

Factors related to academic performance in medical students

José Benjamín Guerrero-López,¹ Ana María Monterrosas,² Carlos Reyes-Carmona,² Araceli Arrijoa Guerrero,² Andrea Navarrete-Martínez,² Felipe Flores Morones,² Mónica Flores-Ramos,³ Héctor Fernando Hernández-Ruiz⁴

¹ Departamento de Psiquiatría y Salud Mental de la Facultad de Medicina, Universidad Nacional Autónoma de México, Ciudad de México, México.

² Departamento de Internado Médico, Facultad de Medicina, Universidad Nacional Autónoma de México, Ciudad de México, México.

³ Dirección de Enseñanza, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, Ciudad de México, México.

⁴ Facultad de Medicina, Universidad Nacional Autónoma de México, Ciudad de México, México.

Correspondence:

Mónica Flores-Ramos
Dirección de Enseñanza, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz.
Calzada México-Xochimilco 101, Huijulpulco Tlalpan, 14370, Ciudad de México, México.
Phone: +52 (55) 4160-5126
Email: flores_ramos@hotmail.com

Received: 10 January 2022

Accepted: 3 January 2023

Citation:

Guerrero-López, J. B., Monterrosas, A. M., Reyes-Carmona, C., Arrijoa Guerrero, A., Navarrete-Martínez, A., Flores Morones, F., ... Hernández-Ruiz, H. F. (2023). Factors related to academic performance in medical students. *Salud Mental*, 46(4), 193-200.

DOI: 10.17711/SM.0185-3325.2023.024



ABSTRACT

Introduction. Academic performance in medical students can be influenced by several factors, including those related to mental health and family relationships. **Objective.** To examine the factors affecting academic performance in medical students, specifically considering potential diagnoses of depression. **Method.** A survey was conducted among 747 fourth-year medical students. The survey included questions on sociodemographic variables, mental health, and well-being. The Patient Health Questionnaire (PHQ) was utilized, encompassing sections on depression, anxiety, panic, eating habits, alcohol consumption, and the Stress Perception Scale. Academic performance was assessed based on students' Grade Point Average (GPA). Descriptive statistics, Pearson correlation coefficients, and a linear regression model were employed for data analysis. **Results.** The study revealed several variables significantly associated with GPA. Age ($r = -.388$), financial situation ($r = .241$), relationships with cohabitants ($r = .165$), and relationships with peers ($r = .217$) were found to have a correlation with academic performance. Additionally, repeating a course was found to be significantly associated with a person's GPA ($r = .518$) even after controlling for depression. **Discussion and conclusion.** The findings indicate that robust mental health, a favorable financial situation, and positive interpersonal relationships are crucial for achieving optimal academic performance in medical students. These results emphasize the need to address mental health concerns, promote a supportive social environment, and provide financial assistance to enhance the educational outcomes of medical students.

Keywords: Medical students, depressive symptoms, academic performance, interpersonal relationships.

RESUMEN

Introducción. El desempeño académico de los estudiantes de medicina puede verse influenciado por varios factores, entre ellos los relacionados con la salud mental y las relaciones familiares. **Objetivo.** Examinar los factores que afectan el desempeño académico en estudiantes de medicina, considerando específicamente los posibles diagnósticos de depresión. **Método.** Se realizó una encuesta entre 747 estudiantes de cuarto año de la carrera de medicina. La encuesta incluyó preguntas sobre variables sociodemográficas, salud mental y bienestar. Se utilizó el Cuestionario de Salud del Paciente (PHQ), que comprende secciones sobre depresión, ansiedad, pánico, hábitos alimentarios, consumo de alcohol y la Escala de Percepción del Estrés. El desempeño académico se evaluó con base en el promedio de calificaciones (GPA) de los estudiantes. Se emplearon estadísticas descriptivas, coeficientes de correlación de Pearson y un modelo de regresión lineal para el análisis de datos. **Resultados.** El estudio reveló varias variables significativamente asociadas con el GPA. Se encontró que la edad ($r = -.388$), la situación financiera ($r = .241$), las relaciones con los convivientes ($r = .165$) y las relaciones con los compañeros ($r = .217$) tenían correlación con el rendimiento académico. Además, se encontró que repetir un curso estaba significativamente asociado con el GPA de una persona ($r = .518$) incluso después de controlar la depresión. **Discusión y conclusión.** Los hallazgos indican que una salud mental sólida, una situación financiera favorable y relaciones interpersonales positivas son cruciales para lograr un desempeño académico óptimo en los estudiantes de medicina. Estos resultados enfatizan la necesidad de abordar los problemas de salud mental, promover un entorno social de apoyo y brindar asistencia financiera para mejorar los resultados educativos de los estudiantes de medicina.

Palabras clave: Estudiantes de medicina, síntomas depresivos, desempeño académico, relación interpersonal.

INTRODUCTION

The academic performance of medical students, expressed through their Grade Point Average (GPA), can be affected by numerous factors that prevent them from fully focusing on their studies. Among these factors, those related to mental health, particularly depression and anxiety, have been widely studied. However, it is difficult to determine whether depression or anxiety occur as a result of poor academic performance or whether these disorders cause poor academic performance. This relationship is thought to be bidirectional since results have been found in both directions (Othman, Ahmad, El Morr, & Ritvo, 2019; Mihăilescu, Diaconescu, Ciobanu, Donisan, & Mihailescu, 2016). Several studies have reported a high prevalence of depression in medical students in comparison with students enrolled in other degree courses, and the general population (Moir, Yelder, Sanson, & Chen, 2018; Pokhrel, Khadayat, & Tulachan, 2020; Dyrbye, Thomas, & Shanafelt, 2006; Kang, Zhang, Zhang, Lv, & Fang, 2016; Dahlin, Joneborg, & Runeson, 2005). A study conducted in Mexico suggests that depressive symptoms are present in 23% of freshmen (12.3% of men and 28.4% of women). This study also reports that depressive symptoms are a factor associated with poor academic performance. It found that 68% of students with depressive symptoms had failed at least one subject, equivalent to a 2.4-fold increased risk of failure compared to those without these symptoms. It also found that the GPA of students with depressive symptoms was significantly lower than that of students without symptoms. This study was undertaken at a state university in Mexico City (Fouilloux et al., 2013). At the same time, in medical students, stress, defined as the distressing perception an individual has of their context, is another factor that can influence their professional development and negatively impact their academic performance, contributing to substance abuse and academic dishonesty, in other words, engaging in behaviors intended to obtain academic benefit by unethical means. Other studies also suggest this can affect patient care and professionalism (Silva et al., 2017). In addition to affective and anxious symptoms, other aspects related to mental health can influence the academic performance of medical students, such as sleep quality, including various parameters such as sleep duration, latency, and self-reported quality. For example, an association has been observed between poor sleep quality, estimated using the Pittsburgh Sleep Quality Index, and daytime drowsiness and poor academic performance, while excellent academic performance is related to an average sleep duration of 7.00 ± 1.9 hours (Mirghani, Mohammed, Almuradha, & Ahmed, 2015). Substance use may be associated with affective or anxious symptoms as well as contributing to poor academic performance. However, in a study evaluating substance use in medical students at a state university in Mexico City, despite the high numbers of substance users (89.8% of respondents consumed alcohol,

48.1% used tobacco, and 14.8% used marijuana), only 4.6% reported having experienced academic problems associated with drug use (Fuentes-Aguilar, 2016).

Certain positive factors are also associated with adequate academic performance. It has been observed that regular physical activity, particularly the use of sports facilities in the days prior to exams, is related to good academic performance. Conversely, reducing visits to sports facilities in the days leading up to exams lowers test scores by an average of one percentage point (Slade & Kies, 2015). The role played by the family is also crucial to the academic performance of medical students. Positive relationships with family members, spending time with the family, and living with both parents are significantly associated with academic success. This is reflected in variables such as motivation, perception of competence and the attribution of academic success, as observed in a study of a private university in the south of Tamaulipas (Gómez López, Rosales Gracia, & Maldonado Vigil, 2015).

Based on the above information, we conducted this study to determine the factors influencing the academic performance of fourth-year medical students at a Mexico City university. We considered key aspects of mental health, which will be evaluated by determining the existence of depressive symptoms and other probable diagnoses such as generalized anxiety disorder, panic disorder, eating disorders, and alcohol use, according to the patient health questionnaire (PHQ). Medical students were selected as the target population because medicine is a challenging degree course, in which a higher prevalence of depression has been observed than in students enrolled in other degree courses, and the general population. Moreover, the psychological well-being of medical students is of vital importance not only for themselves, but also for the quality of the health services they provide (Fahrenkopf et al., 2008).

METHOD

Design of the study / Procedure

A cross-sectional study was conducted of fourth-year medical students. It was decided to study this population because the fourth year of the degree corresponds to the last year in which students engage in clinical rotations prior to their medical internship, as stipulated in their degree courses. All students were asked to give their consent to participate in this study. They were informed that if they did not wish to do so, they should leave the answer sheet for this survey blank. Students were evaluated during an event in the faculty auditorium to decide where they would pursue their medical internships. Filling out the questionnaire took approximately one hour, and answers were coded in such a way that respondents were only required to check the option corresponding to their

current status. It was a self-administered questionnaire. Respondents were not asked to provide their names or any other identifying data. All questionnaires had a page number and a cover sheet specifying the anonymous nature of the answers as well as the fact that respondents would be free not to answer or to stop answering whenever they wished with no academic repercussions. A member of the research team clearly explained the instructions for filling out the answer sheet.

Measurements

Questionnaire created expressly for this study

The questionnaire developed for this study included general variables such as sex (coded as male/female), age, GPA, self-perceived financial situation (coded as good, mediocre, or poor), self-perceived relationships with the people with whom they lived (coded as good, mediocre, or poor), self-perception of their relationship with their superiors at the clinic (coded as good, mediocre, or poor), self-perception of their relationship with their families (coded as good, mediocre, or poor), difficult family situation in the past year (yes/no), difficult personal situation in the past year (yes/no), and whether they exercised or did sports (frequently, occasionally, never), mother's educational attainment (elementary school, junior high school, senior high school, undergraduate or graduate degree), father's educational attainment (elementary school, junior high school, senior high school, undergraduate or graduate degree), travel time from home to their hospital location (up to thirty minutes, up to one hour, up to two hours, up to three hours or more than three hours). Questions regarding the health status of students included the following: Do you consider that your state of health is good? (yes/no), Have you been diagnosed with an illness? (yes/no), Have you received treatment? (yes/no), Have you suffered from depression at any time in your life? (yes/no), Have you received treatment for depression? (yes/no), Have you suffered anxiety at any time in your life? (yes/no), Have you received treatment for anxiety? (yes/no), Have you used any recreational drugs in the past year? (yes/no), Have you received treatment for addictions in the past year? (yes/no), Have you had problems due to the use of recreational drugs in the past year? (yes/no/does not apply), Who have you had problems with due to drug use? (school, family, classmates, authorities, does not apply), Do you smoke, or have you ever smoked? (yes/no). If your answer was affirmative, how many cigarettes a day did or do you smoke? In the past year, have you felt intimidated, harassed, or pressured by a colleague or superior? (yes/no), specify who (colleague, resident, superior, nurses, does not apply), Do you think this situation entailed any emotional, health or other consequences? (yes/no/not applicable). Have you had ideas about no longer wanting to live or have you wished you were dead? (ever in your life, in the past year, in the past month, in the past week, never). Have

you ever tried to kill yourself? (ever in your life, in the past year, in the past month, in the past week, never).

Patient Health Questionnaire (PHQ-9)

The PHQ-9 is a questionnaire created from the mental disorders evaluation questionnaire at the primary health care level (PRIME-MD), developed to have a more efficient, self-administered instrument (Spitzer, Kroenke, Williams, & Patient Health Questionnaire Primary Care Study Group, 1999). It evaluates psychosomatic symptoms, depressive symptoms, panic disorder, generalized anxiety, eating habits, and alcohol consumption. It contains Likert-type answers, and the questionnaire is graded using algorithms that permit the identification of positive cases. The use of this questionnaire separately or as a whole has been validated in various research studies (Kroenke, Spitzer, Williams, & Löwe, 2010). The same questionnaire has been used to assess depression, psychosomatic symptoms, and anxiety in medical students (Moir et al., 2018; Tadeo-Álvarez et al., 2019).

Perceived Stress Scale

The perceived stress scale was administered to evaluate the subjective perception of the importance given to each life situation that may prove stressful. This scale comprises fourteen items with a five-option Likert-type response scale ranging from never (0) to very frequent (4). High scores reflect a high perception of stress. It was adapted for use in the Mexican population (González Ramirez & Landero Hernandez, 2007), and proved to have adequate clinimetric properties. It has been used in numerous studies with different populations, including medical students.

Statistical analysis

Descriptive statistics were obtained using central tendency and dispersion measures. Pearson's correlation coefficients (r) were performed to evaluate variables related to the GPA of respondents. Two-tailed Student's t tests were also used to compare the means of groups of patients with or without a score indicating depression according to the PHQ-9. Finally, a linear regression model was used to identify the predictor variables of academic performance, controlling for depression.

Ethical considerations

The project was reviewed and approved by the internal research and ethics commission (Project 086-2011, no. 49-2012). Students were asked to give their consent to participate in this study, and informed that if they did not wish to do so, they should leave the answer sheet for this survey blank. The cover sheet of the questionnaire included the phrase: If you do not wish to complete the survey, you can leave everything blank. Your participation is voluntary and

Table 1
Characteristics of Respondents

	<i>N</i>	<i>%</i>
Sex		
Female	467	62.5
Financial situation		
Poor	62	8.3
Mediocre	276	36.9
Good	322	43.1
Very good	65	8.7
Excellent	20	2.7
Relationship with peers		
Poor	8	1.1
Mediocre	85	11.4
Good	3	1.1
Very good	238	31.9
Excellent	90	12.0
Relationship with people with whom they live		
Poor	4	.5
Mediocre	45	6.0
Good	194	25.9
Very good	265	35.4
Excellent	238	31.86
Difficult personal situation in the past year		
Yes	303	40.56
No	356	47.65
Mother's educational attainment		
Elementary school	80	10.7
Junior high	160	21.4
Senior high	233	31.2
Bachelor's degree	221	29.6
Graduate degree	49	6.6
Father's educational attainment		
Elementary school	63	8.4
Junior high	145	19.4
Senior high	186	24.9
Bachelor's degree	278	37.2
Graduate degree	71	9.5
Repeater		
Never repeated	451	60.4
Elementary school	2	.3
Junior high	4	.5
Senior high	9	1.2
Bachelor's degree	279	37.3
Intimidated, harassed, or pressured		
Yes	95	12.7
No	645	86.3

there will be no academic repercussions for answering or not answering.

RESULTS

Of the 747 students surveyed, 467 (62.5%) were women and 274 (36.7%) men. The average age was 22.9 (SD = 1.63) years while the average GPA of all the subjects at the time of the evaluation was 88.26 (SD = 3.44). The perception of students regarding their financial situation ranged from mediocre to poor in 45% of respondents, with the remainder reporting that their financial situation was good, very good or excellent. In regard to the relationship with their peers, only 1.1% said that they had a poor relationship with them, while the rest rated it as mediocre to excellent. A total of 40.56% of respondents reported having experienced a difficult personal situation in the past year. Sixty-three per cent of the respondents' mothers had completed basic education (including elementary, junior, and senior high school) while 37% held bachelor's or graduate degrees. As for their fathers, 52.7% had completed basic education and 46.7% held bachelor's or graduate degrees. A few students (2%) had repeated subjects before beginning their degree course. However, during their degree course, 37.3% had repeated a subject while 60.4% had never repeated a subject at the time of the evaluation (Table 1). 59.4% of respondents stated that they often participated in

Table 2
Characteristics of mental health of respondents

	<i>N</i>	<i>%</i>
Depression		
Yes	87	11.6
Generalized anxiety		
Yes	67	9
Panic disorder		
Yes	101	13.5
Binge eating		
Yes	40	5.6
Bulimia		
Yes	11	1.5
Alcohol use		
Yes	161	21.6
Drug use in the past year		
Yes	107	14.3
Suicide attempt		
At some time in their lives	42	5.6
In the past year	7	.9
In the past month	1	.1
In the past week	2	.3

some type of physical activity while 20.3% mentioned that they had an illness. Regarding their mental health, 30.6% of respondents reported having received treatment for depression, anxiety, or stress at some time in their lives, 14.3% admitted having used a drug in the past year while 1.5% considered they had a problem with their substance use.

The percentage of students who had felt intimidated, harassed, or pressured at some point was 12.7%, usually by their peers or the authorities, while 8.2% reported having experienced consequences due to this situation. A total of 30.1% reported suicidal ideation at some time in their lives, with 6.8% experiencing this in the past year. Lifetime suicide attempts were reported by 5.6% of respondents while .9% said they had attempted suicide in the past year. A probable diagnosis of depression (according to the PHQ-9) was found in 11.6% of respondents, together with anxiety in 9%, and panic disorder in 13.5%. 5.6% of respondents tested positive for probable binge eating disorder and 1.5% for bulimia, while 21.6% had scores consistent with probable alcohol abuse or dependence (Table 2).

After the description of the frequencies of these disorders, we evaluated the differences between respondents with and without a probable diagnosis of depression and found that GPA was significantly lower in respondents with probable depression than in the group without this diagnosis (87.54 vs. 88.36; $t = 2.06, p = .039$). A statistically significant difference was also observed as regards stress perception scores, which were higher in the group with probable depression than in the group without this diagnosis (29.5 vs. 17.4; $t = -12.12, p < .000$). Respondents with probable depression were more likely to report a mediocre or poor financial situation than the group without depression ($\chi^2 = 50.38, gl = 5, p < .000$). It was also observed that having experienced a difficult personal situation in the past year was significantly more common in respondents with probable depression than in the group without this di-

agnosis ($\chi^2 = 27.36, gl = 3, p < .000$). Respondents with probable depression were more likely to report having a mediocre or poor relationship with the people with whom they lived ($\chi^2 = 134.37, gl = 5, p < .000$) and a mediocre or poor relationship with their peers ($\chi^2 = 42.87, gl = 5, p < .000$). Drug use in the past year was significantly higher in respondents with probable depression than in those without probable depression (24.13% vs. 13.03%; $\chi^2 = 17.42, gl = 5, p < .004$). At some point in their degree course, 31.03% of respondents with probable depression felt intimidated, harassed, or pressured, whereas among respondents without probable depression, this was true in 10.3% of cases ($\chi^2 = 39.74, gl = 6, p < .000$). We assessed the relationship between GPA and age, and a probable psychiatric diagnosis. It was observed that the higher the respondent's age, the lower their GPA ($r = -.388, p < .000$), and a significant relationship was observed between a probable diagnosis of depression and GPA. Although the psychiatric diagnoses correlated with each other (Table 2), only depression significantly correlated with GPA. Based on the effects of depression on medical students, we built a linear model to evaluate GPA predictors, in which we included the following predictor variables: financial situation, relationship with the people with whom they live, peer relationships, relationship with the authorities, mother's educational attainment, father's educational attainment, difficult personal situation in the past year, and difficult family situation in the past year. This model controlled for depression, with a sequential forward selection. In the model, we found that having a good relationship with the people with whom they lived, and their peers has a positive influence on respondents' GPA. Conversely, age (the older a student, the lower their GPA), and a mediocre or poor financial situation had a negative influence (Figure 1). The most important predictors were age and financial situation. We subsequently built a new model with the same characteristics, including variables such as having repeated subjects during their degree,

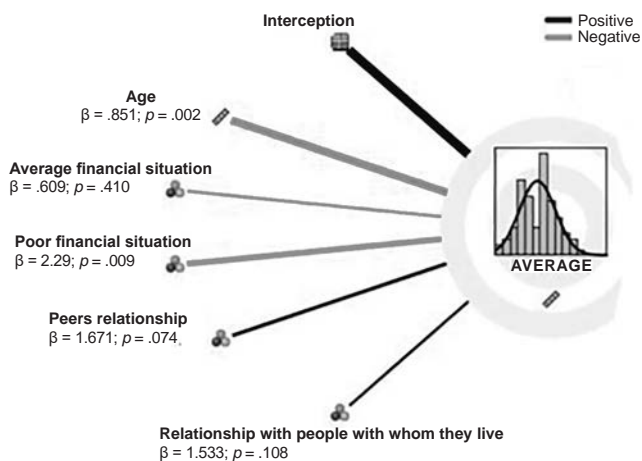


Figure 1. Linear regression model 1: General average predictors controlling for depression.

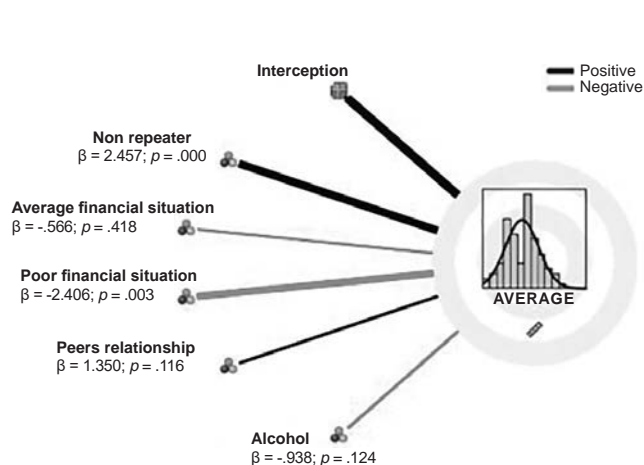


Figure 2. Linear regression model 2: General average predictors controlling for depression, including the repeater variable.

gender, substance use during their degree, participating in sports activities, and total stress perception scores. We found that never having repeated a subject was a significant predictor of good academic performance. The financial situation and peer relationships variables continued to be significant, and the alcohol consumption variable was added as a negative predictor for GPA (Figure 2).

DISCUSSION AND CONCLUSION

The mental health of medical students has been the focus of numerous papers due to their challenging academic and professional workload, which makes them vulnerable to stress, anxiety, and depression. The prevalence of depression or depressive symptoms has been shown to be high in medical students, with reports ranging from 2% to 75% depending on the type of measurement instrument used (Fouilloux et al., 2013; Guerrero et al., 2013; Rotenstein et al., 2016) and the academic year being evaluated (Moir et al., 2018). In the group of students evaluated, we found that 11.6% had a probable diagnosis of depression according to the PHQ. We believe that this figure is within the range of what was reported. The different methodologies used to assess depressive symptoms in medical students, however, produce significant heterogeneity within the range of depressive symptoms reported (Rotenstein et al., 2016). The effect of depressive symptoms on this group of students constituted a significant burden for them. We observed that students with a probable diagnosis of depression were more likely to report a mediocre or poor financial situation, a difficult personal situation in the past year, a poor relationship with the people with whom they lived and their peers, more frequent drug use, and feeling intimidated or harassed. Moreover, their GPA was significantly lower and their scores on the stress perception scale significantly higher. Some of these factors have previously been reported to be associated with depression in medical students, particularly a person's financial situation (Guerrero et al., 2013) and high stress levels (Kumar, Kattimani, Sarkar, & Kar, 2017; Pham et al., 2019; Brenneisen et al., 2016). However, there are also reports suggesting that peer relationships (Mahroon et al., 2018) and academic performance are associated with depression (Mahroon et al., 2018; Alonso et al., 2015). In a previous study, we reported that depression in medical students is associated with levels of state anxiety, stressors, and low socioeconomic status (Guerrero et al., 2013). We observed that a diagnosis of depression could influence academic performance through different pathways and could be mediated by multiple variables such as drug use, recent life events, and a poor relationship with the people with whom they live. In this article, we controlled for the presence of depression and identified the factors predicting academic performance. We found that financial

situation and age are factors which, regardless of depression, may be associated with poor academic performance. It is striking that the older the student, the lower their GPA, which has been reported by other authors. One study reported that young age alone was a predictor of completing a medical degree, regardless of the type of program and other variables evaluated (Garrud & McManus, 2018). However, age could be related to other variables that may directly influence student performance, such as perceived stress. The association between perceived stress and age has been documented in previous articles, with older students reporting greater perceived stress (Kötter, Wagner, Brüheim, & Voltmer, 2017). We evaluated perceived stress and observed a positive relationship between perceived stress and age. We also observed that perceived stress was inversely related to students' GPA. However, when we controlled for depression and added the "repeater" variable, perceived stress proved not to be a predictor of academic performance. This finding could be explained by the fact that the authors of the paper cited evaluated perceived stress using an instrument specifically designed for physicians, in which they evaluated aspects linked to medical degree courses such as competition, workload, social isolation, and financial concerns as sources of stress.

The next variable associated with academic performance, with the lowest strength of association, was alcohol consumption. Students with the highest alcohol consumption had the lowest GPA, a result reported by various authors (Ayala, Roseman, Winseman, & Mason, 2017; Patte, Qian, & Leatherdale, 2017; Machado-Duque, Echeverri, & Machado-Alba, 2015). However, it is difficult to determine whether this is a cause or a consequence of poor academic performance.

Numerous studies have evaluated depressive symptoms in medical students, a population known to have a high frequency of depression. Depression is also known to influence students' academic performance. However, identifying other variables that could be important for student performance despite the presence of depression could shed light on other elements that impact performance. In this article, we found that GPA is associated with age, financial situation, and the relationship with the people with whom they live and their peers. Since we did not evaluate the age at which students began their degrees, only their age at the time of the evaluation, we decided to add the "repeater" variable to our model. It should be noted that a high percentage of students who began their medical degrees had never repeated a school year. However, by the fourth year of the degree (when we interviewed them), 39.6% had already repeated at least one subject. This suggests that medical students usually obtained a high GPA at their previous schools and have strong academic profiles. However, having to cope with the frustration of failing subjects may contribute to stress and the susceptibility to depression. Likewise, having failed subjects speaks

of a greater difficulty in obtaining good grades, which affects GPA. As Kotter (Kötter et al., 2017) mentions in his article, this becomes a vicious circle: greater stress leads to poor academic performance, which in turn increases stress. We agree with this author and suggest that medical students are forced to cope with a much more challenging academic program than they did previously. The frustration of failing a subject boosts their stress and depression levels, interfering with their academic performance.

It is important to note the limitations of this study. Unlike other studies, we did not assess respondents' age at the beginning of their degree courses. Instead, we reported their age at the time of the evaluation (fourth year of medicine), meaning that we did not know how much time had elapsed since students began their studies. We found that increased age is associated with lower academic performance, which may be due to having experienced personal or academic situations that prevented older students from progressing at the same rate as their younger peers. However, by adding the "repeater" variable to the model, we observed that age ceased to be a predictor of academic performance and that the key factor was having repeated subjects. It is also important to mention that the design of this study, with a cross-sectional measurement, does not enable one to determine the causal relationship between the variables studied. It is impossible to know whether a student's GPA is a result of poor interpersonal relationships, or whether academic difficulties predispose individuals to relate inappropriately to their peers and the people with whom they live. Likewise, depression could either be a cause or a consequence of poor academic performance. Being a repeater could also be associated with other variables we did not evaluate, such as place of residence, motivation, parental demands, and type of academic program. Finally, evaluating academic performance through a single measurement (GPA) may be insufficient since other elements are associated with the positive performance of medical students. However, this is the only objective value we had at the time of undertaking the evaluation, which has been used in most studies with a similar objective to ours, including nationwide studies of medical students (Vargas, Ramírez, Cortés, Farfán, & Heinze, 2011). Educational institutions also use GPA as the main indicator of student performance.

Numerous studies have reported the prevalence of psychiatric disorders in medical students. However, only a few have evaluated the association between these disorders and their subjects' GPA. Our study confirms the known association between depression and academic performance, while proposing another series of variables which, regardless of whether a student is depressed, lead to poor academic performance. It also highlights factors that can boost student performance, creating a framework of elements that could be influenced to improve these students' performance. A novel element of this study is the observation that, regard-

less of depression, having a mediocre or poor financial situation negatively influences performance, whereas having good interpersonal relationships with their peers and the people with whom they live positively influences academic performance. Longitudinal studies evaluating how the aforementioned variables behave throughout a person's degree would shed light on the order of events and whether poor mental health is a cause or consequence of poor academic performance.

The academic performance of medical students is influenced by a range of personal and social variables. In this article, we observe that age, financial situation, and interpersonal relationships influence a person's GPA. However, the older age of some students could be explained by the fact that they have had to repeat subjects and fallen behind other students. Repeating subjects was significantly associated with a low GPA. All the variables we observed related to a person's GPA were found even after controlling for a probable diagnosis of depression.

Funding

None.

Conflict of interest

The authors declare they have no conflicts of interest.

Acknowledgements

We would like to thank Juan Pablo Martínez Kobeh and Rodrigo Guiza Zayas for helping to prepare this article.

REFERENCES

- Alonso, J. D., Castaño, J. J., Cerón, Y. E., Dávila, L. M., Julio, A., De la Rosa Marrugo, P. E., ... Olave Peña, C. M. (2015). Frecuencia de Depresión, Según Cuestionario de Beck, en Estudiantes de Medicina de la Ciudad de Manizales (Colombia), 2014: Estudio de Corte Transversal. *Archivos de Medicina (Col)*, *15*(1), 9-24.
- Ayala, E. E., Roseman, D., Winseman, J. S., & Mason, H. R. (2017). Prevalence, perceptions, and consequences of substance use in medical students. *Medical Education Online*, *22*(1), 1392824. doi: 10.1080/10872981.2017.1392824
- Brenneisen, F., Souza, I., Silveira, P. S., Itaiqui, M. H., de Souza, A. R., Campos, E. P., ... Tempski, P. (2016). Factors Associated to Depression and Anxiety in Medical Students: A Multicenter Study. *BMC Medical Education*, *16*(1), 282. doi: 10.1186/s12909-016-0791-1
- Dahlin, M., Joneborg, N., & Runeson, B. (2005). Stress and depression among medical students: a cross-sectional study. *Medical Education*, *39*(6), 594-604. doi: 10.1111/j.1365-2929.2005.02176.x
- Dyrbye, L. N., Thomas, M. R., & Shanafelt, T. D. (2006). Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. *Academic Medicine: Journal of the Association of American Medical Colleges*, *81*(4), 354-373. doi: 10.1097/00001888-200604000-00009
- Fahrenkopf, A. M., Sectish, T. C., Barger, L. K., Sharek, P. J., Lewin, D., Chiang, V. W., ... Landrigan, C. P. (2008). Rates of medication errors among depressed and burnt out residents: prospective cohort study. *BMJ*, *336*(7642), 488-491. doi: 10.1136/bmj.39469.763218.BE
- Fouilloux, C., Barragán, V., Ortiz-León, S., Jaimés, A., Urrutia, M. E., & Guevara, R. (2013). Síntomas Depresivos y Rendimiento Escolar en Estudiantes De Medicina. *Salud Mental*, *36*(1), 59-65.

- Fuentes-Aguilar, E. (2016). Prevalencia de Consumo de Drogas en Alumnos del Último Semestre de la Carrera de Medicina y su Repercusión Académica. *Revista Iberoamericana para la Investigación y el Desarrollo Educativo: RIDE*, 7(1), 423-434.
- Garrud, P., & McManus, I. C. (2018). Impact of Accelerated, Graduate-Entry Medicine Courses: A Comparison of Profile, Success, and Specialty Destination between Graduate Entrants to Accelerated or Standard Medicine Courses in UK. *BMC Medical Education*, 18(1), 250. doi: 10.1186/s12909-018-1355-3
- Gómez López, V. M., Rosales Gracia, S., & Maldonado Vigil, M. P. (2015). Comparación de Factores Sociales Asociados al Estatus Académico en Estudiantes de Medicina. *Investigación en Educación Médica*, 4(15), 133-138. doi: 10.1016/j.riem.2014.11.001
- González Ramirez, M. T., & Landero Hernandez, R. (2007). Factor Structure of the Perceived Stress Scale (PSS) in a Sample from Mexico. *Spanish Journal of Psychology*, 10(1), 199-206. doi: 10.1017/s1138741600006466
- Guerrero, J. B., Heinze, G., Ortiz de León, S., Cortés, J., Barragán, V., & Flores-Ramos, M. (2013). Factores que Predicen Depresión en Estudiantes de Medicina. *Gaceta Médica de México*, 149(1), 598-604.
- Kang, X., Zhang, L., Zhang, G., Lv, H., & Fang, F. (2016). Research on psychological health status of Chinese's young doctors from Hebei province. *Neuropsychiatry*, 6(3), 85-87.
- Kötter, T., Wagner, J., Brüheim, L., & Voltmer, E. (2017). Perceived Medical School Stress of Undergraduate Medical Students Predicts Academic Performance: An Observational Study. *BMC Medical Education*, 17(1), 256. doi: 10.1186/s12909-017-1091-0
- Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2010). The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: A Systematic Review. *General Hospital Psychiatry*, 32(4), 345-359. doi: 10.1016/j.genhosppsych.2010.03.006
- Kumar, S. G., Kattimani, S., Sarkar, S., & Kar, S. S. (2017). Prevalence of Depression and Its Relation to Stress Level among Medical Students in Puducherry, India. *Industrial Psychiatry Journal*, 26(1), 86-90. doi: 10.4103/ipj.ipj_45_15
- Machado-Duque, M. E., Echeverri, J. E., & Machado-Alba, J. E. (2015). Somnolencia diurna excesiva, mala calidad del sueño y bajo rendimiento académico en estudiantes de Medicina. *Revista Colombiana de Psiquiatría*, 44(3), 137-142. doi: 10.1016/j.rcp.2015.04.002
- Mahroon, Z. A., Borgan, S. M., Kamel, C., Maddison, W., Royston, M., & Donnellan, C. (2018). Factors Associated with Depression and Anxiety Symptoms among Medical Students in Bahrain. *Academic Psychiatry*, 42(1), 31-40. doi: 10.1007/s40596-017-0733-1
- Mihăilescu, A. I., Diaconescu, L. V., Ciobanu, A. M., Donisan, T., & Mihăilescu, C. (2016). The impact of anxiety and depression on academic performance in undergraduate medical students. *European Psychiatry*, 33(Suppl 1), S284-S284. doi: 10.1016/j.eurpsy.2016.01.761
- Mirghani, H. O., Mohammed, O. S., Almutadha, Y. M., & Ahmed, M. S. (2015). Good Sleep Quality Is Associated with Better Academic Performance among Sudanese Medical Students. *BMC Research Notes*, 8(1), 706. doi: 10.1186/s13104-015-1712-9
- Moir, F., Yelder, J., Sanson, J., & Chen, Y. (2018). Depression in medical students: current insights. *Advances in Medical Education and Practice*, 9(1), 323-333. doi: 10.2147/AMEP.S137384
- Othman, N., Ahmad, F., El Morr, C., & Ritvo, P. (2019). Perceived impact of contextual determinants on depression, anxiety and stress: a survey with university students. *International Journal of Mental Health Systems*, 13(17), 1-9. doi: 10.1186/s13033-019-0275-x
- Patte, K. A., Qian, W., & Leatherdale, S. T. (2017). Binge Drinking and Academic Performance, Engagement, Aspirations, and Expectations: A Longitudinal Analysis among Secondary School Students in the Compass Study. *Health Promotion and Chronic Disease Prevention in Canada*, 37(11), 376-385. doi: 10.24095/hpcdp.37.11.02
- Pham, T., Bui, L., Nguyen, A., Nguyen, B., Tran, P., Vu, P., & Dang, L. (2019). The prevalence of depression and associated risk factors among medical students: An untold story in Vietnam. *PLoS One*, 14(8), e0221432. doi: 10.1371/journal.pone.0221432
- Pokhrel, N. B., Khadayat, R., & Tulachan, P. (2020). Depression, anxiety, and burnout among medical students and residents of a medical school in Nepal: a cross-sectional study. *BMC Psychiatry*, 20(1), 298. doi: 10.1186/s12888-020-02645-6
- Rotenstein, L. S., Ramos, M. A., Torre, M., Segal J. B., Peluso, M., Guille, C., ... Mata, D. (2016). Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation among Medical Students: A Systematic Review and Meta-Analysis. *JAMA*, 316(21), 2214-2236. doi: 10.1001/jama.2016.17324
- Silva, V., Costa, P., Pereira, I., Faria, R., Salgueira, A. P., Costa, M. J., ... Morgado, P. (2017). Depression in medical students: insights from a longitudinal study. *BMC Medical Education*, 17(1), 184. doi: 10.1186/s12909-017-1006-0
- Slade, A. N., & Kies, S. M. (2015). The Relationship between Academic Performance and Recreation Use among First-Year Medical Students. *Medical Education Online*, 20(1), 25105. doi: 10.3402/meo.v20.25105
- Spitzer, R. L., Kroenke, K., Williams, J. B., & Patient Health Questionnaire Primary Care Study Group. (1999). Validation and Utility of a Self-Report Version of PRIME-MD: The PHQ Primary Care Study. *JAMA*, 282(18), 1737-1744. doi: 10.1001/jama.282.18.1737
- Tadeo-Álvarez, M. A., Munguía-Ortíz, C. D., Benítez-López, V., Valles-Medina, A. M., Delgado-Ramos, G., Flores-Castillo, P. M., & Romo-Guardado, M. (2019). Presence of depressive symptoms in medical students in a Mexican public university. *Salud Mental*, 42(3), 131-136. doi: 10.17711/SM.0185-3325.2019.017
- Vargas, I., Ramírez, C., Cortés, J., Farfán, A., & Heinze, G. (2011). Factores asociados al rendimiento académico en alumnos de la Facultad de Medicina: estudio de seguimiento a un año. *Salud Mental*, 34(4), 301-308.