	All students		Preclinical years		Clinical years	
	r	*P*-value	*r*	*P*-value	*r*	*P*-value
Sex	–0.010	0.804	–0.076	0.148	0.010	0.877
Age	–0.469	0.000	–0.540	0.000	–0.023	0.72
Religion	–0.094	0.051	–0.026	0.618	–0.135	0.052
Ethnicity	–0.013	0.753	0.010	0.843	–0.055	0.401
Original background	–0.018	0.667	0.006	0.914	0.040	0.545
Paternal educational level	0.038	0.354	0.013	0.805	0.019	0.773
Maternal educational level	0.041	0.325	0.014	0.791	–0.018	0.790
Monthly allowance	0.006	0.877	–0.047	0.369	0.031	0.639
Type of preparatory school	0.003	0.941	–0.037	0.485	–0.007	0.918
Withdrawal history by any cause	0.094	0.022	0.064	0.227	0.138	0.036
University entrance examination result	0.356	0.000	0.390	0.000	0.240	0.000
Was medicine their first choice	–0.075	0.067	–0.040	0.452	–0.139	0.035
Substance use before university	0.035	0.389	0.005	0.922	–0.005	0.941
Current substance use	–0.219	0.000	–0.261	0.000	–0.118	0.072
Daily duration of study	0.053	0.202	0.094	0.075	–0.100	0.129
Daily amount of sleep	–0.044	0.280	–0.077	0.145	0.094	0.154
Daily time spent on extracurricular activities	0.006	0.888	–0.020	0.706	0.060	0.365
Missing lectures	0.111	0.007	0.168	0.001	0.038	0.561
Missing bedside/rounds	–0.398	0.000	–0.091	0.186	0.079	0.128
Missing seminars/tutorials	0.147	0.000	0.158	0.020	0.093	0.071

upper quadrant of the x-y axis yielded a sensitivity of 0.61 and 1 – specificity of 0.33. The threshold point that minimizes the trade-off between the sensitivity and specificity of the university entrance examination result was at 72.25%. The area under the receiver operating characteristic curve was found to be 0.68 (95% CI 0.64–0.73). Although the university entrance examination result was associated with the student's self-reported academic performance, an area of 0.68 under the receiver operating characteristic curve implies that the university entrance examination result was poor in setting the threshold for a dependent variable, in this case self-reported academic performance. We also noted an association between participant age and academic performance, with the odds of having a self-reported cumulative GPA ≥3.0 being 70% less for students aged older than 22 years (AOR 0.30, 95% CI 0.20–0.44) when compared with their younger counterparts (Table 5).

Discussion

In the present study, we evaluated the correlation of different independent variables with self-reported academic performance. Self-reporting may affect the quality of study data, even though appropriate measures are taken during data collection to assess actual performance. To minimize this problem, an appropriate explanation was given to the participants on the importance of reporting their actual academic performance, and the data collection tool was pretested on paramedical students. More than three quarters of the participants were male (79.9%) which is consistent with the male predominance found in other studies done in higher institutions in Ethiopia.[13,26–28] This indicates that female involvement in higher institutions is still low, despite continuing recruitment efforts.

In the current study, self-reported academic performance was higher among premedicine students. This is consistent with the findings of a study of freshmen at Jimma University where medical students had the lowest dismissal rate.[29] Although the definition of low academic performance in medical students varies in the literature, two studies done in the USA of 1st-year medical students found low academic performance rates of 11.4% and 14%,[24,25] which are by far lower than the low academic performance level found in the current study.

The identified explanatory variables accounted for only 32.8% of the variation in self-reported academic performance for the total study population, indicating that approximately 70% of the variation in academic performance had to be explained by determinants not assessed in this study. Subgroup analysis showed that these variables explained only 30.1% and 14.7% of the variation in academic performance for preclinical and clinical year students, respectively. This finding suggests that the variables chosen are poorer predictors of self-reported academic performance for students in the clinical years than for students in the preclinical years. This could be due to a difference in the teaching–learning and evaluation system between the two categories of students.

Participant age was one of the predictors of self-reported academic performance in this study. Student age alone accounted for 21.9% of the variation in academic performance, with academic performance decreasing as age

Table 5 Results of multiple linear regression analysis of academic performance among undergraduate medical students at College of Medicine and Health Sciences, Hawassa University, November 2012

	Performance			Performance			Performance		
	All students*			Preclinical students**			Clinical students***		
	Stand B	t static	*P*-value	Stand B	t static	*P*-value	Stand B	t static	*P*-value
Constant		7.88	0.000		3.51	0.001		4.713	0.000
Sex	–0.080	–2.112	0.055	–0.083	–1.359	0.76	–0.070	–1.250	0.212
Age	–0.389	–10.488	0.000	–0.347	–5.510	0.000	–0.148	–2.741	0.006
Original background	0.045	1.209	0.227	–0.036	–0.057	0.571	0.055	0.996	0.320
Monthly allowance	0.057	1.436	0.152	0.111	1.571	0.118	0.107	1.862	0.063
University entrance examination result	0.271	7.665	0.000	0.283	4.792	0.000	0.268	5.331	0.000
Medicine as first choice	0.077	2.264	0.024	0.055	0.949	0.344	0.116	2.383	0.018
Substance use before university	–0.070	–1.954	0.051	–0.122	–1.904	0.058	–0.063	–1.236	0.217
Current substance use	–0.204	–5.332	0.000	–0.330	–4.625	0.000	–0.194	–3.631	0.000
Religion	–0.067	–1.924	0.055	–0.163	–2.731	0.057	–0.043	–0.871	0.384
Missing seminars/tutorials	0.044	1.262	0.207	0.039	0.623	0.534	0.041	0.829	0.408

Notes: *Adjusted R^2 =0.328, *P*=0.000; **adjusted R^2 =0.301, *P*=0.000; ***adjusted R^2 =0.147, *P*=0.000.

Table 6 Binary and multiple logistic regression analysis of academic performance based on CGPA average as a dichotomous variable, College of Medicine and Health Sciences, Hawassa University, November 2012

Variables	Academic performance, CGPA		OR (95% CI)			
	Good (≥3.0)	Low (<3.0)	Crude OR (95% CI)	*P*-value	Adjusted OR (95% CI)	*P*-value
Age (years)				0.000		0.000
≤20	107	10	1		1	
21–25	252	213	9.044 (4.613–17.733)		0.275 (0.058–1.297)	
>25	6	4	7.133 (1.722–29.556)		1.924 (0.484–7.652)	
Religion				0.105		0.923
Orthodox	231	125	1			
Muslim	50	29	0.685 (0.337–1.396)			
Protestant	65	58	0.735 (0.325–1.663)			
Other	19	15	1.130 (0.527–2.426)			
Ethnicity				0.083		0.574
Amhara	158	78	1			
Oromo	92	76	0.680 (0.425–1.088)			
Tigre	31	13	1.138 (0.698–1.857)			
Gurage	22	15	0.578 (0.272–1.227)			
Other	62	45	0.939 (0.439–2.009)			
Maternal education				0.075		0.515
No formal education	156	81	1			
Primary school	77	63	0.983 (0.631–1.532)			
High school	43	36	1.549 (0.953–2.518)			
College and above	89	47	1.585 (0.900–2.794)			
Withdrawal history				0.043		0.513
Yes	11	15	1			
No	354	212	2.277 (1.027–5.050)			
Medicine as first choice				0.046		0.05
Yes	338	199	1			
No	27	28	1.761 (1.009–3.074)			
Current substance use				0.000		0.003
Yes	69	74	1		1	
No	296	153	2.075 (1.417–3.039)		1.945 (1.253–3.019)	
Missing seminars/tutorials				0.003		0.055
Yes	57	58	1			
No	307	169	1.848 (1.226–2.788)			
University entrance result, %				0.000		0.000
60–65	11	14	1		1	
66–70	64	92	3.494 (1.490–8.193)		3.053 (1.248–7.47)	
71–75	150	70	3.946 (2.51–6.203)		3.809 (1.908–4.293)	
>75	140	51	1.281 (0.835–1.966)		1.443 (0.908–2.293)	

Abbreviations: CGPA, cumulative grade point average; CI, confidence interval; OR, odds ratio.

increased. After controlling for other variables, for every 1-year increment in age, the cumulative GPA decreased by 0.389. However, the effect of student age on performance at medical school is a controversial issue. Older students in several studies did less well in scientific reasoning and tended to be graded with lower scores at the beginning of their courses, basically in the 1st year of their medical studies.[30–32] However, recent studies show that older and more mature medical students performed better than their younger counterparts.[33,34]

Student age warrants very careful attention when interpreting the findings of the current study, given that this was at the point of data collection not the age of entry to medical school. It is very difficult to conclude that older students are performing less well than their younger counterparts, because being older could be due to academic delay, a longer time spent at medical school, or a difference in the nature of the academic years rather than age alone.

In the current study, as university entrance examination result of participants increased by one mark, their cumulative

GPA increased by 0.271. Other researchers have demonstrated a similar predictive validity of academic performance prior to entry into medical school.[7,35] A study done on school leaving examination results in New Zealand showed that these were predictive of GPA at medical school, especially in the preclinical years; however, only 16% of the variance in GPA at medical school was explained by previous academic performance.[36] Studies done in the USA and the UK also found that previous academic achievement is a stronger predictor of preclinical academic performance than clinical academic performance, and that its predictive value decreased as students progressed through the academic years.[37,38] This is because prior academic achievement demonstrates that the student has a minimum level of competence and the basic knowledge on which to build and integrate new knowledge.[39]

In the current study, khat, a central nervous system stimulant,[40,41] was the most commonly used substance at university. Similar rates of khat use have been found in other studies in Ethiopian high schools (18.4%),[27] universities (19.6%),[28] and medical schools (14%–33.1%).[13,24]

There was a significant difference in mean self-reported cumulative GPA between substance users and non-users. Substance use alone explained 2.7% of the variation in self-reported academic performance, and students who were not substance users were twice as likely to self-report a cumulative GPA ≥3.0 and less likely to be delayed, have to re-sit, or be warned than their counterparts. This finding is consistent with the findings of a study conducted among medical and health officer students at Jimma University.[13] Similar studies in Ethiopia[14] and Saudi Arabia[42] found that chewing khat is a risk factor for frequent absenteeism from class and poor academic performance in students. A recent study done in the same study area also found that absenteeism was higher among substance users,[43] indicating that substance use has a negative influence on academic performance, perhaps as a result of the waste of valuable time and energy spent chewing khat, absenteeism from class, and lack of concentration during class due to insomnia.

This study has several limitations. It used self-administered questionnaires and instruments, so the reliability of the data could be questioned since bias might have been introduced, resulting in underreporting or overreporting. Further, there could have been some recall bias in students' self-reported GPAs. We recommend future studies designed with appropriate ethical considerations taken into account in order to be able to use students' academic records to assess their academic performance. The cross-sectional design of our study is also a limitation, because the presented associations lack cause-effect relationship. However, we included a representative sample of all undergraduate medical students from year 1 to internship, with a large sample size and a high response rate. Thus, it is possible to generalize the results internally for all medical students at HU. However, generalizability to medical students attending other medical schools might be limited.

Conclusion

The factors investigated in this study explained only 32.8% of variation in academic performance. Other factors known to influence academic performance, such as student motivation, personality, evaluation system, and learning style, should be studied in the future. It would be important to pay extra attention to students with a lower entrance examination result, substance users, and older students, particularly during the clinical years. More education to promote awareness of the harmful effects of substance use in medical schools is needed.

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Author contributions

AG conceived the research idea; AG and AA wrote the proposal; AG and AA were involved in data collection; and AG and BT analyzed the data and wrote the draft manuscript. AG, AA, and BT critically reviewed and edited the manuscript for intellectual content. All authors reviewed and approved the final manuscript.

Disclosure

The authors report no conflicts of interest in this work.

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