

Sociodemographic Factors and Academic Performance of Medicine and Surgery Students in a Course of Gross Human Anatomy

Factores Sociodemográficos y Rendimiento Académico de Estudiantes de Medicina y Cirugía en un Curso de Anatomía Humana Macroscópica

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SUMMARY: The learning of human gross anatomy (HGA) is essential for health professionals, as it is key to achieve diagnoses and carry out clinical procedures safely and effectively. It is essential to recognize the main ideas of human anatomy, such as anatomical position and planimetry, and terms of reference and comparison, to understand the general characteristics of the structures, systems, and functions of the human body. However, the academic performance of students in the course of HGA is low, so this study aimed to determine the relationship between sociodemographic data and their academic performance. For this purpose, students of the academic program of Medicine and Surgery enrolled in a HGA course were surveyed on 17 sociodemographic factors. The grades obtained by the students in the three exams taken in the course were recorded and correlated with the answers obtained in the questionnaire. In order to know the students' characteristics and behaviors in each of the variables, descriptive statistics were performed for each of them, the t-student test was used to compare the means of each group. In the event of behavior far from the normal distribution, the non-parametric tests of Mann-Whitney U and Kolmogorov-Smirnov were used. It was found that factors like previous academic university experience, retaking the HGA course, students' health condition, working and studying at the same time and the students' mother's level of education influence in their academic performance.

KEY WORDS: Human Gross Anatomy; Sociodemographic factors; Higher education students; Teaching; Learning.

INTRODUCTION

The learning of human gross anatomy (HGA) has been considered fundamental in the training of students in the academic program of Medicine and Surgery (Moro *et al.*, 2017; Ghosh, 2017). Therefore, its knowledge and the correct use of its language is necessary for the training of health professionals. HGA learning has been correlated with safe medical practice, since an inadequate anatomical interpretation and description in the diagnosis and treatment of a patient can lead to clinical complications and even death (Rodríguez-Herrera *et al.*, 2019).

McHanwell *et al.* (2007) consider that learning about HGA is essential for health professionals, it is crucial to achieve diagnoses, and carry out clinical procedures safely and effectively. The advance in diagnostic tests has increased

the importance of anatomical knowledge since radiological techniques require a deep understanding of the structure to achieve a complete interpretation. It is essential that the student manages to recognize the main ideas of human anatomy that include anatomical position and planimetry and the terms of reference and comparison, these ideas will allow understanding the general characteristics of the structures, the systems of the human body, its general function, interpret relevant clinical images, recognize the surface anatomy, muscle groups and basic clinical correlation.

Despite the fact that HGA is considered a fundamental subject, the academic performance of students—understood as one of the quality indicators of the academy in the higher education system (Garbanzo Vargas, 2013)—

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is low. In Universidad del Valle, the grade obtained by students in the course of HGA must be higher or equal to 2.95 to pass, if the student obtains a lower result, they must retake the course; and if this is a prerequisite of another one, they fall behind in the semesters of the university program. Yet, the HGA course been considered a multi-repetition subject, which has been associated with academic desertion (Vanegas-Pissa & Sancho-Ugalde, 2019). Since different sociodemographic factors may be influencing the academic performance of students, this study aimed to describe a group of students of the academic program of Medicine and Surgery enrolled in the course of Human Gross Anatomy and determine the relationship between sociodemographic data and their academic performance.

MATERIAL AND METHOD

Methodological Design. The present study is part of the doctoral thesis Teaching, learning and evaluation of Human Gross Anatomy, which has been endorsed by the Institutional Human Ethics Review Committee, act N. 014-021. Before starting the course Human Gross Anatomy I, students were surveyed by means of a Google Forms form with sociodemographic-oriented questions that allowed describing the study group. The form included 17 sociodemographic questions on sex, age, with whom the student lives, level of study of the mother and father, socioeconomic stratum, city of origin, category of the school where the student studied (public or private), health status, whether the student is under medical treatment, whether the student has family support, reading habits, whether it was their first time taking HGA, whether the student had other higher education studies (partial or complete), the practice of physical exercise and whether the student was currently working or not.

This survey was sent from the main investigator's mail to each of the students. Prior to this, a pilot test was conducted with 5 students to identify the clarity of the questions and the time needed to fill them out. To describe the academic performance of the students and its relationship with sociodemographic factors, the grades obtained by the students in the three exams taken in the Human Gross Anatomy I course were recorded. This information was correlated with the answers obtained in the Google Forms questionnaire. For the statistical analysis plan, the database was first cleaned and adjusted. Data management was carried out by the designated statisticians, whose responsibility was to prepare the survey data prior to the statistical analysis. The following validations were performed: First, a review of the missing data, and second, a logical check to assess if

there were inconsistencies in the responses established in the database by means of validation grids. For this research, a univariate and bivariate analysis was performed, which will be explained next.

Univariate Analysis. In order to know the students' characteristics and behaviors in each of the variables, descriptive statistics were performed for each of them. In this phase, the aim was to define some indicators of traits of the set that constitutes the sample and after processing the data, to obtain ideas about their properties and possibly establish some hypotheses about the behavior of these traits, or their relationships in the population.

For this purpose, indicators of central tendency, dispersion and shape were used for quantitative variables. For qualitative variables, whether on a nominal or ordinal scale, frequency tables, bar charts or pie charts were used to describe their modal value. Histograms and box-and-whisker plots were included to study the distribution of certain variables, a priori detection of outliers in the study data.

Bivariate Analysis. A correlation coefficient measures the degree of relationship or association generally existing between two random variables. To identify whether there was a correlation between qualitative variables and the response variable (which is a quantitative variable), the t-student test was used to compare the means of each group. In the event of behavior far from the normal distribution, the non-parametric tests of Mann-Whitney U and Kolmogorov-Smirnov were used. In addition, boxplots were calculated and performed to compare the groups of the k populations.

RESULTS

The present work was performed with a group of 90 students of second semester (first year) of the academic program of Medicine and Surgery enrolled in the course of Gross Anatomy I (HGAI), during the semester from October 2021 to February 2022. To describe the group of students, the statistical analysis was performed with 66 of the 90 who participated. These were the students who completed the information in the Google Forms and remained enrolled until the end of the course.

The group of 66 students who answered the questionnaire consisted of 42 males and 24 females, corresponding to 63.64 % and 36.36 %, respectively. The age of the students ranged from 16 to 28 years, with a mean of 18.7 years.

Regarding the educational level of the mother, it was found that 37 of the students' mothers had high school studies, 22 had postgraduate studies, 4 had primary studies and 3 had no studies at all, which corresponds to 56 %, 33 %, 6 % and 4.5 %, respectively. As for the educational level of the father, it was found that 35 of the fathers have a high school education, 17 have a postgraduate degree, 10 have a primary school education and 4 have no education at all, which corresponds to 53 %, 25 %, 15 % and 6 %, respectively.

The socioeconomic stratum of the students ranged from stratum 1 to 6, most of them (63.64 %) had been classified in strata 1 and 2 (low stratum); the next group of students belongs to the middle stratum (strata 3 and 4) with 30.3 %.

Most of the students in the study group do not live in the city of Cali, 37 of them being considered foreigners (from other regions or cities) (56.1 %). Additionally, 36 of the students attended a public school and 30 attended a private school, corresponding to 54.5 % and 45.5 % respectively. In term of their health condition, 63 of the students reported a good health status (95.5 %) and 3 a fair health status (4.5 %). Likewise, 58 of the students reported being healthy and 8 report being under medical treatment, which corresponds to 87.9 % and 12.1 % respectively.

Regarding the question of whether this was their first time they were taking the course of Human Anatomy, 58 (80.3 %) of the students answered No, whereas 8 (19.7 %) answered Yes. However, when asked if the students had previous undergraduate studies, 48 of them answered No, 11 said Yes and 7 had previously completed partial undergraduate studies, which corresponded to 72 %, 16 % and 10 % respectively.

Regarding the question of whether the students are currently working, 53 of them answered No and 13 Yes, which corresponds to 80.3 % and 19.7 % respectively.

Description of the grades obtained by students. In the development of the HGA I and II course, offered by the Department of Morphology of the Faculty of Health of the

Universidad del Valle, students present three theoretical and three practical midterm exams that are averaged and correspond to the final grade; in some cohorts, dissection of cadavers is included. During the development of the HGA I course, corresponding to the present investigation, there were no practical exams due to the contingency of the Covid-19 pandemic, so only theoretical exams were taken.

In the HGA I course, the general topics of HGA and the anatomy of the dorsum, neck, upper limb and lower limb are taught. The topics are evaluated in three exams without being cumulative, for this atypical semester only theoretical midterm exams were performed, Table I shows the averages of the grades obtained by the students during the semester from October 2021 to February 2022, the average obtained by the students in the three exams was 3.8, with a minimum grade of 2.1 and a maximum of 4.8. The behavior of the grades in the theoretical exams tends to be increasing, that is, as the semester progresses, the average grades improve.

Relationship between sociodemographic data and the grades obtained by students. To determine the relationship between the sociodemographic data and the quantitative grades obtained by the students in the theoretical midterm exams, a normality test was performed on the data in which it was found that the data did not present a normal distribution, so it was necessary to use nonparametric tests for comparison (Fig. 1, Table II).

Table II. Kolmogorov-Smirnov test.

Statistic	0,988996
p-value	2,53E-

With the objective of determining whether sociodemographic data can influence students' academic performance, the grade point averages obtained in the HGAI course were correlated with each of the 17 sociodemographic data obtained in the Google Forms form described above, finding a statistically significant relationship between the quantitative test score and whether the student had previously taken any undergraduate course previously (partial or total) (Fig. 2, Table III).

Table I. Average grades obtained by students.

	Exam I (Back and neck)	Exam II (Upper limb)	Exam III (Lower limb)	Midterm final score
Average	3,24	3,88	4,20	3,81
Standard deviation	1,07	0,86	0,76	0,72
Min	0,20	0,20	1,97	2,10
25 %	2,60	3,40	3,67	3,29
50 %	3,30	3,90	4,47	3,85
75 %	4,30	4,60	4,83	4,46
Max	5,00	5,00	5,00	4,83

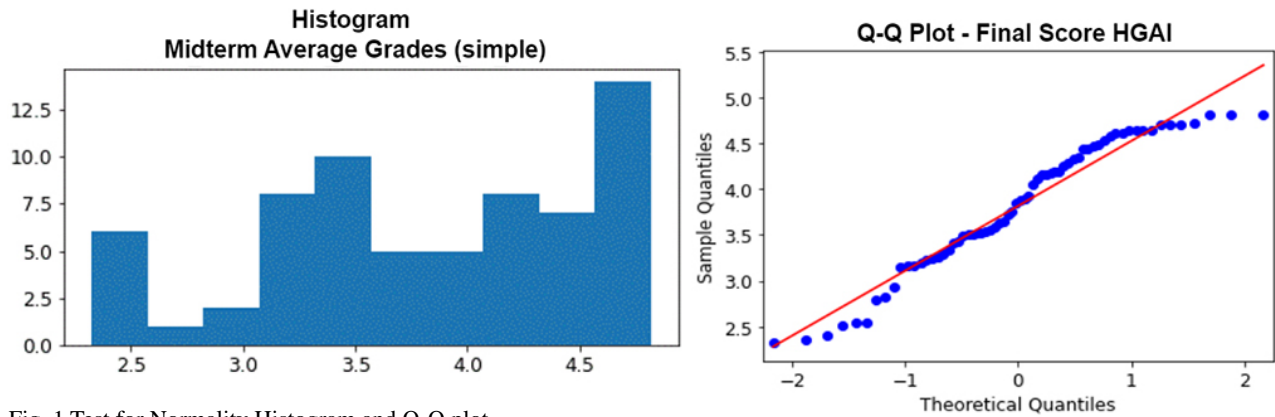


Fig. 1 Test for Normality Histogram and Q-Q plot.

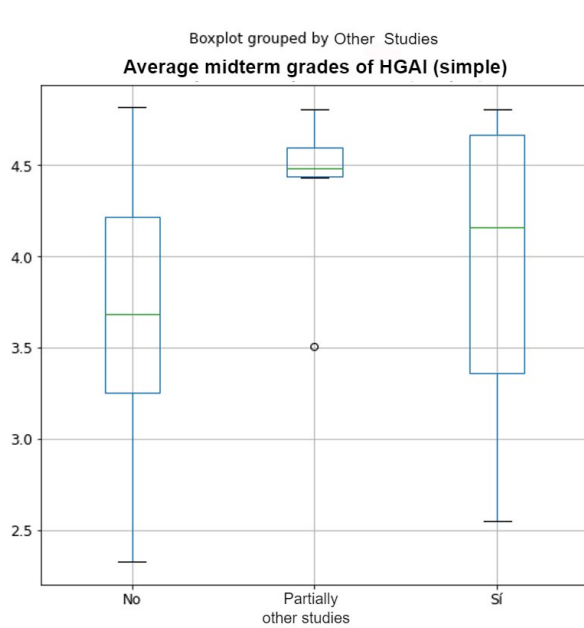


Fig. 2 Relationship between grades and previous studies.

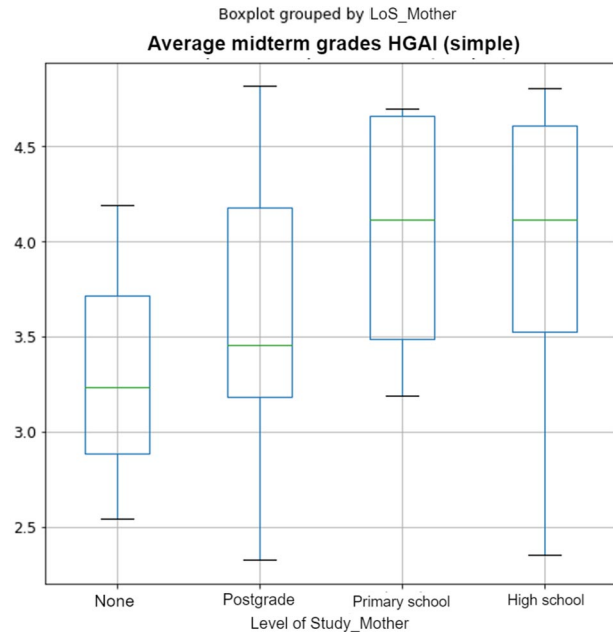


Fig. 3 Relationship between grades and mother's level of education.

Table III Kruskal-Wallis test for the relation between grades and previous studies.

Kruskal-Wallis		Hypothesis
Statistic K	6,0976928	Ho: The median of the groups is equal.
p-value	0,0474136	Ha: The median of the groups is different, lower, or higher.

Some results were also found that do not present statistically significant differences that indicate a relationship between them; however, five of the p-values were close to the rejection zone, so they could be considered factors that can influence the academic performance of the students. The first of the group factors that may impact academic performance was the mother's level of study. Those students whose mother has no education tended to have lower grades (Fig. 3, Table IV).

The second factor that can influence academic performance was the health condition of the students, since those who report a regular health condition tend to have a lower grades, as seen in Figure 4 and Table V.

The third factor that comes close to a correlation corresponds to having previously taken an HGA course. It was found that those students who have already had the approach with the subject tend to have better grades (Fig. 5, Table VI).

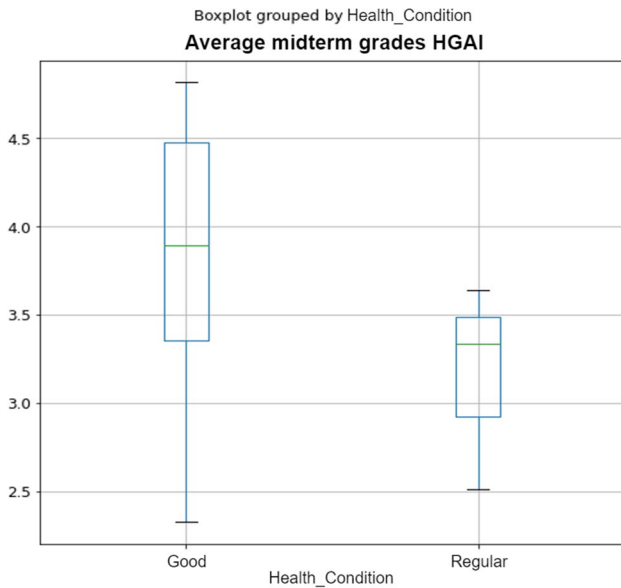


Fig. 4 Relationship between grades and health condition.

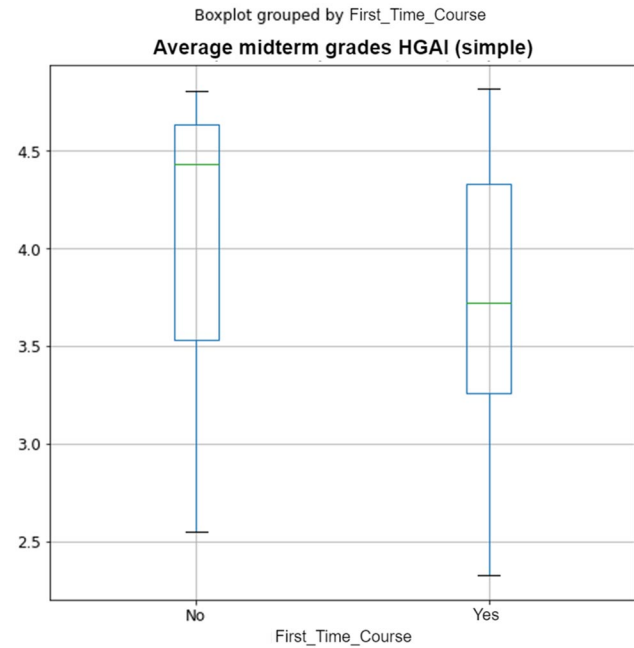


Fig. 5 Relationship between grades and retaking the HGAI course.

Table IV. Kruskal-Wallis test for the relationship between grades and mother's level of education

Kruskal-Wallis	Hypothesis
Statistic K	6,78971
p-value	0,07891
	Ho: The median of the groups is equal
	Ha: The median of the groups is different, lower, or higher

Note. Level of significance (Alpha level) = 0,05.

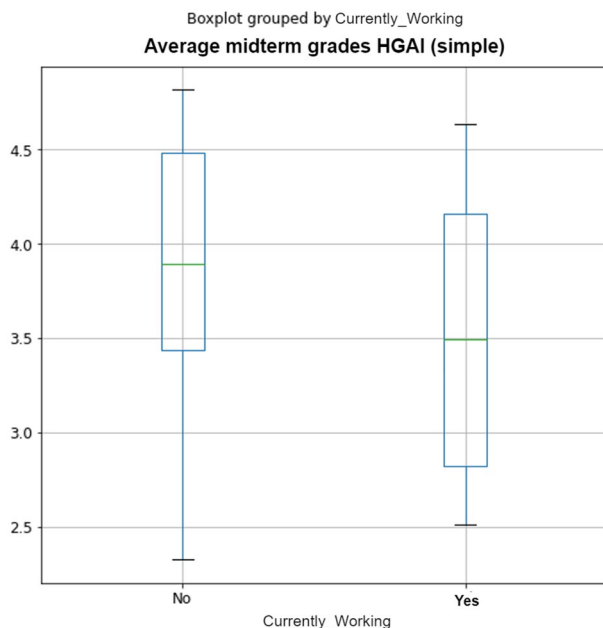


Fig. 6 Relationship between grades and working.

The fourth and last factor corresponds to the relationship between students who work and study with the quantitative grade obtained in the exams, in which it was found that the p-value is close to the rejection limit; therefore, it could be concluded that there is a difference to be considered between the groups. Figure 6 and Table VII show that those students who do not work tend to have better grades.

DISCUSSION

In this research it was found that students in the second semester of the academic program of Medicine and Surgery present varied sociodemographic characteristics, in terms of age, city of origin, characteristics of the school where they attended high school, health status, parents' level of study, socioeconomic status and economic support, among others. These differences in the classroom make the teacher encounter students with different levels of motivation, attitudes and responses to the teaching, learning and evaluation (T-L-Ev) process. Felder & Brent (2005)

Table V. Mann-Whitney U test for the relationship between grades and health condition.

Mann-Whitney U		
Statistic U	143	Ho: The median of the groups is equal
p-value	0,14702797	Ha: The median of the groups is different, lower, or higher

Table VI. Mann-Whitney U test for the relationship between grades and repeating HGAI.

Mann-Whitney U		
Statistic U	450	Ho: The median of the groups is equal.
p-value	0,090662	Ha: The median of the groups is different, lower, or higher.

Table VII. Mann-Whitney U test for the relationship between grades and working.

Mann-Whitney U		
Statistic U	453	Ho: The median of the groups is equal
p-value	0,081599	Ha: The median of the groups is different, lower, or higher

considers that those teachers who understand these differences will have a better chance of satisfying the diverse learning needs of the students; in addition, the author considers that students are heterogeneous and vary in terms of learning style, the way they approach study and their attitude about the nature of knowledge and their role in its construction.

It is important before starting an HGA course to know important aspects of the students, especially for those who are undertaking a university-level study for the first time. It is also fundamental to know if they are retaking the HGA course, how they are in terms of health, if they are currently working, where they are from and the level of study of their parents. In this way the T-L-Ev activities can be conceived to support these students in order to favor the learning process.

Academic performance has been recognized as one of the quality indicators of academia in the higher education system (Garbanzo Vargas, 2013). The grade obtained by students in the different subjects must be higher than or equal to 2.95 to pass the courses; if the student obtains a result lower than this grade, they must repeat the subject again and, in case this is a prerequisite for another, they will fall behind in the semesters of their career.

Although these quantitative measures of learning have been widely criticized, they continue to be used. Academic performance determines in a certain way the current and future goals of students, the average obtained in their grades will allow them to access university, future specializations, participation in events, access to scholarships, discounts and recognitions, so it is common

for students to perceive pressure from parents, teachers and administrators to improve their academic performance (Kapur, 2018).

On the other hand, sociodemographic factors are considered to influence student academic performance; Melo-Becerra *et al.* (2017), in their article on higher education in Colombia, state that these influence the academic performance of students, so it is necessary for institutions to make decisions regarding the hiring of teachers, incentives in research and improvement of administrative processes, all this in order to counteract the negative impact resulting from the conditions of students and other environmental factors.

It has also been reported that, in addition to sociodemographic factors, educational and psychological factors also influence academic performance and school dropout. The most prevalent indicators in these situations are economic difficulties, personal history, family history and shortcomings in secondary education (Zambrano Verdesoto *et al.*, 2018).

Vanegas-Pissa & Sancho-Ugalde (2019) conducted a study on student dropout in the career of Medicine and Surgery at the University of Medical Sciences in Costa Rica, between the years of 2008-2009; in it they found that 55.2 % of students dropped out of the career in the first six semesters, identifying as the main cause the multirepetition in basic science courses. In addition, they identified the need to innovate the didactic methods of the courses, pedagogical strategies, work on the curricular design and favor study methodologies.

Students are characterized by being diverse in all aspects and in constant change; they have different backgrounds and expectations for learning. Generally, teachers know how they learned, but do not consider it necessary to know how their students learn and whether the way of teaching and assessment allows learning to be achieved (Fry *et al.*, 2008).

The following is a discussion of the six sociodemographic data that had the greatest influence on the academic performance of the students, according to the statistical analysis; the first corresponds to university academic experience; the second, whether it is the first time taking HGA; the third, the state of health; the fourth, whether the student works and studies simultaneously; the fifth, the mother's level of education; and the sixth data, the place of origin.

Academic university experience. The sociodemographic factor that presented a statistically significant correlation for this study, i.e., that influences the student to obtain a better academic performance, was the fact that the student had already completed or partially completed a university course. The above is understandable, since these students have already achieved a process of adaptation and have acquired greater responsibility in the learning process, on the contrary, students who enter the university for the first time express concern to meet the academic demands; Sánchez Padilla *et al.* (2014) report in their article that students in the first semesters present decreases in their health status, since they usually have changes in their diet, rest, tranquility, changes in the pace of study, pressure due to the academic load and vocational doubts, among others, considering it a critical period of adaptation.

Isaza Restrepo *et al.* (2016) reported in their study that during the first four semesters of the Medicine career is where the highest desertion occurs, identifying as the main cause the academic factor, specifically the loss of subjects, since novice students find a high academic demand for which they can develop a negative perception of their quality of life. Academic desertion is considered a complex problem with great economic, institutional, social and personal repercussions.

The medical career demands multiple changes in the novice student's life, such as a tight schedule, a heavier workload or staying in competitive environments, factors that have been associated with high levels of stress and psychological illnesses, especially during the first two semesters (Alhussain *et al.*, 2023).

It is common to attribute low academic performance

to students' difficulties in competencies that they should have acquired in middle school (baccalaureate). However, Herazo (2016) states that it is the responsibility of the university to allow students to enter the academic community, since it is common for them to start their careers without knowing the discursive practices of the disciplinary field, and in addition, in high school the approach to specialized discursive genres is almost null and the T-L-Ev proposals are far from those of the university.

Other important sociodemographic factors that, although they did not present statistically significant correlations in this study, did show that they can influence the T-L-Ev process, were taking the subject for the first time, a good state of health, exclusive dedication to study, mother's level of study and place of origin. These aspects are discussed below.

First time taking a HGA course. Taking HGA for the first time is challenging, most of the students at the beginning of HGAI showed low performance. This phenomenon has been reported by other authors such as Cheung *et al.* (2021), who pose the following question: how can students process incomplete information, i.e., when they have never identified certain anatomical structures in real life? Students start the course with the generalities of the HGA and go on to study the topic of dorsal and neck anatomy, in which all structures are related, so the study by regions can become complex for the student's understanding by not integrating the anatomical piece with the body system in which it is located. For example, the study of the larynx (an organ that belongs to the respiratory system located in the neck) is done before knowing the structures located in the head and thorax, however, in the texts and in class the relationship of the organs with other anatomical regions that have not yet been studied is described.

Among the most complex concepts to understand in anatomy has been referenced the spatial location, since for its learning it is necessary for the student to understand the three-dimensional properties and the relative position in the human body. For this, it is important to develop teaching and learning activities that involve the visualization of anatomical structures in different planes, especially the study with cross sections. In order for the student to retain anatomical details and understand the relationship of structures, it is recommended to use different resources such as cadavers, animal models, physical and digital models (Yohannan *et al.*, 2022).

Studies consider that it is necessary for the student to be repeatedly exposed to various types of representations for a prolonged period of time, in order to demonstrate the

functional importance of the structures and to benefit from clinical transfer, since the learning difficulties for the student are complex and could be experienced in a unique way. Some authors consider the use of cadaveric anatomical structures, along with the development of complementary approaches, as fundamental (Erolin, 2019; Cheung *et al.*, 2021).

Human Gross Anatomy courses aimed at programs in the health area stand out for their complexity in theoretical and practical contents, which implies the adaptation of these, as well as the commitment and collaborative work between teacher and students (Mendonça *et al.*, 2021).

Health condition. Regarding the health status of students, the results indicate that it may influence academic performance, since those who report a regular health condition tend to have a lower academic performance. This may be due to the fact that in cases of illness and/or disability, the time to dedicate to academic aspects may be reduced; in this sense, research shows that students who are in a condition of disability or illness must work harder to maintain their academic work and identity while compromising other aspects of their lives, fearing that they will not be seen as people, but as a health condition or disability. Because of the above, it is important to invite the academic community to reflect on the normalization and generalization of students (Brown & Leigh, 2018).

Kapur (2018) considers that physical health problems prove to be an impediment to academic achievement, especially for students with visual and hearing impairments, since it imposes problems for them to understand the activities posed in the classroom, negatively influencing academic performance; the authors of this work consider it fundamental to promote in students a good diet, participation in extracurricular activities and enjoyment of academic life.

In this same sense, a high prevalence of mental health disorders in medical students has been documented, characterized by problems of depression, anxiety, suicidal ideation and eating disorders. Young people between 18 and 24 years of age are at a higher risk, which could lead to undesirable consequences for students and their future patients, possibly affecting quality of life, decreasing academic performance or affecting professionalism and empathy for patients. Incidentally, research recommends that institutions provide psychosocial support and promote students' mental health (Pacheco *et al.*, 2017; Mao *et al.*, 2019).

Working and studying. The results of the present investigation indicate that students who report that they are partially working while studying tend to have a low academic

performance; this could be explained by the less time available to dedicate to study. The career of Medicine and Surgery has a high academic load, the schedules are varied, the subjects taken in each semester are demanding, with a high content, so it is necessary for students to be able to devote themselves to academic activities full time, which implies that they can count on family support. However, some students combine their studies with weekend work or hourly jobs, since they do not have the necessary economic resources for their maintenance, reflected in the fact that most students belong to low socioeconomic strata.

Carrillo Regalado & Ríos Almodóvar (2013) report in a case study that most university students who have work occupations refer to less time available for academic and personal activities, which negatively affects academic performance. The need to work and study could be associated with growing income inequality, low wages, along with an increase in the cost of higher education that makes it difficult for students to have the resources to meet their needs, so researchers recommend that educational institutions design strategies and actions to identify at-risk students and help with local programs (Martínez *et al.*, 2020).

Mother's level of education. The statistical correlations applied in the present investigation indicated that students whose mother did not have any type of education tended to have lower academic performance. Previous research has found that parents' occupation, as well as their educational level show a positive relationship with students' performance, mainly the mother's studies, since she is the one who is usually more actively involved with school activities and favors the development of cognitive activities in children through coexistence (Espejel García & Jiménez García, 2019).

Parents play a fundamental role in favoring the academic development of children, from a young age they can provide a learning environment at home, providing help with homework and projects, in addition, they provide the necessary materials for study, they are a source of security, encouragement and help to provide solutions to students' problems (Kapur, 2018).

In his article on school ethnography, Serra (2004) posits that students belonging to minority groups and children of working-class parents often exhibit cultural resistance and failure in the school system. This knowledge is fundamental for professors, as well as for the institution, since the good treatment of students by the university community, empathy and understanding of their life history, culture and customs, can help them adapt to the university culture and favor their integral formation.

Other studies have identified different factors that influence the academic performance of students, such as school resources, leadership attitude, social circle, parental role, psychological factors, time management, among others (Kapur, 2018). Based on the above, it is pertinent to close this discussion by posing the following question: Why, if students are so different in terms of age, life history, cultural capital and social conditions, do we teachers plan and develop courses with T-L-Ev activities that are the same for all of them?.

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RESUMEN: El aprendizaje de la anatomía macroscópica humana (AMH) es fundamental para los profesionales de la salud, ya que es clave para lograr diagnósticos y realizar procedimientos clínicos de forma segura y eficaz. Es fundamental reconocer las ideas principales de la anatomía humana, como la posición anatómica y la planimetría, y los términos de referencia y comparación, para comprender las características generales de las estructuras, sistemas y funciones del cuerpo humano. Sin embargo, el rendimiento académico de los estudiantes del curso de AMH es bajo, por lo que este estudio tuvo como objetivo determinar la relación entre los datos sociodemográficos y su rendimiento académico. Para ello, se encuestó a estudiantes del programa académico de Medicina y Cirugía matriculados en un curso de AMH sobre 17 factores sociodemográficos. Se registraron las calificaciones obtenidas por los alumnos en los tres exámenes realizados en el curso y se correlacionaron con las respuestas obtenidas en el cuestionario. Para conocer las características y comportamientos de los estudiantes en cada una de las variables se realizó estadística descriptiva para cada una de ellas, se utilizó la prueba t-student para comparar las medias de cada grupo. En caso de comportamiento alejado de la distribución normal, se utilizaron las pruebas no paramétricas de Mann-Whitney U y Kolmogorov-Smirnov. Se encontró que factores como la experiencia académica universitaria previa, retomar el curso AMH, el estado de salud de los estudiantes, trabajar y estudiar al mismo tiempo y el nivel de educación de la madre de los estudiantes influyen en su rendimiento académico.

PALABRAS CLAVE: Anatomía Macroscópica Humana; Factores sociodemográficos; Estudiantes de Educación Superior; Enseñando; Aprendiendo.

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